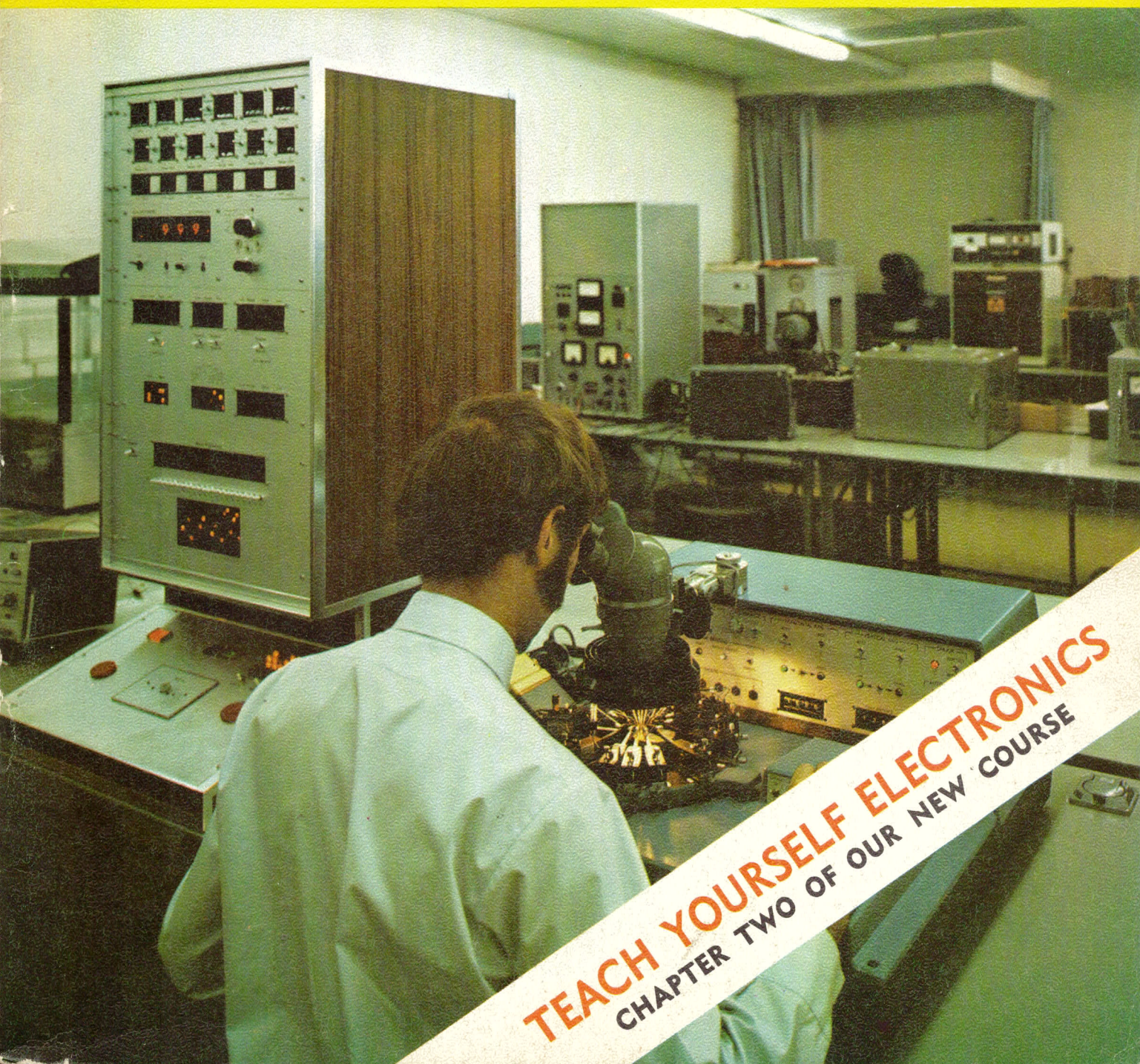
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ELECTRONICS Australia

