ELECTRONICS Australia

June, 1967

Incorporating RADIO, TELEVISION & HOBBIES

Vol. 29 No. 3



30c

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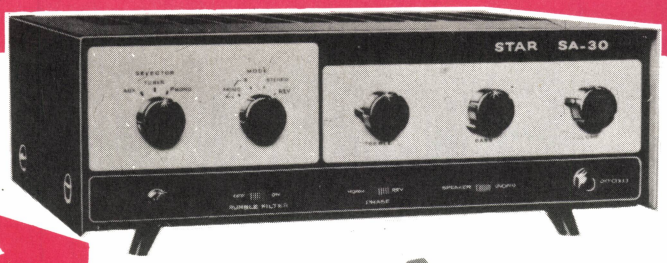
History of magnetic tape • Colour TV in Britain

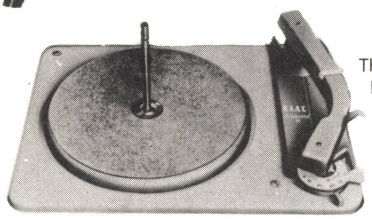
Compatible LP records • New mobile radio rules

Registered in Australia for transmission by post as a periodical

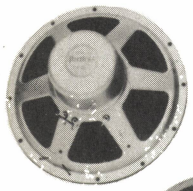
COMPLETE STEREO SYSTEMS BASED ON THE

SUPERB STAR SA30

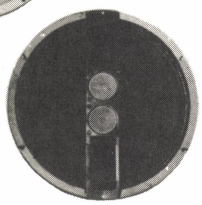


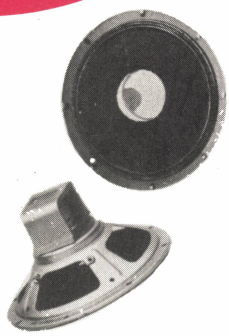


THE ELAC 160
PLAYER/CHANGER



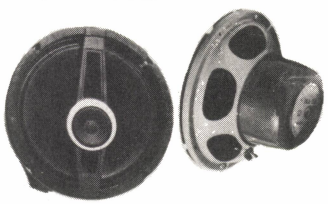
PEERLESS
120-20-20



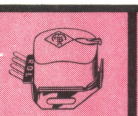


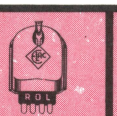
FAMOUS LOUDSPEAKERS

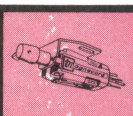
- PEERLESS
- ONKYO
- ALTEC LANSING
- CELESTION
- TEMPO
- MAGNEVOX



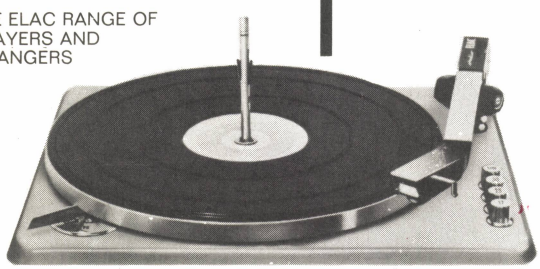
CHOICE OF STEREO CARTRIDGES





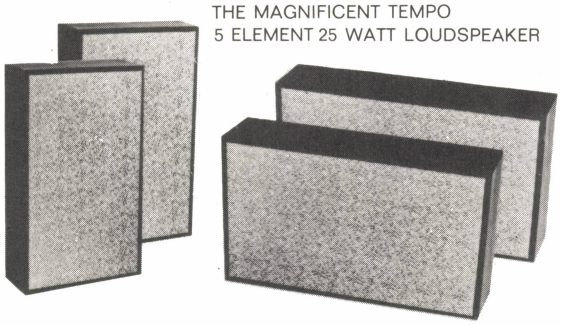


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For those who wish that 'little bit more' there is the STAR SA855 or the AKAI AA5000 amplifiers, there are the ELAC and MAGNECORD turntables and a host of loudspeakers from which to choose.

All these names are known the world over, STAR and AKAI from Japan, PEERLESS the best name in loudspeakers in Denmark, ELAC a famous name for many years from Western Germany.

These well known names coupled with the wide experience that the staff at CHAPMAN HOUSE can offer is, most definitely, the SMART WAY TO BUY HI-FI.

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In tribute . . .



During recent months, two notable figures from the Australian electronics industry have passed on: Mr J. J. Malone and Mr F. Langford-Smith.

Mr Malone was one of the real pioneers in telecommunications. He joined the Postal Department in 1898 as a telegraph messenger, was a wireless operator during World War I, winning the Military Cross. Between 1921 and 1939 he was Chief Wireless Officer for the Commonwealth and was Deputy Director of Posts and Telegraphs in New South Wales during World War II. In 1946 he became Chairman of the Overseas Telecommunications Commission, retiring in 1954.

Along with his official duties, and as part of them, Mr Malone maintained a close interest in the activities of Australian Amateur Operators. In fact, he became something of a patron to the amateur fraternity.

This close personal interest was maintained right up to his death. It was no better illustrated than by a telephone call which we came to look forward to each Christmas eve . . . a call phrased something like this: "Jim Malone speaking; just a short call to wish you the compliments of the season and to say thank you for all the pleasure I've had this year from reading 'ELECTRONICS Australia'."

By contrast, Mr Fritz Langford-Smith was not so much interested in the RF end of the spectrum; high fidelity sound reproduction was his first love.

At a time when most people's ideas were quite vague, F. Langford-Smith produced a series of papers examining the relationship between the output valve and the loudspeaker. He demonstrated the significance of source impedance, negative feedback, matching, etc. on frequency response, power output, transient response and distortion generally. He was keenly interested in obtaining the best from pick-ups, amplifiers and loudspeakers, largely in the frustrating era which immediately preceded LP records, tape and stereo.

But perhaps the younger generation will remember him best for the "Radiotron Designers Handbook," which he compiled in his later years of service with the Amalgamated Wireless Valve Company, and which was subsequently reprinted in many overseas countries.

We pay tribute to the memory of two notable men.

N. H. Williams

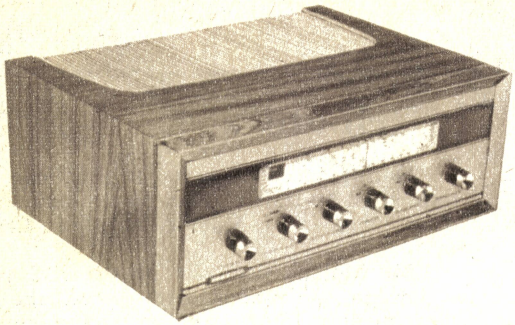
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COVER PICTURE: To relieve possible boredom during intercontinental flights, some airlines offer in-flights movies plus a selection of musical programs in stereo. This photograph, reproduced by courtesy of the Ampex Corporation, shows a "Travel Vision" onboard movie system installed in a 707 airliner. The music comes from a 4-program, 8-track tape.

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BROADWAY ELECTRONICS



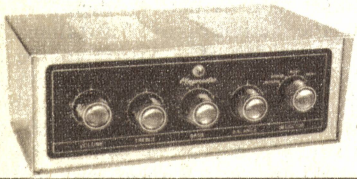
INSTROL AMPLIFIER-TUNER MODEL AT1.
A custom-built precision instrument tastefully presented in a high-quality, craftsman-made cabinet. Designed in Australia to suit Australian conditions and made from readily available local materials. 18-20 watts R.M.S. (Music power 36-40 watts).

PRICE	
Without cabinet	**$133.50**
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JUST RELEASED! NEW MODEL A1 Amplifier only. Same specifications as AT1, but without tuner. Price without cabinet $108 cabinet extra as for AT1).

INSTROL-PLAYMASTER . . A COMPLETE HI-FI RANGE

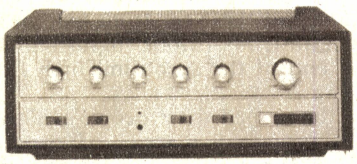
INSTROL - PLAYMASTER No. 4 STEREO AMPLIFIER ("R.T.V. & H.," May, 1962). A high-quality 9-watt-per-channel Stereo Amplifier. The No. 4, and all others in the Instrol-Playmaster range, are precisely to this magazine's original specifications.



Kit of parts, **$73**
Built and tested, **$93.80**





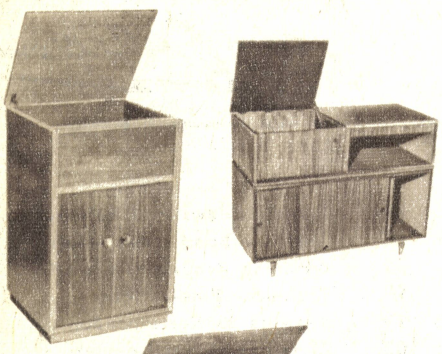


Yes, we carry a range of imported loudspeakers, players, amplifiers and tape recorders. Please state your requirements and we will gladly quote. All well-known brands stocked, **Wharfedale, Goodmans, Elac, Sony, Fisher, Akai, etc.**

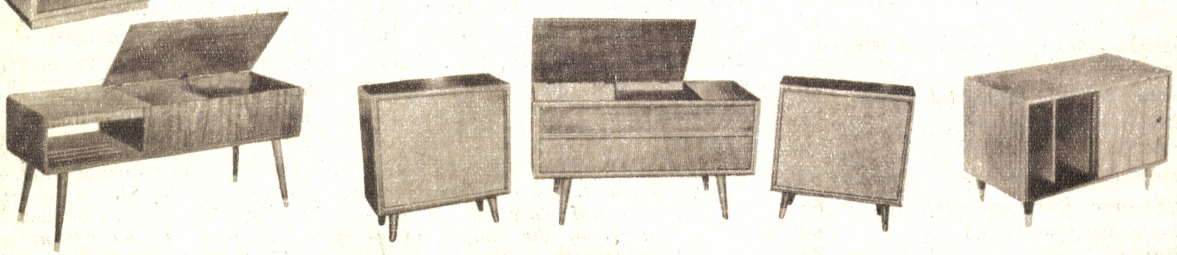
The new INSTROL-PLAYMASTER 115 Solid State Stereo Amplifier ("Electronics Aust.," April/May, 1967). A fully transistorised, 10-watt stereo amplifier using the latest F.E.T. high efficiency transistors.

CRYSTOL/CER.—VERSION KIT OF PARTS	**$95.00**
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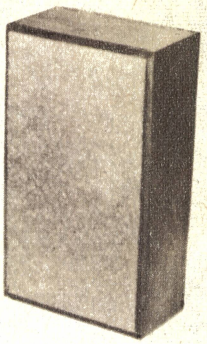


INSTROL SPEAKER SYSTEMS & ENCLOSURES

INSTROL-PLAYMASTER BOOKSHELF SPEAKER SYSTEM

Originally designed by "R.T.V. & H.," December, 1964, this speaker system gives phenomenal reproduction, from a cabinet measuring only 19¼" x 11½" x 6½". It incorporates two twin cone speakers, plus crossover network and Innerbond padding. Amazing bass response plus clean pure highs. Definitely this decade's most outstanding speaker system for both quality and economy. Available in Kit form to build yourself, or ready wired and tested. 15 ohms or 7.5 ohms, and a choice of oiled Teak, Queensland Maple and Walnut, best quality veneers.

PRICE:
Complete Kit of Parts $28.00
Built and Tested $35.80

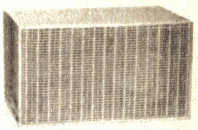


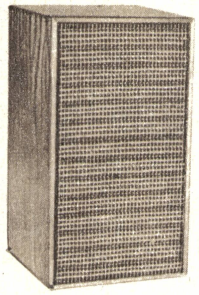
INSTROL MINI-SPEAKER SYSTEM

The Instrol version of the famous Mullard-Magnavox Mini-speaker System. Precisely to specifications, and 100 per cent approved by the designers after rigid laboratory tests.

Highly efficient, yet tiny —only 14¾" x 8" x 8¼". Available Oiled Teak, Qld. Maple and Walnut.

PRICE:
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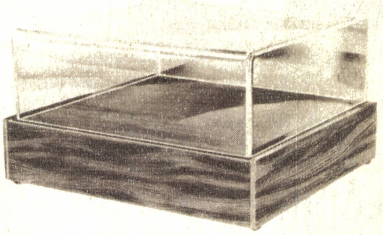


NEW M.S.P. SHELF ENCLOSURE

This highly efficient twin speaker system incorporates newly developed 8" and 4" M.S.P. speakers. Size 20" x 11" x 8" is quite compact considering it accommodates 4" and 8" speakers with crossover network. Descriptive leaflet available.

Cabinet finishes, Oiled Teak, Walnut and Queensland Maple.

PRICE:
Built and Tested .. $49.50



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Rigidly constructed using only best quality veneered panels in oiled Teak, Queensland Maple and Walnut, these Instrol Player/Changer Stands are widely accepted throughout the Hi-Fi Trade for most makes and models of players and changers. Size of player's top is 15¼" wide by 14½", and the inside depth is 3". A neatly set-in protective base with rubber feet is included. For a small extra charge, we can supply the base ready cut for your player or changer.

High grade perspex covers, as illustrated are available either grey tinted or clear and in two sizes: 15" x 14" x 3¾" and 15" x 14" x 5¾". The cover can be supplied fitted with stay-up type hinges if required.

PLAYER STANDS
Oiled Walnut or Queensland Maple **$8.00**
Oiled Teak or matching colour, **$9.65**
Extra for cutting to template .. **$0.75**

PERSPEX COVERS
15in x 14in x 3¾in **$9.00**
15in x 14in x 5¾in **$10.50**
Ready hinged extra **$1.50**

When ordering please add Registered Postage.		N.S.W.	QLD., VIC., TAS.	OTHER STATES
	Bookshelf and MSP.	$1.20	$1.60	$2.20
	Mini-speaker	95c	$1.20	$1.60
	Player Stand	70c	95c	$1.20
	Perspex Cover	95c	$1.20	$1.60

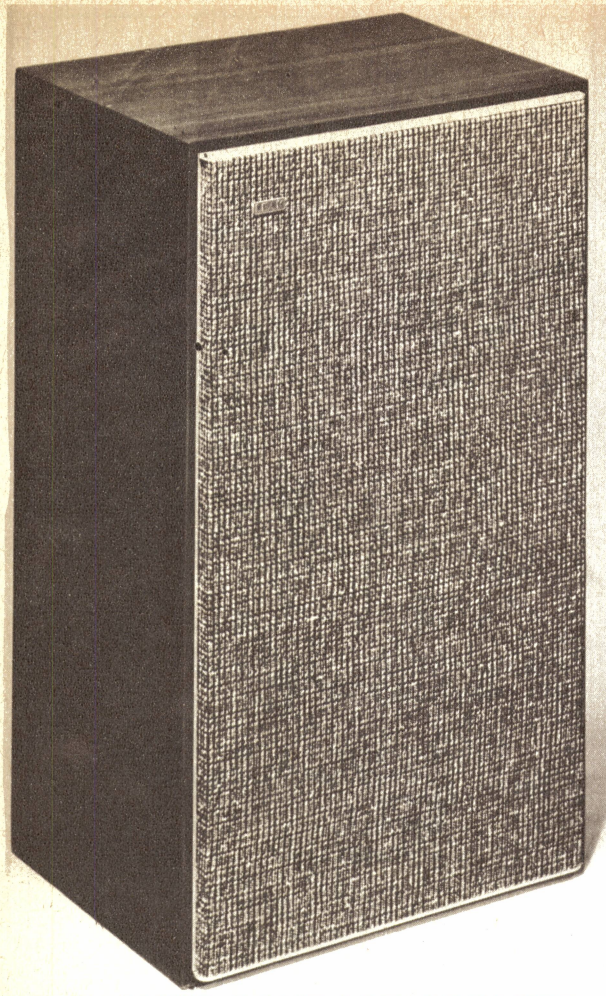
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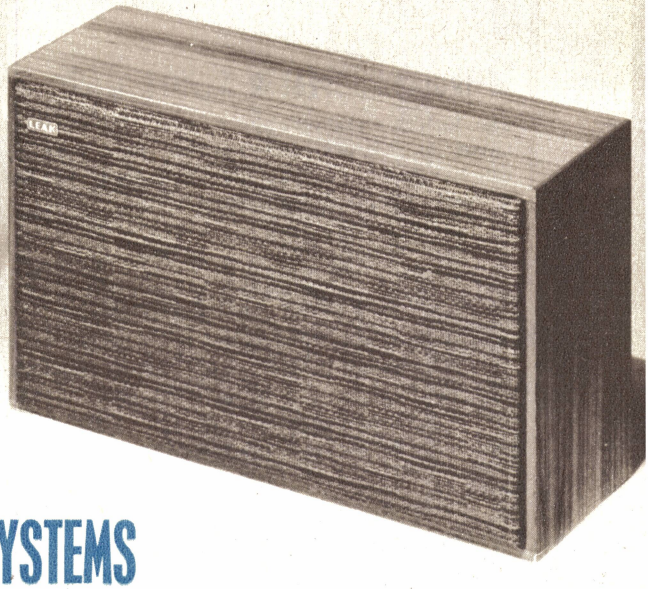
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☐ **Playmaster HI-FI** ☐ **Instrol Cabinets**



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THE ONLY COMPACT SPEAKER SYSTEMS OFFERING SUBSTANTIALLY LINEAR FREQUENCY RESPONSE!

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The release of the new LEAK MINI SANDWICH heralds a new era in small-speaker design and performance . . . for the MINI SANDWICH is designed and made exactly as the larger standard SANDWICH. Although only 18½" x 11" x 7", frequency response is virtually the same excepting only the very lowest octave. Between 75 and 15,000 Hz. response is substantially linear, varying only plus or minus 2 dB. Overall range is from less than 40 Hz. to over 20,000 Hz. This remarkable speaker system is available in mahogany, teak and walnut veneers . . . and the finish is impeccable.

For music lovers who cannot spare space for a standard LEAK SANDWICH, the new LEAK MINI SANDWICH is an excellent and musically satisfying compromise. See and hear the LEAK SANDWICH systems today — at all reputable hi-fi stores and sound centres.

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☐ Advanced design heavy magnet treble unit ☐ Isolated compartment for treble unit to eliminate cross modulation ☐ Airtight outer cabinet ☐ Interior cabinet surfaces coated with unique bituminous material to provide complete internal sound absorption ☐ Bonded acetate fibre with polyurethane lining assures excellent bass response and freedom from resonance ☐ The cone of the bass speaker is 200 times as stiff as conventional speaker units ☐ Highly compliant surround permits long cone excursions ☐ Sound is reproduced free of break-up distortion

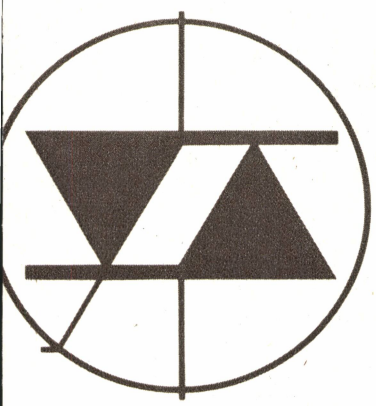
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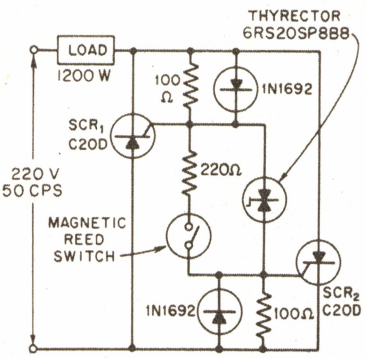
TRIAC simplifies control of full-wave AC power by *reducing the number of power-handling components;* by generally eliminating need for transient voltage suppression; and by reducing size and complexity of gate-control circuits.

Compare the two circuits below. Both show a full-wave AC static switch. The one on the left — the more complex—uses multiple SCR's. The simpler circuit on the right uses a single TRIAC.

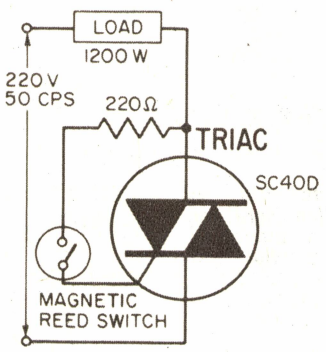
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This circuit can be simplified . . .



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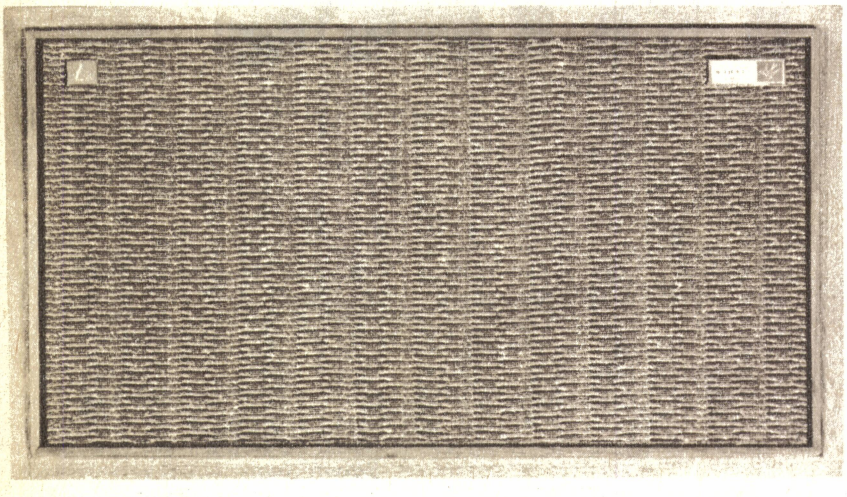
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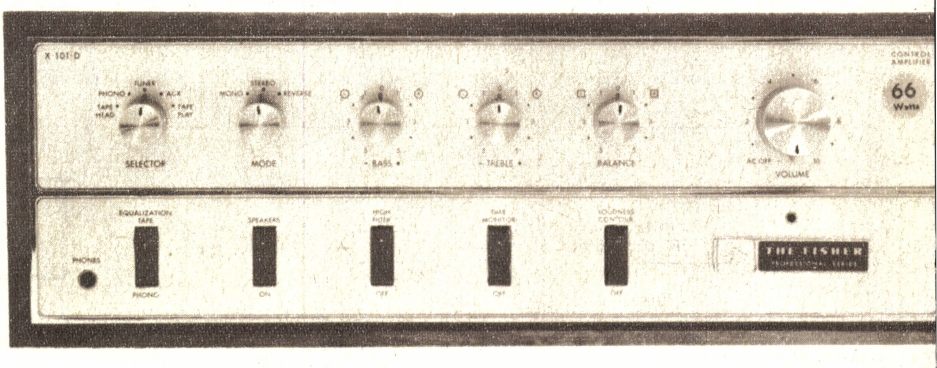
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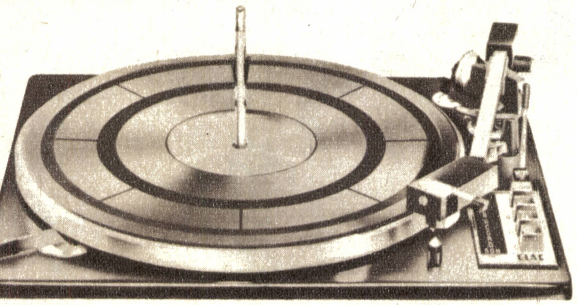
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A History of

MAGNETISM AND MAGNETIC

This story comes from the Ampex magazine "Readout" and traces the development of magnetic recording from the earliest suggestions of nearly 100 years ago to the modern video tape recorder. Apart from the historical dates and facts, it emphasises the stubborn tenacity with which succeeding workers persevered with this idea, in spite of disheartening setbacks. That this tenacity was fully justified is amply demonstrated by the outstanding performance of modern tape recording systems.

The propensity of magnetite ore (Fe_3O_4) for attracting iron has been known for thousands of years. Pliny (A.D. 23-79) thought the word stemmed from the names of Magnes, a shepherd on Mount Ida in Greece, who noticed the iron tip of his crook was attracted to a large rock. But etymologists believe the derivation is from Magnesia, a province in Thessaly, where this natural magnet is plentiful. Ancient peoples knew that artificial magnets can be made by stroking iron with a natural magnet, but not until the twelfth century was it discovered that a freely suspended magnet always assumes a north-south position. Because of this, rocks bearing magnetite came to be called lodestones (leading stones). Practical use of this property in a compass was first mentioned in a European manuscript in 1190, though the application probably originated in China.

Magnetism and static electricity were first studied seriously by William Gilbert (1540-1603), physicist and physician to Elizabeth I. Gilbert found that the compass points north, not because of star-influence as previously thought, but because the earth itself is a magnet. He published his findings in a book, "De Magnete," in 1600.

Many eighteenth and nineteenth century investigators experimented with static electricity and magnetism. However, the realisation that there is a cause and effect relationship between electricity and magnetism was a long time in coming. It waited upon Volta's invention in 1800 of the voltaic cell or battery. When Hans Christian Oersted (1777-1851) connected the terminals of this battery by a wire in 1819, he found that holding the wire near a magnetised needle caused the needle to be deflected. It was also noticed that hooking the terminals to a coil containing an unmagnetised needle induced magnetism in the tiny piece of steel. These classic experiments caused great excitement at the time. They gave the first clues indicating a relationship between electricity and magnetism.

The birth of the electronics industry—that is, electronics in commercial applications as against something primarily of interest to the pure researcher—can be traced to electromagnetism. Samuel F. B. Morse's invention of the electromagnetic telegraph in 1832 started the large-scale use of electricity as mankind's servant. Bell's telephone (1875) added impetus to the harnessing of the electron, as did Edison's work.

Though magnetic recording, early in its career, was intimately tied in with telegraphy and telephony as explained later, investigators first tried to use it to compete with Edison's phonograph. A browser in late nineteenth century publications is frequently rewarded with indications that more than one man was working on the idea. For example, in the September 8, 1888, issue of "Electrical World" (Vol. 12, pp. 116-117) one Oberlin Smith published an article, "Some Possible Form of Phonograph." In it, he claimed to have found a way to impregnate a string with metal particles so that sound could be recorded on it. But Smith noted that he'd been forced to abandoned the project before achieving any practical results. We hear no more of him.

Almost surely such theoreticians contributed to the breakthrough by the Dane, Valdemar Poulsen. His is the credit for actually capturing and reproducing sound through the orientation of magnetic domains by a current. His first patent application was filed December 1, 1898, in Denmark under the title, "Method of Recording and Reproducing Sounds or Signals." He soon made similar protective moves in many other countries. The United States approved his patent for "A device for effecting the storing up of speech or signals by magnetically influencing magnetisable bodies" on November 13, 1900. His "telegraphone," as Poulsen dubbed the instrument, made a great stir in the scientific and technical world. Nearly 20 leading French, Germa English and American scientific journals, including that the French Academie Des Sciences, printed articles on during 1900.

Telegraphy and telephony, the pioneer electron industries, had made considerable advances before magne recording was invented. Yet the two infant businesses w to spur the development of the new recording medi by attempting to improve their services through its use.

From the first, Poulsen's machine captured the attenti of the telephone and telegraph companies. Both th engineers and the inventor saw two practical applicatic for it:

- High-speed recording of telegraphic code messa to save "on-the-wire" time, then slower play-back for e transcribing. This was the precursor of modern tape reco ing's invaluable capabilities for time-base expansion.
- Recording and sending telephone messages with the presence of people at the instruments — anot harbinger, this time of tape's universal use as a memc device.

In Poulsen's first model, a 0.5 mm. steel piano w about 4½ feet long was stretched on a flat surface so t an electromagnet could be drawn along it. One pole of t the magnet, which was in series with a battery and microphone, embraced the wire.

Speech directed into the microphone as the magn slid along at approximately three feet per second caus current fluctuations to be registered on the wire. When t magnet was then hooked to a phone receiver and retravell over the wire, the telephone repeated the original wor Magnetic erasure, a "must" for modern tape machines, w discovered when the magnet was directly connected to fairly strong battery and retravelled again, completely obli rating the previously recorded message.



An early stage of tape manufacture. Large reels of base material—called "jumbo" reels—have been coated with oxide, checked, and readied for slitting. (Ampex picture).

RECORDING*



William Gilbert (1540-1603)

Poulsen published ideas for many variations on the above basic technique in an article appearing in "The Electrician" for November, 1900. One version for which he held great hope might be called the first continuous loop recorder. Further, it was to be equipped with the first individual recording and reproducing heads. As the inventor described the proposed machine, an endless steel ribbon working on rollers was first to pass one writing magnet and then several reading magnets. After the impression of speech on the ribbon through a microphone connected to the record head, each of the series of reproduce heads was to pick up the message as the tape sped past and transmit it to one of a series of phones.

This machine was considered to have possibilities for:

- Making a record of phone conversations.
- Storing phone messages for delayed transmission.
- Recording calls in the subscriber's absence.

Operation of several phones from an equal number of reproduce heads as described was perhaps more of a demonstration "gimmick" than an essential for the functions listed above. However, Poulsen's idea of using several reproduction circuits on one telegraphone had a more practical potential as a means of amplification in long distance telephony. His theory for a telephone amplifier appears below.

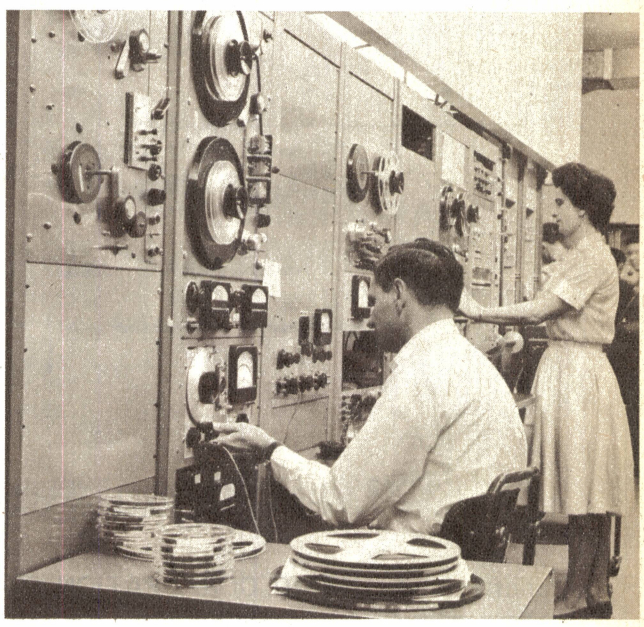
By the time the "microphonograph," as the telegraphone was sometimes called, had been created, the phone industry had been looking desperately for a suitable amplifier for over ten years. Without this "telephone repeater," the then common name for the widely sought amplifier, the phone's range was quite limited. Every means offering any hope of lifting the level along extended lines was investigated, and Poulsen's approach eventually came under scrutiny. The proposed telegraphone modification literally would have been a repeater had it been built. As planned, it was to record the incoming message on a number of "tracks" at, for example, a relay station. Then these identical messages were to be picked up simultaneously by a series of reproduce heads and played back into the outgoing line to augment the signal strength.

The elaborate mechanism would have included a rotating cylinder fitted with a number of iron rings whose planes were perpendicular to the cylinder axis and whose centres were in the axis. With the drum revolving, the message on an incoming line was to be recorded on the first ring. Next, a number of reproduce heads—one for each of the remaining rings—were to pick up the message and relay it for re-record-

Much credit for this article is due to Mr Mark Baer, Director of Ampex Corporation's Technical Information Service. With his co-operation a wealth of source material—over 1,500 titles—was made available to the authors.



Inspection after slitting. Alternate strips from the main—jumbo—reel are directed to upper and lower spooling facilities, to avoid twisting and distortion. (Ampex picture)



Batch testing for quality control. Data recording tape has to pass detailed examination for "dropouts"; irregularities in coating which may be misread. (Ampex picture).

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● **SWITCHES:** Input selector, Mode selector, Low Filter, High Filter, Loudness, Speakers and Phones, Phase, Tape Monitor. ● **DIMENSIONS:** Width 15¼″, Height 5¾″, Depth 12¼″.



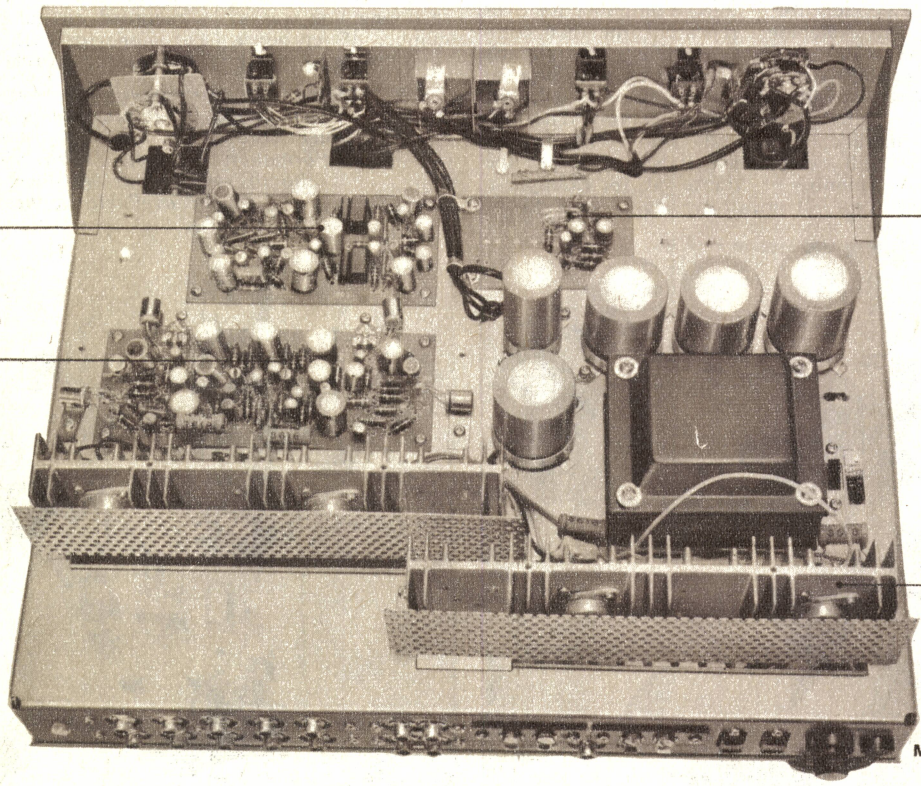
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ing on the remaining circular bands. The identical messages now impressed on all these were then to be simultaneously fed into the line going to the next relay station or to the subscriber. An erase head would then have wiped out the message.

This system to augment signal level was never put into operation. Why the phone companies bypassed it to continue looking for another amplifier is obscure. Probably, difficulty would have been met in synchronising the outputs of the series of reproduce heads and there would have been some delay in two-way conversations. Further, handling a number of such conversations through a relay point would have required a prohibitive number of repeaters.

Poulsen found that the addition of an exact amount of properly polarised direct current to the recording head gave improved reproduction. This discovery was likely an offshoot of observations involving the relative strength and polarities of the erase and recording currents.

Adding a DC bias to the incoming signal is the oldest electronic method of improving recording linearity and reducing noise. Though the technique gives a relatively low signal-to-noise ratio, the simple circuitry involved still makes it useful in some special cases.

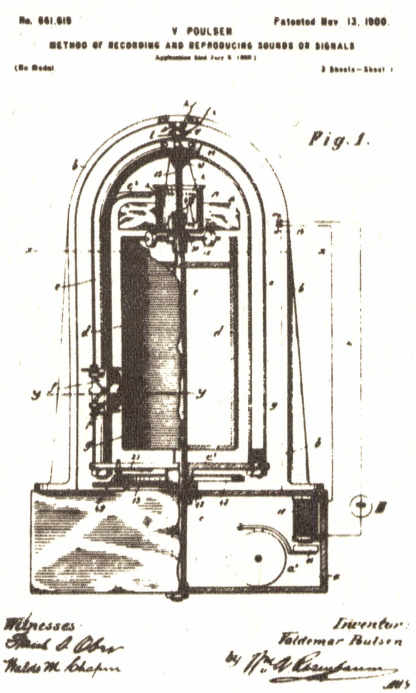
Poulsen's marvel was a sensation at the 1900 Paris Exposition and its possibilities intrigued many businessmen in the U.S.A. Nevertheless, it took him until 1903 to get adequate backing to set up the American Telegraphone Company and start manufacturing. And though the production model was much improved over the prototype, it gradually lost favour and the company finally discontinued operations around the time of World War I.

It seems likely that the failure can be attributed to the instrument suffering from the same limitation which dogged the early telephone—lack of a practical means of amplification. Lee De Forest offered his new amplifier (invented in 1912) to the American Telegraphone Company, but they did not see fit to purchase the right to use the new device, probably because they were already in serious financial difficulty. However, De Forest did borrow one of the company's units in 1913 for some research which augured the future. He used the telegraphone to study the possibilities of synchronising wire recorded sound with moving pictures. But he was too far ahead of his time. Synchronisation of sound and picture was almost impossible. Wire recordings also were too noisy.

Meanwhile, commercial magnetic recording went into eclipse through loss of its primary market, home entertainment. Whereas the telegraphone listener still had to festoon his head with earphones, Edison's improved phonograph, with its morning glory horn to compensate acoustically for the lack of electronic amplification, had eliminated the need for headsets.

As usual, engineers and scientists continued their attention to the yet unsatisfactory medium. De Forest had pointed the way and valve amplifiers were becoming commonplace in the early twenties. Sounds from steel wire and tape could now be amplified, but doing so meant equal amplification of the whole gamut of background noises which were the bane of all early recording.

This difficulty was finally hurdled by two more pioneers, Glen Carpenter and Wendell Carlson, both Naval Research Laboratory engineers in Washington, D.C. Their March, 1921, patent application included the use of AC bias with the input signal. They first note that "Our invention relates broadly to signalling systems and more particularly to a reception system for radio telegraphy," and "The object . . . is to provide an improved method for receiving signals by and of a telegraphone." Then, after describing how the telegraphone used DC for recording, but consequently suffered from noise, they go on to say: " . . . In our improved exciting system . . . the advantages



of the exciting system above (the DC biased telegraphone's) . . . are obtained to a greater degree and without the disadvantages, i.e., objectionable noises. An alternating magnetic field of preferably high frequency is used in the exciting process.

"It has been found that when running a telegraphone at normal speed, frequencies of 10,000 cycles per second and above are not recorded efficiently **but** (bold ours) that they have the effect of agitating the recording element so as to greatly increase the sensitiveness of said element to feeble signal impressions . . ." This patent, so essential to the modern recorder's ability to "get out what goes in," was granted in 1927.

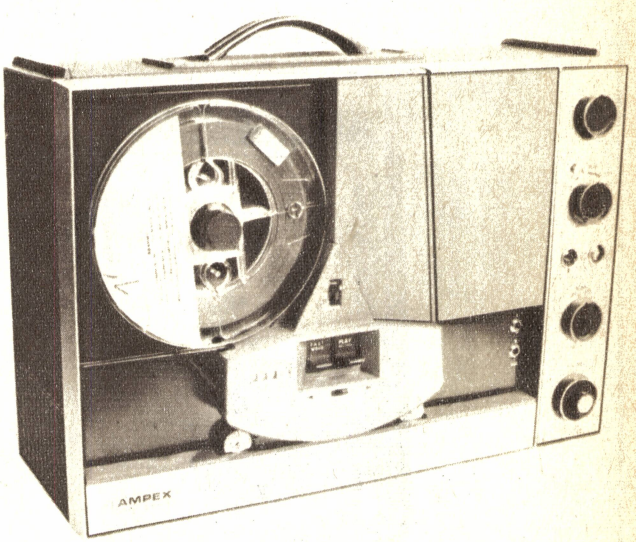
The year 1927 also saw another advance when a German and an American almost simultaneously patented similar processes by which a fluid oxide coating was applied to paper tape and allowed to dry. The German was a Dr Pfleumer. His counterpart in the U.S.A. was J. A. O'Neil.

Such a development was inevitable if only because investigators had been trying everything and anything as a recording medium which offered remanent induction after exposure to a variable magnetic field. Every ferromagnetic alloy — including those with manganese, nickel, gadolinium (one of the rare earth elements), cobalt and chromium — were tried in wire and metal tape forms as well as with a paper backing. Too, these alloys were tried on nonferrous molded bases such as brass. Coated, impregnated and plated discs and drums, even treated rubber in a variety of configurations, had their day.

The supersession of metallic wire and tape for most uses was inevitable because of their inherent limitations. They tend to kink and break and, except when made of stainless steel, rust. Metal wire twists so that the arc contacted on the circumference by the recording head is not necessarily the exact arc encountered by the reproduce head. All steel or metallic media are hard to edit, wire requiring some tricky knot tying and tape being almost impossible to splice.

Paper-based tape with ferromagnetic oxide particles dispersed in a fluid binder which dried on the paper did away with most of solid metal's disadvantages. And, for a time, it remained the preferred magnetic recording medium. But it, too, was soon to be replaced by oxide-coated plastic tape. Any paper has surface irregularities which are reflected in the oxide coating as hills and valleys which cause noise. Smoother plastic thus eliminates most such noise. Plastic is also less subject to tearing, does not deteriorate under dampness like paper, and does not limit tape speed.

Another German, Dr Kurt Stille, who had been working in the field since the

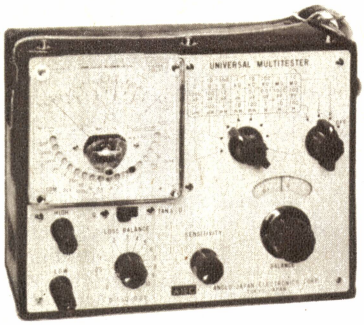


Above: One of the first magnetic recorders. A drawing from an early patent application by Poulsen, dated Nov. 13, 1900.

Right: By comparison, a modern high performance stereo tape recorder loaded with pre-recorded tape (Ampex picture).

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MODEL "UNITER F"

DIMENSIONS 9cm x 20cm x 15cm, 51b

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  Accuracy ±1%, ±0.5% of the full scale.
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  .01 ohm—11 M-ohm, 8 ranges.
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- Q and D 0.1—12 ±10%, ±0.1%.

POWER SUPP:
Battery operated.

BRIDGE SOURCE:
Internal Oscillator 1Kc/s.

MULTIMETER RANGES:

DC VOLTAGE:

0-2.5 volts)
0-10 volts)
0-50 volts)—20,000 ohms per volt
0-250 volts)
0-1000 volts)

AC VOLTAGE:

0-2.5 volts)
0-10 volts)
0-50 volts)—8,000 ohms per volt
0-250 volts)
0-1000 volts)

DC CURRENT:

0-50 microamperes)—250 millivolt
0-0.5 milliamperes)
0-5 milliamperes)—150 millivolts
0-50 milliamperes)
0-250 millamperes)

DC RESISTANCE:

Range —RX1, RX10, RX100, 50 Mohm.
Midscale —74-ohm, 740-ohm, 7.4k-ohm, 434k-ohm.
Minimum —1-ohm, 10-ohm, 100-ohm, 10k-ohm.
Maximum —10k-ohm, 100k-ohm, 1 Megohm, 50 Megohm
|| ——20ma, 2ma, 0.2ma.

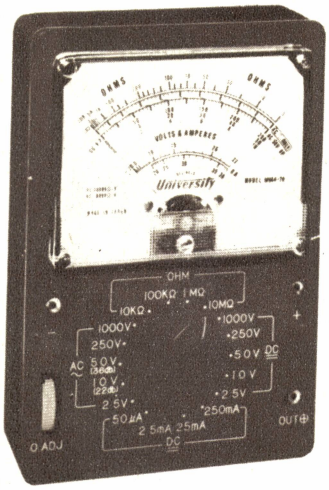
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ALLOWANCES:

DC voltage: ± 3% at full scale deflection.
AC voltage: ± 4% at F.S.D.
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ums of the early twenties. Its rebirth,
t only in Germany but throughout
irope, can be traced to the Telegraphie
tent Syndikat which Stille organised.
ie syndicate's purpose was the acquisi-
n of patents on magnetic recording
iich, in turn, it allowed manufacturers
use on a royalty arrangement. Pur-
ased patents plus those which Stille
mself owned gave the Syndikat a pow-
ful position in the industry. Many mod-
n tape drive systems incorporate his
provements. Even more indicative of
e range of his influence and interest is
s 1929 statement concerning his Berlin
oratory: ". . . research work in pro-
ess . . . includes the electromagnetic
ing and reproducing of optical signs on
el tape as a substitute for television."

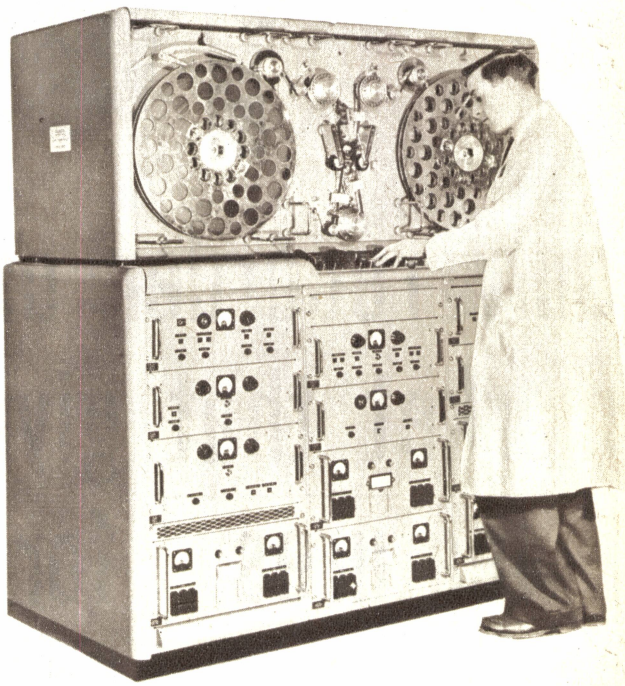
So it was that the Syndikat licensed
uis Blattner to build its steel tape, en-
tainment-type recording equipment in
latter twenties. The resultant Blattner-
one was used by the Blattner Color
d Sound Studios, England, in an at-
npt to synchronise voices and music
ptured on a steel ribbon with the mov-
pictures produced by the studio. But
ording for the "talkies" gave Blat-

Farben and the German Electrical Corporation formed the famous Magnetophon Company which marketed a recorder using a coated oxide film on paper late in 1936. It couldn't compare with the better wire machines, but operating costs were only about one-seventh those of wire instruments.

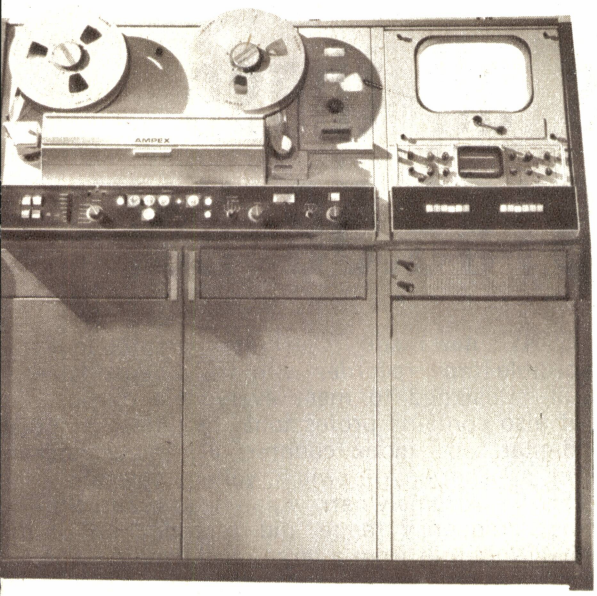
Eventually, the Farben people triumphed. Soon after Hitler had Germany under his heel, the coated-paper Magnetophon was leaving the best wire recorders far behind for most applications. So good was it that the Third Reich used the first commercial model equipped with AC biasing for propaganda broadcasts.

and Weber, also evolved an improved version of AC biasing in 1941. Their advanced Magnetophon, using plastic-backed coated tape, was brought to the U.S. after the cessation of hostilities. Some specifications on the unit are interesting. Tape speed was 22.1 ips with a bias frequency of 80-100KHz and a frequency response within 1dB from 25 to 10,000 hertz. Field models were either spring- or battery-driven.

An American engineer, Jack Mullin, brought two of the Magnetophons to San Francisco. He made some improvements and demonstrated the units before local IRE groups, first in San Francisco



Right: One of the first video tape recorders, "VERA," developed by the B.B.C. It used a narrow tape running at high speed.



Left: One of the latest video tape recorders, the Ampex VR-2000. It can record colour TV signals and produce top quality third generation copies.

er the same headaches De Forest had
t in similar attempts with wire back
1913. Noise was still too great and
nchronising sound with move-
nt nearly impossible. Further, the large
nount of metal tape required for a full
gth feature made reels inconveniently
ge.

However, the Blattnerphone found a
e in radio for quality rebroadcasting
er it was first tried for this purpose
the B.B.C. in airing the 1932 New
ar's message of King George V.

Blattners' organisation did other basic
rk on recording phone conversations,
veloping dictating machines, collecting
dence, and employing recording as a
ching tool.

Generally, Germany led the world in
vancing the art during the fourth de-
le of this century. For example, chem-
of the huge I. G. Farben organisa-
n doggedly kept trying to come up
h a coated paper tape based on the
ents mentioned earlier and which
uld work as well as steel. They were
successful until the late thirties. In fact,

The New British Broadcasting System, one of Herr Goebbel's lie mills, went on the air with this machine from several European cities on February 25, 1940. In trying to convince the British populace that Germany and England shared a common cause, the announcer employed a British accent and the programs opened and closed with "God Save The King." The British, of course, were far from convinced.

Mostly because of the war, the very late thirties and early forties saw increased work on both machines and recording media in many countries. Wire remained the preferred medium in the United States throughout the war. Among other American patents for improving this type of instrument was one granted in 1941 to Marvin Camras of the Armour Research Foundation for improved AC biasing. Camras, who made major contributions to the art in the postwar years, used his principle in a wire recorder developed for, and used by, the U.S. Armed Forces.

Two German scientists, Braunmuhl

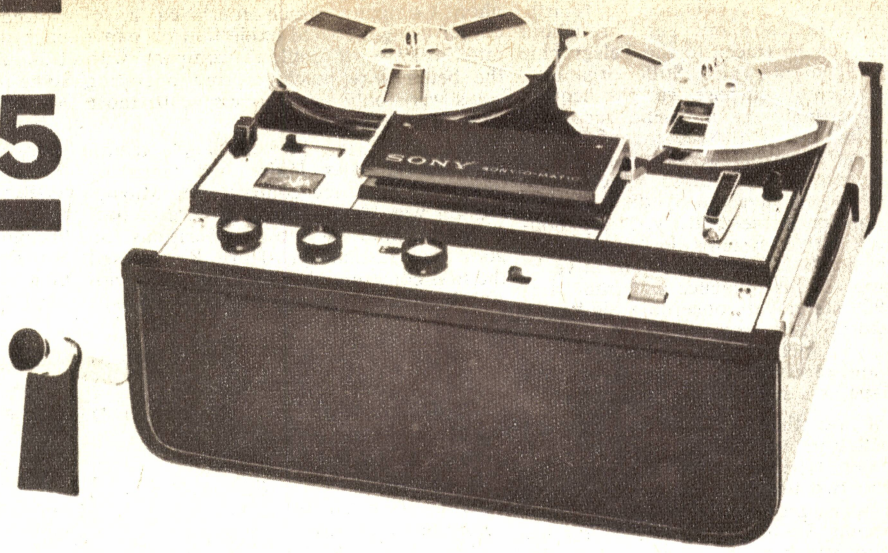
in July of 1946, later in Los Angeles in October. The Ampex Electric Company of San Carlos, California, was making electric motors for the Navy's airborne radar, but looking around for a peacetime product. Learning of Mullin's San Francisco demonstration, Ampex started designing an improved magnetic recorder using the Magnetophon's basic principles.

Tape's first home in the U.S.A. was in the Hollywood studios of the American Broadcasting Company where each Wednesday night Ken Carpenter would welcome listeners "to Philco Radio Time with the Modernairs, Peggy Lee, John Scott Trotter and his Orchestra, and starring Bing Crosby." The time was the late forties, radio's last magnificent years. The networks and sponsors went to great lengths to produce flawless shows, so Crosby's ran for more than an hour in the studio, then was laboriously edited down to a half-hour—sort of The Best of Crosby—for broadcast.

When the original program was recorded on discs, editing was a week-long job. Once a transcription was started, it couldn't be stopped. Any sound effects, voice transitions, commercials and additional music had to be dubbed on to the final disc with frustrating precision. Often as many as five consecutive dubbings were made, with noticeable deterioration of the sound in each one.

Crosby, interested in improving the fidelity of his broadcasts, heard of Jack Mullin's Los Angeles IRE demonstration

SONY TC-105



only recorder on the Australian market that gives all these features for $199.50 list

Features ■ Four-track monophonic — 12 hours of recording and playback ■ Reliable all-transistor circuit using Silicon transistors ■ 3 speeds ■ Automatic recording volume control "SONY-O-MATIC" ■ Wide, smooth frequency response and rich output ■ Easy and quick tape loading with "retractamatic" pinch roller and self-threading "SONY-O-MATIC" reel ■ Speaker monitoring and public address facilities ■ Automatic shut-off, instant stop lever with locking facility, digital tape index counter, speaker on/off switch, tone control, voltage selector, professional level meter, etc.

Model TC-105 SONY's new model TC-105 is a versatile four-trac monophonic portable tape recorder with truly dependable a transistor circuit. Designed to meet everyone's purpose an requirements, it also contains professional facilities: 3 speed tone control, digital tape index counter, VU meter, lockab instant-stop lever, speaker on/off switch, voltage selector, 7-inc reel capacity, etc. Its extremely narrow gap head assures precis recording in wide frequency range and reproduction of hig fidelity with rich 4 W. output from a large, oval dynamic speake

SPECIFICATIONS

Power requirement:	100, 110, 117, 125, 220 or 240 V., 50/60 c.p.s. 45 W.
Tape speeds:	Instantaneous selection 7½, 3¾ or 1⅞ i.p.s. (19, 9.5 or 4.75 cm/s.)
Tracks:	4 tracks, monophonic
Recording Time: (With 1800'/550 m. tape)	45 minutes per track, 3 hours in total at 7½ i.p.s. 1.5 hours per track, 6 hours in total at 3¾ i.p.s. 3 hours per track, 12 hours in total at 1⅞ i.p.s.
Reels:	7" (18 cm.) or smaller
Frequency response:	40-18,000 c.p.s. at 7½ i.p.s. 40-13,000 c.p.s. at 3¾ i.p.s. 50-6,000 c.p.s. at 1⅞ i.p.s.
Flutter and wow:	Less than 0.17% at 7½ i.p.s. Less than 0.3% at 3¾ i.p.s. Less than 0.4% at 1⅞ i.p.s.
Record/Playback head:	In-line quarter track
Erase head:	In-line quarter track
Inputs:	Low impedance microphone (1) High impedance auxiliary input (1)
Outputs:	8 ohm external speaker output (1) High impedance monitor jack (1)
Integrated record/ playback connector:	1
Speaker:	4 x 6" (10 x 15 cm.) PM dynamic
Power output:	Max. 4 W.
Transistors:	2SC402 (4), 2SB381 (1), 2SB383 (1), 2SD28 (2)
Diodes:	FRIU (1) IT22 (1) 5G-D (2)
Dimensions:	14¾ (w.) x 7¼ (h.) x 13⅜" (d.) (37.5 x 18.5 x 34.0 cm.)
Weight:	21 lbs. (9.5 kgs.)
Accessories:	SONY dynamic microphone 5" self-threading reel Pre-recorded 5" reel demonstration tap Earphone Connection cord Head cleaning ribbon Splicing tape
Optional accessories:	Telephone pick-up, TP-4S Microphon mixer, MX-600

SONY

Distributors: Jacoby, Mitchell & Co. Pty. Ltd., Sydney & Melbourne.

To: Jacoby Mitchell & Co. Pty. Ltd. 469-475 Kent St., Sydne

Send me information on Sony Tape Recorders & name of nearest Sony retail

NAME.....

ADDRESS.....

.....

E

ıd asked to try the recorders under roadcast transcription conditions. Mr Tullin's improved Magnetophon was ıed to record an entire show, but a and-by transcription disc was also made ıst in case. The disc was never used. he tape-recorded Philco Hour went out ith a crispness and clarity unheard of ı radio circles.

The delighted Crosby, demanding more these miracle machines, learned of mpex's plan to sell a professional re- ırder and asked to see their product. he demonstration consisted of playing ıck tapes recorded on the German lagnetophons, and was a tremendous ıccess. Crosby financed the production the first twenty-four units and placed me of them in the ABC studios, then ımediately made arrangements to have s company, Bing Crosby Enterprises, c., become Ampex's first sales distri- ıtor.

The recorders cost $4,000 apiece, less an the equipment necessary to make sc transcriptions. And whereas a 16- ch transcription disc ran about $8 for half-hour show, the equivalent mag- tic tape cost only $4.50. The job of ndering the Philco show became enor- ously simpler. The plastic tape could be opped and started at will; it could be t, spliced, dubbed, and re-recorded ithout affecting the quality of the final sult. The program director found he uld lift a sequence from one show here for some reason it didn't fit and op it into another show weeks later. ll of this could be done so quickly that became possible to produce several ows in one week — giving everyone rest.

The remaining recorders were placed key network stations in the four U.S. me zones so that the "broadcasts at a ore convenient time" would retain the ve quality of the original tape.

Thanks to the ingenuity of its first stomers who immediately discovered ıd exploited many of tape's unique tal- ıts, magnetic recording attracted the tention of almost everyone who needed store sounds. Soon broadcasters had veral brands of recorders to choose om.

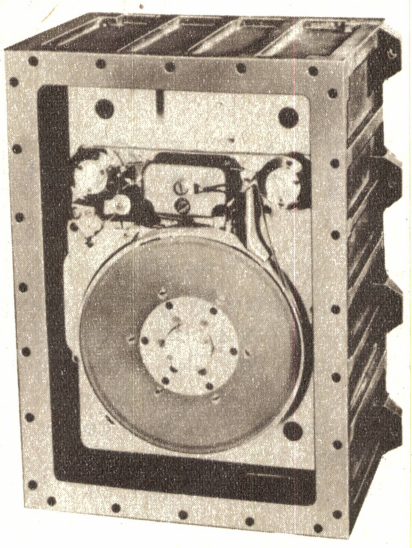
Tape's second test came from Ameri- ın record manufacturers. In 1946, all e major record manufacturers had arted making their master recordings ı magnetic tape, but the reproduction ıpabilities of the finished records and omestic phonographs fell far short the quality of the master tapes. Then ith little warning, Columbia released its rst LP Microgroove recordings perfected Peter Goldmark with the aid of mag- tic tape. That was in the spring of 48. Manufacturers started building tter reproduction equipment, people scovered what was on these new re- ordings, and within two years the high delity surge was on. The new entertain- ent medium was eventually to push agnetic tape into the home, then on to en more demanding applications.

At first, relatively few tape recorders ent on sale for home use. The first in- ıstry outside of radio, motion pic- res and records to really embrace the w storage medium was the people who sted aircraft and were later to test issiles. Until about 1950, the instru- entation of experimental aircraft con- sted of conventional recording oscillos- pes and cameras in the plane's nose, ıd a note pad strapped to the pilot's igh.

As airspeeds neared Mach I, it became fatally obvious that these instruments and methods were inadequate. Pilots were dying and planes under test were being unnecessarily lost because the pilot was not learning about his ship's stress reactions rapidly enough.

Better and faster measurement of dynamic inflight conditions — and almost instant notification of the pilot as to these conditions — was the solution. So flight-test engineers took the recording instruments out of the ship and put them on the ground where they could instantaneously record in-plane measurements by radio. Equally important, the engineers monitoring the recording equipment could let the pilot know by radio of any critical conditions cropping up in his craft in time for him to take corrective steps.

As the use of telemetry (the word



Magnetic recording in outer space. This recorder made a 350 million mile journey to Mars in a Mariner space craft. It recorded, for retransmission to Earth, the now historic pictures of the Martian landscape.

adopted for this remote measuring technique) increased and data-acquisition techniques improved, a better recording medium with greater versatility and bandwidth was needed. The flight-test industry turned to the tape recorder manufacturers who quickly revamped broadcast recorders, extending their capabilities to include such items as 100KHz frequency response.

The upper frequency limit of instrumentation recorders remained at about 100KHz until 1956 when the world's first practical multi-megacycle recorder was demonstrated at the NAB show in Chicago. This was Ampex's VR-1000 Videotape recorder. With a bandwidth of over four megahertz the television recorder was an immediate success. The new machine employed a revolutionary approach — a rotating head assembly (four heads mounted on a disc) which recorded across the tape at a head-to-tape velocity of almost 2000 inches-per-second while the tape moved from reel to reel at only 15 inches-per-second. This design represented the first significant change in the basic approach to magnetic recording since the discovery of AC bias.

As a data recorder, however, the Videotape had some definite limitations. The top end of its response curve dutifully rolled off a la NAB television standards. Transients (spurious signals of a short and sometimes random nature) caused when electronics switched from head to head, could be delayed until the horizontal blanking of a te.evision picture. In continuous data recording, however, where there was no place to hide them, these transgressors were painfully apparent.

Because of these shortcomings the frequency bandwidth of instrumentation recorders remained under one MHz for almost four years after the debut of TV recording. Then in 1959 the limit was moved up from 100 to 250KHz when a significant breakthrough in magnetic head manufacturing greatly increased the effectiveness of the standard recording head used in conventional longitudinal-recording methods. Recording manufacturers got the idea fast, and the bandwidth barier rapidly leap-frogged to 500KHz, then one MHz.

While these standard-recording-method machines were vying for position, the first multi-megahertz recorders for instrumentation were offered for sale in 1960—free of television response curves and built to military specifications. These were the Ampex AR-300 and FR-700. The new machines outdid the Videotape instrument, recording two tracks of data with a response of from 10 hertz to over four megahertz. Additionally, they offered the instrumentation user an unexpected and very welcome bonus: Tremendously improved time-base stability wherein maximum time errors of 20 millimicroseconds or less have already been achieved in laboratory models.

The advent of computers provided another opportunity for tape to show what it could do. The problem was to provide a memory needed in assorted capacities to perform the programming, long and short term storage, and data transfer from computer to readout. Magnetic recording, ultimately in three different forms, was the answer— magnetic cores for limited-quantity instant-access storage, magnetic drums for medium-quantity quick-access storage, and magnetic tape for large - quantity medium-speed access storage as well as extremely rapid data output, input and transfer.

Tape's newest markets are medicine and education. Both video and audio recorders are now aids in training production workers and teaching in all grade levels. Much has been written about the project at Hagerstown, Maryland, where a school was designed and built around electronic teaching aids, and about the Midwest Project of Purdue University. This latter involves Videotape-equipped planes circling at 23,000 feet while transmitting educational TV programming to six States at one time.

It is perhaps too early to evaluate such projects as a revolution in teaching or to determine such fundamental precepts as the optimum ratio of electronic to conventional teaching time. But it is already apparent that devices such as Videotape are helping to relieve a most urgent problem, the shortage of qualified teachers.

As for the future, research in the laboratories of tape recorder manufacturers is producing refinements in present machines and techniques, and promises to uncover completely new methods of storing information. A report

(Continued on page 132)



Colour TV demonstration at the BBC's Lime Grove Studios, London.

BRITAIN PREPARES FOR COLOUR

In about six months from now, Britain will begin regular transmission of colour television, bringing a rosy glow of relief from the dreary winter months — to those able to afford the extra expense of the colour television set. This initiation of Britain's colour service culminates the bitter and prolonged battle which has been going on in Europe over rival colour TV systems for several years.

by Laurence Marks

The present plan is for half the total output of the British Broadcasting Corporation's Ultra High Frequency 625-line channel (BBC 2), which began black-and-white transmissions in 1963, to be in colour. When the service opens, later this year, it will be available to about 70 per cent of the population — or some 35 million people in the main industrial centres and parts of north Wales, east Scotland and Northern Ireland.

There are, broadly, four possible systems of transmitting colour pictures, all closely related members of the same technological family, and each with its own merits. They are N.T.S.C. (developed by the Americans and also now in use in Japan), SECAM III (developed by the French), SECAM IV (a Russian adaptation of the French system), and PAL (developed by the Germans).

It was obviously sensible to try to agree on a common system throughout Europe which would facilitate the exchange of programs by land-line or by satellite. The experience gained with black-and-white television, when America adopted the 525-line standard, France 819 and Britain 405 at different times or stages of development, indicated the need for such agreement, and it was hoped that international co-operation would be possible.

However, even if agreement were not reached, this was not a fatal handicap. So much progress has been made in the development of colour standards converters that difficulties arising from differences can be overcome. The problem these days is not so much what can be done, but how much it will cost to do it. In any case, international exchanges other than those showing topical events are not live but are recorded on film which are unaffected by international differences. So the only really important thing for Britain was to get a firm decision, for one system or another, from the Government.

Nevertheless, while the electronics industry waited to learn of future commitments in colour TV, the debate continued at conference after conference in one European city after another. Finally, at Oslo, in July 1961, six countries chose N.T.S.C. on 525 lines, two N.T.S.C. on 625 lines, 33 SECAM or SECAM III, 16 PAL, and four SECAM IV. So much for unity!

It is to the B.B.C.'s credit that, although its engineers slightly prefer N.T.S.C., it fell in with PAL to conform with the majority of west European countries.

What are the differences that this battle was fought over? N.T.S.C. gives good colour reproduction and compatibility. Compatibility is the ability of the system to provide a picture suitable for reception in black and white on a receiver not designed for colour reception. This feature is regarded as essential in a colour system, to cater for the millions who will not have colour receivers for many years ahead. Even if they cannot receive the programs in colour, they will at least be able to see the same progra in black and white.

Another advantage of N.T.S.C. is th of all the systems, it requires the simpl type of receiver — and therefore t cheapest to make and the least likely go wrong. Its main disadvantage is th it suffers from changes in colour valu due to phase shift of the chrominan (colour) subcarrier.

SECAM does not suffer from th defect, but is likely to be adversely affe ed by hilly terrain and long-distan transmission; it suffers more from t effects of noise; its compatible picture not quite so good, and shows a mo pronounced dot pattern in areas of stro colour.

PAL's great advantage is that it h extremely stable colour balance, but compatibility is not as good as N.T.S Both SECAM and PAL require a rath more complex receiver than N.T.S.C.

While all these differences exercise t mind of the engineering fraternity, a have been the subject of much acrimo ous discussion at numerous internatio conferences, they have little significan for the viewing public. The differences dot patterns, for example, would barely noticeable under average viewi conditions by a layman.

For better or for worse, Britain h now opted for PAL. The decision virtually irreversible, but is less mom tous than the decision to recommen television transmission after World W II, in 1947, with the 405 line, 50 fra standard with which B.B.C. televisi was commenced in 1936. Despite differ standards used in both countries, t B.B.C. plans to transmit programs live, colour, from the 1968 Olympics Mexico, and has begun a crash progra of research on standards converters this purpose.

British manufacturers say that t price range of the first colour receiv will be £250 to £300. However, it expected that the majority of people w rent colour receivers rather than buy o Already, seven out of 10 families Britain have rented black and white se

ıtal for a colour receiver will be be-
ɜen 30 and 35 shillings a week, roughly
ɜe times the rental of a black and
ite set.

Nobody in the television business
ıbts that the public will get value
money from the extra expenditure.
rd-bitten engineers, normally unim-
ssed by electronic "miracles," and
se producers positively glow with
thusiasm when they talk about colour.

Light entertainment is at the top of
ɔst producers' lists of programs which
ll benefit most by being televised in
lour. Ballet comes next. It has never
lly succeeded in black and white.
ɔokery is another subject which needs
our—as the lavish colour supplements
the British Sunday newspapers have
nonstrated. So, of course, is painting.

There is, however, a problem here.
ce many viewers will see transmis-
ns on black-and-white receivers, the
ɔgrams must still be enjoyable in
nochrome. Half an hour devoted to
colour values of contemporary art,
instance, would make pretty poor
wing in black and white.

The B.B.C. has already built up a
ɔpus of experience in handling colour
ring the experimental stages of de-
opment. It recognises the problems.
e of the mistakes in presenting drama,
instance, is the temptation to flood
screen with vivid colour.

"Some designers say: "Oh, colour.
ɛt's put a lot of it in'," says Mr Barry
aroyd, of the B.B.C. "What they
ould say is: 'Oh, colour. Let's take
me out.' The trick is to try to make
erything monochrome except what you
nt to stand out.

"This business of flooding the set with
lour is a terrible mistake. The idea
using colour to reflect the mood of a
ne hasn't begun to be explored yet,
en in the cinema.

"Colour," says Mr Learoyd, "is intensi-
d by being projected through the tube.
ɔu have to tone everything down
cause of this. A picture which has
nost no colour in it is much more
citing than one which has a lot of
lour." It is an old joke at the B.B.C.
at one of the first programs to be
nsmitted in colour will be The Black
d White Minstrel Show—a long-run-
g light entertainment series which has
ade imaginative use of black-and-white
s and costumes.

The most important new factor in
lour television, from the producers'
ɔint of view, is simply time. Lighting
s to be more precisely worked out.
ɔstumes and sets have to be matched
ɔre carefully. Last-minute changes re-
ire more thought.

So does make-up. Some skin-tones
eate problems for the cameramen. Mr
aroyd says that some red-headed
ople have skin with a blueish hue
hich becomes exaggerated on television.

Film inserts are another problem. Most
levision plays are recorded on video-
pe from a single continuous perform-
ce. Pre-filmed sequences are added
here the continuity makes this neces-
ry. The trouble is that the same object
ay not remain constant in colour in
e two different processes. Another of
e B.B.C.'s many contributions to the
evelopment of colour television is a
evice called a tri-stimulus colourometer
hich measures colour quickly and pre-
sely.

Yet another problem is cutting from
ne camera to another. Quick cuts from, say, a man standing against a bright red background to a woman standing against a vivid yellow background may dazzle and confuse the viewer. So the pace of cutting has to be gentler.

Even discussion programs, it is said, are more pleasing to watch in colour. The eye, it is argued, does not have to work so hard subconsciously interpreting monochrome images in terms of colour. However, in America, where colour television has been going for a decade, at least 10 per cent of transmissions on colour channels are still put out in black and white. Often, the percentage is higher.

The B.B.C. has a bank of programs ready for the new service. For the past two or three years, documentaries, travel programs, and State occasions have been filmed in colour. Training courses for producers, technicians and engineers are about to begin.

"We have learned the American lesson," says the B.B.C. "We have one absolute supreme principle: we are not going to transmit sub-standard colour pictures to the public. The Americans started before they were really ready. So, before we begin, studios and staff training must be 100 per cent efficient."

The industry expects to sell about 50,000 colour television receivers during the first 12 months of the new service. They will be slightly larger than black and white sets (25in tubes, instead of the 19in and 23in tubes now used) but will have only one extra knob—to control saturation. In colour parlance, a saturated colour is a pure colour with no white added. The opposite is a dilute colour, made paler by the addition of white. Thus, a pure red is a saturated colour, and pink is a dilute colour.

Obviously, it is impossible to judge absolute values of colour without standards to use as a reference, but it has become customary to use the human face as a norm when adjusting the saturation control. If the flesh tones lock right, then the other colours should have something approaching correct values.

The introduction of colour comes at a vital time for Britain's electronics industry. Sales of television sets, which reached more than 2¾ million in the peak year of 1959, dropped to just over 1¼ million in the year to 31/12/66—partly because more than four out of five families now possess sets, and partly because hire-purchase restrictions during the current economic crisis have reduced sales. The industry expects to be selling 250,000 colour sets a year by 1970, when the service will cover 90 per cent of the country.

But the real boom in colour television should result from a further Government decision about a fourth channel. Britain at present has three television networks, BBC-1, a Very High Frequency (VHF) 405-line channel; BBC-2, on which colour will make its debut; and the commercial television system on the VHF 405-line standard. The B.B.C. networks are financed from licence fees. The commercial system is financed from advertisements.

For some time, the commercial channel operators have been agitating for permission to operate a 625-line system, with colour programs, to enable them to compete on an equitable basis with the B.B.C. 625-line and colour channel. Now the British Government has given its permission, and the commercial channel operators are going ahead with their plans for their own 625-line and colour service.

A recent report in "Wireless World" says: "A single standard for British television plus two more services in colour is what the Postmaster General has now authorised, after recommendations by his Television Advisory Committee. By the end of 1969, BBC-1 and I.T.V. will be transmitting their programs on 625 lines from UHF stations in London, the Midlands and the North, and a substantial proportion of these programs will be in colour.

"The present BBC-1 and ITV 405-line VHF transmissions will continue for some years, so there is no prospect of existing 405-line only receivers becoming obsolete overnight. To achieve this, the BBC-1 and ITV programs which will originate from 625-line cameras, will be standards-converted down to 405 lines and transmitted on the VHF network—that is 'duplicated.'

"Eventually, when the UHF coverage is complete, the VHF television bands will be 're-engineered' to take 625-line transmissions and will be able to accommodate two national services."

The necessity for ITV stations to re-equip their transmitting stations and studios for the new services, will require heavy capital expenditure, However, a fourth channel, devoted to colour, will give a tremendous boost to an important industry and provide the additional impetus of competition to this exciting new development of the medium.

1967 WIMBLEDON ON COLOUR TELEVISION

Since this story was prepared, the B.B.C. has announced plans for a limited colour TV service to begin in July 1, to provide about five hours a week. The full service, with about 15 to 25 hours a week, will start on December 2.

The main aim of the early transmissions appears to be to allow manufacturers and retailers to demonstrate colour TV to the public, and thereby to stimulate interest in colour, so that when the full service begins, many people will have purchased or rented sets.

Colour sets are already coming off the production lines, and market research has shown that the demand for purchase and rental is expected to be greater than originally thought. The Government's decision to allow the commercial television service to broadcast colour programs is expected to stimulate public demand still further, since present indications are that, by the end of 1969, some 100 hours per week of colour TV will be available to the viewing public.

The B.B.C. plans to make maximum impact with its first week of colour. The opening date announced for the new service coincides with the second week of the Wimbledon championships, and the B.B.C. will present about 40 hours of colour TV from the Centre Court. Thereafter, only about five hours a week will be telecast until the full service begins on December 2.

Changeover to 30KHz Channel Separation by 196

All mobile radio systems operating in certain declared areas of Australia, at present licensed for 120KHz and 60KHz channel spacing, will be required to conform to regulations fixing channel spacing at 30KHz by 30/6/69. A recent announcement by the Postmaster-General, Mr Alan Hulme, setting this date, has aroused much comment and speculation among mobile radio users. The event which led up to this announcement, and the likely effect on the various classes of mobile radio users, are discussed in this article.

By Harry Tyrer

In his statement, the Postmaster-General said that the growing demand for VHF mobile radio services had put considerable pressure on the existing allocation of VHF channels. To solve this problem and to meet future demands, the Post Office was requiring land and Harbour mobile radio radiotelephone services which had not already done so to change their channel separations from 60KHz and 120KHz by the date specified.

The statement continues: "In 30KHz channelling areas, VHF mobile radiotelephone services (excluding the International Maritime Mobile VHF Radiotelephone Service and the Departmental Radiotelephone Subscriber's Service) operating within the frequency bands 70-85MHz and 156-174MHz shall comply with the following arrangements: (i) All base station transmitter/receivers (both amplitude and frequency modulated) employed in a base station installation shall be of a type complying with the relative Post Office Specifications and approved for 30KHz operation, and shall be operated in accordance with the terms of that Specification. (ii) All frequency modulated mobile transmitters shall be adjusted to function with a maximum deviation of ± 5KHz."

Some 1,400 base stations and 14,000 mobile units, operating mainly in the city areas of Australia, will be affected by the new requirements. These include many private organisations, such as taxis, carriers, tow truck operators, doctors and building contractors. However, far more are used by public utilities (including electricity and gas authorities), ambulance services, police departments, and fire brigades.

Some emphasis has been given in newspaper reports to the fact that existing users of equipment designed for 120 or 60KHz channel spacing will have to replace these units at their own expense, without receiving compensation. While it is true the Post Office will pay no compensation, it should be borne in mind that the users concerned have been given ample notice of the department's intentions, and many are operating equipment which is reaching the end of its useful life.

In fact, as long ago as 1962 the P.M.G.'s Department notified mobile radio users and manufacturers that a change to these specifications would have to come about some time in the future and that this fact should be given full consideration when buying or designing new equipment. The latest announcement has simply set a firm date for the changeover.

In theory, any base station equipment capable of being modified to comply fully with the relevant Post Office specification could be used under the new arrangements, after testing and acceptance by the Post Office Radio Branch. However, in the majority of cases, and particularly where equipment has been in use prior to 1962, base station equipment will have to be replaced by more modern units designed to comply with the 30KHz specification.

Most equipment supplied during and after 1962 should be of a type which can be modified without difficulty since manufacturers were aware of the eventual changeover, and accordingly designed their equipment with conversion in mind. In general, conversion will involve simply installing new narrow band IF filters in place of the existing units, and adjusting the deviation to ±5KHz.

The only change required in the case of mobiles will be adjustment of the deviation. This will allow all mobiles to continue in operation until the end of their economic life.

While older equipment designed for 120KHz channel spacing will have virtually no value, since it is unlikely that it would be licensed by the P.M.G. for other applications, some older 60KHz equipment could still have some commercial value, since rural areas outside the prescribed 30KHz areas will still have equipment operating with 60KHz channel spacing.

The new regulations will pose a special problem to some State-wide services, such as those operated by the N.S.W. Police which at present operates on 60KHz channel spacing. When the 30KHz channel spacing becomes effective in 1969, part of the service will still be able to operate on 60KHz channel spacing, while those base stations located within the 30KHz areas, and the mobiles associated with them, will be required to conform to the regulations.

One answer which has been suggested to this problem, and it appears to be the only feasible one at present, is for the mobiles located in 60KHz areas to operate with a reduced deviation of about 7 to 8KHz. This will give them a satisfactory degree of compatibility with base stations operating on both specifications, although some sacrifice in terms of performance will be unavoidable.

The announcement by the P.M.G. is the culmination of a chain of events which began shortly after the war, with the introduction of FM mobile radio into Australia.

Immediately after the war, A.W.A commenced tests on VHF communications, and after exhaustive tests decided that FM offered advantages over AM for this application. The compar therefore decided to concentrate exclu ively on FM in this field. Tests we conducted in the 40-60MHz band, the absence of any official indication to the frequencies which eventually wou be allocated for mobile use.

Subsequently, the 70-85MHz ar 156-174MHz bands were allocated, the equipment was further developed f these frequencies. A channel spacing 240KHz was agreed on but, at this stag there was no real frequency plan d veloped by the P.M.G.'s department relation to the channel spacing em ployed. Frequency allocations were mad on an ad hoc basis.

Some of the first FM installatio used a base station of 250W RF outp in conjunction with an aerial showing gain of 6dB, giving an effective radiate power of 1KW. Subsequently the pow of transmitters which could be licence for mobile use was reduced to 50W f all but some special cases, and latter further restrictions on the gain of aeria used have been introduced.

It was not until 1962, when th P.M.G.'s Department published its "spec fications for Radio Equipment Employe in Privately Operated Land and Harbou Mobile Radio Services," that there e isted a complete official specification f mobile radio services. Prior to this, th regulations covered only channel spacin and deviation requirements, and some r striction on effective radiated power, a though the latter was not applicable t all installations but was decided on a individual basis.

Having decided on the channel spac ing to be used, the question of deviatio had next to be resolved. In FM opera tion, deviation corresponds to amplitud in AM systems. Just as in AM system too great a level of modulation will caus interference with adjacent channels, s excessive deviation in FM will caus interference to operators on either sid of the nominal frequency used by station. A deviation of ±15KHz wa regarded as the best arrangement fo optimum signal to noise ratio in th operation of a mobile system, and thi could be accommodated comfortabl within the 240KHz allowed for eac system, without risk of interference t adjacent channels.

If this state of affairs could have bee allowed to continue, everybody — user manufacturers and the P.M.G.'s Depar ment — would have been happy. How ever, as long ago as 1952 it becam apparent that the growing popularit of mobile radio, and subsequent reques

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This 12" woofer is the model used in the Kardioid enclosure; total flux is 250,000 maxwells due to use of a new ceramic ring magnet of "Magnadur 2". Frequency response is 30-5000 Hz. and the recommended crossover frequency is 2500 Hz. The voice coil is embedded in polyester resin — transient peaks of 100 watts will not damage the assembly. Normal power rating is 35 watts R.M.S. **Encel price** **$48.50**



A NEW HIGH QUALITY TONE ARM AT A LOW, LOW PRICE!

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With four independent pre-amplifiers, complete mono and stereo monitoring facilities are provided on the new TRUVOX PD-102 and PD-104. Twin VU meters. Mixing buttons for sound on sound. Separate solid state record and playback amplifiers. Three motors, including papst drive motor, three speeds. Sensitivities match any ancillary equipment of any make. Frequency response — 30-17,000 Hz at 7½ i.p.s. — plus or minus 2 db. Signal to noise is better than 50 db. Input sens. are . . . Microphone — 1 mV at 50k ohms, Radio Tuner or Pick-up — 50 mV at 100k ohms.

A recent British technical review says . . . "At last we have an all British recorder which equals the best Continental and Scandinavian products in accurate equalisation and wide frequency response, and which at the same time gives that subtle subjective satisfaction and impression of smoothness and effortless dynamic range which is so difficult to define and measure."

Write for complete specifications and copies of reviews; both the PD 102 (2 track) and PD 104 (4 track) are now in stock PD102 **$246** PD104 **$236**

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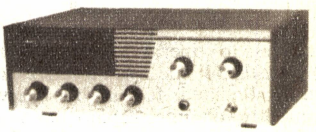


NEW "SONICS" STEREO HEADSETS . . . MODEL HS-303

Suitable for mono or stereo reproduction, "Sonics" headphones have a frequency response of 30-15,000 Hz. 8 ohm impedance and levels of up to 0.5 watts may be used. Foam rubber earpads provide comfort and reduce outside noise. Ideal for all high fidelity personalised listening. Outstanding value at **$11.50**

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Power output is 35 watts R.M.S. with parallel push-pull 6BQ5's, frequency response is 30-15,000 Hz. plus or minus 2 dB. Three inputs-two crystal or dynamic microphones at 5 mV. and an auxiliary input for crystal or ceramic pick-ups, tape recorder or tuner at 300 mV. Output impedance includes 8, 16 and 250 ohms as well as a 70V line. Valve complement: 1 x 12AX7, 1 x 6AV6, 1 x 6AQ8, 4 x 6BQ5. Encel price is only **$68.50**

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Few products have been received by the purchasing public quite as enthusiastically as MICRO tone arms and cartridges . . . performance easily justifies the use of the best available amplifiers and speaker systems. Finish is impeccable — MICRO precision engineering is without equal in this price category. All arms accept standard Ortofon and SME shells; vertical and lateral friction is estimated at less than 20 milligrams. Model MA 88 (16") costs **$35.50** — MA 77 (14") and MA 77S (12") are Encel priced at **$29.50.** Read the reviews in your April '66 copy of "Electronics Australia" . . . and in "Hi-Fi News", February, 1966. Ask for copies of these enthusiastic reports. From **$29.50**

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Now the well known Micro Model SC301 Ceramic Stereo Cartridge with diamond stylus is available for only **$6.90.** Frequency response is 20-15,000 Hz. plus or minus 3 dB Tracking angle is 15°. This popular stereo cartridge is A1 value at **$6.90**

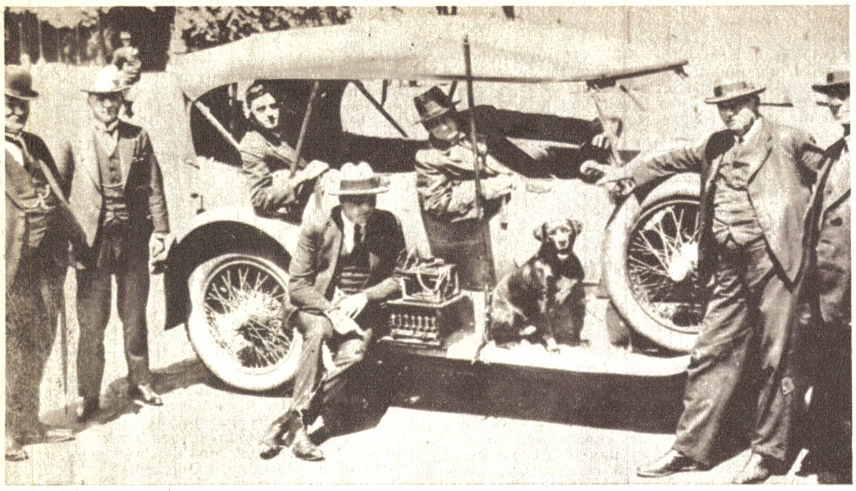
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FIRST RADIO-EQUIPPED CAR



Believed to be the first radio-equipped car in Australia, this police car was operated by the Victorian Police in Melbourne in 1922. Since it provided only one-way CW operation, its scope was rather limited, but it did provide a means of keeping the patrol car in touch with police headquarters and directing it to the scene of reported crimes. Radio equipment was supplied by A.W.A.

for licences to operate mobile systems, would quickly fill the available frequency spectrum allocated for mobile services. Consequently, channel separation was reduced from 240KHz, first to 120KHz and then to 60KHz for all new services licensed, although existing users were allowed to continue using their equipment without modification after each change in the regulations.

Even with the 60KHz channel spacing, users of FM equipment were still allowed a deviation of ±15KHz, since there was still ample bandwidth to guard against adjacent channel interference. It should be noted that reducing the separation from 120KHz to 60 KHz had virtually no effect on signal to noise ratio. This parameter is much more affected by deviation, and since this remained at ±15KHz, mobile radio users operating under the revised conditions did not suffer greatly in terms of equipment performance.

Unfortunately for all concerned, the matter did not rest there. In 1961, the Radio Frequency Allocations Review Committee, under the chairmanship of Sir Leonard Huxley, made its report to the Postmaster-General. Included in this report was a recommendation that, in certain critical areas, where demand for frequencies to operate mobile systems was heaviest, channel spacing be reduced to 30KHz, and to prevent adjacent channel interference, deviation be reduced to ±5KHz.