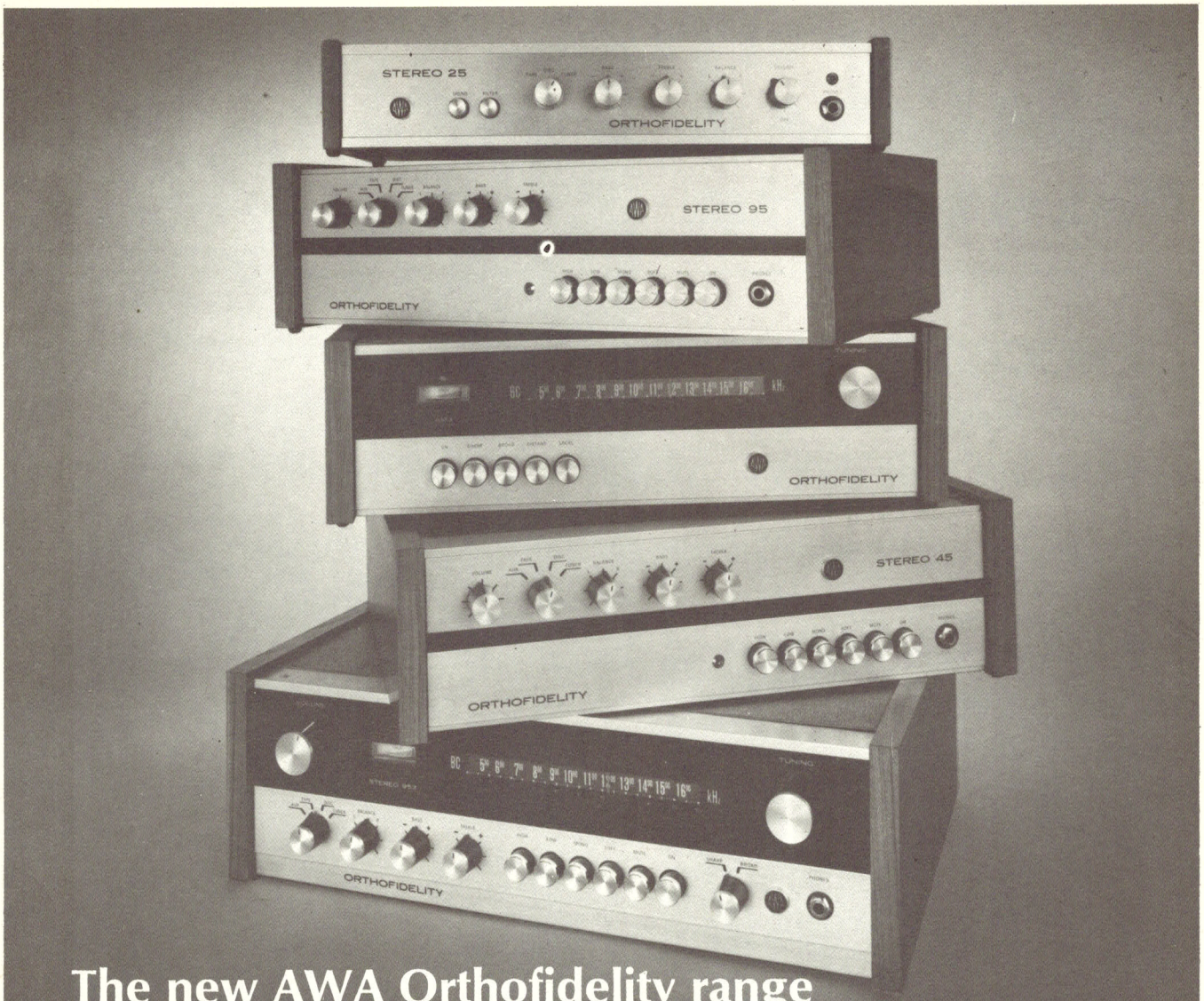
- CHOOSING THE RIGHT MICROPHONE
- FOR RADIO AMATEURS: RF Z-BRIDGE
- BUILD OUR NEW STEREO HI-FI AMPLIFIER

Registered for posting as a periodical — Category B.



TEACH YOURSELF ELECTRONICS

CHAPTER TWO OF OUR NEW COURSE



The new AWA Orthofidelity range

Let's start at the beginning.
A stereo amplifier reproduces sound. Sound from a tape deck. Sound from a radio tuner. Sound from a record turntable.
Ideally an amplifier doesn't alter that original sound.
Any alteration is called distortion.
An amplifier is there to reproduce. Not to add its own characteristics to a recording.
So far so good.
However, many amplifiers seem more concerned with how pretty they look and how complicated they can appear, that they miss the point of what an amplifier is all about.
So AWA are putting the record straight again.
With a range of high quality amplifiers under the name of ORTHOFIDELITY.
They all feature things you can't see.
Just hear.
Like advanced plug-in modular amplifier boards. To give a better sound in the first place.
And to enable any future fault to be isolated and replaced in a matter of minutes.
Things like audio filters to remove rumble, hiss and scratch.
And there are things you can't hear.
Like the no-noise knob.
The name we've given our new twin tandem volume control.
A new concept in volume controls.
New because it is actually connected to several stages of the amplifier.
A normal volume knob has fewer connections.
And fewer chances of keeping control over what's happening.
Like overloading at various stages of the amplifier that will cause background noise.
Our new no-noise knob prevents overloading.
It also eliminates residual noises that start in the pre-amp and tone circuits.
The result is no noise at normal listening levels. No hisses. No rumbles. No distortion.
Just clear, deep, honest sound.
Which we believe is what an amplifier is all about.
But even while we were ahead we didn't stop.
At the end of our range of new amplifiers is our new hi-fi tuner.
Which we've made part of our ORTHOFIDELITY range.
Compared to all the other tuners you've ever been offered it's a completely new animal.
There are improvements in bandwidth. Distortion factors. Sensitivity. Signal to noise ratios and even the way you tune it. By precision meter.
So now you can have crisp, clear reception of any station. Whether local or distant.
And you can buy the tuner on its own. Or as part of the ST953 ORTHOFIDELITY tuner amplifier.
So please ignore our smart anodised front panels. And satin teak ends. And push buttons. And compact styling with its instrument look.
And listen very hard.
Because apart from the music we make no sound at all.