It was recognised that some loss in signal to noise performance would result for those operating equipment under the new standards, but this was regarded as inevitable. In any case, overseas experience had shown that equipment would still give satisfactory performance under the conditions proposed. Regulations to implement the committee's recommendations were drafted shortly after, and were approved by the Postmaster-General.

At the time these regulations came into effect, the Post Office initiated its "type approval" tests. This meant that it would licence equipment only of a type which had been submitted for testing to the Post Office Radio Branch in order to determine that the equipment did in fact fully conform to the Post Office specifications for 30KHz separation equipment. Once a piece of equipment had been type approved, the manufacturer was not allowed to make any modifications to production equipment without the approval of the Post Office, and any such modifications would usually involve new type approval tests.

With the adoption of the Huxley Committee's recommendations, the Post Office granted new licences only for equipment type approved for eventual operation on 30KHz separation and, in the case of FM, with ±5KHz deviation in the areas concerned. Users outside these areas could still be granted licences to operate equipment on 60KHz channel spacing with ±15KHz deviation.

The new regulations did not have any significant effect on the operation of AM equipment, since this type of equipment does not require the bandwidth necessary for good FM operation. However, the imposition of 5KHz deviation on the operation of FM equipment gave rise to a degradation of about 10dB in signal to noise.

A further degradation in performance arises from the phenomenon known as "pulse stretching" which is common to all tuned circuits, and is simply the tendency for any tuned circuit to "ring," or continue oscillating after a noise impulse which excited it has ceased. It becomes worse as the "Q" of the tuned circuit increases and becomes a serious problem where high "Q" circuits are used to provide narrow band IF systems. It is further aggravated by the inclusion of very high "Q" IF filters, as is generally necessary to meet the new separation standards.

Not unnaturally, the existence of the problem has led to attempts to overcome it, and noise cancelling circuits have been developed. These separate the noise, amplify and rectify it and feed it to audio stage to suppress the audio wl noise pulses are present. Unfortunat it proved that, while effective in presence of random noise, these circ defeat their own purpose in areas of s tained noise, such as would be encou ered in city traffic. Under these con tions, suppression of the incoming spe carrier reaches the level where speech unintelligible, and a disabling switch the noise supression circuit must be p vided. This enables the operator to ma the best use of the equipment accord to prevailing conditions, but it is s true that, in the circumstances where noise suppression is most needed, it ineffective.

Car manufacturers have attempted alleviate the problem of noise initia in car ignition systems by installing h resistance wiring harnesses. Howev there is no legal requirement on the p of the user in this direction, and in f many keen motorists have been kno to remove the high resistance harn and replace it with the low resista type, since they imagine they get bet performance thereby.

This then is the situation as it ex at present. The question is, "Where we go from here?" There has been a s gestion that channel spacing may eve ually have to be reduced to 15KHz meet future demands for frequencies. this were to eventuate, with an ine able further reduction in deviation, present superiority of FM for mob radio would have largely disappear any difference in performance being o marginal, regardless of progress in sign of receivers.

At present, manufacturers of FM s tems claim that, even with the pres restriction, FM is still markedly super to AM in terms of signal to noise, a point out that latest licensing figu show the great majority of new users still choosing FM in preference to A even though some AM equipment has price advantage.

Another possibility which has be considered is the use of single side-ba (SSB) for mobile communications. Wh this might appear to have definite adv tages in terms of reduced channel sp ing, manufacturers feel that at present state of the art, the attenda difficulties would appear to be too gr for any success in this direction.

The extreme degree of stability quired for successful SSB mobile op ation would necessitate the inclusion crystal ovens in the circuitry. The would impose a continual drain on t vehicle's battery, and this requirement incompatible with the need for a mob set to draw a minimum of current.

More promising would appear to the use of the UHF band for mob communication. Manufacturers such A.W.A. have already designed equi ment suitable for these frequencies, b at present this has not proved attracti to users of mobile radio for seve reasons.

Firstly, there is the question of creased capital cost. Since the equipme is not made in quantity, at present, cannot be made as economically as t VHF equipment. At present a user co templating the purchase of UHF equi ment must be prepared to pay arou 50 per cent more than similar equipme designed for VHF.

Because of this the 470-520MHz ba

(Continued on page p. 158)

AWA

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REVOX G36

SEMI-PROFESSIONAL PORTABLE TAPE RECORDER

FEATURES

- Mono/stereo operation.
- Tape deck with 3 PABST Outer-Rotor-Motors.
- 6/12 Pole Hysteresis-Synchronous-Motor for two tape speeds.
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- Built-in mixing facilities.
- Separate record and replay amplifiers for both channels.
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- Remote Control facility.

TECHNICAL SPECIFICATIONS
These typical data apply to the 2-track as well as the 4-track recorder.

TAPE SPEED:
3¾ and 7½ ips.

TAPE SPEED DEVIATION:
≦ 0.3% from nominal

WOW AND FLUTTER:
≦ ± 0.1%, peak reading weighted (DIN 45507)

FREQUENCY RESPONSE:
40-18,000 Hz at 7½ ips
40-12,000 Hz at 3¾ ips
+ 2 — 3db

INPUTS PER CHANNEL:
1. Microphone 3mV, Ri = 0.5MΩ max. 600mV
2. Radio 50mV, Ri = 1.0MΩ max. 10V
3. Diode 3-50mV, Ri = 47.0kΩ adjustable

POWER LINE VOLTAGE:
110, 125, 145, 220 and 240V, 50Hz.

HARMONIC DISTORTION (OVERALL):
≦ 3% at peak recording level

SIGNAL TO NOISE RATIO UNWEIGHTED:
2-track recorder: 55db
4-track recorder: 52db
at peak record level with 3% harmonic distortion.

WEIGHT:
approx. 45 lbs.

CASE DIMENSIONS:
19 x 13½ x 12"

Manufactured by: Willi Studer—Switzerland

and distributed in Australia by
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This alone is enough to set Model 3000 apart from the ordinary stereo receiver, but there's more.

Power – 130 watts ±1 dB IHFM, RMS 48/48 ±1 dB, stereo RMS 45 watts × 2 ±1 dB. *Range* – 20 to 20,000 Hz IHFM, with a damping factor of 15. *Hum and Noise* – 70 dB below rated output. *Response* – ±1.5dB from 20 to 20,000 Hz. Plus features every bit as exciting: A fool-proof protection circuit with indicator. Automatic stereo switching with indicator. Versatile input impedance of 4 and 8 to 32 ohms. Four-way voltage selection.

Because of our low-level thinking, we feel Model 3000 is easily the highest-performing all-silicon AM/FM Multiplex Stereo Receiver you could own.

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Technical Review

ULTRASENSITIVE MICROMETER DEVELOPED

Distances as small as 10 micro-centimeters can be measured with a calculated accuracy of 10 parts per million with a simple, stable, contact-free instrument developed in the U.S.A. by the National Bureau of Standards.

This device, a field emission ultra-icrometer, operates in spaces as small s a few hundred angstroms without the eed for physical contact with the object eing measured. Calculations indicate iat the instrument can measure dis-ances of 10^{-8} to 10^{-6}cM with a cal-ulated reproducibility within one part 10^5 and with an accuracy limited nly by available calibration techniques.

The field emission ultramicrometer is asically an arrangement of field emis-on electrodes in a vacuum chamber. he electrodes are connected to a con-ant-current electrical circuit in such a ay that a precise voltmeter in the ectrical circuit indicates a voltage hich is directly related by a well-eveloped theory to the spacing between he electrodes.

The ultramicrometer promises to have a variety of uses: as a strain gauge to measure the deformation of structural materials; as a differential thermal expansion cell; as a contact-free delineator of surface profiles and contours; and as a means for measuring the diameters of balls and holes.

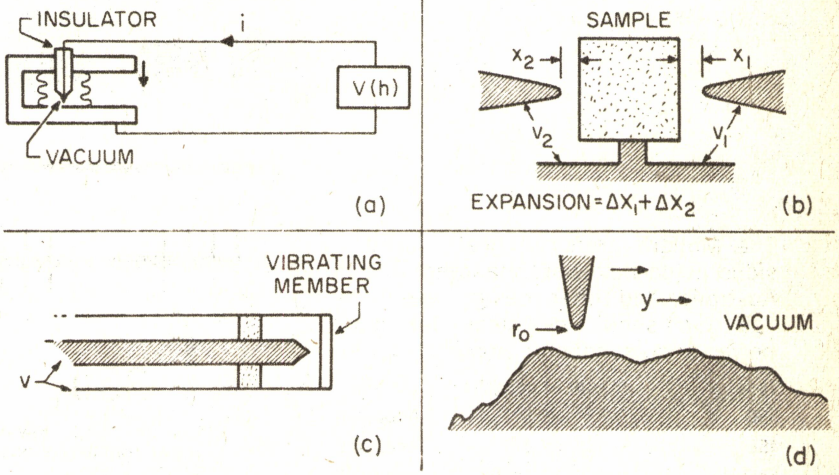
The operation of the instrument in the various applications is essentially the same. For example, as delineator of surface profile a field emission tip serves as one electrode (at a high negative voltage) and the surface to be observed is the other electrode. As the field emitter moves across the surface, recorded changes in voltage indicate changes in profile. Known equations fix the relationship between the voltage and the distance from the emitter to the surface.

With the increasing use of high-precision mechanical devices, a need has developed for more refined measurement of distance, displacement, surface contour, and surface profile. Devices for precise measurement of short distances have been available, but they are limited in two important respects: (1) they involve delicately balanced bridges and mechanical or optical levers which often have high-temperature sensitivity, and (2) they involve physical contact with the object to be measured.

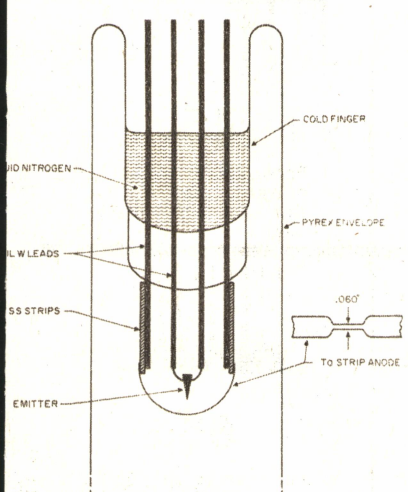
The N.B.S. instrument avoids both of these limitations. It is particularly suited to the measurement of curved surfaces, where error may be introduced by depressing or scratching the surface. Another important advantage is the simplicity and small size of the sensor.

The accuracy of the minimum detectable displacement depends on solutions of Laplace's equation, the precision of the voltmeter, the stability of the constant current source, and mechanical stability of the components. These factors can all be evaluated without recourse to experiment.

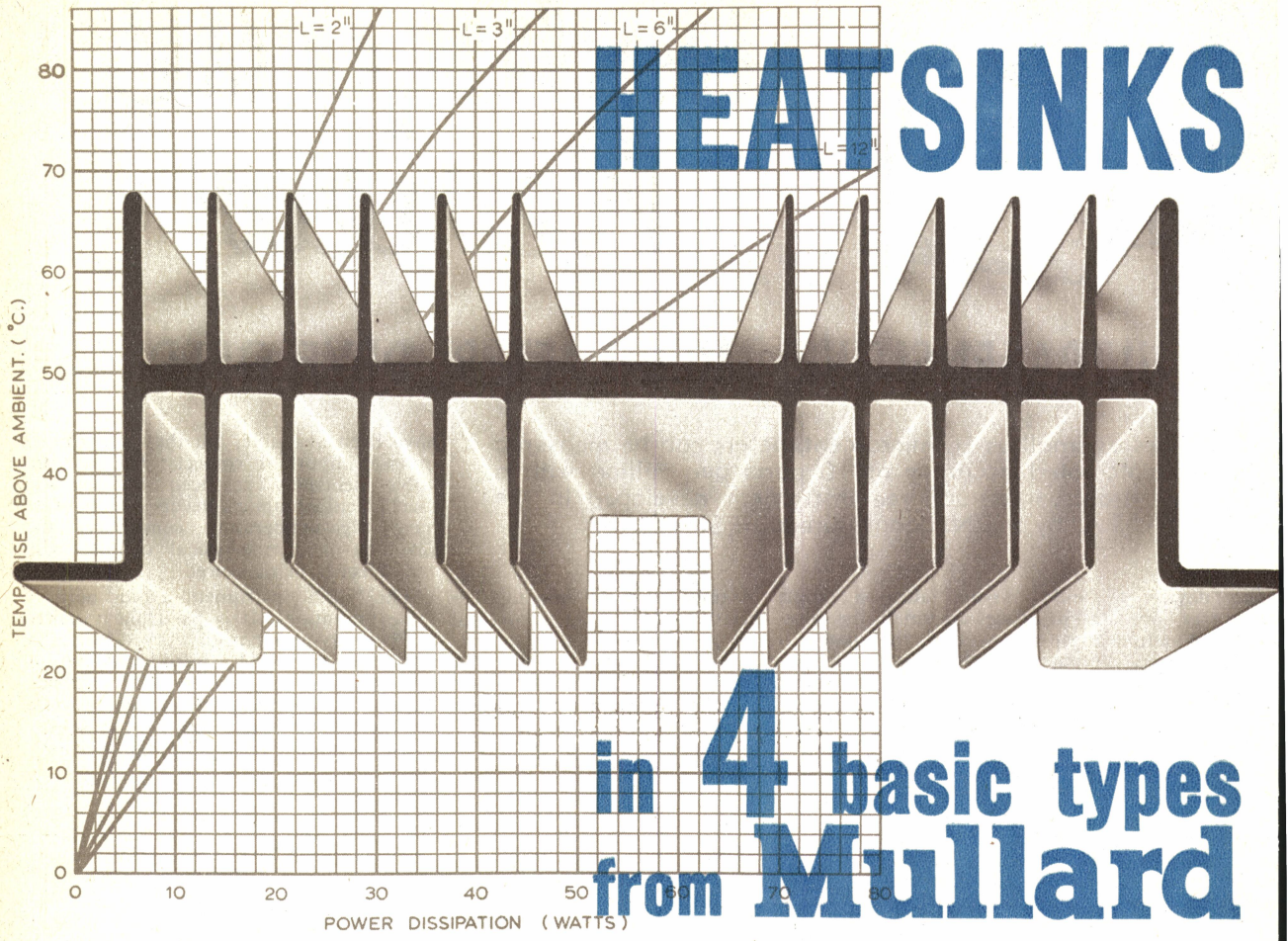
The feasibility of the ultramicrometer was tested by moving a field emitter to within a few hundred angstroms of the tantalum strip and measuring the emitter-anode voltage while maintaining a constant current. It was shown that this process can be carried out without spurious currents or electrical breakdowns, even when the emitter is close to the surface. ■



Possible applications of the ultramicrometer, (a) strain gauge (b) differential thermal expansion cell (c) mechanical vibration sensor (d) surface profile delineator.



Drawing of a vertical cross-section of the field emission micrometer as it was set up for a feasibility study. A precise voltmeter in the electrical circuit indicates a voltage which is directly related to the spacing between the emitter and the anode.



HEATSINKS

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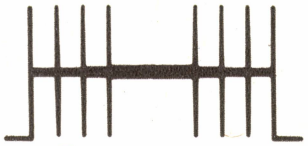
Type	Standard Lengths	Finish
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45D	3" 4" 6"	Anodised
55D	4" 6" 8"	Anodised
65D	4" 6" 8"	Plain

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Further details are available from Mullard offices throughout the Commonwealth.



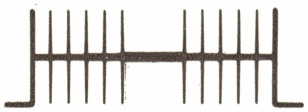
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2 45D

For use with medium power transistors, thyristors and silicon diodes.



3 55D

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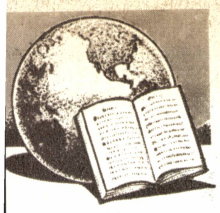
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SLOW-MOTION PLAYBACK FOR VIDEO-TAPE RECORDERS

Slow motion on television has previously been possible only with film taken at faster than normal speed. Now the B.B.C. in U.K. has developed a practical system for slow motion replay of video tape originally recorded at normal speed.

By D. P. Robinson, M.A., Grad. I.E.E.

Until recently television pictures in ow motion have been possible only by e use of conventional film techniques -that is, with film exposed in a fast nning camera and later run through a lecine machine at normal speed. This as many disadvantages, not the least of hich is the time delay involved in the ocessing of the film.

It is true that there have been exriments using a standard tape machine nning at half speed, followed by stanrds restoration, but these methods ffer from poor definition and, further, e reduction in speed is only two to ne. Such systems have been abandoned technically unsatisfactory.

The latest British slow-motion apparas is one designed by the B.B.C., using standard VTR equipment and operag on 625-line signals. Constructed inially for the World Cup football series, is based on three program requireents. First, the machine should be pable of replaying any standard video pe in slow motion. Secondly, it should e able to "freeze" and hold any picture any time. Thirdly, it should be able record and playback in normal otion.

These functions should be as separate possible — for example, the "freeze" ode should work from the tape reay in either slow or normal motion, from the incoming signal if the machine is recording or not in operation at .

Television slow-motion differs fundaentally from film slow-motion in that e incoming pictures occur at a fixed te (50 fields per second) and this nnot be altered; to achieve slow otion, each of these fields is taken and ayed back a number of times to give e required slowing-down effect.

Early experiments suggested that ratios of 3, 4 or 5 to 1 would be suitable— less than this gives insufficient slowing down while more produces a very jerky picture, since the eye is very conscious of the sudden picture change. It was decided to build the machine for a ratio of 4 to 1. Once this was decided, it had to be accepted that the mechanical construction would not allow the ratio to be changed at will, and in fact the machine will play only at this 4:1 speed reduction.

To enable the machine to play other broadcast video tapes the slow-motion system must use 2in tape and rotating heads with transverse scanning. On such a tape the recorded information occurs in a regular manner, succeeding television fields being laid down at similar positions along the tape.

The principle used to obtain slow motion is to scan one such field on the tape and store it in a memory, effectively stop the playback and read the field from the store four times, then re-start the playback and deal with the next field on the tape in a similar manner. The problem is to provide this intermittent motion in the playback machine without damaging the tape in any way.

The basis of the playback machine was an older type of Ampex quadrature recorder (similar to the model VR-1000C) which was extensively modified. The tape path is shown diagrammatically in Fig. 1. The tape leaves the supply reel (left), passes the first pinch roller A then roller B and goes on to the video head. Threaded round roller B' it passes the driving capstan and second pinch roller, C, and so on to the take-up reel. Apart from this unusual lacing, the normal record-replay functions are left unaltered.

In slow-motion playback, the capstan motor is de-energised and power is transferred to a similar motor which drives the original, now acting as a flywheel, through a 4-to-1 pulley system using a flexible toothed belt so that the tape travels at a quarter of its normal linear speed — that is, at about 3¾in/second. The two guides, B and B', are joined together and mounted on an arm which oscillates 12½ times a second, thereby adding an oscillating velocity component to the normally constant tape velocity (quarter speed) in the loop between the guides.

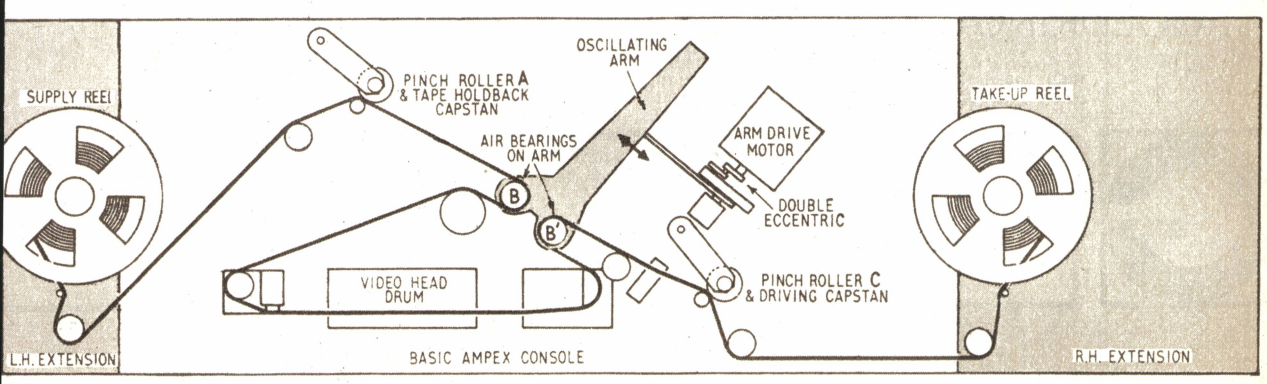
The amplitude of this oscillation is such that the tape moves in reverse at the video head for part of the cycle, and it is to prevent tape spilling off the guides during this time that the extra pinch roller A is added.

During the forward stroke of the arm (to the left) the tape is accelerated to the normal replay speed, about 15in/second, and this lasts for just over one field on the tape, so that for this time the replay head "sees" a standard tape in all respects. One field is thus replayed, with an overlap at each side acting as protection. For the following period of time, corresponding to three fields, the arm slows down and moves in the opposite direction, reversing the tape travel at the head, and finally moves forward again.

Since there is also a constant quarter-speed component of velocity provided by the capstan, the second field on the tape is now replayed. The final output from the video tape recorder is thus one field followed by spurious signals for three field periods, then the next tape field, and so on.

The success of this operation depends on the inertia at all points inside the moving loop being extremely low. If conventional roller guides were used their inertia would be such that it would be impossible to reverse the tape with the rapidity necessary. All the guides between and including the guides B, B' are air bearings, in which the tape is isolated from the metal surface of the guide by a thin film of air, which also provides a very low frictional drag. The air pressure needed is in the region of 5 p.s.i., and this is derived from a small oil-free pump and piped to the

Figure 1. A complex system of rollers and guides is used in the slow-motion playback machine.



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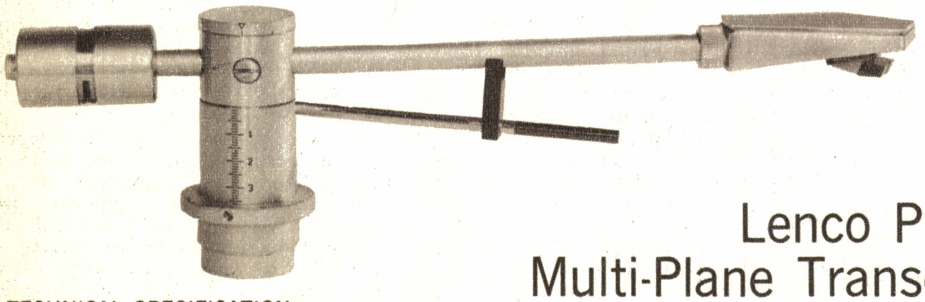
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five guides inside the oscillating tape path.

The motor shaft also incorporates a mechanism for producing a pulse once every revolution, at a point in time just following the linear portion of the arm movement, that is, the time when the information must be read from the tape. The pulse lasts for one television field, and is used to synchronise all the switching functions of the whole machine.

Initially a simple eccentric was used to provide the oscillation of the two guides B, B', but in practice this did not give satisfactory performance as the straight portion of the resulting sine-wave motion of the guides was not long enough to track the whole of one field, and picture break-up resulted. A simple double eccentric was then devised which successfully extended the linear portion of the oscillation to slightly over one field, allowing satisfactory tracking with a little margin for servo errors.

The two heads of each store combine the erase, record and replay functions. They follow an eight-field cycle arranged so that the final output is continuous. It should be noticed that when head 1 on the store is recording, head 2 is playing back, and vice versa. This cycle, and the method of obtaining a form of interlace, is shown in the table, figure 2. Since the recording is initially made on the tape in the normal manner, the replayed fields follow in the sequence of even, odd, even, etc. (lace, interlace, lace) but on replay from the store, the same field (say, even) is played four times in succession.

To make an even field appear to be odd, a half-line delay must first be added to the video path. The technique of adding a delay ensures that the line sync information is correct but the field sync is still wrong, since on even fields it is coincident with line sync while on odd it is not coincident but half a line late.

Thus even after the half-line delay is added, the field sync must be extracted and modified in a similar manner. The waveforms for this switching, and those needed to switch the record and playback signals and their amplifiers, are generated in a small rack added into the store electronics. If the generation of these wave-forms is stopped immediately after one of the heads has switched to playback, the picture which has just been recorded on the disc will be played back continuously—this is the "freeze" facility.

The signal recorded in the store is taken directly from the VTR using that machine's modulating system to produce the RF signal necessary. The frequencies involved are a carrier of 5.5MHz to 5.0MHz at sync tip and 6.8MHz at peak white. This corresponds to the European Broadcasting Union (E.B.U.) low-band recording standard for quadrature recorders, used because video tapes for the World Cup were on this standard. In principle, however, there is no reason why any of the recording standards should not be used.

The only additional circuitry added between the VTR and the store is a simple limiter to keep the FM signal entering the store at a constant level. This is necessary since the recording current through the store heads must be well defined; errors lead to signal distortion on demodulation. As in normal VTRs, the signal from the rotating heads varies in amplitude as the servo-errors cause the heads to move off the track, and this is normally eliminated in the limiter in the demodulator. Since this is not in circuit at this point in slow-motion, the extra limiter is necessary.

The quality of the slow-motion picture is very acceptable, but any defects in the incoming picture are more noticeable in slow motion as there is four times as long to inspect each picture.

Also the random noise on the input signal is recorded in the disc store, and this too is rendered much more visible.

With these two problems outside control, there remain those that can be remedied. The disc store is driven from station field trigger pulses, and does not have any further servo system. It was hoped that the stability of the device, with its large inertia, would be sufficient that the errors accumulated in four fields would be small (at which time new correct information is recorded).

Unfortunately a jitter of about 3usec. can be observed per revolution, producing a sync mistiming of this amount. While hard-lock receivers would ignore this error, certain flywheel sync receivers, with long time constants, would produce a pronounced hook at the top of the picture.

In order to provide a satisfactory signal at all times to all receivers, the signal is passed through a standards converter, which, while producing a picture at any required line standard, does, of course lower the picture quality. It is hoped that it will be possible to modify the system shortly to remove the converter.

Referring back to the table, it can be seen that when head 1 on the store is recording, head 2 is playing back. The signal level during recording is over 100V, and the replay signal is of the order of 3mV, so that there is also a problem of crosstalk between the two channels. Early magnetic discs had a rather low output which aggravated this problem, and thanks are due to E.M.I. Tape Ltd., who at very short notice manufactured a set of discs with an increased stable output making the crosstalk problem negligible. ("Wireless World," December, 1966). ■

TABLE SHOWING FIELD-STORE OPERATING CYCLE

Original recording	Field 1 (even)	Field 2 (odd)	Field 3 (even)	Field 4 (odd)	etc.										
VTR slow-motion replay	Field 1 (even)				Field 2 (odd)				Field 3 (even)				Field 4 (odd)		
Store head 1	Record (even)		Play (even)	Play (even)	Play (even)	Play (even)	Erase	Erase	Record (even)		Play (even)	Play (even)	Play (even)	Play (even)	
Store head 2					Record (odd)		Play (odd)	Play (odd)	Play (odd)	Play (odd)	Erase	Erase	Record (odd)		
Combined store output			Play (even)	Play (even)	Play (even)	Play (even)	Play (odd)	Play (odd)	Play (odd)	Play (odd)	Play (even)	Play (even)	Play (even)	etc. (even)	
1/2 line delay			out	in	out	in	in	out	in	out	out	in	out	in	
Final output			even	odd	even	odd	even	odd	even	odd	even	odd	even	odd	

Figure 2. Table showing the operating cycle of the field store in comparison with the original recording.

The eccentric is driven by a motor locked to station field trigger pulses.

The single field played back by the VTR is taken and recorded in the field store, and is then replayed four times from this to form the output signal, thus circling in the gap until the next field from the tape is available. All four fields of the output signal are taken from the store (as opposed to one from the VTR and three from the store) to minimise any flicker effects which might be caused by slightly differing frequency responses or similar faults.

The store was originally intended for recording single frames, so that it required extensive modification to record and replay in the cyclic manner needed for slow motion. The recording medium is a flat thin disc of Melinex coated with magnetic oxide and this rotates at 3000 rpm, that is, once every field.

The disc floats about 1 micron above the recording heads, and this distance is maintained by a flow of air dragged by centrifugal action from a series of small holes at the centre of the disc on the motor shaft. In this way, wear is virtually eliminated.

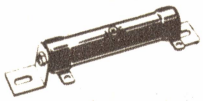
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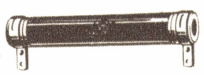
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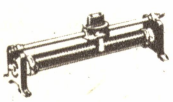
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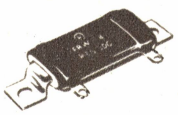
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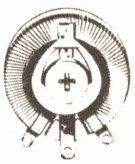
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SCIENTIFIC AND INDUSTRIAL NEWS



Secondary radar for Moscow

A "Secar" secondary radar system developed and manufactured by the Marconi/Thomson consortium, is to be supplied to Russia for six months' evaluation trials, and possible purchase. It will be installed at Vnokovo Airport, near Moscow, one of the two main airports in the Russian capital, and the site of the air traffic control centre which controls the flow of air traffic throughout the area.

The Marconi/Thomson consortium which developed "Secar" was formed from The Marconi Company, of England, and the Compagnie Francaise Thomson-Houston Hotchkiss-Brandt, of France. The "Secar" system is designed to extract information from an aircraft in flight to supplement the normal radar position finding function.

This is achieved by transmitting a number of interrogation signals to the aircraft from a ground station. These signals are received in the aircraft by a transponder which will automatically transmit an appropriate reply in the form of a digital code.

Four interrogation modes are available and each mode corresponds to a definite question; "Who are you?," "What is your height?," etc. The system is automatic, in that the aircrew take no part in the transfer of information once the airborne transponder has been switched on to give the appropriate replies.

Secondary radar provides a valuable adjunct to the normal "primary" radar system. Height-finding "primary" radars are not sufficiently accurate for air traffic control, and without secondary radar, the only way in which the controller can obtain this vital information is by asking the pilot on the radio telephone. With a secondary radar system, the height is derived automatically from the aircraft altimeter, which provides the most accurate measure of altitude available.

Plane position information is also given by secondary radar in addition to the height, identity, etc. The system can be integrated with primary radar signals on a single display if necessary.

Security telephone

The "Identifone" is the name of a new design in party-line telephone systems developed in U.K. by the Plessey Automation Group's data handling division at Poole, Dorset. A feature of the system is that it offers complete security, since the master station is called by a unique signal, and once contact is established the conversation becomes secret. Power supply for signalling and speech is fed from the master station along the line.

The Identifone system is said to be suitable for numerous applications, including post telephones for railways, motorways and emergency call telephones where identification or location is necessary, such as police and fire stations, mines and pipeline checkpoints. The system can also be integrated into automatic telephone networks where calling time identification is required.

Optional extras of the Identifone system include automatic routining and selective call back. Electronic circuitry permits the operation of special party line telephones over cables of smaller gauge than possible with older systems. For example, on railway signal post telephone systems, 20lb per mile cable may be used where 40lb per mile cable has been necessary before. The financial saving in cable may often offset the whole cost of replacing existing systems by Identifones, says Plessey.

Automated air traffic control

The U.S. Federal Aviation Agency is moving towards a semi-automated air traffic control system with the purchase from Burroughs Corporation of 177 radar digitisers, which convert radar signals into computer data. The contract for the supply of these items amounted to $U.S.22,403,010.

The equipment, termed the Common (Civilian Military) Digitiser (CD), converts raw radar information relating to aircraft positions into computer (digital) language. It then transmits this data via telephone lines to computers located in F.A.A.'s air route traffic control centres and to air force air traffic facilities. The computers process the data and put it in a format which shows up as an air traffic display on a radar screen. Only a fraction of a second elapses from the time that a radar signal first bounces off a plane, which may be more than 200 miles distant, until the reflected radar pulse shows up as a coded display on the radar screen.

The Common Digitiser, a key element of the United States' emerging semi-automatic air traffic control system, will be installed at each of 111 radar antenna installations from which air route traffic control centres receive information on the position of planes. The remaining 66 Common Digitisers will serve U.S. defence installations.

Scatter system for Egypt

A new multi-channel telephone link between Egypt and the Sudan, bridging the lake behind the mighty Aswan Dam, is to be supplied by The Marconi Company. The contract, valued at over a quarter of a million pounds, has been awarded by the Government of the United Arab Republic and involves the installation of a two-way, tropospheric scatter radio link of extremely high reliability.

The scheme will provide high-grade, multi-channel communi-



This set-up is used for growing synthetic rubies for lasers at the Rugby, England, works of Associated Electrical Industries Ltd. In the ruby-growing process, single crystals are produced from suitable oxides heated to a molten condition in an iridium or platinum crucible. The crucible is heated by induced current from a HF coil wound around the outside of a silica jacket. With the oxides sometimes reaching over 2,000 degrees C., polarised filters are fitted to the viewing window so that the development of the gem can be observed without hazard to the eyes of the observer.

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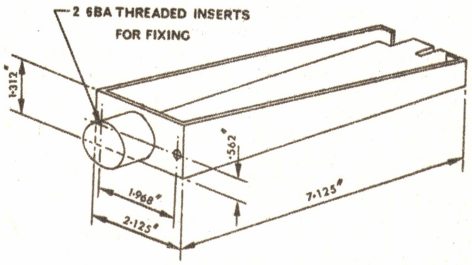
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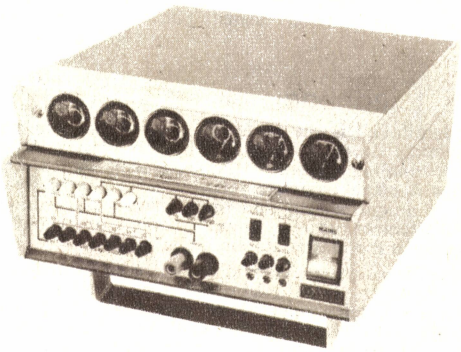
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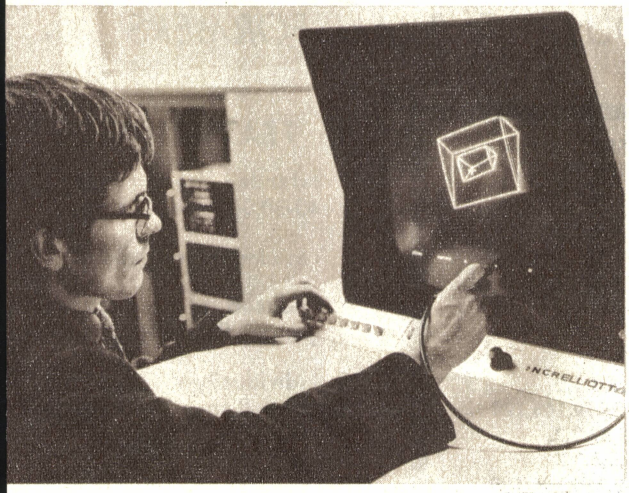
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cations from one end of the lake to the other, replacing the original land lines between Wadi Halfa in the Sudan and Aswan in Upper Egypt. This new installation will be capable of providing 24 telephone channels, one of which can accommodate 24 separate teleprinter circuits. Initially, however, the system will carry 12 telephone channels, one of which will be used for teleprinter signals. Both the performance and the channel capacity will be far superior to the land line link which has been swallowed up by the huge lake.

The total path length of the link is 174 miles and to ensure very low interference characteristics, the receivers will be preceded by parametric amplifiers which amplify the signals without increasing background noise. In order to ensure complete reliability, the system is of the quadruple diversity type and will transmit and receive four different signals, each carrying the same traffic. At each site there will be two transmitting aerials spaced some distance apart, to ensure continued transmission should one path be affected by interference or poor propagation conditions. To avoid similar problems occurring at discrete frequencies, the system transmits dual signals on separate frequencies from each of these aerials.



Now in use at the National Physical Laboratory in the U.K. is this light pen and display system. It has its own computer, communications keyboard and control electronics. The system has been programmed in such a way that the display and its associated electronics can be instructed to do some operations in seconds that would take days of expert draughtsmanship to achieve. For instance, in the case of a bridge, an instruction can be typed on a keyboard to change a perspective view from ground level into a bird's eye view from 200 feet. By placing a light pen on any point of the display the section of the display indicated can be made to enlarge at will.

TV plan for London schools

Plans for the establishment of a full-scale closed-circuit television system to provide educational programs for over 1,300 schools and colleges in London by 1970 are now in an advanced stage. Two complete television studios are being used for training teachers in program production techniques at the Inner London Education Authority's new TV centre in Islington, expected to be the largest educational closed circuit TV system in Britain. Cameras and studio equipment for the two studios have been supplied by The Marconi Company.

Current planning is for the first transmissions to be made in September, 1968 to 300 schools in North London. At that time, the work of adapting Laycock School, Islington, as a TV centre will be completed by the addition of two more studios.

Most of the Marconi equipment in the control rooms, such as vision and audio mixing equipment, television monitors and control room/studio intercom systems, has been especially designed for educational studio applications.

In the Islington scheme, facilities are available to mix vision signals from up to six cameras and sound signals from up to 12 sources such as microphones, telecine machines and disc reproducers. A Marconi telecine bench is installed in the larger control room, providing for the televising of films, slide material and captions. Local and remote control facilities are provided in order that the equipment on the bench can be operated from either studio control desk.

Low cost operational amplifier

A new high performance monolithic operational amplifier with an open loop voltage gain of 30,000 has been developed in the U.S.A. by Motorola Semiconductor Products Inc., to sell at the low price of $15 (U.S.). Designated MC1433, the amplifier is designed to be used as a summing amplifier, integrator, or for any application requiring an amplifier with operating characteristics as a function of external feedback components. It may also be used as a voltage amplifier for general systems applications where a high-gain, low-distortion amplifier is required.

Besides the high voltage gain—at least 30,000, but typically 60,000—the MC1433 has an unusually large output voltage swing. From a power supply of only ±15V, typical voltage swing is ±13V. This means that the high voltage gain of the amplifier is usable at higher output levels.

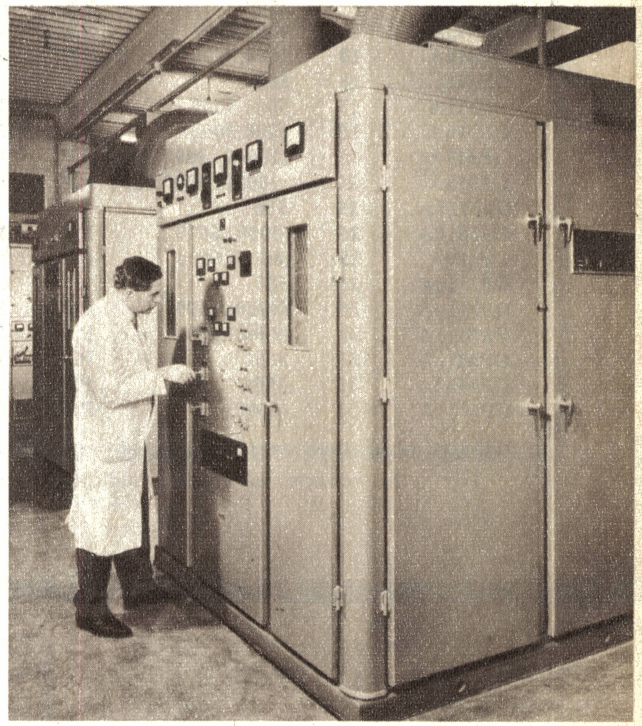
The amplifier is available in both the 10-pin metal can and the ¼in x ¼in ceramic flat pack configurations. Both models are designed for operation over the commercial/indusrtial temperature range of 0 to 75 degrees C.

Weather system expanded

One of the most advanced high frequency communications systems in the world is to be supplied by The Marconi Company for the East African Meteorological Department. The system, which will use remotely controlled, self-tuning transmitters, has been ordered through the World Meteorological Organisation in Geneva. It forms part of a general program to improve and speed up the transfer of weather information throughout the world for the World Weather Watch, an international study aimed at increasing the understanding of the fundamentals of meteorology.

The equipment will be installed at Nairobi, Kenya, at the central terminal for the clearance of meteorological information from Africa to the northern hemisphere. It will provide a greatly improved service from there to the headquarters of the West German Meteorological Service at Offenbach, near Frankfurt. Information received at this centre will be fed into the main meteorological telecommunications trunk circuit, which runs through Offenbach.

The transmissions from Nairobi will also be received in Cairo, for relaying to the Moscow World Weather Centre.



After extensive tests, scientists of Britain's Atomic Energy Establishment at Harwell have established the suitability of high-power broadcasting transmitters for use with the establishment's variable energy cyclotron. The 70in diameter cyclotron will accelerate electrical particles to high energies. One of its applications will be in research work on materials used in the construction of nuclear reactors, which must withstand massive doses of radiation. The cyclotron reduces the time for these tests from months to minutes. The transmitter, seen here, was supplied by Marconi's.

21 NEW OUTPUT TRANSFORMERS

From FERGUSON

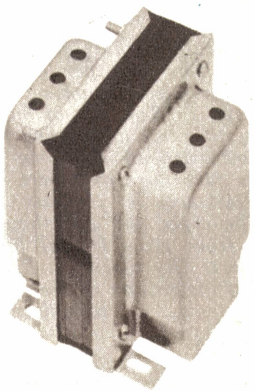
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OPM19A	5	7000,5000	S.E.	500,250,166,100
OPM20A	5	10000,8000	S.E.	15,8,3.7,2
OPM2A	7	10000	P.P.	15,8,3.7,2
OPM15A	10	10000,7000,5000	P.P. or	
		2500	S.E.	3.1
OPM3A	10	4000,2500	S.E.	15,8,3.7,2
OPM4A	10	4000,2500	S.E.	500,250,166,100
OPM16A	10	500		15,83.7,2,
OPM5A	15	5000,3000	P.P.	15,8,3.7,2
OPM6A	15	5000,3000	P.P.	500,250,166,100
OPM7A	15	(10000),8000,7000	P.P.	15,8,3.7,2
OPM8A	15	(10000),8000,7000	P.P.	500,250,166,100
OPM17A	15	500		15,8,3.7,2
OPM10A	25	(8000),6600	P.P.	15,8,3.7,2
OPM9A	25	(8000),6600	P.P.	500,250,166,100
OPM18A	25	500		15,8,3.7,2
OPM14A	35	(8000),6600	P.P.	15,8,3.7,2
OPM11A	35	(8000),6600	P.P.	500,250,166,100
OPM13A	55	3500	P.P.	15,8,3.7,2
OPM12A	55	3500	P.P.	500,250,166,100
OPM21A	100	(4500)	P.P.	500,281,125,31.25

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laths refresher course

A refresher course in mathematics ended mainly to assist teachers who will ve Forms V and VI classes is to be oadcast over Radio University VL2UV, dney. The course will also be of assistance students doing mathematics at the First d Second levels. It will consist of 20 ekly lectures of one hour duration, at p.m. each Wednesday. Two seminars will held during the course.

The course is designed to cover selected pics from the mathematics syllabus issued the N.S.W. Department of Education r the Board of Senior School Studies. ie lectures concentrate upon material in e Second Level course for Forms V and I, but will also include some First Level aterial.

A fee of $4 is charged for the course, nich includes the cost of printed notes. ie course will commence in June.

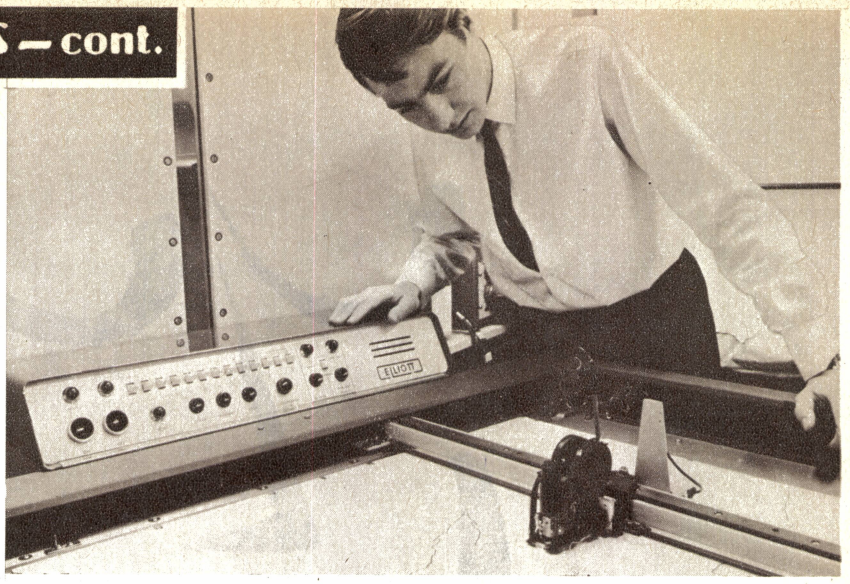
lying test-beds

More than three tons of electronic equipent fill the cabin of Boeing's first new 7 twinjet, which took to the air last onth for a series of exhaustive flight test ograms. In all, six of the 737s will be ed during the test series. Altogether, they ill fly about 1,200 hours during the flight sts, and they are expected to receive ederal Aviation Agency certification toards the end of this year. If only a ngle plane were used for the tests, the sting program would require more than vo years.

Three of the jets will be packed with struments designed to carry out exhaustive chnical tests. These include structural tests, confirm the soundness of the design; comete checks of systems such as fuel, electrial and hydraulic; and further study of ie aerodynamics. A fourth plane will look xternally just like a jetliner in service. his will be used to prove out the systems rovided for passenger service and comfort. ater, two modified versions of the 737—the ng-body 737-200—will join the test fleet.

Data on the flying test-beds will e recorded on inch-wide 14-track tape by special tape recorder which will be able handle 60,000 readings a minute. Literally miles of wire will feed information to the recorder from hundreds of sensitive built-in gauges located all over the jetliners. These gauges provide information on temperatures, pressures and loads as the aircraft is put through testing manoeuvres.

The data so obtained ranges from highly technical information on stability, control and engine performance to simple, everyday details such as the performance of the air-conditioning system. After each flight, the tapes are fed into computers which provide analysed results within 48 hours.



Charts and maps can be made automatically — either directly from measurements or from recorded soundings — by this "Hydroplot" system, developed in the U.K. by Elliot Automation Ltd., Portland Place, London, W.1. The system can receive and automatically process information gathered from the sea; accept positional data from radar and radio navigational systems to produce accurate plots; make maps or statistical tables from magnetic or punched tapes. Hydroplot has been produced for use in the hundreds of small ships carrying out hydrographic and oceanographic research, and also for laboratories ashore.

Biggest generator

Australia's largest turbine-generator is now in full operation at the Electricity Commission of N.S.W.'s Munmorah Power Station on Tuggerah Lakes. The generator has a capacity of 350MW, is 136 feet long and weighs 1200 tons.

A total of 170,000 gallons of water passes through the twin condensers of the machine every minute. The boiler which supplies steam to the turbine-generator burns 130 tons of pulverised coal per hour. The steam is supplied at a temperature of 1053 degrees Fahrenheit and a pressure of 2400 pounds per square inch.

This is the first of four such machines to be installed at the Munmorah station by 1970. The station will then be capable of generating 1400MW of power—seven times as much as the Pyrmont Power Station in Sydney. The output of Munmorah's generators will be fed directly into the State's 330KV transmission system.

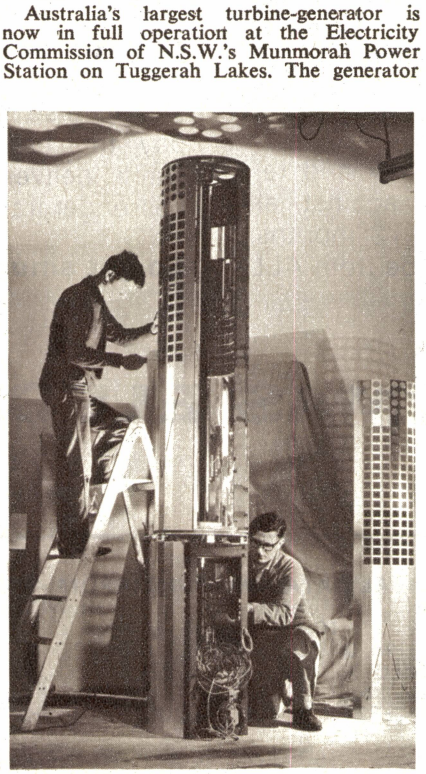
Telephone-call redirector

The "Divertafon," invented in Melbourne by electronics engineer Don Dunn, is an electronic device which diverts an incoming call to any preselected alternative number. It has been completely designed and manufactured in Australia and has been patented in 18 countries. The machine has been approved by the Postmaster-General's Department after three years of testing and study. Two telephone lines are all that are needed to put one of the devices into operation, one for the incoming call and the other for the machine to dial out diverted calls.

Smallest colour TV camera

Tokyo Shibauru Electric Co. Ltd. (Toshiba) of Japan has developed a lightweight colour television camera, the IK-37, which it claims is the world's most compact. The IK-37 is a separate luminance colour camera using three vidicon-type "Sensicon" tubes developed by Toshiba for red, blue and green. An image orthicon tube is used for the black and white (luminance) channel.

The camera is said to be ideally suited for low-lighting conditions, performing satisfactorily with only half the light required for convenional colour telecasting. Toshiba are now manufacturing several of the new cameras for NTV, a leading Tokyo television station.



Destined for Canada's "EXPO '67" exhibition, this device will demonstrate, by means of several hundred apertures which light up in sequence, the pulse code modulation (PCM) system for communications, an entirely British invention. Developed in 1938 by Alec Reeves of S.T.C., PCM is a technique which enables an increased number of telephone channels to be accommodated in existing cables. Recent developments in components and circuitry have made the realisation of the system possible. This rotating exhibit will show how speech waveform is sampled, converted into pulse code, transmitted as a stream of pulses and then reassembled at the receiving end to reproduce the original speech.



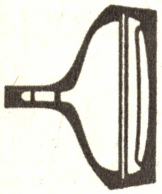
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New Thai transmitter

A new 55KW radio transmitter has been supplied by Standard Telephones and Cables Pty. Ltd. under the SEATO Aid Program for use by the Thai Government, to counter subversive activity in North East Thailand. It will combat propaganda from Communist controlled stations in Peking, North Vietnam and Laos.

The transmitter, installed at Korat, 140 miles north-east of Bangkok, was handed over to the Thai Government recently by the Australian Ambassador to Thailand, Mr A. H. Loomes, O.B.E. Last year a similar station was set up at Khon Kaen, 230 miles north-east of Bangkok.

Carpet industry simulator

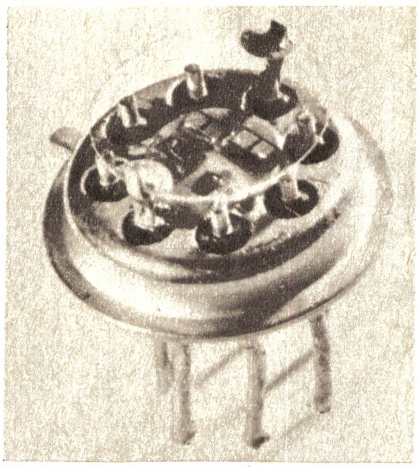
The National Bureau of Standards in the U.S.A. has analysed the tufted carpet industry by means of a model which simulates operations and makes it possible to explore the consequences of change in policy.

The model has as variables the policies used by retailers, wholesalers, manufacturers and yarn suppliers to maintain stocks. It enables operational policies to be altered by experimenters and the consequent behaviour of a typical business in the industry to be studied.

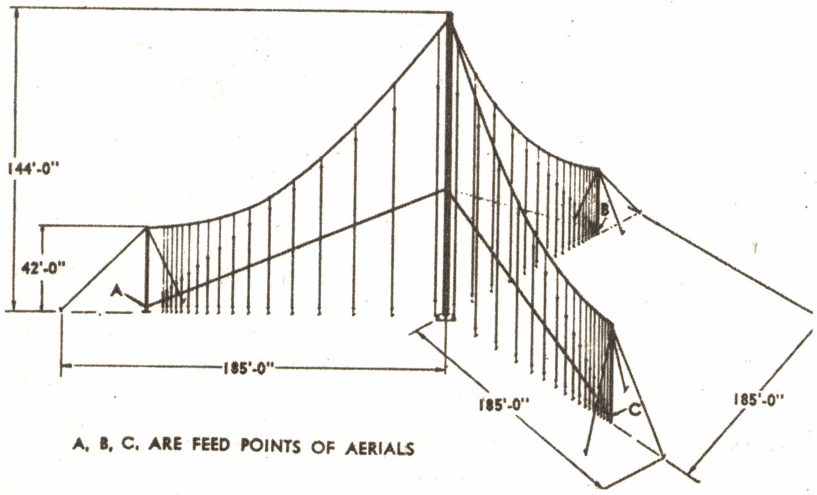
The model simulates the flow of goods in the industry. Operating the model with reduced stocks, for example, demonstrated that such a basis might be practical for sectors of the industry. Although the model simulates the tufted carpets industry, its primary purpose was to demonstrate the usefulness of the technique for other industries as well.

The model was validated by operating and adjusting it until it behaved in the same way as the real industry behaved in similar circumstances. On finding the model to be stable for a fixed input (product demand) the study group subjected it to five types of demand variation, superimposed on a static demand of 90,000 sq. yds. per week. These were a step input; ramp growth (steadily growing demand); pulse input simulating first-day-of-the-week backlog); cyclic input (representing seasonal variations); and random "noise" (representing small normal fluctuations).

The model reacted to each of these demand variations by compensating for the change and then seeking to return to the static level-behaviour of the industry simulated.



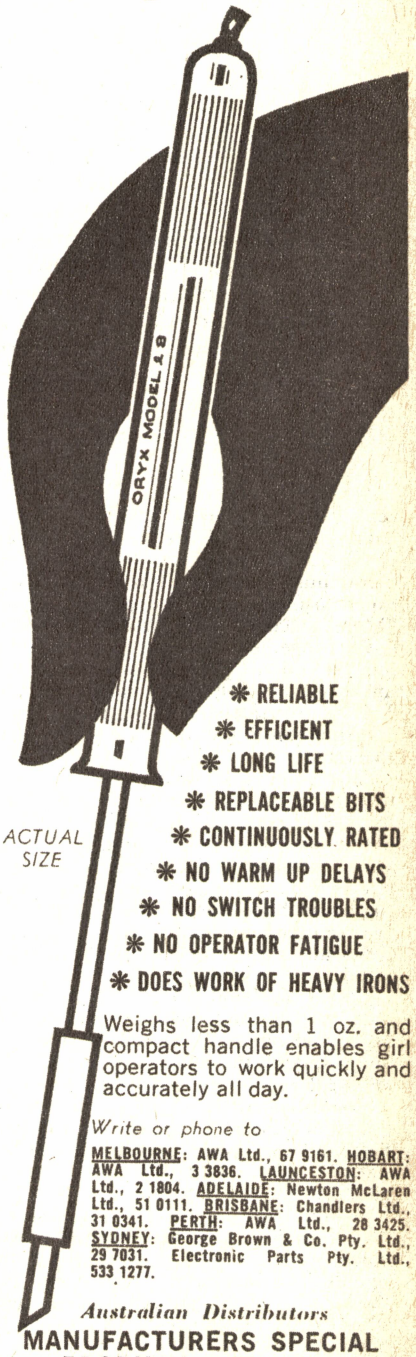
A completely new micro-oscillator, type F3185, developed by The Marconi Company, is shown with the cover removed. The deposited gold electrodes on the circular crystal have been left out to show the microcircuit underneath. Completely sealed inside a TO-5 transistor can, this unit is by far the smallest in the Marconi range of solid state, packaged oscillators. The device is still being developed, but prototypes have already been supplied to a number of customers for their evaluation.



A, B, C. ARE FEED POINTS OF AERIALS

Further information which has come to hand on the vertically polarised log periodic aerials to be constructed at Australia's Antarctic bases indicates that the wrong diagram was used with the story which appeared in our April, 1967, issue, page 31. The diagram above shows the general appearance of the aerial to be supplied by Standard Telephones and Cables Pty. Ltd. This three-bay type of aerial is capable of providing 360-degree coverage, now regarded as necessary for the bases. While having slightly less gain than the four-bay type—specified for many military applications — the three-bay type is considerably cheaper and perfectly adequate for the Antarctic application.

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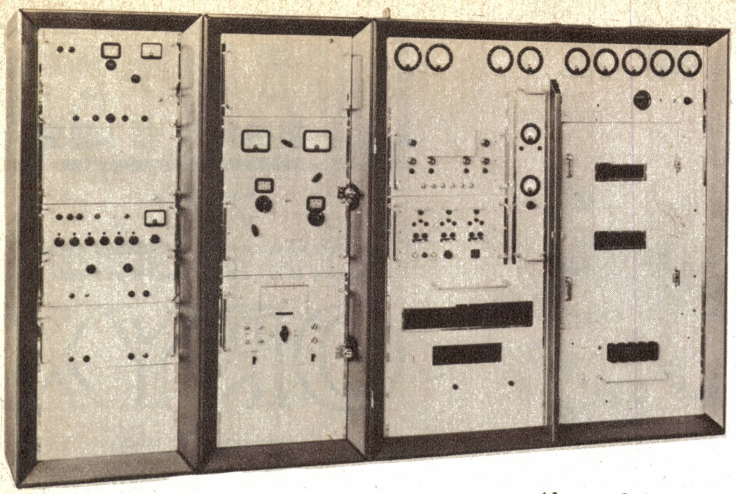
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SSB IS HERE TO STAY

Above, left, is a complete 5KW remote-control long-distance radio telephony equipment manufactured by Racal Electronics Ltd. Employing SSB techniques, it covers the range from 2 to 27.5MHz in 100Hz steps, with a transmitter stability to better than 1Hz. Below is an SSB transmitter for use by amateur operators, described for home construction in our issues for December, 1966, to March, 1967, inclusive

by

Len Buckwalter

For more reliable communication in the crowded radio frequency spectrum, the swing is strongly to the SSB—single sideband—mode of transmission. In this article, reproduced by arrangement with an overseas magazine, the author explains the technique in terms which most readers will find commendably easy to follow.



Ask a Citizen Band User what he wants most. "More range," might be the reply. Or query an amateur operator on his secret wish. "Bigger band, less QRM," could be the answer. And you might ask a communications engineer, "What's your innermost craving?" His possible answer "More efficient radio-frequency power."

Put together those wishes for slim, but booming signals and they'd all be answered by SSB . . . single sideband. This single-sideband system of radio transmission does all those things and then some.

Surprisingly, it wasn't ushered in by the space age, solid-state or some last-minute breakthrough. SSB is nearly as old as high-button shoes and, until recent years, considered too mysterious for all but commercial communications. Today single sideband has been snapped up by the military, is embraced by amateur radio and soon may invade the Citizen's Band.

Single sideband is to AM, or amplitude modulation, what the car is to the horse and buggy. Both get you there but one is quaint, the other cool and efficient. As we'll see, single sideband is actually a sophisticated form of AM, but one that squeezes each watt for all it's worth. Sideband can whip a conventional AM signal of 100 watts into sounding like 800.

As far back as 1914 it was suspected that a radio wave, when modulated by voice was not one but three distinct signals. The regular AM signal had been shown as a single signal; a radio carrier whose strength changes with audio information.

That conventional "envelope" pattern is in figure 1. An audio signal from the microphone is strengthened in the audio amplifier, then is applied to the RF amplifier (in the transmitter) where it meets the steady carrier.

At this common meeting point, the modulator, audio voltages aid or oppose the carrier during modulation with the results shown. It's a convenient picture that provides a reassuring explanation of what happens during amplitude modulation. If the audio signal is 1KHz (a high-pitched tone) then carrier strength varies 1,000 times per second.

But a patent issued in 1923 destroyed the one-signal concept or, should we say, demanded that the single envelope (which is really a resultant) be broken down into its basic components.

As the first practical SSB system, i contended that an AM signal should b considered in three parts. And the clai was backed up by the first successfu SSB transmission between the Unite States and England — about 22 year after Marconi made the first trans-Atlan tic hop between the same countries Here's what the new image of AM looked like.

In figure 2 is the triple signal, base on a radio carrier of 600KHz modulate by an audio tone of 1KHz. (This woul be roughly equal to conditions existin at the moment you're hearing a tim

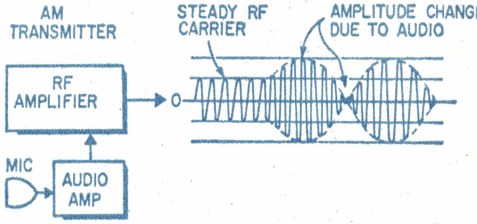


Figure 1: Conventional picture of AM signal shows modulated RF output as varying envelope pattern. But output from transmitter is actually a carrier plus adjacent sidebands — all RF signals.

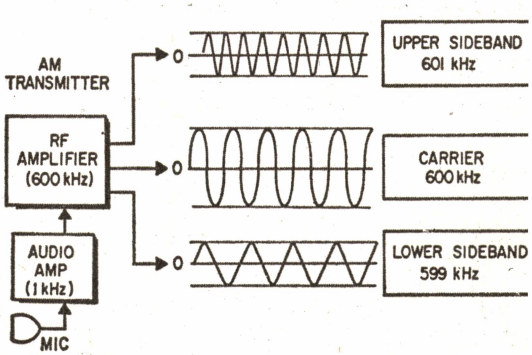


Figure 2: Correct depiction of AM signal reveals three distinct components: the original 600 KHz carrier in addition to carrier-plus-audio and carrier-minus-audio sidebands. Since carrier contains no information, it can be eliminated from the transmission and an equivalent signal supplied at the receiver.

gnal sounded by a station in the standard broadcast band.)

Most shattering feature in the waveforms of figure 2 is how the carrier in the middle appears. It bears not the ast trace of modulation! The carrier as smooth as a bag of mortar left at in the rain. It never changes amplude by one whit. The audio signal an be found in two sidebands which lie st above and below the carrier frequency. These sidebands deserve close spection.

When the audio tone (1KHz) combined ith the carrier (600KHz) in the transitter, a mixing process occurred in the F amplifier. As audio and radio frequencies beat against each other, they rmed carrier-plus-audio and carrierinus-audio frequencies. That creates e two sidebands, an upper one at 01KHz, a lower sideband on 599KHz.

This may also be recognised as the eterodyne process, where mixing signals dd and subtract. Thus sidebands are lways spaced from the carrier by a requency a number of Hz or KHz dermined by the audio signal. Modulate ith voice or music and sidebands spring urther from the carrier as tones grow igher in frequency — or move in close the carrier for low-pitch sounds. Again, 's due to the frequency-mixing process.

The signal can be viewed as a collecon of frequencies strung out along a eceiver dial, as shown in figure 3. Let's ay the dial pointer is at 600KHz, tuned o the carrier. Since a receiver has bandvidth — it accepts a group of closepaced frequencies — we pick up sidebands just above and below 600. Each of those sidebands represents the whole band of modulating frequencies that might occur during a voice transmission.

If an audio note reaches up to 3KHz it generates an upper sideband on 603KHz (3+600). Too, there's a mirrorimage appearing at 597KHz, the lower sideband. The intermediate lines in figure 3 indicate the product of other audio tones.

One precaution when interpreting the image is this: sidebands are not in themselves audio tones. They are RF signals whose frequencies are determined by the original audio. RF remains the medium which carries signals, via the antenna, out "over the air."

If upper and lower sidebands repeat the same intelligence, why transmit both? There is one good reason. On arriving at the receiver, power from sidebands add, so two are better than one.

But there's a strong argument against transmitting duplicates. It is available room on the bands, which now groan under heavy communications traffic. Wouldn't it be better to recover the power in one sideband and inject it into the other? This would effectively halve the signal band width — and almost double available space in the radio spectrum.

As we'll see, this is one significant advantage of single sideband. There's a second one — just as important — and it's given in figure 4.

This diagram illustrates how a regular 300-watt AM transmitter divides its power: the carrier contains 200 watts, while each sideband has 50. That's a colossal waste since carriers, as we've noted, contain no modulation. Total useful power — in two sidebands — is a mere 100 watts, or one-third the carrier level.

If a carrier spills two-thirds of the transmitter power down the drain, why is it produced in the first place? The reason is that an RF signal is a necessary ingredient in the recipe for cooking up sidebands. Audio must mix with RF, and during the conventional modulating process watts divide into that uneven, 3-way split.

This underlies the first step toward the single sideband transmitter. The SSB rig generates a carrier, but a negligible one — at most a few watts. Once sidebands are produced, the carrier will be rejected before it gulps RF watts further along in high-level stages. First part of the process is done in the balanced modulator.

Before plunging into the circuit, consider the push-pull amplifier shown in figure 5. In a normal amplifier of this type, an input signal is applied in push-pull (the top tube grid is driven positive as the lower goes negative). But the input signal in figure 5 is being applied equally to both grids, or in a parallel connection. Both amplifier tubes commence to conduct. Since the output transformer is split by a centretap, two magnetic fields are created. The interacting fields, however, are opposite and cancel each other.

The upshot is this: whenever you feed in parallel, but extract in push-pull, there'll be no output signal since it's phased out. But feed and extract in

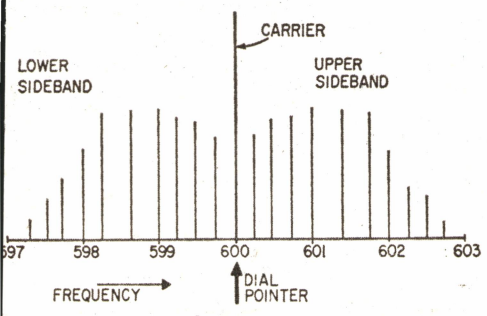


Figure 3: Some idea of conventional AM's spectrum-wasting properties is evident in this diagram. Note that a 3KHz signal fills an area fully 6KHz wide.

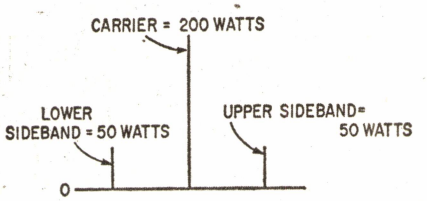


Figure 4: A conventional AM transmitter also is extremely inefficient with the power at its disposal. In the case of a 300-watt rig, roughly 66-2/3% of the total power is poured into the carrier, which carries no information whatever. Balance of power — a mere 100 watts—is split between upper and lower sidebands.

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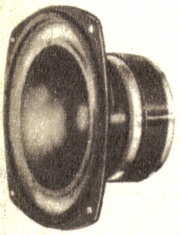


SPECIFICATIONS
Size : 50 mm (2 in.)
†Impedance : 8 or 16 Ω
Frequency Range : 2,000 ~ 20,000 c/s
Sensitivity : 100 dB
Power : 30 W max., 8 W nom.
Dimensions : 82 × 82 mm, 29 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 615 g (1 3/8 lbs)

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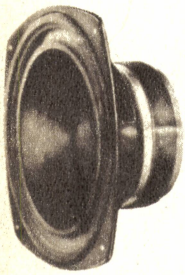
FW-162



SPECIFICATIONS
Size : 160 mm (6 1/2 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40 ~ 50 c/s
Frequency Range : f_0 ~ 2,000 c/s
Sensitivity : 97 dB
Power : 30 W max., 10 W nom.
Dimensions : 166 × 166 mm
81.6 mm depth
Magnet Weight : 500 g (1 1/8 lbs), Ceramic
Weight : 1,660 g (3 11/16 lbs)

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FW-202

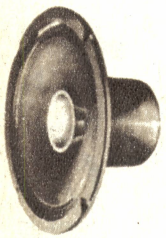


SPECIFICATIONS
Size : 200 mm (8 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 30 ~ 40 c/s
Frequency Range : f_0 ~ 2,000 c/s
Sensitivity : 98 dB
Power : 45 W max., 15 W nom.
Dimensions : 208 × 208 mm
90.8 mm depth
Magnet Weight : 830 g (1 13/16 lbs), Ceramic
Weight : 2,760 g (6 1/16 lbs)

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Double-cone speakers

PW-65A

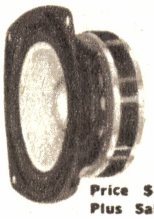


Size : 160 mm (6 1/2 in.)
*Impedance : 8 Ω
Resonant Frequency (f_n) : 70 ~ 100 c/s
Frequency Range : f_0 ~ 15,000 c/s
Sensitivity : 97 dB
Power : 6 W max., 5 W nom.
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Weight : 476 g (1 1/16 lbs)

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*at 400 c/s; †at 3,000 c/s

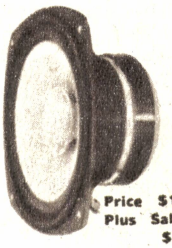
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Resonant Frequency (f_0) : 65 ~ 95 c/s
Frequency Range : f_0 ~ 18,000 c/s
Sensitivity : 96 dB
Power : 5 W max., 3 W nom.
Dimensions : 105 × 105 mm, 46.6 mm depth
Magnet Weight : 193 g (6.81 oz), Ceramic
Weight : 630 g (1 3/8 lbs)



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Size : 160 mm (6 1/2 in.)
*Impedance : 8 or 16 Ω
Resonant Frequency (f_0) : 40 ~ 60 c/s
Frequency Range : f_0 ~ 20,000 c/s
Sensitivity : 98 dB
Power : 10 W max., 5 W nom.
Dimensions : 166 × 166 mm, 73.7 mm depth
Magnet Weight : 398 g (14.04 oz), Ceramic
Weight : 1,260 g (2 3/4 lbs)

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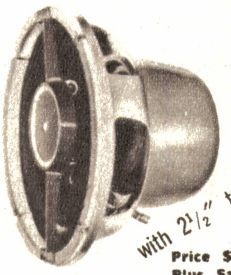


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Weight : 2,200 g (4 7/8 lbs)

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Frequency Range : f_0 ~ 18,000 c/s
Sensitivity : 101 dB
Power : 10 W max., 5 W nom.
Dimensions : 206 ϕmm, 140.7 mm depth
Magnet Weight : 234 g (8.21 oz)
Weight : 2,200 g (4 7/8 lbs)

2-way network



LC-100
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Crossover Freq.: 2,500 or 3,500 c/s
Impedance : 16 Ω
Attenuation : 6 dB/oct.
Dimensions : 63.1 ϕmm, 69 mm height
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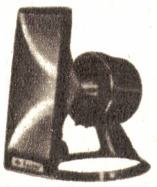


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Crossover Freq.: 350 or 700 c/s, 2,500 or 5,000 c/s
Impedance : 8 or 16 Ω
Attenuation : 6 dB/oct.
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Weight : 1,430 g (3 1/8 lbs)

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†Impedance : 16 Ω
Frequency Range : 2,500 ~ 16,000 c/s
Sensitivity : 100 dB
Power : 10 W max., 5 W nom.
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Weight : 330 g (11.75 oz)

FHT-1

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push-pull (as done in a hi-fi output stage) and full amplification occurs. Both parallel and push-pull can be used in the balanced modulator to produce a sideband signal.

Begin with an audio signal and apply it to the input side, as in figure 6. This signal will enter in push-pull since it rides through an input transformer whose secondary winding is centre-tapped. Since the output side is similarly arranged for push-pull operation, it can be assumed that audio input will not cancel.

Meanwhile, a steady carrier signal is also applied to the tube grids. But since the RF input transformer has no centre-tap, an equal (parallel) signal drives the tube grids. Steady RF, therefore, always cancels on the output side.

Now start talking into the microphone.

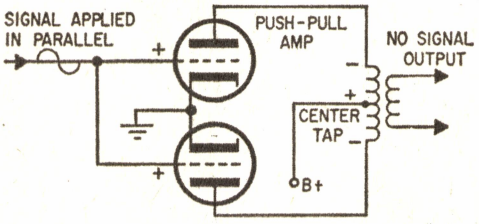
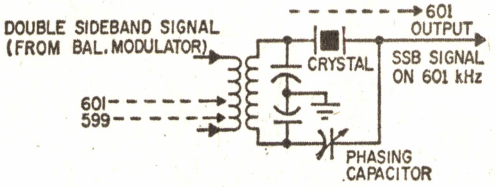


Figure 5 (left): Properly balanced push-pull amplifier cancels in-phase (or parallel) signals, which explains need for phase inversion in push-pull circuits. SSB rigs utilize this property to cancel out carrier.

Figure 7 (right): Crystal filter affords one method of dumping one sideband, passing the other. Here, crystal passes signal on 601KHz, rejects signal on 599KHz. Once adjusted, crystal performs function indefinitely.



As the audio signal drives the top grid positive, it drives the lower grid negative. During this moment, the RF signal doesn't encounter the same conditions (tubes balanced), as when no audio was present. Audio voltage has unbalanced the tubes and RF can flow during this time with no cancellation at the output.

A similar condition also exists when audio reverses and drives the lower grid negative.

Thus the audio signal continuously varies bias and upsets tube balance. The net result is an RF signal at the output side which varies at an audio rate—the familiar modulation envelope pattern. And since there has been a mixing process between RF and audio, the RF output signal consists of upper and lower sidebands.

Note in figure 6 that the carrier (steady RF) doesn't appear at the output. The output signal, consisting of upper and lower sidebands, is known as double sideband suppressed carrier.

One method of getting rid of an unwanted sideband is by means of a crystal filter. A simple notch filter, as in figure 7, could be set up to pass one of the sidebands in figure 6, rejecting the other. More typically, where it is desired to pass one whole set of sidebands, resulting from normal speech modulation, a more complex type of filter is required using two or more crystals in a suitable configuration. Such a filter would normally be selected with a passband wide enough to accommodate one set of sidebands, blocking the other set completely.

Another popular method uses the mechanical filter. It is a series of mechanically resonant metal discs, as shown in figure 8.

Both sidebands are applied to the mechanical filter and their voltages converted to mechanical movement (via an electromagnetic coil and rod). This spurs the discs into action. Since resonant motion can occur only over an extremely narrow range of frequencies, the undesired sideband signal cannot slither through.

At the output end of the mechanical filter is a second coil-and-rod assembly to convert the mechanical signal back into electrical energy. Both crystal and mechanical filters are not only far sharper than coil-capacitor (L-C) combinations but are smaller, very stable and require virtually no adjustment.

There are other sideband techniques. We've been describing the filter system but there's the phasing system, too. Since it is somewhat more critical to set up and keep in adjustment, the phasing approach seems to be less popular than the filter in much of the presently used circuitry.

The phasing technique takes audio and RF signals then splits each into two parts in suitable phasing networks. The four signals are then recombined in two balanced modulators where they add and subtract. All undesired mixed signals cancel; the wanted sideband emerges.

Another variation lies in the actual type of balanced modulator circuitry selected by the single-sideband transmitter designer. As we've described it, a double-sideband signal is produced by a type of push-pull amplifier. There's also a "bridge" balanced modulator, seen in figure 9. Again, there are two inputs — one for the RF carrier and one for audio. The carrier, however, is suppressed when no audio signal is present since it produces equal RF voltage across bridge points A and B. (For current to flow there must be a voltage difference

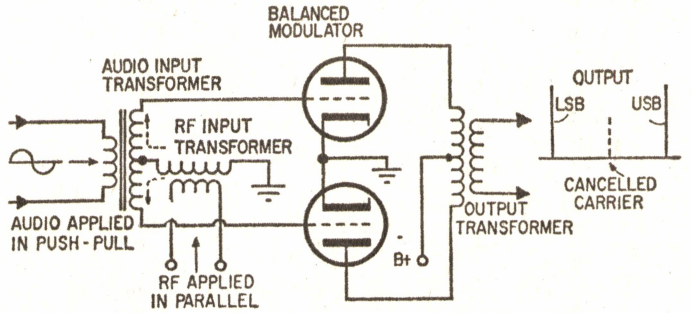


Figure 6: One type of "sideband" rig delivers two sidebands but no carrier in what is known as a double-sideband suppressed-carrier hookup. As explained in the text, the output signal consists solely of a lower sideband (LSB) and an upper sideband (USB), since the carrier cancels out in the modulator.

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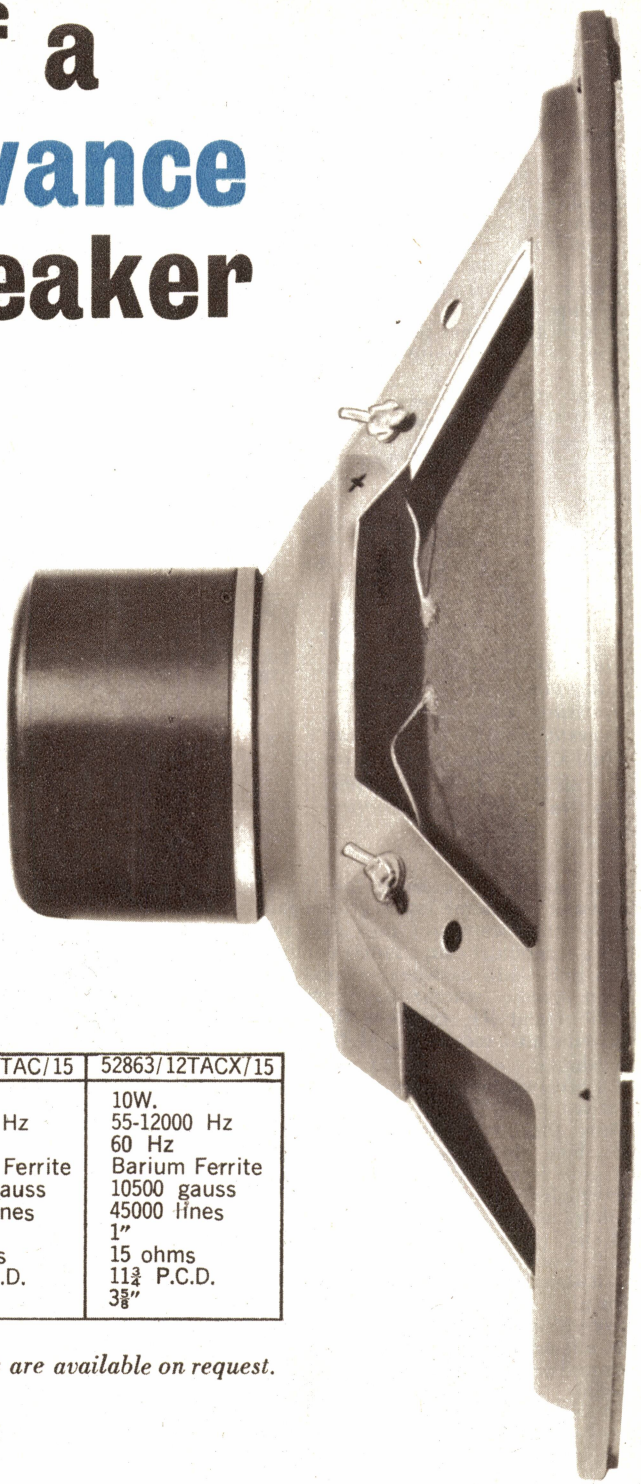
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Frequency Range	45-6000 Hz	55-6000 Hz	55-12000 Hz
Resonance	50 Hz	60 Hz	60 Hz
Magnet Material	Alnico V.	Barium Ferrite	Barium Ferrite
Flux Density	13,000 gauss	10500 gauss	10500 gauss
Total Flux	100,000 lines	45000 lines	45000 lines
V. C. Diameter	1¾″	1″	1″
Impedence	15 ohms	15 ohms	15 ohms
Mounting Hole Centres	11¾″ P.C.D.	11¾ P.C.D.	11¾ P.C.D.
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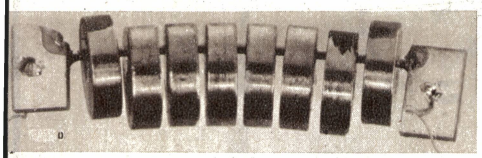
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etween "hot" and ground sides of the rcuit.) At this time the bridge is in alance.

When audio is applied across top and ottom, the bridge becomes unbalanced. or example. when the audio cycle is ositive, diodes 2 and 3 are biased to

Figure 9: Still another technique for suppressing a carrier relies on a bridge balanced modulator. Both AF and RF are fed into bridge, but the circuit cancels the carrier, allowing only two sidebands to emerge.



nduct, while diodes 1 and 4 are reerse biased (no current flows). This upet in the bridge enables RF voltage develop at the output — at an audio ate. Thus the double sideband signal esults.

Still another technique is the balanced odulator which produces signal mixing the multigrid structure of a tube. ere audio and RF combine within the ube's electron stream, but the underlyng concepts are the same.

Consider the status of the single sideand generated by the balanced modulator and filter. It is superior to the onventional AM signal since it occuies half normal bandwidth; it's about KHz wide instead of 6KHz. And if e SSB signal is now applied to an RF mplifier, only pure intelligence — not seless carrier — is boosted to desired utput wattage. But there are further eps before that efficient signal can ride ff an antenna.

The SSB signal is developed at low ower levels in the transmitter, not more han a few watts. In fact, it is usually andled in tubes commonly found in reeivers. But there's another low-level eature in sideband generation. Its requency.

For a sideband filter — crystal or echanical — to operate with high sharpess and selectivity, operating frequency ust be low. Usually filtering process ccurs at less than about 6MHz. Thus a ideband signal must undergo a shift to he desired final frequency. In an amaeur band rig, for example, single sideand output may be needed on one of he popular bands in the 3.5, 7, 14, or 8MHz range.

Conventional transmitters increase frequency with multiplier stages. An RF mplifier tube is strongly driven by an nput signal until it produces distortion n the form of harmonics, or frequency ultiples. That approach works well in egular AM transmitters since only the F carrier signal is distorted. This oesn't matter since it bears no intelligence during the frequency - multiplyng step. The audio modulation is tacked n at the final RF amplifier and thus scapes distortion.

Multipliers, however, would destroy sideband signal. To preserve its audio nvelope, the sideband signal must be eterodyned up or down to the final perating frequency. The mixing step will appear as we trace the simplified diagram of a complete SSB transmitter.

In figure 10 there is a block diagram of a transmitter which includes operating features like selectable sidebands and continuous tuning. Tracing the signal paths begins at the left, where the carrier is initially generated. It's simply an oscillator which generates a low-level

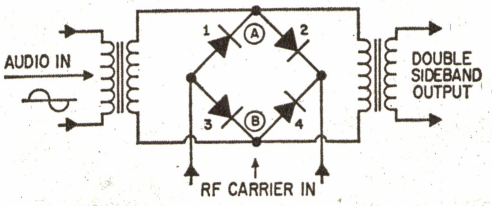


Figure 8 (left): The transducers at each end and the system of discs from a stripped-down mechanical filter.

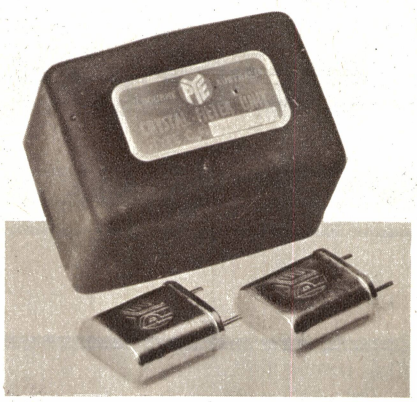


Figure 8b: A typical crystal bandpass filter unit and, below, crystals for the receiver oscillator which allow it to be switched from upper to lower sidebands.

RF signal at 455KHz — a popular frequency since it can use the IF transformers manufactured for standard AM receivers. Found in this stage is the sideband switch. By selecting either of two capacitors, oscillator frequency can be changed a small amount. Further along the circuit, this shift will determine which sideband is picked up by the mechanical filter.

Next major stage is the balanced modulator which receives carrier and audio signals. As already described (figure 6), its output is a double-sideband signal with the carrier suppressed.

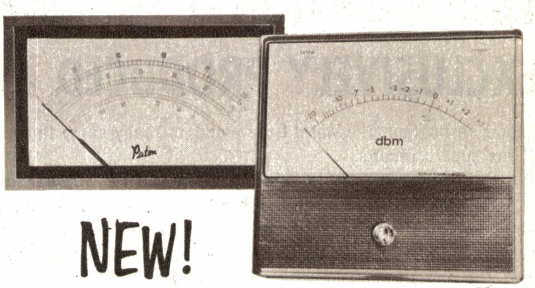
The single-sideband signal appears after the next stage — the mechanical filter. Although the filter is nominally rated for 455KHz, the important figure is its bandwidth. In this case, the filter's "opening" is stated as 3.1KHz by the manufacturer, equivalent to the span of frequencies contained in one sideband.

Back in the carrier oscillator, the sideband selector shifts the carrier just enough so the desired sideband lines up in the passband of the filter. Thus the operator may choose upper or lower sideband. Output of the mechanical filter is a lower sideband signal nominally on 455KHz.

Next is the mixing process. We'll trace how the 455KHz sideband is heterodyned up to the 75-meter amateur phone band, 3.8-4MHz. (The figures are based on American band allocations. Ed.)

The mixer receives the 445KHz sideband signal at its control grid, and a mixing (RF) signal on its screen. That second RF signal arrives from the VFO (variable frequency oscillator) stage. The two signals add in the mixer and output is on the desired operating frequency, as shown. Note that the operator can change output frequency by tuning the VFO. Shown, too, in figure 10 is a second mixer stage. By subjecting the signal to further mixing, output on other bands is obtainable.

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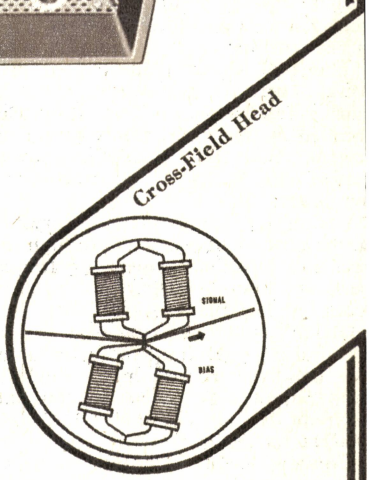
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To beef up the single-sideband signal, it is fed to a final RF amplifier. Here again circuitry differs from that of conventional AM rig. Regular CW and AM transmitters utilise a Class-C output amplifier, the type that's most efficient, but one that creates greatest distortion.

Distortion is no problem in regular AM since modulating audio is applied only at the plate of the output stage, and doesn't ride from grid to plate. But in SSB, a final amplifier must preserve the envelope pattern since the grid signal contains audio intelligence. For that reason, the final stage for single sideband is a linear amplifier.