AWA

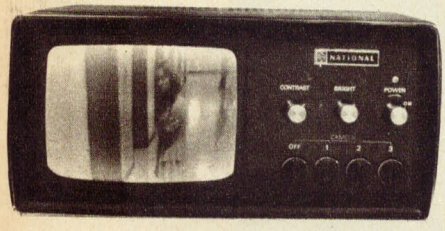
A trusted name in electronics

ELECTRONICS Australia

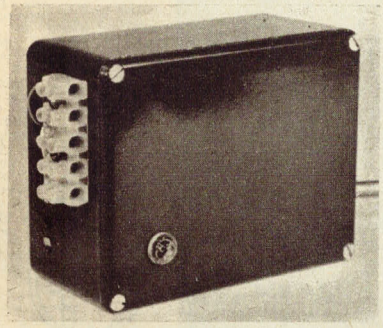
Incorporating "RADIO, Television and HOBBIES"

ABC certified circulation in excess of 50,000

VOLUME 33 No 3



INSTALL-IT-YOURSELF CCTV: Full details of a new low-cost closed circuit TV system which is ideal for use in either the home, school or club. See page 20.



PROXIMITY SWITCH: Designed for beginners, this simple device detects the presence of a hand and activates an alarm or other electrical circuit. See page 41.

MICROPHONES: The first part of an article to aid audio enthusiasts in the choice of a microphone starts on page 85. It discusses the limitations of inexpensive units and the problems associated with typical situations.

On the cover

A modern computer-controlled microcircuit probe test station installed at the Philips' microcircuit facility, Hendon, SA. It is capable of applying a large number of tests in rapid succession to each on-wafer device. (Photograph by courtesy of Philips Industries Ltd.)

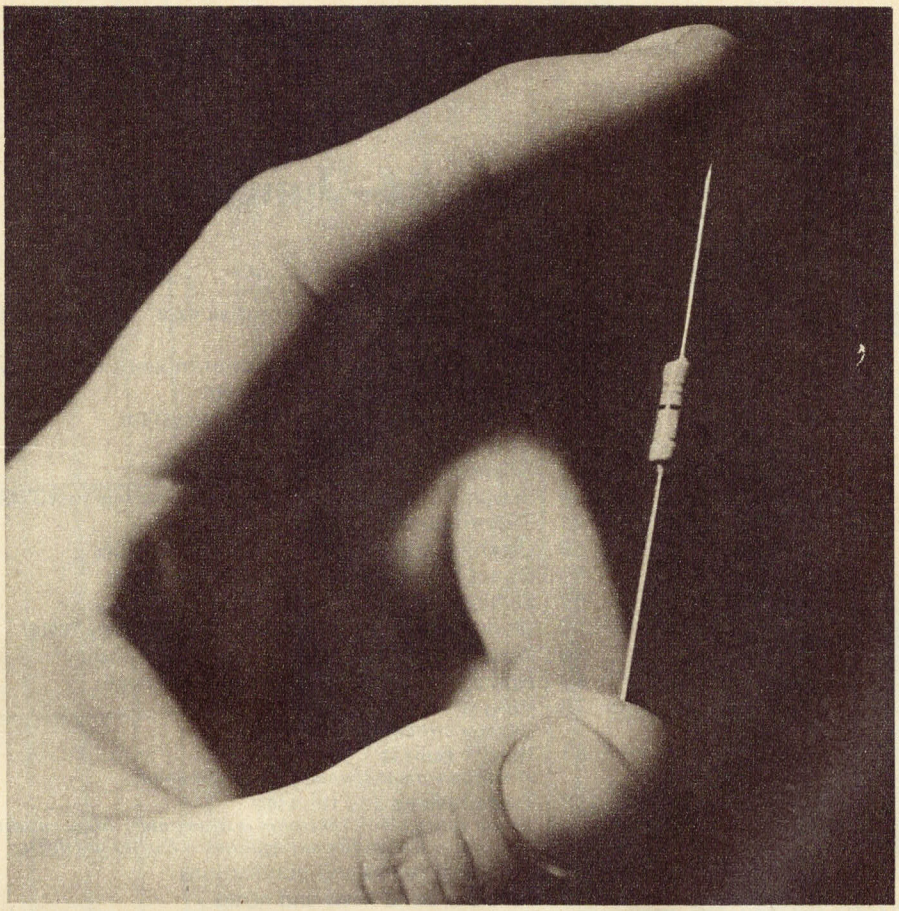
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The Philips resistor.



PHILIPS

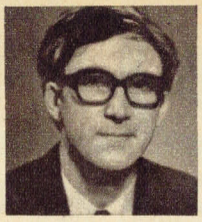
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EDITORIAL VIEWPOINT

Keeping "intensive care" within bounds . . .