By reducing grid bias on an RF amplifier it operates at somewhat less efficiency (Class B) but imparts little distortion to the modulated signal.

When you first see specs on a linear amplifier for amateur band or CB radio, you may be in for a surprise. It's often rated at twice the legal wattage (2,000 for amateur, 10 for CB.) That's because linear amplifiers are not measured in the same fashion as their conventional Class C cousins.

In the regular AM rig, wattage is determined by measuring steady carrier power. Since the sideband signal has no carrier — signals are always rising and falling in step with modulation—ratings are given as PEP (Peak Envelope Power). This describes power developed when a steady tone drives the amplifier to its maximum rated output. Since this only happens during modulation peaks, it is accepted within legal limits prescribed by the FCC.

Sideband transmitting systems may seem complex at first glance but it was probably the receiver that held back single sideband acceptance for many years.

Superficially, it is possible to receive an SSB transmission on any communications receiver which contains a BFO for making code signals audible. The BFO can be used to reinsert a carrier and this, beating with the incoming sidebands, allows the original speech to be reconstituted.

In practice, most such receivers perform poorly on SSB because:

(1) Frequency drift makes it difficult to keep the reinserted carrier in correct juxtaposition to the sidebands.

(2) Insufficient amplitude of reinserted carrier produces what is in effect an over-modulation condition, leading to distortion.

(3) Inadequate selectivity admits adjacent channel interference from outside the frequencies actually occupied by the wanted sidebands, so that noise discrimination suffers.

In practice, receivers are required which have been designed with possible use on SSB in view.

Picking up single-sideband is mainly a matter of reinserting the carrier. In any receiving system, the detector must reverse the process that began back at the transmitter. As you may recall, a carrier was required to create sidebands. It's also necessary to recreate original audio. It's the mixing process all over again. When the conventional AM transmitter sends carrier and sidebands to the receiver, the detector heterodynes them to produce audio.

Using our earliest example: A 600-KHz carrier mixes with a 601KHz sideband to produce a 1KHz difference which is the original audio. (The lower sideband contributes to the identical result). But an incoming single sideband signal is carrierless. This is corrected by turning on the receiver's BFO and adjusting it to a suitable frequency and amplitude in relation to the incoming sideband signals.

Tuning a single-sideband signal on a receiver is done slowly and with care. The reason is that the BFO must inject a signal which corresponds exactly to the frequency of the original carrier — if it had been transmitted.

As the BFO dial is adjusted, an incoming speech transmission first sounds like a signal of tremendous distortion.

Then it assumes a characteristic "Donald Duck" quality. But when tuning is on the nose, the sideband signal can be crystal clear and intelligible, even during difficult band conditions.

So effective is single sideband that the new definition for conventional AM may very well be "Ancient Modulation." ■

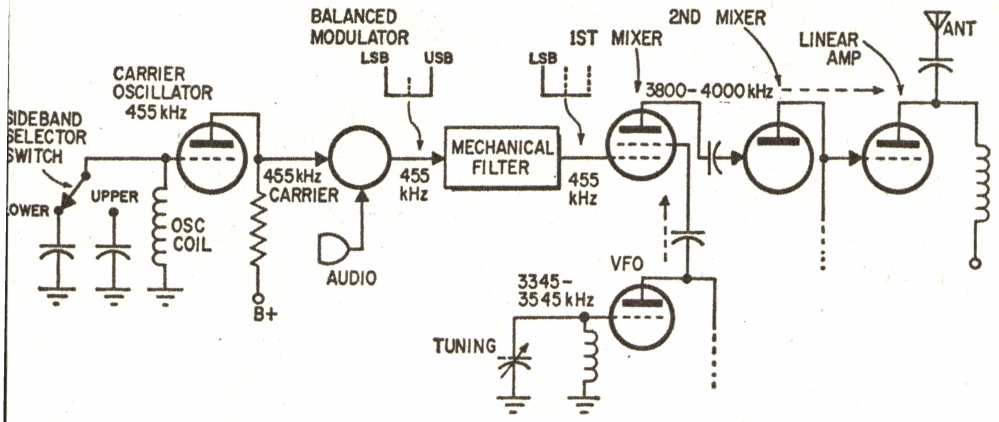


Figure 10: Block diagram of a basic SSB transmitter. Unlike conventional AM transmitters where audio is injected at the final, SSB rigs insert audio comparatively early. Mixers therefore replace multipliers in circuit.

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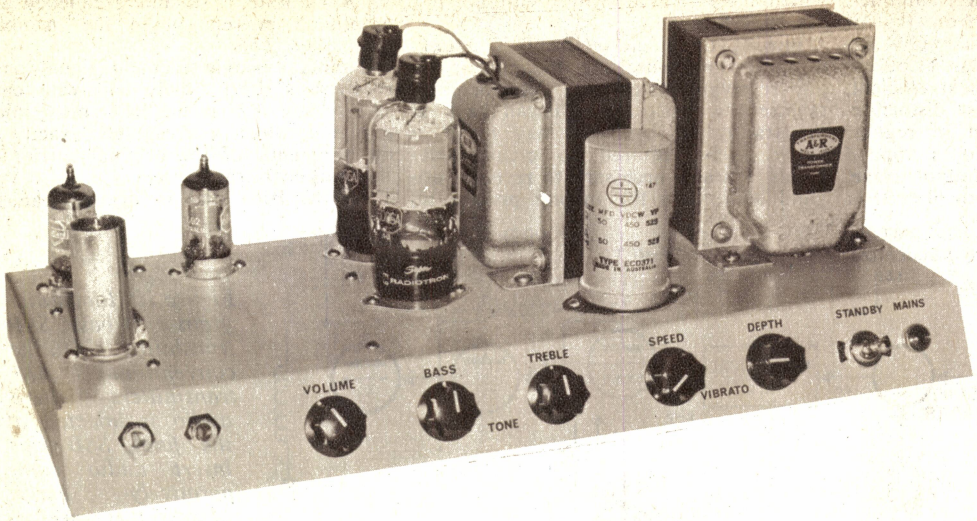
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The preamplifier is in the left foreground, followed logically by other valves providing vibrato, voltage amplification and phase splitting to the two 6DQ6A output valves.

A Basic 40W Guitar Amplifier

Here is an amplifier that should meet many a need, particularly for readers with an interest in amplified musical instruments. With a power output of 40 watts RMS and full vibrato and tone control facilities, it can be used with bass, rhythm or lead guitars, electric bass or electronic organs. Alternatively, with the controls set for level response, it can double as a high-powered public address unit.

By Anthony Leo

While, as indicated, the new amplifier has been designed with a number of possible uses in mind, it will undoubtedly find its greatest application in connection with electric guitars, and this is the basis on which it is being presented.

Our last venture in this field was in the issues from October, 1962 to January, 1963. In this series, we presented a basic 12-watt guitar amplifier (the Playmaster 102) which was expanded to a two-channel 12 + 12 watt unit (the Playmaster 103).

Reflecting the whims of the market at the time, the 103 was a compact unit, of necessarily limited power output, but with vibrato facilities (tremolo would be the more correct word) plus a second channel which could be used for extra power output, reverberation, straight guitar or voice public address.

The 102/103 amplifiers met a particular need and are still being built in significant numbers. In fact, interest in them has persisted to the point that we will almost certainly have to up-date the designs and feature them again.

However, they have also prompted another and persistent demand for a higher-powered single-channel amplifier, suitable for use, if necessary, with a bass guitar. The incentive to build rather than buy has been strengthened by the fancy mark-ups which seem to apply to higher-powered amplifiers bought through "music" sources.

It is apparent also that many would-be constructors have put aside their one-time objections to the large loudspeakers and large enclosures which are necessary to handle power of 30 watts or more. In fact, an enclosure which needs to be trundled in on castors would seem almost to have reached the stature of a status symbol!

Perhaps it is only fair to observe that, along with the call for higher power, the basic instruments and group playing techniques have developed greatly in recent years and today's electric guitars are a far cry from the early units with a single pickup coil pushed under the strings.

The question of valves v. solid-state is also being debated by guitarists. Some prefer transistor equipment on the basis of its compactness, cool running, and reliability. Others stick to the "good old valves" which might get hot but don't blow up when the loudspeaker leads are accidentally broken or shorted. Price enters into it also, along with argument about "transistor tone" and "valve tone" which probably has more to do with different response contours selected by individual designers.

We used valves for this present amplifier, mainly because components were conveniently available and we had built up a background of suitable circuitry. Inevitably, at some future date, we will have to produce a solid-state equivalent, with appropriate effort to keep the cost down and to make it reasonably proof against the type of accident that blows up costly power transistors.

In terms of power output, a more o less accepted "norm" appears to be abou 40 watts RMS—a figure stemming partl from the economics of ordinary amplifie design and partly from what can b accommodated by practical "portable loudspeaker systems.

In quoting this figure, we refer t actual constant-tone output over th fundamental musical range, measure across the load—a very practical figur for guitar applications.

How it relates to the published figure for commercial guitar amplifiers i another point. Actual measurement would suggest that these figures ar sometimes "optimistic" as evidenced b one very large, very imposing 60-wat amplifier which, under test, yielded exact ly 45 watts at the onset of clipping.

Our new amplifier, as shown, deliver a measured 40 watts RMS into a 15-ohm load. The output transformer secondary is tapped to provide a match to othe load impedances as, for example, two 15-ohm loudspeakers in parallel. A such, it should meet most practica requirements.

For those who may want still highe power, and are prepared to provide loud speakers to cope, we have in mind the possibility of substituting more expen sive grain-oriented transformers and modifying the operating conditions t provide about 60 watts RMS. We do not expect the circuit or layout to be otherwise affected.

With powers of this order, it is usua to have the amplifier in its own carrying case, which sits piggy-back fashion on top of the loudspeaker enclosure. The chassis has been designed with this in view and is relatively compact, being little longer than is necessary to accommodate the front panel controls.

The amplifier itself may be suited fo bass, rhythm or lead guitars by simply setting the tone controls for the desired bass/treble response contour. The ulti mate result will be dependent, however on the choice of loudspeaker system Bass guitars need big, husky loudspeakers

big husky enclosures, with treble response of no great significance. At the other extreme, lead guitars can get by with less ponderous loudspeaker systems but treble response is a "must."

We may be able to say more about this, in a general way, later on.

Looking now at the circuit, it will be noted that the output valves, arranged in "push-pull" configuration, are a type not normally found in an audio power application. The 6DQ6A is a power valve used primarily as a power amplifier for horizontal deflection in television receivers. Because of volume of production, it is comparatively inexpensive.

As an output valve, the plate characteristics are not greatly different from those of the more familiar audio types, such as the EL34 and the 6CA7. Because of its television heritage, the valve has a high peak plate voltage rating, but this is of little consequence when the valve is used in a strictly audio application.

If anything, however, its "top cap" plate connection offers some advantage, in that it allows better isolation of the plate leads from the high sensitivity input stages of the amplifier.

A definite advantage of the 6DQ6A is that it is a good deal shorter than either the EL34 or 6CA7. As may be seen from the photograph, the overall height of the valve, including the insulated plate connecting caps, is about the same as that of the transformers, making for a clean profile.

The output valves operate under push-pull class AB1, fixed-bias conditions, a mode which avoids grid-drive problems, ensures good power supply economy, and which minimises cross-over distortion. The total harmonic distortion from the amplifier, incidentally, at 40 watts output, is less than 1 per cent.

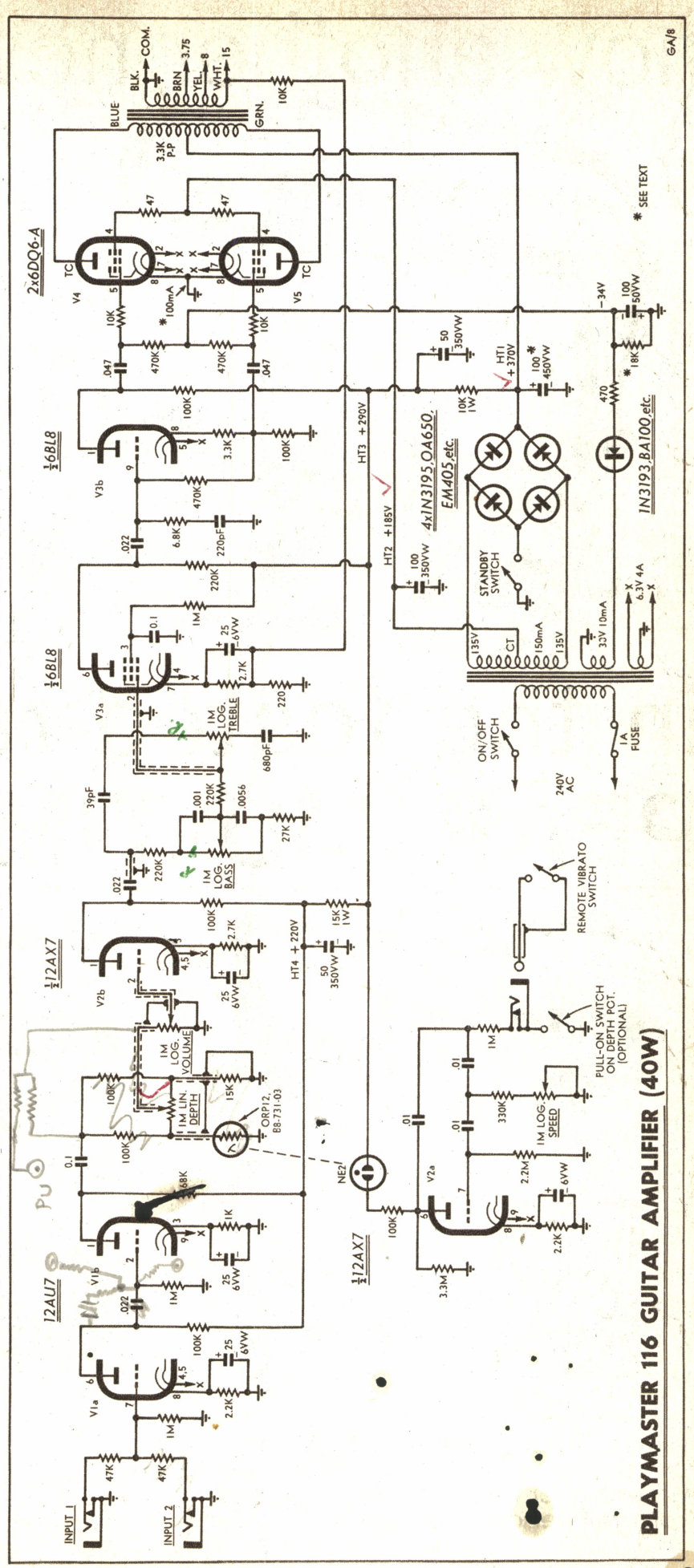
Class AB2 or class B operation would have posed additional grid-drive, power supply and distortion problems and, fortunately, are not necessary for the orders of power output required and achieved.

As it is, the valves operate with a total standing current of about 100 milliamps, rising to more than double this figure with sustained signal. "Stopper" resistors are included in series with each grid to inhibit oscillation during any part of the signal cycle.

Three voltages have to be supplied to the power stage—a nominal 370 volts for the plates, 185 volts for the screens and —34 volts for the grids. This latter is probably the most critical of the three, for on it depends the quiescent current of the output valves and therefore their quiescent plate and screen dissipation.

While we have suggested a figure of —34 volts, and while the bias network should give something very close to this figure, the quiescent current in the

Apart from the rather unusual configuration of the power supply, the circuit follows well proven techniques. Of particular interest is the vibrato system, which we developed some years ago, and which gives a wide range of speed and depth without any tendency to cone "pumping." The gain is ample for typical commercial guitars, most of which deliver signal levels of at least 30mV RMS.

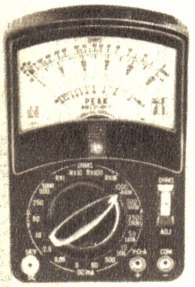


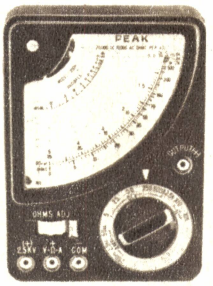
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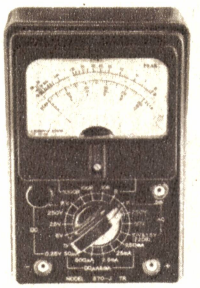


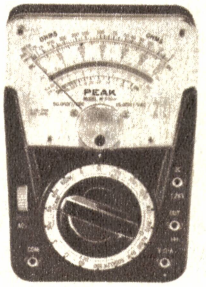
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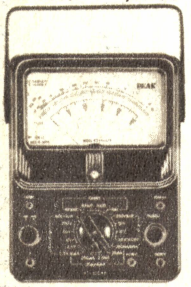
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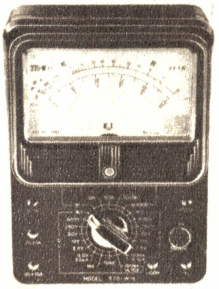

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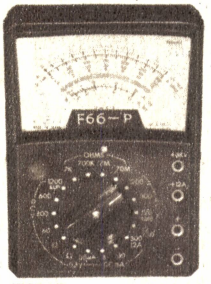

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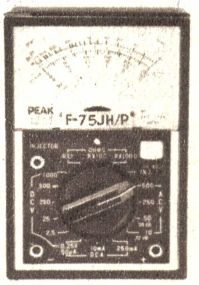

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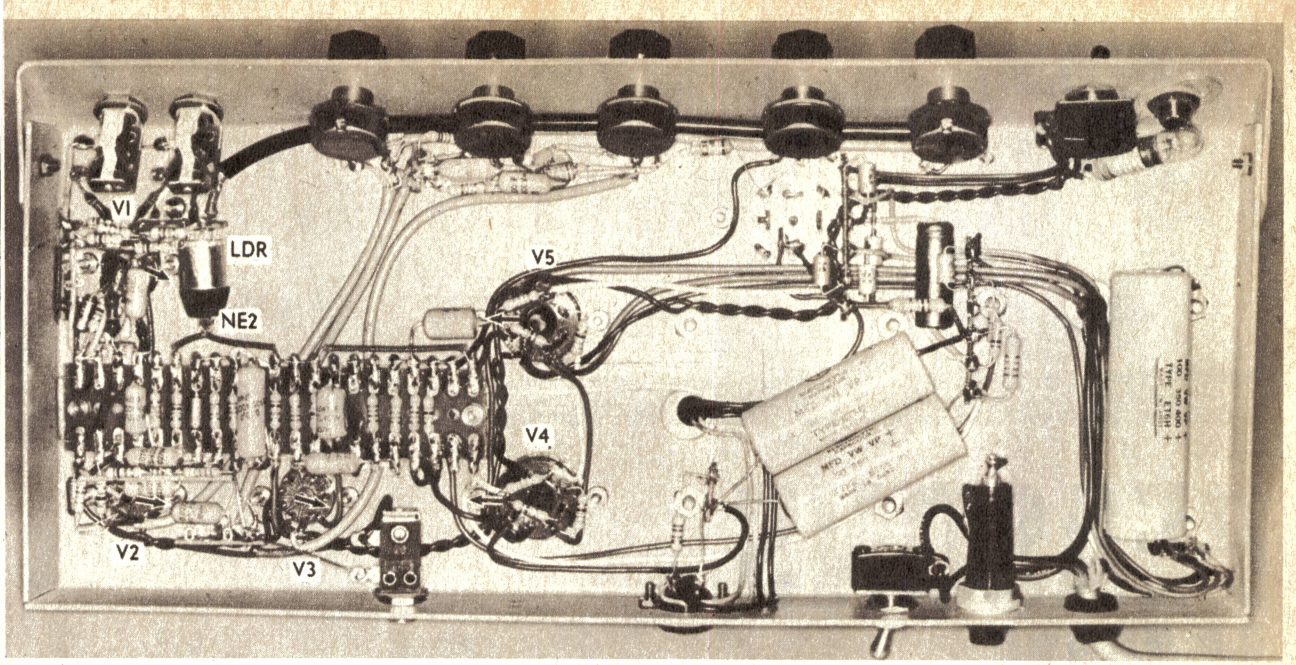
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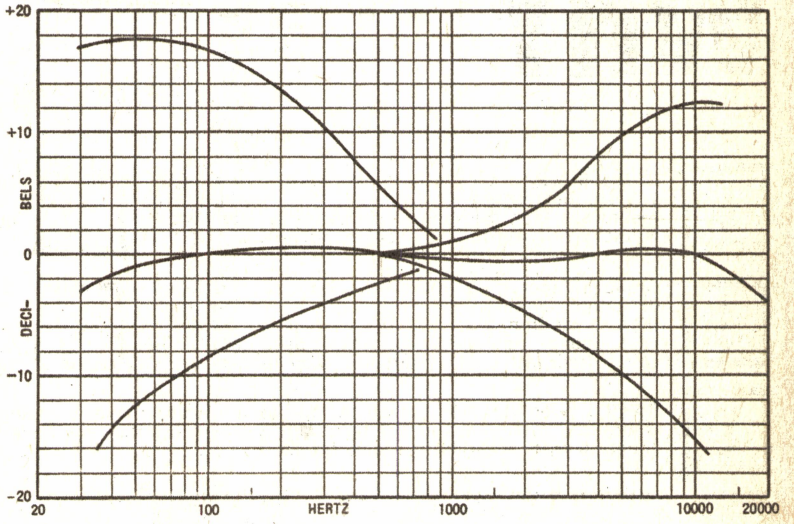
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The underside of the new guitar amplifier has space to spare, apart from the "busy" area around the low-level stages. Along the rear lip of the chassis is a jack for vibrato foot control, the loudspeaker socket, mains switch and mains fuse. At the time the photograph was taken we had not installed the clip to secure the mains lead.



Typical contours, with the tone controls set approximately level, as per the centre curve, and for maximum and minimum bass and treble. Note that the maximum bass/minimum treble curves, and their converse, tend to merge into continuous slopes, suiting the amplifier for either bass or lead guitars, as required.

common cathode lead to the output valves should be checked to see that it does not exceed 100 milliamps, representing full rated dissipation. The bias can be varied, if necessary, by varying the 18K shunt resistor.

A single electrolytic capacitor serves to filter the bias voltage, partly because of the high impedance of the circuit and partly because residual hum tends to be cancelled, anyway, by the push-pull connection of the output valves.

The main HT power supply is of rather unusual configuration, supplying separate and appropriate voltages to the output valve plates and screens.

The main secondary winding of the power transformer is wound for 135 volts on either side of a centre-tap, with a nominal current rating of 150mA.

The full secondary voltage is applied across a conventional bridge rectifier configuration, with one side of the bridge taken to earth through the "Standby" switch. From the other side of the bridge comes the main HT supply for the plates, just a trifle less than the peak value of the AC input.

The screen supply is the less obvious part of the arrangement, the positive screen supply potential being derived from the secondary centre tap. However, examination of the circuit will show that the two diodes connecting to earth through the "Standby" switch, and which form half of the main bridge, represent a back-to-front full-wave rectifier system, with the centre tap at a positive potential, rather than negative as in a more conventional system.

Filtering for the main HT supply could hardly be more straightforward, since it comprises a single effective 100uF capacitor, rated at 450VDCW; in fact, we used an available unit containing two 50uF capacitors, and connected them in parallel. This single large capacitor not only provides the requisite hum filtering but also serves as an effective reservoir for peak signal current demand.

From it also is derived supplementary supplies for the earlier stages through a cascaded decoupling network, using ordinary small resistors and pigtail electrolytics.

The phase splitter is the triode section of a 6BL8, another valve widely used in television receivers. Equal loads in the plate and cathode circuits ensure balanced signal to the output valves, each signal being about 0.9 times the amplitude of signal fed to the phase splitter grid. Due to cathode circuit degeneration, the input impedance to the stage is many times the value of the .47meg grid resistor and this has a bearing on the gain which can be expected from the preceding stage.

We gave some thought to the use of a "long-tailed pair" type of phase inverter but to be tied to a twin triode would have dictated much lower gain in this portion of the circuit than we were prepared to accept.

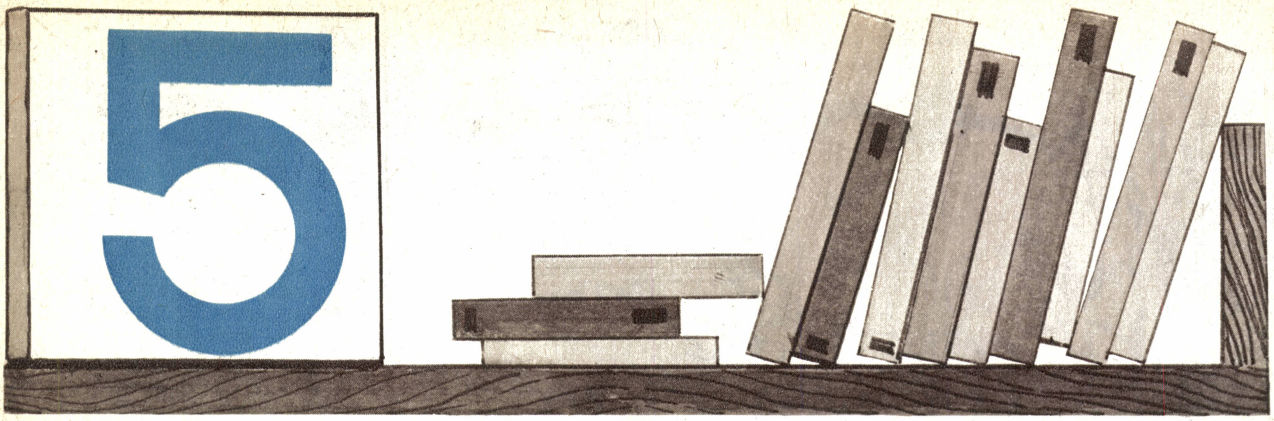
In designing an amplifier such as this, it is important to envisage, not only the overall gain, but also the distribution of gain between the stages and relative to the control functions.

Too little gain after the controls would necessitate multiple high-gain input stages and a "front-end" which could too easily be over-loaded by unexpectedly large input signals.

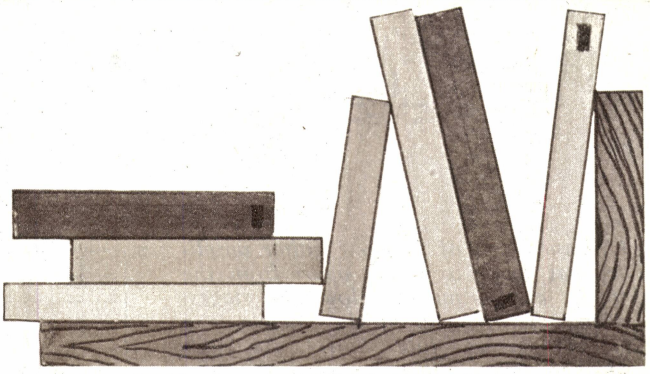
Too much gain after the controls could magnify the unwelcome sound of "noisy" potentiometers and dictate the use of a premium quality audio valve in the voltage amplifier stage to minimise risk of hum and microphony.

Microphony is an important consideration in connection with guitar amplifiers. Close proximity to the speaker system may introduce acoustic feedback, particularly in the case of a bass-guitar amplifier, since the frequencies are such that the vibration is easily transmitted through solid objects.

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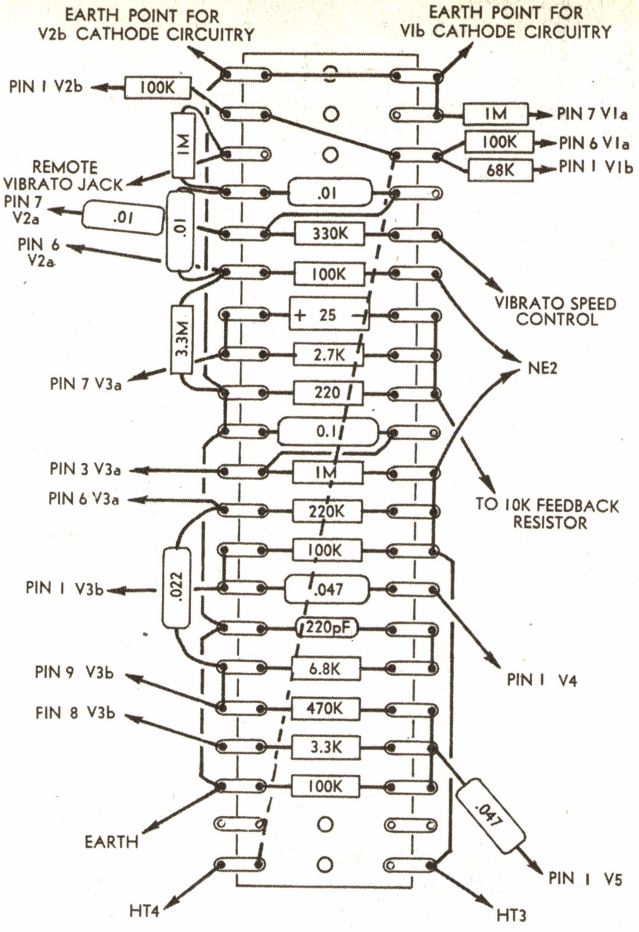
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A wiring diagram of the miniature resistor-panel unit is shown at right. Elsewhere two tag strips are used to mount the components for the first and second stages, together with the "modulator" network components. An additional two tag strips are used for the rectifier diodes and decoupling resistors.

valves involved in this amplifier, we were glad to take advantage of the 6BL8 pentode section for the main voltage amplifier without, however, getting down to a level where microphony in the stage was likely to be a problem.

The 6BL8 pentode stage has an overall gain of about 150 times, without external feedback, allowing for a small amount of degeneration from the 220-ohm resistor, across which the external feedback voltage is applied. The total feedback, using the constants specified, is about 16dB, a figure which we consider to be an advisable maximum, to minimise the risk of instability due to phase change within the output transformer.

The circuit, as drawn, shows the "Common" end of the output transformer secondary as being earthed and feedback taken from the 15-ohm connection back to the cathode circuit of the 6BL8 pentode, through a 10K resistor.

The colour coding on the circuit and the identification of the output valves should allow the feedback to be wired in correct polarity for the A&R output transformer type 2843, as used in our prototype.

With other types of output transformer, it may be necessary to establish the polarity of the feedback by trial and error. In this case, it would be logical to complete the wiring of the basic amplifier section but to leave the feedback initially unconnected.

After switch-on and with this portion of the amplifier operating normally, the feedback connection can be made. If the amplifier remains stable and/or there is a drop in the level of any test signal which is being fed through it, the feedback is negative and all is well. If the gain increases, however, and/or the amplifier howls, it is a sure sign that the feedback is positive.

Since it is logical to leave the "Common" end of the secondary earthed and not to cross over the flying leads to the output valve plates, the simplest modification is to swap over the leads from the component board to the grids of the two output valves.

It will be noted that no phasing capacitor is shown across the feedback resistor. Such a capacitor is frequently used in valve amplifiers to offset the phase rotation which commonly occurs in output transformers at supersonic frequencies and which can cause supersonic oscillation in isolated cases.

While phasing capacitors can be very effective for this purpose, they should really be selected for the particular circuit and output transformer type with the aid of an oscilloscope and square-wave generator. Any value which we might specify would not necessarily be optimum for an amplifier built up with a different brand or type of output transformer.

As an alternative measure, we have specified a "step" circuit comprising a 6.8K resistor and a 220pF capacitor in series, from the phase splitter grid to chassis. The effect of this circuit is to produce a sharp step or reduction in the gain of the amplifier above a certain frequency, normally selected to be just outside the audible range. Because of reduced response in the supersonic region, an amplifier with such a step circuit is most unlikely to become actively unstable, even with considerable phase rotation in the output transformer and feedback system.

The tone control network which precedes the 6BL8 pentode is a passive system very similar in configuration to the controls used in our various valve-type Playmasters intended for use with pickups and radio tuners. The curves have been manipulated, however, to suit them better to the present purpose.

With amplifiers intended for reproduction from tuners and records, there is a tendency to make the bass control most effective in the general region of 50Hz and to look for full treble control in the region of 10KHz. The treble control therefore has its greatest effect on musical "overtones" rather than fundamentals, tending to make the sound more or less "bright," according to the preference of the listener.

Guitarists, however, seem to want to operate on the fundamentals and low order overtones and therefore prefer a treble control which functions much lower down into the range than is common with ordinary hi-fi amplifiers. More appropriate adjectives would be "strident" and "piercing."

At the bass end, they look for copious control over frequencies in the 70-100Hz region.

The chase after sensational effects has, in fact, produced commercial amplifiers with huge orders of boost and cut over various parts of the spectrum and controls which interact so much, or so lack a balance position, that it is difficult to achieve anything like a level response.

To talk to guitarists is to realise how confused is the whole control situation and how subjective the preference for different kinds of sound.

In our case, we have tailored the constants so that the amplifier can be set up for a substantially level response, allowing it to be used for other electronic instruments, for public address or for two dissimilar guitars, each using their own in-built tone facilities.

On the other hand, maximum bass and minimum treble will give steep slope eminently suitable for a bass guitar, while rhythm and lead guitars can boost the treble to maximum and cut the bass back as necessary.

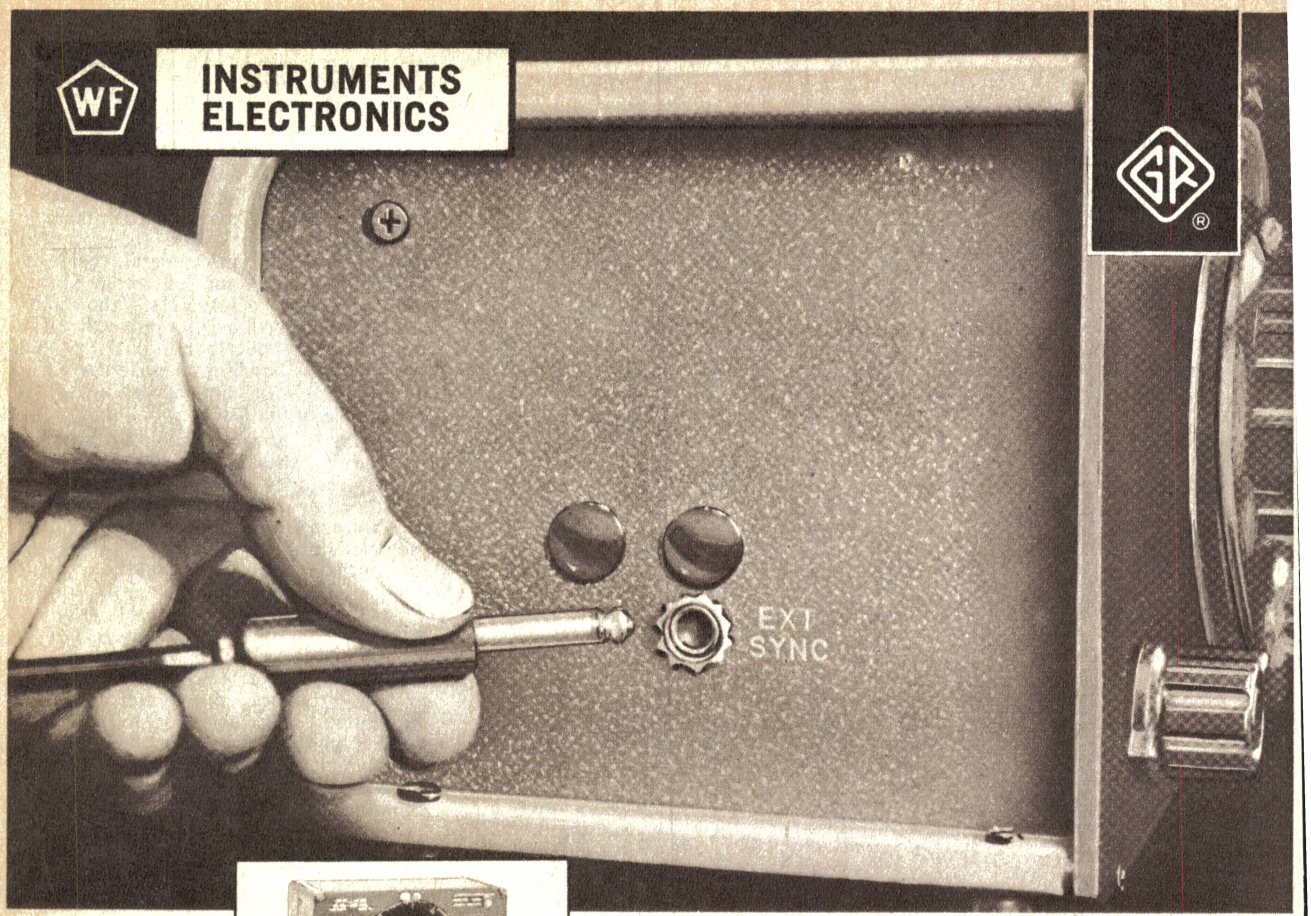
For the rest, as we said earlier, it is a matter of choosing the appropriate type of loudspeaker and enclosure.

The tone control network is preceded by three triode stages of amplification with the vibrato "modulating" circuit and volume control intermediate between the 12AU7 and the 12AX7. This vibrato circuit, based on a circuit which we published in August, 1964, gives full speed and depth control by employing a light dependent resistor (LDR) in a balanced resistance network.

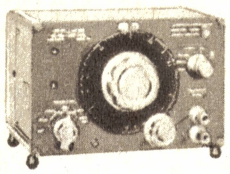
Electrically, the system has the same effect as if one were to turn the volume control rapidly up and down varying the signal level without changing any DC potentials in the amplifier. This being so, here is no tendency to "pump" the loudspeaker cones in and out and no sound to be heard other than the modulation of the signal itself. Guitarists who checked the amplifier during its development voted it as about the best vibrato (or tremolo) that they had ever used.

Another feature of the circuit is that switching the vibrato in and out, or changing the depth, does not materially alter the average loudness of the signal.

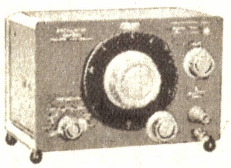
A small neon tube is used as the light source and is wired in series with the plate circuit of the oscillator. A 3.3M resistor shunts the plate of the triode to prevent the neon "going out" on the



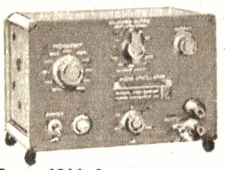
'Sync-able' Oscillators



Type 1309-A
- 10Hz to 100 kHz
- Distortion < 0.05%
- Calibrated attenuator



Type 1310-A
- 2 Hz to 2 MHz
- Distortion < 0.25%
- Constant output



Type 1311-A
- 11 fixed frequencies, 50 Hz to 10 kHz
- 1-watt output
- Distortion typically < 0.1%

Each of these compact, solid-state oscillators can be phase-locked to an external frequency source. Or, they can furnish synchronising signals to other instruments. These capabilities permit many applications never before possible with a general-purpose laboratory oscillator.

For instance:

Several of these oscillators can be locked to a frequency standard to provide a highly stable signal for each station in a production set-up. Thousands of dollars can be saved over current practices.

They can be used as frequency multipliers, since they can lock to a harmonic as well as to the fundamental frequency. Multiplying in this manner is more precise and more convenient than manually setting two different oscillators.

They can serve as high-Q filters. If a small signal (1 volt or less) with distortion, noise, and hum is applied at the SYNC jack, this signal will appear "cleaned up" and amplified at the oscillator output terminals.

The constant-amplitude signal available at the SYNC jack can be used as a separate output to trigger a counter, scope, or other oscillator.

Other features common to all three of these oscillators are: solid-state circuitry, flat output, low distortion, high accuracy, small size, internal power supply, and low cost. There is no better oscillator value on the market. For complete information write to Warburton Franki Ltd., at any of the addresses below.

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positive excursion of the plate voltage. The inclusion of the resistor thus prevents irregularities appearing in the "modulating" waveform which would produce unwanted clicks from the amplifier. Further filtering of the "modulating" signal is afforded by virtue of the natural time constant of the light dependant resistor.

The vibrato or "modulating" signal is derived from a phase-shift oscillator, which consists of the second half of a 12AX7. A high-mu triode is required in this application because a phase-shift oscillator is rather critical as to gain. The oscillator frequency is varied by means of a 1M potentiometer included in the phase-shift network.

A facility for remote control of the vibrato has been provided, by way of a "shorting" type telephone-jack on the back panel. The remote control usually consists of a foot-switch which can be either of two types, a push-on and push-off type or push-on type with a self returning spring action. Either way, they must be of such construction as to stand up to the pressure of a somewhat large, heavily clad foot!

In certain instances it may be inconvenient to use a foot-switch, particularly where a number of guitars are involved. In such cases a player may desire the vibrato switch to be on the amplifier within easy reach and with a convenient switch action. An optional vibrato "hand" switch has been shown on the circuit as being part of the depth control potentiometer, and is wired in series with the "remote" telephone jack. Potentiometers incorporating "pull - on" switches are readily available, being commonly used in television receivers.

The preamplifier valve, shown in the left foreground of the photograph, is a 12AU7A medium-mu twin triode. The valve was selected for its ruggedised construction, which makes it useful in situations critical to microphonics. The input has a low impedance network with "shorting" type jacks which tends to present a constant load to the guitars regardless of whether there are two guitars or only one. Having the jacks shorted when there are no input connections also prevents "stray" signal pick-up.

Construction might well begin with the mounting of the "hardware" with power and output transformers first, followed by the can-type electrolytic and valve sockets, using the various mounting screws to secure the tag strips where required. Orientation of the valve sockets is indicated on the under-chassis photograph.

As will be apparent from the photograph, the potentiometers were set back inside the front panel with 3/16in spacers, which we managed to obtain from a parts supplier. By using these spacers, or an equivalent thickness of washers, only enough thread need protrude to accommodate the locking nut, thus allowing the control knobs to locate fairly close to the panel.

Our own prototype chassis was handmade, sprayed and the panel lettered with adhesive transfers. We imagine, however, that suppliers will organise to make available pre-punched chassis to our specifications and lettered panels to suit.

As a next step, it is probably logical to lay in the twisted leads to the heaters and to the 6.3V pilot lamp.

Wiring of the power supply could begin with the "pigtail" electrolytics, the decoupling electrolytics mounting obliquely as a matter of convenience. The two-lug tagstrip which secures the earthed end of these electrolytics and the associated decoupling resistors is also used to mount the 10K feedback resistor from the loudspeaker socket.

The power diodes are mounted on a tag strip adjacent to the can-type electrolytic, with the positive end of the bridge supporting the 10K decoupling resistor. The other end of the bridge is connected to the "Standby" switch which is mounted on the front panel. The mains off-on switch is mounted on the back panel, adjacent to the fuse holder. Note that the power cord should be passed through a chassis grommet and secured by a suitable clip to obviate stress on the internal connections.

The next logical step is to wire the power output stage, having in mind earlier remarks about polarity of the feedback.

As can be seen from the photograph, the screen and grid resistors of the output valves have been wired across the sockets using the vacant lugs as anchor points. Connection to the grid and circuit of one of the output valves is made by the coupling capacitor from the main component panel, while the other grid circuit is connected via a lead.

Because the top caps of the 6DQ6A's are exposed and at full plate potential, the connectors should be of the protected type, as used in TV receivers.

The main component panel may be wired as a unit and secured in position, using long screws with nuts as spacers. With the panel in position the various connections can be made to the adjacent valve sockets.

The earthed lugs at one end of the panel have been used to secure the earthed ends of the cathode resistors and their bypass capacitors, belonging to the first two valves. Similarly, the lugs carrying the HT have been used to terminate one end of the load resistors to the same valves.

Mounting the light dependant resistor and the neon posed a small problem. In some commercial guitar amplifiers, the light dependant resistor and neon are simply mounted adjacent to but separate from one another, on an open tagstrip. Without shielding, however, any spurious light which may fall on the light dependant resistor will affect the modulation characteristic of the vibrato circuit.

We mounted our modulating assembly in a small can which was obtained by "butchering" a discarded electrolytic capacitor. A scrap of tinplate would do just as well. A rubber grommet retains the neon lamp while the light dependant resistor is a neat fit in the tube.

As will be evident from the under-chassis picture, the components in the LDR circuit are mounted on a tag strip adjacent to the input jacks, with a twin core shielded cable to the outside lugs of the vibrato "Depth" potentiometer. A separate shielded lead is used to connect the centre lug of the same potentiometer, to the volume control.

Having completed the input circuitry, the amplifier should be ready for operation. ■

POWER: 40 watts RMS output.

DISTORTION: Total harmonic distortion at 40 watts output is 0.8 per cent.

INPUT SENSITIVITY: 15mV for 40 watts output at 500Hz.

LOAD IMPEDANCE: 3.75, 8 or 15 ohms.

PARTS LIST

1 Chassis 16in x 7in x 1½in with outward sloping front panel.
1 Power transformer 240V to 270V at 150mA with centre tap, 30V bias winding, and 6.3V at 4A with centre tap. A&R Transformer type PT5892, or similar.
1 Output transformer 3.3Kohms plate to plate with 3.75, 8 and 15 ohm secondary taps. A&R transformer type OT2843, or similar.
2 Octal valve sockets.
1 9-pin shielded valve socket.
2 9-pin valve sockets.
2 6DQ6A valves, 1 6BL8 valve, 1 12AX7 valve, 1 12AU7A valve.
4 Power diodes, types EM405, 1N3195, OA650 or similar.
1 Bias supply diode, types, BA100, 1N3193, or similar.
1 LDR, type ORP12, B8-731-03 etc.
1 Neon lamp, type NE2.

RESISTORS

½-watt, 10 percent, unless specified.
1x3.3M, 1x2.2M, 1x1M, 3x470K, 1x330K, 3x220K, 7x100K, 1x68K, 2x47K, 1x27K, 1x18K, 1x15K, 1x15K 1 watt, 3x10K, 1x10K 1 watt, 1x6.8K, 1x3.3K, 2x2.7K, 2x2.2K, 1x1K, 1x470 ohms, 1x220 ohms, 2x47 ohms.

POTENTIOMETERS

4 1M log. (C-taper).
1 1M linear (A-taper).

CAPACITORS

1 100uF 450VW electrolytic.
1 100uF 350VW electrolytic.
2 50uF 350VW electrolytic.
1 100uF 50VW electrolytic.
5 25uF 6VW electrolytic.
2 0.1uF 400V plastic.
2 .047uF 400V plastic.
3 .022uF 400V plastic.
3 .01uF 400V plastic.
1 .0056uF L.V. plastic.
1 .001uF L.V. plastic.
1 680pF L.V. plastic.
1 220pF L.V. ceramic
1 39pF L.V. ceramic.

MISCELLANEOUS

2x6-way tag strips, 3x4-way tag strip, 3x2-way tag strips, 21 lug length of miniature resistor panel.
2 single pole toggle switches.
1 pilot lamp assembly.
1 fuse holder.
3 "shorting" type jack sockets and plugs.
1 4-pin speaker socket and plug.
Power flex and plug, clamp and rubber grommet, knobs, shielded cable, hookup wire, nuts, bolts, washers, solder, etc. Remote foot switch and mounting, if desired.

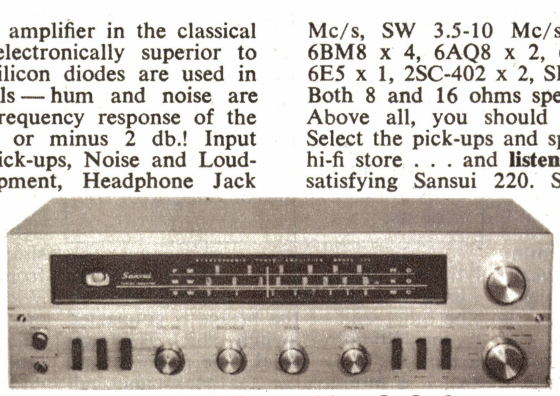


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with AM/FM/SW *tuners and 22 watts total output..*

the model 220

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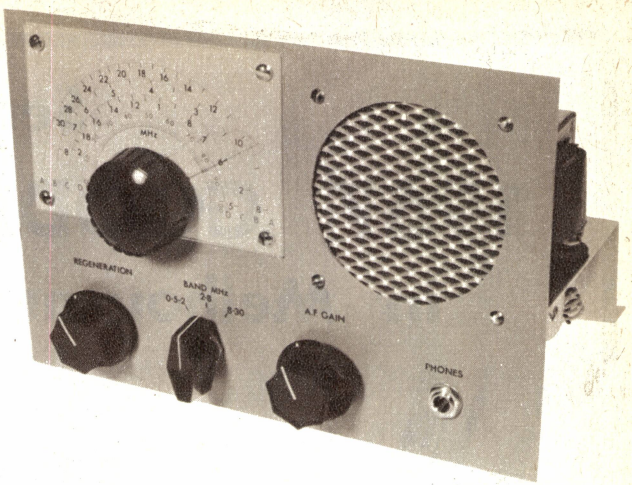
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A SIMPLE 3-BAND RECEIVER

Although this little receiver nominally has two valves, there are in fact four valve functions and it performs accordingly. It should meet the demand for an all-wave receiver, suitable for construction by younger readers, relative beginners and novices alike. We hope that it will be the forerunner of a series of progressively larger receivers, which are only on the drawing board at this stage.



The finished receiver. It may be fitted into a metal or wooden case if so desired.

By Ian Pogson

No matter how refined the modern communications receiver becomes, there is always a place for the small regenerative receiver. Such a receiver has a strong appeal by virtue of its simplicity and relatively low cost. In spite of the simplicity, it is quite surprising just how well it can perform, given an efficient aerial and a little skill in operation.

In view of this, it is understandable that our mailbag contains repeated requests for a receiver, simple in design and which will give full frequency coverage. To meet this and other similar requests, we have developed the 67 All-Wave Two, which is presented in this article. It is hoped to follow up this design with another series of multi-band superheterodyne receivers but more of that later on.

A glance at the circuit will show that we have used two valves, nominally a 6BL8 followed by a 6GW8. The triode section of the 6BL8 is used as a grounded grid stage. Although it affords little amplification, it performs two very desirable functions. Firstly, it isolates the aerial from the tuned circuit, so that the aerial has little or no effect on the tuning characteristics. Secondly, it reduces to a minimum any radiation which could take place as a result of the following stage oscillating.

The pentode section of the 6BL8 is used as a regenerative detector and is the vital part of this receiving system. This part of the circuit is very similar to that used in our Three-Band-Two receivers, which were published in May, 1957, and October, 1966. Basically, the circuit is a Hartley oscillator, with the cathode tapped into the grid coil to give the required amount of feedback. Feedback, regeneration, or reaction is then controlled by a potentiometer which varies the voltage on the screen grid of the valve.

The cathode tap method of regeneration has some advantages, when compared with other systems. Instead of a third winding being required on each former, it is only a matter of tapping at the appropriate point on the grid coil. We have also used a potentiometer in the screen grid supply circuit to control the amount of regeneration, mainly on the score that it is perhaps easier to obtain a potentiometer than a small variable capacitor, which would be the other alternative.

Following the detector stage is the volume control, which feeds the audio signal into the triode section of the 6GW8 valve. Here, the audio is amplified to a useful level whereby it may be used to drive a pair of high impedance headphones, or feed into the power pentode section of the 6GW8 to drive the speaker.

The power supply is obtained from a small transformer, rated at 30 milliamps on its secondary winding, which is ample for our purpose. Rectification is by means of two silicon diodes and two 50uF electrolytics in a voltage doubler arrangement. Extra filtering is provided by a 2.2K 5 watt resistor and another 50uF electrolytic.

If you happen to have a 6U8 type valve, it may be used in place of the 6BL8, with little or no difference in performance. Also, it would be possible to replace the 6GW8 with a 6BM8. However, it would be necessary to make changes to the socket connections, in addition to which there would be somewhat less audio gain. In short, it would be better to use the 6GW8 if possible.

Having had a quick look at the circuit, let us now examine some of its aspects in a little more detail.

In common with other small receivers, this one depends to a considerable extent for its performance on the use of a regenerative detector. When used intelligently and with a suitable aerial, the number of stations which can be logged is little short of surprising and often compares favourably with larger receivers.

For readers who may not be familiar with the subject of regeneration, or reaction, a short expanation follows.

The incoming signal from the aerial is fed into the grounded grid stage already mentioned, after which it appears at the tuned circuit in the grid of the pentode section of the 6BL8. As well as the detection process in this stage, the RF signal is also amplified. Some of this amplified signal is fed back into the tuned circuit via the cathode tap on the coil, resulting in regeneration. In other words, the original signal is reinforced and if carried far enough, will cause the stage to oscill ate at the frequency of the incoming signal.

The signal fed back, tends to make up for losses in the tuned circuit and with the system adjusted to give just the right amount of feedback, there is remarkable increase in sensitivity and selectivity.

If the amount of signal fed back is sufficient to make the circuit oscillate, this self-generated signal will beat with, or "heterodyne" with the incoming signal. This causes a whistle which changes in pitch as the receiver is tuned across the signal.

This whistle can be put to good use when it is desired to receive morse code transmissions. Under these same oscillating conditions, it is also possible to tune in SSB transmissions.

For the reception of AM signals, it is normal to set the regeneration just below the point of oscillation, otherwise a whistle will be heard with the wanted signal.

An important feature of the 67 All-Wave Two, is the use of switched coils instead of the alternative plug-in coils. Switching is a decided advantage in operating and prevents any possibility of lost or damaged coils. Admittedly, the use of switching does complicate the wiring a little but it is well worth the effort in the long run.

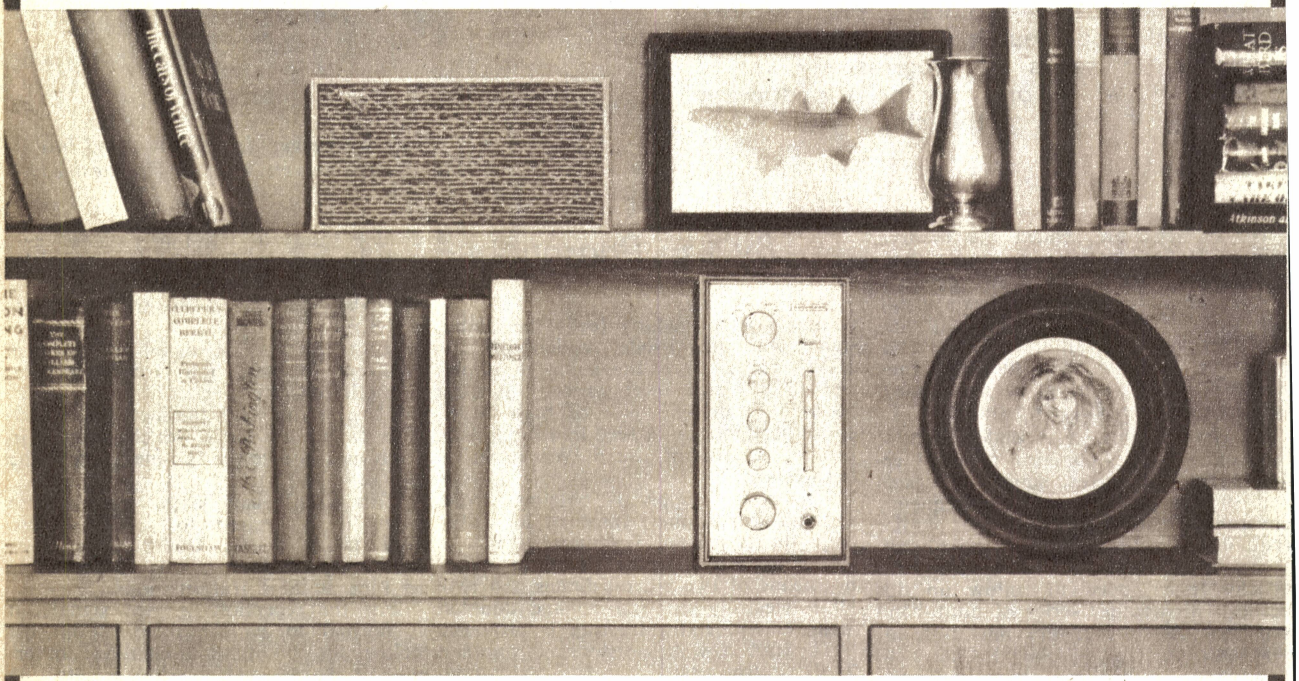
While we are on the subject of coils, we are now in a position to discuss some relevant points. As we elected to use the tapped coil method of obtaining feedback and reflecting that a similar approach was used previously in the Three-Band-Two we decided to use these coil details as a starting point.

Beginning with the coil which covers the lowest frequency range, we found that the 32 B&S enamelled wire specified, was in at least temporary short supply. As a result, we decided to use 34 B&S, which could be readily obtained. It was also found that the tapping point had to be reduced to two turns from the earthy end, instead of the original six turns. With 141 turns on the secondary winding, we obtained a frequency coverage from 0.5 to 2MHz, using a standard 415pF Roblan variable capacitor.

Next, we wound the coil for the highest frequency range. The number of secondary turns (7½), is the same as the original but we brought the cathode tap down from 2½ to 1½ turns, for best results. This gives a coverage from 8MHz to over 30MHz.

In the Three-Band-Two, there was a

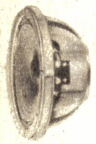
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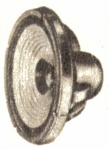
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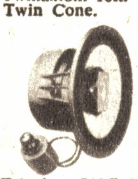
Axiette 8in Single Cone.



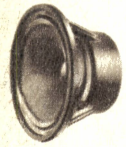
Twinaxiom 10in Twin Cone.



Axiom 301 12in Twin Cone.



Triaxiom 212C 12in Multi Element.



Audiom 61 12in Bass.

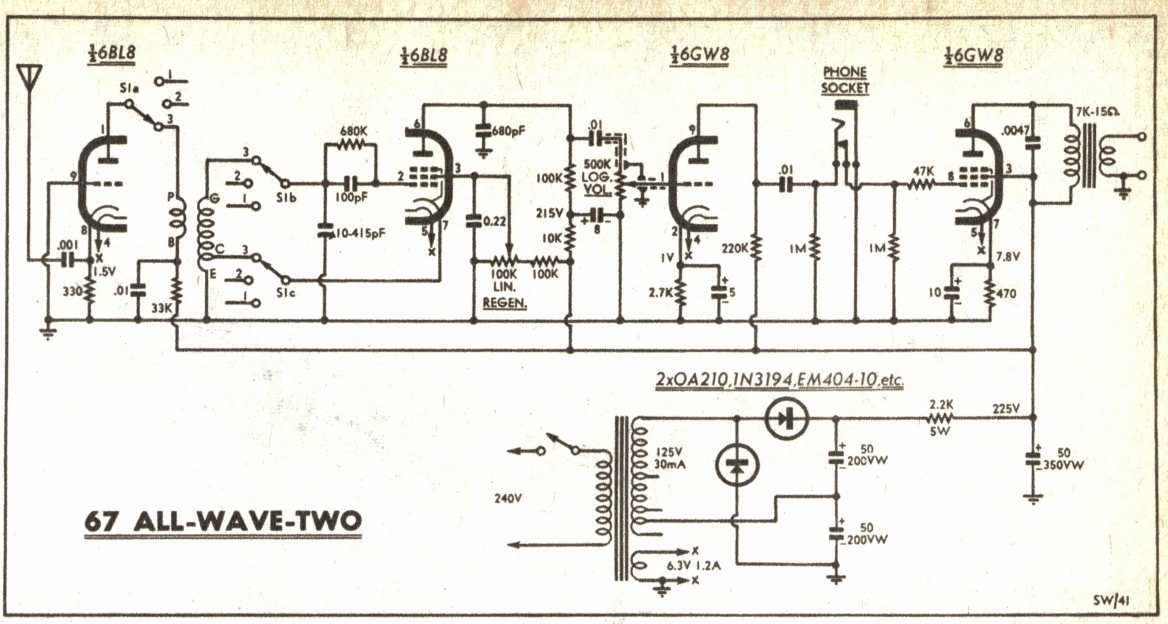


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Main features of the circuit are the use of two triode-pentode valves to provide four valve functions, the grounded grid stage ahead of the detector, and switched coils.

gap in the coverage between 2.2 and 8MHz. It is obvious that this gap should be avoided if at all possible. With a coil having 35 turns on the secondary and tapped at 4 turns, we obtained a coverage from 2 to 8MHz, which gives complete coverage, with just a convenient amount of overlap at each end.

The cathode tapping point on each coil is tied in with other requirements of the pentode operation. The amount of regeneration is controlled by varying the voltage on the pentode screen grid, with the potentiometer. If the tap on the coil is too high, it will be necessary to operate the screen voltage at a very low value. If the tap is too low, then the valve will not oscillate.

This section of the valve, as well as functioning as a detector, is also an audio amplifier. If the screen voltage is low, then the audio voltage at the plate will be restricted, resulting in insufficient drive to the 6GW8 audio amplifier. To meet both requirements, it is desirable to keep the cathode tap as low on the coil winding as possible, consistent with reliable oscillation over the range of the particular coil.

The 6GW8 audio amplifier is conventional and does not call for much comment, with the possible exception of provision for the use of headphones. We have fitted a phone jack in the grid circuit of the 6GW8 pentode. This is arranged to feed the output of the triode section into the phones and cut off the drive to the pentode. This arrangement is intended for high impedance phones. Low impedance phones could be connected across the speaker voice coil terminals.

Unless you have a particular use for headphones, then this facility could be omitted and the space fitted with a pilot light. During the period when we were testing the 67 All-Wave-Two on the air, we did not find it necessary to use headphones at all. Any worthwhile signals were all audible at usable strength on the speaker.

The complete receiver is built on a chassis measuring 8¼in x 5in x 2in, with a front panel measuring 9in x 6in. It should be noted that the minimum depth of the chassis must not be less than 2in, or such a dimension that will clear the length of the coil formers used.

We made our chassis with open ends from a piece of aluminium and this calls for a minimum of facilities. The front panel is also made from a piece of aluminium. The only possible problem with the panel is the method of cutting out the hole for the speaker. We used a nibbler but other methods will suggest themselves. It is possible that some of our advertisers may make metalwork available and this would make the job so much easier.

The layout of the major components can be seen from the photographs and it will be noted that we have included a 3in speaker on the front panel. This does not lead to any acoustic problems and makes for a very convenient arrangement. If desired, the receiver may be housed in a metal or wooden box. This has been provided for with a half-inch flange along the rear of the chassis by which it may be secured. In addition, the front panel overhangs the chassis by 3/8in, so that the unit may be screwed to the box around the edges of the panel, if necessary.

Unless you have some good reason for doing so, we suggest that you stick to the original layout. This has been worked out so that the various components are in logical relation to each other. Changing the layout could possibly lead to some unexpected problems.

The three coils are located as close to the switch as could be arranged. This is about the simplest arrangement, with the lowest frequency coil in between the others. The highest frequency coil is the one nearest the centre of the chassis.

With such a simple switching and coil layout, it is difficult to avoid completely the problem of unwanted coupling between the coils. In this particular case, when the 2-8MHz coil is in circuit, the low frequency coil has a self-resonance at about 6.7MHz. This means that, when the 2-8MHz coil is tuned at or near to 6.7MHz, there is sufficient coupling between it and the low frequency coil for the latter to absorb some energy.

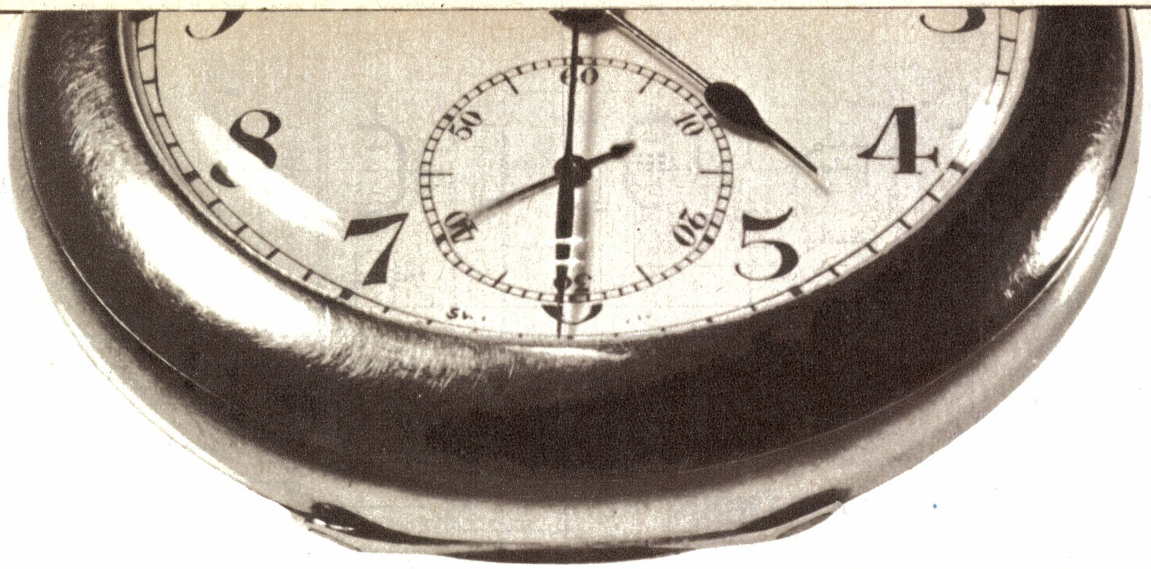
If the coupling is close enough, there will be so much energy taken from the coil in use that the stage will not come anywhere near the point of oscillation, with a consequent serious falling off in performance. Indeed, it is possible that the receiver will be virtually useless at this frequency and a small range on either side. Fortunately, when the coupling is not very great, then it is only necessary to increase the amount of regeneration to restore the performance to a usable level. This is the case in the 67 All-Wave-Two.

Pursuing this point further, when the highest frequency coil is switched into circuit, the middle frequency coil has a self-resonant frequency at about 25.2-MHz. When the high frequency range is tuned at or near this frequency, the coupling is such that the other coil absorbs sufficient energy to kill the receiver completely. Fortunately, there is very little to listen to between about 25 and 26MHz, so the problem is scarcely worth worrying about. In the light of this fact and in the interests of simplicity, we decided to "live with" this condition.

For readers who would like to avoid these two "holes," it is possible to take steps to avoid them. It will be noted that in both cases, the 2 to 8MHz coil is involved. The remedy is to get this coil out of harm's way, electrically at least. Perhaps the simplest approach would be to reduce the coupling between this and the other coils to a minimum, by making up a bracket for it and laying it on its side. There is room to do this and it will then be mutually at right angles with the other two coils.

A common and alternative approach to this problem is to short out the offending coil(s), when not in use. In this case, the 0.5-2MHz coil should be shorted when the 2-8MHz coil is in use. The 2-8MHz coil should then be shorted when the 8-30MHz coil is in use.

This involves the use of a more complicated and expensive switch, which requires two wafers and so will occupy more space. However, there would be just about enough space for the extra wafer to be fitted. We leave it up to



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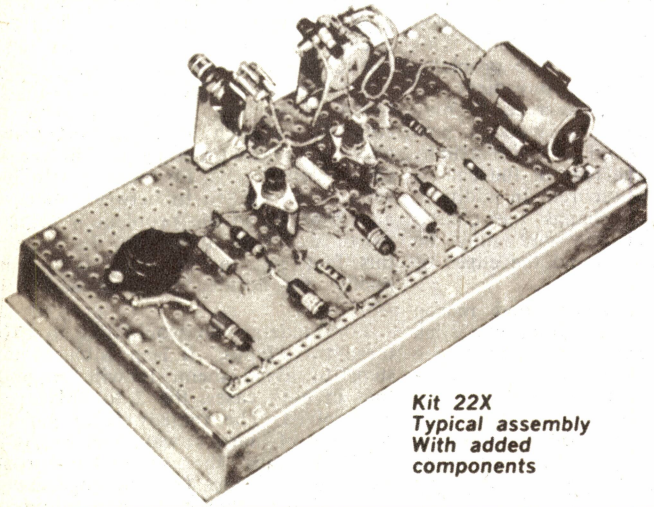
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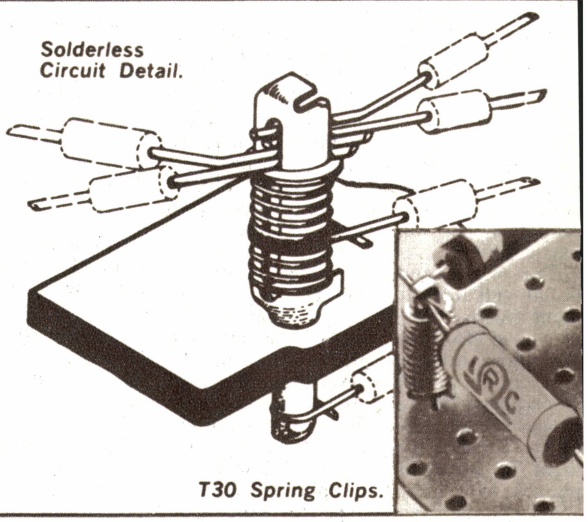
The heart of the system is the Vector SOLDERLESS SPRINGCLIP Terminal, T30N. SPRINGCLIPS hold as many as six component leads without soldering or crimping wires. This allows re-use and prevents heat damage to expensive components. Contact resistance is less than .01 ohms.

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individual readers to decide whether it is worth the extra effort or not.

Another point worthy of careful consideration, is the choice of a suitable dial assembly. On our prototype, we used a Jabel type JB6/1. This unit has a planetary drive with a ratio of about 6:1. The drive is very smooth and it is about the best available for the minimum outlay. If you would like something better for a small additional cost, then the Jabel type JB6/36 may be fitted. This drive has a dual ratio movement, 6:1 and 36:1.

With the single ratio movement, careful tuning is required, the need increasing with increasing frequency. Even more skill is required when attempting to tune SSB signals. By using the dual ratio movement, this problem is alleviated to a marked degree and we feel that it is well worth the extra cost.

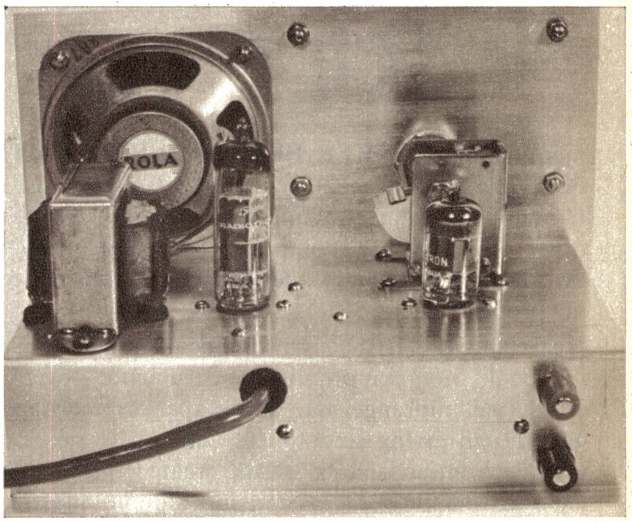
Should you decide on the dual ratio movement, it will be found that the mechanism is deeper than the single ratio unit which we used. It will be necessary to shorten the spindle of the variable capacitor by about 3/8in.

Both dial movements are supplied with a relatively small knob, as can be seen from the photograph. This knob may be retained but it is possible to improve the tuning facility, by fitting a slightly larger knob. This gives an extra vernier action and is well worth while, particularly if you intend to be tuning the higher frequencies and SSB signals. A suitable knob for this purpose is the Aegis type MV25.

A copy of the original dial scale is reproduced here. This gives some idea of the calibrations, but it is hardly likely that the coils of each unit will be sufficiently close to the original such that this scale could be used. However, it could be used as a starting point, until such time that the dial can be calibrated. More will be said about calibration later on.

The power transformer needed is a type PF2235, PT5890, or similar. This is a multi-tapped transformer and we used the 125 volt AC tap to feed the voltage doubler. The speaker output transformer is type K7K/15, K7/15, or similar. There are smaller speaker transformers available but in the interests of efficiency, we decided on the above type, as we could not afford to throw away audio power unnecessarily. Transformers of equivalent types, made by other manufacturers should be suitable, provided they can be accommodated.

We now come to the actual construc-



The layout of the major components above the chassis. The 6BL8 is behind the tuning capacitor, the 6GW8 to the left, and the power transformer at extreme left.

tional details and we will assume that you already have all the parts. Before starting the assembly of the parts, it would be a good idea to wind the coils and have them ready to drop into place, at the appropriate time.

Perhaps the most convenient coil formers to use are the ¼in diameter plastic moulded ones by Jabel which we used in our receiver. The material is easy to drill when necessary and provision is made at one end for screwing the coil down. The length of these formers is such that they will just fit under a chassis with an inside depth of 2in. Be very careful not to touch these formers with a hot soldering iron, as the material melts very easily.

The job of winding the coils is a rather demanding one, particularly when the wire is fine. Unfortunately, there is no easy way out of this, but a few suggestions are offered in the hope that they will make the task a little easier.

The coil drawings will serve as a guide as to the relative placing of the windings. Terminations can be a problem, but can be tackled in a number of ways. Holes may be drilled at the appropriate spots, through which the wire may be threaded. On the other hand, fine wire can be stuck down with a good adhesive tape. To make a better job, after sticking the end down with tape, it may be permanently sealed with some cellulose or other suitable adhesive.

Another question arises as how best to make the tap on the coil. A couple of holes side by side can be drilled at the

PARTS LIST

1 Chassis, 8¼in x 5in x 2in
1 Front panel, 9in x 6in
1 Dial, Jabel JB6/1 or JB6/36
1 Switch, 3-pole 3-position, single bank
1 Tuning capacitor, Roblan single section, 10-415pF
1 Power transformer, 125V 30mA, 6.3V 1.2A, PT5890, PF2235, or similar
1 Speaker transformer, 7K-15 ohms, K7/15, K7K/15, or similar
1 Speaker, 3in with 15 ohm voice coil
1 Valve, 6BL8
1 Valve, 6GW8
2 Diodes, EM404-10, OA210, 1N3194
1 Potentiometer, 500K log., with switch
1 Potentiometer, 100K 1in
1 Phone jack
2 Valve sockets, 9-pin
2 Terminals, one red, one black
3 Coil formers, ¼in diameter
1 3-tag strip 2 5-tag strips
1 4-tag strip 1 6-tag strip

Resistors
(½W unless specified)

1 330 ohm 1 33K 1W
1 470 ohm 1W 1 47K
1 2.2K 5W 2 100K
1 2.7K 1 220K
1 10K 1 680K
2 1M

Capacitors

1 100pF plastic
1 680pF plastic
1 .001uF ceramic
1 .0047uF 400V plastic
1 .01uF ceramic
2 .01uF 400V plastic
1 0.22uF 160V plastic
1 5uF 2.5VW electro
1 10uF 10VW electro
1 8uF 300VW electro
1 50uF 350VW electro
2 50uF 200VW electro

Sundries

Power flex and plug, knobs, cable clamp, solder lugs, hookup wire, 34 B&S enam. wire, 24 B&S enam. wire, expanded aluminium, screws, nuts, solder, etc.

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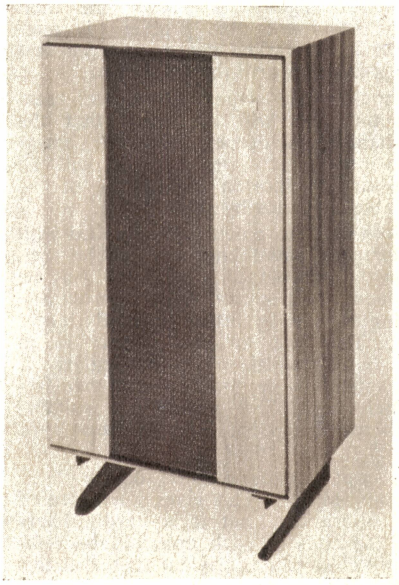
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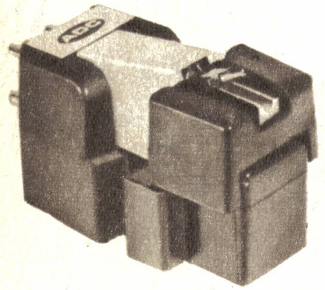
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pping point and the wire can be thread- through and twisted. Another effective ethod is to scrape the enamel from the ire for about ½in at the required point id tin it. Another short piece of wire n then be looped around the point id soldered to it. Care should be taken ot to introduce a short circuit between is point and adjacent turns.

To cope with the actual winding pro- ss, the job can be made easier with ordinary hand drill and a vyce. Clamp e hand drill horizontally in the vyce, ch that the handle can be turned in a rizontal plane. A ¼in Whitworth screw out 1in long is fed through the mount- g hole of the former, with the screw ead inside and a nut on the outside. The otruding screw is then held firmly in e drill chuck. This set-up steadies the il former and it may be turned by e drill handle. In all cases, we used the tual winding wire for connecting the il to the switch and other parts of the rcuit.

Having wound the coils, we are now ady to get on with the main job of ssembly and wiring. The following is suggested sequence of carrying out ese operations.

Three rubber grommets are required the chassis, one for the power cord, nd two for the power transformer leads. hese should be fitted first. The front anel is held to the chassis by two poten- ometers, band switch and phone jack. it the speaker to the panel, with a iece of prepared expanded aluminium. protect the cone. Mount the variable apacitor on the chassis and then follow with the dial assembly on the panel. he valve sockets should be mounted ich that pins 2 and 7 are facing the ront and back skirt of the chassis, re- pectively. A solder lug is placed under ll four screws holding the valve sockets. 3-tag strip and a solder lug are placed nder the screw holding the tuning capa- tor, nearest the regeneration control. he strip is used to mount the 33K re- stor and the lug is to earth the re- eneration control and the .01uF ceramic y-pass capacitor.

Then follows the mains transformer on p and the speaker transformer, under he chassis in that order. A 4-tag trip nd a power cable clamp are also fixed nder the speaker transformer screw, earest the centre of the chassis. This g strip is used for the 240 volt mains rmination and connections to the On/ ff switch and the transformer primary. solder lug is placed under the screw olding the mains transformer, nearest he phone jack. This is the chassis con- ection for the 50uF electrolytic at the utput of the filter.

Fix the aerial and earth terminals and wo 5-tag strips to the back skirt of the hassis. Make sure the aerial terminal s provided with a solder lug and that it s insulated from the chassis. On the ther hand, make sure that the earth ter- minal makes good contact with the hassis. The two tag strips are used to nount the two 50uF electrolytics and he two silicon diodes of the voltage oubler.

A 6-tag strip is mounted between the wo valve sockets but somewhat towards he back skirt of the chassis. This pro- ides a convenient termination for items etween the 6BL8 and 6GW8 valves. hat just about completes the assembly f the major components.

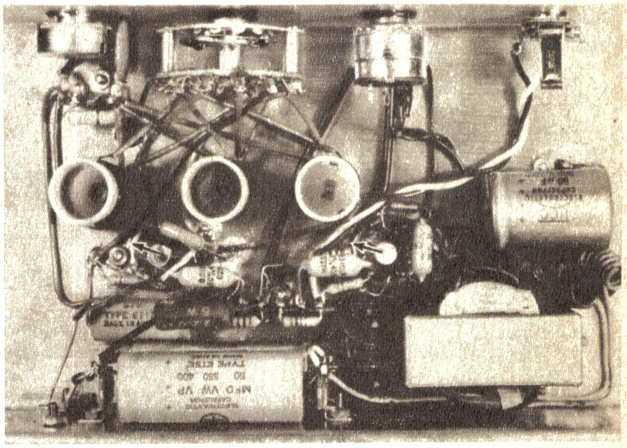
Wiring may be started by terminating ll the flying leads from the two trans- ormers. If you use a mains trans- former similar to ours, you will find that there are three secondary winding leads which are not needed. We disposed of these by winding each one around a pen- cil to form a "coil," which is left float- ing. Be sure to cut off any bare tinned wire which may be on the ends. These "coils" can be seen in the underneath view of the chassis.

Clamp the power flex and terminate it on the tag strip and run the leads to the switch on the volume control. The rest of the wiring may be done as seems logical. Run the leads to the volume control with shielded wire. Make sure that the 2.2K 5 watt filter resistor is stood away from all nearby compon- ents, as it gets rather warm.

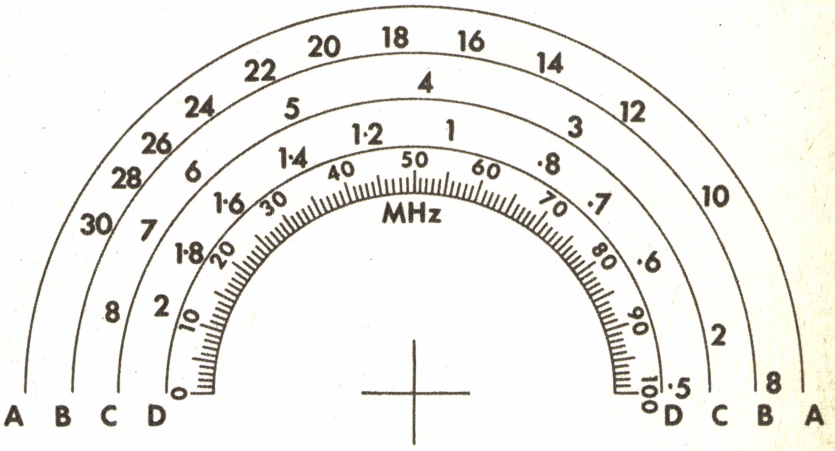
With the rest of the wiring completed, the remaining job is to fit and wire up the three coils. If you have used the Jabel moulded formers as we have done, you will notice that there is a 5/32in Whitworth thread in one end. You may use 5/32in screws if you have them, otherwise 1/8in Whitworth screws may be used, as we have done. This means that a nut is needed inside the former.

The 2 to 8MHz coil is mounted near- est the end of the chassis and with the screw used to fix the variable capacitor. The 0.5 to 2MHz coil is next and it is fixed with the other screw holding the variable capacitor. The 8 to 30MHz coil is fixed with a separate screw. All the terminating leads are made to face to- wards the switch.

A considerable amount of care should be exercised in wiring the coils into cir- cuit. Some of the finer leads are quite fragile and they can be easily broken. Set the switch to the position correspond- ing to the coil being wired. This helps avoid wiring mistakes. We used a piece of spaghetti on each lead from the coils. This protects them and improves the appearance of the wiring.



Under the chassis. Note the switch and coils arrange- ment. The broad- cast coil is in the centre, the 2- 8MHz coil on the left. The speaker transformer is at bottom right.



The dial scale, exact size. The actual calibration markings have been deliberately deleted from this version, so that constructors may add their own. Copies will be available through the query service.

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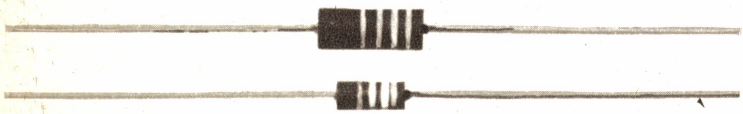
metal film

1/16 to 180 watt



cracked carbon

1/20 to 1/4 watt



moulded carbon

1/2 and 1 watt



wire wound

1·5 to 1000 watt

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This completes the wiring, but do not be in too much hurry to switch on, no matter how much you may be itching to do so. Carefully check all the wiring and check with a multimeter that there are no short circuits on the high voltage line.

Having done this, switch on and observe closely for any signs of distress in the valves or other components. If such becomes evident, switch off immediately and clear the fault. If all is well, a light hum will be heard with an ear close to the speaker. Depending upon circumstances, it should be possible to tune in broadcast signals, after having fixed an aerial to the input.

Having established that the receiver actually works, the next job is to calibrate the dial scales. If you are fortunate enough to own or can borrow a signal generator, calibration can be easy and interesting. Assuming that you have a signal generator, proceed as follows.

Unscrew the four screws holding the perspex plate which covers the dial scale. Remove the perspex and replace the screws. Set the band switch to the 0.5 to 2MHz position and connect the signal generator to the aerial and earth terminals.

Set the signal generator to 0.5MHz and set the output level no higher than is necessary for any easily detected signal. Adjust the regeneration almost to the point of oscillation and find the signal on the receiver. Mark this position in pencil on the appropriate scale on the dial. Repeat this operation at 100KHz steps, right across the dial to 2.0MHz.

Turn the band set switch to the 2 to 8MHz position. Calibrate this range with points at 500KHz intervals. Finally, with the band switch set to the 8 to 30MHz position, calibrate at intervals of 1MHz.

Now remove the dial scale and carefully mark each point with a lining pen and black drawing ink. Figures corresponding to the calibrations are filled in and the scale is then refitted to the dial. The reproduction of our scale will serve as a guide to the finished scales.

If you do not have access to a signal generator, then the dial scale just mentioned will give a good idea where to expect the various calibrations to fall. Unfortunately, it is hardly likely that the coils which you make will match exactly the coils which we have made and so the calibrations are not likely to be accurate for your receiver. Guided by our scale, however, you can log stations progressively at known frequencies and so build up the calibrations in that way.

Some comments have already been made regarding tuning techniques for this kind of receiver. However, as this is quite important, some further pointers could be helpful.

When regeneration in the detector circuit is increased, the sensitivity is also increased and selectivity is sharpened as well. Sensitivity and selectivity reach a maximum just as the point of oscillation. For the reception of AM signals, the regeneration should be set just below the point of oscillation. When attempting to receive very weak signals which are not satisfactory under these conditions, it is often possible to copy them if the detector is made to oscillate and the signal carefully tuned so that there is no whistle.

For the reception of morse code signals, the detector is brought to the point of oscillation and then the signal is tuned slightly to one side or the other, thus producing a whistle or beat note. The note is selected to suit the desires of the listener. The side selected does not matter but if interference is present it can often be avoided by selecting a particular side.

Again, for SSB reception, the detector is made to oscillate and the signal is resolved by carefully tuning for best speech quality. When the detector is made to oscillate for all the conditions just mentioned, there is no point in advancing the regeneration control beyond the position where reliable oscillation is achieved.

Another important point concerns adjustments for volume with strong AM signals. Do not back off the regeneration control if the volume is too high. This practice will certainly reduce the volume, but the selectivity will be seriously degraded as well. The correct procedure is to leave the regeneration at maximum and use the volume control For CW and SSB reception, the question does not arise, since the volume level can be adjusted only with the volume control.