In recent years one of the areas in electronics which has undergone especially dramatic growth is that concerned with medical instrumentation, providing a particularly good example of the way in which interdisciplinary co-operation can produce outstanding benefits for mankind. Electronics has played, and is continuing to play an important role in the development of many of the techniques of modern medicine, both in its research and in its day-to-day application. No doubt there are today many who owe their lives to a few modest-looking pieces of medical electronic equipment, and to those who have worked to develop and use it.

Like many technological developments, however, the growth of medical electronics brings with it the inevitable risks and potential dangers – many due to lack of knowledge. There is a growing awareness, both within the medical fraternity and in the wider community outside, that the same equipment which can assist so dramatically in saving a life can also be responsible for accidentally endangering or even severing it. Increased instrumentation is bringing with it an increased incidence of electric shock, as was shown by the excellent article in our August 1970 issue.

Now Ralph Nader, the champion of consumerism and environmentalism in the USA, has made the alarming claim that at least 1,200 Americans are electrocuted every year during cardiac care. This is the sort of statistic which is almost impossible to verify; it may be grossly pessimistic. However at the very least it provides strong evidence that there are quite real dangers involved.

There is no suggestion, of course, that doctors or nurses are knowingly responsible for these unfortunate deaths, or that they are due to "negligence" as such. Nor that anyone has wilfully suppressed the true facts about such accidental deaths. It seems much more likely that in the vast majority of cases the demise of the patient has been attributed in all good faith to "inexplicable" heart failure, without the realisation that the event might have been directly caused by a tiny electrical leakage.

The fact is that the more electronic equipment connected to a patient, and the more intimately it is connected to his body, the greater the risk of accidental injury or death. With the development of new medical electronic equipment and its application, there is thus an undeniable responsibility on the part of all concerned to exercise the greatest possible care. This applies not only to those directly responsible for physically attaching the equipment to the patient, but equally to those concerned with developing, building, and testing the equipment, and also to those who train the ultimate operators.

When a measuring instrument disturbs the operation of a piece of equipment, even one as complex as a large digital computer, operation can usually be restored without too much difficulty. But with a human being, it is generally not quite that simple . . .

Jamieson Rowe

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ON SALE THE FIRST MONDAY OF EACH MONTH

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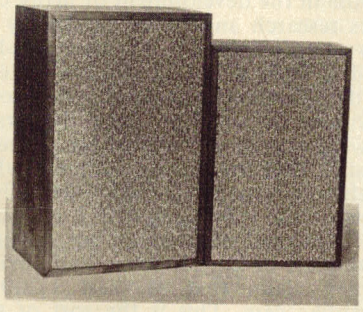
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SPEAKER SYSTEMS

NEW MAGNAVOX 8-30 SYSTEM



Featured in "E.A." Jan. 1971. It handles 30 watts RMS, features a new high performance 8" speaker, two 3" tweeters, and is available in cabinet 20⅞" x 12⅞" x 8⅞" (1 cu. ft.) or 23⅞" x 15½" x 10⅞" (1.6 cu. ft.). Available in teak or maple veneer.

COMPLETE SYSTEM

Kit of Parts . . . . . **$49.00** (1 cu ft), **$59.00** (1.6 cu ft)
Built and Tested . . . . **$61.00** (1 cu ft), **$74.00** (1.6 cu ft)

SEPARATE COMPONENTS

Enclosure kit (1 cu ft) . . . . **$16.50** (maple), **$19.00** (teak
Enclosure kit (1.6 cu ft) . . . . **$28.50** (maple), **$31.50** (teak)
Built Enclosure (1 cu ft) . . **$28.00** (walnut), **$32.00** (teak)
Built Enclosure (1.6 cu ft) . . **$43.50** (walnut), **$48.50** (teak)

ECONOMY BASS REFLEX SYSTEM

"E.A." design, Nov. 1970, consists of a Rola C8MX speaker in cabinet 20" x 11" x 9". Ideal for low wattage.

COMPLETE SYSTEM

Kit of Parts (teak or maple) **$24.00**
Built and Tested (teak or walnut) **$36.00**

SEPARATE COMPONENTS

C8MX speaker only **$8.26**
Enclosure kit . . . . . **$15.00** (maple), **$16.50** (teak)
Built Enclosure . . . . . **$26.50** (maple), **$29.00** (teak)

WHARFEDALE SPEAKER SYSTEM KITS

The Wharfedale Super Linton, Melton and Dovedale III are now available as build-yourself kits, featuring INSTROL quality cabinet kits in choice of maple or teak veneer.
The Super Linton kit employs an 8" and 3" speaker, frequency response 40-17,000Hz, cabinet 21" x 11½" x 9½". 15 watts RMS
The Melton kit employs a 12" bass and a tweeter, cabinet 22¾" x 13" x 10". 25 watts RMS.
The Dovedale III kit employs a 12" bass, 5" mid-range and 1" tweeter. Cabinet 28" x 15½" x 10". 35 watts RMS.