Suitable aerials could be quite a topic in itself. For best results over the full coverage of the receiver, a number of different type of aerials would be desirable. The needs will vary according to the location and the frequencies on which most interest rests.

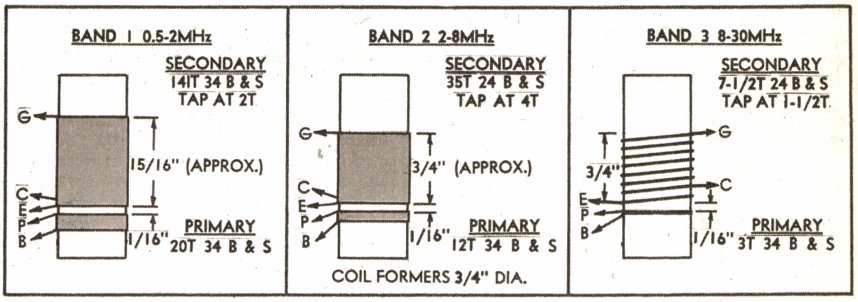
As a guide, for the broadcast band and frequencies up to about 3MHz, a random length of wire would be suitable. This may be inside or outside of and of such a length as suits local conditions, proximity of wanted stations, etc. For general short wave reception, the Twin Doublet Aerial as described in the issue for November, 1963, would be very good. If some of the amateur bands are of interest, then an aerial designed specially for these bands would be the logical choice.

When the 67 All-Wave-Two was completed, the job of testing it for performance began in our laboratory in the city. Reception conditions are notoriously bad in this location and, although aerial systems are available, the amount of noise picked up is often comparable with the wanted signal. In the circumstances, we used about 25 feet of hookup wire within the confines of the laboratory. Even with this setup, we were able to receive at good strength all the local broadcast stations. In addition, quite a selection of short wave stations were logged, including the B.B.C., Voice of America and amateurs.

Further tests were done over a weekend in one of the outer suburbs and the results were most pleasing for such a small receiver. On the broadcast band, in addition to the local stations, many country and interstate stations were heard at good strength. In addition, quite a number of short wave stations were tuned in, along with some Australian amateurs. This was achieved with the receiver sitting on the kitchen table and with nine feet of hookup wire thrown over the refrigerator for an aerial.

This check was followed by feeding more efficient aerials into the receiver. With an outside aerial made specially for use on 3.5 and 7MHz, short wave stations from various parts of the world were heard at very good strength. This applied more to frequencies up to about 12MHz. For reception up to about 29MHz, a Tri-Band beam, tuned to 14, 21 and 28MHz was used. Again, the performance was very good. Among other signals, amateurs were heard on the three bands just quoted and some of these came from as far away as the United States and England.

So there it is. With a little practice in tuning and experimenting with aerials, it is possible to have a lot of enjoyment from this little receiver. ■



If the coils are wound to the above specifications, with the wire gauges shown, the dial calibrations should approximate our own. Other gauges are discussed in the text.

ERRATA AND NOTES

Transistorised Vox parts list, August, 1966. The two .047uF capacitors should read 0.47uF. The 1M ½W resistor was omitted.

BCD-Decimal Decoding article, December, 1966 (Logic and Counting No. 7). The diagram marked Figure 7 on page 53 is not that of a bi-quinary decoder, as marked, but represents a qui-binary decoder. For bi-quinary conversion the first five gates should connect to the F-complement line, and the last five gates to the F line. The existing diagram may be converted into the correct diagram by renumbering the output terminals 0-6-2-8-4-5-1-7-3-9, reading from top to bottom.

The 250W Linear Amplifier, April, 1967. In the circuit, the floating rotor of the band-switch should be earthed. In the parts list, only one 220pF 2KV stacked foil mica capacitor is required.

"Forum," April 1967, page 73: The telephone number for the Department of Civil Aviation should read 92-0411.

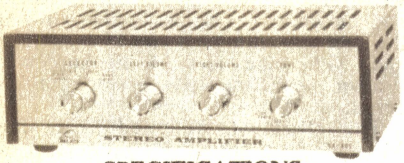
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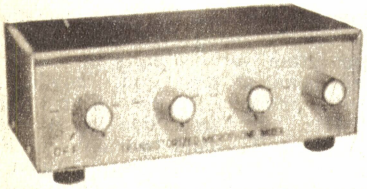


SPECIFICATIONS:

● Output Power: 8 Watts, 4 Watts per channel. ● Frequency Response: 60 to 15,000 cps ± 1db. ● Harmonic Distortion: Less than 3 per cent. ● Hum and Noise: 52 db below rated output. ● Sensitivity: Phono (Crystal) 100mV 250K ohm Tuner 100mV. ● Tube Complements: 12AX7 x 1, 30A5 x 2, 1S315 x 1 (Silicon Rectifier). ● Dimensions: 9¾in x 6¼in x 3in. ● Weight: 5.1lb.

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BELPHONE HOUSE TELEPHONE



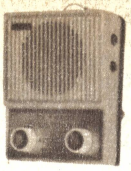
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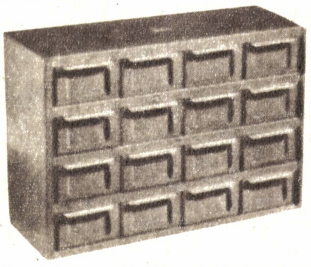
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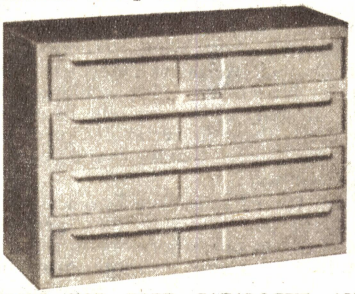
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48.S	¾in	0.742in	⅜in	5/16in	$2.80
56.S	7/32in	0.884in	⅜in	⅜in	$3.80
64.S	1in	1.008in	—	⅜in	$4.10
72.S	1⅛in	1.133in	¾in	⅜in	$4.83
76.S	1/3/16in	1.172in	—	⅜in	$4.83
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88.S	1⅜in	1.382in	1in	7/16in	$5.97

With Heat Treated, High Tensile Steel Hex. Head Bolt and Nut.

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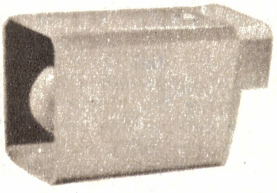
96.S	1½in	1.512in	—	9/16in	$6.68
112.S	1¾in	1.762in	1¼in	9/16in	$7.60
128.S	2in	2.014in	1½in	9/16in	$8.33

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Television Servicing	No. 4	$1.25
Philips valve data Book	New Issue	$3.00.

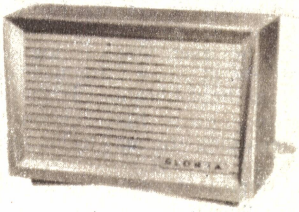
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DECISIONS . . . DECISIONS!



This little gadget, capable of giving random "yes-no" answers can be treated as a humorous gimmick, if that's the way it appeals to you. Alternatively, it can be used to demonstrate randomness and probability or to nominate random numbers.

By John Horsfield

"To be or not to be" — that is a uestion which frequently confronts a usy executive. What is more, the choice etween two courses of action is often omplicated by the presence of an nportant client who perhaps would not ppreciate the tossing of a coin to de-de the issue!

The answer lies in an electronic ecision-maker, operated secretly in a rawer, or with due flourish and in full iew on the executive table top.

The electronic decision-maker is a mple neon multivibrator, which flashes pidly from one lamp to the other ch that both neons appear to be lit at e same time — indicating also that is switched on and ready for the big oment. When the decision button is ressed, the device is locked in one state, splaying one light with its correspond-g momentous decision — "yes" or no."

For those more interested in sport an business, a possible use for the ectronic decision-maker is to replace e pennies in the traditional game of wo-up." The "spinner" would press the utton twice for each "toss." Perhaps a mbined unit could be built with two rcuits operated by one double-pole ush-button switch, although some may gue that a degree of randomness may ereby be sacrificed.

The game of two-up has been descri-ed by a Sydney judge as "a good ame, when played fairly." Appropri-ely, no amount of polishing by the oxer" can influence the decision of e simple electronic "penny," which can nsure a very fair game!

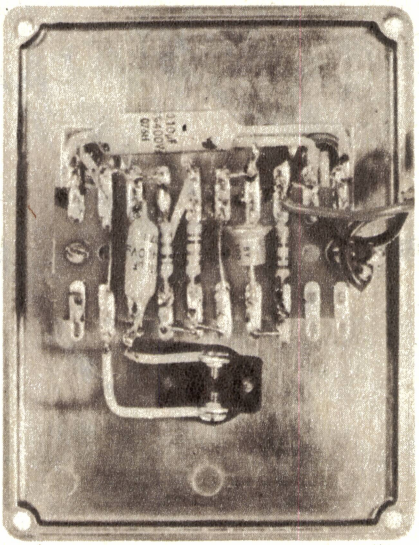
More seriously, however, the decision-aker can be employed in schools and sewhere for probability experiments nd for generating random numbers in inary form. For these applications, it ay be desirable to take extra pre-autions (to be described later) to ensure qual probabilities for "heads" and tails."

Actually, the whole subject of random-ess, chance or luck is a very complex ne, and some may recall the article What do we mean by Luck?" by Jamie-on Rowe, in the April, 1961, issue.

The probability of a specified result f certain events is the relative frequency f occurrence of that particular result n all events of the same kind. Where ppropriate it is thus the ratio of favourable" cases to the total number f possible cases.

If all results in a series of experiments re favourable, the apparent probability hat all possible results would be so

If you build this gadget, whatever the reason, use a substantial box, as for our prototype, and take full precautions against accidental contact with the mains voltage.



tends towards one, which is the highest probability and amounts to a "certainty." As the number of experiments moves towards infinity, this apparent probability can be assumed to approach the actual probability. On the other hand, if all results in the series are unfavourable, the apparent probability tends to zero and to "impossibility."

Practical probabilities lie between these two extremes, and are expressed as fractions. For example, the probability of a new-born baby being a boy is about 0.51. This is calculated from the records of many births, or "experiments," which show that slightly more boys than girls are born.

The probability of winning first prize in a N.S.W. Opera House Lottery with a single ticket is one in 100,000 or 0.00001 — a figure based not on experiment but on a knowledge of the tickets sold.

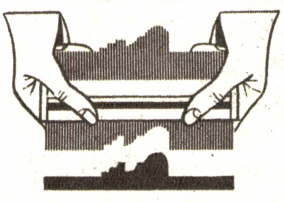
But whether or not subject to mathematical definition, the factors which combine to produce any given results are commonly called "chance" — a collective word embracing all the complex causes and circumstances which affect a result.

Some probabilities are easy to calculate, since the possible number of results is fixed. To calculate the probabilities which are relevant to rolling dice, we need to consider an individual die first. Each die has six faces and, if it is symmetrical, each face has an equal chance of being on top when the die comes to rest. The die cannot stand on an edge or on a corner, so there are only six possible results. The probability of throwing a specified number is therefore one in six, or one-sixth.

If a penny is tossed, it is reasonable to expect that the probability of it falling heads is one in two, or 0.5. A penny has little chance of standing on edge, and the possibility of this is so remote that it can safely be discounted.

Some claim, however, that a person with practice can toss a coin so as to give a desired result more often than not. Again, a deformed penny may conceivably tend to land on one side more frequently than the other. In such cases, the probabilities of heads and tails must be verified experimentally.

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The experimental method of determining the probabilities of heads and tails is simply to toss a penny a number of times and note the results. If the process is repeated a sufficiently large number of times, the pattern of results will permit an experimental determination of the probability of heads or tails for the penny (or other device). The larger the number of tosses, or experiments, the more accurate will be the final answer.

The results at first may appear to be contrary to expectation. Out of the first 20 tries, for example, there may be only eight tails. However, by the time there has been 100 attempts, tails could total 48. At 1,000, tails might have reached 498. In other words, with a larger sample the proportion of tails will normally approach half the total to agree with the predicted probability.

If the first four tosses all show heads, for instance, do not immediately doubt all you have read on probability. There will be many continuous runs of heads and of tails in any series of experiments.

The probability of a head turning up is one in two, or 0.5. It does not follow, however, that to maintain the correct ratio the next toss must produce a tail. Many gamblers think that if there has been a run of heads the chance of tails coming up next throw must be increased to give the correct proportion of results. This is not the case. No past result can prejudice a succeeding try.

The probability of 0.5 only means that if we could toss a penny an infinite number of times, the number of heads and tails would be exactly equal. If we take a very large sample, we will obtain approximately equal numbers. With a small sample, however, the ratio of heads to tails can vary considerably.

The probability of a run of say 20 heads can be computed and, although very small, is finite. The probability of a tail being thrown next time is still 0.5 regardless of all the heads.

Consider now a different experiment. If two pennies are tossed (as in two-up), or the decision button of our electronic gadget is pressed twice, what is the probability of two heads appearing?

If the problem is considered intuitively, it would seem reasonable to expect the probability to be one third. There are three possible results: Two heads, two tails, and a head and a tail. One result out of three would be favourable.

But experimental results would almost certainly not agree with this prediction. Out of 1,000 tries, about 250 double headers would turn up instead of the expected 330-odd. Why?

This discrepancy would arise from the assumption that the three possibilities were equal, but this is not so. If the possible results of the double tosses are tabulated, we get the following:

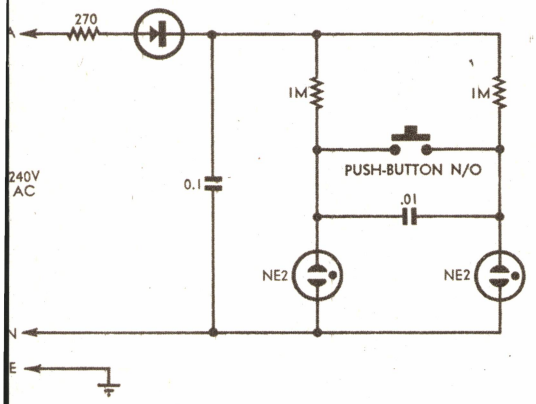
Possibilities	1st toss	2nd toss
1	heads	heads
2	heads	tails
3	tails	heads
4	tails	tails

There are in fact **four** equal probabilities and not three, two of them being indistinguishable when identical pennies are used. The probability of a double head appearing is therefore one in four, or 0.25.

Having learned something about chance and probability, we can now take a look at the electronic "decision-maker" and see to what extent its yes-no decisions are truly unbiased.

The circuit is a simple neon multivibrator, with a half-wave recifited mains supply. Any rectifier can be used with a peak inverse voltage rating of 800V or greater. The series resistor should be chosen to limit the initial surge current to less than the peak surge current rating

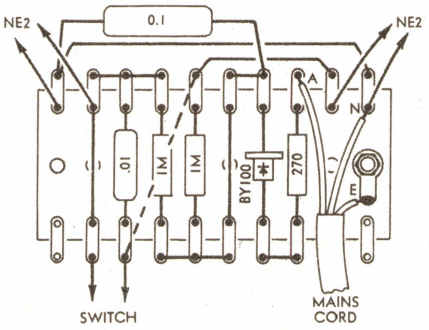
BY100,EM408-10,etc.



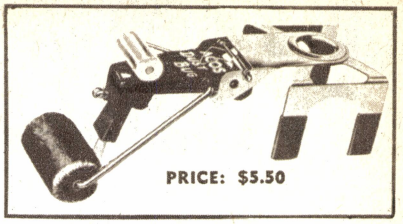
Two ordinary neon oscillators, interconnected as shown, will give adequate symmetry for gimmick use. However discrete adjustment to balance the yes-no probabilities would be justified, if more serious use is anticipated.

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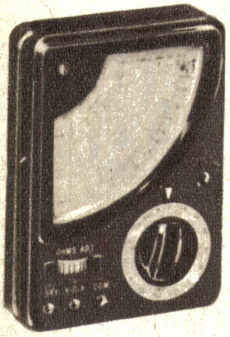
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of the rectifier. The reservoir capacitor may be of any value not less than 0.1uF, with a working voltage of 400V or greater.

When the circuit is switched on, the voltage across the reservoir capacitor is applied through the two resistors to the neon lamps. As this voltage increases, one of the neons will strike. When it has struck, the voltage across it falls to its maintaining voltage. There is no initial charge on the capacitor between the two neons, so that the other end of the capacitor must also fall to the maintaining voltage. This is less than the striking voltage of the other neon which is thus temporarily prevented from firing.

In this state, one end of a capacitor is connected to a comparitively low voltage, through the struck neon. The other end is taken to a high voltage through a series resistor, the other neon being effectively an open circuit. The capacitor therefore charges up exponentially towards the high supply voltage.

The increasing charge on the capacitor raises the voltage across the neon which has not struck until its reaches its striking voltage. When this happens, the voltage across the neon falls abruptly to its maintaining voltage. The voltage across the other neon is pulled down by the potential across the capacitor, which is equal to the difference between the striking and maintenance voltages of the second neon. This reduces the voltage across the first neon sufficiently to extinguish it.

The capacitor now charges up in the opposite direction until the first neon fires once more, extinguishing the second neon. The cycle then repeats itself continually. The frequency of this oscillation is high enough for the neon lamps to appear to be lit continuously.

When the "decision" button is pressed, the timing capacitor is shorted out. The two neons are connected together, and the one which has not struck is held at somewhere near its maintaining voltage and is unable to strike. After the button is released, the original cycle starts again.

If the times taken by the capacitor to charge to the sriking voltages on the two half-cycles are different, the two half-cycles will have unequal time lengths. When the button is pressed, it is more likely to happen during the longer half-cycle, thus increasing the probability of the associated result. The difference is not likely to be worth worrying about if the device is intended as a fun-gimmick but for deliberate observations to do with randomness and probability, more attention to the matter may be warranted.

The voltage range over which the capacitor must charge is equal to the sum of the two differences between striking and maintaing voltages for the neons. This voltage is the same for both half cycles. However, if the voltages associated with the individual neon lamps are not equal, the capacitor will have to charge up from different minimum voltages towards the fixed supply voltage.

To ensure greater uniformity, therefore, it is desirable to select a pair of neon lamps with approximately equal striking, maintaining and extinguishing voltages. For serious work, it might be advantageous to buy a number of lamps and compare their characteristics experimentally.

One other factor which can make the changing times unequal is a difference in value of the series resistors. It is necessary to select closely matched resistors (perhaps specifying one per cent tolerance) to obtain a high order of randomness of the results.

To perform a rough check of the randomness the mark-space ratio of the circuit should be checked on an oscilloscope, which should preferably be an accurate measuring instrument. A necessary precaution is to isolate the device from the mains with a suitable transformer. If no isolation transformer is available, the device must be correctly polarised with respect to the mains input (as in the circuit diagram) before connection is made between the oscilloscope and the device.

Provided that the two states of the oscillator are carefully balanced, fairly random binary numbers can be generated very simply on the decision-maker by calling one result "0" and the other "1." The button is pressed the necessary number of times, and the results noted. The resultant series of digits may be converted, if required, from binary notation to a decimal number.

(Binary numbers and their conversion to and from decimal numbers are discussed in the third of the series of articles on "Logic and Counting," published in "ELECTRONICS Australia" in August, 1966).

For example, to obtain random two-figure numbers using a pure binary approach the button must be pressed seven times for each number. This will give decimal numbers up to 127, so some results producing three-figure numbers will have to be discarded. For example, assuming heads to represent "0" and tails "1," seven successive results from the decision maker are:

1001011.

When converted to decimal notation, this gives the decimal number:

75.

Alternatively, when generating large decimal numbers, it would be possible to generate each decimal digit separately as a 4-bit BCD group by pressing the decision button four times for each digit. The resultant binary numbers would then be converted into decimal numbers.

For example, assume that in generating a random three-figure decimal number we obtain the following sequence of results:

0111 0011 1001.

If 8421 BCD code is assumed this converts to:

7 3 9

which gives 739 as the required random number. This principle can be extended to generate random numbers of any magnitude.

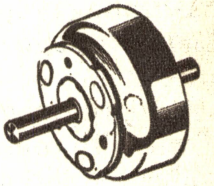
Our simple circuit was mounted in a solid metal case. However, a plastic case could be used provided that the metal parts of the lamp bezels and switch are earthed. Most of the components are mounted on a pre-wired tag-strip supported on aluminium brackets, one of which also carries the earth connection. The layout can be seen in the accompanying photograph. A wiring diagram of the tag-strip is also given to assist constructors.

If this unit gives pleasure to some and assistance to others, it will have served its purpose. ■

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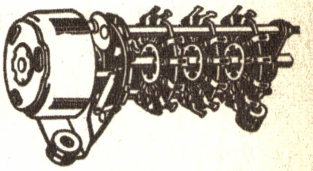
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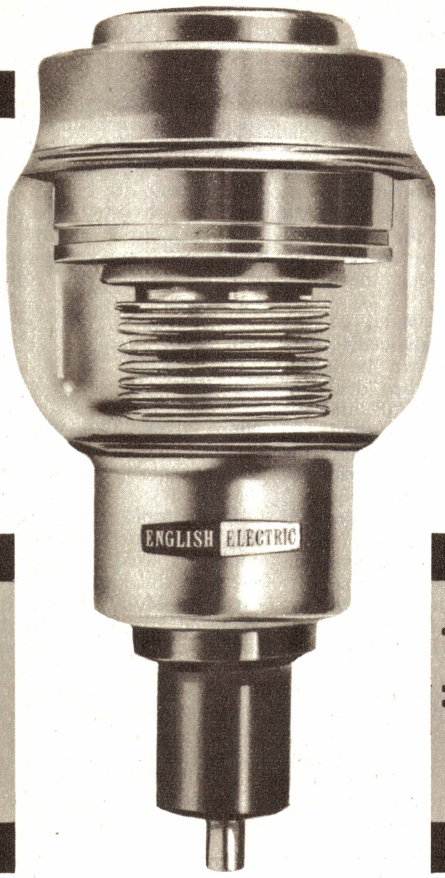


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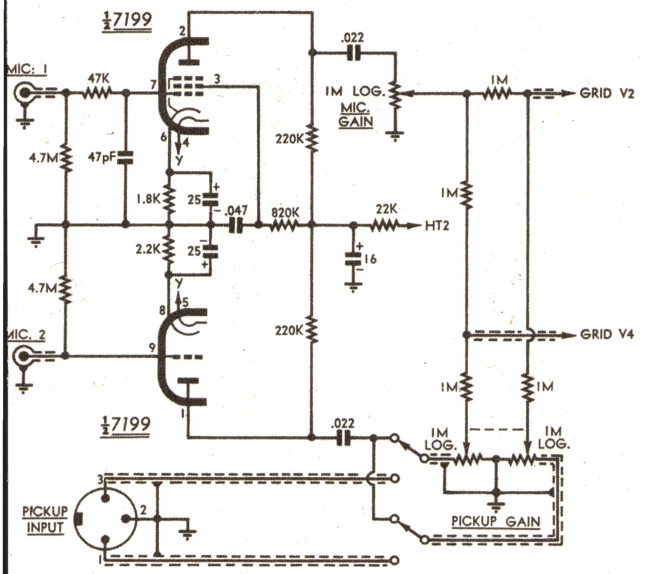
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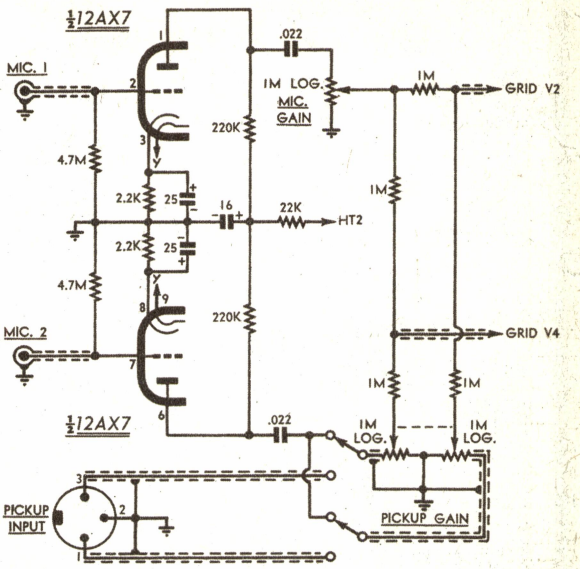
EXTRA MICROPHONE CHANNEL FOR THE STEREO P.A.

Following our description of the "Stereo P.A. Amplifier" in November last, several readers have enquired as to the possibility of providing an extra microphone channel, with its own gain control and mixing facilities. This article suggests ways and means by which it can done.

By Leo Simpson

The majority of ordinary P.A. jobs can be handled with one microphone and one pickup channel, as provided in the original design. Where multiple microphones and/or multiple pickups are called for, it is fairly common practice to use a supplementary signal mixing unit, having the requisite number of channels and fed into the "pickup" input of the main amplifier.





Simplest method of providing a second microphone preamplifier is by using a double valve, preferably a 7199, as shown at left. Output from the second preamp. is switched to the pickup channel, as required.

Current inquiries have focussed on an "in-between" course, aimed at providing two independent microphone channels on the existing chassis.

The present chassis already has provision for two microphone connectors, originally intended to accommodate an identical pair of microphones. These can be used just as easily for separate inputs but the problem remains of where to accommodate a separate microphone preamplifier and where to put its associated gain control.

A possibility which suggests itself is to replace the present single microphone gain potentiometer with a dual-concentric type, each element accepting the input from its own preamplifier and with the extra section feeding the grids of V2 and V4 through 1M resistors, exactly as for the original mic. gain control.

The main problem about this is that there would be some extra loss in the mixing circuit, leaving inadequate gain for lower level microphones and ceramic pickups. Where experience with an individual system has shown that there is gain to spare, the idea could well be adopted, however.

The alternative scheme, which we suggest, should meet most requirements and avoids further compromise in gain. It involves feeding the second microphone through an additional preamplifier into the existing pickup channel, with a slide switch to change from pickup to mic. It thus provides two fully-controllable microphone channels for stage work, with ready access to pickup input, should this be necessary at any time.

The slide switch could be mounted on the front panel but, to avoid interference with the panel layout, it can more easily be mounted on one side of the chassis, on a plate bolted behind a hole originally provided for a supplementary equipment socket.

But, having provided suitable input and control facilities for an extra microphone channel, the problem remains of arranging a second preamplifier.

One obvious course is to substitute a 12AX7 in place of the original EF86, using the same socket, and with each triode section serving as a separate preamplifier, as shown in the accompanying diagram. The circuit could probably be simplified further by using a common 1200 ohm cathode resistor and 50uF bypass.

The disadvantage of using a 12AX7 is that the respective channels will have less gain than the original EF86 pentode —a point which may or may not be important, depending on the microphones which it is intended to use. We checked the effect of using a triode preamplifier in our prototype by simply disconnecting the screen components of the EF86 and bridging screen to plate. The triode-connected EF86, with lower gain than would be expected from a high-mu 12AX7 section, appeared still to be adequate for the typical crystal and high-impedance dynamic microphones which we had at our disposal.

If in doubt, individual constructors could duplicate this test easily enough, before making any changes.

An alternative to the 12AX7 is the 7199 triode/pentode, a version of the 6U8 selected for audio applications. The pentode can take over the function of the original EF86, with about the same gain, leaving the triode to serve as the second preamplifier with much the same gain as from one section of a 12AX7.

In the typical circuits no RF filtering has been shown for the triode grids, partly because of the lower gain involved and partly because they have a higher natural input capacitance. If any trouble is experienced with RF signal breakthrough, filtering can be added as for the pentode—47K and 47pF.

A still further possibility, and the one we have illustrated, is the use of a transistor preamp to provide about the same gain as the existing EF86. This is a somewhat more expensive approach than using dual valves but it does provide a second high-gain channel for use with a dynamic microphone.

Power for the transistor preamp is taken from the cathodes of either pair of 6GW8 pentodes via a decoupling network. This will not upset the operation of the valves, since the current drain is negligible.

The preamp is wired up on a 10-tag panel and mounted vertically near the microphone inputs, as shown in the illustration. This will necessitate the removal of any spare tags on the existing amplifier tag panel and re-arrangement of components around the EF86 socket. The decoupling network for the supply was wired to a couple of spare tags on the existing tag panel, adjacent to the 6GW8's.

Looking at the illustration, one mic. input is wired direct to the grid of the



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35	(ref:160.35)	50-400V	C140 F-D 2N3649-2N3653	200 min.	15 max.	High-frequency power switching up to 25 KHz.
			C141 F-D 2N3654-2N3658	200 min.	10 max.	
55	35	50-1200V	C145 F-PB*	200 min.	50 typ. (faster available)	Compact size, high voltage, high du/dt, economical.
110	70	100-1300V	C150, C152 E-PC*	200 min.	75 typ.	High voltage, high dv/dt.
110	70	100-1000V	C151, C153 E-PA*	200 min.	50 typ.	High voltage, fast turn-off time—converters/inverters.
110	70	100-500V	C154, C156 A-E*	200 min.	10 max.	Very-high-speed inverter type.
110	70	100-500V	C155, C157 A-E*	100 min.	20 max.	Very-high-speed inverter type.
235	150	100-1300V	C180 A-PC*	200 min.	75 typ.	High voltage and high dv/dt.
235	150	100-1200V	C181 A-PB*	200 min.	50 typ.	High voltage. Fast switching for inverters, converters.
235	150	100-500V	C185 A-E*	200 min.	20 max.	Very-high-speed inverter type.
235	150	700-1700V	C280 S-PS	100 typ.	100 typ.	Highest-voltage SCR available. High di/dt.
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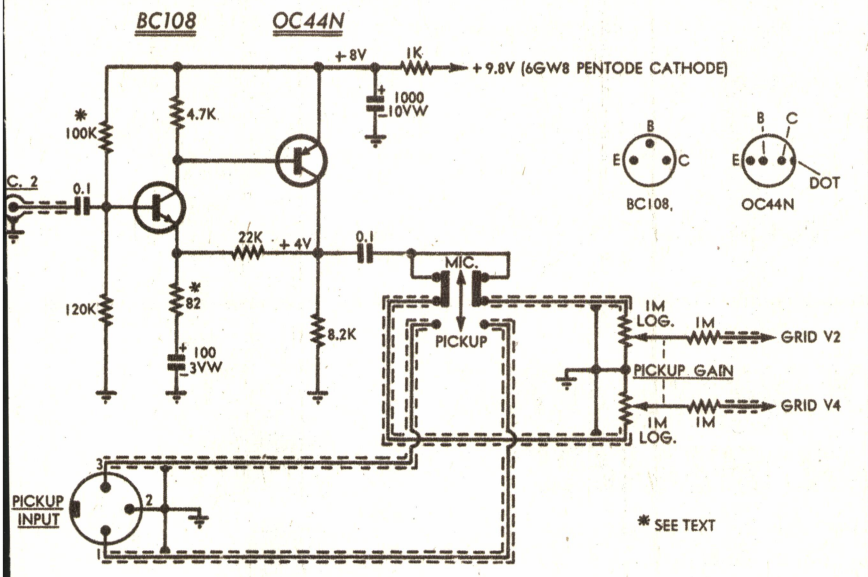
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EF86 via the existing coupling network and the other to the transistor preamp. A suitable layout for the preamp tag panel is shown on the diagram, although this is not mandatory. All earth returns for the preamp are made via the braid of the input lead.

As may be seen from the circuit diagram, the preamp uses one PNP and one NPN transistor in a rather novel configuration that could be called a common-emitter complementary amplifier. This gives a high gain at low distortion and S/N ratio. A similar circuit was described in the October, 1965, issue in an article entitled "A Preamp For Magnetic Pickups-Tape Heads."

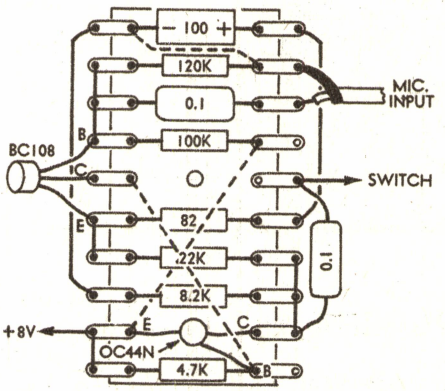
AC feed-back around the preamp is fixed by the 82 ohm resistor connecting the BC109 emitter to earth via a 100uF electrolytic. If the gain is too high, this resistor could be increased to reduce it slightly; the opposite procedure should not be used to increase gain as distortion will rise and input impedance reduce with less feedback.

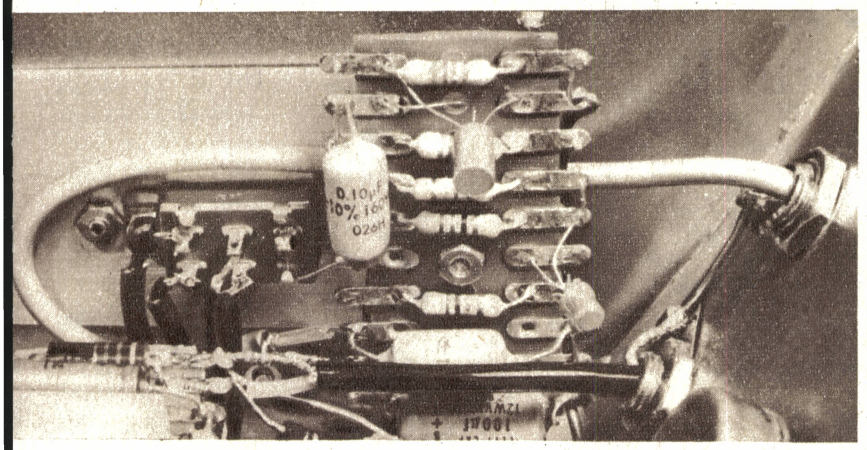
As shown, the preamplifier has an input impedance of about 50K, which will suit most "high impedance" dynamic microphones. ■



PARTS LIST

1 PNP Germanium transistor 0C44N
1 NPN Silicon transistor BC109, 2N3565, or similiar.
1 100K ½ watt.
1 120K ½ watt.
1 4.7K ½ watt.
1 82 ohm ½ watt.
1 22K ½ watt.
1 8.2K ½ watt.
1 1K ½ watt.
1 1000 uF 10VW Electrolytic.
1 100 uF 3VW Electrolytic.
2 .01 uF miniature plastic film capacitors.
1 DPDT toggle or slide switch.
1 10 tag panel, hook-up wire etc.





The diagrams and picture above show how a transistor preamplifier can be added to the stereo P.A. to provide a second mic. channel with a gain nearly equal to that of the existing EF86. The transistor preamp. can be used only with a dynamic microphone; the valve preamps can be used with either dynamic or crystal.



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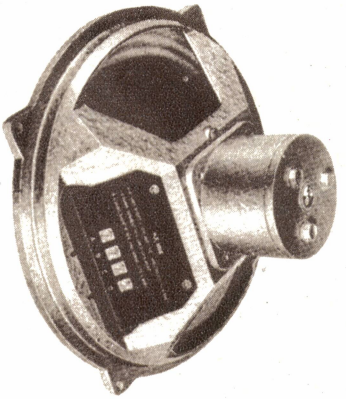
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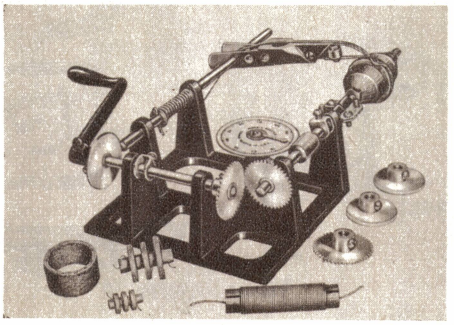
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Forum

Cold-cathode tubes — radio activity hazard?

Did you know that certain type of radio tubes contain a dangerous quantity of radioactive material? That an accident with such a tube could result in contamination of your body through an open cut, inhalation or food intake? Such is the claim made, this month, by a correspondent who says he is merely repeating what is contained in a current military training course.

Conducted by the Editor

If the claim is valid, it should be ventilated. If it's not, then I fear that a sizable number of trainees will have been led up the garden path.

To put you in the picture, let's quote from his letter, directed to the Editor and to "Forum": At his request, some of it has been paraphrased:

Dear Sir,

"Having gone through a course of training as a member of one of the Armed Forces, I am rather sensitive about safety precautions which, if understood and adhered to, will keep injuries and damage to a minimum under unforeseen circumstances.

"Since 'ELECTRONICS Australia' is at least partly directed to those who are self-taught and amateurs in electronics, I wonder whether you may have considered including a higher proportion of safety material in your publication.

"If so, I would like to plug for a first article containing some information on radioactive tubes and their possible hazards. I feel that this could be a very little known area and a large number of your readers could be unknowingly handling tubes they do not realise are radioactive and dangerous, if they are not treated properly.

"In fact, electron tubes containing radioactive material are used a good deal in service and other equipment — typically tr, atr, spark-gap, glow lamp and cold cathode tubes.

"Radioactive material is intentionally added to these tubes to produce a continuous supply of ionised particles, to ensure that the gas within the tube will always ionise at the same voltage.

"The principal radioactive materials contained in tubes and the intensity levels which should be considered dangerous are:

MATERIAL	INTENSITY (microcuries)
Carbon 14 (C14)	5.0
Cesium-barium 137 (CsBa137)	1.0
Cobalt 60 (Co60)	1.0
Nickel 63 (Ni63)	1.0
Radium 226 (Ra226)	0.1

"One list I have seen mentions about 500 types of tube of American manufacture only, containing a variety of radioactive substances, as mentioned earlier. I imagine that this must only be a small fraction of the total number of types, including those made in Europe.

"Information at my disposal suggests that the hazard is slight as long as the tubes remain intact but that a broken tube immediately becomes a potential hazard. Tubes should therefore be transferred directly from carton to equipment and vice versa and never carried unboxed on the person.

"In the event of a tube breakage, it should not be allowed to come in contact with the body, food or smoking material; precautions should be taken against inhaling dust or fumes, and radioactive decontamination procedures should be followed in respect to the area where the breakage occurred and the clothing of personnel involved.

"When a wound is caused by a radioactive object, mild bleeding should be stimulated by pressure. Do NOT suck wound by mouth. Wash with soap and plenty of clean water. For a puncture wound, make an incision to promote free bleeding and facilitate washing.

"I would be very interested to hear your views on this suggestion. I realise that there are many other areas of safety which could be covered but I suggest this one first, as one that is apparently not widely known. Other areas of safety include shock, X-ray hazards, cathode-ray tube implosion, etc."

(Name supplied but withheld by request).

Well now?

Faced with a such a letter, it would be easy enough to make diligent inquiries and come back with the appropriate comments—carrying the implication: "Of course, we knew all the time."

In fact, we didn't and, to say we read the letter with surprise, would be to put it mildly!

A whip around our staff which represents, in toto, a fair order of association with electron tubes, brought similar expressions of surprise. None could remember the question of radioactivity ever being mentioned as a hazard in any commercial literature they had seen.

Either commercial interests had been extraordinarily negligent in failing to issue such warning, or someone responsible for Armed Service training literature had been diligent to the point of gross exaggeration.

Or so it seemed.

Our next step was to ring various people in places where the traffic in radio tubes (or should we say valves?)

Radio messages are secret

The Australian Post Office has expressed concern over some evidence that radio communications are being intercepted from time to time and the information so gained used to the listeners' advantage or as the basis for news items in the Press and radio or for television news sessions.

It is pointed out that the persons who intercept the messages and the news media publishing such information contravene regulations under the Wireless Telegraphy and the Broadcasting and Television Act which prohibits the disclosure or the use, without authority, of any messages transmitted by a radio station, other than a broadcasting or television station.

The Post Office has a responsibility to ensure the secrecy of all messages and conversations exchanged through radio communication stations whether they be provided for public use by the Department or stations operating in licensed services, such as those used by Police, Ambulance, Fire Brigades, and other public authorities, or by commercial undertakings.

The Post Office feels that it is perhaps opportune to remind all those who in their enthusiasm for DX listening may overhear many types of radio transmissions of the privacy of all that passes between radio stations and their obligation to comply with the secrecy provisions of the Regulations.

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78rpm Records

Dear Sir,

I read with interest the article under "AUDIO TOPICS" in the May issue of "ELECTRONICS Australia" written by David McCallum regarding the playing of old 78 records.

The obvious impression I gain from what Mr McCallum says is that no suitable 78 playback pickups are available for the playing of these old records, recorded back in the 1930s and before; I would first like to correct him on this point.

For some years the East Recording Company has been engaged from time to time in re-recording old discs of this vintage on to either tape or acetate disc and, for this purpose, have used an Australian-made pickup quite commonly found in broadcasting stations which is available with either LP or 78 standard heads of a plug-in type. It will no doubt surprise readers interested in this field that the 78 heads are available with special wide-radius stylii for the very purpose for which Mr McCallum—and no doubt many other enthusiasts—has gone to so much trouble to obtain or construct specially.

In Victoria we supply quite a number of these pickup arms and heads to people similarly enthusiastic about playing vintage 78s and we consider the price of $35 quite reasonable for the high quality of the equipment for use in a rather specialised field. The purpose of this letter, therefore, is to let your readers know about the availability of this equipment. In this regard we will be very pleased to forward information to them if they care to write to us.

On the technical side I agree with Mr McCallum and the editorial comment, although I have some doubt about Mr McCallum's statement that "H.M.V. records made up to about 1932 will play properly only with a stylus of .004in to .005in tip radius." Our experience is that a tip of radius greater than about .004in tends to "skate" on the top of the groove walls. We actually use a radius of between .0034in and .0038in with a general preference for the latter. However, I wouldn't argue with Mr McCallum on this point, as it is highly probable he is referring to older records than those with which we have had experience.

Of course, we are all aware that the reproduction from these records is largely dependent upon the condition of the disc in the first place and, for this reason, the noise level can still be intolerable even if a perfect stylus radius was used for a particular disc.

On the premise, however, that such records are in excellent condition, having little or no more noise level than was usual during the era in which they were recorded, the next point is that of correct equalisation which has been fairly well covered by both Mr McCallum and the editorial comment.

It is probably true to say that the average enthusiast would be playing his records through a modern-type pre-amplifier—whether a separate unit or integrated with the main amplifier—and this, of course, should have independent bass and treble controls capable of providing "cut" and "boost" in both the treble and bass regions.

Unfortunately, in many instances, such equipment does not provide a sufficiently wide control to compensate adequately for the various response curves of many of the old recording characteristics.

At our studios we use a pre-amplifier tone-compensating unit which includes fixed equalisation in the front end of 78s as well as for modern LP discs; the independent bass and treble controls provide a 15dB boost and cut in both these regions. This, together with a large radius stylus, permits excellent reproduction of these old records, depending on the condition of the disc.

Sush an amplifier is available commercially but is relatively quite expensive. However, technically it is not difficult to construct for anyone with reasonable experience, and we would be happy to provide a photostat copy of the circuit for a modest 20 cents to cover copying and postage if any of your readers are interested. The output of the unit is ample to drive into the pickup inputs of most amplifiers and tape recorders.

A much more suitable and flexible unit, of course, would be a passive equaliser providing simultaneous "peak" and "dip" positions at various points in the bass and treble regions. These are available, but at a price which would not justify the expense for other than professional recording studios.

In conclusion I would say that there are a far greater number of people interested in the preservation, recording and playing of these old vintage 78s than one would think. They probably do not come to the surface because they are unaware that much can be done about this satisfactory playing of their records. For this reason I trust these few comments may prove useful and heartening.

Your faithfully

A. MAXWELL HULL,

(Technical Director, East Recording Company,
10 Elm Avenue, Elsternwick, Victoria.)

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s heavy and to throw the question at hem. The answers, given off the cuff, ere along remarkably parallel lines:

1: Yes, for the reasons stated, gaseus tubes do contain a small amount of adioactive material.

2: The radiation from such material s normally of such a kind and of such n order that it would be of quite negliible intensity outside the glass envelope.

3: It would normally be provided by tiny captive coating or pellet, quite nlikely to spill or float or fume and thus o render necessary elaborate decontamination procedures.

4: The level of dosage or exposure from isolated instances of broken tubes would be minimal and the hazard would be less than from a luminous wrist watch, or straight poisoning from the getter material in ordinary valves!

5: Postal and transport authorities, health authorities and others who are normally sensitive to potential hazards, have never questioned the handling or despatch of whole cartons of such tubes.

6: In Europe, at least, there was some sort of convention or requirement to mark products containing radioactive

(Continued on page 156)

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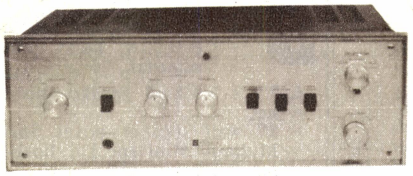
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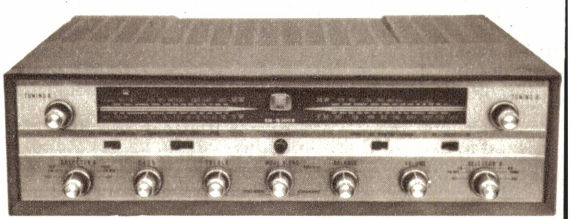
Model SA-400



Music Power:	30 watts total.
Audio Circuitry:	Power tubes 6BM8/ECL82 pushpull output circuit. 2 channels.
Harmonic Distortion:	Less than 1% (at rated output).
Frequency Response:	Plus/minus 1 db. From 30—20,000 cps over-all
Audio Sensitivity:	MAG PHONO: 2.3 mV. CER PHONO: 38 mV. TAPE HEAD: 1.5 mV TAPE P.B. (MONI): 150 mV. AUX: 150 mV.
Terminals:	8 or 16 ohms speaker output, headphone jack. TAPE REC jack. TAPE MONITOR switch. TAPE REC P.B. jack (DIN standard).
Equalisation:	PHONO: RIAA TAPE: NAB.
Tone Controls:	BASS. TREBLE.
Loudness Contour:	ON-OFF switch.
Power Supply:	230 V. AC 50.

40 WATTS FM/MW-MW/SW STEREO RECEIVER-AMPLIFIER

Music Power:	40 watts total.
FM Tuning Range:	80-108 mc.
FM Usable Sensitivity:	10 uV (IHF).
AM Tuning Range:	MW: 535-1,605 kc. SW: 3.8-12 mc.
AM Maximum Sensitivity:	MW: 13 uV. SW: 13 uV (at 1 mc, 500 mW output 30% modulation).
Audio Circuitry:	Power tubes 6BQ5. EL84 pushpull output circuit. 2 channels.
Frequency Response:	Plus minus 1 db. from 20—20,000 cps over-all.
Audio Sensitivity:	MAG PHONO: 3.4 mV. CER PHONO: 38 mV. TAPE MONI:: 160 mV. AUX: 160 mV.
Terminals:	4, 8, 16 ohms. TAPE REC jack. TAPE REC/P.B. connector equipped with TAPE MONITOR switch, for centre channel amplifier.
Equalisation:	PHONO: RIAA.
Tone Controls:	BASS, TREBLE.
Filters:	RUMBLE: cut 8 db (50 cps). SCRATCH: cut 20 db (7,000 cps). WHISTLE: cut 30 db (10,000 cps).
Loudness Contour.	ON-OFF switch.
Power Supply:	230 V, AC 50.



Model SM-Q300B

22 WATTS SW/MW-MW STEREO RECEIVER AMPLIFIER



Music Power:	22 watts total.
Tuning Range:	MW: 535-1,605 kc. SW: 3.8-12mc.
Audio Circuitry:	Power tubes 6BM8/ECL82 pushpull output circuit, 2 channels.
Frequency Response:	Plus/minus 1 db. from 20-20,000cps over-all.
Audio Sensitivity:	MAG PHONO. 2mV, CER PHONO: 23mV. AUX 115 mV.
Terminals:	4, 8, 16 ohms. TAPE REC jack.
Equalisation:	PHONO: RIAA.
Tone Controls:	BASS. TREBLE.
Loudness Contour:	ON-OFF switch.
Power Supply:	230V. AC 50.

Model SM-B161

80 WATT STEREOPHONIC PREAMPLIFIER-AMPLIFIER

Music Power Output: RMS Rated Power Output:	40 watts per channel. Plus/minus 1 db, from 15 cps to 100,000 cps.
Harmonic Distortion:	Less than 1% (at rated output).
Damping Factor:	13.
Hum and Noise (at rated output):	Magnetic, more than 60 db below full output. Auxiliary, more than 80 db below full output.
Input and Audio Sensitivity:	Tape head 2mV. Magnetic 3mV. Mic 2mV. Crystal (Ceramic) 25 mV. Auxiliary 150 mV. Tape Play 200 mV.
Bass Control:	Boost 13 db. Cut 13 db, at 50 cps.
Treble Control:	Boost 13 db. Cut 13 db. at 10,000 cps.
Filters:	High cut minus 10 db at 10,000 cps. Low cut minus 8 db. at 50 cps.
Equalisation:	Phono-RIAA Tape-NARTB.
Power Supply:	Silicon Diode Rectifier circuit.
Power Requirements:	230 volts, 7 amp. 145 watts (max.) 50-60 cps.
Tubes:	12AX7/ECC83X3 6AN8X2. 7189AX4, SE-05BX2 (Silicon Diode).



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Magnet Demonstrates Battery Performance

Most readers will have seen the TV commercial which portrays a motor car and a pair of attractive girls being held aloft on an electromagnet powered by only three small dry cells. For the story behind this spectacular demonstration we are indebted to Union Carbide Australia Ltd., makers of "Eveready batteries.

The carbon-zinc cell, also known as the Leclanche cell, has improved so much over the last 20 years that there is no comparison between the performance of those original cells and the cells manufactured in Australia today. The present-day cell has approximately twice the effective capacity of the cell produced towards the end of World War II. Even so, the chemists at the Eveready plant at Rosebery, N.S.W., are continually striving to increase the performance and reliability of the carbon-zinc cell.

Recently they succeeded in producing a carbon-zinc cell that has characteristics superior to most such cells produced today. In simple terms, they lowered the internal resistance of the cell and increased its current capabilities so that the discharge curve of voltage versus time looks very similar to the curve produced by a secondary battery. For example, even if a No. 1050 "D" size cell is subjected to a load of 1A there is very little drop in terminal voltage, indicating that the cell's internal resistance is quite low.

This improved formulation has been included in most of the "Eveready" red label premium batteries on the Australian market.

However, it was realised that it was going to be difficult to inform the public of the capabilities of the improved cells. Therefore, it was decided to show, in some spectacular way, the immense capabilities of these small power units.

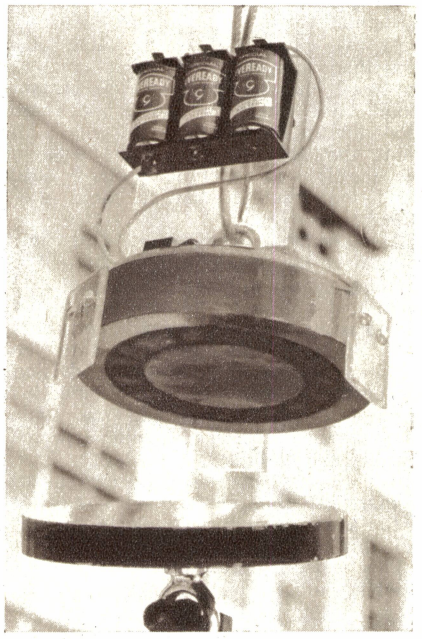
A number of different and challenging methods were considered and, finally, it was decided to produce an electromagnet capable of lifting 2,240lb — or more, if possible — with 3 only No. 1050 "D" size cells.

Considerable time and research were needed to perfect an electromagnet capable of doing the job required. Both the body of the magnet and armature had to be made from steel with very low carbon content so that the armature and magnet could be parted when no current was flowing through the winding, thus allowing the small amount of residual magnetism in the magnet to be destroyed.

The magnet was designed on the basis that the cells could deliver continuous high amperage without adverse effects. Because of the low voltage available, the best way to provide the required ampere turns was to design a coil using relatively few turns of heavy gauge wire, rather than a large number of turns which is the usual design concept.

On this basis an optimum design figure of 360 ampere turns was finally established, to be used in conjunction with a magnet having a surface area of about one third of a square foot. This proved to be capable of holding the magnet and armature together against a force of more than the required 2,240lb.

The finished magnet is shown in the accompanying photograph, and a good idea of its size can be obtained by comparing it with the three "D" size cells



A close-up of the magnet and armature assembly together with the three torch cells which powered it. It held the load for more than 45 minutes.

above it. The volume of steel in the body of the magnet is high so that it can never reach saturation point.

The centre of the machined body of the electromagnet was bored out to accommodate the winding which was bonded into place with an epoxy resin.

The surfaces of the electromagnet and armature were surface ground to correct any irregularities produced from the machining process and the ground surfaces then lapped together until they were perfectly matched.

The finished unit drew slightly more current than had been calculated, but this could still be satisfactorily supplied by the cells.

To film the commercial using the electromagnet the producer required at least 45 minutes to set up cameras, check lighting etc. This meant the vehicle had to be held up by the electromagnet, powered only by the batteries, for that period of time. In fulfilling this function, the "Eveready" No. 1050 cells exceeded all expectations and in fact, held the vehicle for a much longer period. ■



Yes, it's real! The total weight of the car and the two models is held by the power from three ordinary torch cells.

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The Serviceman

IS IT THE SET—OR THE CUSTOMER?

It has been said that the most difficult part of servicing is the customer; a statement which must have been echoed thousands of times by frustrated servicemen in their day to day encounters with the general public. Maintaining good public relations in spite of the customer's ignorance and apathy is one of the tricks of the trade.

In the early days of radio, when most owners attempted their own repairs, there used to be a story about a particularly stubborn set which defied all attempts on its owner's part to coax a signal out of it. Finally, in utter desperation, he called in a professional serviceman. The serviceman took one look at the set-up, connected the disconnected aerial, and held out his hand for his fee.

There were many variations of this story. Sometimes it was the aerial, sometimes it was the speaker plug, and sometimes it was simply the on-off switch. Sometimes the story was told at music hall level, against the amateur constructors of the day, and sometimes it was told in all seriousness against the serviceman who, believe it or not, was not supposed to charge for such a job!

But whether it was meant to be taken seriously or not, there was undoubtedly a true story somewhere — or possibly quite a number of them — on which the various versions were based.

Rather strangely, this kind of problem seemed to disappear in later years. I'm not quite sure why, but it may have been due to the apparently contradictory fact that, with a set in every home, the majority of listeners knew a good deal less about what made them tick. They were therefore less inclined to start pulling a set to pieces and looking for complicated faults as soon as it failed, but they did know enough to check the more obvious details before they called for help.

I was reminded of all this by a couple of recent incidents concerning a TV set. And, while I have had some strange calls in my time, these must constitute some kind of a record, at least within the TV era.

Both calls were on the same set. It is owned by an elderly gentleman who lives alone and, I suspect in the light of these events, is not always "with it." On the other hand he always appears bright enough, and I can only assume that he unfortunately suffers from brief lapses of memory.

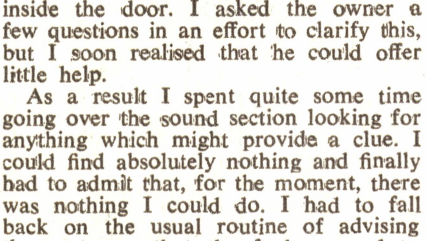
The first call, nearly 12 months ago now, was for a complete sound failure. I walked into the loungeroom, switched on the set, and waited for it to warm up. When it did the picture came up normally but there was no sound. Quite automatically I reached for the volume control. It was right off and as I turned it up the sound came in as clear as one could wish.

At that moment I wasn't quite sure what had happened. My first reaction was that the set had an intermittent sound fault which, as usual, had come good the moment I had put my foot inside the door. I asked the owner a few questions in an effort to clarify this, but I soon realised that he could offer little help.

As a result I spent quite some time going over the sound section looking for anything which might provide a clue. I could find absolutely nothing and finally had to admit that, for the moment, there was nothing I could do. I had to fall back on the usual routine of advising the customer that the fault seemed to be intermittent and to call me again immediately it recurred. I fully expected another call within a few days.

In fact, that was the last I ever heard of that fault. The next time I was called to the same set was a couple of months ago, this time for lack of picture height.

This seemed a straightforward enough problem, and I commenced by replacing



"Watch what he does then we shan't have to send for him another time." (TV Times).

first the vertical output valve and then the oscillator. Neither made the slightest difference, so I withdrew the chassis far enough to reach the appropriate underside area, and made a complete voltage check. Again I could find nothing wrong, and I was beginning to think in terms of more subtle faults, and the possible need to take the chassis back to the shop, when it occurred to me to check the height control setting.

It turned out to be almost fully retarded and a quarter turn restored normal height. What was more, a further check convinced me that there was absolutely nothing wrong with the vertical circuit. All that had happened was that — somehow — the height control had been turned down!

How?

Why?

It had me wet, as they say in the classics. The owner appeared as bewildered as I was. He was adamant that he hadn't touched it, and equally adamant that there had been nobody in the house who would have been likely to.

Yet I couldn't help recalling the mysterious "no sound" fault which, incidentally, I am quite sure the owner had now completely forgotten. I'm afraid I could not avoid the conclusion that the owner had, in fact, been responsible for both incidents, even though he was quite unaware of it afterwards. In the case of the "no sound" incident, it may have been no more than a moment of confusion during which he thought he had advanced the volume control, but actually had not.

The height control incident is more puzzling, since it is on the back of the chassis where he would normally have no occasion to go — a fact which was partly responsible for my being caught, for it never occurred to me that anyone would have touched the control.

On the other hand, I have known people to make quite strange mistakes in this region of a TV chassis. One customer rang me up in a flap one day because, in pulling the set out from the wall to dust behind it, his wife pulled the aerial feeder off the terminals.

It wasn't the accident so much that he was worrying him as the fact that he couldn't get the two aerial terminals unscrewed to put it back. When my instructions over the phone didn't seem to help, I told him to leave it until I would be passing his house later in the day.

When I arrived and he showed me what he had been trying to do I realised that the two "terminals" which wouldn't "unscrew" were the black bakelite shafts of the height and linearity tab pots! When I replaced the aerial feeder under its proper terminals I had to completely reset the whole height-linearity system.

I wonder if something like this happened to my elderly customer, and that he subsequently forgot what he had done or was unable to relate it to the fault in the set?

To change the subject, here is a story with purely technical ramifications. The complaint in this case was lack of vertical hold and, having examined the set, I had to agree with the owner that the vertical hold was extremely poor. True, one could make it lock if one fiddled with the hold control for long enough, but it was a major operation with not a very permanent result.

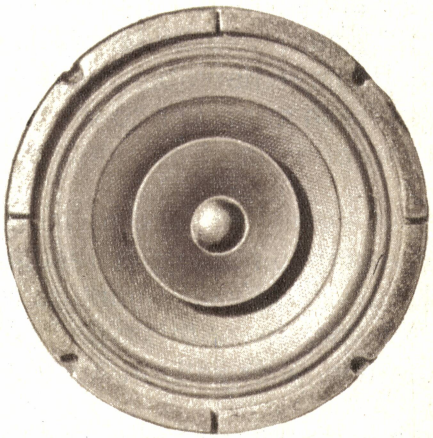
Such a fault can be due to many causes. It can be due to reduced sync pulse amplitude which, in borderline cases, may not be immediately apparent in the horizontal circuit. Alternatively it can be a fault in the vertical oscillator itself. In either case it can involve quite a large number of components which may need to be checked.

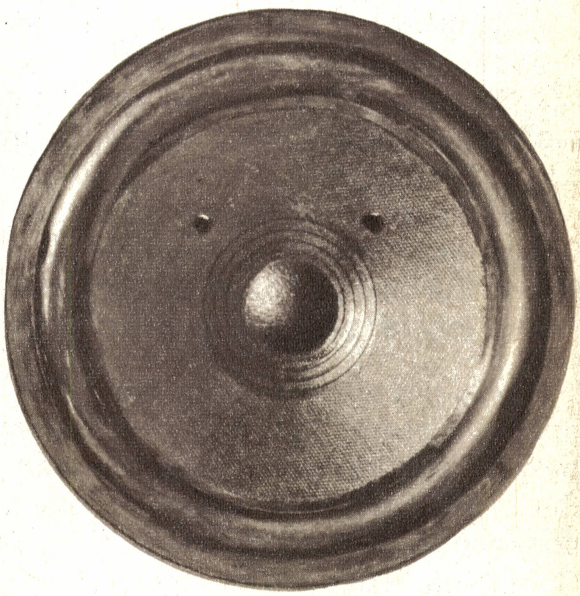
Replacing valves in both these sections

PLESSEY

announces the development of **Mini-fi**® - a completely new miniature high-fidelity speaker system



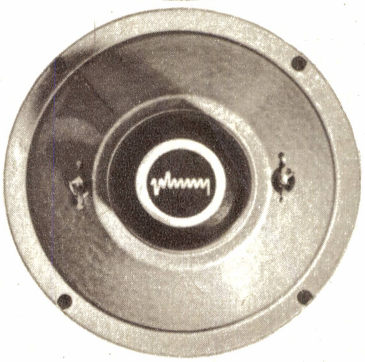




soon to be released by Rola Division this radical new speaker system creates brilliant new dimensions in sound reproduction from minimum size enclosures. Design features never before seen in Australian-made speakers will make Mini-fi the most discussed, most sought after speaker system ever available in this country. Check the following details!

Mini-fi®
is a completely new miniature speaker system





Neoprene suspension ring used on the C65-0 woofer
The Rola model 5FX tweeter — back view
The Rola model 5FX tweeter — front view
The Rola model C65-0 woofer — front view

Designed for the enjoyment of true high fidelity sound Mini-fi follows the trend towards miniaturisation with dimensions just 14″ high x 8″ wide x 8″ deep. Rola Divisional Engineers have produced this remarkable speaker system using a new and fresh approach to the problem of fine sound reproduction from small enclosures.

A completely new high compliance, long excursion woofer was required to give results which would put a locally produced miniature system in world class. No speaker of this type had ever been produced commercially in Australia.

After many months of basic research and testing a development programme produced the revolutionary new Rola model C65-0 woofer. The C65-0 woofer with advanced specifications became the key component in the new Mini-fi system. It allows bass reproduction never before possible with standard speakers in such a small enclosure. Combined with an upgraded version of the well known Rola model 5FX tweeter the performance of the system ranges from 35 Hz to 18,000 Hz.



The Mini-fi is an important advancement in audio design. It proves that miniature systems can provide high fidelity reproduction comparable to the large, bulky, multi-speaker systems. The combination of the high compliance, long excursion C65-0 woofer and the remarkable 5FX tweeter in a small totally sealed enclosure is a revolutionary advance in Australian-designed miniature speaker systems.

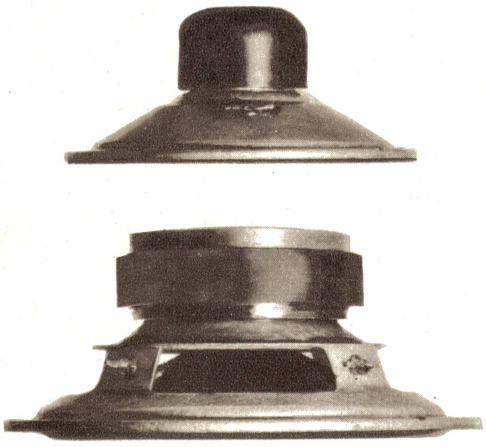


Ⓣ Trade Mark

Mini-fi®

design details

The dimensions of the Mini-fi are 14" high x 8" wide x 8" deep. Finish is in oil rubbed teak with an attractive acoustic grille cloth front panel. Mini-fi is completely air sealed during manufacture. Air leaks, interfering with the critical match between the enclosure's air compliance and the woofer's suspension compliance, would be detrimental to bass response. Nominal impedance of the system is 8 ohms, however, high fidelity amplifiers requiring loads up to 15 ohms can be used satisfactorily.



The Rola model 5FX tweeter — side view
The Rola model C65-0 woofer — side view
The Mini-fi system with front grille removed



woofer

The completely new C65-0 woofer is the first speaker ever in Australia to use a pneumatic neoprene rim suspension principle. Combined with a large 4" diameter voice coil spider of open weave fabric the C65-0 has a remarkably low 25 Hz free air resonance. No standard speaker of any size manufactured in Australia has such a low fundamental resonance. The suspension compliance of the C65-0 is critically matched to the air compliance within the enclosure. This is in contrast to the cone to box resonance match desirable in vented enclosure design. Under extreme cone excursions the neoprene rim inflates with the pressure build up in the totally sealed box. The speaker would be seriously damaged by even small low frequency inputs if not correctly baffled.

A long copper on aluminium voice coil permits high linear excursions for distortion free bass. The resin bonding of the voice coil wire on the aluminium former is completely reliable under the heat rise experienced with high power inputs. Because of the strain placed on the speaker pigtails by the long cone excursions the toughest, most dependable braid available is used.

A massive 17 oz. ferrite magnet is used in the magnet assembly to provide a flux density of 12,500 gauss in the air gap.

An important design feature of the C65-0 is the sharp cut-off at 5000 Hz.

By engineering a sharp roll-off slope (20 db per octave) through advanced cone apex design, the need for an inductor has been eliminated and the associated phase shift avoided. A sharp cross-over with minimum phase shift, an entire absence of "hole in the middle", and savings in space and cost are direct benefits of this characteristic.

tweeter

Mini-fi uses an improved version of the well-known Rola model 5FX for brilliant high frequency response. Improvements in the voice coil design and strict quality control of throat felting and pressing result in performance extending to 18,000 Hz. Under anechoic conditions the response deviation is no greater than 6 db from cross-over to 18,000 Hz. A protective capacitor to isolate low frequencies from the 5FX is the only additional component used in the Mini-fi system.

performance

Teamed together in the Mini-fi the new C65-0 and the 5FX speakers provide exceptional response from 35 Hz to 18,000 Hz (± 6 db under anechoic conditions) when used with an amplifier providing 6 db of bass boost at 100 Hz. The degree of bass boost, however, depends entirely on personal preference and the environment in which the Mini-fi system is operated. The Mini-fi system is remarkably efficient compared to similar imported miniature speaker systems.

It does not require high power input to drive it at high fidelity listening levels. A modest amplifier delivering only 2 watts RMS will drive the Mini-fi satisfactorily in an average room. The Mini-fi can handle 15 watts RMS — sufficient capacity to handle the output of most modern high fidelity amplifiers. Resonant boom or one note bass has been eliminated in the Mini-fi. The system is so effectively controlled by the combination of electromagnetic and acoustic damping the bass remains remarkably smooth, rich and clean down to 35 Hz. Intermodulation distortion is extremely low and transients throughout the range are sharp and well defined. The mid range is smooth with no sudden changes of response in the cross-over region.

From every aspect Mini-fi is a remarkable speaker system Make certain you hear it at your earliest opportunity.

Specifications Mini-fi®

speaker components	
C65-0 6.5″ diameter woofer	25 Hz free air resonance
	12,500 gauss, gap flux density
	65,000 maxwell total flux
5FX 5″ diameter tweeter	9,300 gauss, gap flux density
	18,600 maxwell total flux
cross-over frequency	5,000 Hz
frequency response	35-18,000 Hz ± 6 db
power handling capacity	15 watts RMS
impedance	8 ohms at 400 Hz
	For optimum performance the
	Mini-fi speaker system should be
	driven from an amplifier providing
	6 db of bass boost at 100 Hz.
physical dimensions	14″ high x 8″ wide x 8″ deep
weight	10 lbs.
finish	oil rubbed Teak veneer
	tentative specifications

Plessey Components Australia Rola Division

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The Boulevard
Richmond E1 Victoria
telephone 42 3921 telex 30383
telegrams and cables ROLA Melbourne
Christina Road Villawood
New South Wales
telephone 72 0133 telex 20384
telegrams and cables ROLASYD Sydney

had no effect, meaning that a more detailed check under the chassis would be necessary. For a start I concentrated on the oscillator circuit, since this seemed more suspect than the sync. circuit. But after I had checked this out pretty thoroughly, with no result, I went over the sync. circuit too — again with no result.

It was while I was contemplating what to do next that I had another fiddle with the hold control. It was just as critical as before, but I suddenly discovered that pulling or pushing the control knob also varied the oscillator frequency.

Suddenly I had a horrible suspicion. Suppose the vertical hold control had a defective spot on the element right where it needed to be set for correct frequency? This could be all that was needed to produce the symptoms I had observed

The theory wasn't hard to prove. An injection of contact cleaning fluid into the offending control, plus a couple of sweeps of the wiper across the relevant part of the element, removed all signs of the trouble. In fact, the control worked so well that I am convinced that the trouble was basically foreign matter and unlikely to occur again. There certainly didn't seem to be any justification in involving the owner in the expense of a new control.

Incidently, if my reference to "contact cleaning fluid" in the above paragraph seemed vague, this was deliberate. There are currently available two types of such cleaner, basically quite different chemically, but which both do a very good job. A few words about them both might be appropriate.

The older of the two is basically carbon tetrachloride, a powerful degreasing agent. In fact, it is so effective in this role, that, if used alone, can be too effective, leaving contacts so "dry" and devoid of any suggestion of lubrication, that wear is seriously increased. For this reason commercial contact cleaning fluids have suitable lubricants added which remain after the more volatile carbon tetrachloride has evaporated.

A relative newcomer to the scene is the moisture penetrating or moisture repelling type of liquid. These were originally presented as suitable for expelling moisture from electronic (and other) equipment which had been exposed to humid conditions, or even completely immersed in water. Some quite dramatic demonstrations have been staged in which electronic equipment, after immersion in water, has been restored to full operation in a few minutes by spraying or dunking in the repellent.

Another dramatic — and essentially practical — demonstration can be provided by any moisture laden car ignition system on a wet day. Anyone who has ever encountered such a situation will be only too well aware of the problem it presents, and can fully appreciate what it means to simply spray the ignition system for a few seconds, press the starter, and see the engine spring into life.

It is also extremely useful for freeing nuts or bolts which are "frozen" due to rust or other corrosion, and is an excellent means of removing light coatings of rust. The makers usually claim that, having removed rust, it provides some protection against the return of this condition.

Of late, many servicemen have been using this product, in preference to the older carbon tet. mixtures, for most of the routine contact cleaning jobs, including tuner contacts. As far as anyone can tell at this stage, it seems to do just as good a job, and has a few advantages besides.

Convenience is one of these, because it is packaged in an aerosol and this means that it can be sprayed into the offending component even when the latter is mounted in an awkward corner, and with a good chance that it will penetrate to where it is needed.

Another advantage is that it does not seem to have the toxic properties of carbon tet. Carbon tet. is normallly safe in small quantities in well ventilated conditions, but can be quite toxic in confined spaces, or if it comes in contact with hot surfaces.

Carbon tet. also has the disadvantage that it dissolves certain plastics, notably some types of white knob. And a damaged knob can be quite embarrassing in the case of an old set for which there may be no replacements. For this reason it is worth noting that the makers of the moisture repellent claim that it will not attack plastic — a claim which seems to be supported by experience.

Right now I carry both in my kit, and use which ever seems to be most appropriate in any particular case. I shall probably continue to do so for a long while yet.

But I must say that I find that aerosol mighty handy.

To finish off, here is a brief comment about the "spider" story from the April issue. This told of a reader's problems with a spider who insisted on blocking off the light beam of a photo-cell relay system, thus giving rise to false alarms. The story ended with the remark, "Any suggestions?"

In spite of this, my main purpose in telling the story was to emphasise the unusual nature of the problem, rather than to seek a solution to it. In fact I imagined that the writer of the letter would have solved the problem himself by the time the story appeared.

As it turned out, I received quite a number of suggestions, ranging from facetious ones like "put salt on its tail," to those which were nearly as novel as the problem.

One of these is, I feel, worth quoting.

"One possible solution is to make the shading tube of irregular shape. Since the web is built symmetrically and the spider always (usually?) stays at its centre, the irregular shape of the tube will put the centre of the web, with the spider, out of the line of the light beam."

The main flaw in this learned argument seems to be the assumption that the spider will automatically take up a position in the centre of the web, particularly as the writer of the original letter suggested that it might be attracted by the warmth of the light beam. On the other hand, if the "centre" theory is valid, it would be sufficient to simply mount the shade off centre.

But aren't we all in danger of overlooking the obvious in an effort to be scientific? Wouldn't it be a good deal easier and much more effective to simply close the open end of the tube with a piece of fly screen? Or, if the loss of light is intolerable, a piece of glass or perspex? ■

UNIQUE ENCEL OFFERS FOR JUNE!

1 Sound Model 202B solid state stereo amplifier (6 watts R.M.S. or 12 watts I.H.F.M. per channel), Labcraft 643 turntable with stereo diamond cartridge, two Wharfedale 8in RS/DD wide range Speakers .. **$123**

2 The mighty Lux SQ 101 solid state stereo amplifier, Connoisseur Craftsman II turntable, Micro MA-77 tone arm, Lux T-15-M or Micro VF-3000-E (elliptical stylus) stereo cartridge, two Celestion Ditton 10 speaker systems or two Celestion co-axial CX 2012 wide range 12in speakers **$389**

3 The Lux SQ65 stereo amplifier (30 watts R.M.S. per channel), Connoisseur Craftsman III three-speed turntable, Micro MA-88 professional tone arm, Ortofon S15 stereo cartridge with elliptical stylus, two Leak Sandwich Speaker systems. One of the most outstanding units ever offered at this price **$605**

4 Planet MG 1504 stereo amplifier, Connoisseur Classic turntable, Connoisseur SAU-1 or the Nikka tone arm, Micro magnetic cartridge with diamond stylus (M-1007-G), two Wharfedale 8 inch RS/DD speakers **$139.50**

With Labcraft 643 and B and O magnetic cartridge substituted for the Connoisseur group, price is only **$128**

5 Cosmos SW-30c stereo amplifier, Connoisseur Classic turntable, Connoisseur SAU-1 or Nikka tone arm, Connoisseur SCU-1 ceramic stereo cartridge with diamond stylus, two Model AS-61 multiple-speaker teak bookshelf speaker enclosures **$189**

6 Your choice of the following stereo amplifiers . . . Leak Stereo 30, Akai AA-5000, ADC-60 or Lux SO 101—an Orpheus Silex or Goldring G99 transcription turntable, Connoisseur Model SAU-2 tone arm (just released), ADC 10/E stereo cartridge with elliptical diamond stylus, two Celestion CX 2012 co-axial wide range loudspeakers **$445**

7 Truvox Model PD-104 stereo tape unit, Lux SQ 101 solid state stereo amplifer, Connoisseur Craftsman II turntable, Nikka tone arm, Lux T-15-M stereo cartridge with diamond stylus, 2 Celestion CX 1512 co-axial wide range 12in speakers (or two Wharfedale Super 10 RS/DD's) .. **$575**

8 New model Akai AA-7000 tuner/stereo amplifier, Orpheus Silex or Goldring G99 turntable, Connoisseur SAU-2 or Micro MA 77S tone arm, Micro VF-3000/E or Lux T-15-M stereo cartridges, two Leak Sandwich speaker systems **$665**

9 Sound Model 202 B stereo amplifier with pre-amplifier for magnetic pick-ups, Connoisseur Classic turntable, Nikka tone arm, Micro magnetic stereo cartridge Model M 2000/5 with diamond stylus, two Sonics Model AS-61 multiple speaker enclosures **$189**

With Sonics AS-302 speaker systems **$212**

10 Cosmos SW-30 C stereo amplifier, Labcraft 605 or JH turntable, All-Balance or Nikka tone arm, Micro 3000/5 stereo cartridge with diamond stylus, two Wharfedale 10in RS/DD speakers **$169**

With Sonics AS 61 speaker systems in place of the Wharfedales **$189**

IMPORTANT: All equipment is absolutely NEW and fully guaranteed. Mail orders will be care-packed and despatched anywhere. Service if ever necessary is available from Encel Stereo Centres in Melbourne and Sydney.

ENCEL ELECTRONICS PTY. LTD.

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NEW POCKET SIZE AUSTRIAN DICTATING MACHINE

The new Stuzzi "Memo-Cord" is a compact and versatile completely self-contained dictating machine which may be used anywhere . . . in the office, at home or in the car. This four track unit incorporates a built-in microphone/speaker . . . a wide range of accessories is available — lapel microphone, extension speaker, foot switch, hand microphone, telephone adaptors, etc. Recording/playing time is 1 hour, size is 4½" x 3½" x 1½", weight is 11 ozs. with batteries. Fully transistorised. Fast push-button operation. Encel priced at only **$39.90**

CONNOISSEUR STEREO CARTRIDGE MODEL SCU-1

Regarded as the finest ceramic stereo cartridge produced anywhere in the world, the Connoisseur SCU-1 will load any normal amplifier or tape recorder. Tip mass is 1 milligram, vertical compliance 8 x 10-6 cms-dyne, lateral compliance 12 x 10-6 cms/dyne. Sound qualities are exceptional—and include a pleasant musical transparency. Ask for copies of reviews in the "Gramophone" and "Records and Recording". **Encel price** **$10.80**

LEAK MINI SANDWICH ENCLOSURES NOW IN STOCK!

With a performance parallel to the full sized Leak Sandwich excepting only the lowest octave, the new Mini appeals to enthusiasts because of its modest size. Write for an EMQ or a trade-in valuation.

THE TRUVOX TSA-100 SOLID STATE STEREO AMPLIFIER

One of the most expensive and a top seller in the competitive U.K. market, the TSA-100 offers flexibility and simplicity of control, an output of 10 watts R.M.S. in each channel, pick-up sensitivity as low as 3.5 mV and inputs of tape recorders, tuners, pick-ups (magnetic and ceramic/crystal) and auxiliary equipment. At full output frequency response is 20-20,000 Hz, plus or minus 1 db. Encel price is only $156. This amplifier was priced at $270 until recently . . . and Encel Electronics made the change! See the review in the "Gramophone"! **$156**

TAPE RECORDERS

Although our range of recorders is wide, Encel prices have assured a speedy turnover . . . ask for EMQ's or trade-in valuations. Stocks include Akai, Truvox, Geloso, Sony, Teac, Tandberg, Revox, Philips, Toshiba and many more. Save more at Encel Electronics!



CONNOISSEUR CRAFTSMAN III TURNTABLE

Perfection in a precision 3 speed transcription turntable is the only way to describe the Craftsman III. Fitted with a 12" non-ferrous lathe turned turntable and a hysteresis synchronous motor . . . and a built-in illuminated stroboscope. Speed variation of 8% may be made. See the reviews in "Gramophone" and "Hi-Fi News" or write for your own personal copy. **Encel price** **$67.50**

THE COMPACT CELESTION "DITTON 10"

Measuring only 12" x 6¼" x 8¼", the "Ditton 10" is regarded as the **most advanced compact high fidelity system available.** Read the reviews in "Hi-Fi News", page 433, October 1965 and the "Gramophone", page 41, June 1965. The latest models of this proven miniature enclosure are available with 3 or 15 ohm impedances and are better than ever! Power handling capacity is 10 watts RMS. Separate bass and treble units. Available in walnut or teak **$59**



TRUVOX R102 ($226) AND R104 ($236) TWO AND FOUR TRACK MONO RECORDERS

Featuring three heads, three motors and three speeds, the Models R102 and R104 have been very favourably reviewed overseas. Frequency response at 7½ i.p.s. is 30-17,000 Hz., plus or minus 2 db. Separate record and play-back amplifiers. VU meter. Write for complete specifications and copies of reviews R-104 **$236**

SUPERLATIVE IMPORTED WOOFERS—BOTH 15" and 18" AVAILABLE NOW!

Rugged and powerful Celestion woofers are particularly suited to public address, guitar and electronic organ applications — and for the bass registers in multiple speaker systems. In Europe both speakers are very popular . . . often they are supplied as standard equipment with expensive imported electronic organs and guitar amplifiers.

G15C. A 35 watts RMS 15" speaker, this new Celestion unit has been designed for use with organs, guitars and public address systems. Feroba II ceramic magnet, total flux 180,000 maxwells. This powerful reproducer is Encel priced at only **$68.50**

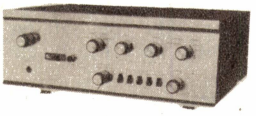
G18C. The most powerful Celestion speaker made. Rated at 100 watts RMS and with a total flux of 285,000 maxwells. Fundamental resonance 35 Hz. Voice coil diameter is 3"". Ideal for electronic organs, electric guitars and public address systems. This 18" speaker is massive in every way but the price, and is used as standard equipment on the highest quality imported guitar amplifiers **$98.50**

TAPE BULK ERASERS

Now available . . . WAL bulk erasers! Spools may be wiped absolutely clean in only a few seconds. Use any AC power point **$24.50**

THE NEW COSMOS SW-30C STEREO AMPLIFIER

8 watts R.M.S. or 15 watts I.H.F.M. per channel. P.P. 6BM8's. Wide frequency response. Speaker matching 4, 8 and 15 ohms. Sens. for p.u. 5 mV. Headphone jack. **Encel price** ... **$69.50**



THE MAGNIFICENT NEW LUX SQ65 INTEGRATED STEREO AMPLIFIER

Rated at 30 watts R.M.S. in each channel, the Lux S65 has a frequency response from 20-20,000 Hz, plus or minus 1½ db. The circuitry features silicon diodes and 11 valves including P.P. 7868's . . . and input sensitivity for magnetic pick-up is 4 mV. Tone compensation circuits include a U.S. patented type of M.F.B. system and the new Lux NF electronics. Substantial grain oriented output transformers, tape monitoring circuit, phase switch, blend control, speaker switch, head phone jack, scratch filter, rumble filter . . . all are standard equipment. The SQ65 MFB circuitry is effective on normal speaker systems. Write for full details **$199**

THE NEW ORTOFON S-15 STEREO CARTRIDGE AVAILABLE AT ALL ENCEL STEREO CENTRES!

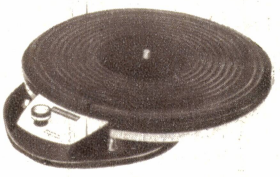
World wide acclaim provides significant testimony to the outstanding performance of the new S-15. Ask for an EMQ or a trade-in valuation.

NEW JANSZEN SPEAKER SYSTEMS WITH ELECTROSTATIC ELEMENTS

The all new Janszen Z600 speaker system is revolutionary in design and construction — provides a magnificent "transparent" sound. Response is 30 to beyond 30,000 Hz. The natural treble response results from the use of Series 130 Janszen mid/high range radiators—electrostatic units with 176 push-pull sheathed conductors. The bass reproducer is the Janszen Model 350B dynamic. Impedance is 8 ohms only. Encel price is $178 for the Z600 . . . and the cabinet can only be described as a masterpiece. Finish is oiled walnut. Truly an audiophile's delight. Ask for copies of elated reviews **$178**

HAND CRAFTED "SONICS" MULTI SPEAKER SYSTEMS

A wide range of "Sonics" multi-speaker systems is now on display at Encel Stereo Centres . . . and individual prices are as low as **$19.50.** Budget conscious music lovers and tape enthusiasts wishing to up-grade their speaker systems will appreciate the value of these beautifully finished oiled teak and walnut enclosures. Model AS-40A; **$19.50;** Model AS-60, **$25;** Model AS-61, **$35.50;** Model AS-302, **$47;** Model AS-63, **$39.50.** See them at Encel Stereo Centres. Mail orders despatched anywhere.



CRAFTSMAN II TURNTABLE

Very popular overseas, the Craftsman II features two fixed speed and a full 12in. lathe-turned non-ferrous turntable. This precision instrument employs an hysteresis synchronous motor which is dynamically balanced—wow is 0.15%, flutter 0.1% and rumble—50 dB at RIAA characteristics when referred to 7 cm/sec. at 1 kHz. Ask for copies of reviews. **Encel price** ... **$49**

NOW . . . A HIGH PERFORMANCE STEREO SYSTEM FOR SMALL LOUNGE ROOMS AND MODEST BUDGETS . . . THE ENCEL "COMPAX"!

Many music lovers have little space to spare —and require a small stereo system. The new Encel "Compax" consists of the Sound SAQ-202B solid state stereo amplifier with an output of 6 watts R.M.S. or 12 watts I.H.F.M. in each channel, a Connoisseur Classic turntable, the precision Nikka tone arm, a Micro ceramic stereo cartridge with diamond stylus, a teak base for the equipment and two hand finished multiple-speaker bookshelf enclosures. Stereo headphones may be added for only **$11** more. **Encel price** including sales tax is only **$156**

SPECIAL TAPE/DISC STEREO SYSTEM!

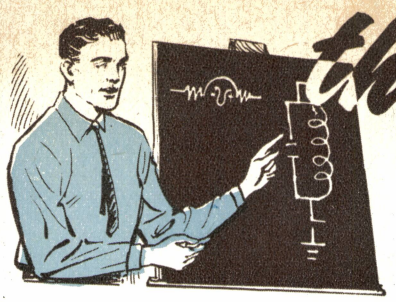
Here's value for the discriminating purchaser whichever way you look at it. Comprising a Tandberg Series 12 stereo tape recorder, Connoisseur Classic turntable on a teak base, the precision Nikka tone arm which suits high quality magnetic cartridges, a Connoisseur ceramic stereo cartridge with diamond stylus, two 5-speaker Sonics AS61 hand finished enclosures . . . all brand new and fully guaranteed. **Encel price is** ..... This low price **includes sales tax.** **$457**

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the "Answer Man" Explains

SOLDERING IRONS AND CLAD TIPS

I noticed a reference in one of your advertisements to soldering irons using "clad" type tips. What is the meaning of the term?

If we had taken it upon ourselves to answer the question, we would probably have suggested that a clad tip was simply one in which the tip was coated, for longer working life, with a metal which was somewhat more durable than copper.

As it happened, at the psychological moment, we had the opportunity of raising the question with a representative of the company to which you are probably referring and they came up with a more detailed explanation. This is what they had to say on the matter:

THE PROBLEM: In many first-rank electrical and electronics manufacturing plants in Australia a fruitful area for cost reduction and increased productivity has been entirely neglected.

"This area is occupied by the copper soldering tip and the soldering iron barrel to which it clings with unyielding tenacity.

"Copper reigns supreme as the most efficient material for storing and transferring heat from the heat-source to the termination to be soldered. However, its solubility in the tin content of the solder alloy and its high scaling rate at soldering temperatures, accelerated by flux fumes, cause frustrating and costly interruptions in production, while tips are 'dressed' and/or replaced.

"Other avoidable costs are those associated with element breakages in belated attempts to remove seized tips from the soldering iron barrel.

"These appreciable costs often go unrecorded since, in many plants, they are covered by 'supervision' or 'maintenance.' To a lesser degree, similar problems and costs are incurred by organisations or individuals concerned with servicing electronic or electrical equipment, or circuit assembly on a non-commercial basis.

"The very act of dressing a soldering tip aggravates the problem since, with the reduced dissipation area, the soldering face temperature increases; this in turn increases both solubility and oxidation rates of the copper. At the same time the volume (heat content) of the tip is reduced, slowing production soldering operations.

"When the tip is dressed close to the soldering iron barrel, tip seizure becomes a virtual certainty. Further, if inexperienced operatives partially withdraw the tip from the barrel to maintain a soldering face, the reduced heat dissipation rate, from the soldering iron element, rapidly shortens its life.

"A further consideration, important to manufacturers assembling equipment to military specifications, is the impurity level, forbidden in the soldering specification but imparted to the solder joints by the migration of copper from the soldering tip.

"In the face of these deficiencies, many attempts have been made to substitute sheathing or cladding of copper in the manufacture of soldering tips. All have been unsuccessful. No other usable metal has thermal conductivity characteristics amounting to more than 25 per cent of those of copper and with calorific heat content by volume also appreciably less."

THE ANSWER: Industry in the U.S.A. and in Europe has long ago turned to sheathing or cladding of copper soldering tips, in order to retain the advantages of the copper core while eliminating the disadvantages inherent in this metal. Ordinary electro-plated deposits are quickly removed by the corrosive action of flux fumes (including those from non-corrosive residue fluxes).

"The cladding process requires special plant and techniques so that the initial cost of cladded tips may be two to three times that for ordinary unprotected copper tips; also thermal conductivity at the soldering face is marginally reduced by the cladding.

"However, in practice, the economies in the use of clad tips have been established beyond doubt and, in many applications, it has been found that long-life clad tips have a service life as much as 10 times that of untreated tips.

"The clad tips require very little maintenance and no abrasive dressing during their service life; they maintain their shape and volume (heat content), resist seizure in the soldering iron barrel and do not impart impurities to the solder joint.

"The ultimate life of the long-life clad tip is determined by the degree of abrasive action to the tinned surface during each soldering application. When, by their abrasive action, the copper core is finally exposed, the tip should be discarded.

"Sheathed or clad soldering tips are in regular use by several of the most technically advanced electronic organisations in Australia.

"Adcola Products Pty. Ltd., of Mont Albert, Victoria, manufacturing clad soldering tips for both production and servicing applications on a commercial basis, has developed a process equal or superior to any in the world. Apart from rapidly accelerating sales within Australia, the company is exporting clad soldering tips to major overseas electronics centres, including the U.S.A., Great Britain and Hong Kong."



"There's a word you don't often hear outside television." (TV Times.)

★ ★ ★

Recently, 50 yards of coaxial cable was installed as a link in the school P.A. system. When connected to the amplifier input, and with no other connection to the cable, the amplifier played 2UW loud and clear, with no trace of signal from other stations. How could this be so?

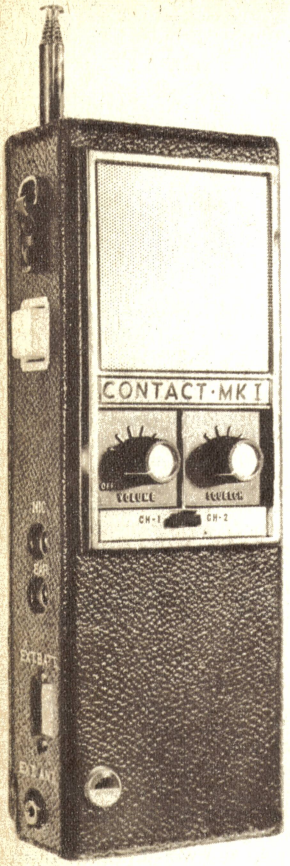
These days, with the airspace around us filled with all kinds of radio signals, any length of conductor will have radio frequency currents induced in it, corresponding with the many radio signals which affect it.

Normally we are quite unaware of this, unless we feed the energy to some kind of a radio receiver capable of amplifying it and making it apparent. Couple a receiver to a clothes line, for example, or a wire fence, and it may turn out to be functioning quite effectively as an aerial.

In your case, the coaxial cable would be as prone to pick up radio frequency currents as any other length of wire and, evidently the resultant RF signal voltage is being fed to the grid of the first valve in the amplifier.

Ideally, the first valve, operating as a "distortionless" amplifier, should be incapable of detecting RF signals and making the audio modulation available for further amplification. In practice, however, no amplifier stage is perfect and, fed with enough modulated RF input,

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it will demodulate the signal to some extent and produce a small amount of audio in its plate circuit. With enough gain in the following stages, this audio will be heard in the loudspeakers.

This is a fairly common occurrence and explains why broadcast signals are sometimes heard when one puts a finger on the mic. input terminal of a sensitive amplifier.

But how could it happen with shielded cable, whose outer braid was presumably earthed?

To be sure, the braid may have been connected to the chassis of the amplifier at the input connector but this may not fairly be regarded as "earthed" in terms of an RF signal. Most likely, the actual path back to earth would have been fairly long, via the third wire in the power circuit. But, even if the amplifier chassis were earthed fairly directly by a separate wire, the far end of the cable could have quite a substantial RF potential by reason of its physical length and its own self inductance.

It is not at all outside the realms of possibility that an RF potential could exist on the inner cable, simply by virtue of the RF current and potential on the outer braid.

But why just 2UW, which is not particularly close to the school site or necessarily more powerful than other stations?

Almost certainly, some characteristic of the cable installation—its length, its associated capacitances, the manner of its earthing, etc.—had conspired to give it, quite accidentally, a resonant condition very close to 2UW's frequency.

In thus "tuning" 2UW, it would probably give an artificial boost to the amplitude of the signals from the station.

To stop the effect, it may only be necessary to experiment with the earthing of the amplifier, possibly running a direct earth wire rather than relying on the power wiring earth. Again, an earth at the far end of the cable braid might effect a cure, although it might conceivably introduce hum into the amplifier by reason of earth currents at mains frequency.

Within the amplifier itself, an RF choke or a resistor of about 10K in series with the first grid and wired right at the grid pin, might stop the effect. A small ceramic bypass from grid to earth (say 47pF) might also help.

★ ★ ★

When parking a car out-of-doors in frosty conditions, mention is sometimes made of the possibility of the radiator freezing. Nobody seems to say much about the battery, which also contains water. Why not?

Some of our readers have probably had a lot more practical experience than ourselves with freezing of a car's cooling system. We gather, however, that most motorists take a risk and get away with it in areas where it gets uncomfortably cold and frosty but not more than that. Apparently, there's enough insulation provided by the bodywork, in still air, and enough stored heat from the day's motoring to keep freezing at bay in such conditions.

However, a question to the N.R.M.A. Office in Sydney evoked the opinion that glycol is so cheap and available that it's a good safeguard to add it to the radiator water anyway, if there is any thought of touring in areas where the overnight temperature falls substantially below freezing point.

As distinct from the radiator, the battery has a measure of in-built protection, because the liquid in it is not just water but a mixture of water and sulphuric acid.

Even if the battery is virtually "flat," with the specific gravity of the electrolyte down to a nominal 1100, the freezing point is at 19 degrees F. Thus, one doesn't even need to begin to worry, except when caught in an unusually low-temperature situation, with an unusually flat battery.

But, with a motor as cold as that and a flat battery, one is likely to have more to worry about than mere ice in the cells!

With rising specific gravity, the freezing point of the electrolyte falls rapidly to 5 degrees F at 1150, minus 16 degrees at 1200 and minus 90 degrees at 1280. In short, the temperature at which the electrolyte will freeze in a fully charged battery is more than 100 degrees lower than the freezing point of a discharged battery.

The motorist who is wise enough, therefore, to keep his battery fully charged, to cope with a "Cold" start in the morning, need not worry about it freezing up overnight—unless the motel happens to be sited pretty close to the fringe of outer space!

★ ★ ★

How do you go about replacing an old electrodynamic loudspeaker with a permanent magnet type in an old set?

It would take quite a long article, with several diagrams, to answer this question fully but we may be able to give you the basic idea in the limited space available.

In most cases, the field coil of electrodynamic loudspeakers was used as a filter inductor for the high tension supply, doing the job that would otherwise be done by a filter choke. The current flowing through it provided the necessary energisation for the magnet system of the speaker.

When a permanent magnet type loudspeaker is substituted, it does not require provision to energise its magnet system but, of course, something has to take over the function of the field coil in the filter system of the receiver.

In ordinary 4- and 5-valve domestic receivers, the field coil commonly had a DC resistance from about 1000 ohms, for small speakers in small sets, to 2500 ohms for larger speakers in larger sets.

Flowing through such an order of resistance, a typical HT current of about 60mA would produce a voltage drop of between 60 and 150 volts, representing a wattage dissipation from about 3.5 to 9 watts. The power transformer and rectifier system naturally had to be designed to produce the required HT volts, PLUS the voltage drop across the field coil filter system.

In general, it is not satisfactory simply to substitute for the field in the filter system, either a heavy duty resistor or a filter choke of adequate current rating.

Because it lacks inductance, a resistor may not provide adequate filtering, with the result that the hum level of the receiver will be unduly high. A filter choke, on its own, may not have sufficient DC resistance, with the result that the receiver's high tension supply will be too high.

As a rule, it is necessary to use a filter choke and a heavy duty resistor in series with it, to make up the total resistance to that of the field coil which the combination replaces.

Alternatively, if the field coil of the old speaker is still intact, it may be possible to discard the housing and cone and use the field coil assembly in its original role as a filter choke.

Coming to the actual speech circuitry, it was the custom, in the days of electrodynamic speakers, to mount the output transformer on the speaker, running the output plate and HT leads to its primary, from the receiver chassis proper.

By contrast, many permanent magnet speakers are sold, these days, without output transformers, on the assumption that these will be included in the receiver.

If the original loudspeaker has an output transformer attached, try to obtain a permanent magnet replacement speaker with output transformer similarly attached and with a rated primary impedance to suit the output valve in the receiver. Or you may have to buy it separately and attach it yourself (but carefully!).

If you want to use the existing output transformer, either on the chassis, or from the old loudspeaker, try to obtain a replacement loudspeaker with a voice coil impedance similar to the one you are discarding.

It is not a question of it working or not working. A loudspeaker system will work in a fashion, whether or not the output valve, output transformer and loudspeaker are mutually suitable; when they are properly matched, however, they will produce greater power output for less distortion. ■

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SOLID STATE WIPER CONTROL

Following a recent Reader Built It suggestion for a modified windscreen wiper circuit, we have received another suggestion along similar lines. Although a little more complex it should also be rather more flexible, and may appeal to readers on this score.

"In the February, 1967 issue of "ELECTRONICS Australia" you published a circuit of a windscreen wiper control using a time-delay circuit. Your readers may be interested in a solid state version of this device.

"I adapted the accompanying circuit from a note in the Motorola Semiconductor Circuits Manual (available locally) and it has worked very satisfactorily in my vehicle for some months.

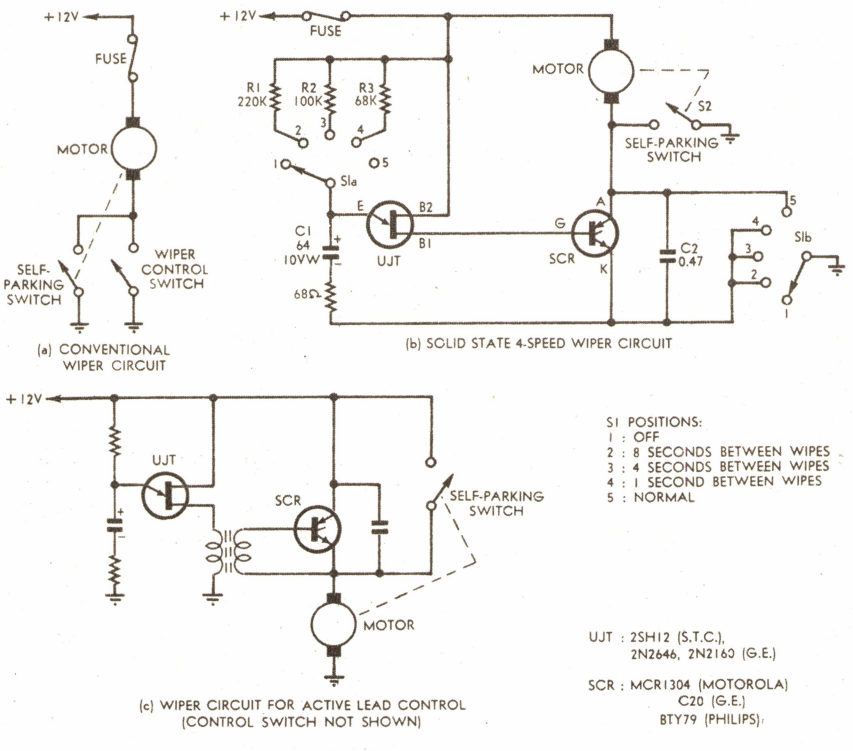
"A simple unijunction transistor trigger circuit provides a range of repetition rates dependent on R1, R2 or R3 (selected by S1) C1, and the standoff ratio of the UJT. When SCR is triggered by UJT, the wiper motor begins to operate and closes the self-parking switch S2. S2 short-circuits the SCR, turning it off, and carries the motor current for the remainder of the wiping cycle at which time the motor stops (S2 opens). The wipers remain in the rest position until the next UJT trigger pulse initiates another wiping cycle. C2 protects the SCR and the contacts of S2 from voltage transients caused by opening of the motor circuit.

"In my circuit the control switch S1 selects: off; 8, 4, and 1 second between wipes (approximately), and full speed. Some experimentation with resistor values is necessary, depending on the range of speeds required, the value of the timing capacitor C1 (50 to 100uF) and the UJT characteristics. The SCR can be any type rated at 4 or 5A RMS or more, at a PIV of 25V or more.

"The low duty cycle makes a heat sink unnecessary. All components are wired between the control switch S1 (a two-pole, five-position wafer switch) and a lug strip mounted on the rear of S1. The control switch is mounted on the dashboard in place of the original control switch.

"The circuit shown is applicable to vehicles having motor control in the chassis side (e.g., Holden). For vehicles with control on the active side, a simple pulse transformer is required, as indicated."

(From Mr Colin S. Fisher, 18 Langdale Avenue, Revesby, N.S.W.)



(a) CONVENTIONAL WIPER CIRCUIT

(b) SOLID STATE 4-SPEED WIPER CIRCUIT

(c) WIPER CIRCUIT FOR ACTIVE LEAD CONTROL (CONTROL SWITCH NOT SHOWN)

S1 POSITIONS:
1 : OFF
2 : 8 SECONDS BETWEEN WIPES
3 : 4 SECONDS BETWEEN WIPES
4 : 1 SECOND BETWEEN WIPES
5 : NORMAL

UJT : 2SH12 (S.T.C.), 2N2646, 2N2160 (G.E.)

SCR : MCR1304 (MOTOROLA) C20 (G.E.) BTY79 (PHILIPS)

Above: Circuit and connections for windscreen wiper control.

☆

Right: a simple square wave and sawtooth oscillator with many applications.

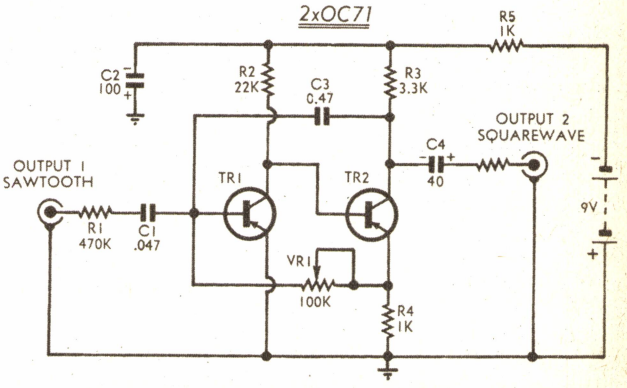
SAWTOOTH OSCILLATOR

Mr P. J. Shaw, 19 Dorothy Street, Ryde, N.S.W., submits details of a square and sawtooth oscillator which he built, and which he considers can be incorporated in our "Basic Test Oscillator," as described in the September, 1966, issue.

"The simplicity of the design can be seen by the circuit, which is not my own, but one from an English magazine. In the original, the transistors were: Tr1 MAT101; Tr2 MAT120. In my unit I used two OC71s, because they were two I had on hand. Almost any audio PNP transistors may be used, and suitable ones could be found by experiment.

"The oscillator is suitable for providing musical tones and sound effects. Colouring of the tone can be altered by using suitable filter networks in the output.

"With minor alterations to the circuit, this unit can be converted to a



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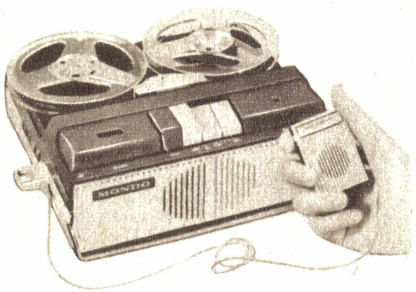
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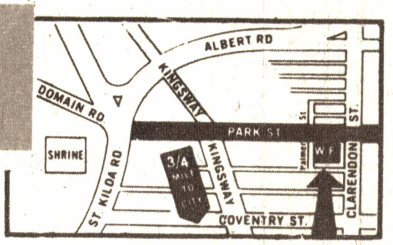
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metronome. The following modifications will be necessary.

(a) Remove C3 and insert in its place a 8uF capacitor with the positive end to the base of Tr1.

(b) C1 and R1 may be omitted altogether, and only Output 2 is required.

"Using a crystal earpiece or audio amplifier connected to Output 2, a regular beat will be heard. The frequency or time interval between beats can be controlled by VR1.

"The oscillator is quite inexpensive to build. In fact, the one I constructed cost something in the vicinity of $3. This little unit is very versatile and should be most useful to many readers."

TRANSISTOR DIP OSCILLATOR

"This unit was built using readily available transistors to test the design and feasibility of transistorised dip oscillators before purchasing a more exotic transistor to extend the range beyond the present 56MHz, thus making it even more useful around the VHF shack.

"The circuit as described uses an OC170 followed by almost any audio type and provides coverage of 5.5MHz to 56MHz in five ranges. It gives a healthy dip on the lower frequencies but above about 35MHz the dip gets weaker but this may be due to a poor OC170. As the battery drain is only about 1 to 1.5mA per battery their lives approach shelflife.

"The main trouble in getting the unit going was its apparent refusal to oscillate below 13MHz which was cured by the inclusion of a 1K resistor in series with the OC170 collector line.

"The coils can be constructed on the bases from old octal valves. The socket provides several tagpoints thus permitting compact construction. Most of the components apart from meter, batteries and the DC amp., may be accommodated on them.

"Resistor R1 is selected for the transistor and the band in use and may therefore vary from unit to unit. This resistor should be mounted close to the base with leads as short as possible to reduce any feedback tendencies.

"The 33pF series capacitor was put in to extend the range in the 52-54MHz section for use as a wavemeter on 6 metres but may be left out on the lower section of the range. It is hoped, at some future date to extend the range to the 250-300MHz mark when a better transistor has been obtained."

(From "INFO"; journal of the Elizabeth Amateur Radio Club, P.O. Box 8, Elizabeth, S.A. Project submitted by VK5ZMT).

MOVING TARGET RANGE

"Here is the circuit for a version of your 'Electronic Pistol Range,' modified to make it suitable for moving targets. By using an oscillator to switch on the light in the gun, I achieved a machine-gun effect, which is almost essential because of the accuracy required.

"The multivibrator oscillator followed by an inverter gives a series of short pulses separated by a time interval whose length is determined by the setting of R2. I used a 1M pot, but this gives a lot of unnecessary space, and so a smaller value would probably be of more use. The pulses switch a 2G302 transistor (Texas Instruments), which has the gun in its emitter.

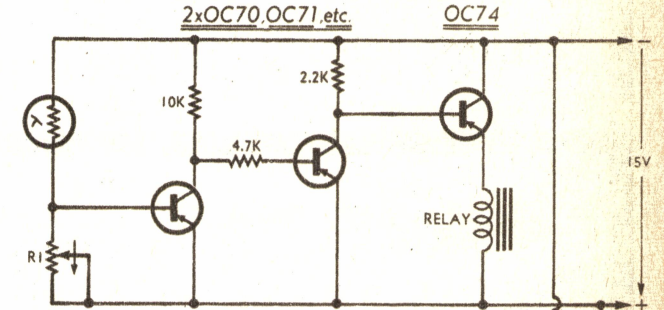
In the receiver, an LDR forms half of a voltage divider. The pot which forms the other half controls sensitivity, and a value of 10K seems to be about right. On both pots the arrow shows clockwise rotation. When light strikes the LDR, the potential at the base of the first OC70 increases. This is amplified, and the relay operates.

The relay which I used was a P.M.G. one having a resistance of 1K. I connected a couple of red pilot lights and a filament transformer to it, but have not shown these, because almost anything could be used. The LDR was mounted inside a tube of black paper, to keep down ambient light, and this was mounted inside a wooden box, open at the front, which also houses the target moving mechanism. The two red lights are also in here, placed so that they do not affect the LDR. When they light up, it looks as if the target has blown up.

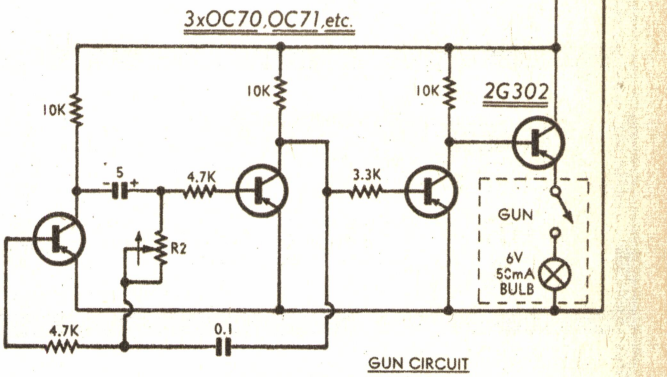
The gun is a piece of metal tubing attached to a wooden handle. The switch is inside the handle, and the globe inside the tube. A lens salvaged from an old camera fits on the end of the tube. To add realism, I connected a speaker in series with the gun.

From: Mr D. Colquhoun: 1 Staffa Street, Broadview, South Australia. ■

Right: Circuit of the moving target "receiver" (top) and the machine gun "transmitter" (lower) forming the complete shooting range. Addition of a speaker in the gun circuit adds realism.

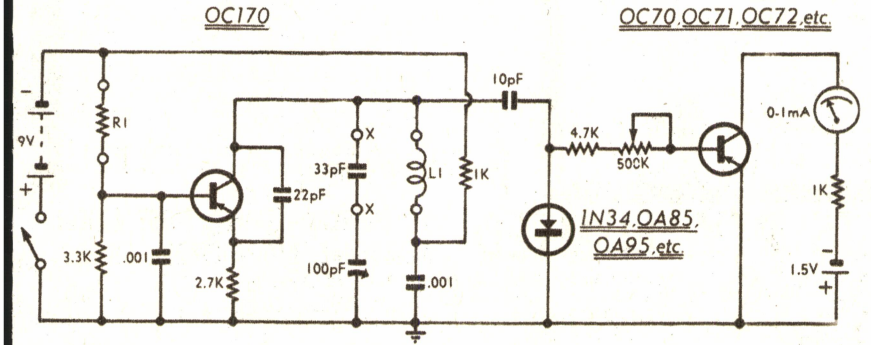


RECEIVER CIRCUIT



GUN CIRCUIT

Below: Circuit of the transistor dip oscillator. The upper tuning range will depend, in part, on the type of transistor used. Below the circuit are the coil data.



COIL DATA

RANGE MHz	COIL	LINK X	R1*
5.5 to 10	43 Turns ¼in Dia.	Short	15K
10 to 18	17 Turns ¼in 32 TPI	Short	15K
18 to 30	7 Turns ¼in 32 TPI	Short	4.7K
30 to 52	3 Turns ¼in 32 TPI	Short	10K
51 to 56	2 Turns ¼in 32 TPI	OPEN	3.3K

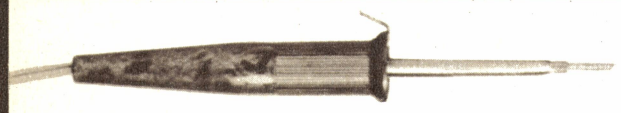
COILS WOUND WITH 24 GAUGE ENAMEL WIRE.
* SELECT ON TEST.

ADCOLA

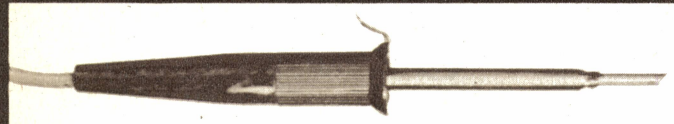
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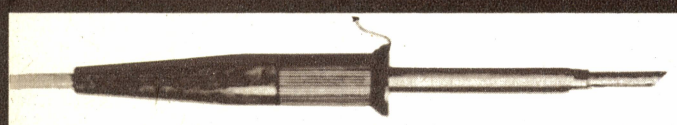
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M70 Tip Shaft Dia: 1/8" Rating: 19 watts Weight:* 3 ozs.
Application: Transistor, miniature and micro-miniature electronics and instrument work.

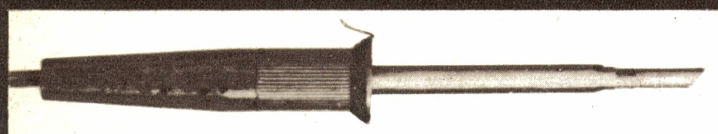


M64 Tip Shaft Dia: 3/16" Rating: 23 watts Weight:* 3½ ozs.
Application: Standard tool for radio and television assembly and servicing.



M107 Tip Shaft Dia: 1/4" Rating: 27 watts Weight:* 4 ozs.
Application: Servicing in telecommunication centres and similar heavier tagging.

*Weight of tool only, without cord set.



M150 Tip Shaft Dia: 5/16" Rating: 45 watts Weight:* 6 ozs.
Application: General Purpose Solder Tool, sheet metal, earthing strips and other heavy duty work. Tip incorporates unique anti-seizing ferrule

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Soldering For The Electronics Hobbyist

Beginners sometimes hesitate at the sight of a soldering iron. Yet the ability to solder is essential in electronics and, while it is an art and requires some skill to carry out correctly, it is well within the ability of the average person. This article should help the beginner get off on the right track.

by John Schroeder*

Soldering plays a vital part in virtually all forms of electronic devices, so there is a good reason for learning to do it properly. An experimenter who cannot solder properly is as hopeless as a carpenter who cannot drive a nail. Many problems are avoided by using the proper method right from the start. Faulty solder joints can cause an enormous amount of unnecessary trouble.

Some people may, at least to start with, think that twisting together a pair of wire ends is as good a connection as a solder joint. However, the saving in time is only for the moment. Sooner or later the apparatus will begin to operate unsatisfactorily. A crackling noise in the loudspeaker, or an unsteady deflection of a meter, are often the results of poor contacts.

It is not sufficient that two wires rest against one another. After the contact surfaces have become oxidised, the transfer resistance between the two wires will change repeatedly. In the end, there may be a complete interruption.

However, one must not think that by joining two wires and then applying a little solder at the contact-point one automatically solves the problem. Such soldered joints may be as troublesome as an unsoldered metallic connection.

The main cause of faulty solder connections is that the two metal parts have not been sufficiently heated. The tin alloy, having a relatively low melting point, has been melted by the soldering iron, but the metal has not reached a high enough temperature to make the solder stick properly to the contact surface.

In order that the solder be able to flow freely over the metal surfaces, and thoroughly "wet" them—in just the same way as water wets a porous surface—it is essential that the parts to be joined are raised to a temperature at least equal to that of the melting point of the solder being used.

It is only then that the solder can achieve intimate contact with the metal and alloy with it to make an effective joint.

A faulty joint cannot stand any stress, for even at a minor load the solder lets go of the metal, and a poor contact, perhaps a complete break, is the result.

It is often suggested that the correct way to make a joint is to apply the soldering bit to the surfaces to be joined, then apply the solder to the surfaces and wait until the solder melts. In this way correct temperature of the surfaces is guaranteed, since the solder cannot melt until this condition is achieved.

This is a very nice theory, and in some practical applications is quite satisfactory. In general, however, it is unsuitable for electronic work.

The main objection is that it almost inevitably results in the associated components being seriously overheated. As a general rule, the heat transfer between the clean flat face of a soldering bit and a circular wire, is quite poor. Therefore, the bit has to be kept in contact with the wire for a relatively long period in order to bring the latter to the required temperature. But during this period the heat is travelling along the wire to the component to which it belongs, which is then also heated, often dangerously.

In practice most workers adopt a different technique. Solder is applied to the bit either immediately before or at the same time as the bit is applied to the job. This allows a blob of solder to form around the parts to be joined and, because it engulfs them, provides a very effective heat transfer.

Thus the parts are raised to the required temperature in the shortest possible time, and before any substantial amount of heat can reach the component proper.

The sign that this temperature has been reached is a sudden change in the behaviour of the solder blob. While the parts are too cold they will tend to reject the solder, much as a greasy surface rejects water. When the correct temperature is reached the solder will suddenly "flow," as if the greasy surface had vanished. The bit is then removed unless it appears that more solder should be added. If so, it is added quickly and the joint allowed to cool as rapidly as possible.

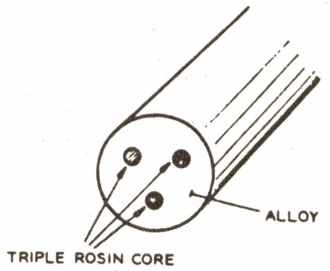
A bad habit which some beginners acquire, is to apply the solder to the bit while the latter is well away from the job, then carry the blob to the job on the end of the bit. The objection to this delay is that it allows the flux contained in the solder to evaporate, leaving little or none by the time the solder reaches the job.

It is also important that the surfaces to be joined by soldering make good metallic contact with one another. It is therefore advisable that a wire which is to be soldered to a solder lug be hooked around the lug, so that the wire rests against the solder lug at one or more points. Another method is to press the wire firmly against the solder lug, in order to establish good metallic contact during the soldering process. The pressure should not be released until the solder has set.

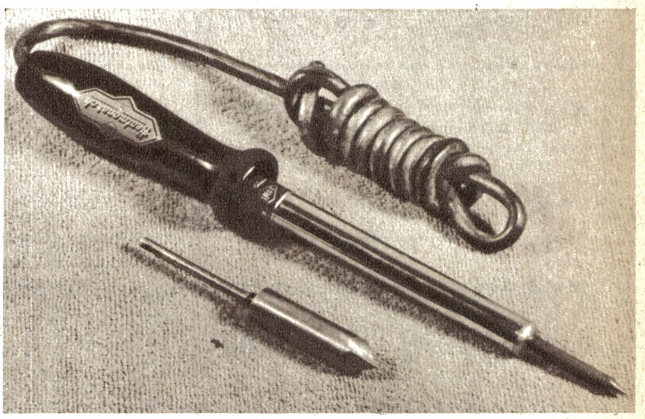
It is very important that the contact surfaces to be joined are cleaned properly before they are soldered. For this purpose the metal surfaces must be carefully scraped with a knife or a small file. Wire ends may be scraped clean using diagonal cutters. Paste-type flux has a certain cleaning effect but can hardly be recommended, for one cannot be sure that it does not contain acid.

The function of a flux is really twofold; to remove any oxide film remaining after physical cleaning, and to provide a protective film over the surface while the metal is heated, to prevent fresh oxide from forming.

In order that the flux can remove existing oxides, it must be corrosive to a greater or lesser degree. The more corrosive it is the better it will function



Above: Figure 1. Cross section of triple cored solder. The flux in the cores may be pure rosin or rosin plus chemicals.

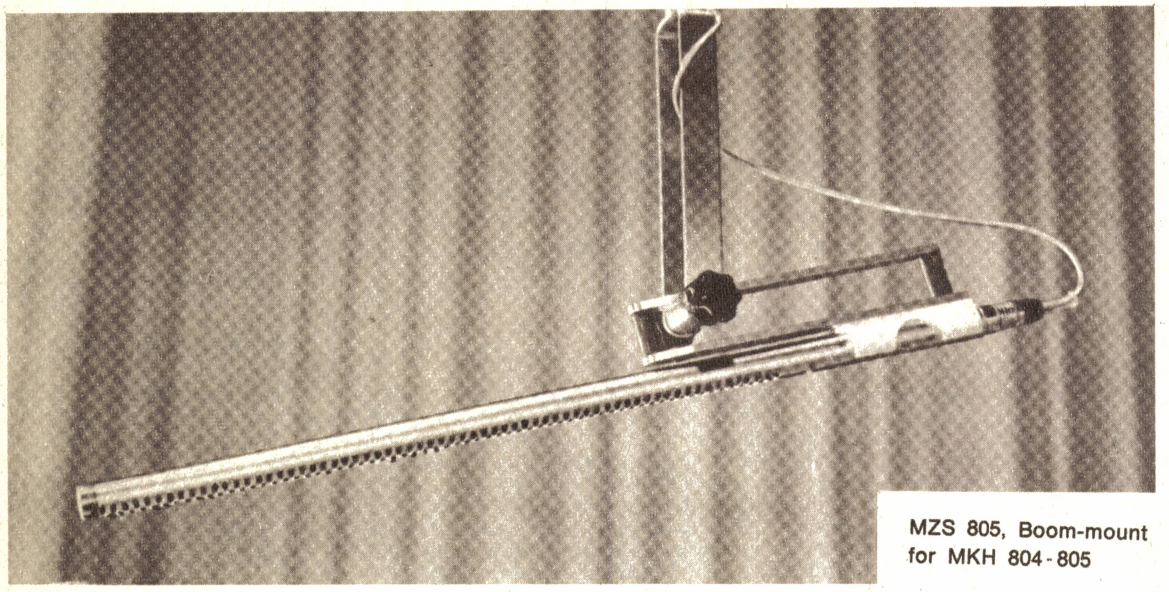


Right: Figure 2. A typical soldering tool of the older, heavier variety. Note the extra bit, intended for heavy duty work.

* Adapted by arrangement from an original text by the author.

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but, equally, the more likely it is to damage delicate wires and components. In electronic work, therefore, the tendency is to use so-called "non-corrosive" fluxes, resorting to mechanical cleaning and pretinning to provide as clean a surface as possible before soldering commences. Strictly speaking, the term "non-corrosive" is relative rather than absolute.

Rosin is a popular non-corrosive flux and is usually provided as a core—or cores—within the solder. (Figure 1). Its main advantage is that its corrosive action is largely confined to the period during soldering when it is molten. After it cools and sets it can do little damage.

More recently, pure rosin fluxes have given way to "activated fluxes." These are still basically rosin, but the addition of small quantities of other chemicals give them a better cleaning and fluxing action. Since they have been approved by most military and civil communications authorities, after extensive testing, there seems little doubt that they are perfectly safe.

(Refer "Let's Talk About Soldering," R. TV. & H., Nov. 1962).

So far as soldering tools are concerned, the preferable type is an electric tool; a soldering iron, a soldering pencil or a soldering gun. It is possible to get along somehow with a soldering iron heated in other ways, for example by means of an alcohol lamp or blowtorch, but it is inconvenient. Such an iron is unwieldy, and it is unsuitable for soldering small parts.

Until the advent of miniature electronic equipment the conventional 60 to 75 watt electric soldering iron was the workhorse of both industry and the home constructor. More recently it has been necessary to scale these down both physically and electrically to bring them into line with modern equipment. In broad terms, however, the construction is much the same.

A heating element of resistance wire is wound on a metal tube, but insulated from it with mica. This assembly is insulated externally, usually with mica and asbestos, then mounted within another metal tube. This latter is sometimes called the barrel of the iron, and is fitted into a wooden or composition handle at one end.

The other end is open sufficiently to allow the bit—normally a short length of copper rod—to be inserted inside the smaller tube, i.e., the tube on which the heating element is wound. The bit is held in position with a set screw and the temperature can be controlled by moving it into the tube (hotter) or out of it (cooler).

As this type of tool has been scaled down, some changes have occurred. Many now feature a barrel which is smaller in diameter than the bit, so the latter fits over the former, rather than the other way round.

Since these smaller tools are required to do a good deal less work than their larger brothers, the power rating is much reduced. Ratings of 20 watts or lower are frequently encountered. They are sometimes called soldering pencils and, in fact, the tendency is to hold them much as one does a pencil. (Figure 3).

Another popular type of soldering tool is the quick heat variety. (Figure 4). This is a low voltage device, operating from between three and six volts from either a transformer or—in an emergency—an accumulator.

The heating element is a small pellet of carbon which, by means of a thumb operated control on the handle of the tool, is pressed against the back of the bit when the latter is to be heated. The relatively heavy current which flows through the carbon pellet heats it very rapidly, and the bit normally reaches operating temperature within a few seconds.

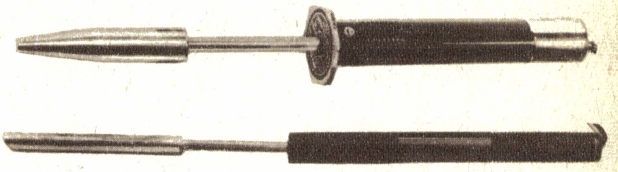


Figure 3. Two lightweight soldering tools, sometimes called soldering pencils.

This kind of tool is most useful for intermittent work, such as in the home workshop, the laboratory, or in the field when servicing appliances. The fact that it can be brought to operating temperature within a few seconds saves a lot of valuable time in those cases where it is inconvenient to have a tool operating continuously simply to satisfy an occasional demand. It also has the advantage of being relatively small and light, yet capable of producing a lot of heat for heavy duty work, at least on a short term basis. Both bits and elements are easily replaced and cost only a few cents each.



Figure 4. A soldering tool of the quick heat variety. Note the white thumb control on the handle.

A device which has enjoyed some popularity overseas — but of which we have seen little in Australia—is the soldering gun. (Figure 5).

A soldering gun consists of a power transformer which has a secondary winding of a few turns of very heavy wire. To this secondary winding is connected a U-shaped loop of copper wire. At the tip, the wire is somewhat thinner. The current through the loop is very strong, and the thinner wire at the tip—used for a soldering tip—is heated to a high temperature. A switch in the form of a trigger is used to turn the primary voltage on and off.

The soldering gun is advantageous because it takes only a few seconds to heat the tip. However, a disadvantage is that the power transformer makes the gun fairly heavy and unwieldly. Furthermore, this tool is quite expensive, and for that reason the soldering iron is probably the beginner's best choice.

Regardless of the type of tool used, the bit is the part most in need of care and attention. It should at all times be properly tinned, i.e., covered with a thin layer of solder. A tip which is not tinned will soon be covered with a dark layer of oxide which prevents heat transfer from the tip to the metal to be soldered. This may easily produce faulty joints. Before applying solder to the tip, one has to make sure that it is perfectly clean.

The copper tip—even when tinned—is likely to become oxidised after having been in use for some time. Therefore, it is necessary to wipe it off with a rag and carefully remove the oxide with a file. Then it must be tinned anew.

It is a good idea to have more than one bit available for a soldering tool, since a proper size and shape often makes an otherwise awkward job easy. By using a file, the tip is shaped in a suitable way. Ordinarily, the tip consists of a cylindrical piece of copper, which is easy to shape. Various shaped tips are used for different soldering jobs. In some

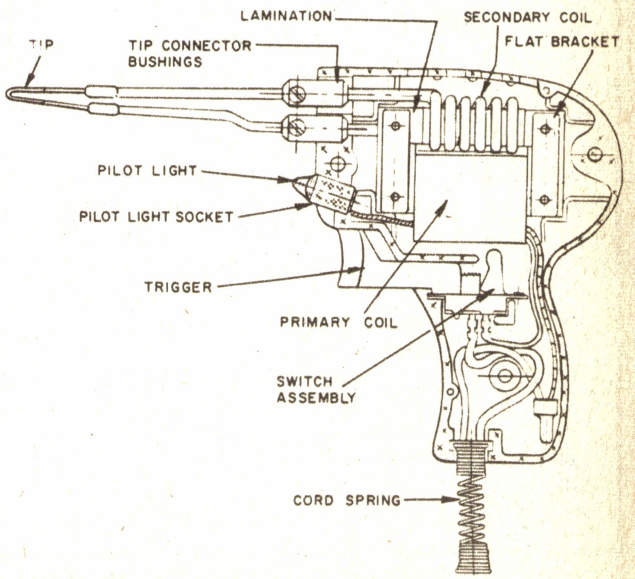


Figure 5. The soldering gun. Its main advantage is the quick heating facility, which is very useful in special applications. On the other hand, it is both bulky and expensive.

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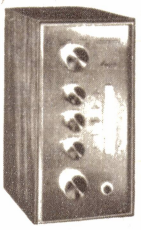
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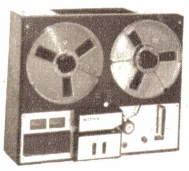
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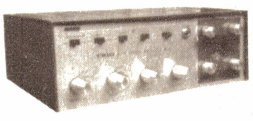
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cases a point tip is the most practical one: in other cases a chisel-shaped tip is more suitable.

The tip tends to oxidise inside the tube, thus impairing the heat transfer. It is a good idea, therefore, to loosen the set screw now and then, remove the tip and clean it with a fine file or sandpaper.

One problem which has arisen concerning electric soldering tools in general is the risk of leakage currents damaging solid state devices — notably the MOSFET and, in lesser degree, the FET—when these are being soldered into circuit.

The situation envisaged is one where the soldering bit acquires, by one means or another, a small voltage relative to earth. If this bit is now used to solder a transistor lead, in a piece of equipment which is earthed, either directly or via a piece of test equipment or ancilliary device to which it may be connected, it is conceivable that a damaging voltage may be applied between certain sections of the device.

The voltage may appear at the bit in a number of ways. It may be due to small orders of insulation leakage, to induction, or to capacitive coupling. In theory, any such voltage should be nullified by earthing the frame or barrel of the tool via the customary third wire but, in practice, the formation of scale and oxide on the bit may prevent this from being effective.

In any case, small soldering pencils operating from low voltages normally do not extend the earth wire beyond the transformer frame, leaving the tool itself to acquire any potential able to influence it.

In the case of quick heating tools, the bit is an actual part of the low voltage electrical circuit, and would seem to call for particular care.

In spite of the above warning, practical experience would seem to indicate that, for ordinary run-of-the-mill work involving conventional germanium or silicon transistors, there is little risk of damage. However, where special types such as the MOSFET are involved the risk is real and the equipment involved should at least be disconnected from any possible earth reference.

Another soldering problem involving solid state devices, and a rather more universal one, concerns the heat which is transferred from the soldered joint at the end of the lead to the device itself. If excessive, the device may be damaged. Germanium transistors are the most vulnerable in this respect, silicon types being much less sensitive to heat.

The best precaution is to provide a temporary heat sink for the lead being soldered and this may be nothing more than a pair of long nose pliers used to grip the wire between the point of soldering and the device proper. An alternative device is an alligator clip with a pair of small flat metal plates soldered to the ends of the jaws. These plates are so mounted that they meet face to face when the clip is closed and, in use, the lead wire is sandwiched between them. When the joint has cooled, any heat sink may be removed.

The problems in removing components from soldered joints have made a new technique necessary. This is called de-soldering and has become quite important in repairing printed or etched circuits. The major problem is that heat applied for too long will loosen the foil conductors from the phenolic printed-circuit board. This is particularly true when trying to remove a component that has several leads that must all be heated at the same time.

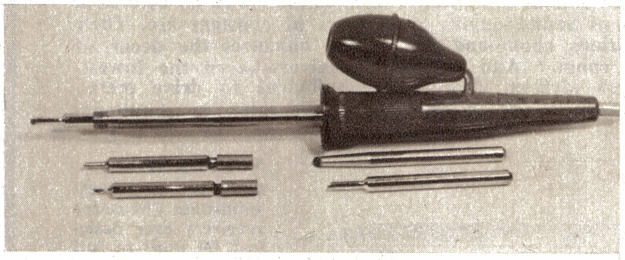


Figure 7. A de-soldering tool which sucks molten solder into a hollow bit. It may also be used for conventional soldering.

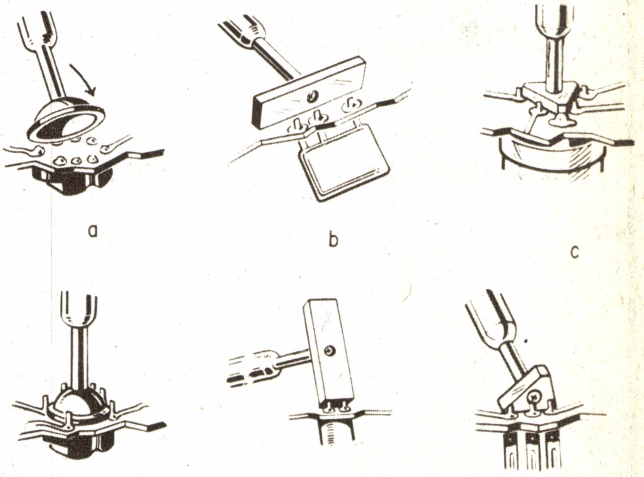


Figure 6. Specially shaped bits or "tiplets" used for desoldering several connections at the same time. These are most useful when designed for a particular component assembly.

One approach, mainly suitable for special applications and production line working, is to use specially shaped de-soldering "tiplets" that will fit many of the special shaped terminal groupings (figure 6). Being larger they require more time to heat before they reach solder melting temperature. It might be necessary to use a higher wattage heating element for the tiplets than is normally used for soldering.

Pronged tools are also used. These are for lifting and straightening leads and tabs. If these pronged shapes are fitted to the soldering iron and heated they are called tiplets too. Others made of stainless-steel or sometimes aluminium (so solder doesn't adhere) and fitted to a handle are called soldering aids.

Another approach is to melt the solder with a conventional bit, then brush the joint with a small wire brush. This will remove most of the solder, but care must be taken to see that blobs of molten solder are not scattered indiscriminately into other parts of the equipment.

A different type of de-soldering tool is shown in figure 7. This is similar to a conventional soldering tool in that it has a heating element and removable bit and, in fact, it can be used in this role by fitting a standard bit.

For de-soldering, the standard bit is replaced by a hollow bit lined with stainless steel. When inserted it couples to a tube running through the centre of the tube to a plastic bulb on the handle.

To remove solder from a joint, the bulb is depressed with one finger and the hot bit then applied to the joint. When the solder melts the bulb is released and the molten solder drawn into the hollow bit. The solder is subsequently ejected by depressing the bulb again with the bit held over a suitable receptacle.

A holder of some kind for the soldering tool is indispensable, for without it one can easily ruin the work-bench. Such a holder can easily be made from a piece of sheetmetal, bent in the proper way and fastened to a piece of wood.



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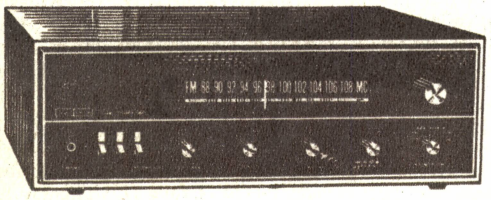
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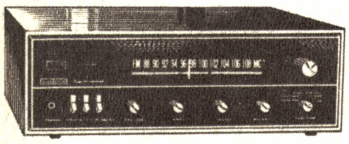
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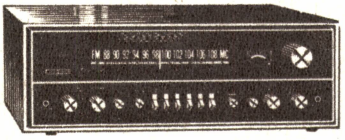
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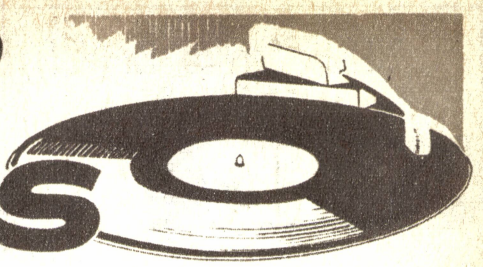
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AUDIO TOPICS



HOW COMPATIBLE IS COMPATIBLE?

Having for years operated on the basis of separate discs for stereo and moho, the record industry is now faced with the apparent enigma of "compatible" disc. What are these discs and how is it that manufacturers are now offering for sale what they said was impossible in the early days of stereo?

By Neville Williams

To cut the preamble and get back o fundamentals, the original mono LP ecord carried a groove which was ntended to be played with a stylus aving a nominal tip radius of 1mil, or ne-thousandth part of an inch.

With modulation, the groove was dis-laced from side to side of its normal nmodulated position so that, when layed, it imparted a side-to-side motion o the stylus tip.

As a basic requirement, mono pickups o play these records were designed rimarily to exhibit high compliance and ow tip mass in relation to side-to-side .e. horizontal) tip movement. Any com-liance in terms of vertical movement as largely a by-product of their design nd the ideas of their designer. Some ono pickups exhibited a fair amount f vertical tip compliance, others very ttle.

The 45/45 system of stereo recording -the system which was universally dopted—makes use of a vertical as well s a horizontal component of groove odulation and, as a basic requirement, ereo cartridges have to be so designed at the stylus exhibits high compliance nd low tip mass in respect to both orizontal and vertical modulation. And aturally, to be of any use, the cartridge s to translate these movements into roper left and right channel signals.

As a refinement, groove shape was ore closely controlled, especially near e bottom, to allow the use of stylus os having a smaller radius. While 5mil was regarded as a desirable figure anufacturers tended to prefer a slight-larger figure — usually between 0.6 d 0.7mil. This larger "compromise" ylus was less liable to skate in old ono grooves with a heavily rounded ttom, and also presented a larger rface area to support the playing eight of the pickup.

With the appearance of stereo discs the market, two questions have come more or less routine. The first

"Can I play existing mono records th my new stereo cartridge?"

In practical terms, the answer is in e affirmative. Provided the cartridge is ted with the compromise stylus (0.6 to 0.7mil) there is every chance that it will sit in the groove without touching the bottom and play the record well. In fact, because of the more ambitious design criteria for stereo cartridges, there is a good chance that a new cartridge will have better characteristics than the older mono cartridge which it replaces.

Some enthusiasts, with large collections of early mono discs did strike a certain amount of trouble with the finer styli "skating" on the bottom of "blunt" grooves but, by and large, most enthusiasts play mixtures of mono and stereo discs on stereo equipment without further thought.

The other question, of course, is:

"Can I play stereo discs with my existing mono cartridge?"

To this question, two answers have commonly been given. One is "Yes, provided you fit it with a stereo stylus—0.7mil instead of 1mil."

This answer has normally been deprecated as worthy only of non-technical salesmen, who could not be expected to know that it was wrong!

And, in terms of accepted theory it is wrong! While it observes the difference in stylus dimension, it completely ignores the requirement that the cartridge must be able to track vertical groove modulation, even if it does not put the vertical "information" to any practical use.

The approved answer has long been: "Don't take the risk. Unless your mono cartridge just happens to have adequate vertical compliance, playing stereo discs with it will scour the vertical deviations and ruin the disc for future stereo playing.

Record companies have long supported this stand by carrying warnings on their stereo discs that they must be played only with stereo pickups.

This has meant that dealers throughout the world have had to handle mono and stereo versions of the same albums, a situation which has been unwelcome but seemingly inevitable.

Initially, stereo versions were in minority demand, but the position has gradually been changing so that, in the realm of long-playing albums, mono has become the poor relation.

There is more to this than a simple reversal of priorities. A few years ago, the urge to keep a secondary stock of stereo pressings was strong, because stereo was new and up-coming. But a secondary stock of mono pressings lacks this advantage; mono is old and seemingly obsolescent!

It is of little wonder that, in the face of heavy competition, some manufacturers, distributors and retailers have been looking hard at the economies which might be effected by eliminating the duplication of titles and producing discs which can be played in either mode.

Overseas comment on the proposition suggests that three major producer areas reflect different lines of thinking.

The British attitude, as expressed by such notables as Arthur Haddy and Dr G. F. Dutton is politely but firmly against the idea of compatibility. If mono is wanted, let it be the best mono; if stereo, let it be the best stereo—each without the compromises that compatibility would mean.

The American attitude, as summed up by Norman Eisenberg in "High Fidelity" is: "Egh! which translates to why bother? or who needs it? or why make life easy for the dealers; we all have problems!"

The present stronghold of compatibility is Europe where many new covers are displaying the lines: "Stereo—auch mono abspielbar" or "Stereo—peut etre joue en mono."

For the English market, the endorsement is more likely to read: Compatible stereo/mono. This is a full stereo recording, but it has been specially engineered so that it can also be played on a mono system, without suffering damage.

It all leads to the vital question: Is there such a thing as a truly compatible, no-compromise stereo record, which can be played without damage by any existing mono microgroove cartridge?

To this might well be added another question: "Is it possible to produce a record containing stereo information, but for mono playing, which will sound just as good as a purely mono equivalent?"

On completely purist grounds, the answers to both questions are probably in the negative but the purist answer is not necessarily the most practical one, commercially. One should at least consider and listen to some of the records which are being sold, right now in this country.

What then might be involved in producing compatible records?

To begin with, groove depth and dimensions would have to be kept large enough to hold mono styli (together with any likely "plus" tolerance) between the

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groove shoulders. While not a major consideration, the requirement would limit the degree which grooves could be packed together to secure longer than usual playing time.

Within the groove itself, it would seem obvious that compatibility would require a limitation on the amount of vertical modulation, to ease the problem of tracking, without catastrophic damage, with a mono cartridge.

This might, for example, be achieved to a degree by limiting either the overall amount of groove modulation or simply the amplitude of loud passages. In the one case, it would be at the expense of signal-to-noise ratio; in the other of dynamic range.

A further possibility would be a deliberate manipulation of the content to relieve either channel of the responsibility of handling heavy passages, particularly heavy brass passages, on its own. By making sure that such signal is shared substantially by both channels, in phase, the weight of modulation would assume a horizontal (mono) character, with the lighter instruments and overtones exploiting the vertical (stereo) to lend a sense of direction.

Commenting on this technique, Norman Eisenberg (mentioned earlier) has this to say:

"This approach ties in nicely with the so-called 'MS' method of stereo microphoning long in favour on the Continent. 'MS' stands for 'middle-side' — a term that derives from the typical pickup patterns of the mikes employed. This setup senses left and right groupings, but with a strong emphasis on the centre-mix signal.

"The ambience of the place — the 'room effects' or reverberation — is suffused subtly with the sound itself to further tonedown any 'extreme' stereo effects. An appreciable amount of the sound to be recorded is about evenly split betwen the two channels and, if due attention is paid to phase relationships — which, we are assured, it is — the channels can be combined for an acceptable mono version.

"The deepest bass, in such a setup, is handled in one of two ways. If the heavy bass choirs (string bass, tuba, and perhaps the heavy end of the percussion battery) are seated predominantly to one side of the orchestr their sonic output becomes mixed with the hall's reverberant sound (mentioned earlier) so that a great deal of its directionality is suffused with the over-all ambience. As a result much of the sound appears as a mono signal that will not make great demands on a pickup's vertical response.

"If the heavy brass happens to b centred at the rear (as it sometimes is in the seating plan of European ensembles), so much the easier for the compatible approach: the most demanding sonic passages are then 'naturally' split between left and right sides and can be recorded as is.

"The result, in either case, is bass virtually in mono— that is, on stereo playback, it will be just about centred between the two speakers.

"At its best, this recording technique can make for a thoroughly enjoyable sound — warm bass, full midrange and clean 'well-rounded' highs. According to the opposition, however it is not suited for full-impact sound for the 'sonic spectacular,' for the most dramatic kind of stereo spread that

no-compromise recording setup can yield.

"Be that as it may, it is essentially the technique that many European recording outfits have been using all along."

It would appear that this dependence on microphone choice and placement is behind many of the compatible records which are currently on sale or planned for sale in Australia. Reportedly, the masters are being cut locally on standard stereo recorders, fed from master tapes "which already contain the compatible signal."

To what extent this may differ from the original stereo tape is a moot point.

On the other hand, the emergence of techniques for sensing and limiting waveform conditions which would embarrass playback styli would suggest that electronic circuits could assume much of the responsibility for limiting vertical modulation to any predetermined parameters.

In fact, it is possible to visualise a system which would produce a "compatible" track with normal stereo characteristics, except for individual wavetrains where the limiting provision would modify the recording towards mono characteristics.

It would be a kind of "now stereo, now mono" recording, which exhibited good separation most of the time but cheated on critical passages. Since this would be achieved in the cutter amplifier system, such a recording could be contrived from any master tape.

On the practical side, the writer reviewed two "synchro-stereo" discs from the Concert Hall Record Club in the April issue, last (page 119). Judged as stereo records, these were given high marks for quality and stereo characteristics, with a special mention of long playing time! The one observation was that the heavier bass components seemed to be concentrated towards the centre, which is in line with this discussion.

It also lines up with remarks on such discs made in "High Fidelity Magazine."

"Meanwhile, compatible discs from several companies are on the market, and a few general comments may be in order. The stereo effect of these records is on the whole more subtle than that of typical releases from the big British or American companies. It is more a matter of suggesting air and space than of fully documenting left-to-right spread of the ensemble.

"One excellent way to judge left-right-and-centre signal "weight" is to listen via headphones, switching the amplifier from mono to stereo. While on compatible recordings the sounds of instruments whose outputs are predominantly in the midrange (for instance, trumpets and violins) take on a stereo spread, the bass choirs (and on pops, most of the rhythm section) remain dead-centre.

"The difference between mono and stereo is even less apparent when one listens over loudspeakers."

Against this, other compatible records which have been observed by the writer and fellow reviewer Harry Tyrer have been seemingly quite normal in their stereo emphasis. They must obviously have contained a generous helping of vertical component in the signal, to sound that way.

It is difficult, in the face of this, to be sure how much of the so-called compatibility is attributable to technical achievement, how much to deliberate compromise or how much to mere words on the jacket.

According to reports, the German record companies found that, out of some 4.5 million pickups now in use, only 400,000 were so "strictly mono" that they could not track normal stereo discs; further, that all the mono pickups manufactured in the country since 1960 had been designed with in-built vertical compliance and .7mil styli.

On these figures, only 8 per cent of all German pickups could not play stereo discs and of these:

- Some would ride the shoulders of grooves leaving the lower walls in reasonably good shape for later playing with a new stereo cartridge;
- Some would be accommodated by a modest compromise in the recording practice;
- Some might damage the stereo information on records which would never be played critically on stereo anyway.

In short, the odds for taking the risk look pretty favourable.

Apparently, the major record companies outside continental Europe are unwilling to adopt techniques which would limit their exploitation of the full stereo potential, nor are they convinced that the so-called compatible pressings are as proof against damage by mono pickups as their sponsors claim

Their present attitude is to let mono die at its own rate and to encourage its residual adherents to re-equip with good quality stereo cartridges, connected for mono output. This way, the full stereo facility will be preserved both for present-day users and for mono supporters themselves, when they re-equip fully to play their rising collection of stereo records.

This thinking is fine from the viewpoint of the stereo purist and those with a vested interest in re-equipment.

It is not so good for the enthusiast limited to mono reproduction, because at least some of the current "no holds barred" type of stereo discs can lose far more than mere direction by being played in mono mode.

It is, in fact, an interesting exercise to switch a system to mono mode, from time to time, when playing stereo discs. In some cases there is little change in the general balance—just a concentration of the sound origin to the zone between the stereo loudspeakers. In other cases, the whole "body" seems to drop out of the reproduction.

Presumably, in a genuine mono pressing of the same performance, the signals from the multi-track tape master would have been mixed and balanced differently to obtain maximum sonic impact.

How all this will work out in the next couple of years is hard to say. To stereo users, it may not amount to a great deal because, overall, they will probably continue to get much the same range of records and recording techniques as they have in the past, endorsements notwithstanding.

The real rub is to collectors of mono LP albums, who emerge as the poor relations, facing three somewhat disagreeable propositions:

- A diminishing supply of genuine mono records.
- Compatible records which some claim are still prone to damage.
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16mm	1,000 ft	Z	1R-2994	B	612
16mm	1,000 ft	Z	1R-2994	A	618
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ACOUSTIC TREATMENT OF THE QUEEN ELIZABETH HALL

In recent months, there has been a lot of discussion about the acoustic requirements of the various halls in the Sydney Opera House complex. Against this background, it is interesting to see what is being done in London's new Queen Elizabeth Hall, to manipulate the acoustics to meet requirements.

The recently opened Queen Elizabeth Hall (situated next to the Royal Festival Hall), London, is by no means a new concept. A need has existed for some time now for a medium-size concert hall.

In fact, the hall was planned at the same time as the Royal Festival Hall was conceived in 1948 but, for various reasons, work on it had been delayed.

The acoustical design of the concert hall, which is medium-sized with about 1,100 seats, and of its smaller neighbour (Purcell Room) with about 370 seats, was thus settled some considerable time ago. The acoustical consultants for the hall were P. H. Parkin, of the Building Research Station, and Hugh Creighton. (Mr Parkin is well known for his work in connection with the Royal Festival Hall acoustics and assisted resonance.)

One of the main problems in the design of concert halls is the exclusion of external noise carried by both air and structure. The present hall is on a site with a relatively high ambient noise level — due to the proximity of road, rail, river and air traffic (a helicopter route is close by), and the air-conditioning plant.

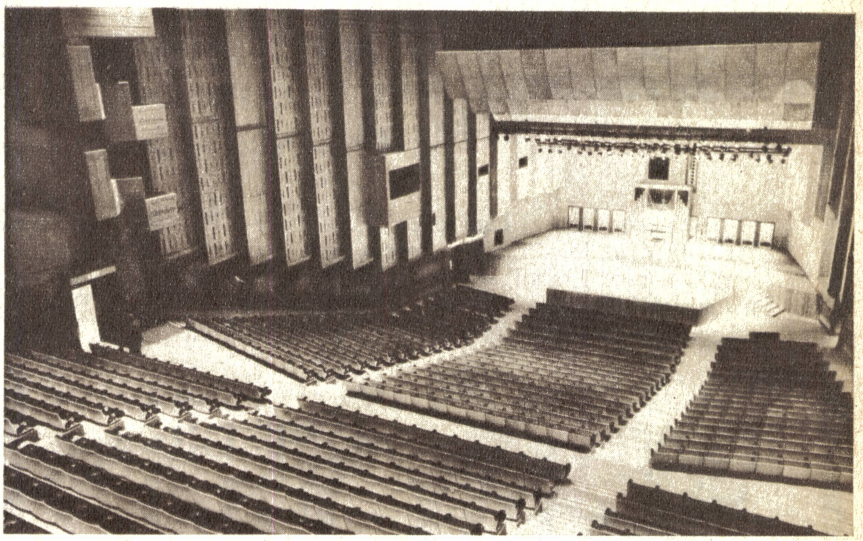
The required noise level reduction (to conform to criterion A*), was met in the case of the Queen Elizabeth Hall by 15in of surrounding concrete, care in the air-conditioner installations and by acoustically treating the airways or ducts for lengths of 70-80ft. Noise absorbed into the air stream was reduced with honeycomb absorbers installed in the main supply. (Incidentally, air is extracted from under the seats and discharged at roof level by air outlets, which also serve to break up ceiling reflections.)

The elimination of noise from the smaller Purcell Room was a special problem since the air-conditioning plant was immediately above the auditorium ceiling. To give the required sound attenuation, the supporting structure for the plant room straddles and is separate from the Purcell Room and a sealed air gap of 3in is allowed for between the two rooms.

As is well known the reverberation time (RT), of a hall depends on its volume and on the absorption by the surfaces and audience. The audience size for the Queen Elizabeth Hall was, relatively, a fixed quantity and the reverberation time was required to be two seconds at 500Hz.

These two factors meant a large volume and in fact, although the hall seating capacity is only one-third that of the R.F.H., its volume (about 350,000-cu. ft.), is approximately a half. Absorption at the high frequencies is minimised by lack of soft furnishings. In order to control the low frequency RT large wood panels with air spaces behind are an obvious choice but in the Q.E.H. (and Purcell Room), use is made of Helmholtz resonators as absorbers.

The resonators consist of an enclosed box of 2in thick block-board coupled to the auditorium by a vertical slot. There are four slot sizes corresponding to fun-



An interior view of the new Queen Elizabeth Hall. Note the slots in the wall panels giving access to Helmholtz resonators, but appearing externally to be part of the decorative treatment. Note also the reflecting panels above the stage-front.

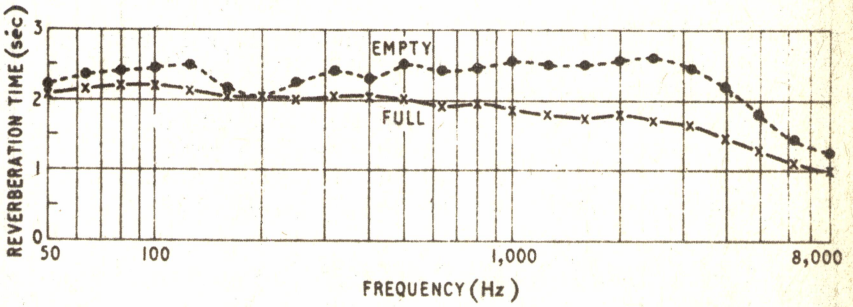


Figure 1: Reverberation time of Q.E.H. measured by the Building Research Station at 1/3 octave intervals using recorded pistol shots. Design reverberation time was 2 sec. If necessary, the low-frequency reverberation time can be increased by blocking up a number of Helmholtz resonators.

"Acoustics, Noise and Buildings," P. E. Parkin and H. R. Humphreys, p. 196 (Faber).

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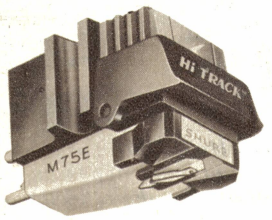
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damental absorbing frequencies of 50, 70, 90, and 140Hz, these being chosen after studies made at the National Physical Laboratory.

The undamped Q of the resonators was around 30-40 giving too sharp a response and necessitating damping. Q was reduced to 10 by placing polyurethane at the rear of the cavity throat. The number of resonators required has been deliberately over-estimated by 25 per cent, making the low-frequency absorption greater, but this can be decreased in order to increase the reverberation time, should this be found necessary.

In the case of the Purcell Room, half of the 70 and 90Hz resonators on two sides have been found to require sealing because of an unexpected dip in RT. The great advantage of using Helmholtz resonators as absorbers is the ease with which modifications can be made — the larger slots can be readily partly or wholly blocked if less absorption is required. (Less conveniently, perhaps, the slot sizes could also be increased.)

Thus the curve of figure 1 can to some extent be tailored at the lower end of the spectrum.

Apart from giving some absorption at low frequencies, the surfaces (the ceiling also gives some LF absorption by virtue of the fibrous plaster panels between the concrete beams) should also give some degree of diffusion towards the rear and this is achieved by the cast aluminium air-conditioning outlet on the ceiling and also by the stepped surface. along both sides. In the Purcell Room some diffusion is given by large corrugations on the rear wall.

Consideration of the task of ensuring good sound at the rear of the hall led to the use of a three-tier reflector above the stage area. The reflectors may be moved (electrically), into an inoperative position. An advantage of this arrangement is that the reflected sound can be optimised by altering the reflector angle for performing groups of differing size and arrangement.

Additionally, the reflectors can also be moved vertically, within certain limits.

The stage, incidentally, comprises four sections each of which can be adjusted up to a height of 6ft above floor level. (Two of these can be lowered to provide an orchestra pit and one can be lowered below the stage to carry heavy instruments on and off the stage.) The surfaces around the stage are concrete and this allows some acoustical re-information for the players.

Seating is, of course, raked in order that direct sound can reach the hall rear without passing directly over the audience. This is arranged because of the phenomenon in which sound travelling directly over a horizontally seated audience suffers a frequency selective absorption, particularly around 200Hz.

The results of a test concert held in January showed that no obvious faults existed, such as echoes. The reverberation time was measured (figure 1), and the effect of varying the reflectors positions investigated.

With the reflector up, results were said to be good by 80 per cent of those questioned — however, one test concert is felt to provide insufficient evidence. Experience gained at future concerts will reveal whether some blocking of the Helmholtz absorbers is necessary — it has been stated that low-frequency reverberation time should be about 1.5 times the mid-frequency value ("Wireless World").



Classical reviews

By JULIAN RUSSELL

VERDI . . . Bernstein's "tenseness"

VERDI — Falstaff. Complete Opera. Dietrich Fischer-Dieskau (Falstaff): Regina Resnik (Mistress Quickly): Ilva Ligabue (Mistress Ford): Rolanda Panerai (Ford): Graziella Sciutti (Nanetta): Juan Oncina (Fenton): Hilde Rossel-Majdan (Mistress Page): Gerhard Stolze (Dr Caius); Murray Dickie (Bardolph): Erich Kunz (Pistol). The The Vienna Philharmonic Orchestra and Vienna State Opera Chorus conducted by Leonard Bernstein. C.B.S. Stereo SBR235186/7/8.

There is no gainsaying the beautifully pointed playing of the orchestra nor the clarity of the engineering that enables the ear to catch every detail of the brilliant score. Changes of tempo, ensemble, and accenting are always carried out without a jar. It has, too, its long moments of enchantment under Bernstein's tense, nervous direction. And the many strands of the magical score can be heard in this recorded version better than is the case in many a great opera house. But the prevailing feature of Bernstein's performance is tenseness, sometimes so screwed up that I found it a little difficult to listen to.

If Bernstein's reading is compared with Karajan's for Columbia, the mono version of which was issued some 10 years ago and shows its age in its engineering, you will find that Karajan, whom no one could accuse of ever being slothful, sounds much more relaxed. His reading makes many of Bernstein's tempos sound too fast — when they're not too slow. It is not difficult to imagine Bernstein saying to himself that this is a comic opera to be played all out for laughs. A truly comic opera it is, full of wit and good humour.

But Verdi surely meant it all to be more urbane than the version you hear here.

There is, by the way, a third complete "Falstaff" — the RCA set conducted by Solti with Geraint Evans in the title role — which has never been issued in Australia. Karajan's Falstaff was Gobbi, in wonderful voice and displaying at their best his incomparable gifts of vocal characterisation. Bernstein's Falstaff is Fischer-Dieskau, unquestionably one of the finest and most versatile baritone's singing today. But Falstaff is not his best role. His preoccupation with the perfectly rounded phrase is often achieved at some sacrifice to characterisation. True, you have here a German singing a role in an Italian opera about a genial English scoundrel, whereas in the other versions you have an Italian in one set and a Welshman in the other. And it may be for this reason that Fischer-Dieskau, despite many a glorious page, leaves one with the impression that his reading is a thought too fussy on this occasion.

One of the most enjoyable features in the new C.B.S. set is the delicious singing of those two enchanting young lovers, Fenton (Juan Oncina) and Nanetta (Graziella Sciutti). But I get the impression that Bernstein deliberately eases the pressure to let their silken phrases emerge without the prevailing tension.

Regina Resnik is an efficient but slightly overwhelming Mistress Quickly, but here again I felt that the famous "courtesy" theme was slightly overdone, so deep is her obeisance. The rest of the cast all do very well though there is a spot in the first act when three men singing together sound like a male chorus, so closely are they recorded.

The playing of the Vienna Philharmonic is brilliantly accurate and no detail will be missed by an attentive listener. If only the whole thing hadn't sounded quite so hectic I might have been able to be more appreciative of the enormous amount of preparation that must have gone into the production. But you might like it that way, especially if you haven't heard the Columbia. Of the RCA I cannot write since I have never heard it, but overseas reviews were tremendously enthusiastic.

MAHLER . . . Bernstein "better suited"

MAHLER — Symphony No. 8. The London Symphony Orchestra, Leeds Festival Chorus, London Symphony Orchestra Chorus, Orpington Junior Singers, Highgate School Boys' Choir, Finchley Children's Music Groups. Hans Vollenweider (organ). Erna Spooreberg, Gwynneth Jones and Gwyneth Annear (sopranos); Anna Reynolds and Norma Procter (altos); John Mitchinson (tenor); Vladimir Ruzdjak (baritone); Donald McIntyre (bass). Conducted by Leonard Bernstein. C.B.S. Stereo 235197/8.

Bernstein is temperamentally much better suited to the more violent expressions of Mahler than to Verdi's urbane statements. In this symphony his nervous demands win for him wonderfully alert response from the orchestra and the large number of singers involved. At its premiere in Munich in 1910, no fewer than a thousand performers took part, since when it has been known as "The Symphony of the Thousand." I don't know just how many were used in this recording, but it must have been a great number. And it is very much to the credit of the producer, John Clure, that such enormous forces were deployed with so much discretion and sensibility.

The problems of balance in recording a work of these dimensions are enormously complex and, though it must have been possible, by scattering microphones freely among the hundreds of performers, to achieve a false but vivid equilibrium, Clure has been satisfied to allow some of the vocal bodies to sound more remote than others in just the way they might be heard in a good concert hall. Also, although the work generally appeals primarily to lovers of the grandiose, it has many long passages of great beauty that will move those who are not so easily impressed by size and noise.

Bernstein can stir the bubbling cauldron of a climax until the contents seem to have no place to go but to shoot out of the pot in a molten shower. But in this superb performance he shows that he can, too, handle the more fragile reaches of the score with ear-delighting delicacy. Nor are the moments of bitter irony in the first movement ignored. For, as usual, though Mahler employs mammoth forces, he never fails to keep his marvellous scoring transparent, and is well served by Bernstein in this important feature.

The symphony is in two long movements, the first running 24 minutes, the second 55. The second is divided into sub-movements played without a break. It is based on the last scene from Goethe's "Faust" in which are pictured many saintly characters hovering among mountains and valleys, constantly changing their elevation like, for all the world, a cloud of gnats. But however absurd the picture might be in the mind's eye, Mahler makes much of it very beautiful to the ear.

I always find the first movement overlong for a statement of pure jubilation. However exciting it may be during the first few minutes, it cannot sustain the exhilaration it initially generates. Beethoven ordered things better in the last movement of the Ninth Symphony in which he leads you from deep-seated joy at the beginning to a state of ecstasy at the end. Even with the incandescent cooperation of Bernstein, Mahler fails to bring this off. But Bernstein comes closer than anybody else I have ever heard and it seems unlikely that a better performance than this will be recorded in the predictable future.

★ ★ ★

RODRIGO—Concierto De Aranjuez for Guitar and Orchestra.

CASTELNUOVO-TEDESCO — Concerto for Guitar and Orchestra in D Major, Op 99. John Williams and the Philadelphia Orchestra conducted by Eugene Ormandy, CBS Stereo SBR235191.

In the long history of music I can think of no other instrument that has, in so short a time, won such universal popularity among those interested in serious music as the classical guitar. Its performers have lately achieved almost cult proportions. If Segovia is the undisputed king of all the exponents of his art, two younger men, Julian Bream, an Englishman, and John Williams, an Australian, are both well in the line of succession. That this claim is not extravagant can be checked by Williams' playing of the Castelnuovo - Tedesco concerto which was written in 1939 for Segovia himself and recorded by him for Columbia as far back as 1952. That Williams has nothing to fear from the

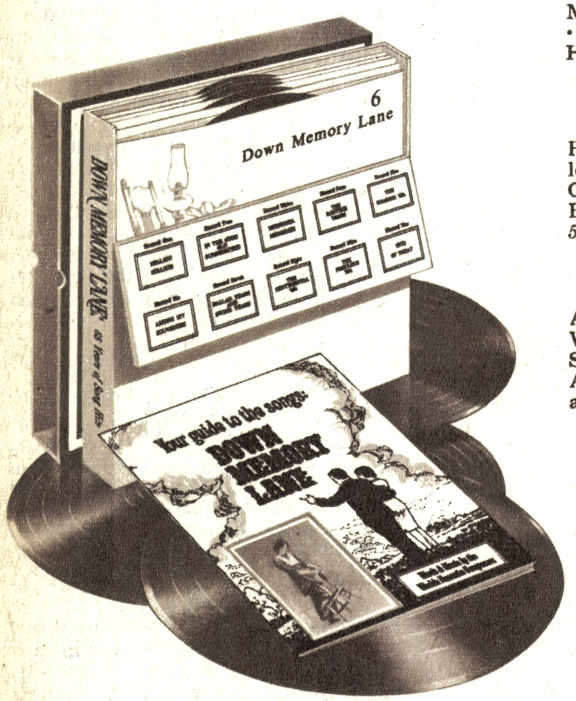
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omparison is not entirely due to the plendid modern engineering of the performance under review, nor to the superiority of Ormandy's Philadelphia Orchestra over that used by Segovia. The act cannot be ignored that Williams, ffers a very real challenge to Segovia's itle. So much so that I think most lovrs of the guitar would be happy to ave a more up-to-date recording of both oncertos by Segovia to get a real idea f what the relationship might be today.

Both works stem from about the same eriod and neither has much more than vhat might be called local guitar interst to recommend it. Of the two the todrigo wears a little better than its ompanion on the disc. Guitar-players tell me that it is much more difficult to play than the Castelnuovo-Tedesco, indeed it is very much more difficult han it sounds. And in this statement can e estimated the great success of Wiliams' performance, because under his kilful fingers all effort seems to have een overcome and every note seems to e easily within the reach of a moderate erformer. Moreover the recording is of o high a standard of fidelity that countss nuances and tiny expressive inflecons keep the mind as well as the ear onstantly alert to his extraordinary ifts.

Both works are discreetly scored with he view of giving the solo instrument he necessary prominence when playing ith the orchestra. But all this might ave been contradicted by an unsymathetic accompaniment. Ormandy is reful never to let this happen. His ccompaniment never intrudes when it ight easily have overwhelmed the solo strument, yet he never passes an oppority to let the Philadelphia blossom to its customary gorgeously rich and nsuous sound whenever he can do so ithout prejudice to the virtuoso he is pporting.

★ ★ ★

USIC IN CASTLES AND CATHEDRALS, Vol. 2. "Le Petit Trianon." Lily Laskine and Odette Le Dentu (harps); Huguette Fernandez and Ginette Carles (violins); Anne-Marie Beckensteiner (harpsichord); Jean-Francois Paillard Orchestra conducted by Paillard. Record Society stereo S/6214.

The program in the second disc in this cord Society series consists of the llowing:

Francois-Joseph Gossec — Sinfonia ncertante for Two Harps and Orches-

Joseph Chevalier de Saint-Georges — fonia Concertante in G Major for o Violins and Orchestra.

Johann Schobert—Concerto for Harphord. No. 4 in C Major, Op. 15.

None of the three composers featured e are likely to be known to any but dents of the French school of the ddle to late 18th century. Indeed the ord's sub-title, "Le Petit Trianon" and association with Louis XVI and Marie toinette is as good a reminder as any what to expect from its contents. e music is in turn witty, delicately suous, and unfailingly elegant, its protions, if miniature, exquisitely scaled. The playing throughout is utterly beching with, perhaps, the delicious ying of the two harps in the Gossec ce an outstanding feature. The Saintorges work is no less refreshing in its pastel shades and firm, yet finely etched outlines.

But the item I found the most interesting—and enjoyable—although by this I hope not to be taken as meaning that I did not enjoy the whole disc, was the Schobert. Schobert was German born but spent so much of his life in France that he came to think like a Frenchman. As an aside I might mention that his music was much admired by Mozart who is said to have been influenced by it in his early compositions. What struck me most forcibly was the effortless spontaneity that pervades both the composition and its execution. Of this last I must spare a special word of praise for the harpsichord playing of Madame Beckensteiner. The whole disc provides an entrancing reminder of an elegant past that will never return.

★ ★ ★

VAUGHAN WILLIAMS — Symphony No. 5 in D Major. Philharmonia Orchestra conducted by Sir John Barbirolli. World Record Club stereo S/T4187.

To understand this symphony better, a knowledge of its predecessor, the Fourth in F Minor, would help. For the F Minor is a ferocious work inspired by the war Vaughan Williams knew to be inevitable, and in which that bloody conflict seemed already to be engaged. Eight years separated the Fourth and Fifth Symphonies and though the latter received its premiere during World War II the hope it offered to mankind must have been a great comfort to many of those suffering under that struggle.

The Fifth is astonishingly serene for a work written in those circumstances, full of broad, characteristic melodies. Barbirolli adds to this serenity in the first movement an intensity that always prevents it from cloying. His Scherzo, though steadily placed, is impressively rhythmic, and the Passacaglia is at once vivid and exhilarating.

The engineering is good; the first release of the recording was made only some four years ago. The string tone is rich and the brass shines without glare. Flute solos sometimes sound a little too close for comfort. Most of Vaughan Williams' symphonies are well worth either re-recording or re-issuing. The period of eclipse that usually follows the death of a composer promises to be shorter in his case than is usual. If rerecordings are to be made I know of no conductor better able to make them than Barbirolli—or Boult.

★ ★ ★

WAGNER — Overtures to Rienzi, The Flying Dutchman, and the Overture and Bacchanale from Tannhauser Original Paris Version). Vienna Philharmonic Orchestra conducted by Georg Solti. World Record Club Stereo S/T4146.

Solti's reputation as a Wagnerian conductor is safely established in his monumental direction of the complete recording of "The Ring" and "Tristan and Isolde." This disc merely confirms just how well he conducts Wagner. The old "Rienzi" Overture still wears very well, though a friend who recently attended a revival of the opera in Germany told me that the rest is nowadays pretty difficult to sit through. Solti plays it admirably. But I was ever so slightly disappointed in his performance of "The Flying Dutchman." I am used to a more

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vigorous reading with more contrast between the stormy Dutchman and storm themes with the gentler Senta motif. However, it is still eminently acceptable.

Although the sleeve notes claim that the "original" version of the Paris bacchanale is offered here I am used to its being spliced on to the overture at the climax of the old Venusberg music, where it can thrill with the sudden richness of the scoring which Wagner added many years later, during his "Tristan" period, in order to satisfy a Parisian audience that insisted on always having a ballet with its opera. As presented here, the overture finishes as originally written — with the "Pilgrims' Chorus." The Paris music starts after a break of a few seconds. But this, of course, has one advantage. If you don't want to wade through an overture that no longer attracts you, you can go straight to the Paris music.

★ ★ ★

CHOPIN — Ballade No. 3 in A Flat Major. Op. 47; Andante Spianato and Grande Polonaise Brilliante in E Flat Major, Op. 22; Fantaisie in F Minor, Op. 49; Polonaise Fantaisie, Op. 61. Wilhelm Kempff. World Record Club Stereo T/4142.

CHOPIN—Piano Sonata No. 2 in Flat Minor, Op. 35 (Funeral March Piano Sonata No. 3 in B Mino Op. 58.
Wilhelm Kempff. World Recor Club Stereo S/T4202.

CHOPIN—Impromptus Nos. 29, 36, 5 and 66. Berceuse in D Flat, Op. 5 Barcarolle in F Sharp, Op. 60. No turne in B Major, Op. 9, No. Scherzo in C Sharp Minor, Op. 4 Wilhelm Kempff. World Recor Club Stereo S/T4201.

Here is excellent Chopin playin especially for the club price at whic these three discs are offered. Generall speaking I find Kempff at his best i the slower, more lyrical movements i which the recitals abound. But he is onl a little less successful in the more force ful pieces such as the C Sharp Mino Scherzo—in this Rubinstein has no pee —and the Polonaise-Fantasie. Kempff approach is essentially patrician, whic means that his outlines are always firm no matter how much rubato he use and gush in any form is resolutel avoided at all times. He has a true pearl Chopin touch which he never allows t become effeminate. Altogether first rat value.

★ ★ ★

FRENCH AND SPANISH ROMANTI SONGS. Victoria de los Angele H.M.V. stereo OASD2260.

The recital consists of: L'Annee e Vain Chasse l'Annee (Debussy) an Scheherazade, Five popular Greek Mel dies (Ravel) with the Paris Conserv toire Orchestra conducted by Georg Pretre. Seven Popular Spanish Son (Falla), La Maja Dolorosa Nos. 1, 2 an 3 (Granados), Montsalvage—Cancion Cuna Para Dormir a un Negrito (Mon salvage), and De los Alamos Veng Madre (Rodrigo), with Gonzalo Soria (piano).

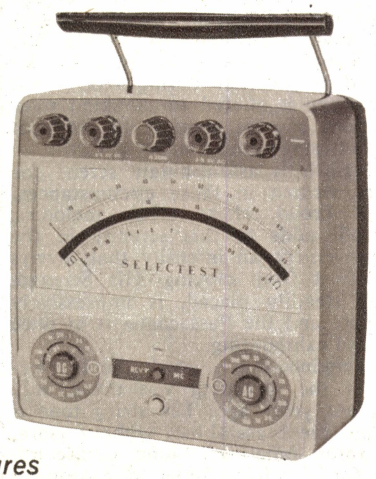
All these songs have been previous issued in other recitals by this fi artist, but they make a useful collecti as offered here. In the "Scheherazad cycle, Los Angeles' "Asie" is not n favourite version. I still prefer the nc aging Danco performance despite somewhat dated sound. But Los Angel sings both the other songs in the gro with all her customary purity of to and fastidiousness of phrasing. The sam might be said of Ravel's settings of t Five Greek Popular Songs, too.

In the Falla bracket Los Angeles careful not to use too refined a produ tion and manages to put a true "can hondo" edge on a voice more notab for its elegance than for flamen "roughness"—which, of course, is or relative here. I don't think anyone l ever sung them with all the gusto a sparkle of the late Conchita Superv but these come very close.

The Granados Tonadillas provide L Angeles with a splendid opportunity display the beauty of her low regist Montsalvage's berceuse hints at a p sonality I can only describe as a sort Spanish Moussorgsky. She croons it w the utmost tenderness. And I don't thi you're likely to hear Debussy's "Air Lia" from his student work "L'Enf Prodigue" better sung anywhere than y will hear it here.

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DOCUMENTARY RECORDS

Reviewed by Glen Menzies

ROBERT BROWNING: "My Last Duchess" and other poems. Read by James Mason. Caedmon L.P. TC 1201.