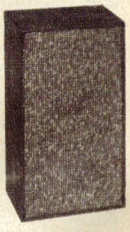
COMPLETE SYSTEM

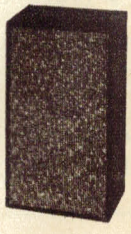
Super Linton kit (Unit 3) **$49.50**
Melton kit (Unit 4) **$90.00**
Dovedale III kit (Unit 5) **$128.00**

SEPARATE COMPONENTS

Unit 3 encl. kit . . . . . **$16.00** (maple), **$19.00** (teak)
Unit 4 encl. kit . . . . . **$23.00** (maple), **$26.00** (teak)
Unit 5 encl. kit . . . . . **$29.00** (maple), **$32.00** (teak)

NEW LEAK SPEAKERS





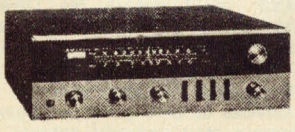
Leak have just released three new speaker systems.

The model 200 is 0.78 cu ft (18 watts RMS).
The model 300 is 1.3 cu ft (18 watts RMS).
The model 600 is 2.65 cu ft (40 watts RMS).

Model 200 . . . . . **$81.00**
Model 300 . . . . . **$106.00**
Model 600 . . . . . **$177.00**

SPECIAL INTRODUCTORY PRICE SAVINGS. Write to INSTROL for special savings on the new Leak systems, together with full technical details.

SPECIAL FOR JUNE



ONLY $333

COMPLETE HI-FI SYSTEM WITH AM/FM TUNER ONLY $333

- Kenwood TK 20U amp/tuner, 10 W. RMS per channel
- Dual 1210 changer with 4 pole motor
- Teak player stand with tinted perspex cover
- Audio Technica magnetic cartridge
- A pair of Wharfedale Unit Three Speaker Kits
- A pair of Teak Unit Three enclosure Kits

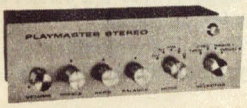
LIST PRICE $476.80. SAVE OVER $140.00

ELECTRONICS CENTRE

91a York St. between King & Market Sts.

AMPLIFIER KITSETS

127 CONTROL UNIT



A fully solid-state control unit incorporating a dual linear integrated circuit. (Refer E.A. Nov. 1969.)

Kit of Parts **$49.00** (Reg post $1.35)
Built and Tested **$69.00** (freight $2.00)
Aluminium knobs extra .. **$2.00**

SEPARATE COMPONENTS

Printed Board .. .. **$3.05** (Post 20c)
Etched Label .. .. **$2.12** (Post 25c)
Metalwork .. .. .. **$7.00** (Post 75c)

PLAYMASTER 128 AMP.

A high-powered transistorised stereo amplifier for use with the 127 control unit, providing a performance equal to most expensive imported amplifiers.

Refer "E.A." Jan., 1970.

Kit of Parts $105.00 (Reg Post $2.00)
Built and Tested $125.00 (freight $2.00)

SEPARATE COMPONENTS

Printed Board .. .. **$2.37** (post 20c)
Metalwork .. .. .. **$6.80** (Post $1.05)

PLAYMASTER 129 AMP.



A high quality stereo amplifier built around just two IC's. 3 watts per channel. Refer Oct. 1970.

Kit of Parts **$54.00** (Reg Post $2.00)
Built and Tested **$68.50** (freight $2.00)

SEPARATE COMPONENTS

Printed Board .. .. **$3.23** (Post 20c)
Etched Label .. .. **$2.52** (Post 25c)
Metalwork .. .. **$5.67** (Post $1.05)

ELECTRONIC MUSICAL INSTRUMENTS

KEYLESS ORGAN

Played by touching a stylus on to a series of metal contacts, it has a 1½ octave range including sharps and flats. Refer "E.A." Jan. 1969.

Kit of Parts **$35.00** (Reg Post $1.35)

SEPARATE COMPONENTS

Printed Board (Gold plated) **$4.60** (Post 20c)
Printed Board (Nickel plated) **$3.68** (Post 20c)
Metalwork .. .. .. **$5.03** (Post 65c)

ELECTRONIC BONGOS

This unit, which can be fed into any amplifier, can simulate bongos. Refer "E.A." Apr. 1970.

Kit of Parts **$13.00** (Reg post $1.35)
Built and Tested **$19.00** (Freight $2.00)

SEPARATE COMPONENTS

Metalwork .. .. .. **$6.13** (Post 75c)

GUITAR AMPLIFIERS

Instrol specialises in Guitar amplifiers and Guitar Speakers, and the Instrol-Playmaster 116 and 117 guitar amplifiers are the finest available (precisely to "Electronics Australia" specifications).
They are available as kits of parts as well as built and tested, each kit being complete in every detail down to the last nut and bolt. Chassis is ready drilled, cadmium plated and finally passivated to avoid fingermarking. The front label is beautifully finished with black lettering on silver-white background. The amplifiers include such extras as 3 inputs, vibrato and extra treble pull switches and chrome housed foot switch.