A recital of this kind is perhaps the most effective way to approach the writing of a poet who enjoyed immense popularity in his own day, but is something of an acquired taste for people today. Now, almost 70 years after the death of Robert Browning, we are far removed from the cult which surrounded his name and work. The very bulk of his output is forbidding to say the least —one narrative poem can take up as much as a whole book. Consequently, the album compiler has his problems— it may take a ton of ore to yield an ounce of pure metal.

Another problem is that Browning's particular kind of back slapping Victorian optimism doesn't ring true today, failing to correspond with our own experience of life. He remains, however, one of the best known of the Victorian poets, who, in his best moments, reveals a lightness of touch, considerable lyrical feeling, and is mostly enjoyed today through his shorter poems.

There are two of his longer poems included in this album, on Side 1 the narrative poem "Childe Roland to the Dark Tower Came," a richly allegorical work set in a fantastic landscape, which is rather daunting at first, but improves on a second hearing. The other on Side 2, "Rabbi Ben Ezra," is banal in the extreme and steeped in the kind of optimism already mentioned. After several hearings I still find it somewhat hard to follow and extremely tedious.

But the poet is at his best in the three dramatic monologues taken from the "Dramatic Lyrics" volume of 1842. In these he brings to life such characters as the duke of "My Last Duchess," the friar of "Soliloquy of the Spanish Cloister," and the lover in "Porphyria's Lover." The latter is one of the finest of its kind and is a frightening study of madness which suggests more than it discloses, and has much in common with the psychological approach of the twentieth century dramatists. The author of the album's sleeve note remarks very aptly, "Robert Browning was one of the world's great dramatists and one of the world's worst playwrights. His plays were miserable failures on the stage, but his poems are full of drama."

The most significant event in Browning's life was his clandestine marriage to Elizabeth Barrett in 1845 and their secret flight to Italy where they enjoyed 15 years of domestic happiness. The romance of Wimpole Street has certainly continued to echo down the years, its latest form being the musical comedy, "Robert and Elizabeth." During the 15 years of their marriage, Browning wrote what is considered to be some of his best poetry, and included in this collection is the lyrical and nostalgic "Home Thoughts from Abroad" which begins with the famous line, "Oh, to be in England, now that April's there."

Allowing that the lengthy poems, and the complexities of some of the shorter ones, do not make for easy reading, it must be said that James Mason is not really up to a whole L.P. Instrumentally, his voice is limited in range and expression, with a tendency toward nasality and some lack of clarity. He is at his best when he works within the limits of his voice rather than trying to extend it too far, especially in the lower regions. With a few exceptions, in the majority of poetry records, the use of several voices helps to keep the listener interested, and does more in the long run for the poet's works than relying too heavily on the selling power of a name "star." Ardent fans of James Mason, however, may disagree with me.

A better indication of Browning's range of expression might have been given by using more of his shorter verses, with some selected stanzas from his larger poems. A text has not been included with this album, which is a pity, as I feel that a text always leads to a greater appreciation. In this case particularly, it would have helped to illuminate some of the darker obscurities of "Childe Roland" and "Rabbi Ben Ezra."

Records of this kind invariably lead one to look afresh at a poet's works, which is not a bad thing in an age where the art is given only limited recognition by the public at large.

★ ★ ★

SHERLOCK HOLMES: "The Red-Headed League" and "The Speckled Band" with John Clements and Walter Fitzgerald. Produced by Fiona Bentley. E.P.45, C.G.50 and C.G.40. Children's Record Guild of Australia.

Having only recently reviewed Basil Rathbone's reading of "The Red Headed League" which occupied the whole of one L.P., I wondered just how successfully it could be fitted on to an E.P. 45. In adapting the story, scriptwriters Fiona Bentley and Morys Aberdare have retained all the essential elements which go to make the thriller. In fact, this must have been their main aim, with young listeners in mind, to present the story largely as a thriller leaving out the lengthy dissertations of Holmes and Watson.

The atmosphere of these productions is somewhat melodramatic, but after all the setting is London at the end of the nineteenth century. In "The Red-Headed League," liberal use is made of sound effects depicting noisy city streets, echoing passageways and the hollowness of dark and gloomy cellars. They add to the excitement of an ingenious plot involving an advertisement for a red-headed man to copy out the Encyclopedia Britannica. An unlikely enough occupation, which leads to the unmasking of a plot to rob a London bank of all its French gold by a remarkable tunnelling operation.

"The Speckled Band" has all the ingredients of a first-class thriller with more generous doses of hi-fi sound effects including footsteps in the hall, thunderstorms and a couple of blood curdling screams, all set, very appropriately, in an old manor house. There is also a tyrannical step-father, Dr Roylott, who keeps a cheetah and a baboon in the grounds of the manor house, and a poisonous death adder in his safe. His two step-daughters are Helen and Julia Stoner, and Holmes enters the story when Helen Stoner seeks his aid in solving the mystery surrounding the unexpected death of her sister.

On these recordings, Walter Fitzgerald as Dr Watson carries the story along as the narrator and acts as the foil to Holmes, played here, very convincingly, by John Clements. It is intriguing to note that no matter who plays the respective roles of Holmes and Watson, they never depart far from the style we seem to have long associated with these famous fictional characters.

The other members of the cast all give adequate support in what are very polished productions. Cyril Ornadel's catchy little theme tune, "Baker Street," is used in both stories. These Sherlock Holmes stories for juniors will not only serve to introduce the great detective, but also, no doubt, help in ensuring that yet another generation will fall under the spell of Conan Doyle's master sleuth. ■

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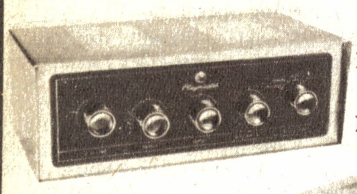
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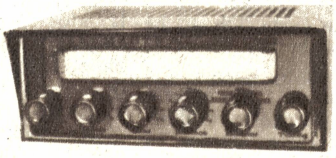
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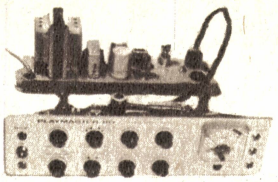
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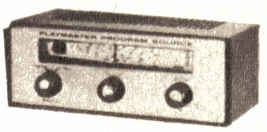
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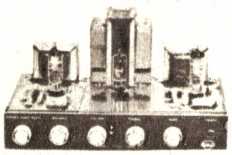
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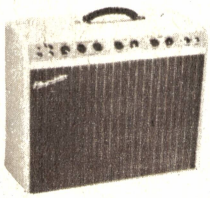
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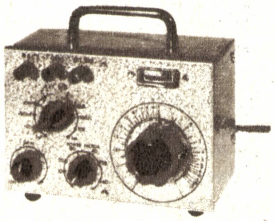
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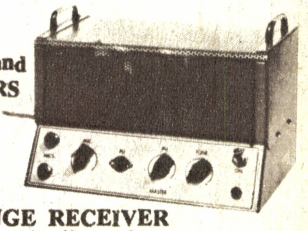
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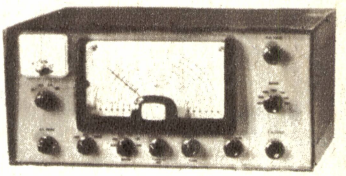
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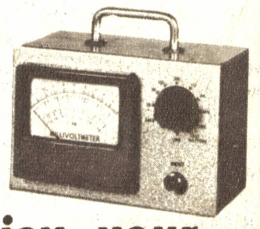
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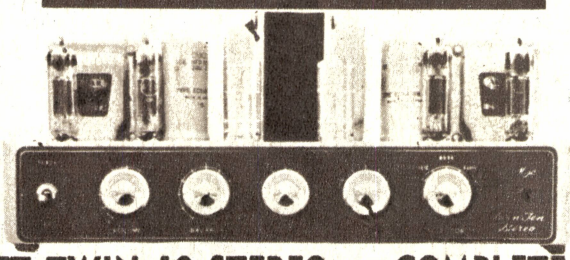


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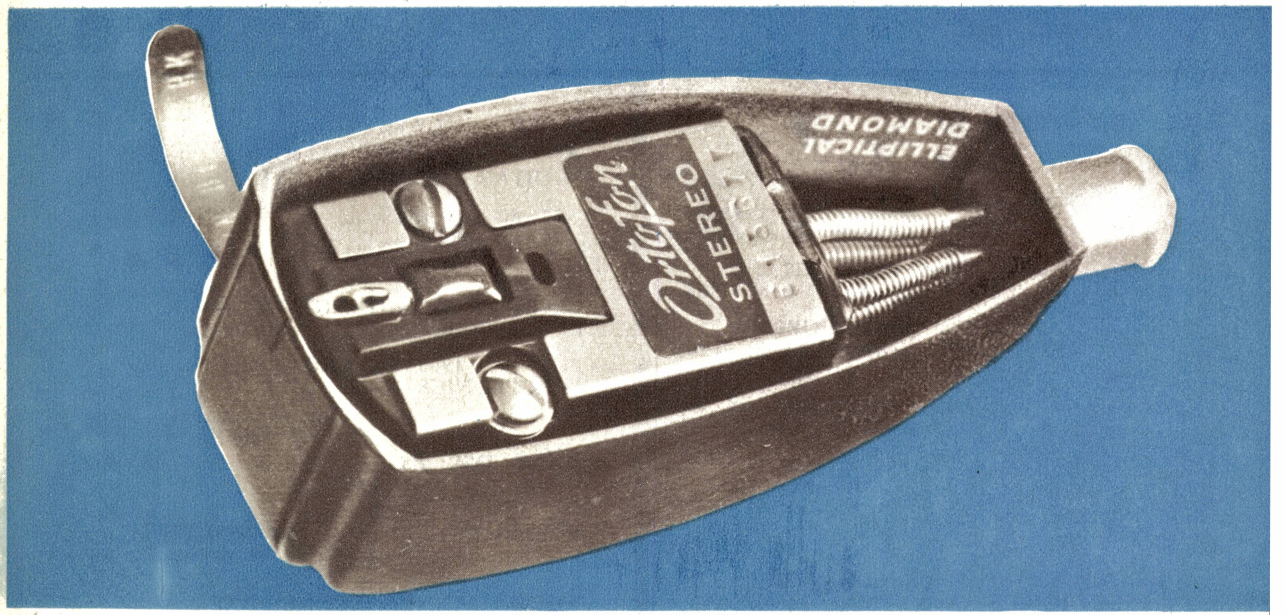
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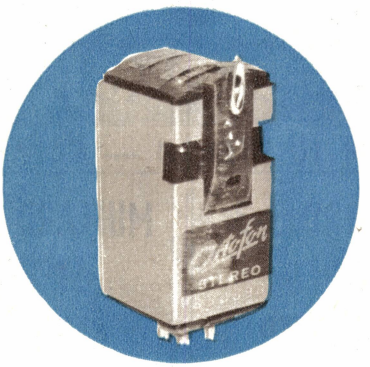


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VARIETY FARE

★ "ELECTRONICS Australia" ★ Staff Review Panel

Devotional

OLD TIME RELIGION. The White Sisters. Arranged and produced by Kurt Kaiser. Stereo. Word (Gospel Film Ministry) WST-8345-LP.

Interest: Well-known Gospel trio.
Performance: Good.
Quality: Good.
Stereo: Average.

Anyone who has heard the White Sisters could not fail to have been impressed by their natural musicianship and harmony. Interest in the trio has been such as to justify publishing their musical arrangements which have been adopted with varying success by local groups.

However, I must confess that I didn't find them quite so convincing in this album, with its higher content of "old time" Gospel songs. Or maybe it was because the arrangements didn't provide quite the same scope for their talents.

Let there be no mistake—the girls sing very well and there may be some who will prefer this one to the earlier album. It's a matter of preference.

The titles: Must Jesus Bear The Cross Alone? — Sweet By and By — Sing With Joy And Gladness — When I See The Face Of Jesus — Steps Of A Good Man — I'll Fly Away — Old Time Religion — Lily Of The Valley — Jesus Breaks Every Fetter — I Cannot Hide From God — Let The Lower Lights Be Burning — Someday When Jesus Comes.

You should certainly have a White Sisters' album in your Gospel collection but ask to hear one of the earlier ones before making your choice. (W.N.W.)

★ ★ ★

THE GOOD OLD HYMNS. The Roger Wagner Chorale, conducted by Roger Wagner; Soprano soloist Maurita Philips; Baritone James Tippey. Stereo. Capital Encore series SENC-9256. Also in mono ENC-9256.

Interest: "Good old hymns."
Performance: Excellent.
Quality: Mostly good.
Stereo: Effective.

This very good example of straightforward hymn singing, originally reviewed in June, 1964, has now been reissued on the economy "Encore" series label.

The jacket notes stress that hymns are these are meant to be sung by ordinary congregations and that uncomplicated harmony is one of their essential characteristics. Here the Chorale sings them with a minimum of embellishment, but so capably that they could not fail to win an audience from those who have a liking for hymns sung in this fashion. Furthermore, the stereo version, which I had not heard before, adds a very worthwhile quality in the spread of the sound.

The hymns, all very familiar, are: Jesus Loves Me — The Old Rugged Cross — In The Garden — What A Friend We Have In Jesus — God Of Our Fathers — Nearer My God To Thee — In The Sweet By And By — Abide With Me — The Little Brown Church — Lead Kindly Light — Rock Of Ages — Fairest Lord Jesus — Now The Day Is Over.

Technically the sound is good, except for a few isolated spots where the heavy and complex voice patterns caused some tracing distortion. But it's a good buy, nevertheless. (W.N.W.)

★ ★ ★

ELVIS Sings His Hand In Mine. RCA 7-inch EP, 20406.

One of a recent batch of "Elvis" 7-inch E.P.s, this one contains four tracks from the L.P. album "His Hand In Mind:" His Hand In Mine — The Mansion Over The Hilltop — Working On The Building — I'm Gonna Walk Dem Golden Stairs, the last two spirituals.

With backing by the Jordanaires, it's a pleasant bit of swinging Gospel, well worth a hearing if you're not inclined to buy the full album. (W.N.W.)

★ ★ ★

THE GOSPEL FOLK SING. Swordsmen Quartet. Stereo, Supreme S-207. Also available in mono M-107. (Supreme Productions S.E. Asia Ltd., P.O. Box 15, Footscray, Vic.)

Interest: Gospel, folk style.
Performance: Very smooth.
Quality: Good.
Stereo: Well spread.

"Folk style" could possibly suggest a rather corny presentation, with banjo, guitars and a slap-happy type of vocal. Banjo and guitars, there are, but there's nothing corny about the playing or the singing of the Guardsmen. All of them university graduates and musicians, their arrangements are excellent and varied and their harmony disciplined and smooth.

Their numbers range from a swinging "Noah Found Grace" to the contemplative "Sands of Time." The full list:

There's A Friend — Livin' Humble —A Balm In Gilead — Noah Found Grace — All The Way My Saviour Leads — My Jesus Knows — Jubilee — Forth He Came — In His Care — Over Hill and Valley — The Sands of Time.

This is the first time I've reviewed an album of the Guardsmen and it proved a very pleasant task. Recommended. (W.N.W.)

★ ★ ★

THE OLD RUGGED CROSS. Wayne Newton. Arranged and conducted by Hank Levine. Mono, Capitol T-2563. Also in stereo ST-2563.

Interest; Newton and Gospel.
Performance: Smooth.
Quality: Good.

Wayne Newton, well known in this country for his recordings and his nightclub and television appearances, takes his turn to do a devotional album, with jacket notes to match. I imagine that individual inclination to hear and buy will be strongly influenced by one's reaction to the artist himself.

The essential lightness of Wayne Newton's voice is very evident throughout and, in numbers like "Just A Closer Walk" the sound is very like that of any one of a number of Negro artists. But it is smoothly presented, with backing from a 25-voice choir and electronic organ.

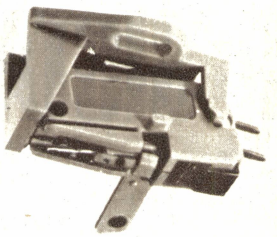
The titles: The Old Rugged Cross — It Is No Secret — Somebody Bigger Than You And I — Who At My Door Is Standing — The Gifts Of God — Whispering Hope — Just A Closer Walk — What A Friend We Have In Jesus — Rock Of Ages — Take My Hand, Precious Lord — The Power Of Prayer — The Lord's Prayer.

If you like Wayne Newton's style, you can buy with confidence. If you're not sure, have a listen first. (W.N.W.)

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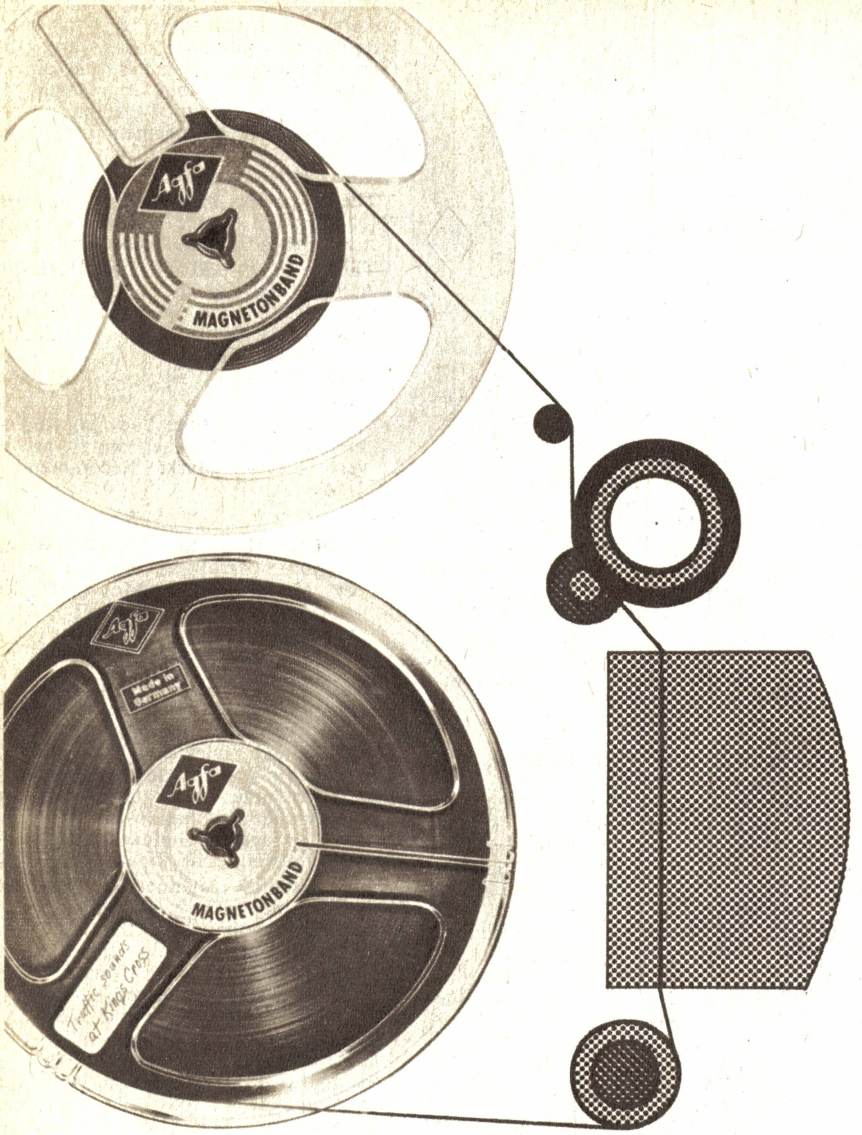


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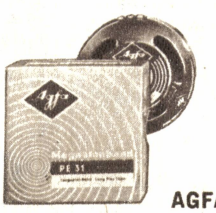
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SEMPRINI PLAYS FAVOURITE MELODIES. Semprini, piano, with orchestra conducted by Kenneth Alwyn. E.M.I. Studio 2 Stereo, SCXO 6110. Available in mono.

Interest: Light classics.
Performance: Pleasant, relaxing.
Quality: Excellent.
Stereo: Good separation.

Those who like to listen occasionally to light classic music, without having any particular partiality for the "heavies," will find much to please them in this selection of light classical snippets and popular tunes, some extracted from full-scale works. I am sure Semprini would not mind if I said that he is not in the same class as, say, Rubinstein, but he is in his element in the type of lighter works presented here.

These are: Lark in the Clear Air — Limelight and Theme from "Modern Times" (Chaplin) — Rondalla Aragonesa (Granados) — Ave Maria (Bach-Gounod) — Concerto No. 2, extract from 3rd movement (Rachmaninoff) — Rosa Maria (Semprini) — Tristesse (Chopin) — Impromptu, Op. 90, No. 3 (Schubert) — Rhapsody in Blue (Gershwin) — Piano Concerto No. 1, extract from 1st movement (Tchaikowsky).

I could not hazard a guess why, but Semprini has arranged the beautiful Schubert "Impromptu" (originally a piano solo) for piano and orchestra, while his rendering of "Rhapsody in Blue" is an abridged arrangement for piano solo. "Tristesse" is, of course, the main theme from Chopin's E Major study, and the "Rondalla Aragonesa" is one of the 12 Spanish Dances of Granados.

On the technical side, it is worth noting that this is one of the first releases of EMI's new "Studio 2 Stereo" discs. This has all the features of the best present day recording practice, with bright clear sound, good stereo separation and absolutely silent surface. At several places in the first playing of the disc, I was somewhat puzzled by the effect of the stereo, but more attentive listening showed that the sounds of two separate pianos were issuing from the two speakers. Although nothing is said in the sleeve note to guide the listener, I concluded that Semprini was playing duets with himself, using the "sound on sound" technique. (H.A.T.)

★ ★ ★

MORE I LIKE TCHAIKOVSKY. Stereo. Capitol SP-8632. Also in mono P-8632.

Interest: Familiar classical melodies.
Performance: First rate.
Quality: Good.
Stereo: Excellent spread, definition.

"I like Tchaikovsky" almost invites the retort: "Who doesn't?" Some may not, of course, and others may have something of an aversion to excerpts, on the basis that, if one is going to listen to a work, let it be the whole work — not just a segment!

But there's a lot of other people like this reviewer, who can thoroughly enjoy well-played excerpts —or "lollipops" as Sir Thomas Beecham was wont to call such presentations of this kind.

This second album is just as enjoyable as the first "I Like Tchaikovsky." In it you get: Waltz from "Sleeping Beauty" (Joseph Levine conducting the Ballet Theatre Orchestra) — Introduction to Act II; Spanish Dance; Pas de Deux; "Swan Lake" (Joseph Levine, the Ballet Theatre Orchestra) — Andantino From the "Piano Concerto No. 1 in B-flat" (Leonard Pennario with Erich Leinsdorf conducting the Los Angeles Philharmonic Orchestra) — Waltz from "Eugene Onegin" (Felix Slatkin conducting the Hollywood Bowl Symphony Orchestra) — "1812 Overture" (Felix Slatkin conducting the Hollywood Bowl Symphony Orchestra) — Dance Of The Sugarplum Fairy, Trepak, Dance Of the Flutes, Waltz Of the Flowers, from "The Nutcracker" (Felix Slatkin conducting the Hollywood Bowl Symphony Orchestra).

As noted above, the playing is good, likewise the general quality and the stereo. One you can buy with confidence. (W.N.W.)

★ ★ ★

THE SOUND OF STRINGS, conducted by Reginald Kilbey. World Record Club stereo, S/T4214. Available in mono.

Interest: Light music for strings.
Performance: Smooth and competent.
Quality: Very good.
Stereo: Restricted spread.

This is another of those very good records issued from time to time by the World Record Club which, without having any special claim to fame, make pleasant relaxed listening during quieter moments. The Sound of Strings orchestra plays, very smoothly and competently, a selection of excellent tunes which may be conveniently classified as "light music."

These are: Belle of the Ball — My Heart Stood Still — Blue Island — Dusk — Kiss Serenade — March from "Serenade for Strings" (Dag Wiren) — Happy Times — Concetta — Westminster Waltz — Love's Last Word is Spoken — Arriverderci Roma — Noel Coward Waltz Selection; I'll Follow my Secret Heart, I'll See You Again — Zigeuner — Some Day I'll Find You — Dearest Love.

The technical quality of the disc is excellent, but the stereo spread is rather restricted—something that I have noted before on some WRC discs. (H.A.T.)

★ ★ ★

THE VERY BEST OF MOTION PICTURE MUSICALS. Original soundtrack performances. Mono, MGM. Encore series VO2-9197.

Interest: Original performances.
Performances: Good enough in their day.
Quality: Mediocre.

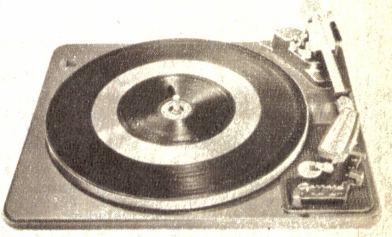
One is likely to pick up this record in the expectation of a pleasant nostalgic journey back through the years. To me, unfortunately, it turned out to be a pretty rough ride!

First off, to modern ears, the distortion, the poor balance and the limited dynamic range make it tough going for the artists. And, compared with performances we have heard since, some of them aren't all that good to begin with, I'm afraid. Still, to provide a topic for reminiscence, I guess the album should be handy enough. Titles and artists are: Johnny One Note (Judy Garland)—Gigi

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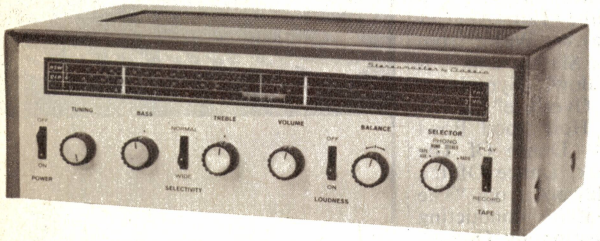
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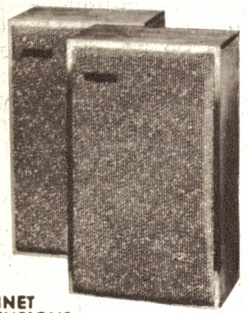
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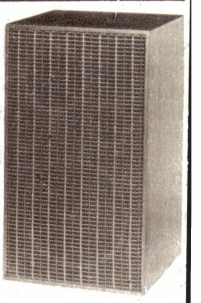
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If you're looking for nostalgia, O.K. If you're more interested in the music, go for more recent performances! (W.N.W.).

★ ★ ★

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Interest: Dance music a la Ros.
Performance: Elegant.
Quality: Excellent.
Stereo: Good spread.

The title of this disc gives a clue to the contents. It is dance music recorded at the Edmundo Ros Club in London, and delivered in the smooth, elegant style for which Ros is famous. Latin American music is featured prominently, as is usual with Ros, but included among the cha cha chas, mambos, sambas, tangos and baios are a few quick steps and waltzes.

Obviously with the intent of appealing to the widest possible audience, the selection consists entirely of tunes which have become firm favourites after standing the test of time: The Nearness of You — La Vie en Rose — The Rose in Her Hair — Orchids in the Moonlight — Dolores — April in Portugal — National Emblem — Under the Bridges of Paris — Ramona — Jealousy — La Rosita — Estrellita.

I think it is safe to say that most people will be familiar with at least the greater number of these tunes, and personally, I cannot imagine a better collection of tunes for an evening's dancing, particularly when played in the Edmundo Ros style. Incidentally, in view of Ros' propensity for arranging popular tunes in the Latin American rhythms, I was intrigued to notice that he has turned the famous tango "Jealousy" into a quickstep in this recording. (H.A.T.)

★ ★ ★

MASTERPIECES FOR GUITAR. Jose Luis Gonzalez. CBS mono, BR 235214.

Interest: Classical guitar.
Performance: Expert.
Quality: Excellent.

When CBS released "Contemporary Guitar Music" last year, shortly before Jose Luis Gonzalez left Australia, one was left with the impression that, regretfully, we had had the last of the excellent series of Australian-made recordings by this talented young Spaniard. Now CBS have released this further disc, devoted mainly to music of the sixteenth and seventeenth centuries — a direct contrast to the disc mentioned above. Presumably this material was recorded by Gonzalez before his departure, and has only now been released.

As before, Gonzalez demonstrates exquisite skill and dedication to his playing, but it did seem to me that just here and there, in some of these pieces, there was a slight relaxation in attention to detail.

The pieces themselves should have wide appeal, as they all are fine examples of the melodic invention which characterises the best of early music. Those not familiar with the work of the great Spanish master for the guitar, Fernindand Sor, will be surprised at the melodic invention contained in the three pieces of his composition included.

The pieces are entitled: Six lute pieces of the Renaissance — Suite (Roncalli)—Sonata (Scarlatti) — Two Minuettos and Sonata (Sor) — Melancholy Galliarde and Allemande (Dowland) — Siciliano (C.P.E. Bach) — Soiree (Campion) — Allegretto (Rameau) — Fantasia (Weiss). This represents a very full program since some of these pieces have several movements or sections. If you liked the other recordings by Gonzalez, you are sure to find this to your taste. (H.A.T.).

★ ★ ★

SELECTIONS FROM "THE SOUND OF MUSIC" AND "MARY POPPINS." The Hammond Brothers at the Hammond organ. Stereo, Festival SFL-932,179. Also in mono FL-32,179.

Interest: Multiple Hammond Organs.
Performance: Well co-ordinated.
Quality: Not above criticism.
Stereo: Good spread.

In my review of their earlier album SFL-932,025 (December, 1966) I remarked on the fine co-ordination of these two Belgian players Jan D. Nef and Co Pilley. The observation holds equally true for this one, as they swap the lead from side to side and, incidentally, make good use of the varied voices of the modern Hammond.

On side 1 are selections from "Sound of Music": The Sound Of Music — My Favourite Things — Edelweiss — The Lonely Goatherd. And from "Mary Poppins": A Spoonful Of Sugar — Supercalifragilisticexpialidocious — Chim Chim Cheree — Feed The Birds.

On side 2 are four danceable tracks—a selection of foxtrots, waltzes, Bostons and slow foxtrots. The Bostons include an arrangement of Chopin's Nocturne —a real teaser in which the lead organ weaves into tempo against one's normal expectations.

Hammond organ enthusiasts will enjoy this album provided they are not too fussy about ultimate quality. Somewhere between the original Belgian Eurovox recording and Festival's Australian pressing a bit of fuzz has crept in which will show up on wide-range systems. (W.N.W.)

★ ★ ★

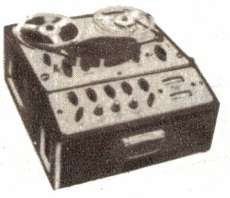
ACAPULCO TRUMPETS. Bob Moore and his Orchestra. Monument (Festival) stereo SPL-932,185.

Interest: Trumpets, strings and Mariachi.
Performance: Satisfying.
Quality: Very good.
Stereo: Good spread.

If you can imagine Herb Alpert and Mantovani joining forces for a program of popular music, you will gain some idea of what to expect on this disc. On one side there are the dual trumpets playing in close harmony, with backing of Mariachi rhythm and guitar. Opposing these is a fairly large string section playing sweetly in unison.

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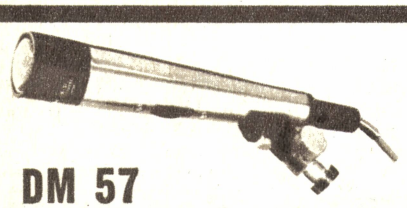
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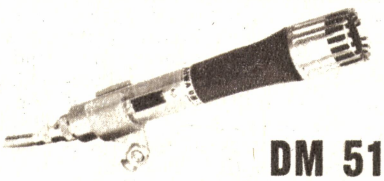
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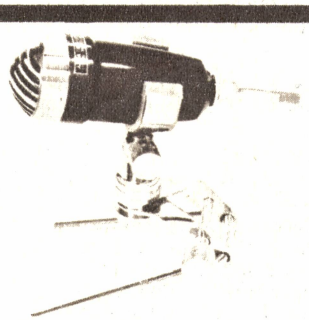
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Excellent sound quality, and good tereo, make this a disc worth listening o. (H.A.T.).

★ ★ ★

GREAT CONTINENTAL HITS. Caterina Valente with orchestra conducted by Stanley Black. World Record Club stereo. S/T4215. Available in mono.
Interest: European popular songs.
Performance: First rate.
Quality: Very good.
Stereo: Good spread.

Catherina Valente has been a popular ntertainer in her native France, as well s in other European countries, for sevral years, but this is the first time I have had an opportunity to hear her ing. By the end of the first side of this lisc, I was convinced that I had been nissing quite a lot. She projects an enhanting personality in her singing, with voice of ringing quality and bell-like larity, shows an unfailing sense of hythm, with phrasing and intonation xactly right.

Although born in Paris, of Italian/ French parentage, she sings in English vith hardly a trace of accent. Her dicion is perfectly clear, with no trace of he painful habit possessed by some vomen singers, of dragging out the owels.

The songs are good to: If You Go— utumn Leaves—Melodie D'Amour— oo Soon—Volare—I Wish You Love -Song of the Sea—Why Do You Pass fe By—April in Portugal—If You Love fe—Wonderful to Know—Scandinavian ong. Most of these were originally comosed to French, Italian or Spanish rics, but are all sung in English here. ighly recommended. (H.A.T.)

★ ★ ★

MEXICAN SHUFFLE. The Living Brass. RCA Camden, stereo CAS-907. Available in mono.
Interest: Tijuana style music.
Performance: Competent.
Quality: Good.
Stereo: Normal.

This is a frank imitation of the ijuana Brass and although, in general, he might say that an imitation can ever be as good as the real thing, this sc has the advantage that it has been leased on RCA's economy Camden bel. Apart from that, it features some etty good playing, and, if one had ver heard of the Tijuana Brass, this sc could come in for some favourable mment. All I can say is, if you like e Tijuana Brass, there is no reason hy you should not like this also. You ay not think it is quite as satisfying t against this can be set the low price, most half that of current Herb Alpert leases. Sound quality and stereo separion are both of good standard.

Tune titles are: Mexican Shuffle—La loma — Mexican Pearls — Whipped ream—Mexican Hat Dance—Magic rumpet — El Relicario — Jave — rompeta Tijuana—Up Cherry Street.

Observant readers may notice that ere are only 10 tracks adding up to 12½ minutes on side 1 and 12 minutes on side 2—hardly a generous offering. (H.A.T.)

★ ★ ★

IN THE MOOD. Lenny Dee, organ, with orchestra and chorus. Decca, U.S.A. (Festival), stereo, SDL-932,-164. Available in mono.
Interest: Popular organ.
Performance: Sparkling.
Quality: Excellent.
Stereo: Normal spread.

Lenny Dee plays most entertainingly for 11 of the 12 tracks on this disc, with plenty of bubble and sparkle in his renderings of the excellent selection of tunes included. In the remaining track ("In The Mood," from which the disc takes its title), all the vitality and rhythm of this favourite of the 1940s are replaced by a kind of clod-hopping beat which gives an odd impression of a middle-aged pair of jitterbugs trying vainly to recapture the carefree days of their youth.

Since the skill and taste of the performer are amply vindicated in the other tracks, one concludes that "In The Mood" does not lend itself to organ treatment.

Apart from the title track, the tunes are: Cute—Spanish Eyes—The Shadow Of Your Smile—Call Me—Meditation —Spanish Flea—Lara's Theme—A Man And A Woman—Summer Wind—The More I See You—Happiness Is.

Unfortunately, Decca have not provided Mr Dee with very effective support. The instrumental work of the supporting players is pedestrian and the choral group can only be called inept. Fortunately, both groups are not very prominently recorded, so one can still appreciate Mr Dee's skill. The technical quality of the the disc is excellent. (H.A.T.)

★ ★ ★

THE MUSIC OF ERNESTO LECUONA. Trio Los Panchos. CBS stereo, SPB 233384. Available in mono.
Interest: Latin American composer.
Performance: Very enjoyable.
Quality: Excellent.
Stereo: Well placed.

There can hardly be a person with even a passing interest in popular music who would not instantly recognise the tune of "Siempre En Mi Corazon," known in the English speaking world as "You Are Always In My Heart." Yet I venture to suggest that not more than one in a thousand would know the name of the composer — Cuban-born Ernesto Lecuona.

In addition to this outstanding success, Lecuona wrote many other excellent tunes, many of them familiar in all parts of the world where dance music is played. In Latin America, Lecuona is as well known as Gershwin and Kern are to us.

In the sparkling style which has won for them international recognition, Trio Los Panchos sing 12 of Lecuona's songs in the original Spanish in this selection: In addition to the famous "Siempre En Mi Corazone" they sing the following: Malaguena — La Comparsa — Noche Azul — Juventud — Es un Golfo — Maria La O — Canto Karabali — Siboney — Aquella Tarde — Como Presiente — Sin Nombre.

Some of these (e.g., Malaguena, Siboney) are, of course, very popular songs, but included in this list are some of the composer's work which, although popular in Latin America for many years, has not so far made much impression elsewhere. Listeners hearing them for the first time on this disc may well wonder why this is so.

Technically, the disc is beyond reproach, with clean sound, silent surface and good stereo separation. (H.A.T.)

★ ★ ★

RICHTER IN ITALY. Sviatislav Richter. Program of Piano Works by Schumann. Papillons, Op. 2. Sonata No. 2 in G Minor. Op. 22. Carnival of Vienna. Op. 26. World Record Club Stereo T4131.

In the works of almost any composer you like to name Richter is one of the world's greatest pianists. But in the works of Schumann he is peerless. Not even the great Artur Rubinstein can match him. This recital, chosen from 40 hours of tape recorded live by Richter during a tour of Italy five years ago is devoted entirely to Schumann's music. His playing of all three works in the recital is marked by a deep sense of poetry and generous use of the impulsiveness so characteristic of this composer.

I have only one small criticism to make of the disc. The piano, which Richter took with him on the tour and which caused more than a little trouble and inconvenience from time to time, does not do full justice to the player's exquisite touch. Though against this might be weighed the merit of live audiences who so far as the recording shows behaved with the utmost decorum during the various recitals. (J. Russell.)

★ ★ ★

THE ROAD TO MANDALAY. Owen Brannigan, bass, with Ernest Lush, piano, and Gilbert Vintner and his orchestra. E.M.I., mono, OCLP 3581. Available in stereo.
Interest: Kipling in song.
Performance: Shows great experience.
Quality: Good.

Those who like Kipling will find much to enjoy in this selection, taken mainly from "Barrack Room Ballads" and the "Just So Song Book," sung by veteran bass Owen Brannigan. Mr Brannigan has been singing these songs as long as I can remember and may be counted something of an expert. His rendering of "Boots" was standard fare on both the B.B.C. and the A.B.C. for years and equally popular was his "Road To Mandalay."

It is interesting to note that for most of the time in these songs Mr Brannigan seems to be singing more in the

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aritone register than as a true bass. eldom do the rich, deep tones of the ue bass ring out.

Nevertheless, this is very enjoyable nging, which sustains the interest all rough. I doubt whether anybody uld convey the spine-chilling account the execution of the unfortunate anny Deever better than the artist does re.

Side one is devoted mainly to the lection from "Barrack Room Ballads" id consists of all the favourites: Route larchin'—Boots—Gunga Din—Mother Mine—A Smuggler's Song—Danny eever—On The Road To Mandalay. n side two are the "Just So" songs: hen The Cabin Portholes — The amel's Hump — This Uninhabited land—I Keep Six Honest Serving Men I Am The Most Wise Baviaan—Kanroo And Dingo—Merrow Down—Of l The Tribe Of Tegumai—The Riddle The First Friend—There Was Never Queen Like Balkis—Rolling Down To o.

I was not entirely happy with the und quality, which did not seem to me be up to the usual excellent E.M.I. ndard. (H.A.T.)

★ ★ ★

METHING SPECIAL. The Kingston Trio. World Record Club stereo S/T4205. Available in mono.

Interest: Folk singers.
Performance: Enjoyable.
Quality: Good.
Stereo: Normal.

The Kingston Trio have always been pleasure to listen to. Despite their cess, they retain a freshness in their formances, and have not acquired the se professionalism of some other ular groups.

The title of this disc promises "Some- g Special," so I looked forward with surable anticipation to hearing the tents. In the event, I was not entirely py with the result. For this perfor- nce, the Trio have added the backing instrumental and choral groups. In book, they are quite good enough to d alone, and the extra weight does ing to improve their performance.

Iowever, the renderings on this disc very enjoyable, and the "extras" are all that distracting. So, if you like group, this one is worth looking at. he tunes are very much in line with type of thing the Trio has recorded he past: Brown Mountain Light — More Town — O Willow Waly — It On The Mountain — Little — Strange Day — Away Rio — in' Away — She Was Good To — Jane, Jane, Jane — Portland n—Old Joe Clark.

ound quality and stereo are up to dard. (H.A.T.)

★ ★ ★

LADS OF THE SNOWY MOUNTAINS. The Settlers. RCA Camden, stereo. Available in mono.

Interest: New Australian folk singing group.
Performance: Shows talent.
Quality: Very good.
Stereo: Normal spread.

In this, their first disc, the new Aus- an folk singing trio, The Settlers, e that they have plenty of talent. ever, they appear to have set them- s a difficult task on their road to — they apparently sing only the bers written by one of their number, Ulick O'Boyle. Moreover, he apparently writes only about life on the Snowy Scheme.

However, they sing well, their guitar playing is adequate, and the songs are entertaining enough, even if the tunes do seem to have been unduly influenced by the efforts of radio cowboys. It is to be hoped that Mr O'Boyle will develop a more original style in time, since he is obviously capable of writing a good tune.

Some idea of the homespun nature of the lyrics can be gleaned from the tune titles: Jindabyne Farewell — Blowering Dam — Snow Kitten — Old Talbingo — The Thredbo Slop — Song of the Mountains — A Bottle of Scotch and an Old Guitar — The Ballad of Big Pedro — The Cooma Cavaliers — Hard Rock Drillin' — I've Done It — The Dozer Driver Man — Watson's Crag.

The sentiments expressed range from slapstick comedy and sly rib-poking humour to heavy sentiment of the "He was a good guy who died for others" type. As a change from imported country and western material, this disc is refreshing and is well worth the Camden price in terms of entertainment. (H.A.T.)

★ ★ ★

MY HEART'S IN THE COUNTRY. Skeeter Davis. RCA Dynagroove, stereo LSP-3667. Available in mono.

Interest: Country singer.
Performance: Authentic.
Quality: Excellent.
Stereo: Good spread.

Another country and western music disc to swell the already large list of RCA releases in this genre—this time featuring popular entertainer Skeeter Davis. Miss Davis has already made a number of EP 45 discs, but this is the first full-length LP album I have reviewed. She is a genuine country girl, having been born and reared on a Kentucky farm. She certainly sounds authentic, so country music fans can buy this with the assurance that this is no city-bred entertainer adopting a phony accent.

The country song repertoire is so vast that most of the songs were quite new to me as, no doubt, they will be to many other Australians: My Heart's in the Country—Put It Off Until Tomorrow—Ain't Had No Loving—Think of Me—I'm Living in Two Worlds—Goin' Down the Road—Foggy Mountain-Top—You Ain't Woman Enough—Guess My Eyes Were Bigger Than My Heart—If I Ever Get to Heaven—Before I'm Over You—Evil on Your Mind.

The technical quality of the disc is excellent. (H.A.T.)

★ ★ ★

EVERYBODY GOTTA BE SOMEPLACE. Myron Cohen at the Royal Box Americana of New York. Recorded live; produced by Tom Berman. Mono, RCA LPM-3534.

Interest: Top-line raconteur.
Performance: Laughs-a-plenty.
Quality: Normal.

I've grown wary of funny-man albums. All too frequently the stories turn out to be old, blue or political, with not much to laugh at at all.

Not so this album by Myron Cohen. There's an occasional touch of the above, as one might expect from a club show, but there are plenty of laughs besides.

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Response—50-12,000Hz.

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Some of the stories would probably fall flat from the lips of a raconteur less skilled than Myron Cohen, but his real-life image of a quaint little Jewish gentleman, telling stories at the expense of his own race, gives him a head start.

I've often wondered about the value of comedy recordings in a private collection, but this is one of the few that could justify its place for the entertainment of guests. Well worth a hearing. (W.N.W.)



Graeme Bell Says . . .

THE VINTAGE YEARS. Unforgettable favourites by The Nat King Cole Trio. Capitol, Mono T 2529.
Interest: Jazz piano and vocal.
Performance: Great artistry.
Quality: Good remaster.

With the tragic death of this great artist only a recent event, our thoughts often turn (apart from lung cancer) to the days of the Nat King Cole Trio, when Cole was known as a pianist who also sang.

He created a delightful new sound by not using drums. The trio consisted of Oscar Moore on guitar, and Johnny Miller on bass, with delightfully melodic and swingy jazz piano from Nat himself.

All of these tracks are well worth re-issuing, and to the great credit of these musicians do not appear at all dated, although they were recorded in 1945, '46 and '47.

The titles themselves are sufficient to bring back memories of the days when the Cole Trio was a smash hit. That it was disbanded after the 40s was a great loss—but then the world gained a great singing star.

"When I Take My Sugar to Tea," "You're the Cream in my Coffee," "Naughty Angeline," "You're Nobo 'Till Somebody Loves You" are ju some of the unforgettable tracks exper remastered by David Cavanaugh a Carson Taylor from the old 78s.

★ ★ ★

LOUIS ARMSTRONG AND THE A STARS. Concert Hall Synch Stereo SJS 1262.
Interest: Louis.
Performance: Restrained.
Quality: Not Live.
Stereo: Dull.

The tracks on this L.P. are the wo of the group Armstrong was leading 1959, and comprise Trummy Young trombone, Peanuts Hucko on clarin the late Billy Kyle on piano, Mort H bert on bass, and the All-Stars' pr ent drummer, Danny Barcelona.

The playing is particularly subdu on this album, and the only real exci ment comes from Louis' own trump playing with some sharp thrusts here a there from Trummy Young.

It is all very musical, but lacks th spontaneous spark we all associate w the Armstrong All-Stars.

On the other hand, this is a wonder collection of jazz tunes belonging to t days when Louis was on the way They include "Drop That Sack," "Je Roll Blues," "Panama," "Chimes Blue "Dr Jazz" and a wonderful vocal "St. James Infirmary."

Louis excels himself on "Hot Ti In The Old Town Tonight" and carr an otherwise rather sober front line ri through to the end in majestic fashion.

★ ★ ★

BROADWAY . . . BASIE'S WA Count Basie and His Orches Command Records. Stereo SNI 932-134. Also available on Mon
Interest: Swinging Big Band.
Performance: Excellent.
Quality: Excellent.
Stereo: Exciting Realism.

One of the most thrilling records the market, by probably the hottest most exciting big band in the wo today.

Tunes have been carefully selec from the big Broadway shows, such "Hello Young Lovers," "A Lot of Li To Do," "Mame," "Baubles, Bangles

"On this excellent album . . ."

THE JAZZ SOUND OF THE DON BURROWS QUARTET. Don Burrows. — Fife, Flute, Alto-Flute, Clarinet, Alto-Saxophone. Ed Gaston. — Bass. George Golla. — Guitar. John Sangster. — Vibes, Percussion. Columbia, Stereo SCXO7781. Also available on mono.
Interest: Australian Jazz.
Performance: Excellent.
Quality: Good.
Stereo: Unobtrusive.

If there is anyone in Australia interested in jazz who has not yet heard the Don Burrows Quartet, then they should have their head read.

These talented musicians — the cream of local jazz — have been playing in Sydney for years now, and can be heard at the El Rocco Jazz Cellar, Kings Cross.

On this excellent album, of which all Australians should be proud, the creativity of these four musicia extends beyond their instrumen playing, for all of the tracks a either composed or arranged by o of the Quartet.

John Sangster's Japanese influenc "Rain on Water" is one of the m beautiful recordings made in t country, and his "Kaffir Song," condensed into a 2½ minutes versi could quite easily become a hit sing

George Golla's contributions clude a beautiful melody cal "Algeciras," and Don Burrows' ori nals include a laughing bouncy pi called "Hard Sock" with Sangs doing the soft shoe dance with mallets on dampened vibes. T humour of this piece even exte to the inevitable show biz repea tag.

Produced by Eric Dunn and w cover notes by John Rippin, it is be hoped that this example of A tralian Jazz gets a release overse

eads," "People," "Everything's Coming Up Roses," and for once we hear plenty f Basie's unique piano playing contrasd with the huge sound of his brass nd reed sections.

Great soloists who literally sparkle ie band include Roy Eldridge, Eddie Davis, Al Grey, Marshall Royal and Al arons, the young trumpeter who also lays flugelhorn.

This is one of those albums which is difficult to review because of its perection, and two other important factors part from this great orchestra go to make it so. One is the brilliant and mpathetic arranging by Chico O'Farll, who has adapted these show tunes well to the Basie style, and the other the great clarity and realism obtained y Command Records' engineers.

One of the finest sound reproductions his year.

★ ★ ★

ASIE SWINGIN' VOICES SINGIN'. Count Basie with the Alan Copeland Singers. Ampar, Stereo SML 932,097. Also available mono.

Interest: Clever vocal arrangements.
Performance: Excellent.
Quality: Fair.
Stereo: Normal spread.

Here we have an eight piece continent from the big Basie Orchestra, inuding the Count himself, collaborating th six male and six female singers, all der the baton of Alan Copeland.

It is a tremendously successful sesn, and owes as much to Copeland's cellent arranging as it does to the inging influence of the Basie rhythm ction, plus Roy Eldridge on trumpet, Grey, Billy Byers, trombones, and die "Lockjaw" Davis on tenor sax.

All of the arrangements have an inesting twist to them, such as "You e My Sunshine" with a beautifully red unaccompanied verse. The numdevelops a funky flavour, and then re's 8 bars from the male voices in ison with George Duvivier's bass ding into an all-in bit of revival eting stuff.

All the tunes swing, especially "Oh, dy Be Good," "One For My Baby," all Me" and "Candy."

A record you wouldn't tire of easily.

★ ★ ★

MON AND HEAR: DELLA REESE. Universal Record Club. Stereo SU-812.

Interest: Vocal Stylist.
Performance: Good.
Quality: Good.
Stereo: Normal spread.

Della's gospel background is apparent this, her first album for A.B.C.-ramount, now released through the iversal Record Club.

In her early days she spent five years h the Mahalia Jackson troupe and stered every nuance of the gospel art. d to this her wide experience and her sequent chance to study the great z singers, and we have on this album unique and dynamic Della Reese e.

ncluded are some lovely old standds, such as "Home," "My Devotion" "A Hundred Years From Today," addition to her single hit "After Lov-You."

The voice of Della Reese has a very sculine quality, however, which some eners like myself might find rather tating after repeated hearing.

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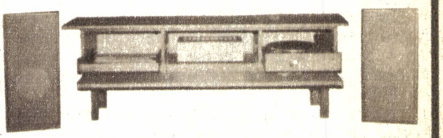
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4. WHARFEDALE SUPER 8 RS/DD in enclosures.
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TRADE REVIEWS AND RELEASES

SONY TC-260 STEREO TAPE RECORDER

The new Sony TC-260 four track stereo tape recorder, submitted recently for review by the importers, Jacoby, Mitchell and Co. Pty. Ltd., should appeal to those who require a straightforward machine without frills and gimmicks, yet able to provide a high standard of performance.

The main intention of the designers appears to have been to produce a machine with a high performance specification, to sell in the medium price range. To achieve this, they have concentrated on the basics and eliminated the features found on many machines which can be classed as "extras" — not concerned primarily with the operation of the machine for recording and playback.

The TC-260 is an all solid state design with a complement of 21 transistors and diodes. Power output from each channel is 5 watts RMS. It is pleasingly finished in the standard Sony styling of black and grey with panels and trims in brushed aluminium. The carrying case is finished in grey imitation grained leather, and is provided with a recessed carrying handle. Overall size is fairly large, being approximately 21¼ x 15½ x 8in, including projections.

The head complement consists of a combined record-playback quarter-track stereo head and a stereo erase head. The usual azimuth adjustment by opposing screws is provided.

The machine can be used in either the horizontal or vertical position. Two push-on rubber caps are used to retain the spools in the vertical operating position. Rubber feet are provided for operation in either position.

As is common with many of the better quality domestic recorders, it offers the choice of two operating speeds, 7½ips and 3¾ips. Changeover is by means of a stepped pulley to the main drive, operated by a push and turn-to-lock control in the centre of the deck, behind the head housing.

Performance data provided by the manufacturer are as follows: Frequency response: 50Hz to 15Hz plus or minus 3dB at 7½ ips, 30 to 13,000Hz at 3¾ips (no 3dB points quoted).

Signal-to-noise ratio: better than 50dB at peak recording level. Wow and flutter: less than 0.19 per cent at 7½ips; less than 0.25 per cent at 3¾ips. Output power: 5W per channel.

A frequency response check in record and playback provided figures which substantially confirmed the manufacturer's claimed response at 7½ips. The right channel response was well within the claimed performance, being flat from 100Hz to 12-KHz, rolling off to 3dB down at 50Hz but sustained to 2dB down at 16KHz. The left channel was not quite so good, and was in fact flat from 100Hz to 8KHz, thereafter rolling off gradually to be 4dB down at 15KHz and 3dB down at 50KHz.

Since the manufacturer omitted to quote reference levels for the 3¾ips operating speed, the claimed figures must be taken as meaning "useful response." Our checks showed that response was within 6dB from 30Hz to 10KHz, which is regarded as above average for this speed, and certainly adequate for reasonable quality sound reproduction through good external speakers.

Standard accessories supplied with the machine are two dynamic microphones, two plastic microphone supports, two sets of interconnecting leads, a head cleaning ribbon, a 7in take up spool, two rubber spool retainers and a demonstration tape.

The maximum size of spool which can be accommodated is 7in. Two inbuilt speakers are provided at 200K ohms. for monitoring purposes while, for better quality reproduction, external speaker outlets are on the rear panel, fitted with phone type jacks. For headphone monitoring and listening, a stereo headphone jack is also provided. Low impedence line outputs allow playback through a separate amplifier system.

All controls are located so as to be easily accessible in either the vertical or horizontal operating mode. The playback controls, contained on a panel to the right of the deck, comprise a speaker ON-OFF switch which allows the internal speakers to be silenced, presumably to prevent acoustic feedback when using the microphone close to the recorder; separate bass and treble tone controls (ganged to control both channels simultaneously); separate (concentric) volume controls for each channel.

The record mode controls are grouped together in a recessed housing with hinged cover at the left side of the deck. Individual switch potentiometers are used for each channel, so that the machine can be used for either quarter-track mono or twin track stereo operation. Two recording level meters allow separate monitoring of each channel; these are uncalibrated, but have a section marked in orange to indicate overload.

A single rotating lever serves to control the tape deck. This has the normal forward, fast forward, rewind and pause positions. Adjacent to this on the deck is a main ON/OFF button which is illuminated in the ON position.

To prevent the formation of "flats" on the various rubber drive pulleys which would result from leaving the machine in any one of the ON positions over a period, the control lever must be returned to the OFF position before the lid can be replaced.

All motion of the deck is powered by a single motor, coupled by an elaborate system of linkages and pulley wheels to the various drive spindles. Both spools have slipping clutch type drives to prevent tape breakage.

There is a certain amount of initial snatch in both the normal and fast forward motions which could impose strain on tape susceptible to stretch. Braking in both directions is smooth and positive, with imperceptible over-run.

A "talkthrough" facility is available using the microphone after setting the machine to the record mode and moving the control lever to the pause position. Output level can be controlled by either the input level control for the channel being used, or by the loudspeaker volume control.

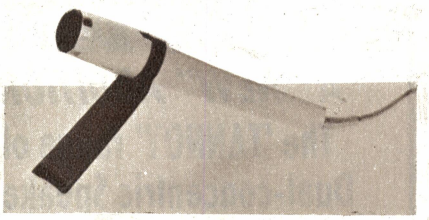
In addition to twin microphone inputs there are two auxiliary high-impedance inputs at the rear of the machine, for recording from external sources. These have a sensitivity of 120mV at 200K ohms.

To cater for the growing popularity of the DIN standard connectors, a five-pin DIN socket allows both record and playback to be accomplished through a single lead.

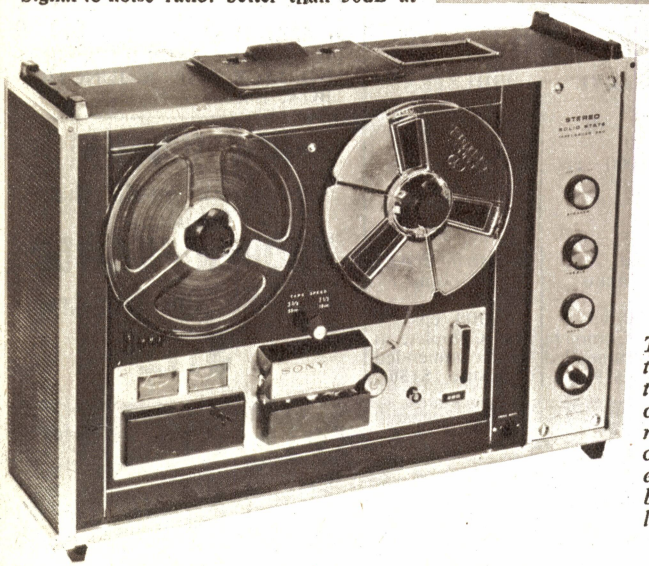
Our conclusion after examining the machine is that it is a good performer within its price range; without possessing any special gimmickry it has all that is necessary for convenient operation.

The only points we could find for criticism concern only minor detail. The rewind and fast forward were rather slower than one could wish for—in both directions—a full two minutes were required for complete run through of a 5in spool of 1½-mil tape (600ft). Another point concerns the very simple plastic pieces which do duty as microphone supports. These have only limited usefulness, and do not really provide stable support for the microphone with the result that microphones are easily knocked over.

Retail price of the TC-260 is $359. Further information may be obtained from the importers, Jacoby, Mitchell and Company Pty. Ltd., 469-475 Kent Street, Sydney, or from normal Sony retail outlets. (H.A.T.)



The TC-260 is supplied with two dynamic microphones and supports, as illustrated above.



The recorder in the vertical position. The playback controls are on the right side. Record controls are housed under the flap below the two level meters at left.

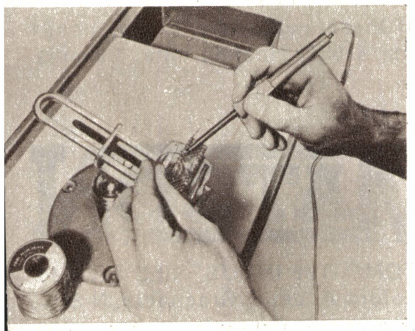
MINIATURE SOLDERING TOOL

A new lightweight, robust, miniature soldering tool of novel design is announced by Adcola Products Pty. Limited of Melbourne.

Designed to meet an Air Force need for soldering terminations in miniature and micro-miniature assemblies, the Adcola M20 (illustrated) also meets American Underwriters' Laboratories standards and is enjoying increasing sales in the U.S.A.

The tool weighs 7/8 oz., without cord, and is rated at 12 watts. It is available for 6, 12, 24 or 32 volt AC or DC operation (also 110/120 volt against export orders).

The design of the Adcola M20 differs from other miniature soldering tools in that it incorporates a "plug" type tip for the most efficient heat transfer from element



to soldering face, with minimum dissipation and radiation while retaining an extremely slim barrel. The barrel length is 2-3/8in to reduce tip tremble to a minimum.

Eight different soldering tips, with face diameters ranging from 3/64in to 1/8in, are available. The standard tip supplied with the tool is of 1/16in face dia.

A frame terminal is provided at the rear of the Lexan handle to allow the elimination of electrical potential between the soldering face and sensitive components.

Also illustrated is a universally mounted component work holder. This is one of a range of similar items for which an associate company, Royston Electric Pty. Ltd., are Australian distributors.

Further details may be obtained from Adcola Products Pty. Ltd., 12 Churchill St, Mont Albert, E.10, Victoria.

Cartridge Player

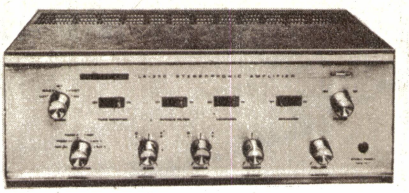
A cartridge tape recorder has been developed from the EXPO 67 "talking chair" developed by the Rola division of Plessey components. Designated the CT80, it is available in rack-mounted, or desk-top recessed or flush-mounted versions.

The CT80 operates with three, five, or seven-inch cartridge containers, and is available as either record-and-play or play-only. An optional "trip cue" attachment is available for all versions. This enables cue tones to be recorded on the tape, either while recording or at a later date.

The cue tones may be used to control slide projectors, film projectors, display lights, etc. Suggested uses include remote control applications in radio and TV studios, and to supply information at railway stations, airports and similar places.

Further information may be obtained from the Rola division of Plessey Components, The Boulevard, Richmond, Victoria.

LAFAYETTE *Hi-Fi Amplifiers*

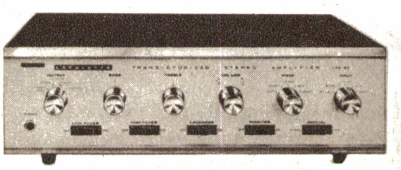


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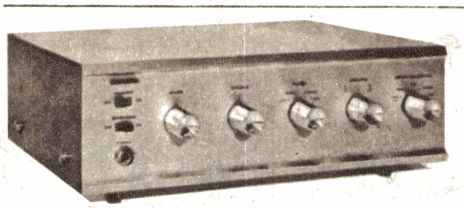


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LA-340A **$146.50**

A medium-priced amplifier of high performance. Sounds really good when used with two LAFAYETTE "Criterion 50" speaker systems.

40-WATT SOLID STATE STEREO AMPLIFIER

- 19 Transistors 4 Diodes.
- Response 1db 30 to 20,000 cps.
- Power 40-Watts IHFM; 20 Watts per Channel.
- 5 Pairs of Stereo Inputs for All Sources.
- Controls — Bass, Treble, Dual Volume, 4-Position Mode, 5-Position Input, Power On/Off, Speaker/Phones.



LA-224T **$99.50**

A "Remarkable" value by any standard of comparison. Destined to become Lafayette's most popular amplifier in the low price field.

NEW! 30-WATT SOLID STATE STEREO AMPLIFIER

- 19 Transistors 8 Diodes.
- Response 2db 30 to 20,000 cps.
- Power 30-Watts IHFM; 15-Watts per Channel.
- Input Sensitivity (Mag. Input) 3 mv at 1-Watt; Tuner/Auxiliary 250 mv.
- Controls — Bass, Treble, Dual Volume, Mode (Mono, Stereo), 3-Position Input, Power On/Off, Speaker/Phones.

NOTICE TO TRADE

Enquiries are invited from retailers throughout Australia who are interested to act as stockist resellers of LAFAYETTE Hi-Fi Stereo Amplifiers, Speaker Systems, Tape Recorders, etc.

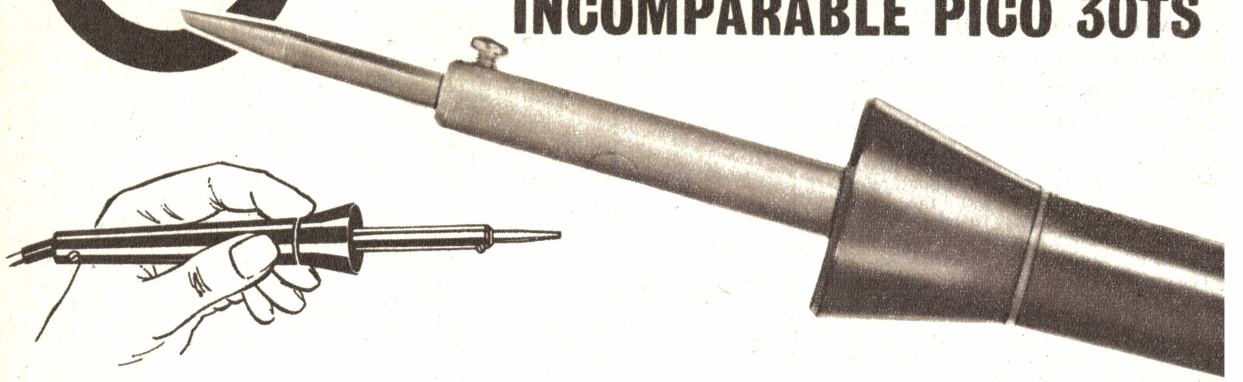
SEND REMITTANCE WITH ORDER FOR IMMEDIATE DELIVERY ANYWHERE OR WRITE, PHONE OR CALL FOR DETAILED INFORMATION.

LAFAYETTE ELECTRONICS

Division of Electron Tube Distributors Pty. Ltd.

VICTORIAN SALES CENTRE AND HEAD OFFICE, 15A WELLINGTON STREET, WINDSOR, S.1, VICTORIA 51-6362

LOTRING BRINGS YOU THE INCOMPARABLE PICO 30TS



The 30TS is a precision soldering tool. It has been developed for the modern production line and technician, and proves to be a universal tool for the entire radio, telephony and electronics industry.

This is due to its optimum thermal and physical characteristics.
Here are some of these:— Watts: 30; Weight: 2½ ozs.; Max. tip temp.: 410°C; Heating time: 1.8 mins.

Write or call for illustrated leaflet.

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MATSON

AUTOMOTIVE INDUSTRIES Pty. Ltd.
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NEW IMPROVED 30 WATT

12v. All Transistor P.A. AMPLIFIER

No. 598—Complete Kit of parts to smallest screw. $57. No. 656 — Wired ready to operate, $60. Freight extra. Size: 6in w. x 3in h. x 8¼in d. Weight 6¼lb.

MAGNETIC STEREO PRE-AMP



In 5Mv. out 500Mv. Bass and treble 18 D.B. No. 700C, $29. Wired ready for use, $31. Postage 30c.

COILS & IF's 455 Kc

Aer, R.F. osc. and IF's . .. $1.70 ea.
Ferrite Aer .. . . . $2.
No. 265 Universal Tape OSC coil, $6.
Postage 10c. Write for details and price



STEREO

MULLARD 12 TRANSISTOR

5 watt x 5 watt.
Distortion ½ of 1%. Frequency response 30 cycles to 18Kc. Output 15 ohm speaker.
12in lg. x 7in d x 4in h.

Pre-Amplifier kit No. 616C	$26.00
2—5w Main Amplifiers No. 675C	$34.00
1—5w Power supply No. 681C	$16.00
Steel chassis, plated No. 649	$ 2.50

COMPLETE KITS, nuts, screws, etc. No. 471C $78.50
Wired and tested, No. 471D, extra $5.00. Freight extra. Write for blueprint list of parts.

R.C.S. PRINTED CIRCUITS

For all R. & H., E.A., Mullard, Philips and other designs. Clearly coded. White letters and numbers, easy assembly and service, polished and resined for easy soldering. With blueprint parts list.
SPECIALS: To your drawing under 6in x 6in, $4.

New Printed Circuits

700 Magnetic pre-amp $3
703 Mull. 7W. stereo, $3
704 Pre-amp 67.P2 . $2.50
707 10W stereo, 67. P3 $2.50
708 10W. amp. 67. A3 $2.50
709 Pre-amp 67.P5 $2.50

Recent Designs

Part No.
675 Hi-Fi 5W. amp. $2.50
684 Pre-amp. 65.P10, $2.50
685 Pre-amp. 65-P12A $2.50
686 Pre-amp 65.P12B $2.50
690 Philips 10W. amp $2.50
695 Electronic Flash, $2.50

Write for full list. Immediate despatch. Postage 10c.

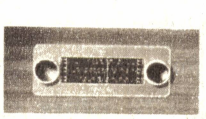


Postage $1.

R.C.S. COMPLETE DO-IT-YOURSELF KITS

Peak reception, low price. No expensive test equipment. Everything fits. 1964 RF Transporta 7. Complete kit—No. 640 . . . . . $43.50
Portable car radio, identical to 640 above, plus extra switch and car coil, etc. No. 642 . . . . . $46.00
(Write for booklet on 640 and 642.)

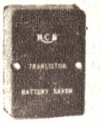
HI-FI BROADCAST TUNER UNIT 4 TRANSISTORS—HI SENSITIVITY



R.F., mixer, I.F., pwr. dectr. stages, adjustable aerial coupling. Kit of parts No. 659C, $24. Wired and aligned 659D, $25.50. Complete as illust., with 461 dial knob and switch pot, No. 474, $31. Postage 40c.

IMPROVED BATTERY SAVER KIT

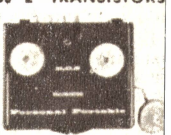
4½, 6 or 9 volts. Replaces transistor battery power input 240 volts A.C. Maximum milliamps 100. Hum-free operation. Size 3½in l. x 2½in w. x 1½in h. No. 657, $6.50 (post 10c).



PERSONAL PORTABLES

Range 30 miles, 200 with short aerial and earth. Earpiece only, no speaker. Wired ready to use, No. 666D, $10.
Postage 20c.
Do-it-yourself kit, No. 666C, $9.00.

2 TRANSISTORS



1 TRANSISTOR—1 DIODE

582 Do-it-yourself kit $5, post. 10c
593 Wired ready to operate, $6, post 10c.

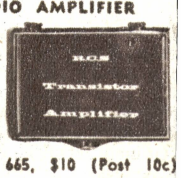
DIAL KITS

Scale gold with white letters. Size 6¾in. x 2¾in. to match.

- No.459 300pf gang, $4.00
- No.461 200pf gang, $4.00

Post 20c.

NEW AUDIO AMPLIFIER



4 transistors, ½ or 1 watt. Small size: cabinet 3" x 2" x 1" plastic. Suitable crystal P./up, intercom., microphone radio, etc. (9 volt)
Do-it-yourself kit 665, $10 (Post 10c)
Wired ready for use, 665D; $11.50.

NEW TRANSISTOR PREAMP KITS

SIZE 3 x 2 x 1in 2 req. for Stereo.
LOW IMP. input 2 trans. 672C $6.5
Wired ready for use, 672D . . . . . $
HIGH IMP. silicon 2 tran. 680C $6.5
Wired ready for use. 680D . . . . . $
HIGH IMP. silicon 3 tran. 682C . . $
Wired ready for use. 682D $9.5
Postage 10c each. Write for data.

R.C.S. *Order by Mail Order, Postal Note or Money Order (add post.), direct to—* **RADIO PTY. LTD., 651 FOREST ROAD, BEXLEY, N.S.W. 58-3491, 58-5385**

NEW SCIENTIFIC-ATLANTA INSTRUMENTS

Amalgamated Wireless (Australasia) Ltd. have announced the availability of two new instruments manufactured by Scientific-Atlanta Inc., of Atlanta, Georgia, U.S.A.

The Remote Differential Preamplifier, model 116, is for high impedance transducers and has a differential or single-ended FET input. The input signal reference, amplifier common and the outer case can be connected together at the front panel to minimise earth current interference.

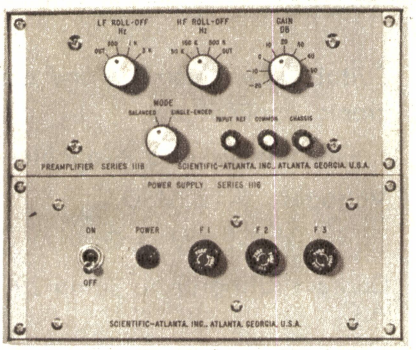
The manufacturers quote the following specifications for the instrument. The gain is from 20dB to 60dB in 10dB steps. The output is 1 volt into 75 ohms and is flat within plus or minus 1dB over a maximum bandwidth of 20Hz to 2MHz. It includes selectable upper and lower cutoff frequency filters with an 18dB per octave attenuation slope. In the differential input mode, the equivalent imput noise is 15uV. The input resistance is 200Mohms.

The instrument is available in rack-mounted or modular construction. The output coaxial cable driver and the optional remote controlled gain and power provide additional installation flexibility.

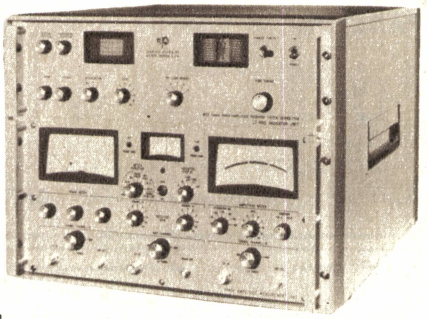
The Wide Range Phase Amplitude Receiving System, series 1750, was developed to provide an accurate, wide dynamic range, lightweight system for measuring the phase between two RF circuits, where one or both are varying in amplitude. The system uses phase locked local oscillators and harmonic mixing.

It is claimed to provide extremely high sensitivity over the frequency range of 2 to 40GHz. Digital and analog phase output are available with 0.01 degrees phase resolution. Meter or recorder output is provided for the amplitude channel over a 60dB dynamic range.

Further information on the instruments can be obtained from Engineering Products Division, Amalgamated Wireless (Australasia) Ltd., 47 York Street, Sydney, N.S.W.



Top: Model 116 Remote Differential Amplifier. Below: Series 1750 Wide Range Phase Amplitude Receiving System.

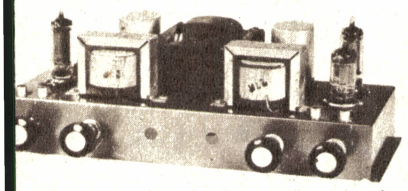


ECONOMY STEREO AMPLIFIER

The amplifier pictured was submitted by Messrs Tudor Radio and is designated TU13. It is one of four "economy" stereo amplifiers available in kit form and comprising chassis, loudspeakers, valves, transformers, controls, knobs, wiring parts, etc. The assortment of components would suggest that some of them at least, came from clearance sources, representing a saving over current stock prices.

One 6BQ5 (or 6HG5) is used in each channel, preceded by ½12AX7's as voltage amplifiers. In addition, an OC71 transistor is used as a microphone pre-amplifier stage. A conventional "top cut" tone control is fitted, together with separate volume controls for each channel.

Inputs are provided for ceramic or crystal pick-up cartridge and dynamic micro-



phone as mentioned above. Tape outlets are provided, fed via 0.1 uF capacitors from the respective speaker outlets, so that the level of these outlets would be dependent on the setting of volume and tone controls.

Connected to a pair of good quality speakers and a typical ceramic cartridge the amplifier gave a pleasant sound at ample room volume. Power output was about 2 watts RMS per channel, somewhat down on that quoted, but this probably refers to the power from the primary, rather than from the secondary of the output transformers.

To summarise: the amplifier is intended as an "economy" amplifier and would probably perform in much the same fashion as the audio system of an ordinary radiogram. As such, it is good value for money at the quoted retail price of $32, complete with 7 x 5in loudspeakers.

Inquiries should be directed to Tudor Radio, 103 Enmore Road, Enmore, N.S.W. (L.D.S.)

IMPROVED STYROSEALS

Ducon Division of Plessey Components has introduced two significant improvements to the range of its Styroseal capacitors. Extremely high reliability has been achieved by the use of specially developed automatic controls during the welding cycle which eliminate the possibility of operator error. In addition, copper leads used by Ducon are now plated by a special process to ensure positive welding of the leads to the aluminium electrode foils.

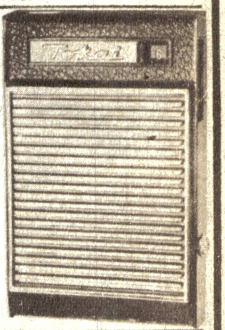
This wire has a uniformity of coating hitherto unobtainable and adds a further bonus of improved solderability which is so necessary for printed wiring applications. In the design of the improved component, Ducon has paid particular attention to transistorised circuitry employing extremely low voltages. The new product is a refinement of Ducon's well known Styroseal type DFB, over 50 million of which have been produced in the last decade.

60 SIMPLE ELECTRONIC PROJECTS YOU CAN BUILD NOW!

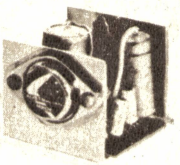
How would you like to make a 2-transistor Radio, an Intercom Unit, a Burglar Alarm, Electronic Thermometer, Stereo Headphone Amplifier, Short Wave Radio, Electric Fence or any one of 60 exciting, easy-to-build projects?
IT'S EASY THE S.E.W. KIT WAY.
• All Kits Transistorised and use special printed Circuit Boards.

NEW RELEASE

6 Transistor Radio Kit, complete. Incl. Instruction manual—$17. Incl. Tax.
Wired and Tested $19.



TRANSISTOR MODULES



Unit 1. 10/20 Amplifier, 10 Watt into 1.5 Ohms 20-20 kc/s 12V supply, $15. Plus Tax, OR 3W to 50W. From $9. Plus Tax.
Unit 13. 10 Watt RMS Continuous. 15 Ohms, 40V Supply, $21. Plus Tax. Also 25W, 35W, 35K, 75W, RMS Amplifiers, 8 Ohms. From $44. Plus Tax. Also 50W Guitar Booster Amplifiers.



Unit 10A TRANSISTORISED. Tuners: Bandwidth 8 Kc/s
With Power Supply $23 plus 25% Tax.
With RF Stage $33 plus 25% Tax.

TAPE RECORDER KITS
Unit 14, TAPE PRE-AMPLIFIER, Unit 15. 60/90 Kc/s Push/Pull Transistorised Bias. Erase Oscillator Module.
Unit 16. Transistor Tape Recording Amplifier Module. Used with Unit 14. 12V Transistorised P.A. Amplifiers from 3W to 50W. From $9.50. Plus Tax.

SPEAKER UNITS
MULLARD
PLAYMASTER AWA
From $27.



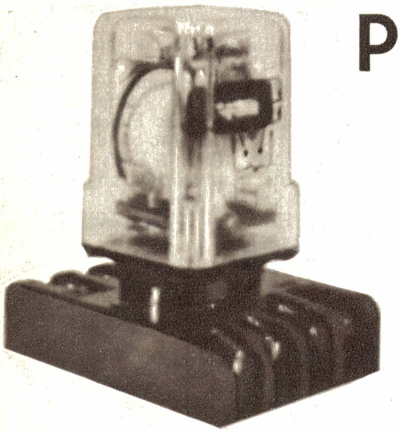


PLAYMASTER No. 106 Stereo Amplifier Tuner
$114.50.

TRANSISTORS AND DIODES AT SPECIAL PRICES, including
BC107, $1; AF114, 95c; AC125, 90c; BC108, 90c; AF1115, 95c; 2N301, $2.50; BC109, $1.30; AF116, 90c; OC74, 95c.
Also Components, Tape, Films, etc.
Send S.A.E. for Details and List.

S. E. WILLIS TRADING CO.
38 RIVERSDALE RD., CAMBERWELL, E.6., VICTORIA. 82-5787.

A Range of Miniature Plug-in Relays



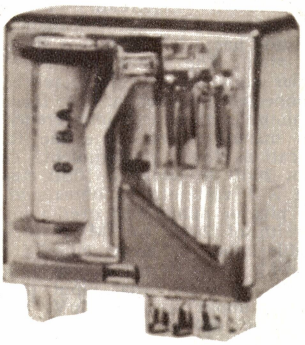
Suitable for electrical and electronic applications.

Open types also available.

Voltages: 6-120V D.C.
6-240V A.C.

Contact rating up to 5amp 240V A.C.

Prices from $3.00 each



ASSOCIATED CONTROLS PTY. LTD.

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Eastern Instrument Services Pty. Ltd.,
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MALVERN S.E.4 Phone. 20-1156.

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Instrument Engineering Pty. Ltd.,
32 and 40 Annerley Road,
WOOLLOONGABBA. Phone 91-5111.

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Box 45,
LOWER MITCHAM. Phone 76-3224.

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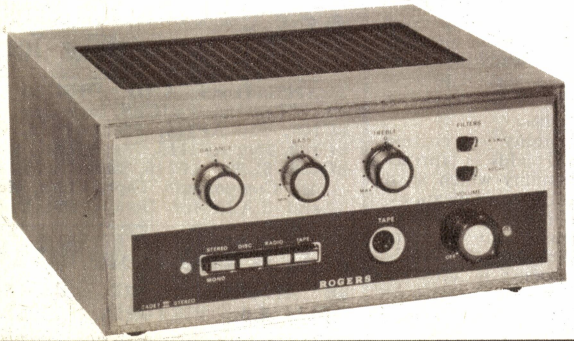
THE ROGERS *CADET Mark Three*

The CADET III offers remarkable value for money, and has become firmly established as the most popular medium-priced stereo amplifier on the British high-fidelity market. It combines versatile performance with attractive styling and permits the assembly of a complete home stereo system at a new low price.

(CHASSIS MODEL)
$136.00

(CASE MODEL)
$150.00

Technical. Power Output: 10+10 watts (sine wave), 12.5 watts (music power).
Harmonic Distortion: 5 watts .25% at 1 kc/s. 10 watts .8% at 1 kc/s.
Output Impedance: 3-5 and 12-16 ohms. Operating voltage: 110-122-220-244 V.
Input Sensitivity: Radio: 100 m/V (470 K). Tape Replay: 600 m/V.
Disc. (Magnetic): 3.8 m/V (68 K); (Crystal/Ceramic): 65 m/V (2 megohms.)
Tape Record Output: 600 m/V. (External load not less than 100 K.).
High Pass Filter: 60 c/s 10 dB per octave. Low Pass Filter: 6.5 kc/s 10 dB per octave.
Cross-talk: 42 dB 1,000 c/s. 26 dB 10,000 c/s. Balance Control: 9 dB range.
Valves: 4 x ECL86. 2 x BY114 (Amplifier). 3 x low noise ECC807 (Control Unit).
Dimensions: 10" x 6½" x 4" (Amplifier). 10¾" x 4¾" x 4½" (Control Unit).
11¼" x 4½" (Front Panel). 11¾" x 11" x 5 1/4" (Case Model).
Weight: 10 lb. (Amplifier); 4lb. (Control Unit); 19 lb. (Case Model).
(Each amplifier supplied complete with comprehensive Installation and Operation Instructions and all necessary connectors).



For further details please contact:—

UNITED RADIO DISTRIBUTORS PTY. LTD.
Shop 32, Ash Street, Angel Arcade.
SYDNEY
Telephones: 28-3718, 28-3926.

D. G. LOCKWOOD & CO. PTY. LTD.
810 Glenferrie Road.,
HAWTHORN. VIC. Telephone 81-6381

TRADE RELEASES—IN BRIEF

TOKYO SHIBAURA ELECTRIC COMANY LTD. (TOSHIBA) of Japan has eblished a new Australian office at Western ouse, 83-89 William Street, Melbourne, ith Mr Toshio Ito as manager. The terriry to be covered from the Melbourne fice consists of the States of Victoria, outh Australia, West Australia and Tasania, also Northern Territory. N.S.W. and ueensland will continue to be covered by e Sydney office, established in 1965.

Mr Ito said the two main reasons for tablishing the Melbourne office were the cent success of Toshiba in gaining a conact to supply two 350MW steam turbine nerators for the new Yallourn Power ation, and the increasing importance of ustralia as a market for heavy electrical uipment and consumer goods. The new fice would co-ordinate with State Elecicity Commission of Victoria staff on the sign and contract administration of the allourn project.

The Sydney office of Toshiba moved cently to new premises located at Goldlds House, 1 Alfred Street, Sydney Cove, dney. Telephone numbers are: 27-1685, -7657, 27-1677 and 27-8037.

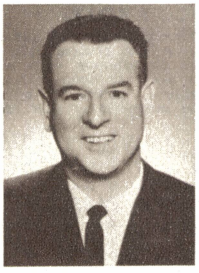
STANDARD TELEPHONES AND ABLES PTY. LTD. and its subsidiaries rned a consolidated net profit of $1.87m r the 12 months ending 31/12/66, showg an increase of $424,788 on the previous ar's result. This represents an earning rate 14.9 per cent on shareholders' funds.

The chairman, Mr G. C. Remington, reorted that export earnings for the year re in excess of $3m, the highest ever corded. STC has traded with 48 countries all parts of the world. Principal export arkets were Spain, Mexico and India. ain and Mexico were entirely new marts for the company, and after the initial les, follow up orders were received.

PLESSEY PACIFIC PTY. LTD. has pointed Mr E. Richardson general manr of Ducon. He was previously with Rola Company, where he had 26 years' rvice, and was secretary/controller before ng appointed general manager in 1965. Plessey has also announced the appointnt of Mr D. R. Brown as general manr of the Rola Division, in succession to



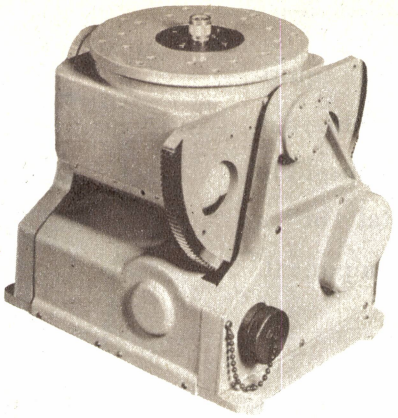
r E. Richardson



Mr D. R. Brown

Richardson. Mr Brown, who was preusly the Rola production manager, has been with the company for 26 years. These appointments follow the resignan of Mr N. C. Stevens, who has left con to take up another appointment. th Mr Richardson and Mr Brown will directly responsible to Mr R. W. R. Wiltre, director of Plessey Components oup.

GENERAL TELEPHONE AND ELECRONICS (AUSTRALIA) PTY. LTD. is w operating as the Australian subsidiary General Telephone and Electronics Inrnational, of New York, after purchasing me of the assets of its former agents, utomatic Electric Telephones, Pty. Ltd. General Telephone and Electronics Corration, known as Gentel. is the second rgest private telephone operating company



A new small (one cubic foot) Azimuth-over-Elevation Positioner, model 5301, for model aerial experiments is available from A.W.A. Engineering Products Division, 47 York Street, Sydney. It is claimed to be able to support a load of 50 pounds with a bending moment of 75ft lb. Synchros of 1:1 and 36:1 ratios are installed in each axis. Optional accessories include azimuth limit switch and coaxial rotary joint.

in the world, ranking only after Bell Telephone. A subsidiary, Sylvania Electric Products, is one of the world's biggest manufacturers of fluorescent and incandescent lamps and a major manufacturer of electronic and telecommunications equipment.

The managing director of the newly formed General Telephone and Electronics (Australasia) Pty. Ltd. (Mr Jim Thomson) said today that his company would gradually become more active in two main fields in Australia — telecommunications and electrical consumer products.

In telecommunications the company would be interested in supplying equipment under long term contracts to customers such as the Post Office, Electricity Commission, gas companies and similar authorities and corporations, Mr Thomson said.

The world wide Gentel group has assets of about $US4,000 million and in the U.S.A. is ninth among the top industrial corporations. Gentel has over 65 manufacturing plants throughout the world, 45 in the U.S.A. and the rest in different parts of the world. Altogether the Corporation has around 140,000 employees.

EMERSON AND CUMING, INC., of U.S.A., has sent details of the following new products.

Eccosorb LF. This rigid flat sheet material extends the range of Eccosorb termination materials into the UHF range. Terminations made of Eccosorb LF are useful down to at least 300MHz. The material is available in 12 x 12in sheets with nominal thicknesses of 5/8 and 3/8in. The material is made from special ceramic tiles laid in a high temperature resin, both of which exhibit high values of magnetic loss factor in the UHF range.

Eccoshield SV-R. This is an addition to the family of conductive sheet materials offered by the company. Based on silicone rubber, it has flexibility and elasticity together with conductivity approaching that of many metals. It can be die cut into gaskets, to provide RF and hermetic seals; it can be bonded to metals with Eccoshield VCA. Volume restivity increases as the material is stretched. Insertion loss as high as 100dB is achievable.

Eccofoam SH. This is said to be unique in the world of urethane foams, in that it is supplied as sheet stocks in seven different

UNITED TRADE SALES

PTY. LTD.

MILLER IF STRIPS
455 Kc at 6DB
Centre Frequency 455 Kc plus or minus 2 Kc.
Transistorised, **$8.70** each.

AUDIOCRAFT SPEAKER
Enclosures filled with two Rola 8 CMX Speakers, 20 x 13 x 7,
$38 each.

L.S.G.11 SIGNAL GENERATORS.
120 Kc to 350 Mc. **$30** each.

WIRE WOUND POTENTIOMETERS.
Wide range available from 5 ohms to 100 K. ohms. **40c** each.

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Carbon ½ and 1 watt **$2** per 100.

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Assorted values Mica and Ceramic, 80 for **$2.**

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Model K142.
Ranges 1.5v—5v—15v—50c—150v—500v—1,500v AC and DC. Resistance Rx 1 x 10 x 100 x 1K x 10K x 100K x 1 meg. **$56.25.**

VALVES. 6AL5. 20c.
6AC7, 12 for **$2.** 6J6, **50c.** 815, **$1.** 6AM5, **50c.** 7C7, **10c.** 6C4, **50c.** 6FQ5, **50c.** TZ40, **$1.25.**

SPECIAL.
416B Planar Triodes Hot front end tubes, excellent on 432 Mc, only **$4.**

VARIACS.
115v, 18A, **$18** each or **$32** pair.

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Eico 753 55B Transceiver Triband solid state VFO, 180 watts. P.EP all modes. Kit **$328.78** inc. tax.

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UR70 72ohm
Coax. Cable. 27yd Length w/- Belling-Lee Connecter on end.
$2.00 length plus **75c postage.**

PERSPEX SHEETS
16 x 4 x 1/8. Optical.
30 cents per sheet.

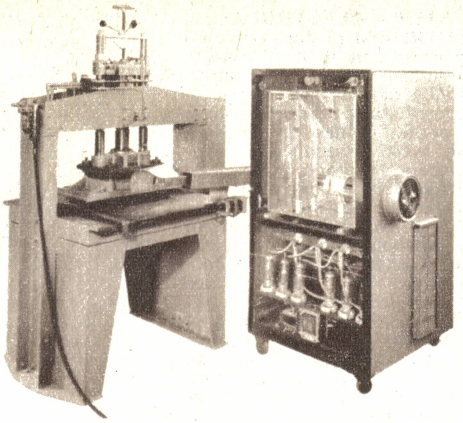
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We are specialists in close tolerance work for the communications industry in light engineering, sheetmetal, timber or plastics. If your problem involves one or more of these fields, it will pay you to see us— **WE COULD HAVE THE ANSWER.**

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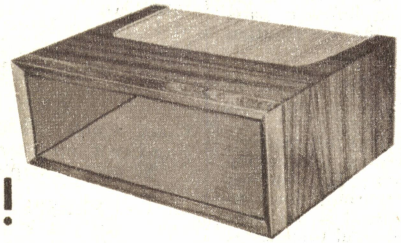
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We can supply the **complete kit** for the 115, including metal case, and all best quality components precisely to "Electronics Australia" specifications.

CRYSTAL/CER'VERSION KIT OF PARTS	$95.00
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EXTRA FOR MAGNETIC SECTION KIT OF PARTS	$10.50
BUILT and TESTED	$12.00

Instrol components are all best quality throughout, and made accurately to the specifications laid down by "Electronics Australia."

INSTROL PRINTED CIRCUIT BOARDS.

To make component assembly easy, Instrol pre-fluxed printed circuit boards are clearly printed on the reverse side with a coded component location map. This corresponds with a separate component code sheet. No guesswork, every component must fall correctly into place. For the crystal/ceramic version 3 boards are required (2 amplifiers, 1 pre-amp). The magnetic version requires one additional magnetic pre-amp board.

PRICE: Crystal Pre-Amp .. $2.00 (plus postage 10c).
Main Amplifier, each .. $1.60 (plus postage 10c)
Magnetic Pre-Amp .. $1.60 (plus postage 10c).
Set of 4 .. $6.80 Post Free.

INSTROL METALWORK AND LABELS

The complete set of Metalwork comprises chassis with sub chassis and 2 brackets (cadmium plated and passivated) plus front panel and case (oven backed hammer tone beige-duco) Labels are high quality anodised, either gold with black lettering or simulated white with brown lettering.

PRICE: Chassis, sub chassis, 2 brackets and front panel (Less case) .. $9.19 (Postage Extra $1.00)
Case only .. $3.71 (Postage Extra 75c)
Complete set .. $12.90 (Postage Extra $1.40)
LABELS .. $2.00 (Postage Extra 10c

KNOBS

Same as used on original, the set comprises 2 large and 4 small knobs.

PRICE: Set of 6 .. $1.28 (Plus 20c Postage)

TIMBER CABINETS

We have produced a beautiful timber case for the 115, similar to that used on the most expensive imported amplifiers. Available in Teak, Walnut and Maple Veneers.

PRICE: Teak .. $17.50 (Plus 50c Postage)
Walnut and Maple .. $16.50 (Plus 50c Postage)

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E.S. & A. BANK BUILDING, CNR. BROADWAY & CITY RD., SYDNEY
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nsities, ranging from 2lb/cu. ft. to 14lb/ ft. It is supplied in sheets 24 x 12in, and cknesses up to 4in. It is intended inly for such applications as dielectric ndows, support pieces and matching sec- ns. Because electrical loss is extremely v, and dielectric constant is also low, can be used in transmission lines and in ial structures with a minimum effect on tem performance.

Details are available from the company's stralian agents, Wm. J. McLellan and . Pty. Ltd., The Crescent, Kingsgrove, S.W.

OANAR ELECTRONICS PTY. LTD. ise that the phone number of its prem- at 15 Conder Street, Burwood, N.S.W., been changed to 747-4772.

YE INDUSTRIES LTD. has announced appointment of The Honorable Sir ward Beale, K.B.E., Q.C., as chairman directors. Sir Howard has just returned m a visit to the U.S.A., where he was ting Professor in Law and Business ministration at Marquette University, Mil- ukee for one month.

member of Federal Parliament from 6-1958, Sir Howard has extensive experi- e of several important portfolios, includ- Immigration, National Development, and Defence. He became Minister for ormation and Transport in 1949. In 0, he was appointed Minister for Supply retained this portfolio until he resigned m Parliament in 1958 to become Aus- ian Ambassador to Washington.

/ARIAN ASSOCIATES, 611 Hansen y, Palo Alto, California, U.S.A., has warded details of the following new ns:

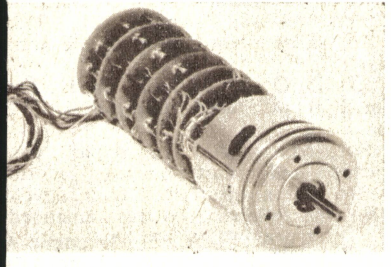
eries G-1000 of 5in strip chart recorders use with laboratory and process control rumentation.

-4000 4in magnet system (air cooled) Hall Effect and susceptibility studies, ic EPR and NMR studies, classroom nonstrations and undergraduate labora- experiments.

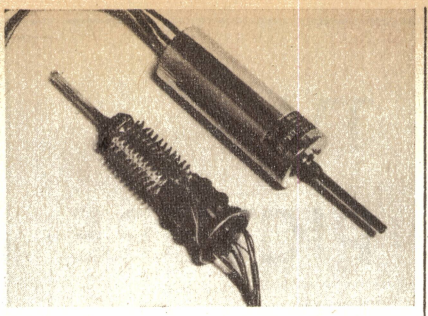
TA-9-30-40-50 high level, solid state post plifier, which offers broad band width high power output (1.5W minimum ut at 1dB compression with centre fre- ncy of 30 MHz and band width at 1dB nts of 40MHz).

I-221 bench top high vacuum system production evaporation work, material ing, laboratory demonstrations, space ulation studies lasting 10,000 hours and ous high vacuum experiments. The sys- offers base pressures below 5 x 109 r.

-229 goniometer, which permits owners Varian 9.5GHz spectrometers to make R measurements in anisotropic crystal ems by providing accurate rotation of ples. Features include 360 degree rota-



Size 18 Contact Encoder incorp- rating the noise-free M. R. Scan rinciple of operation is now in full roduction by Moore Reed and Co. td. Simple electronic circuits built nto the body of the encoder enable he manufacturers to guarantee wenty million shaft revolutions in ure binary with complete absence f noise spikes or miscounts. The ncoder will be distributed in Aus- alia by Astronic Imports of 622- 26 Nicholson Street, North Fitzroy, Victoria.



These Digishift decimal switches, when inserted between the decimal output of a Digikit scale and a digital display, enable the operator to reset the displayed figures individually to any desired reading without upsetting the carry-over conditions from one figure to the next. These switches are being distributed in Australia by Astronic Imports, 622-626 Nicholson Street, North Fitzroy, Victoria.

tion, a vernier with ½ degree increments, vernier magnifying lens and mounting alignment chuck.

VA-311 Ku-band reflex klystrons, for use as local oscillators or low power sources. They deliver 20mW into a matched load over their entire 750MHz mechanical tuning range. Models are available for any specified frequency between 15 and 22GHz.

Inquiries should be addressed to the Australian company, Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W.

FERRIS BROS. PTY. LTD. has introduced a car stereo tape player. Model CTP45. Announcing this, the company says the CTP45 is a precision built tape cartridge unit designed to operate in any car, motor coach, truck or boat which is equipped with a 12V electrical system. It uses solid state circuitry (12 transistors) and average total current requirement is 0.8A. The units are made for either positive or negative earth systems. Tape cartridges can be removed or inserted only when the unit is switched off, thus ensuring protection for the tape.

Features of the design are: capstan drive; four-track, two channel playback system; tape speed, 3¾ips: wow and flutter less than 0.3 per cent WRMS; output power, 2.5W per channel; frequency response, 100-7000 Hz; total harmonic distortion, better than 3 per cent at 1KHz at rated output power; separation (cross talk), better than 45dB; signal to noise ratio, better than 40dB; dimensions, 7 x 7 x 2in; weight 6lb 20z.

Retail price of the Ferris car stereo tape player, with two speakers, is $129.90; or without speakers, $115.75. Trade inquiries may be addressed to the company's head office at 752 Pittwater Road, Brookvale, N.S.W., or branch offices in each State.

MELLONICS SYSTEMS DEVELOPMENT DIVISION of Litton Industries has opened a new systems analysis design, engineering, and programming headquarters whose express purpose is to cope with the needs of government and industry clients, including those located overseas. The Australian office of Mellonics is the Litton representatives, David Charles Associates, 15th Floor, Castlereagh Street, Sydney.

Mellonics has been widely known as a supplier of computer software to government agencies and military programs, but more recently has extended its activities in the commercial field. The Mellonics personnel are conversant with virtually all commonly available computers. In more than 3,000 sq. ft of floor space at the Mellonics headquarters the new data centre has two digital computer systems plus remote data link and other peripheral equipment and a further digital computer is to be installed later.

TAPE RECORDER CLEARANCE

SOILED AND DEMONSTRATION MODELS TO CLEAR

Genuine reductions — all models must be cleared many below cost

SONY TC123 MONO.
£28/10/ reduced to **£20**

SONY TC900
Battery/Electric portable.
£51/9/ reduced to **£40**

SONY TC600
High impedance output Stereo.
£256/4/ reduced to **£135**

SONY TC580A
Stereo 4-track 2-speed,
£214/4/ reduced to **£155**

STANDARD SRF217
Capstan drive portable,
£30/9/, reduced to **£15**

NATIONAL RQ151
Battery/AC with adaptor extra, 2-speed, capstan drive, 5in reels, £61/19/, reduced to **£49.10**

NATIONAL RQ150
Battery portable, 2-speed, 2-track, 5in reels, capstan drive. Automatic voice operated stop, start.
£82/19/, reduced to **£49.10**

GRUNDIG TK6
Battery/AC portable.
£149, reduced to **£81**

AKAI 910
2-speed, professional mono,
£101/18/6 reduced to **£79.10**

AKAI 707
2-speed, professional mono.
£143/8/9 reduced to **£99.10**

PAROS 750
3-speed, 4-track, stereo with extension speakers,
£156 reduced to **£99.10**

PAROS 707
3-speed, 4-track stereo with extension speakers.
£144/10/ reduced to **£119.10**

PAROS 310
2-speed, 4-track stereo.
£94/10/ reduced to **£85**

PHILIPS EL3552
"Continental S2" with automatic modulation control, means you cannot make a mistake.
£49/19/6 reduced to **£42.10**

PHILIPS EL3547
2-speed, 4-track, stereo.
£128/2/ reduced to **£95**

PHILIPS EL3534
4-track, 4-speed, stereo.
£236/5/ reduced to **£185**

PHILIPS EL3549
4-speed, 4-track, mono with parallel playback.
£164/19/ reduced to **£85**

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All sizes, except bonded available.
Lowest prices in Sydney. 2nd quality new tubes from $8 plus good dud.

5" Magnetic Test Tube for **$8.00**

FULL WARRANTY:
Any tube returned to Sure Brite under warranty is replaced with another one at no extra charge, regardless of whether it tests good or not, so long as it is not broken.

COUNTRY CUSTOMERS
Rail tubes to Lewisham Station. Passenger Rail freight paid. Orders filled same day received. All freight charges to be paid by customer.

LARGE STOCK
We always have all types in stock 70°, 90° and 110°. When ordering state which type tube you want.

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New tubes and bonded tubes available at lower than usual new cost.

Duds with broken necks are acceptable on new tubes.

WE BUY DUDS.

Sure Brite Picture Tubes

22a VICTORIA ST., LEWISHAM, N.S.W.

MAGNETIC RECORDIN(

(Continued from page 15)

issued by Ampex summarises the are under investigation and describes an i teresting form of micro-memory:

"In today's recording processes a computer memory elements, 'smallnes as a practical goal, means minimu elements with critical dimensions in t order of a few thousandths of an inc The possibility of using completely d ferent techniques to reduce this eleme size by several orders of magnitude h recently been suggested.

"A simple technique of storing info mation as well as reading it out with electron microscope has been tried und laboratory conditions. The basic idea such a tiny record is in itself m fascinating. The electron microscope h a resolving power in the order of 2 Angstrom units (one Angstrom equ 10^{-8} of a micro-inch.) The importance being able to look at information pac ed as densely as this is that the millio of data contained on a piece of ta some inches wide and thousands of f long could be fitted into an area of l than one square inch."

The ultimate memory—if capacity, a cess time and size are all considered— the human brain. It would take a lar room full of today's magnetic memor or several cubic feet of micro-memories just described to equ the brain in capacity alone . . . a hopes for equalling its access time a dim, indeed! Yet it may be that ma netic recording, now intensively used the study of how the brain wor will help reveal the secrets which enal man to approach duplication of a f of the activities of his own mind.

REFERENCES

READOUT, April-May, 1961. Cov the growth of medical instrumentati and the use of magnetic tape in neu physiology, electrocardiography, car vascular studies, sensory function a central nervous systems studies, a psycho-physiology.

Athey, S., "The Continuing Sear for Advanced Memory Technique **READOUT Special Report,** Septemb 18, 1959.

LEE de FOREST, "The Audion-D tector and Amplifier, **Electrician,** V 72, pp 285-288, November 21, 1913.

For an excellent history of the phon graph see:

READ, O and WELCH, W. L., **Fro Tin Foil to Stereo,** Bobbs-Merrill C Inc.

For comparisons of metal, pap backed and plastic-backed recordi media and a history of their develo ment, the following are recommended

1. STEWART, W. E., **Magnetic R cording Techniques,** Chap. 2, pp 41-6 McGraw-Hill Book Co. Inc.

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3. TALL J., **Techniques of Magne Recording,** Chap. 3, pp 29-43. T MacMillan Co.

Camras M., "A New Magnetic W Recorder," **Radio News,** Vol. 30. 3-5, 38-39. November, 1943.

For contemporary comments on t Blattnerphone see:

"Blattnerphone," **Wireless World,** 8-10, Vol. 34, January 5, 1934.

AMATEUR BAND NEWS AND NOTES

Should Region III Have Sub-Zones?

Of the three regions of the world as defined by the International Telecommunication Union only in Region I is there a well-established organisation of International Amateur Radio Union member societies.

By Pierce Healy, VK2APQ*

From time to time the need has been tressed for the amateur radio societies in Region III, as defined by the International Telecommunication Union, to consolidate heir aims and efforts in order to maintain, n an international level, the status of the mateur service similar to the activities in Region I.

Arising from discussion on the subject, has been suggested that the geographical nake-up of Region III does not lend itself o a close liaison between societies as does Region I. The thought has been expressed hat it may be more workable if Region III vere divided into sub-zones of say, Oceania-outh-East Asia and Japan-Asia.

Whatever the final result may be in the ndeavour to form a Region III Division f the International Amateur Radio Union, is essential that the interest of the mateur service be safeguarded both by ndividual amateurs and by the various ocieties within the region.

This can be done by bringing to the orefront the services and benefits that an ctive amateur radio body within a com-unity can offer, particularly in the fast eveloping or isolated areas of the world.

Through the courtesy of Roy Stevens, 2BVN (vice-president) and John Clarri-oats, G6CL (secretary) of the Region I ivision, copies of the Region I and adio Society of Great Britain bulletins re being received. This will enable up-to-ate and authentic news of the activities n Region I to be included in these notes.

The International Amateur Radio Union, egion I Division, was formed in 1950 promote the special interests of member ocieties in the International Telecommuni-ation Union Region I (Europe, Africa and arts of Asia) and to represent their inter-sts at I.T.U. Radio conferences.

The subscribing member societies in A.R.U. Region I Division are:—

.R.I.	Italy
.R.C.C.	Czechoslovakia
.A.R.S.	Ghana
R.T.S	Ireland
.A.R.S.	Nigeria
.R.R.L.	Norway
.Z.K.	Poland
.A.A.G.	Greece
.E.F.	France
.E.P.	Portugal
.L.	Luxembourg
.S.F.	Soviet Union
.S.G.B.	United Kingdom
.S.S.R.	Rhodesia
R.A.L.	Finland
R.J.	Yugoslavia
.S.A.	Sweden
.B.A.	Belgium
.R.E.	Spain
.S.K.A.	Switzerland
.E.R.O.N.	The Netherlands

News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W.

The members of the Region I executive committee are:

Chairman: Lt.-Col. Per-Anders Kinnman, SM5ZD.

Vice-Chairman: R. F. Stevens, G2BVN.

Secretary: John Clarricoats, O.B.E., G6CL.

Treasurer: W. J. L. Dalmijn, PA0DD.

Members: Herbert Picolin, DL3NE; Janez Znidarsic, YU1AA.

A quarterly bulletin, under the editorship of John Clarricoats, G6CL, is produced and circulated to Region I member societies. The January, 1967, issue just received 32 foolscap pages, contains a number of articles of general interest to all amateurs as well as the domestic activities within Region I. A precis of some of the articles is given and the source of the information acknowledged.

ANNUAL REPORT REGION I DIVISION.

The Executive Committee of the Region 1 Division, in the Annual Report for the year ended December 31, 1966, covered many activities and facets of amateur radio as applying to conditions in Europe.

The membership of the Division now consists of 23 subscribing member societies. During the year invitations were extended to, and accepted by, the Nigerian Amateur Radio Society and the Central Radio Club of Czechoslovakia.

Several additional societies in the area covered by I.T.U. Region I have become members of the International Amateur Radio Union and invitations have been extended to them to join the Region 1 Division. The societies concerned were, Amateurs Radios Algerians (A.R.A.), Cyprus Amateur Radio Society (C.A.R.S.), Liberian Radio Amateur Association (L.R.A.A.), Radio Society of East Africa (R.S.E.A.), Malta Amateur Radio Society (M.A.R.S.) and Faroes Radio Amateurs (F.R.A.).

The outstanding event of the year 1966 was the triennial conference held at Hotel Kvarner, Opatija, on the Adriatic Coast of Yugoslavia from May 23 to May 28. The conference was supported by 16 of the, then, 22 subscribing member societies.

The societies who sent delegates were: O.E.V.S.V. (Austria), U.B.A. (Belgium), S.R.A.L. (Finland), R.E.F. (France), D.A.R.C. (Germany), I.R.T.S (Ireland), A.R.I. (Italy), V.E.R.O.N. (Netherlands), N.A.R.S. (Nigeria), N.R.R.L. (Norway), P.Z.K. (Poland) R.S.F. (Soviet Union), S.S.A. (Sweden), U.S.K.A. (Switzerland), R.S.G.B. (United Kingdom) and S.R.J. (Yugoslavia).

Also in attendance as observers were the President of the I.A.R.U./A.R.R.L., Robert Denniston, W0NWX, the General Manager of the A.R.R.L. and secretary of I.A.R.U., John Huntoon, W1LVQ and the Honorary Treasurer of the I.A.R.U. Region II Division and Canadian Director of the A.R.R.L., Noel Eaton, VE3CJ. The Central Radio Club of Czechoslovakia was represented by its President Milos Svitak, OK1PC.

The Conference was attended by 60 delegates and about 12 observers. The opening ceremony was conducted by Slobobodan Nakicenovic, YU1A, President of S.R.J. the Yugoslavia radio society.

It was decided that contributions made by subscribing member societies shall, in future, be based on membership figures as at January 1 each year, commencing January 1, 1967. Contributions for the period 1967-1969 shall be on the basis of 75 Swiss centimes (approx. 19c Australian) per licensed member.

Arising from discussions by the VHF working group at a meeting held in Brussels during the latter part of 1965, further steps were taken during 1966 to finalise the program of a European Oscar-type satellite. The fundamental design of this had been done by Karl Meinzer, DJ4ZC.

The sum of 500 Swiss Francs was granted for the project from Region 1 funds and appeals for financial support were answered by the D.A.R.C., R.S.G.B., U.S.K.A. and V.E.R.O.N. societies, as well as donations from numerous individual amateurs. The OSCAR Association has offered to arrange for the satellite to be launched from the United States.

At the Opatija Conference it was agreed to make available 2000 Swiss Francs annually for the period 1967-1969 to permit the construction of at least one Region I OSCAR-type satellite each year.

The report concluded with this observation:— "The year ahead augurs well for the Amateur Radio movement. Interest is increasing in many countries and there are clear signs that the first steps are being taken in some of the new developing countries to establish national organisations.

"A more liberal licensing policy seems to be operating generally throughout Europe but unfortunately this does not yet apply to many countries in Africa and Asia. The committee is hopeful that before long the national societies in Bulgaria, Hungary, Rumania and Turkey will decide to join the I.A.R.U., thereby bringing closer the day when all national societies in Europe and the Middle East are members of Region I Division."

OPATIJA CONFERENCE.

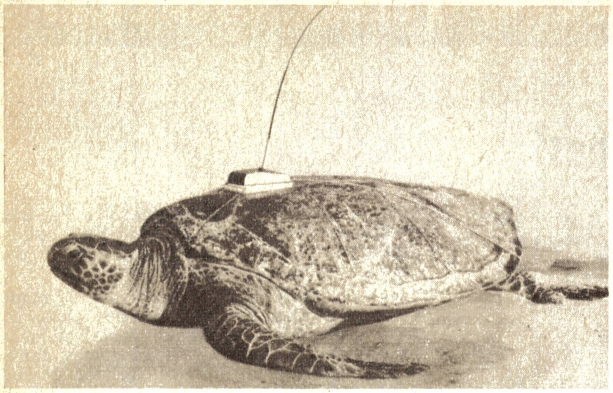
Some of the recommendations adopted at the Opatija Conference were: Societies agreed to examine their membership records to ascertain if they have any members who, because of their professional backgrounds, may be suitable persons to represent amateur radio at future I.T.U. Conferences.

The conference agreed that a booklet should be prepared for use by Region I Societies setting-out the policies of and information about the amateur radio movement as well as giving reasons for the continuance and expansion of the movement.

Societies agreed to communicate lists of intruders into exclusive amateur bands to other national societies in Region I. Where it was reported that commercial stations were intruding, the national societies of the countries concerned would take the matter up with their respective administrations.

The conference agreed that societies in those countries affected by the decision not to accept QSL cards at commercial paper rate, should ensure that their postal authorities (i) immediately ask the International Bureau of the Universal Postal Union for an interpretation of Article 128 of the Vienna Convention 1965, insofar as QSL cards are concerned. (ii) support

ELECTRONICS ARE GOING PLACES



A radio-equipped turtle is tracked by orbiting satellites to check its migratory voyages in the Atlantic Ocean. One of the million incredible uses of electronics for commerce and industry.

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BE HIGHLY PAID IN THE WORK YOU LIKE MOST. You already have the interest you need to be successful in electronics—you can get the training you need through International Correspondence Schools. You can train for your career in electronics at night, in your own time, with the help of a School of Electronics as close as your mail box.

ACT NOW! Fill in the coupon below and send it to I.C.S.—we will send you by return mail our Free Book "Your Career in Electronics." You could be earning more money, doing the work that you like, sooner than you think.

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vourable interpretation of Article 128 hen this matter is raised at the meeting the U.P.U. during 1967.

The conference, having regard to the clash the dates of several contests that now ke place, agreed that societies shall sub- it to the committee (Region I division) advance a full list of international con- sts, showing proposed dates, frequencies d other essential information.

Societies also agreed to advise the Execu- e Committee (Region I division) before mmunicating proposals for alterations to isting amateur bands to their national ensing authorities.

SKOPJE CONFERENCE

More than 200 delegates from 25 coun- es and many different organisations at- nded an international conference in opje, Yugoslavia, from October 25-30, 66, to discuss natural disaster protection oblems and methods of providing assis- nce after a disaster has occurred.

More than 100 reports dealing with ganisation, protection, technical and sani- y questions were presented by represen- ives who had analysed the experiences ined from past disasters such as earth- akes, floods, land-slides and the like.

As the conference was held in Skopje, ne of a devastating earthquake three rs ago, many who had participated in cue work on that occasion were able contribute personal accounts of their ex- iences — both positive and negative.

The conference was opened by United tions representative Mr Sen Sudhir, who phasised that its chief purpose was to cuss methods for co-ordinating activity ned at protecting the civil population from consequences of natural disasters, which cur nearly every day somewhere in the rld.

The conference operated through plenary etings and three committees which dealt h general, sanitary and technical ques- ns. Conclusive recommendations adopted the committees were submitted to the nary meeting for approval.

Basically the conference recommended t the authorised organisations of each ntry shall prepare plans to meet disasters sing from the elements of earthquake, or flood, and to organise a uniform ordinating body which will set the plan motion as soon as a disaster occurs.

The plan would embrace all appropriate te, social, charitable and voluntary or- nisations able to help in an emergency.

t was also recommended to establish tres in each country where first aid mat- al could be stored ready for immediate in a disaster.

The Yugoslav Amateur Radio Society R.J.) was represented at the conference its Secretary, Mr Ferid Suman, YU1AF. organisers were aware that radio ama- rs had proved very effective in making first contacts by radio on the occasion the Skopje disaster, as well as at other es when natural disasters in Yugoslavia, h as serious flooding in Zagreb, had dis- ted communications.

Ferid Suman submitted a paper to the ference in which he related the experi- es of radio amateurs in the field of ster relief. The paper outlined the pos- lities of radio amateurs being included communication plans prepared to deal h future disasters brought about by elements.

The paper gave information about the ngth of the amateur radio movement ughout the world and referred to the e links which already exist between the Cross and national amateur radio ieties.

After the presentation of the paper, which very well received by the conference, Charles Amman, representing the In- national Red Cross Committee, spoke ut the humanitarian actions of radio teurs; and of the amateur radio emer- cy networks which operate in conjunc- with the Red Cross in many countries. He publicly thanked the amateurs of Yugoslavia for their co-operation and help in maintaining permanent radio communication between Red Cross headquarters in Belgrade and the International Red Cross Committee in Geneva.

Local networks, he said, had been very useful on many occasions and would, he believed, continue to be helpful in the future regardless of developments in normal radio communications.

The presence at and participation in the Skopje Conference of a representative of the S.R.J. greatly helped delegates to understand the purpose and objects of the amateur radio movement and was, incidentally, not without value as a further example of how the work of radio amateurs may be publicised internationally.

VHF IN IRELAND

During a spell of good conditions in August and September, 1966, Shane McNamee, E12A, succeeded in achieving "firsts" on 144MHz between Ireland and Czechoslovakia on August 12th with OK2WCG by meteor scatter; with SM6PU in Sweden on September 3rd, also by means of meteor scatter; and on September 26th he contacted HB9QQ in Switzerland by means of tropospheric propagation.

In addition E12A has worked 101 stations in the United Kingdom and Ireland including GC31T/P at Alderney, Channel Islands.

WRITTEN LONG AGO

Under the above heading a note of interest relating to early experiments between Australia and England appeared in the March issue of the R.S.G.B. Bulletin.

"At 6.50 on the memorable night of November 13, 1924, I heard 3BQ's call-sign from Australia and for the first time in history two-way wireless communication was established between Britain and that country.

"I am now endeavouring to explore the possibilities of low power communication on a wavelength of 20 metres. This is an entirely new field of research and although we are experiencing considerable difficulty in obtaining permission from the Post Office I think it will be safe enough to go ahead in a few weeks time.

"My belief is that on a wavelength of 20

VHF RECORDS OF NEW ZEALAND ASSOCIATION

VHF records given in the March issue of "Break-in" (the official journal of the New Zealand Association of Radio Transmitters) are:

Band	Stations	Date	Distance
50MHz	ZL1DE-KP4ACH	18/4/58	8800 miles
144MHz	ZL2HP-VK5BC	23/12/65	1985 miles
420MHz	ZL1BFA-ZL2TFJ	22/1/67	240 miles
2400MHz	ZL4BP/4-ZL4DH/4	8/12/48	2 miles
10000MHz	ZL1ADE/1-ZL1AZR/1	?/2/65	29 miles

The Annual Convention of the N.Z.A.R.T. is set down for the weekend June 3rd-4th inclusive, the location Hawkes Bay. (It is regretted that the details of the convention were not received in time for publication prior to the event.)

In a letter to "Break-in," Bill Honor, ZL2AWW, stresses the need for a Youth Radio Scheme in New Zealand and suggests that an elementary theory course should be available, to be supplemented by a two-hour class in theory and practical work every fortnight at branch level. At the end of 12 months, a simple test could be held and a certificate issued to those who passed.

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B7G, HC18U, ETC.
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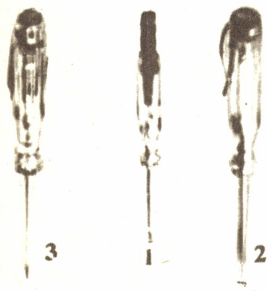
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30,000 Ohms per Volt D.C.

13,000 Ohms per Volt A.C.

1 p.c. Multipliers and Shunts used. Printed circuit.

Clear Scale, rugged moulded case.

SPECIFICATIONS

DC Voltages: 0-0.3-1.2-3-12-30-120-300-600-1,200 V at 30,000 Ohms per volt.

AC Voltages: 0-3-12-30-120-300-600-1,200 V at 13,000 Ohms per volt.

DC Current: 0-.06-6-60-600 mA, 0-12 A.

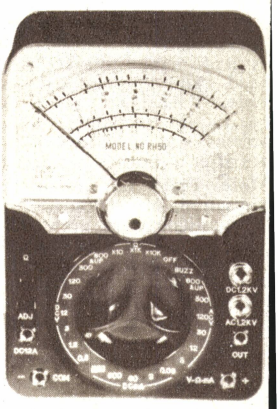
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).

Decibels: minus 20 to plus 57 dB (0 dB equals 1 mW, 600 ohms).

Audio Out: Capacitor in series with AC volt ranges.

Short Test: Internal buzzer.

Accessory: 1 pr. heavy test leads.



Price $31 (£15/10/)

with leather case, $38.0

Postage 50c to $1 extra.

Batteries: 1 (1.5V), 1 (15V)

Size: 3 5-16" x 6 5-16" x 2

Weight: 1.4lb approx.

NEW MODEL A-10 MULTIMETER AND SIGNAL INJECTOR

With Test Leads and Injector Probe



30,000 o.p.v.

SPECIFICATIONS: 6in x 2½in scale.

DC Voltage: 0-0.5, 2.5, 10, 50, 250, 500, 1,000V at 30,000 o.p.v. 5,000 and 25,000 V at 10,000 o.p.v.

AC Voltage: 0-2.5, 10, 50, 250, 500, 1,000 V at 10,000 o.p.v.

Volume Level in Decibels.

DC Current: 0-50 uA, 1, 50, 250 mA, 0-1 and 10 amps.

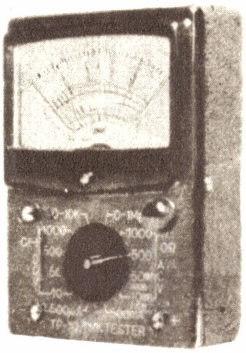
AC Current: 0-1, and 10 amps.

Resistance: 0-10K, 100K, 1M, 100 Megohms. Signal Injector Output Jack. Zenor Diode Overload Protection.

Price $60.00

LIMITED STOCK ONLY

Model RH-10



RANGES:

DC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

AC Voltages: 0-10-50-500-1,000 V at 2,000 Ohms V.

DC Current: 0-500uA 0-500 mA.

Resistance: 0-10K-1Meg: 60 ohms, 6K ohms at centre scale.

Capacitance: 250uuF to 1uF, in two ranges.

Decibels:—20 to plus 36db, two ranges.

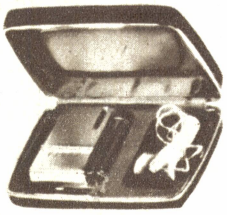
Output: 0-1,000 V in four ranges.

Size: 5in x 3¼in x 1¼in.

Weight: 13oz approx.

Price $10.75 (£5/7/6)

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New Model $31.50

Replacement Battery only 12c.

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Model RH-5

- High sensitivity-20,000 Ohms/V DC, 10,000 Ohms/V AC.
- 3in Meter.
- Handy pocketable size.

SPECIFICATIONS

DC Voltages: 0-10-50-250-500-1000 V (20,000 Ohms/V).

AC Voltages: 0-10-15-250-500-1000 V (10,000 Ohms/V).

DC Current: 0-50uA, 0-5-50-500mA.

Resistance: 0-10K, 0-100K, 0-1Meg, 0-10 Meg. (62 Ohms, 620 Ohms, 6.2K, 62K at centre scale).

Capacitance: 0.0001uF-0.005uF, 0.05uF-1uF.

Decibels: minus 20db to plus 36db in 2 ranges.

Dimensions: (3½in x 5¼in x 1¾in).

Weight: 15oz approx.

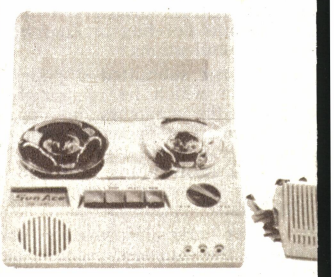


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res we shall be able to maintain two-
communication with Australia and New
land at any hour of the day or night
not be limited to the periods of dawn
twilight as we are at present."

hat statement was made by Ernest J.
monds, G2PD, in an interview with a
resentative of "The Sun" of Sydney,
stralia, on 19th March, 1925. (G2PD
the first British amateur to work Aus-
ia and Canada on telegraphy and the
to work Australia on telephony.)

ITALIAN EMERGENCY

he world news services gave graphic
ails of the greatest flood in its history
struck Italy on November 4th, 1966,
n more than 100 people died and
nage estimated at £stg10,000,000 was
orted.

lthough a complete amateur radio emer-
cy plan was not available, an emergency
was organised on the spot. Notwith-
nding great difficulties the emergency
k proved to be very effective and re-
ved the acknowledgment of the Minister
Posts and Telecommunications.

hree types of operations were performed:
) Point-to-point transmission of inqui-
concerning the safety and health of
ple resident in the stricken areas.
i) Transmissions from portable equip-
t installed in isolated villages. In some
s amateurs were carried to the spot
elicopters.
ii) Transmissions from amateur stations
alled in post offices of principal towns
the stricken areas to take the place
nterrupted telegraph lines.

he Board of the A.R.I., encouraged by
success of the operation and looking to
future is now pressing for recognition
he Italian Government of a permanent
teur radio emergency corps. Such a
s was proposed shortly after the 1951
ds but until now the proposal has been
ved in departmental files.

TERNATIONAL REPLY COUPONS

lthough radio amateurs are among the
d's greatest users of International Reply
pons, few realise that history was made
ntly when, for only the second time
8 years, the design was changed.

he design to which we have become
stomed was authorised by the 9th
gress of the Universal Postal Union
ondon as far back as 1929 and appro-
for the new design was given at the
Congress of the Union held in Vienna
ng 1965.

he obsolete design consisted of orna-
tal columns to left and right with date
p circles halfway up each column, the
re space being reserved for the text.
coupon was printed entirely in blue
pt for a yellow background imprint
he globe behind the text.

the new design the two date stamp
es are on a rectangular panel to the
t, one above the other, and the main
consists of the text boxed-in by the
ds UNION POSTALE UNIVERSELLE
three sides and COUPON-RESPONSE
ERNATIONAL at the bottom.

he printing is again in blue but slightly
hter than before. There is a background
rint, in yellow, of a bird carrying a
r across the globe, beneath the text
the U.P.U. emblem.

he Universal Postal Union International
eau building at Berne is shown in the
date stamp circles. The country name
ow printed in red.

or the benefit of those who have not
the wording on the I.R.C. the follow-
is the English version of the vital part
he universal text:

This coupon is exchangeable in any
ntry of the Universal Postal Union for
stage stamp or postage stamps represent-
the amount of an ordinary single-rate
r destined for a foreign country."

he details are always printed in French
a local language if required, but the
is usually quoted only in the language
he issuing country.

he primary purpose of the International
y Coupon, first authorised by the 6th
ference of the U.P.U. held in Rome in
, is to facilitate international reply-paid

RADIO SOCIETY OF GREAT BRITAIN

No doubt many amateurs and those interested in various aspects of amateur radio have heard or read references made to the R.S.G.B.. but apart from knowing that it was the amateur radio organisation in Great Britain, few other details were known. Here then are some details:—

The Radio Society of Great Britain was incorporated in 1926 and is a member society of the International Amateur Radio Union. The headquarters are located at New Ruskin House, 28 Little Russell Street, London, W.C.1. Its official journal, "R.S.G.B. Bulletin," is published on the first Wednesday in each month.

The patron of the society is H.R.H. The Prince Philip, Duke of Edinburgh, K.G.

Council 1967

President: A. D. Patterson, GI3KYP.
Executive Vice-President: J. C. Graham, G3TR.
Immediate Past President: R. F. Stevens, G2BVN.
Honorary Treasurer: N. Caws, G3BVG.

Ordinary Elected Members:

B. Armstrong G3EDD; J. Etherington G5UG; J. C. Foster G2JF; E. G. Ingram GM6IZ; L. E. Newnham G6NZ; G. M. C. Stone G3FZL; J. W. Swinnerton G2YS; E. W. Yeomanson G3IIR.

Members Elected by Zones:

L. N. Goldsbrough G3ERB; J. C. Graham G3TR; H. E. McNally G13SXG; F. K. Parker G3FUR; J. F. Shepherd GM3EGW; G. Twist G3LWH.

General Manager and Secretary: J. A. Rouse, G2AHL.
Assistant to the General Manager: D. W. Robinson, G3FMT.
QSL Bureau Manager: A. O. Milne, G2MI.

To cope with the increasing number of inquiries from the Press, schools, colleges and youth clubs and to ensure that the true facts about amateur radio are readily available to the general public, the R.S.G.B. council have appointed Sylvia Margolis as public relations officer. This is an honorary appointment and is for a trial period of one year to work out what the scope of the task should be.

Correspondence to the public relations officer should be addressed to 95 Collinwood Gardens, Clayhall, Ilford, Essex.

correspondence but in amateur radio circles it is used for many subsidiary purposes, of which payment for certificates and awards is but one such purpose. However, with postage rates ever increasing it is becoming more and more expensive to "pay by I.R.C." (Acknowledgement for information was made to the January, 1967, issue of "The Stamp Magazine").

RED CROSS TRANSMISSIONS

The International Red Cross Society in Geneva will be conducting test transmissions on 7200KHz during alternate months this year. Information required is signal strength, time, interference from nearby stations (quoting nationality if possible), whether any fading was present and how other stations were being received in the same band during the same period.

Transmissions will be at 0600-0700GMT, 1130-1230GMT, 1500-1600GMT, and 2300-2400GMT, on July 17th, 19th and 21st; September 18th, 20th and 22nd; and November 20th, 22nd and 24th.

Reports should be sent direct to the International Red Cross Society, Geneva, Switzerland.

INTRUDER WATCH

At the 1967 Federal Convention of the Wireless Institute of Australia it was decided to introduce an "Intruder Watch" activity in relation to interference on the amateur bands. Similar activities are already in existence in a number of I.A.R.U. member societies.

Members who are interested in operat-

FM TRANSMITTERS AND RECEIVERS $25 pair

80 MC A.W.A. type FJ52860 Transmitter and FC52859 Receiver in good condition but less output valves, crystals and control unit. They can be consigned freight payable to your nearest attended station.

100 RESISTORS $2

100 assorted new resistors by well known manufacturers in values up to 3 meg from ½ to 3 watt mainly close tolerance and including some high stability types.
Post and packing, 20c.

30 CONDENSERS $2

30 assorted electrolitic condensers by a well-known manufacturer, ranging from 4 MF 600V to 500 MF 12V, including pigtail and can types.
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807 output valves	$1.50
2N3565 Transistors (BC108)	75c
5 mf 6VW Miniature Electrolitic	10c
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1-5 pf Ceramic Trimmers	5c
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P.M.G. Key Switches	20c
3¾in .5-0-.5 MA Meters	$3.75

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3 ohm 75w Flat	$1.00
150 ohm 25w	20c
330 ohm 10w	5c
1000 ohm 8w	20c
1800 ohm 30w Slider	30c

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Brand new, low noise, single valve V.H.F. Amplifiers. Boosts signal to one set, giving improved picture or allows up to 3 sets to be used off one aerial. Normally $25
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2½in plug-in type, 0 to 1 amp R.F. ammeter with internal thermocouple. Moving coil 5 milliamp movement, ideal for experiments or recalibration.
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. . . pocket size instrument finds defective circuits— IMMEDIATELY!

For every technician or engineer who must find defective circuits quickly and exactly, the **new** MOSQUITO with detachable probe — pocket size, cordless, pen-type instrument which generates and injects a rich signal covering the audio, IF and RF spectrum!

The Mosquito contains a transistor oscillator, powered by a single 1.5 volt pen light cell, which completely eliminates the need for a large, expensive signal generator. It can be coupled into magnetic pickups and circuits **without leads.** And the MOSQUITO oscillates at approximately 1,000 cycles per second, with a wave form which is rich in harmonics. This is truly the simplest, fastest, **most effective,** most economical way to find defective circuits — it belongs in your pocket now!

Some typical applications for the new MOSQUITO Transistorized Signal Injector

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Adelaide:	1 Ifould St., Adelaide	23-3979
Perth:	151-155 Brisbane St., Perth	28-4338
Hobart:	141 Murray St., Hobart	3-3707
Canberra:	P.O. Box 766	49-6677

such a watch on the amateur frequency cations may be interested to hear that a is now available from International communication Union Headquarters h illustrates different classes of emission the procedure for dealing with interce problems.

his tape was made at the United King- Post Office receiving station at Baldock, tfordshire, and is accompanied by a ten commentary in English, French and nish.

he tape is available from the General etariat, I.T.U., Palais Wilson, Geneva, zerland. Price, 21 Swiss Francs.

ERTZ OR CYCLES PER SECOND

rom this explanation given in the Region lletin some light has been thrown on doption of the term Hertz in preference ps.

here has been a good deal of discus- recently, expecially in English speak- countries and among technical journal- about the unit of frequency. The posi- has now been clarified by Mr Clifford d, Councillor of the International Tele- munication Union, in a letter to the or of the journal "Wireless World."

s quoted in the February, 1967, issue Stead wrote:—

think it might be useful to explain exact situation in the I.T.U. on the use ertz for the unit of frequency. A long ssion on this subject took place at the . Administrative Radio Conference h, in 1959, adopted the current Radio lations. As a result, it was agreed to Hertz in documents (printed or written) rench but to maintain cycles-per-second nglish and ciclo-por-segundo in Spanish. practice was also followed by the potentiary Conference, the supreme n of the I.T.U., in 1965.

he Plenary Assembly of the C.C.I.R. (Oslo, 1966) recommended that, in future Hertz should be used for the unit of frequency and, in fact, decided that it should be introduced forthwith in documents published by the Specialised Secretariat of the C.C.I.R. However, as regards documents published under the provisions of the Radio Regulations we (I.T.U.) are obliged to continue to respect the decision of the 1959 conference until such time as these regulations are amended by an appropriate conference. We (at I.T.U.) do not know when such a Conference is likely to be convened."

A.R.R.L. NATIONAL CONVENTION.

The National Convention of the American Radio Relay League for 1967 is to be held in Montreal, Canada, during the period July 1st - 3rd. As this weekend is a national holiday both in Canada and the United States and because Montreal is holding a World's Fair — Expo '67 — during the same period, a very large attendance is anticipated. This year Canada celebrates its Centenary of Nationhood.

Noel Eaton, VE3CJ, Director of the Canadian Division of the A.R.R.L., expresses the hope that, as this is the first A.R.R.L. Convention to be held in Canada, amateurs from all parts of the world will be present.

REGION II MEETING.

The Inter-American Union of Radio Amateurs — Region II of the I.A.R.U., was, at the time these notes were being compiled, scheduled to hold its second General Assembly in Caracas, Venezuela, from May 14 to 17, 1967.

Region II of the I.A.R.U. incorporates both North and South America. It is hoped to give some news of this meeting in some future issue of these notes.

WIRELESS INSTITUTE ACTIVITIES

e official historian of the Wireless In- e of Australia, George Glover, VK3AG, ll looking for information on the early of amateur radio in Australia. This mation is needed to enable him to ile details of experiments and experi- of those associated with early opmental work.

orge would be pleased to hear from ne having old records or news cuttings ng to such activities. Such informa- may be sent to:— Federal Historian, ess Institute of Australia, Box 2611W, D., Melbourne.

NEW SOUTH WALES

drive to increase the membership of lew South Wales Division of the W.I.A. been inaugurated by Keith Finney, KJ, the newly elected president of the ion. The initial suggestion has been that each member endeavour to obtain member for the institute. It is pointed hat the additional funds resulting from crease in membership will enable the es to members, especially country bers, to be improved.

WICEN

er Campbell, VK2AXJ, chairman of WICEN committee, points out that im of WICEN is to establish VHF to cover as much of the State as ble and to link these nets to a central ol by means of HF channels in the of a civil emergency. Country mem- of the division are asked to give deration to establishing VHF nets in zones.

e members of the WICEN committee

er Campbell VK2AXJ, Chairman; Doman VK2ZPD, Secretary; Kevin n VK2ANT, Treasurer; Gerald Sabin AGS, Publicity Officer; Don Miller GN, Technical Officer; Vic Cole VK- Operations co-ordinator.

e last two officers have the power -opt other members to assist them in particular functions.

Saturday, April 29, members of the EN group combined with the Wil- by Civil Defence organisation to provide a display at the Chatswood High School fete.

MORSE PRACTICE.

Every night of the week morse practice sessions are transmitted from VK2AWI, the official station of the N.S.W. Division. Transmissions commence at 7.30 p.m. on a frequency of 3550KHz in the 80 metre band.

A recorded tape service is also available; tapes may be obtained on loan. For details write to Ern Hodgkins, VK2EH, Supervisor, Morse Tape Service, Mangrove Road, Narara, N.S.W.

HUNTER BRANCH.

Ian Fyfe, VK2ZIF, a well-known Newcastle amateur, displayed and described his all-transistor transceiver for 3.5MHz and 14MHz bands, at the April meeting of the Hunter Branch.

The unit, which was designed and constructed by Ian, uses the recently announced 9MHz filter available from Germany and so does away with the need for intermediate frequency transformers.

In addition, the design contains many novel features which have been added to give improved handling and to reduce the cost. Printed circuits were used extensively in the transceiver and, for display purposes, the base panel was constructed from transparent plastic.

The tiny unit, only one-quarter the size of the normal small transceiver, is far from being a display piece only — it is in regular use by its designer in a 144MHz transverter for Single Side Band operation on VHF.

Before the lecture, a film on "Artificial Respiration" using expired air was shown. A film at the commencement of each meeting will be a regular feature of Hunter Branch meetings and some very interesting subjects have been arranged for the remainder of the year.

The July meeting is to be addressed by Gordon Sutherland, VK3ZSG, who will explain how to make command receivers really go, including such modifications as double conversion for added selectivity.

RECEIVER AND C.R.O. UNITS

Comprising power supply, 5in CRO and ZP1 receiver. Frequency 150 megs. 19in rack mounted in cabinet 32in high x 20in wide x 19in deep. 115 volt operation. Cabinet alone would cost more than complete unit price. An ideal unit for conversion to 144 meg band.

ABSORPTION WAVEMETERS

Type 758A. General Radio Co. U.S.A. 55 to 400 megacycles.

$5.75

INDICATOR UNITS

5 inch. Containing 5AP1 C.R.O. tube, with mu-metal shield. Adequate chassis space for conversion.

$9.50

C.R.O. TUBES

New, in wooden crates.

9HP7 (9 inch) **$3.50**
5AP1 (5 inch) **$2.50**
5BP1 (5 inch) **$2.00**

VARIACS

Genuine variacs. As new. General Radio Co. U.S.A. Units mounted in pairs on single shaft. Rated at 115 volts 18 amps per unit, the pair will operate on 240 volts when coupled.

$30.00 per pair.

SELSYN MOTORS

3in transmitters. 50 volt A.C.

$2.50

RHEOSTATS

7.5 ohms 4 amps.

$3.00

METERS

Excellent used condition. 3in square, panel mounting.

(a) 0-35 kilovolts.
(b) 0-1.5 kilovolts.
(c) 0-500 volts D.C.
(d) 0-50 amps A.C.
(e) 0-100 milliamps D.C.
(f) 0-20 milliamps (centre zero).

$1.25 each.

TRANSFORMERS

Oil filled. Primary 230 volts A.C. Secondary 21,000 volts at 100 milliamps.

$15.00

HIGH VOLTAGE CONDENSERS

(a) 1 mfd at 25,000 volts **$2.50**
(b) .01 mfd at 25,000 volts, oil filled **$3.00**
(c) .002 mfd at 6000 volts (mica, Sangamo U.S.A.) **$1.00**
(d) .005 mfd at 6000 volts (mica, Sangamo U.S.A.) **$1.00**

SEATS

Swivel seats, with backrest. Floor mounting on metal stand. 360 degree rotation. Ex-Army radar cabins. With upholstered seat. Ideal for "ham" shacks.

$6.00

RADIATORS

Wall mounting, 1300 watt, 115 volts. Two in series for 240 volt operation.

$5.00 per pair

VALVES

New, in cartons.

2A3	**$1.00**	1616	**35c**
2V3G	**40c**	218	**$5.00**
2X2	**40c**	807	**75c**
5X4G	**40c**	866A	**75c**
5Y4G	**40c**	878A	**$1.00**
6AC7	**50c**	955	**35c**
6AG7	**75c**	956	**35c**
6H6	**35c**	105-30	**50c**
6SJ7	**50c**	150-30	**50c**
6SK7	**75c**		

Above valves, removed from equipment, half-price.

TRANSMITTER/RECEIVERS

Type 9092

"Talbe" survival transceiver, manufactured in 1960 (Burndept Ltd., England). Crystal controlled, frequency 121.5 megs (distress band). Waterproof. Complete with transducer speech unit. Weight 2lb. Brand new, in original cartons.

$30.00 per pair

ROTARY BEAM AND TOWER UNITS

(12 only available)

Consists of a 12-foot metal tower, with 24-foot wooden boom. Motorised, with reduction gear-box, shaft coupled to boom. A precision commutator unit couples antenna to tower, enabling continuous full rotation. No "unwinding" necessary. Unit equipped with selsyn motor as direction indicator. The finest ex-disposals equipment of their type we have seen, offered at a fraction of their original cost.

$90.00 complete

Prices quoted above do not include freight and packing. Please allow sufficient to cover these (charged at cost).

NOTE: We have a large range of switchboards, relays, motors, blowers, valves, etc. We welcome your inquiry, no matter how difficult. Call in and look around.

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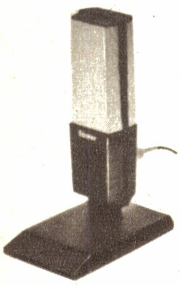
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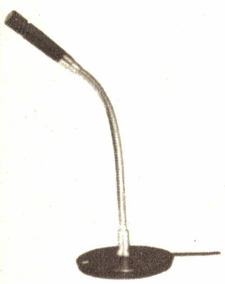
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dynamic microphones



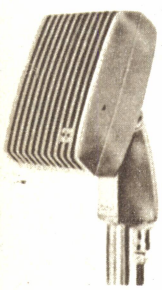
*MDF-600B cardioid microphone

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −52 dB±3 dB,
Dimensions : 148×48×34.5 mm without stand
Cable : 4 ϕmm, 3 m
Weight : 1¼ lbs (525 g)



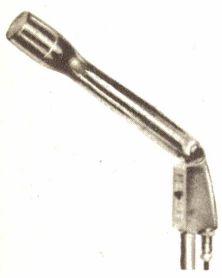
DF-1DE

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~10,000 c/s±8 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 385.5 mm high
21 mm diameter, microphone
128 mm diameter, stand
Cable : 4 ϕmm, 1.5 m
Weight : 1⅝ lbs (840 g) with cable



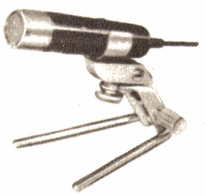
*DF-14B

SPECIFICATIONS
Impedance : 50 kΩ Variable
Frequency Response : 100~10,000 c/s±8 dB
†Sensitivity : −48 dB±3 dB,
Dimensions : 136×75×47 mm
Cable : 6 ϕmm, 4 m
Weight : 2 lbs (900 g)



*DF-22B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±7 dB
†Sensitivity : −57 dB±3 dB,
Dimensions : 32.5 mm diameter, 220 mm long
Cable : 6 ϕmm, 4 m
Weight : 1¼ lbs (575 g)



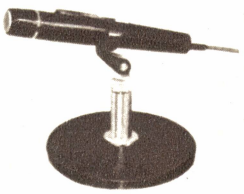
DF-1/*DF-1B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±8
†Sensitivity : −57 dB±3 dB,
Dimensions : 21 mm diameter, 82.7 mm l
Cable : 3 ϕmm, 1.5 m
Weight : 3.9 oz (110 g) with cable



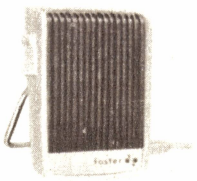
DF-3

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 50~12,000 c/s±8 d
†Sensitivity : −56 dB±3 dB,
Dimensions : 33.5 mm diameter, 133 mm
Cable : 4 ϕmm, 1.5 m
Weight : 9.0 oz (255 g) with cable



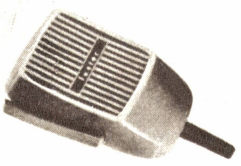
DF-12/*DF-12B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 80~12,000 c/s±8 d
†Sensitivity : −57 dB±3 dB,
Dimensions : 23 mm diameter, 158 mm lo
Cable : 3 ϕmm, 1.5 m
Weight : 6.3 oz (180 g) with cable



*DF-2B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 100~10,000 c/s±10
†Sensitivity : −56 dB±3 dB,
Dimensions : 75×53×30 mm
Cable : 3 ϕmm, 1.5 m
Weight : 4.8 oz (136 g) with cable



*DF-51B

SPECIFICATIONS
Impedance : 50 kΩ
Frequency Response : 150~8,000 c/s±7 d
†Sensitivity : −57 dB±3 dB,
Dimensions : 98×58×36 mm
Cable : 6 ϕmm, 1.6 m, Coiled
Weight : 7.3 oz (207 g) with cable

* with switch ; † at 1,000 c/s, 0 dB=1 V/μ bar

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W.I.A. YOUTH RADIO SCHEME

The Australian Postal Institute Radio Club in Melbourne now operates on Monday, Wednesday and Friday each week on 144MHz AM from 12.30-1 p.m. under the call-sign VK3ZTT.

Frequent contacts are made with VK3ACQ, Scots College Radio Club, to discuss various activities and projects. One such experiment was cross-mode AM-FM operation.

The A.P.I. club instructors are Bob Whally, VK3ZWZ Tony King, VK3ZUA, Dave Buck, VK3ZMX, Don Reid, who looks after the audio section of the activities.

NEW SOUTH WALES

The Newsletter of the Y.R.S. is now under the editorship of Roger Davis, VK1RD, who in the April issue paid tribute to the work of Jim Webster, who found it necessary to relinquish the position due to pressure of work as a subject master in the Education Department.

Officers and responsibilities are:

D. Craig	Registrar
D. Williamson	Examiner, Elementary Certificate
K. Howard	Examiner, Junior Certificate
D. Jeanes	Examiner, Intermediate Certificate
J. Scougall	Wireless telegraphy and telephony certificates
C. L. Mathews	Incentive Packets
J. Flynn	Boy Scouts-Y.R.S. Liaison
I. Agar	Prizes
R. Davis	Postal Groups
Mrs M. Swinton	Y.R.S. Correspondent

WESTERN AUSTRALIA

The activities of the Christian Brothers College Radio Club are now in full swing. Two groups, boys and girls, meet on Saturday mornings, when theory and morse practice sessions are held. Following this those interested are able to continue and make use of the physics laboratory facilities to build practical apparatus.

It is proposed to carry on the morse sessions for most of the year so as to permit members to become as efficient as possible. At the moment there is evidence that a large number of younger students are interested in joining the club, so it is likely that another group will be formed in the college.

Jim Thompson, VK2AHT, at present holidaying abroad, is keeping in touch with home via SSB. When he visits his amateur friends in foreign parts he gives a call back home to Jack Early, VK2KQ, who is at present operating Jim's gear. Up to the present time the contacts have all been 100 per cent proof to Jim of his reputation for putting the loudest VK signal into many parts of the world.

There has been increased activity on the 146MHz FM channel with the introduction of several new carphone units to the area. A small network now exists and good communications paths have been established over most of the Newcastle area, north to Maitland and south to The Entrance.

Monday night session of Hunter Branch station, VK2AWX, has been rearranged so that a number of operators may participate in turn. A quite extensive roster has been drawn up and this will ensure both maximum participation by members and good coverage from rostered stations.

The broadcast takes place each Monday evening at 7 p.m. on a frequency of 3595KHz with a relay on 144MHz, from VK2ZFX. Either station appreciates reports which will be acknowledged by a QSL card.

The Hunter Branch meets on the first Friday of each month in the Clegg Building, Newcastle Technical College, Tighes Hill, Newcastle. Proceedings commence at 8 p.m. Visitors are always welcome to attend.

ILLAWARRA SECTION

At the Annual Meeting of the Illawarra Section held in March, the following officers were elected:—

President, Lyle Patison, VK2ALU.
Vice-President, Laurie Jordan, VK2ALV.
Secretary-Treasurer, Alan Ward, VK2VH.
Assistant Secretary, John Simensen, VK2ANO.
Committee, Peter Fackender, VK2BJF, Eric Fisher, VK2DY, Bob Isaacs, VK2ZAI.
Auditor, Basil Dale, VK2AW.

General meetings are held on the 2nd Monday in each month at the Coniston Scout Hall on the corner of Strathearn Avenue and South Street, Coniston. Proceedings commence at 8 p.m. Visitors to the Wollongong area are welcome to attend.

Intending members or visitors are invited to contact either the President, phone 28-6984, or Secretary, phone 84-3520 (Wollongong), or each Sunday morning at 10 a.m. A VHF net is active on 53.98MHz.

CANBERRA RADIO SOCIETY

The Canberra Radio Society meets every Friday evening commencing at 8 o'clock in Electronics House, Barton, A.C.T. A lecture on some topical subject is given once a month. The other evenings are devoted to discussions between members on various subjects such as — modern techniques in use; VHF v HF; SSB v FM and other modes. There is always plenty to interest members and visitors at C.R.S. meetings.

One item of news relating to VHF activity in the A.C.T. is that the first 52MHz contact between home stations located in VK1 and VK2 call areas was made in late March. This is the first contact recorded on 52MHz between Canberra and Sydney for many years. On the last occasion, A.C.T. was still part of the VK2 call area.

The contact was made between Graham Cashion, VK1ZCG, located in Watson, A.C.T. and Denis Walker, VK2ZDW, of Rosebery, Sydney.

QUEENSLAND DIVISION

Although there were only six nominations received for a council of nine in the Queensland Division several other members offered their services. The council is now at full strength and the officers are:—

President	Les Brennan	VK4XJ.
Vice-President	Bill Bentson	VK4QF.
Secretary	Alan Simpson	VK4ZAE.
Treasurer	Alan Williams	VK4A1.
Inwards QSL	Jack Files	VK4JE.
Federal Councillor	David Portley	VK4DP.
Minute Secretary	Mike Willet	VK4ZMW.
Disposal Officer	Tom Lane	VK4ZAL.
Library Officer	Ron Guttermsen	VK4RL.

It is also reported that approval has now been given for the Queensland Division to become incorporated under the Company Act. Appreciation for the work done in preparing submissions and representing the division in discussions relating to the incorporation has been extended to Pat Kelly, VK4KB and David Portley, VK4DP.

TOWNSVILLE AMATEUR RADIO CLUB

The officers elected for the ensuing year are:

President	P. Fitzherbert	VK4ZEE
Vice-presidents	R. (Bob) Grummit	VK4ZRG
	C.Bahr	VK4BQ
Secretary-treasurer	A. Doelle	Assoc
QSL-Publicity Officer	M. Deakin	VK4DV

The club meets on the first Thursday in every month and full details of the activities can be obtained by writing to the Secretary, Miss A. Doelle, P.O. Box 964, Townsville.

TASMANIAN DIVISION

The Council and Divisional Officers of the Tasmanian Division for 1967-68 are as follows:

Council:

President	T. Allen VK7AL
Snr. Vice-president and Treasurer	T. Connor VK7CT
Vice-president and Minute Secretary	G. D'Emden VK7ZAS

(Continued on page 158)

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136 VICTORIA ROAD, MARRICKVILLE — 51-3845

K 20 CT330 — K 20 CT500



220S 4000 O.P.V.

D.C. Volts 5, 25, 125, 500, 2500. A.C. Volts 10, 50, 250, 1000. Current: 250uA, 250mA. Resistance: 0-10K, 0.1 Meg.

£3/19/6 Post 5/-

C.T.330 20K.OPV

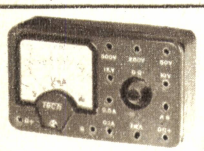
D.C. Volts 6, 6, 30, 120, 600, 1200, 3000, 6000. A.C. Volts, 6, 30, 120, 600, 1200. DC. Current, .06-6, 60, 600mA Resistance, 6K, 600K, 6meg. 60meg. D.B. minus 20 to plus 62 5 Ranges. Specially suitable for transistor use

$15.95 Post, 50c.

C.T.500 20K.OPV

D.C. Volts, 2.5, 10, 50, 250, 500, 1000, A.C. Volts, 10, 50, 250, 500, 1000. D.C. Current, .05, 5.50, 500mA. Resistance, 12K, 120K, 1.2 meg., 12 meg. D.B. minus 20 to plus 62

$13.25 Post., 50c



P.T.34 1000.OPV

D.C. Volts, 0, 10, 50, 250, 500, 1000.
A.C. Volts, 0, 10, 50, 250, 500, 1000.
M.A. 1-100-500 RESISTANCE.

$5.25 Post., 50c.

200H. 20K.OPV

D.C. Volts, 5, 25, 50 250, 500, 2500. A.C. Volts, 10, 50, 100, 500, 1000. D.C. Current, 50UA, 2.5, 250mA. Resistance, 6K, 600K. Capacitance, 2 D.B. Ranges.

$10.50 Post., 50c.

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KAMODEN HT 100B MEASUREMENT RANGES

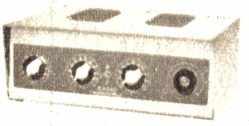
1. D.C. VOLTAGE Sensitivity: 100,000 ohm/volt, 500 mA 2.5V, 10V, 50V, 250V, 500V, 1000V.
2. A.C. VOLTAGE Sensitivity: 12,500 ohm/volt, 2.5V, 10V, 50V, 250V, 1000V.
3. VOLUME LEVELS IN DECIBELS 20 plus or minus 62db in 5 ranges.
4. RESISTANCE

	Centre Scale
R x 1	0-20,000 ohm 160 ohm
R x 10	0-200,000 ohm 1600 ohm
R x 100	0-2 Meg. ohm 16,000 ohm
R x 1000	0-20 Meg. ohm 160,000 ohm

5. D.C. AMPERE 10UA 250UA 2.5 mA 250 mA 10A.

$28.75 (Post $1.25)

AMPLIFIERS Public Address Range 240V-AC



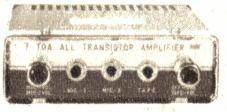
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Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing. P.P. EL.84 output $39.50
30 Watt, As above, EL34 P.P. $95.50
40 Watt, As above EL34 P.P. $79.50
60 Watt, As above EL34 P.P. $98.50

LINE OR VOICE COIL TRANSFORMERS. MULLARD HI-FI RANGE.

5/10 with pre amp base and treble boost. Ultra Linear output $43.50
5/20in. As above $65.50

TRANSISTOR P.A. AMPLIFIER C.A.-512



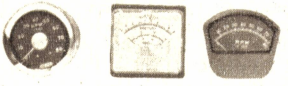
12VDC Operation. Output 20 watts. Current consumption at max. output 2.2 amps. Input. High imp. mic. Also 600 ohms and tape. Independent gain controls. Output: Imp. 4-8-16 ohms. Freq. Response: 200 cps—6000 cps. Dimensions: 2in x 6¼in x 8½in. Complete with instruction book with circuit. All plugs.

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DYNAMIC MICROPHONES

DMS-3 HI-Imp $5.50
DM-305, 600 ohms or Hi-Imp. Suitable stand mounting $9.75
DM-304 Dynamic Cardoid. 50 ohms or HI-Imp. Suitable stand mounting . . $15.75
D.M. 307 HI-Imp. £7/10/-
CM-10 Crystal HI-Imp. Suit stand mount $5.75
DM-108 Cardoid £5/17/6
DM-202 Flexible T Stand £3/17/6
3 Section Floor Stands . . £3/12/6
Post., N.S.W., 25c; Interstate, 35c.

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Mullard ACE. Scaled for 5.7 or 9K. £10/7/6—$20.75.
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OHNAR. 240 degree, Circular Movement, Scaled 6K or 8K. £12/7/6—$24.75.
Standard Scale, 6 or 8K, £9/17/6—$19.75.
Postage: N.S.W. 5/; Interstate 7/6.



REVERBERATION UNITS

Latest design to suit organs, stereo, guitar, any hi-fi equipment.

£2/17/6 $5.75

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2,000-20,000 Response. 20 Watts Power. Sensitivity 110 dbw. Weight 1¾lb.

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De Luxe Model. Fully machined and balanced. Heavyweight turntable. Ceramic cartridge.

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With padded earpieces.
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4in Single Tweeter $2.75
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2¾in, 15 ohms $2.75
3¼in, 8 ohms $2.85
3½in, 15 ohms $2.85
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8in $4.25
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	Square.	Clear Plastic.
2¼in	50 UA	$4.75
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2¼in	500V A.C.	$4.25
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3in Mylar LP 300ft		10	6
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Post 26 per spool.

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Channel. Bass and Treble Boost. Twin Cone eakers $109.05 £54/10/6
brato with foot control and 2 pre- controls for frequency and in- nsity. $10.50 (£5/5/) extra on ove models.

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240V A.C. Operation.
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WIRED AND TESTED. **$88.75**

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WIRED AND TESTED **$79.00**

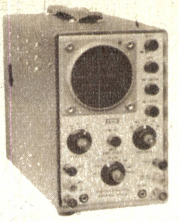
V.T.V.M. MODEL TE-40 MILLIVOLTER

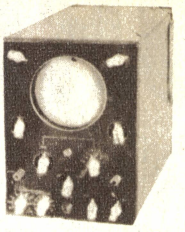
Spec. AC.V. Imv.—300 Vrms. 10 ranges. Accuracy 5 cps—1.2 mc, plus-minus 2dB. 10 cps-1 mc, plus-minus 1dB. 20 cps-250 KC., plus-minus 0.2dB.
dB. Scale: 40-30-20-10.0. 10.20. 30.40, 50 dBm. 240 V.A.C.
$47.50.

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DC.V 0-1.5-5-15-50-150-500-1500 V. Rms. AC.V. 0-1.5-5-15-50-150-500-1500 V Rms. 0-1.4-4-14-40-140-400-1400-4000 V. P.P.
Resistance RX10.100, .1K, .10K, .100K, .1M, .10M. Decibel—10db, minus-plus 65dB.
240 V.A.C.
$42.50

TEST EQUIPMENT



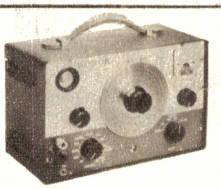


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Capacity 20 pfd to 2,000 mfd. Resistance 2 ohm to 200 megs. Also tests power, factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.
Indications by eye and meter.
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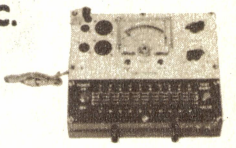
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Freq. range 120 KC—500 Mcs. 7 Bands. Accuracy 2 per cent. Output 8V. Provision for Xtal. Suitable for self calibration. Marker generator. Printed circuit. 240 V.A.C.
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Checks. Nu Vistas. Compactrons, etc.
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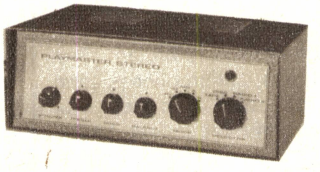
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T.E. 15 Transistorised, 7 Band, 360 Kc to 270 Megs.
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AUDIO GENERATOR

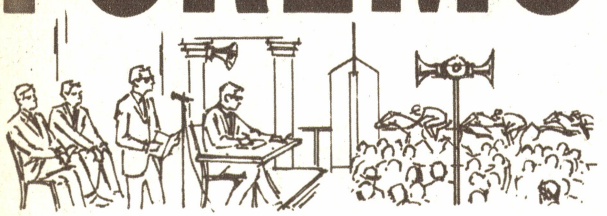
DeLuxe Model TE—22D.
Freq. range. Sine 20 cps—200 KC. SQ. 20 cps—25KC. Output voltage, Sine 7V. SQ. TV P-P. Output impedance 1000 ohms. Acc. 5 per cent. Distortion less than 2 per cent. 4-range attenuation.
1/1, 1/10, 1/100, 1/1K. Printed circuit.
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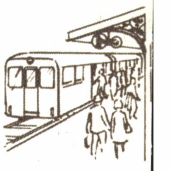


PLAYMASTER 115

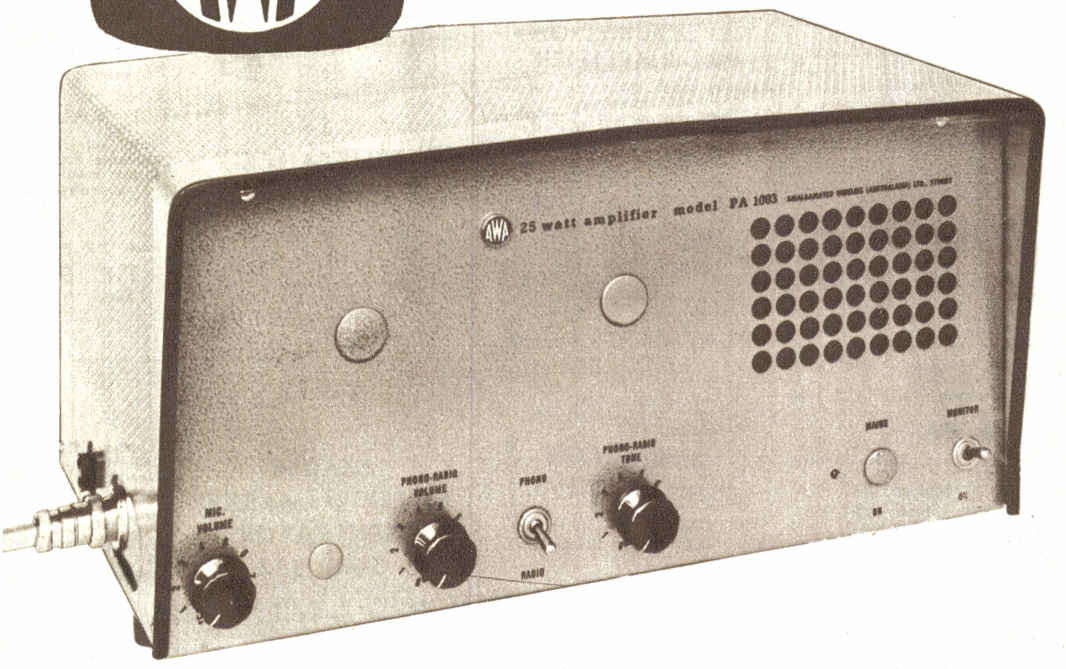
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April Issue.
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LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

Survey of Transmissions from Europe

Our six-monthly survey of signals from Europe shows the typical winter situation, with daylight signals being dominant. The survey will assist new Australians to hear signals from their former homelands, and listeners in general to gain an overall picture of signals from Europe.

ALBANIA — Radio Tirana has several ansmissions in English which are giving ood reception in the Pacific area. News in nglish is at 0630GMT on 6160KHz, at 00 and 2200 GMT on 7265KHz. A trans-ission to North America 0230GMT is eing received on 9715KHz.

AUSTRIA — The Austrian Radio at ienna relays mainly its home program, and e transmissions are beamed to various eas of the world. All programs are in Ger-an but identification in English, French d German is given each half hour during ansmissions. Broadcasts for Australia and ew Zealand are on the air 1000-1200GMT ing 17755KHz. To Japan, 0400-0600GMT, e service is on 17855KHz. The service Europe on 6155KHz provides good re-ption in the Pacific area 0500-1300, 1700-00GMT. The service to South America 00-0400GMT on 11760KHz.

BELGIUM — Brussels in Belgium does t carry any English transmissions, but rries mainly programs in French and emish. Reception at 1000GMT on 21510 Hz in the program to Africa is one of the gular signals. This is also on 17860 and 690KHz.

The service at 2115GMT in French and utch is on 11895, 9615, 9740KHz. From 15-2400GMT, broadcasts are in French d Dutch on 11895, 9615, 9745KHz. The tion opens with the familiar drum beat ntification signal.

BULGARIA — Radio Sofia transmis-ns in English include transmissions 1930-00, 2130-2200GMT to Britain on 6070, 50KHz. To North America the services at 0000-0030GMT and 0400-0430GMT ng 9700KHz.

CZECHOSLOVAKIA — Prague's broad-t to Australia and New Zealand in glish is on the air 0700-0755GMT. The quencies of 9550,1528 and 21450KHz in use. The same program is carried North America, 0330-0425GMT on 1199 50, 7345, 7115 and 6095KHz. The service Africa 1730-1830 is also well received on 30, 7285, 7345, 9795, 11990KHz.

DENMARK — Copenhagen's service to Pacific is 0700-0745 in Danish, 15165 Hz. English is 0745-0815 on the same quency, and also on 15165KHz, with vs at 0745GMT. A service to Africa 15-1945GMT is also on 15165KHz, with nailbag on the Saturday transmission.

FINLAND — Hensinki Radio has its vice to the Far East at 0955GMT useing 185KHz. Station sign-on is in several guages, including English. A DX session Friday at 1600-1700GMT is received on 20, 9555, 11805 and 15185KHz. The low wer of this station makes it one of the rdest to hear from Europe.

FRANCE — O.R.T.F. Paris has a trans-sion in English at 0515GMT on 9500 and 11965KHz, and a further service at 1100GMT on 21580 and 17785KHz. A Far East transmission on the air at 1300GMT is carried on 15240, 17780, 21580KHz. Some of the Far East transmission, particularly the English 15 minute session at 0515, is relayed by Radio Brazzaville on 11725, 15440KHz, and preceded by 15 minutes in French.

WEST GERMANY — The Deutsche Welle, Cologne service to the Pacific covers both morning and evening listening. Transmissions in English are 0845-0940GMT on 11925, 15275, 17845KHz, and 2110-2200 GMT on 7290, 9685KHz. The service in German to the Pacific area is 0645-0945 on 11795, 15205, 17880KHz. English to North America is broadcast 0445-0545GMT using 6145, 9735KHz, providing good afternoon reception.

EAST GERMANY — Radio Berlin International transmission in English to the Pacific is aired 1200-1245 using 17820 and 17880KHz, and 1415-1445GMT on 17880 and 15240KHz. To North America, it is 0445-0515 on 9650 and 11970KHz.

GREECE — Athens Radio has few overseas transmissions, the major target area for these being Cyprus. English broadcasts are 1830-1900GMT, on 9605, 7295KHz, with Europe as the target area.

GREAT BRITAIN — The B.B.C. London operates the World Service 24 hours a day with two transmission periods specifically beamed to the Pacific at 0545-1130 and 2000-2200GMT. The schedule is 0545-0730, 7150KHz; 0545-0915, 9640 and 11955KHz; 0700-1130, 15070KHz; 0900-1130, 17790 and 21550KHz; 2000-2200GMT 9410, 11860, 75070 and 1526KHz. B.B.C. signals are relayed in the winter over Tebrau relay base near Singapore to provide good reception in Australasia. During daylight hours, the new Ascension Island base in the South Atlantic enables more frequencies to be heard with B.B.C. World Service programs.

HOLLAND — Radio Nederlands transmission in English to the Pacific is 0730-0820 on 9525, 9715 11730KHz. On Sunday it is replaced by the Happy Station program, 0600-0720, on 6020, 9715KHz, repeated 0730-0850GMT on 9525, 11730KHz. Dutch to New Zealand is 0600-0720GMT on 9525 and 1173KHz, repeated 0830-0950 on 21570 11730 and 9715KHz.

HUNGARY—Radio Budapest beams its program in English 0300 and 0430GMT using 9835, 7220, 6234, 6140KHz. To Britain it is 1930GMT on 21685, 17890, 9833, 7100, 5902 and 3995KHz.

ITALY—Rome Radio has a transmission in English for morning reception, 2205 to 2225GMT using 9710 and 6010KHz. In Italian, transmissions for Australia and New Zealand are 1200-1255GMT on 21570, 17770, 15325KHz, also 2045-2110GMT on 11905, 9710, 9575KHz.

LUXEMBURG — Radio Luxemburg carries commercial programs for listeners in Europe on 6090KHz, and can be heard at 2000GMT mixed with VL16. The station has programs in English 1730-0200GMT.

NORWAY—Radio Norway from Oslo broadcasts to the Far East at 1100GMT, using 25900, 21730, 21665, 17825KHz. A service to Australia and New Zealand is 0800-0830, with English opening and closing announcements, on 11850, 15175, 21730, 21655, 25900KHz. A service 0000-0030 is also giving good reception on 9645, 9610, 11850, 15345KHz.

MONACO—Trans World Radio at Monte Carlo is heard frequently with its gospel programs. The transmission best received in English is at 0730GMT on 7295KHz and on Sunday from 0830GMT when using 9585KHz. Frequent transmissions in some 40 languages are heard from this station and also over its relay base at Bonaire in the Netherlands Antilles.

POLAND—Radio Warsaw has broadcasts to Australia and New Zealand at 0730GMT and at 0830GMT in two 30 minute transmissions. Broadcasts are beamed at 0730GMT on 9675, 11815, 15275KHz. and 0830-0900 on the same frequencies. A service to the United Kingdom in English is carried 1930GMT on 7125, 7285, 9525KHz.

PORTUGAL—Radio Nacional in Lisbon transmission to the Pacific 0730-0815GMT on 11840 and 17740KHz, while a further service 0815-0900 is received on 21495 and 17740KHz. The program includes the Radio Portugal DX Club each Monday. The program the Voice of the West, to North America 0400-0445, is carried on 9685, 6185, 6025KHz.

RUMANIA—Radio Bucharest gives best reception in transmissions to America in English 0300-0330 and 0430-0500GMT on 6150, 6190, 9510, 9570, 9590, 11885, 11940KHz. A service to Asia 1500-1530GMT is on 15250KHz, while one to Africa at the same time is carried on 11810, 11885, 15380KHz. To Europe, transmissions are 1930-2030GMT, using 5990, 7225, 9510KHz.

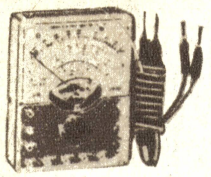
SWEDEN—From Radio Stockholm an English service to the Far East is at 1100GMT on 1524KHz, while at 0900GMT a program is carried on 21585KHz. To Africa reception is good 1900-1930 on 11705KHz, with the DX session on Tuesday. The South Asian service at 1400-1430 is also carried on 21585KHz.

SWITZERLAND—The Berne transmitters have services in English of 105 minute duration. A service to Japan, which also provides good reception in the South Pacific, is 0700-0845GMT using 11775 and 17800KHz. A program at 0900-1045GMT is beamed to Australia and New Zeland on 11865, 15320, 17800 and 21520KHz. The service to North America 0115-0245 is on 11790KHz, and at 0500-0645GMT on 9665KHz. The DX session is heard in Swiss Short Wave Merry Go Round in the Saturday transmission, the first and third Saturday being devoted to the international shortwave bands and the other Saturday sessions to the amateur bands.

TURKEY—Radio Ankara is best in two transmissions in English. The first at 1515GMT is carried on 17820KHz, and the second at 2200GMT on 15160KHz. The station has 30 minute transmissions at 1415 and 2200, on 15160KHz.

U.S.S.R.—Radio Moscow, and its Far East relay bases, provide reception in New

SAVE UP TO 90% WITH ONLY DIRECT DISPOSALS



"POCKET TESTER" MULTIMETERS

69/6 ($6.95)

Post free.

Brand new circuit tester with high sensitivity and ruggedly built for checking any electric apparatus, car and truck ignitions, motors, shorts, broken leads, etc. Measures all voltages to 1000v A.C. and D.C.—D.C. current (amps) resistance, etc. Complete with full instructions and probes. Also famous make **20,000 ohm 200 H model.** Extremely sensitive — for use in laboratories etc. Also use for checking any electrical apparatus: **measures to 2,500 volts etc. 97/6 $9.75**

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Made by "Plessey" have 24/32v D.C. electric motor. Unit is 11" long, adjustable stroke by microswitches to 3" with adustable slip clutch. 100 lbs. push or pull. Fully guaranteed.

95/- ($9.50)

"Dunmore" Linear Actuators 1/12th h.p. for 24v D.C., 3" travel 250 lbs. **95/- ($9.50).** **Rotary Actuators by "Plessey"** (size 6" x 4"). **59/6 ($5.95).** ALL MOTORS. Pack, post 3/- (30c).

Write for 4-page list of Hydraulic Components in stock: pumps £9½, valves £6½, etc. Also 2 page hydraulic information sheet, diagrams, etc., price 15c.

"NIFE" BATTERIES 9/6 (95c)

Pack, despatch & freight, 1/-. Brand new! Nickel iron, spill-proof, leak-proof cells— Lasts forever, 4 A.H., 1.2 volts. Sizes 3½" x 2½" x 1". Couple together for any voltage—superb for spotlights, lamps, bells, flash equipment, etc. **Set of 10 gives 12 volts, 4 A.H. 79/6 Pack, post 7/6.**

Type B2 Ref. No. 5U/4317.

24V. ENGLISH REPEATER MOTORS 37/6 ($3.75)

Pack, despatch and freight 5/-. Selsyn (synchro) to indicators and other mechanism. **Size 4" x 4" x 3".** Shaft ¼" x ½", work **also on 12V. or 32 volts.** New in cartons.

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Freight 10/- Rotary Actuators

Highest quality make with microswitches in attached box for 24V. A.C./D.C. use (perfect on 12V.), 75 inch lbs. torque; 1½ r.p.m.; ½ amp. draw; ½" shaft with removable 5" arm. Has mounting bracket and base. Size 7" x 4" x 5". Ideal for large shop display turntables and turning antennaes

Famous English Automatic "Garrard" Record Changers

£13.19.6 $27·95



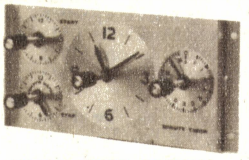
Type 1000, automatic record changer and player wired for stereo. Latest 240V 1967 model just released. Takes all size records 45's, 10" and 12"—up to 9 records at a time. Features many refinements: 4 speed laboratory series motor, adjustment for pick-up height, adustment for stylus pressure, etc. Brand new in cartons. Complete with "ACOS" G.P. 90-k Sapphire Stylus. With "ACOS" stereo 73-2A Sapphire cartridge extra $3.25. List price $52.90. Pack, post $1.50. Our price only

4 Transistor 3 Watt Output

AUDIO AMPLIFIERS

79/6 ($7.95) Freight Free

Fresh 1967 current production brand new in cartons with instructions. Specially designed to provide a complete and reliable basic unit for portable gramophones, radios, intercoms, tape recorders, P.A. systems, etc. Latest printed circuit design suitable for 3 to 15 ohm speakers. For use with 9v. transistor radio battery. Frequency response 150-10,000 c-s. A pair are ideal for stereo. Size only 3" x 2".