	Price	Freight
40 watt (116) kit ...	**$79.00**	($2.00)
60 watt (117) kit ...	**$87.00**	($2.00)
40 watt (116) built ..	**$99.00**	($3.00)
60 watt (117) built ..	**$107.00**	($3.00)
Fuzz Box Kit	**$13.00**	(85c)
Cover with handles, extra	**$9.93**	(75c)

SEPARATE COMPONENTS

Chassis .. .. **$4.72** (Post 65c)
Chrome foot switch housing **$2.15** (Post 25c)
Etched Label .. .. **$2.45** (Post 25c)

MUSICOLOUR



It will audio-modulate coloured 240V lamps to give vibrant, colourful displays, being fed from your amplifier. Refer "E.A." Oct. 1969.

Kit of Parts, **$47.50** (reg. post $2)
Built and tested, **$59.50** (freight $2)

SEPARATE COMPONENTS

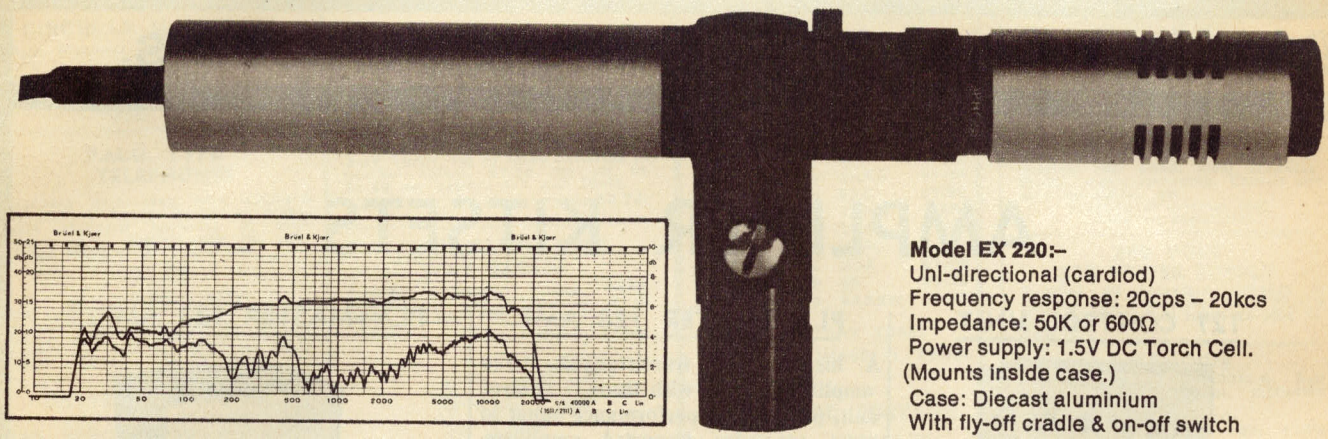
Printed Board .. .. **$2.89** (Post 20c)
Etched Label .. .. **$2.12** (Post 25c)
Metalwork .. .. .. **$3.73** (Post 65c)

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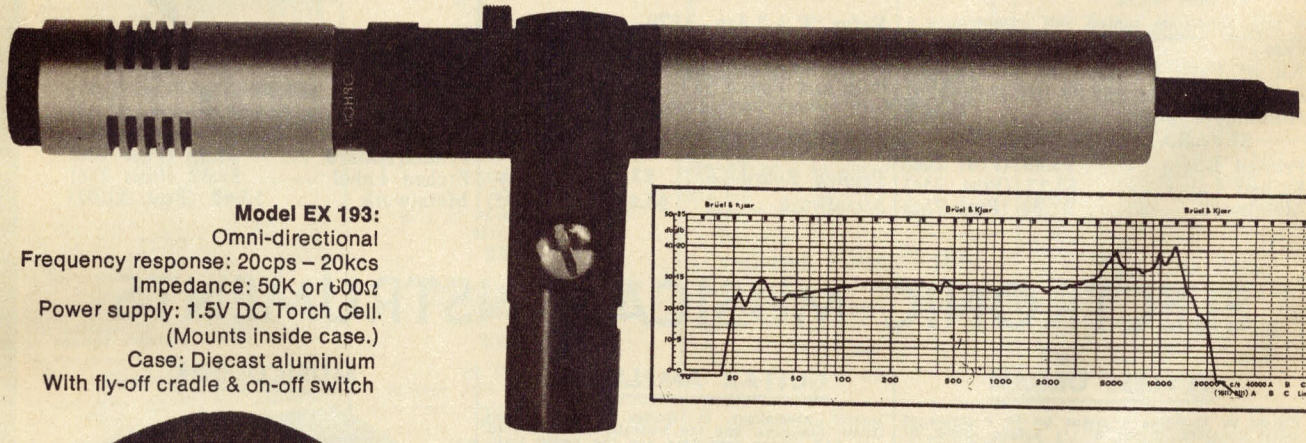
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GOLDRING CONDENSER MICROPHONES

First release in Australia incorporating Electret Type System — excellent quality for both recording and stage use.



Model EX 220:–
Uni-directional (cardiod)
Frequency response: 20cps – 20kcs
Impedance: 50K or 600Ω
Power supply: 1.5V DC Torch Cell.
(Mounts inside case.)
Case: Diecast aluminium
With fly-off cradle & on-off switch



Model EX 193:
Omni-directional
Frequency response: 20cps – 20kcs
Impedance: 50K or 600Ω
Power supply: 1.5V DC Torch Cell.
(Mounts inside case.)
Case: Diecast aluminium
With fly-off cradle & on-off switch



Stereo Headphones

◀ Goldring Ms450-V:

Professional type with separate volume controls enabling sounds to be adjusted to the optimum level. All outside noise is eliminated by thick soft earpads. Adjustable padded head band. Frequency range: 20cps – 20kcs. Matching impedance 4-16 ohms, maximum input 0.5W. Cord length 15 feet. Weight 16.7 ozs.

Goldring MS45-V: ▶

Professional type. Due to the employment of volume controls incoming sound waves can be adjusted as required. All outside noise is eliminated by thick soft earpads. Adjustable padded head band. Frequency range 20cps – 18kcs. Matching impedance 4-16 ohms, maximum input 0.5W. Cord length 15 feet. Weight 16.7 ozs.



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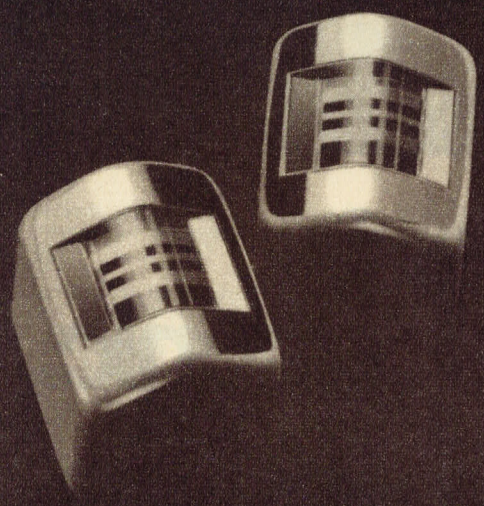
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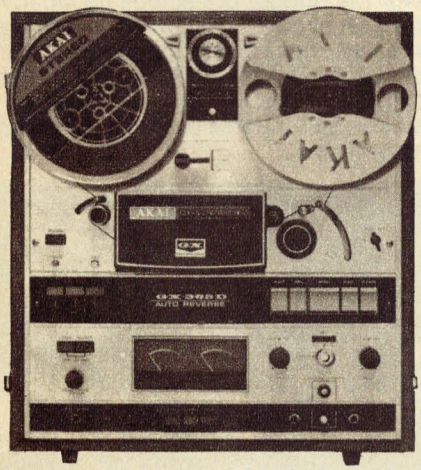
Good news for tape recorder enthusiasts

what Akai's GX (glass & crystal ferrite) Head means to you



150,000 hours of recording/ playback service life!

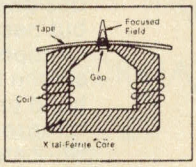
It means you won't have to change the head of your tape recorder for 150,000 hours! And when you start calculating what 150,000 hours means, you'll be very much surprised. If you were to use this GX-HEAD for 8 hours every single day of the year, it would last you for over 51 years! If you were able to play your tape recorder continuously without stopping for a single minute, this AKAI GX-HEAD is guaranteed for a service life of little over 17 years! That's why you can really call this GX-HEAD a "wear free" lifetime possession.



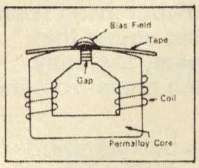
GX-365D ...one of our latest models with GX- Head.

GX-HEAD is "Dust Free"

It means you won't have to clean the head of your tape recorder as often as conventional heads. The core of the GX-HEAD is made of single crystal ferrite, and the inner circumference of the head shield is mounted and set in glass. Crystal ferrite is a magnetic gem, and as such has all the resolute, long-enduring qualities associated with precious, sparkling gems. As a result, the GX-HEAD is "dust free" from magnetic tape dust. Thus, sound quality is not affected even under excessively high temperatures and dense humidity. Wear and abrasion are almost completely eliminated and enhanced tape motion stability is produced because of the high degree of glass and crystal ferrite hardness.



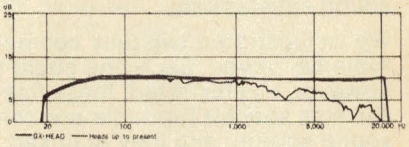
GX-Head



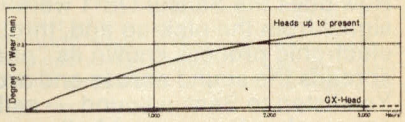
Heads up to present

GX-HEAD guarantees preeminent recording

It means highest quality recording sounds are now available to you. On conventional recording systems, when high frequency signals are being recorded on tape, the signals are weakened by the prevailing influence of the bias current. As a result, the frequency response is not good and sound is not reproduced in all its true dimensions. On the new GX-HEAD, AKAI engineers were successful in focusing the magnetic bias field so that the influence of the bias is drastically lessened. And greater frequency response was obtained because an ideal gap width and gap depth were developed and ultra-precision processing techniques were used in the manufacture of this head.