"G.E." TIME CLOCKS

97/6 $9·75

Post, pack 7/6. Another fantastic purchase. Canadian "General Electric" 240 volt A.C. mains, time clocks originally for "G.E." automatic stoves. 30 amps. rating (7,200 watts). Size 7½" x 3½". Has modern, inbuilt, cont. duty electric clock with start and stop settings; in a 12-hour range. Also separate '0 - 60 mins' clock. Beautifully made and selling at a fraction of their original cost. Use for "stop-start" electric motors on pumps (up to 9 h.p.); ideal for our 240v pump units—lights etc. or use as a very accurate electric clock.

Ideal for early morning start of radios, automatic switch-off of TV, tape recorders, etc.



NEW ARMY TANK AERIALS 22/6 ($2.25)

Rail freight collect.

3 piece 12' coppered spring steel. **Mounting base to suit, 15/6 ($1.55).**

English Microphone TRANSFORMERS . . . suits all types of microphones . . . **6/6, 65c.**

Vibrators, English, 12 volt, 4 pin. **New, checked.** List price $4.35, **now only 8/6, 85c.**

G.E.T. 8 Transistors by General Electric.

G.E.T. 8 TRANSISTORS in matched pairs. Operates up to 30v. and two give up to 40 watts in push-pull.

PAIR—$2.95

Famous "Richard Allan"

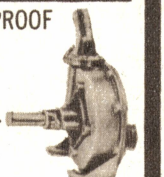
NEW ENGLISH 12" SPEAKERS

77/6 ($7.75)

FREIGHT FREE

Terrific offer—highest quality 12" loud speaker with built-in tweeter. Uses powerful Hi-Flux magnet for wide frequency range reproduction. Hi Fi and Stereo. Size is 12" x 5" deep. 2 types available, 3 ohm and 15 ohm. Takes 6 watts easily.

SALTWATER-PROOF ¾" CENTRIFUGAL PUMPS



£6/10/- ($13.00) **Pack, Despatch & Freight, 10/-.** A real scoop! Direct purchase of top quality pumps, **1" inlet: ¾" outlet; capacity up to 2,400 g.p.h.** Rust-proof, all metal, with **replaceable bronze bearing. ½" stainless steel** shaft for pulley or direct drive. Pump will pass lint, sand, dirt, etc., through pump without clogging. "Oiled for life" design. ¼ h.p. motor 1,500 g.p.h., 10' head—900 g.p.h. 20' head. ½ h.p. motor 1,800 g.p.h. 25' head—1,000 g.p.h., 50' head. Brand new 1967 model fully guaranteed

INDUCTION MICROPHONES 17/6, $1.75

Will pick up sound waves from a distance. **Has suction cap, long cord and plug for tape recorder, etc.** Sticks to wall or case of telephone for recording speech.

Famous American 'MAGNESYN'

REMOTE READING MARINE COMPASSES

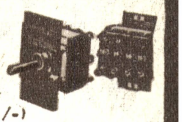
£16½ ($33.00)

(Pack, despatch and freight 15/-). Comprises sealed compass transmitter, fully compensated; repeater indicator, fully luminous; 3 dial with course setting pointer; 24v. power unit. Unit complete with all plugs. New, completely checked and calibrated by top instrument maker. Compass transmitter can be positioned anywhere on boat away from magnetic interference with remote indicator near wheel.

Magnificent "Cutler Hammer"

TOGGLE SWITCHES

7/6 (75c)



(Post pack 1/-)

4-pole 3-way (3-position) panel switches (centre off). Made for U.S. Govt. at a cost of 35/- ea. Luminous tip on switch. Solid silver contacts. Size 1½" x 1¼" x 2" high. Handles 10 amps. at 12 or 24/32 volts D.C. Ideal for panels, control boards, etc.

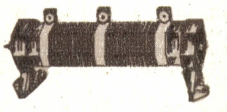
24v. 35 amp 2 position **AIRCRAFT SWITCH, SILVER CONTACTS. NEW 7/6** (75c). Post free.

ADMIRALTY PATTERN MICROPHONE & HEADPHONE SETS, 20/-



Pack, Despatch and Freight, 5/-

Comprises double earphones and metal "Tannoy" microphone with "press-to-talk" switch. Beautifully made. 6' lead. Ideal for transmitters, P.A. systems, **"Tannoy" Mike separately 7/6. Post 3/-. Earphones separately 12/6. Post 3/-.**



Variable Resistors (400 watts). 1 ohm, 12 amp use for any voltage. Made by "Birch", England. **25/- ($2.50).** Post 3/- (30c).

U.S. NAVY RELAYS—12 volt, 50 ohm — 2 make and for 2 circuits — beautifully made — silver contacts.
New ! **15/-, $1.50**
SINGLE MAKE & BREAK up to 10 amps for 12/24/32v. D.C. Size 4" x 1½".
New ! **15/-, $1.50**
"LEECH" 2 MAKE & BREAK 24V. D.C. (O.K. for 12V.) 95 ohms. Size 3" x 1½".
New ! **15/-, $1.50**
U.S. SEALED RELAY, 28V., 250 ohms, 1.5 amps at 24V. or 115V. A.C. Size 3" x 2".
New ! **15/-, $1.50**

PACER PHOTOCOPIER

Only £28'10'-; ***one-third the cost of the nearest competitor plus performance and economy to rival machines in the $2,000 bracket.***

PACK, DESPATCH & FREIGHT, 30/-

Write for full information

Silicon Rectifiers

Huge direct manufacturer's purchase! Fresh 1966 production by S.T.C. Type Type RTCDD Rated 800 P.I.V. **¼ amp** **$1.65**
B.T.H. Germanium junction rectifiers G.J.7.M. P.I.V. 70 **¼ amp** **95c**
Amps of both can be increased by 100% by using sheet tin cooling fin.

MAIL ORDERS: 36 HELEN ST., VALLEY, BRISBANE, Q'LAND

• GILT-EDGED MONEY BACK GUARANTEE ON ALL GOODS RETURNED UNUSED • WRITE FOR OUR FREE CATALOGUE —

Zealand of the Moscow programs in English on both medium and short waves. The transmissions are 2130-2200GMT on 647KHz (Moscow) and 6100, 7250, 9540, and 11735KHz (relays); 1130-1200GMT on 1477, 6100, 9540KHz; 1230-1300 on 1477KHz, and 6110, 7250, 9540KHz; 1330-1400GMT on 1477KHz and 6110, 9540, 11860, 15130KHz.

VATICAN—Vatican Radio has two transmissions in English for Australia and New Zealand. The 2202-2220GMT service is on 9650 and 11740KHz, and the same program is repeated at 1130 to 1150GMT, on 17820 and 21515KHz.

YUGOSLAVIA—Radio Belgrade has English broadcasts to South Asia, 1530-1600GMT on 11735, 15240KHz; also on 1830-1900GMT session on 6100, 7200KHz and 2200-2215 on 6100, 7200KHz.

SAO TOME RELAY BASE

Radio Portugal in Lisbon has announced the use of its first overseas relay base. This is the Sao Tome station, off the coast of West Africa, for rebroadcasting some of the Lisbon programs, which uses 4807KHz and the power of 10KW. It carries the English program from Lisbon at 2145GMT. The program is beamed for listeners in Africa, but should be heard world-wide. Radio Portugal will be pleased to receive reports on this new relay over the Sao Tome transmitter and these can be sent to Lisbon or Sao Tome. A special verification card is being prepared for this relay station.

Sao Tome is located on the equator and is the most south-westerly on a line of four islands running diagonally across the Gulf of Guinea.

GREENLAND VERIFIES

A verification card has been received from Greenland, together with a folder showing a photograph of the Broadcasting House at Godthab. Details on the card confirm reception of the station on 5980KHz at 1030GMT, and also remarked that it was as a "real round the world reception" report. The station operates daily an 8 hour program schedule in Greenlandic and Danish, which includes current activities, news, entertainment and music. The station's medium wave operates on 570KHz with 1KW, 650KHz 5KW, 820KHz 5KW and short wave on 5960 and 5980KHz with 1000 watts.

Greenland is the world's largest island, according to the card (what about Australia?), the polar circle passes through it; the climate is arctic; it is part of the Kingdom of Denmark; has a population of 50,000; and the area is 840,000 square miles. Godthab, the capital city, has a population of 5,000, and is the site of the broadcasting studios.

THREE 250KW FOR DARWIN

The Collins company, of the U.S.A., is to supply three 250KW transmitters for Radio Australia's new relay base at Darwin (the booster station for the Melbourne program). The contract includes all power supply and ancillary equipment. Work has now begun on the station buildings and masts, and tests should begin later this year. However, the base is not expected to be operational until about the middle of next year.

The base has been under construction for some time, but considerable preliminary work had to be undertaken to provide access roads, because of the remoteness of the location.

When the station is in operation, Radio Australia will have a very strong signal into South-East Asia, and its world-wide coverage will be considerably improved.

CANADIAN SIGNALS

Marconi Radio, Montreal, is the identification announcement of CFCX 6005KHz at 0800GMT, which has been received at good level. The station, which relays CFCW medium wave, was established in 1919 and claims to be the oldest station in North America. Power is now 500 watts, raised from the former 75 watts. The all-night transmission was received to 0900, when the channel is blocked by Radio America, Swan Island.

Halifax Nova Scotia is received on CHNX 6130KHz and the signals from this commercial station have been received at 0700GMT when a news bulletin is presented. The station has sports news at 0730GMT, and can be heard till after 0800, with some sideband interference from Tahiti 6135KHz. CHNX relays CHNS the broadcast band key station.

AFRICAN SIGNALS

Reception of African stations is best during the equinoctial seasons March and September, but during the winter months reception from 1700 to 2000GMT is possible in New Zealand, and for a much later period by listeners in Australia.

Recently Bob Padula of Melbourne reviewed the reception of some of the most interesting signals for us, and his summary is given below. Most of these stations should be heard during our winter months.

LIBERIA — The voice of America station at Monrovia is using the frequency of 15295KHz for a relay of the V.O.A. Portuguese transmission, beamed to Brazil. Broadcast times are 2200 to 0100GMT.

TANZANIA — Radio Tanzania at Dares-Salaam is using 5985KHz for a program in Swahili. Transmission time is 1900 to 2000GMT, when the station sign off is with full identification and national anthem.

ANGOLA — CR6RU Radio Club de Congo Portuguese is noted on 4850KHz at 2030GMT. Radio Angola on 4820KHz at Luanda is heard at 1930GMT on Saturday with a football relay in parallel with 6025KHz. Radio Commercial on 4795KHz is heard at 2045GMT with a weak signal.

MOZAMBIQUE — Radio Club of Mozambique, Lourenco Marques is heard on 6050KHz with a commercial program in English. Signals were received from as early as 1730GMT, and the station left the air at 1800GMT. Religious service on Saturday on 4755KHz is noted 2000 to 2100GMT, while a further frequency, with English programs is on 4855KHz at 2000GMT.

TRANS WORLD RADIO

Trans World Radio was founded in 1952 as a media for mass communication of the gospel message and while officials of the station were visiting Morocco, it was found that the establishment of the station at Tangier would be permitted. Spain, its major target area, was across the Strait.

So the Voice of Tangier came on the air in 1954 with a 2500W transmitter. On January 1, 1956, it extended its broadcasting by using a 10,000W transmitter. By 1959 expansion had reached the stage when programs were being beamed to 42 countries, in more than 20 languages. In February, 1959, all communication facilities in Morocco were nationalised and so the Voice of Tangier had to close.

Monaco then agreed to be the new home of Trans World Radio, and on October 16, 1960, Trans World Radio at Monte Carlo, with a 100KW transmitter, replaced the Voice of Tangier. A system of eight high-gain directional antenna was subsequently put into service to beam programs in 43 languages to Asia, Africa and Europe.

Efforts were then put in hand to reach Latin America more effectively, and in 1962 recommendations from communication experts placed Bonaire in the Netherlands Antilles as an excellent site to cover Latin America. A 180-acre site on Bonaire was made available to Trans World Radio and construction of the station started in 1963. Today with its Monte Carlo and Bonaire facilities Trans World Radio is now the most powerful gospel broadcaster in the world, utilising a power of over 750,000 watts. The Bonaire transmitters are also used by Radio Nederlands for relay of its programs to both North and South America. Trans World Radio signals are consistently received by listeners in the Pacific area.

SOMALI RECEPTION ON 6105KHz

Signals from the Voice of Somali at Mogadisco on its new frequency of 6105-KHz are providing good reception. Transmissions in English have been extended and are now 1700-1800GMT with news at 1730GMT. On Wednesday at 1745 the program "This Week at the United Nations" is broadcast, while on Friday the time is devoted to popular music. The station uses 50KW on this frequency, and announced it was also carrying the same program in the 41 metre band.

The Somali station is received at fair level, though sideband interference from nearby signals is often troublesome. Identification is given as "This is the Voice of Somali Republic broadcasting from Mogadisco." Local time is three hours ahead of GMT.

During the program, some commercial announcements have been heard. These are normally transcribed announcements for world famous products which have been recorded in Britain.

BEIRUT MOVES TO 11785KHz.

The frequency move by Radio Beirut in Lebanon, from 11760KHz to 11785KHz has resulted in clear reception of the signals. Previously, transmissions were blocked by Vienna for the period 0200-0400GMT on the 11760KHz frequency, while at 0345-GMT the B.B.C. European Service also uses the channel. Radio Mozambique and Radio Havana (Cuba) have also been observed on this crowded frequency. Beirut has English from 0230 to 0300GMT, following the Arabic service from 0200GMT. After programs in Spanish, the station leaves the air at 0400GMT.

Beirut verifies with a card giving details on the frequency, time and date of reception and has been one of the most regular Middle East signals in this area in the afternoon listening period for many years.

FLASHES FROM EVERYWHERE

AFGHANISTAN: Radio Kabul now broadcasts in German at 1730-1800GMT using 11765KHz. Another frequency, 15265KHz, is used in chain, according to verification. In addition, the frequency of 4770KHz, using 50KW, has been observed with English news at 1400GMT. The station closes at 1700GMT, after programs in Persian.

BRITISH HONDURAS: Radio Belize is now verifying with a beautiful verification card reports Sweden Calling DXers. The station is on the air daily 1200-0400GMT on 834KHz medium wave, with 20KW, and 3300KHz with 5KW.

CAMEROON: Radio Garoua is being heard on 5010KHz after 1930GMT. Reception is blocked before this time by the use of the channel by Malagasy station, also on 5010KHz. Programs from Garoua are in French at 1930GMT. The station verifies with a card.

BEIRUT: Transmission from Radio Lebanon to Africa, on the air 1830-2030, has moved to 15350KHz. The transmission opens with English at 1830GMT, and continues in other languages, each with a 30-minute time duration. A transmission to North America in English 0230-0300GMT continues to be received on 11760KHz.

SOUTH AFRICA: Radio RSA Johannesburg has opened a new 16M band frequency. Using 17792KHz the transmission has been heard 1700-1755, 1800-1855 and 1900-1955GMT. A transmission at 1800-1855 in English is beamed to the United Kingdom; this was formerly scheduled to use 11785, 9525KHz.

PAKISTAN: Radio Karachi has news at dictation speed 1335-1350GMT. Two frequencies are in use, 9635 and 21590KHz. The latter frequency replaces 17945KHz. Karachi is interested in having reception reports on this transmission of dictation speed news.

SOUND PROJECTORS

Cinevox Prefect 16mm in good working order. 240v operated, complete with speaker and amplifier.

£57-10-0 $115.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

12/6 $1.25 each

Post 10 cents

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1½in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule,
1 Lampholder.

18/6 $1.85

Post: N.S.W., 30c: Interstate, 40c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

£11-10-0 $23.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

AERIAL CAMERAS

F.24 Mark IV 2.9 Lens, stops 11, 8, 5.6, 4, 2.9.
With 3in x 3in F1 Dallmeyer Lenses complete with wooden case.

£19-10-0 $39.00

50c Cartage to Rail. Freight payable at nearest attended railway station.

SHIPS' CLOCKS

(No bell). Smith's 8-day, fully jewelled. Original cost $120. Special 7in brass $25. 10½in Seth Thomas splash-proofed bakelite

£15 $30

Post N.S.W., 70c: Interstate, 95c.

MINIATURE ELECTRIC MOTORS

1½ to 3 volts DC, ideal for model boats, cars, planes, etc. Strong torque. Only

39 cents each

(Post 7c)

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1,320ft coil of twin (equal ¼ mile). $7.00 per coil.
Post, N.S.W. 70c: Interstate $1.20.

3000 TYPE RELAYS

P.M.G. 200 Ohm — 1,500 Ohm Coils, $1.25 each.

AWA OSCILLOSCOPE

Calibrated with delay time base. 5in, 240 vac., perfect.

£97-10-0 $195.00

AMPLIFIER

Subminiature 4-Transistor, Audio Push-Pull.

£3-10-0 $7.00 Post 50c

GOOSE NECK LAMP

NEW. IDEAL FOR DESK or WORK BENCH. Adjustable shade, strong metal lacquered base and frame. Height 18in. Complete with lead.

12/6 $1.25

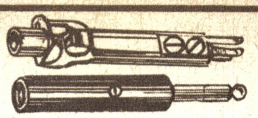
Post and packing, $1.00.

HAND BEARING COMPASS

Brand new in wooden carrying case, complete with batteries.

£17/10/- $35.00

Post, N.S.W. 70c; Interstate, 95c.



P.M.G. Phone Jack and plugs, 25c each, 45c the pair.
Post 7c.

NIFE CELLS

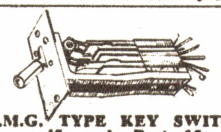
1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

10/- $1.00 each

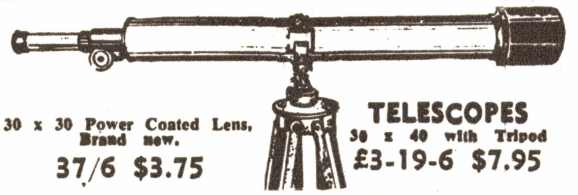
Post, N.S.W., 25c; Interstate, 35c.
1.2 volts 15 AH, 8in x 4in x 2in, $2.95.
2.4 volt 10 AH, 6in x 2½in x 2in, $2.50.
Post, N.S.W., 30c; Interstate, 40c.

PERSPEX

Slightly domed shape, 16in x 12in, $1.55. 2ft 6in x 18in tapering to 6in, $1.75. 2ft 6in x 2ft, $2.45. Domed approximately 3ft 6in x 2ft, $5.50.
50c cartage to rail. Freight payable at nearest attended railway station.



P.M.G. TYPE KEY SWITCHES. 45c each. Post, 15c.



30 x 30 Power Coated Lens, Brand new.

37/6 $3.75

60 magnification with a 60mm coated objective lens. With Tripod.

£11-10 $23.00

As illustrated.
Postage, 95c; Interstate $1.20.

TELESCOPES

30 x 40 with Tripod

£3-19-6 $7.95

ASTRONOMICAL TELESCOPES

3¼" Reflector. 126 Magnification complete with 4X Finder and Equatorial Mount.

£29-10-0 $59.00

Post N.S.W. 70c, Interstate $1.20

HIGH STABILITY RESISTORS

I.R.C. brand new ½w., 1w, 2w, tolerances between 1 and not exceeding 5% including 100, 360, 560, 750, 15K, 22K, 27K, 100K, 180K, 220K, 560K, 820K, ohms. Usual price 40c each, 50 assorted different values for only

37/6 $3.75

Post 15 cents

GENUINE VARIACS

0-115 V.A.C. 18 Amps, $29 each, or couple 2 together for 240 V.A.C.

The two for $45

Genuine American Zenith Variacs

0-115 V.A.C. 7.5 Amps, $19.50 each or couple two together for 240 V.A.C.

The two for $36.

50c cartage to rail. Freight payable at nearest attended railway station.

522 TRANSCEIVERS

100 to 150 m/cs.

£17-10-0 $35.00

KLYSTRON MIXER/DUPLEX units, 9375 megs, complete with crystals, $13, £6/10/ each.
Post, N.S.W., 45c; Interstate, 50c.

FRACTIONAL 240V AC MOTOR

1/25 h.p., new, with coupled 2-speed gearbox. 1425 and 300 r.p.m. Ideal for rumbler, etc.

£10-0-0 $20.00

Post N.S.W., 70c; Interstate, 95c.

SWITCH BOARD FRAMES

Steel ex-P.M.G. Height 45in x 27in x 34in will make ideal test bench. £5 — $10.
Freight payable at nearest attended railway station.

VALVES

BRAND NEW

IN CARTONS.

Special discount for quantity

807	$1.75	6AG5	50c
6SN7GT	95c	12AU7	$1.00
89	$1.00	X61M	$2.20
12SA7	$1.25	CV850	$1.50
6H6	45c	1H6G	30c
41	$1.25		
5U4G	95c	832	$5.00
77	$1.00	6F13	75c
VR150-30	$1.00	6AK5	$1.50
		6X4	$1.00
5CPI	$3.95	6F8	75c
EF50	35c	6N7	$1.00
6U7	75c	12SK7	50c
V1103	$1.00	VR1120	50c
VH120	75c	VR118	75c
IL4	$1.00	VR65	25c
5Y3	$1.50	VT4C	75c
6C4	50c	AU3	$1.00
CV2184	$2.25	80	$1.25
2 x 2	75c	6AK5W	$1.50

PLEASE ADD POSTAGE ON ALL ARTICLES.

C.M.A. CABLE

240 volt 3/.036 black, new and perfect. 100 yds. rolls, $3.00, 6 or more.

£1-5-0 $2.50

30c cartage to rail. Freight payable at nearest attended railway station.

MICROMETERS

Brand new Goodell-Pratt, 0 to 1in, $7.50; Slocombe, 1in-2in, $7.85; Starrett 1in-2in, $9.85.
Post, 32c.

CHOKES, 7.5H, 60mA 95c
VIBRATORS, 6 volts, 7-pin, 75c each.
UNISELECTORS, 4 BANK, $4.00
INVERTERS, 26v-115v 2Kw 400 cycle $9.50
HAND MICROPHONES, with Press-to-Talk Switch . . 95c ea.
Post, N.S.W., 25c; Interstate, 30c.
INSTRUMENT TRIPODS, sturdy wooden frame. Telescopic Extend to 4ft 6in $13.00
SELSYN MOTORS MAGSLIP Mk. II . . . . . $5.25 ea.
No. 19 2-way radios, with hand set, power supply, leads. $35.00
Meggers, bridge type, complete and tested $75.00
EVERSHED and VIGNOLES, 500 volts.

BINOCULARS

PRISMATIC. Coated Lenses. Brand new. Complete with case.

8 x 30	$18.75
7 x 50	$22.15
10 x 50	$23.07
12 x 50	$23.95
20 x 50	$24.75

Post, N.S.W. 70c; Interstate, $1.20

ELECTRONIC KIT

With solar cell can experiment with 20 different circuits, including wireless, microphone, morse code, transistor radio, audio frequency amplifier, telegraph, transmitter, intercom., signal tracer, etc. No tools, no soldering. Easy to assemble. Assembly manual included.

$19.95

Post N.S.W. 45c, Interstate 60c.

PROJECTOR LAMPS

BRAND NEW PHILIPS

240 volts. 750 watts. Base down.

£1-5-0 $2.50 Post 13 cents.

4 DIGIT RELAY COUNTERS

50-volt D.C., suit slot car. Lap counters, etc.

$1.25. 12/6 each.

Post 13c.

RECORDING TAPES

SCOTCH BRAND.
EX-WOOMERA.
SLIGHTLY USED.
PERFECT ORDER.

Ideal for professional quality audio recording.

1200ft 7in reel ¼in $2.75. Post 12c.
600ft 5in reel ¼in $1.68. Post 12c.
200ft 3in reel ¼in 65c. Post 10c.

CRYSTAL CALIBRATOR

With 500kc crystal up to 32 m/cs. used, good condition. £4/17/6 ($9.75). New (£6/10/-) $13.00

ALTEC STUDIO MICROPHONES

639B Western Electric, top grade, original cost $250, ideal Broadcast Studio, music recording, Church and play recording etc., £45, $90.

SCOOP PURCHASE

Gramo. Motors, New. Made in U.S.A. 4-speed. 240 volt A.C. 50 cyc. Only $2.75 each.
Post, N.S.W., 30c; Interstate, 40c.

240-110 VOLT 6KVA TRANSFORMERS

Encased, including switches, as new, $50, £25.

SPECIAL lucky dip valve offer. 15 new valves in cartons for only $2.00. We haven't got time to sort them, so you reap the benefit. Post, 30c.

SOLENOIDS

Plunger Type 12V 300M.A. Suit electric camera control, miniature trains, radio, etc.

$1.25. Post 10c.

200 Mill. amp., 24 volt, 1/8in push movement.

$1.25. Post, 10c.

BATTERY CHARGER

6 or 12-volt, 2½ amp, without meter, $10.50, £3/5/.
2½ amp with meter, $12.60, £4/6/6.

Post, N.S.W., 70c; Interstate, 95c.

TELEPHONES

Sound Powered. Can be used as Microphone and Receiver. New. With 50ft cable.

$3.85 pair.

Post, 25c; Interstate, 40c.

CARPHONES

A.W.A. or S.T.C.

Two-way radio. 75-80 megs. cycles. 12-volt operated. £22/10/ ($45) each.

EX ARMY TELESCOPES

4 x 40 Handley, $6.50.
7 x 40 Otway angle telescope, $9.85. Freight payable at nearest attended railway station.

Deitch Bros.

70 OXFORD STREET, SYDNEY

SORRY, NO C.O.D.

PT: Cairo Radio is using the new 15KHz frequency with various langu- s for its external services. Station ses at 1430GMT with announcements Arabic. In the Pacific, interference is m All India Radio also on this same quency in the earlier part of the trans- ssion.

NCE: The ORTF transmissions from is carry news for relay by Brazzaville ly 0500-0530 in French and English 9500, 11960KHz; 1100-1145GMT in glish, Portuguese, and French 17850, 50KHz; 1845-1930 in Portuguese, nch and English on 9700 and 45KHz. Each language program is 15 nutes in duration.

ENLAND: Godthab is heard on 9KHz at 1110GMT till after 0GMT, and though this frequency is fering from interference, reception of nals from Greenland is fair in Europe.

GUAY: Radio Oriental, Montevideo, s been heard on 11735KHz at 2330 after 2400GMT in the United States. wer is listed as 5KW, but seems to have n increased recently.

K and CAICOS ISLANDS: The local tion uses a Marconi transmitter of 100 tts, with a half-wave centre-fed hori- tal aerial, 50 feet high, with main tern east-west. Broadcasts are daily, nday to Saturday, at 1830, for the pple of Turk and Caicos, and last for to 20 minutes. Programs consist of ather reports, forecasts, local news and asional advertisements. Hurricane rnings are also broadcast on the fre- ncy of 8000KHz, reports a recent rld Bulletin.

IOPIA: Addis Ababa over Radio Ethio- is back on 7290KHz from 7265KHz. program in English has been heard at 0-1700GMT. The same broadcast is medium wave 870 and 940KHz. Other glish sessions are at 1015-1100 on 6185, 0.

OI: The "Voice of the Democratic ublic of Vietnam" is now being re- ed at 1300 and 1530GMT in two 30- ute sessions in English. Frequencies 11760, 9760KHz and 1240KHz on dium wave. Signals are best on 60KHz at 1300GMT in this area.

GOLIA: Ulam Bator is reported from ope and America as being received on low frequency of 3222KHz. The sta- opens its transmission at 2200GMT.

LIN: Radio Berlin International, East Germany, has transmissions to rth America in English. Two trans- sions are to the East Coast and two he West Coast of North America. Best ption is at 0445-0515GMT when the smission is on 9650KHz. Every second day the program is devoted to the dio Berlin DX Club session which udes DX tips and information general short wave reception.

OTES from readers should be sent ARTHUR CUSHEN, 212 Earn et, Invercargill, N.Z. All times are enwich Mean Time, add 8 hours for h, 10 hours for Sydney and 12 hours Wellington time. All frequencies in hertz (KHz) previously shown as cycles (KC).

.: Voice of America is to celebrate twenty-fifth anniversary on August 1. s is being marked by the issue of a commemorative postage stamp by the ted States Government. Listeners who to receive a first-day cover should d to the Postmaster, Washington, D.C., .A. sufficient to cover the new stamp prepared return envelope.

'UGAL: Lisbon now has its DX Club gram on the air every Monday. Trans- sion to the Pacific is at 0745GMT 40KHz. At 0830GMT the program med to Japan is received on 17740 and 21495KHz. The session is of 15 minutes duration, and some of its material is prepared and recorded in the United States.

HAITI: Station 4VEH at Cap Haitian now operates in French 1000-1700, and in French and Creole 1730-0330 on 2450 and 6120KHz. Also 1000-1100 in Spanish, 1100-1400 English, 1700-210 in French and 2100-2400 Spanish, on 9770 and 11835KHz.
Station 4VEH is also providing good reception when it opens transmission on Sunday at 1000GMT. The frequency of 6120KHz is used, and the station opens with an interval signal of chimes, then the Haitian National anthem, followed by station identification in French. At 1000 GMT a program of gospel music is presented.

BRAZIL: Station ZYU60 uses 5965KHz for its transmissions from Porto Alegre. The station opens at 0900 and the program on Sundays is best received at this time. Light music, with frequent commercials in Portuguese, are a feature of the session, which can be heard to as late as 1000GMT. The station slogan "Radio Guaiba" is heard frequently.

NICARAGUA: Radio Zelaya is now answering reports with a printed letter, and verification card. According to the letter, reports in English will be accepted. The station operates on 5950KHz with 500 watts, and has been heard opening at 1100GMT. At times, it uses an English sign-on announcement.

THAILAND: Station HSK9 at Bangkok is now using the new channel of 11920KHz. Formerly on 11910KHz, the station has been heard at 0930GMT, opening transmission. English from Bangkok is broadcast at 1030GMT. Another Bangkok station, operated by the Ministry of Education of Thailand, uses 6062KHz. This opens at 1100GMT with English announcement at fair signal level.

PAKISTAN: The headquarters of Radio Pakistan is now Rawalpindi, and the full address for reports is Radio Pakistan, Listeners' Research, Directorate-General, Radio Pakistan, Rawalpini. East Pakistan from Dacca has been noted on 21685KHz 0700GMT.

HUNGARY: Radio Budapest transmission to Australia and New Zealand has inaugurated a DX program which is broadcast on Wednesday at 0800GMT to 0815GMT. On Friday the session is repeated at 1015GMT, both on 11910, 15160, 17795KHz. The station is keen to learn of reception in this area and reports should be sent to Radio Budapest, Hungary. The North America service has the DX program at 0140 and 0440GMT on Tuesday, and Friday at 0330, Saturday 0310GMT, using 9833KHz, while 7220, 11910KHz also carry the same program.

WNYW DESTROYED BY FIRE

On Sunday, April 9, the transmitting facilities of WNYW Radio New York World Wide were destroyed by fire. The transmitting plant of five short-wave transmitters located at Scituate Mass was completely destroyed and WNYW is no longer on short wave. The station plans to commence broadcasting as soon as possible. Readers will recall an announcement some months ago of a scheme for a new high powered transmitting plant near New York, and it is anticipated this project will be rushed to provide the transmitters necessary for WNYW.

The new transmitter site is near Chatsworth, in New Jersey, and it will include two 250KW, one 100KW and two 50KW transmitters, beaming programs to Europe, Africa and Latin America. It is due for operation later this year.

KENYA: The Voice of Kenya at Nairobi has recently opened a new service using a 100KW transmitter. The frequency of 4915KHz is used daily 0300-0500, 0900-1100, and 1400-1700 according to a letter from the station, and reported by Sweden Calling DXers.

U.S.A.: Voice of America relay station at Honolulu, Hawaii has been withdrawn from service and is not scheduled in the latest V.O.A. transmission schedule. First used as a wartime relay station with the call KRHO, the station was frequently heard in the South Pacific. In recent years it has been a small relay point for V.O.A. programs. While the Okinawa and Philippines relays of V.O.A. have been extended in their facilities to include million-watt transmitters, the Hawaii relay has been using its initial 100KW wartime equipment.

ECUADOR: Station HCJB in Quito uses 15385KHz for its service to Europe. The new channel is heard 1830-2100GMT at good level. HCJB's best signal is in the service to the South Pacific 0700-1000GMT on 11915, 9745 and 6050KHz.

BROADCAST BAND NEWS

ALBANIA — Radio Tirana is being well received on the new 1214KHz frequency at 1630GMT, in its service to Europe, and reports from Britain indicate that the signals cause interference to the B.B.C. Light Program on 1214KHz. The other new frequency for Radio Tirana is 1394KHz, which is on the air 0300-0330, 1600, 1630, 1930-2200. A session in Russian has been observed 2030-2100GMT.

MOZAMBIQUE — The Radio Club of Mozambique has made some frequency changes. Vernacular is now on 1295KHz, which replaces 1223KHz. Radio Pax is moved from 1295 to 1304KHz or 1310KHz.

AUSTRALIA — Recent tests on compatible single side band modulation have been conducted by the University of Queensland in conjunction with A.B.C. station 4QG in Brisbane, using 4QG's frequency of 790KHz and a 4QG 2KW auxiliary transmitter. In charge of the tests is Mr M. P. Moody, post graduate student of the University, who is preparing a thesis on the subject for his doctorate degree. In a letter to us, Mr Moody commented favourably on the fact that his signal had reached so far on only 2KW; a fraction of 4QG's normal power. The tests took place after normal sign off of 4QG from 1405-1505 and were divided into four 15-minute sections, two on normal transmission and two on single side band. The identification of each was not given to the listener in order to obtain an unbiased opinion of reception. A tape recording we supplied showed the order of performance for each type of modulation system, as observed in Invercargil.

INDIA — New stations put into service by All India Radio in recent months are: Bhagalpur (1470KHz), Mathura (1530), Udaipur (1170), Aijal (920), Agartala (1270), Colmbatore (1010), Gulbarga (1110). Indore has changed frequency to 1590KHz. Most of these stations carry the A.I.R. news in English at 1530GMT.

MALAYSIA — Three 50KW transmitters are to be installed for coverage of southern Malaysia and are to be located at Johore Bahru. The transmitters are part of the Malaysian Government's expansion plans aimed at strengthening the transmissions in the southern Malaysia area. Johore Bahru is the site of a present Radio Malaysia transmitter. The new transmitters are being built by Tokyo Shibaura Electric Company (Toshiba) of Japan. The transmitters are the latest model and the largest transmitting complex ever exported by the Company. Radio Malaysia also announced plans to install one 250KW short-wave transmitter for its overseas coverage.

New Electrolytic Condensers

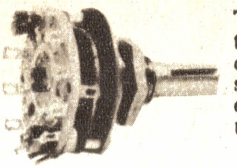
These condensers are miniature pigtail type insulated new stock in packets of 12, each packet containing; 3, 16mfd 300V.W., 2-32 mfd. 300V.W., 1 25mfd. 450 V.W. and 6 low voltage electrolytics. **$2.50.**

Post and packing 20c extra.

NEW IMPORTED 4" P.M. SPEAKERS

Available with a 4 or 16 ohm voice coil. **$2.50.**
Post and packing 30c extra.

New English Miniature 11 x 1 Switch



These new miniature eleven-p tion single-bank switches are diam. with ¼" spindle, they h silver-plated contacts and h quality insulation suitable for H use.

65c each. Post and packing 10

Imported National Transistorised Shoulder Megaphone

These shoulder megaphones manufactured by National Radio Japan have an output of 4 watts, and are supplied complete with inbuilt horn type speaker, batteries and microphone. List price $78.

Special Price $50. Post extra
Other types also available.



NEW AMERICAN TWIN TELESCOPE TV AERIAL

Extends to 36in each sect can be used singly for ca portable .. **$1.50** Post

NEW 4-SPEED STEREO PLAYER F.O.R. .. $17.50 (£8/15/)

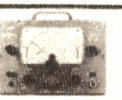
NEW STEREO CHANGER. 4-SPEED F.O.R. .. $21.50 (£10/15/)

SLIDER-SWITCHES
10 pole 2-way silver plated contacts

POWER TRANSFORMER

Prim. 240V Sec. 350 volts a side. 60 M.A. One 6.3V, one 5V F11.

$2.75 **Post N.S.W. 60c, Interstate 80c.**



LEADER SIGNAL GENERATOR LSG

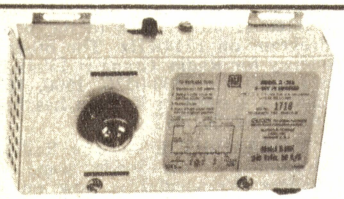
240V A.C. operated, 6 band 120KC to 390 r
Provision for crystal.
Post N.S.W., 75c; Interstate, $1.25. **$29.**

BATTERY CHARGER RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volt, with circuit for charger, $4.75. Post, N.S.W., 75c; Interstate $1.00. As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; Interstate, 45c. Transformer for above, $3.75. Post, N.S.W., 35c; Interstate, 45c.

NEW 240V. A.C. MOTORS

These small motors, size 5in x 3in x 3¼in, are 1-12 h. but are only suitable for intermittent use. $2.95. P N.S.W. 35c; Interstate 50c.



$9.75 (£4/17/6) POST FREE

NEW AMERICAN TV POWER BOOSTER UNIT AT LESS THAN HALF PRICE

(EX LIQUIDATION STOCK H. G. PALMER)

These TV POW-R boosters can be used in two ways. Firstly as a "straight-th circuit giving extra boost to the TV signal for improved performance on receiver.
Secondly to boost signal strength to two or three TV receivers coupled to one aerial.

Full instructions supplied with each unit. 240 volt A.C. operation.

THE NEW COLLARO 3-SPEED TAPE-DECKS $48.00 TRACK

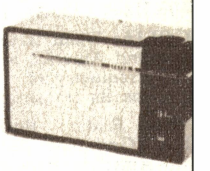


The ideal deck for the home constructor, as amplifier and all controls can be mounted on deck.

- 3-speed 1⅞, 3¼, 7½.
- Pause control.
- Takes 7in. spools.
- Simplified controls, 4 Tracks, $48; OSC Coils, $1.50.

NEW 4" EXTENSION SPEAKERS

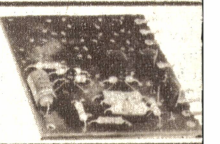
These 4" speakers are mounted in polished cabinets suitable for use as intercom, units or extension speakers.
LIST PRICE $12
SPECIAL PURCHASE ENABLES US TO SELL THESE UNITS AT $4.
Post and packing, N.S.W., 68c. Interstate, 98c.

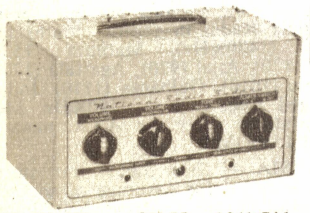


A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October Electronics Australia complete with kit of parts including transistors mono **$7.50**, stereo **$13.00**, 240 power supply for above **$7.00.**
Please specify if required for pick-up or tape heads.





25 WATT .. $53.75, £26/17/6
17 WATT .. $43.75, £21/17/6
Post Extra on 15 Watt. N.S.W., 10/; Interstate, 15/. 25 Watt by Rail or Air. Too Heavy for Post.

NEW 17 & 25 WATT P.A. AMPLIFIER

The 25 Watt Amplifier uses 5 valves plus 2 rectifiers including two EF86 low noise valves microphone preamplifier and two EL34 valves Ferguson push-pull output.

All amplifiers are fitted with Ferguson output transformers with voice coil tappings of 2 to ohms. The 25 watt amplifier can be supplied with line output transformers tapped from 1 to 600 ohms if required at $2.00 extra.

Inputs provided for microphones, pick-up, and radio with mixing facilties and tone contr

The 15 watt is as above but using two 6BQ5 valves in push-pull output.

12in speaker for above (10 watt) .. .. $6.75 .. 67

Crystal Microphones for amplifier .. .. $4.75 .. 47

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.



NEW TRANSISTOR SIX PORTABLE KIT AT LESS THAN HALF PRICE

(DESIGNED TO SELL AT OVER £30/-/-)

Excellent fidelity is obtained in this new kit set by the use of large speaker and polished timber case with attractive gold metal front panel. By using heavy duty batteries it is economical to operate and is ideal for portable use or that second set. Complete kit of parts is supplied with full instructions. CAN BE SUPPLIED WIRED AND TESTED AT £2/10/- EXTRA.

$23.75 (£11/17/6)

Post and packing N.S.W., $1.25 — Interstate, $1.75.

RESISTORS, CONDENSERS AND POTENTIOMETERS

We have purchased the resistor and condenser stock of manufacturers including S.T.C. and Stromberg-Carlson who have ceased the manufacture of television and radio receivers and can offer the same at less than 25 per cent of list price.

The resistors are mainly I.R.C. and Morganite in values from 200 ohm. to 5 meg. in ½, 1 and 2 watt ratings and include some wire wound resistors.

List price, $9.00 per 100. **Our price, $2.00 per 100.** Post and packing 25c extra.

The condensers are in most popular makes and include mica, ceramic, paper, and electrolytic in standard values.

List price, $11 per 100. **Our price, $2.96 per 100.** Post and packing, 35c extra.

The potentiometers are all current types and include switch pots, dual concentric and T.A.B. pots.

List price, $12 per dozen. **Our price, $2.50 per dozen.** Post and packing, 25c extra.

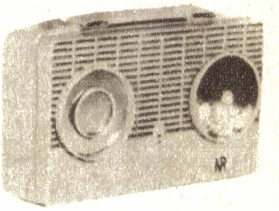
FREE For a limited period with each lot of resistors, condensers or potentiometers purchased we will supply free: One New Type Valve Type 6U7G, 6X5GT or 1T4.

SPECIAL — OFFER

Complete KIT for TRANSISTOR 6 PORTABLE $17.50

The complete kit of parts for the transistor six includes six transistors, printed circuit board, coil kit, 4in speaker, Ferguson driver and output transformers, heavy duty battery and all necessary parts to complete the set with full instructions. **Set is housed in attractive plastic case as illustrated.**

Dials available for all States. Post and Pack: extra. N.S.W., $1.00, Inter., $1.30.



NEW ENGLISH MAZDA TRANSISTORS

TYPE	EQUIVALENT		
XA101	OC45	R.F. Transistor	55c
XA102	OC44	Osc. Transistor	75c ea.
XB103	OC75	AUDIO general purpose	75c

Ducon type SFT 123 equiv. OC74 .. .. .. 75c ea.
Available in matched pairs at .. .. $1.50 pair

AUDIO OUTPUT

Post and packing on transistors 15c any quantity.

V.A. 23" E.H.T. transformers and 23" 110 deg. deflection yokes. New manufacturer's stock E.H.T. units $5.00. Deflection yokes $5.00. Post free

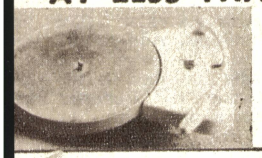
NEW VALVES AT BARGAIN PRICES

807	$1.75	3Q4	75c	6H6G	35c	6SJ7	95c
1A7GT	95c	3S4	$1.00	6K7G	45c	6SN7GT	95c
1C7G	30c	5V4G	$1.00	6K8G	68c	6SS7 equiv. 6SK7	85c
1D8GT	95c	6B8	$1.00	6Q7G equiv. 6B6G	$1.00	6U7G	45c
1K5G	40c	6C8G	50c	6SA7GT	95c	6X5GT	75c
1K7G	49c	VR99A equiv. 6J8G	$1.50	6SH7	55c	7C7	35c
1M5G	40c						
1P5G	25c						
1Q5G	25c						
1T4	45c						

12AT7	$1.00
1L5G	95c
12A6	50c
12SK7	50c
12SK8	50c
12SH7	50c
866	1.50
954	25c
955	25c
EK32	68c

Please add postage on all valves.

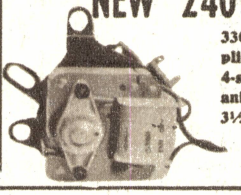
W 4-SPEED STEREO & MONO PLAYERS AT LESS THAN HALF PRICE



PHILIPS 4-SPEED
6V BATTERY PLAYER
MONO $9.75
STEREO $11.75

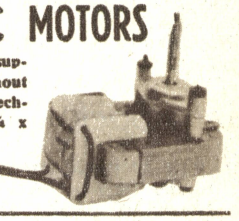
Post and Packing, N.S.W., 75c.
Post and Packing, Inter., $1.25 Extra.

NEW 240V. ELECTRIC MOTORS



3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾ x 3½, including spindle.

$2.75



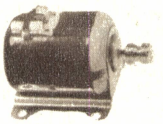


NEW PORTABLE RECORD PLAYER CASES TO SUIT THE ABOVE TURNTABLE

Attractive two-tone cabinet with plastic trim. Supplied with 5in x 7in speaker in felt-lined enclosure Space for amplifier and batteries or power supply.

Dimensions: 15in x 13in x 7in.

$11.50 Post and Packing: N.S.W., 90c; Interstate, $1.20.



NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1½ to 3 volts, 6,000 r.p.m. 39c each or $3.50 per doz. Post 10c.

EXTENSION SPEAKERS

.50 New 9 x 6 speakers in case. Post: Interstate, 55c; N.S.W. 40c.

W POWER TRANSFORMERS

A prim.: 240v with 230v tapping Sec. x 285 with 6.3v filament winding. A, $3.00. Plus Postage: N.S.W., 35c; rstate, 52c.

n.: 240v, Sec. 385 x 385 at 80mA, fil. and 5v, $4.50. Post.: N.S.W., 40c; rstate, 75c.

A H.T. Chokes, 75c. Post.: 20c.

T.M.K. MULTIMETERS

Before buying see our range of T.M.K. test instruments. As advertised in April issue of Electronics Australia.

NEW MIDGET POWER TRANS.

40mA prim., 240v. Sec 225 x 225 with 6.3v. Fil. Winding.

$3.25 Postage: N.S.W., 25c. Interstate 45c.

30mA 240v Prim. 150 x 150v. Sec. with 6.3v Fil. Winding.

$3.25 Postage: N.S.W., 25c. Interstate 35c.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools. spools.

2 Track, $35, 4 Track, $40.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398.

TECHNICAL BOOKS AND PUBLICATIONS

Plasma — "The fourth state of matter"

THE FOURTH STATE OF MATTER, by B. Grycz. Published by Iliffe Books Ltd., London, England. Soft covers, 8in x 5in, 120pp., many diagrams.

The author of this book is a Czech. and it was first published in Czechoslovakia in 1962. The work was translated by Zdenek Rudinger and the first English edition was published in 1966 by Iliffe Books Ltd., in co-edition with SNTL — Publishers of Technical Literature, Prague. It was printed in Czechoslovakia.

Although this book is only quite small, it is packed with information on the subject and is of a quite advanced nature. It is intended particularly for students of advanced physics and science, at colleges and universities.

The ancient Greek philosopher Empedocles advanced the theory that the world is formed of four basic substances; earth, water, fire and air. This idea was later replaced by the concept of the solid, liquid and gaseous states of matter. More recently, research into the effects of conduction of electricity in gases, has resulted in the study of a fourth condition, termed by Langmuir "plasma."

Before proceeding, it would be a good idea to arrive at some sort of definition of plasma. Webster quotes it in part as "an ionised gas containing about equal numbers of positive ions and electrons." An excerpt from the book under review says on page 15, "With respect to its composition, the common plasma constitutes a specific 'gaseous' mixture of a variety of particles: Molecules, atoms, ions, electrons, light quanta (photons), etc., their quantitative proportions depending on the given form of the plasma."

Note the word 'gaseous' in quotes. It appears that plasma only exists in the gaseous state and, although the elements concerned could be metals, they are in the form of a gas by virtue of the tremendous temperature. Without attempting to pursue this deep and involved subject further here, it is safe to say that the student of this book will gain much information and food for thought.

To give some idea of the contents, here is a list of the chapter headings: 1 — States of Aggregation of Matter, 2 — What is Plasma Physics?; 3 — Atoms, Molecules, Ions, Electrons; 4 — Fundamental Concepts of the Kinetic Theory of Gases; 5 —Charged Particles in Electric and Magnetic Fields; 6 — Interaction of Particles — Elementary Processes in Plasma; 7 — Fundamentals of the Kinetic Theory of Plasma, 8 — Thermal Properties of Plasma; 9 — Plasma as a Source of Light; 10 — Electrical Properties of Plasma; 11 — Energy Balance of Plasma; 12 — Macroscopic dynamics of Plasma; 13 — The Plasma/-Solid Interface; 14 — Plasma Diagnostics; 15 — Plasma in Nature and in the Universe; 16 — Electrical Discharges in gases; 17 — Plasma Torches; 18 — New High Temperature Manufacturing Processes; 19 — Technical Utilisation of some Magnetohydrodynamic Principles; 20 — Controlled Thermonuclear Reactions.

The foregoing list is a comprehensive coverage of the subject and in my opinion, students and other interested readers would do well to have a look at this book. Our copy came direct from London but it is reasonable to assume that copies should be available from the larger booksellers in the near future. No Australian price is available but to give some idea, the English price is quoted at fifteen shillings (I.L.P.).

Gernsback — Charts and Nomographs

CHARTS AND NOMOGRAPHS for Electronics Technicians and Engineers, by Donald W. Moffat. Gernsback Library book No. 121. Hard covers, 11¼ x 8¾in, spiral wire binding. Published in U.S.A. by Gernsback Library, Inc., New York. Australian price $7.40.

A review of this book appeared in our July, 1965 issue, when a copy was received directly from the publishers. At that time, we were unable to give information about local distributorship or price. We have now received a further copy from recently appointed distributors for Gernsback, who are Grenville Publishing Company Pty. Ltd., 154 Clarence Street, Sydney.

Our original reviewer gave the opinion that the book would be more useful to technicians than to engineers, and expressed disappointment that there were no transmission line charts, filter amplitude and phase charts, or frequency compensation curves.

However, it does contain a useful selection of data charts and nomographs intended to save time in some common mathematical calculations and to assist those who dislike doing long "sums."

The introductory chapter is a review of elementary maths, and this is followed by charts for straightforward unit conversion — voltage, wavelength, angular frequency, decibel/nepers, watts/horsepower, altitude scale, square root, resistor values, conversion of vectors, RMS/P-p. The nomographs cover current, voltage, power ratios vs. dB, various impedance combinations, reactance, efficiency, circuit Q vs. bandwith, square wave tilt, crossover networks, per cent modulation and others. The final chapter deals with the uses of curves to illustrate mathematical functions.

Even if it cannot claim to be comprehensive, this book does seem to contain a considerable amount of very useful and time saving material. (H.A.T.)

Amateur's Handbook

THE RADIO AMATEUR'S HANDBOOK, 44th edition. Edited by Byron Goodman, Soft covers, 9¼in x 6¼in. 704pp., over 1,300 illustrations. Published by the American Radio Relay League, Newington, Conn., U.S.A. Price in Australia $5.85.

This annual publication does not often change greatly from edition to edition. Last year some fairly extensive modifications were made, so it is not to b expected that there will be many significant changes this year. Such changes as have been made may be summarised as follows: The chapters on radio communications theory have been brought up-to-date to keep in line with latest developments; some new designs have been incorporated into the section devoted to equipment construction; valve and conductor data have been brought u date.

Every radio amateur should have a of this book, and, of course, most do. the benefit of those new to amateur who may not yet possess or have hac opportunity of seeing a copy, the follo summary of its contents may be usef

Chapter I deals with the matte amateur radio in a general way, natu with emphasis on the development of hobby in the U.S.A. Chapters 2 to 19 c basic theory and basic circuits in a comprehensive manner which is at lea good as, and in some cases rather b than, the material to be found in re textbooks. Chapters 19 to 24 deal more practical aspects, and include designs of transmitters, receivers and as ated equipment for the home constru operating practice, interference with stations, and other matters which the teur should know in the operation o station.

Chapter 25 is concerned with valve semiconductor data. This is followed comprehensive index and a "catalogue tion" — in other words, manufact advertisements.

If you bought last year's edition, th probably little in this latest edition to a you. If your copy is older, it coul worth your while to obtain this up-to edition.

Review copies were received direct the A.R.R.L., and also from The Tech Book Company, 295-299 Swanston S Melbourne. (H.A.T.).

TV Servicing

TV DIAGNOSIS AND REPAIR, by "P.F. Reporter" editorial staff. O ally published in U.S.A. by Foul Sams Technical Books. This ve published in U.K. by W. Foulshan Co. Ltd., Slough, Bucks. Hard c 8¾ x 5-5/8in, 96pp. Price in Aus $2.30.

This book is something of a "bitse far as the Australian reader is conce Since it was originally published in U.S.A., the fault-finding and case his are based on sets of American manufa This edition printed in U.K. has been vided with an introduction intende assist the British reader to relate the to British conditions. Add to this the that the material has been adapted articles originally published in the Ame servicing magazine "P.F. Reporter" an patchwork nature of the text becom parent.

However, these defects are by no as severe as one might be pre-dispos think. In the first place, despite the this book is not a guide to TV ser concerned with basic theory and ser technique. Rather, it is concerned l with accounts of the off-beat type of which causes the average servicema much bother, as readers of our re "Serviceman" feature will be aware.

Secondly, much of the material is sented in an entertaining case history —in fact, in this respect, it has a affinity, both in content and presentati our "Serviceman" stories. It can thu regarded as rather light but inform reading for servicemen generally an other technically-minded types.

The newly-fledged Australian servic with limited field experience could quite a lot from the case histories out It should also be borne in mind that Australian TV receivers are circuits loped in the U.S.A.; that a blocking lator, horizontal output stage, FM stage and other sections of a TV re are basically pretty much the same where; and that the need to adopt a l approach to servicing—to "use your nc —when faced with a puzzling fau universal. In view of this, despite th promising beginnings, this book cou

worthwhile having in the bookshelf or on the service bench.

Our review copy came from Grenville Publishing Company, 154 Clarence Street, Sydney. Copies should be available from the major booksellers. (H.A.T.)

★ ★ ★

TV TROUBLESHOOTER'S HANDBOOK, by the editors of "Electronic Technician." Published in U.S.A. by TAB Books, Drawer D, 18 Frederick Road, Thurmont, Md. 21788. Hard covers, size 7¾ x 5in, 192pp. Price in U.S.A. $6.95.

It is hard to discern much value for the average Australian reader in this publication. According to a short editor's note, it consists of "a collection of service hints, circuit description, production changes, field service notes, etc., for various makes and models of TV receivers manufactured during the last four years." Since the receivers referred to are all designed for the American domestic market, interest in the text for the Australian reader can be only of a purely academic nature.

It is, of course, possible that many of the faults described could also arise in sets released on the local market, but it is to be hoped that our own manufacturers will anticipate many of these by the release of the type of information presented here.

Our review copy came direct from the publishers. No details are available on local supply arrangements and selling price. (H.A.T.)

Loudspeakers

LOUDSPEAKERS AND LOUDSPEAKER CABINETS, by P. W. Van Der Wal. Philips Paperbacks series, printed in Holland. Distributed in other countries by Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1. Stiff paper covers, 8½ x 5¾in, 114 pages.

In picking up this book one more or less expects it to follow the pattern of many other such books, devoting portion of the space to the principles and types of loudspeakers and the rest to a detailed examination of the various types of enclosure.

In fact, the treatment is along markedly different lines.

The operation of loudspeakers is certainly explained but with more than usual reference to formulas, graphs, tables and to technical terms: Maxwells, Webers, Oersteds, etc. This need not deter the more casual reader but it will be appreciated by those with a background of technical training.

Following the introductory material on loudspeakers, a chapter on "A Few Fundamentals" covers such matters as matching to amplifiers, series and parallel connections, phasing, filters, etc. This is followed by a chapter on distortion.

Chapters 5 and 6 deal with stereo installations and the acoustic effects of using loudspeakers indoors and out of doors—this is in a quite descriptive fashion.

Loudspeaker baffling receives fairly summary treatment, being largely limited to a statement of why a baffle is necessary, followed by a brief explanation of baffle boards, sealed boxes and reflex enclosures.

The book concludes with hints and tips on building enclosures and with quite a few sketch plans, which turn out to be specifications to suit loudspeakers in the Philips range. These could doubtless be adapted for other brands but only to the extent that the readers can select types with corresponding parameters.

In short, to some readers, the book may seemingly fail to sustain the promise of the early chapters but its treatment in these is sufficiently different to be read to good purpose alongside other purely hi-fi oriented texts. At $2.55 plus 10c postage the price is quite modest.

Our copy came from The Technical Book Company, 289-299 Swanston Street, Melbourne, C1. (W.N.W.)

QA

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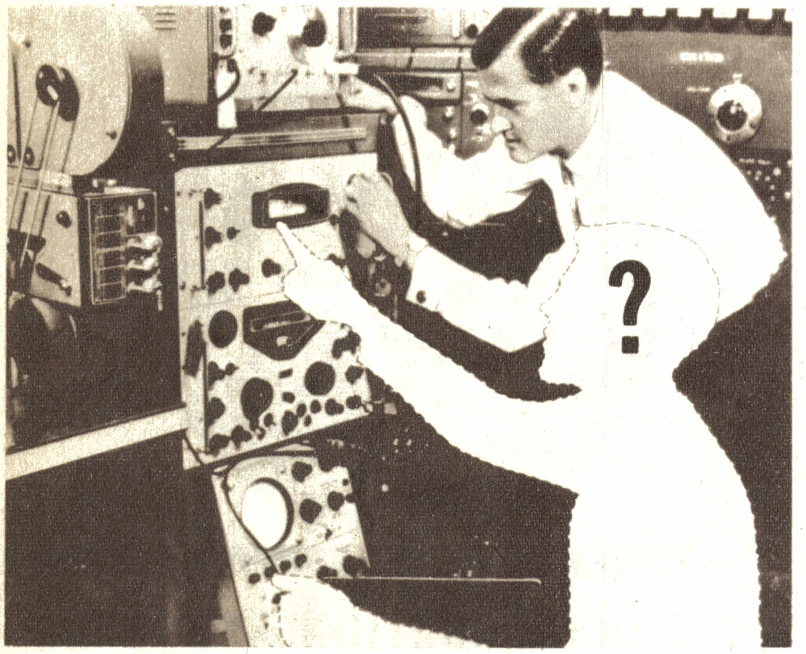
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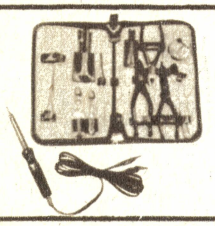
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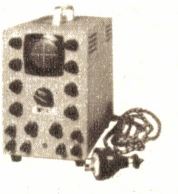
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EA

BROADCAST ANTENNA SYST HANDBOOK, Edited by Verne Ray. Published by Tab Books, T mont, Maryland, U.S.A. 1966. covers, spiral binding, 158pp., 8½ 5½in. Many diagrams, tables, and pl graphs. Our copy from the publis U.S. price, $7.95.

To avoid any possible confu it should be emphasised that this title r exclusively to transmitter antennas. It w be of no value whatever to experime interested in receiver antennas.

Having said that, it is almost auto cally implied that the book is directe broadcast transmitter engineers — a tinctly limited reader group, even in country of origin. This fact is empha by the relatively high price for a book in a simple binding.

The local interest would be even fu restricted, since a good deal of the is devoted to discussion and interpret of the American F.C.C. and F.A.A. lations concerning the erection and formance of such aerials.

On the other hand there are several ters dealing with the purely technica pects of broadcast transmitter aerial directivity, pattern shape, multiple towe tems, measurement of power, and imped phasing etc. — as well as chapters de with TV and FM antennas, and cov such subjects as UHF, aerial perform and measurement, dual polarisation, e

To sum up: A useful book for the li group to which it is directed, but will be even further limited in this cou Its price is high for this reason, and well be higher in this country. (P.G.W.).

★ ★ ★

THE HANDBOOK OF ELECTR TABLES, by Martin Clifford. Publ by Gernsback Library, Inc., New 1965. Soft covers, 8½in x 5½in, 1 Price in Australia, $3.70.

This book would be useful for th perimenter or hobbyist who is not fa with the multitudinous conversion for or does not use a slide rule. It co a comprehensive list of just about conversion table imaginable. A partia of the tables reads: Resistance vs. Co tance, Design values for attenuator works, R-L Time Constants, R-C Constants, Vector Conversion, Alpha Conversion, Basic Colour Code, Reac Tables, Mathematic Tables, etc. Most tables are of 4-figure accuracy.

A list of television channel freque is also given, but these are applicable to the American TV system; e.g., thei aration between video and sound ca is 4.5MHz whereas the Australian separation between carriers of 5.5MHz.

Our copy came from the Grenville lishing Co., 154 Clarence Street, Sy However, we understand that copies be available immediately from all tec bookstores. (L.D.S.).

★ ★ ★

HOW TO BUILD PROXIMITY DE TORS & METAL LOCATORS John Potter Shields. Published b Foulsham and Co. Ltd., Slough, land. 1966. Hard covers, 128pp., 5½in. Many diagrams, circuits, etc. in Australia $3.40.

Most experimenters are intrigued b seemingly "magical" way in which su electronic circuits can pinpoint hidde jects, such as water pipes, cables, or "buried treasure" — at least in theory. those who would like to put theory practice, this book should provide m the answers.

The first chapter deals with the g principles of proximity detection, co such phases as capacity relays, Do effect detector, beat frequency loc coupled field locators, and Hall-effect tors. It also discusses typical uses for devices, such as liquid level control,

ss gauges, novelty displays, burglar alarms, unters, metal locators, etc.
The following chapers are devoted to tailed descriptions of how to build a de range of devices of this kind, some ing valves and some using transistors. ie devices range from extremely simple relatively complex, although the instruc-ns should be adequate for even the be-nner.
Although this book was originally pub-hed in U.S.A., this version was printed England, and carries an introduction for glish readers detailing many of the differ-ces between American and English elec-nic practice, terminology and components. is will help to make the book more ceptable for the Australian reader.
In view of the undoubted interest in this oject we were disappointed to discover t there seems to be one serious omission m the text. Nowhere could we find a gle reference to the "sensitivity" or likely ler of performance of the devices de-ibed. As a result, the reader is left to ess whether they will detect a coin at eral feet, or only a buried car body a v inches under the surface of Bondi ach!
Nevertheless, for those who simply wish experiment, and do not have to guaran-a specific order of performance, the ok should provide valuable guidance to them on the right track. They will n learn for themselves what a particular vice will or will not do.
Our copy from Grenville Publishing Co., Clarence St, Sydney, N.S.W., but copies uld be available from technical book-ps. (P.G.W.)

★ ★ ★

WAYS TO USE YOUR SIGNAL GENERATOR, by Robert G. Middleton. Published by Howard W. Sams & Co., Inc., New York, 1967. Soft covers, 144pp., 8½in x 5½in, many diagrams. Price in Australia $3.05.

As may be gathered from the title, book is aimed at the service technician is intended to increase the technician's satility with a signal generator.
Being of American origin the book otes several chapters to FM-Multiplex reo and colour television and for this son it may not seem so attractive to stralian readers. However, a major part the book is relevant to the Australian ne.
elow is a partial list of contents likely be useful.
Calibrate a Signal Generator against a artz Crystal Oscillator.
Check the Percentage Modulation of a nal Generator Output.
Calibrate the Attenuator of a Signal nerator.
Check the Tracking of a Sig/Gen.
Check the Frequency Response of an illoscope.
Check the AGC Action of a TV Receiver.
AM Receiver Alignment.
Check for Parasitic Oscillation in Video plifiers, and many others. All in all, e a useful little book.
ur copy came direct from the American lisher but we understand that it will published shortly by Foulsham-Sams London, and will be available from nical bookstores at approximately the ve price. (L.D.S.)

★ ★ ★

W SKILL-BUILDING TRANSISTOR PROJECTS AND EXPERIMENTS, by Louis E. Garner, jr. Published by Gernsback Library, Inc., New York, 1966. Soft covers, 8½in x 5½in, 192 pp., many circuits and diagrams. Price in Australia $3.70.

his book would be suitable for the nger generation or for the older reader wants to gain practical experience transistors. The author presumes that reader has an elementary knowledge begins the book with a chapter on ole transistor measurements such as base collector currents, beta, etc. No basic sistor theory is given.

MATHEMATICS OF AUTOMATIC CONTROL, by Toshie Takahashi. Translated by Scripta Technica, Inc. Published by Holt, Rinehart and Winston, Inc., New York, 1966. Hard covers, 6½in x 9½in, many diagrams, 434pp. Price in Australia $15.30.

The author of this book is a lecturer in mechanical engineering at the Waseda University in Japan, and the present volume has been translated from the 5th Japanese edition of an original work qritten by him as a text for a lecture course in applied mathematics. However it is essentially intended for undergraduate engineering students in general, and to serve as a basic introduction to the concepts linking the mathematical theory of complex functions with dynamic linear control system theory.

In his first preface the author stresses that the book should not be regarded as an introduction to automatic control theory itself, but rather as a complement to such a volume. He anticipates that after an initial reading its main function will be as a reference when difficulties are encountered in acquiring the mathematical concepts associated with the control theory proper.

From a necessarily incomplete reading of the book I would say that it would be very well suited for the intended purpose. Not only this but it would seem also well suited as a reference for practising control engineers. It is very well laid out, commendably concise, and very readable — although there are admittedly a few places where the expression seems to have become slightly ruffled in translation. I imagine this is almost inevitable in any work which has undergone such a radical translation.

The chapter headings should give a fairly clear idea of the material covered and the order of presentation:

1. Transient Response.
2. Frequency Response.
3. Functions of Complex Variables.
4. The Laplace Transformation.
5. Transfer Functions (Part 1).
6. Stability.
7. Transfer Functions (Part 2).

The book ends with a comprehensive list of references, an appendix listing transfer functions and transform pairs, a supplement giving explanatory discussion of difficult points, and answers to exercises given in the main text.

The mathematical background assumed of the reader is a reasonably solid grasp of basic calculus to about 2nd year tertiary level.

To summarise, a well-written book which should be found of considerable value to those commencing a study of automatic control or practising in it.

Our copy came from the Australian and New Zealand distributors for the publisher, Rigby Limited. We understand that copies should be available from the larger bookstores by the time this review is published. (J.R.)

Some of the projects described are:

1. Headphone Amplifier.
2. Hi-Fi Preamplifier.
3. Light-powered Receiver.
4. Electronic Metronome.
5. Basic Audio Amplifier.

All the projects use RCA or General Electric transistors which are readily available in Australia. However, some other components, such as particular types of I.F. transformers, may be virtually unobtainable.

Chapter 6 is very informative on general trouble-shooting and receiver alignment methods. Chapter 7 gives a list of transistor terminal connections, the resistor colour code, etc., and concludes the book with a description of printed circuit construction which would be very useful to those who wish to make their own.

All in all, a very useful book for those who wish to gain experience on simple transistor projects. Our copy came from Grenville Publishing Co., of 154 Clarence Street, Sydney, although copies should be available immediately from technical bookstores. (L.D.S.)

★ ★ ★

TRANSISTOR CIRCUIT DESIGN AND ANALYSIS, by E. Wolfendale. We have now received from The Technical Book and Magazine Co. Pty. Ltd., a bound copy of this book, which was reviewed from a printer's proof copy in our March, 1967 issue. We are also advised that the price originally as quoted ($10.90) is not correct, and that the Australian retail price is $12.30, plus 25c postage.

LITERATURE—in brief

HEWLETT-PACKARD JOURNAL, Volume 18, Number 7 (March, 1967) features a main article entitled "A Computer for Instrumentation Systems." This describes a new integrated-circuit computer which solves problems of interconnection, programming and environment which arise in the design of systems containing both computers and instruments. The article commences by examining these problems and considers how the instrumentation computer eliminates them.

Other articles in this issue are "Success-

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ful Instrument-Computer Marriages," which gives four examples of how an instrumentation computer can be incorporated in a system containing electronic, chemical or medical instruments; "A Wideband Analog Frequency Meter and FM Discriminator," describing the model 5210A Frequency Meter; "Phase Noise and Phase Modulation Measurements with the Analog Frequency Meter," describing how to make phase measurements on the new frequency meter.

Inquiries should be addressed to the Australian agents for Hewlett-Packard, Sample Electronics (Vic.) Pty. Ltd., 9-11 Cremorne Street, Richmond, Vic.

WATKIN WYNNE PTY. LTD. has issued the first instalment towards the revision of its trade price list issued in March, 1966. It includes a small all-round increase in the prices of A.G.N. potentiometers which has been in force since December, 1966. A list of R.C.S. Radio components is also given which covers the components available through trade channels. The list mentions that complete kits, wired and assembled units and certain other items are only sold direct by R.C.S. Radio at advertised prices.

The price of Veroboard has been reduced and the range of stock increased. A data sheet is available in addition to the amended price list detailing the new range. Inquiries should be addressed to Watkin Wynne Pty. Ltd., 32 Falcon Street, Crow's Nest, N.S.W.

ULTRA-HIGH VACUUM FURNACES, is the title of a new 18-page brochure produced by Vacuum Division of Varian Associates. The booklet presents descriptions specifications, and operating principles for these furnaces. It contains various performance curves, schematic diagrams, and photographs for the hot zones, heating elements, thermal watt converters, and other components. Copies may be obtained from Varian Pty. Ltd., 38 Oxley Street, Crow's Nest, N.S.W.

EMERSON AND CUMING, INC., U.S.A., has produced a new four page folder which describes the construction and performance of several types of RF shielded chambers. The brochure lists the typical insertion loss versus frequency which is achievable with each type of construction. The shielding effectiveness against magnetic fields, electric fields and plane waves is shown. Inquiries should be addressed to the Australian agents, Wm. J. McLellan and Co. Pty. Ltd., The Crescent, Kingsgrove, N.S.W.

STC COMPONENTS REVIEW, Vol. 4, No. 3, March, 1967, has descriptions of the following products: Klein tools; stand-off insulators; Brimistor surge suppressors; Safe-T-StaC surge suppressors; carbon film resistors; storage trays; 2N3375 VHF/UHF power transistor. Also included in this issue is part 1 of an application note on VHF/UHF power transistor amplifier design. Inquiries should be addressed to Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W.

TELECOMMUNICATIONS JOURNAL, Volume 34, Number 4, April, 1967, publishes an article by N. Olennikov on t training of telecommunication specialists the U.S.S.R., and an article by H. Schm entitled "Telephone Switching Techniq Looks Ahead." Also included in this iss is the full text of the "Treaty of Princip Governing the Activities of States in t Exploration and Use of Outer Space, I cluding, the Moon and Other Celesti Bodies". Other articles include a descripti of the American OSO satellite, and applic tions of modern telecommunications in ed cation.

Two new features are contained in th issue. The first, entitled "Telephilately," w appear whenever warranted and describ stamp issues devoted to telecommunicatio The second, entitled "I.T.U. Conferences will appear monthly giving a summa of each conference held by the Internation Telecommunication Union since its creatio This month's issue features the Internation Telegraph Conference held in Paris in 186

Telecommunication Journal is the month publication of the I.T.U. and is publish in three separate editions in English, Fren and Spanish. Annual subscriptions by su face mail are: one language, 20 Sw francs; two languages, 30 Swiss fran three languages, 40 Swiss francs. Price f a single copy is 2 Swiss francs. There a special rates for delivery by airmail. T Journal may be obtained from the Public tions Service of the International Teleco munication Union, Place des Nations, 12 Geneve 20, Switzerland.

NEW DEVELOPMENTS, Issue N B031, April, 1967, the new products bulle of Jacoby, Mitchell and Co., has descr tions of the following items; Advance El tronics 2MHz Timer Counter TC7; Alfr Sweep Oscillator 6400 series; PRD Therm electric Power Meter 6685; Sony Tape R corder/Reproducer TC530; TRW Semico ductors UHF Transistor 2N4976; and range of products of Wiltron Co. includi Fidelity Test Set 701 and Envelope De Instrument 332. Inquiries to Jacoby, M chell and Co. Pty. Ltd., 469-475 Kent Stre Sydney, N.S.W.

TECHNICALITIES. May, 1967, the n products magazine of Tecnico Electron Pty. Ltd., includes the following: Prin Circuits with Plate-Through Holes; D High-Voltage Power Supplies; Aerometr Ferrosonic Ultrasonic Cleaners, Porta Phase Meters, Portable Electronic Co ters, Pulse Generator PG200, Sampler series; F. W. Bell Hall Effect Gaussmete Ceramic-encapsulated Probes; Transmet Gravimetric Manometer 1305; P.A.R. Ult stable Power Source, Signal Process Equipment, Signal Correlator 100 (includ a two page description of the mathema of correlation); Rustrak Recording Py meter 122, DC Recorders; Aeroflex Vib tion Isolators; Bach-Simpson AC/ VTVM; Newmarket Packaged Amplifiers.

Also available is a catalogue of series a shunt wound motors manufactured by T nico. Inquiries should be addressed to T nico Electronics Pty. Ltd., Carrington Ro Marrickville, N.S.W., or branches in cap cities.

FORUM — continued from page 75

materials but the one person who remembered this didn't know whether it applied to special purpose radio tubes, at the level of radioactivity involved.

And so on . . .

In short, while some of those asked probably went away and started looking up references, not one, in the whole of his technical career, had come up against the kind of warning reported by our correspondent.

And what of textbooks?

Again, following the "whip around" technique, we looked through the books in our library to discover what they had to say about radioactive material in valves and possible hazards therefrom. Going on the section headings, the indexes and a quick scan of likely chapt we could find only fleeting references radioactive materials and no suggesti of any complications or hazards.

In short, the books in our libra which would represent a fair-cross-s tion of what a technician or engin would be likely to encounter in everyc training and activity are completely sil on the subject raised by our corresp dent.

And that seems as good a place as a to leave matters for the present—in manner of many "open-ended" discuss films.

Why the heavy emphasis in an Arm Forces training material, of someth which is seemingly ignored elsewhere?

ANSWERS TO CORRESPONDENTS

When writing to us:—

- *Please give your name and full postal address, including the State.*
- *Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.*

NEW CAR RADIO

(Willoughby, N.S.W.) says that it is several years since we described the "Karset." He asks "What about a new car radio?"

ir question. The main reason why we n't moved on a new car radio was uccess of the "Karset" design. We'll a look at it and see whether there d be an advantage in superseding it.

"WIRELESS WEEKLY"

(Perth, W.A.) wants to know where e can obtain old copies of "Wireless Weekly."

ertainly have none of these available lves, F.J., and we know of no likely e. However, it may be that some r can oblige, in which case he may o write to you directly. The full name address is: Mr F. Johnson, 62 Colin est Perth, Western Australia.

SUPPLY FOR PORTABLE

(Townsville, Nth. Qld.) says he uses is portable transistor radio quite a lot n the car, with a car type aerial. He vonders whether it would be feasible o devise an adaptor to allow the set o operate from the car's electrical ystem.

uld doubtless be possible to devise such t and, in fact, some transistor port-um-car-radios are designed for the al-tives. Few people worry about the idea a conventional portable, however, because of the complication of extra and connections and partly because y costs are not all that significant in verage case. That is why we have not d much about it ourselves. Two prob-do suggest themselves, however, over bove that of obtaining a suitable and nt voltage. One is the possibility of ducing ignition hash via the power ction; the other, that of ensuring that olarity requirements of the receiver ot conflict with those of the vehicle. but we cannot help immediately.

CAPACITOR COLOUR CODE

(Inverell, N.S.W.) is a beginner in lectronics and would like to see pub-shed, the colour codes for resistors nd capacitors, also a table of some ather "ambiguous" abbreviations used n the magazine. Furthermore, he dis-kes the use of "Hertz" instead of cycles per second." However, he finds he magazine helpful and says that the ew cover styling is attractive. Finally, .B. makes a request for the descrip-on of a "small, simple and easy-to-uild" computer as a conclusion to the ogic and Counting series of articles.

k you for your helpful suggestions and liments, A.B., we shall certainly try ep up the standard. We set out the r colour code in the "Basic Radio e," but due to its infrequent use, until tly, we have not published the capa-colour code. As to the ambiguities, e not sure just where you find these, e trust that the "Basic Radio Course" will help clarify some of these points. In adopting the term "Hertz" we are conforming to the now almost universally accepted term for frequency, as has been discussed in the columns of this magazine. Unfortunately, the cost of a computer, to perform even the most elementary mathematical problems, would tend to prohibit the description of it as a project for the beginner.

LANGUAGE LABORATORY

J.S. (West Heidelberg, Vic.) writes further to his letter replied to in March, 1967. He says that the language laboratory he had in mind was for up to three or four students to supplement their classroom work. He further comments on the answer to M.A.L. (Bandiana, Vic.) regarding Service careers. He points out the division between Royal Australian Signals and R.A.E.M.E. in the repair of electronic equipment and advises any correspondent who wishes to write an article to contact Army Headquarters to ensure accuracy in accordance with current policy.

Thank you for the information, J.S.; we hope it will be of interest and assistance to our other readers.

PULSE GENERATOR

C.O'C. (Warburton, Vic.) suggests that we should add a pulse generator to our range of test equipment, since the commercial instrument is so expensive.

Unfortunately, it is not at all clear just what kind of pulse generator you have in mind. Multivibrators, the UJT impulse generator in our Logic demonstrator and the basics of our recent metronome are all pulse generators. Or you may have something in mind with a wide range of frequency and mark/space ratio, which would be much more complicated. Then again, you could be referring to television pattern generators, which are also quite complex in design for anything really worthwhile. Perhaps you could let us know what you have in mind.

TAPE AMPLIFIER

R.H. (Roseville, N.S.W.) asks if we could develop a transistorised version of the "Playmaster Tape Amplifier" along the lines of a recent 7-watt stereo power amplifier described in another publication.

Thanks for the suggestion, R.H., this is something we must keep in mind for future projects, although the problems of a tape amplifier are considerably more complex than a straight amplifier of the type you mention.

FIRST AID

J.S. (Torrensville, S.A.) asks if it would be practical to publish some information on elementary First Aid.

It would hardly be appropriate for us to do more than cover the treatment of electric shock. It would really be better for those interested to seek a special booklet on the subject or ask about a practical course at their local ambulance station.

SIMPLE ORGAN

H.E.W. (Albion Park, N.S.W.) has a suggestion for I. McL. (Liverpool, N.S.W.) who, in "Answers to Correspondents" of March, 1967, asked for something simpler in the way of electronic organs. H.E.W. suggests that "Electronic Gadgets for the Constructor" by E. N. Bradley has several interesting circuits with which to fiddle.

Thank you, H.E.W., for the suggestion. We hope it will be of assistance to I. McL., and other interested readers. We may add that we have some plans of our own to produce a simple monophonic instrument in the near future.

"ELECTRONICS Australia" INFORMATION SERVICE

TO assist readers, "ELECTRONICS Australia" conducts a technical information service.

Conditions governing this service are set out below:—

(1) Address letters to: Assistant Editor, "ELECTRONICS Australia," Box 2728, G.P.O., Sydney.

(2) Requests for copies of circuits or technical information requiring a postal reply must be accompanied by postal note or stamps to the value of $0-20 (2/-). Queries not accompanied by a fee will be answered in rotation on these pages.

(3) For the $0-20 fee, we will supply circuit data, as available, from our files. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuits will be answered more speedily if they are not complicated by questions requiring the attention of technical personnel. Where articles are not on file we can usually provide a photostat copy at $0-20 PER PAGE.

(4) The information service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits. Please note that the inclusion of an extra fee does NOT entitle correspondents to special considerations.

(5) The editor reserves the right to return fees or to limit the scope of an individual reply when it is felt that a partial answer will be better than none at all.

(6) In addition to the above service, chassis blueprints are available for most of our projects showing the position of holes and cutouts for metal-working, but containing no details of wiring. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost $0-50 (5/-) each. Original photographs of most projects are also available, from $0-50 for a 6in x 8in glossy print, postage $0-08 (9d).

(7) "ELECTRONICS Australia" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications should be obtained from advertisers.

(8) Technical queries are not answered by telephone.

(9) We have no file of circuits for commercial radio or TV sets, etc.

(10) A fairly good range of back numbers is available. On issues up to 6 months old there is a surcharge of 5c (6d). On issues from 7 to 12 months old the surcharge is 10c (1/-). Over 12 months, it is 20c (2/-).

Changeover to 30KHz Channel Separation

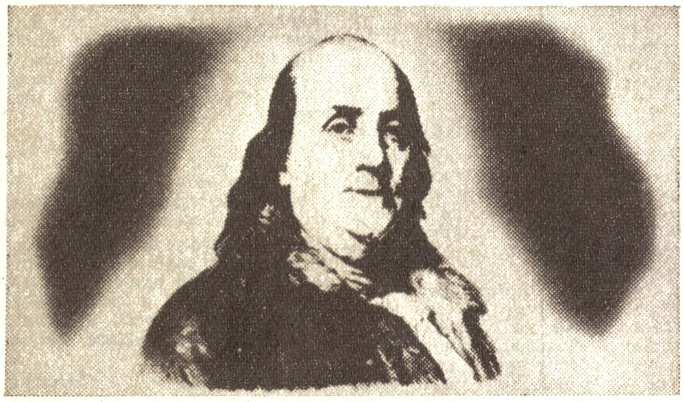
(Continued from p. 20)

has till now been almost entirely neglected, despite the advantage of retaining 60KHz channel spacing, and that this band suffers less from electrical noise. Against this must be set the disadvantage that radio waves at these frequencies behave more like light waves than those on the lower frequencies, with the result that more base stations may be needed, possibly in conjunction with repeaters, to cover a given area effectively.

While at this stage, the cost loading on 470-520MHz equipment is high, because of limited demand, this differential would be greatly reduced if the demand for the equipment was larger. At this stage, although there are a few mobile services operating in the band, at the moment the available frequencies are used mainly by radio link equipment.

The Post Office has said that it has carefully considered the needs of operators and manufacturers, and has ad ed a program for conversion designe cause the least inconvenience to all cerned. Details of this program ca obtained from he Superintendent, R Branch, at the P.M.G. headquarter all States. The Postmaster-General self has pointed out that users of m equipment should make the conver as soon as possible, since leaving al tion to the last few months of the pe allowed for this purpose could lea difficulties in meeting the deadline

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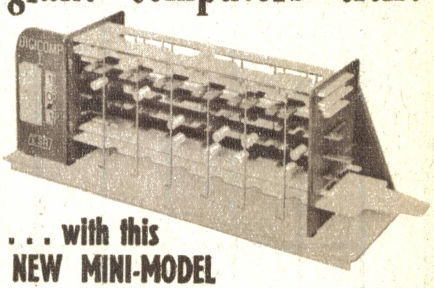
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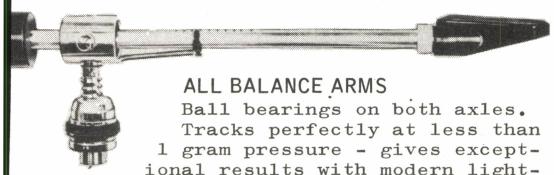
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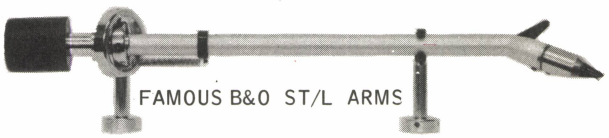


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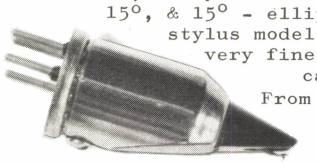


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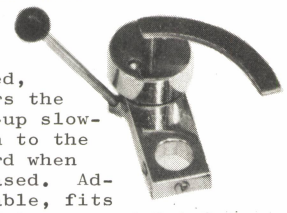
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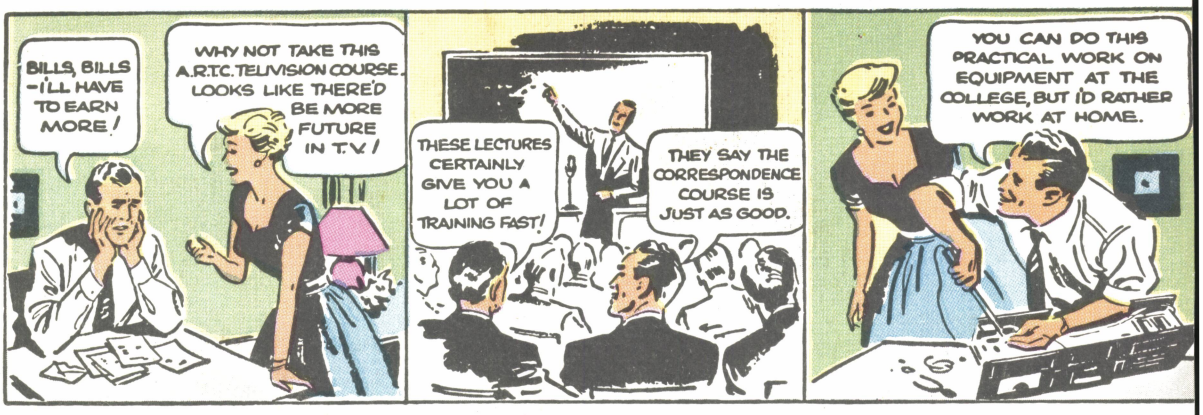
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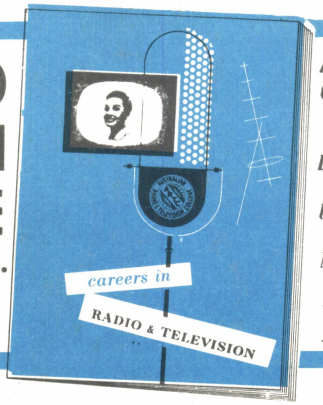
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