Change in the Characteristics of Frequency Response due to Adhesion of Dust (using tape of inferior quality at 40°C (104°F), 85% humidity)



Comparison of Degree of Wear

The sharply contoured shape of the GX-HEAD permits low frequency signals to be recorded smoothly without distortion. 20 to 30Hz super low frequencies can be recorded and played back with maximum stability.

AKAI's GX-HEAD is the answer to true sound reproduction. Don't settle for anything less.

Audio & Video

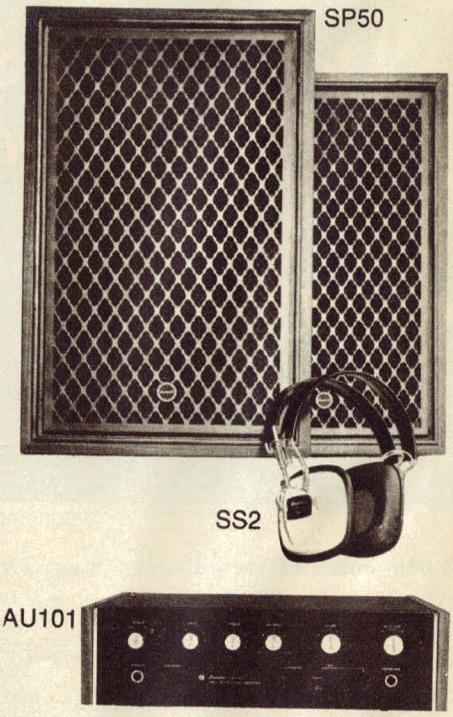
AKAI

AKAI ELECTRIC CO., LTD.
Ohta-ku, Tokyo, Japan

AKAI AUSTRALIA PTY. LTD.: 276 Castlereagh St., Sydney, N.S.W. Tel: 61-9881/146 Burwood Rd., Hawthorn, VICTORIA Tel: 81-0584/399 Montague Rd., West End, Brisbane, QUEENSLAND Tel: 4-0171/8 Arthur St., Unley, S.A. Tel: 71-1162/579 Murray St., Perth, W.A. Tel: 21-2561 SONNY COHEN & SON: 20 Isa St., Fyshwick, A.C.T. Tel: 9-1551 P & M DISTRIBUTORS PTY. LTD.: 87A Brisbane St., Launceston, Tasmania Tel: 2-5282

THE ONLY QUESTION IS . . .

Sansui stereophonic.. or quadphonic?



Sansui design and performance is so advanced and outstanding that your quest for high quality stereo sound equipment is over. One question only remains . . . Sansui **stereophonic** or **quadphonic?** Either way you get the best of both audio worlds and true, lasting, sound satisfaction.

We've illustrated two fully compatible Sansui stereo systems for you. Each one could be complete in itself; however, as illustrated, these fine solid state stereo systems share a turntable and tone arm (the record sound source) and they're linked by the remarkable new Sansui Model QS-1 Quadphonic Synthesizer. This unit simply converts 2 channel sources into dramatically effective four channel stereo.

How does the Sansui QS-1 work? It takes the stereo signal from the pick-up and, through a complex electronic process known as "phase modulation", spreads the sound **across** and **around** your living room. You listen to Sansui sound — **satisfying sound that approaches the concert hall more closely than any sound you've ever heard.** And you don't move from the comfort of home!

With Sansui Quadphonic Systems you use standard stereo recordings. No existing stereo equipment becomes obsolete, additional costs are reduced to a minimum. Already heralded overseas as the **"audio event of this generation"**, Sansui Quadphonic sound represents the beginning of a revolution in the enjoyment of recorded music.

You can start with Sansui stereo . . . with the best Sansui stereo system you can afford. This can eventually become your **front** left and right system for quadphonic. The supplementary stereo system, which should be fully compatible, can be considerably less expensive. It could eventually become the **rear** left and right system when you move to Sansui Quadphonic. Let us call them systems "A" and "B".

Sansui System "A" is illustrated on the right. This system would suit the dedicated stereo enthusiast. An AU-666 solid state stereo amplifier is linked to a matched pair of Sansui Model SP2000 4-way 6-speaker systems. Frequency response is 10-40,000 Hz. and power handling capacity 35 watts R.M.S. per channel into 8 ohm speakers. Wide range personal listening through the Model SS-20 stereo headset matches the audio quality of these beautifully finished speaker systems.

Sansui System "B" has been specifically designed for the budget conscious music lover, but becomes an excellent system for eventual quadphonic use. It combines the popular all-silicon transistor AU-101 stereo amplifier with hand crafted SP50 speaker systems. In the foreground you see the low priced Sansui Model SS-2 stereo headset.

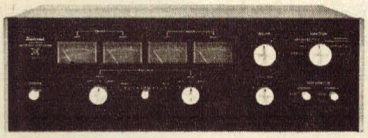
Sansui
SOUND SATISFIERS

AVAILABLE FROM ALL FRANCHISED SIMON GRAY DEALERS

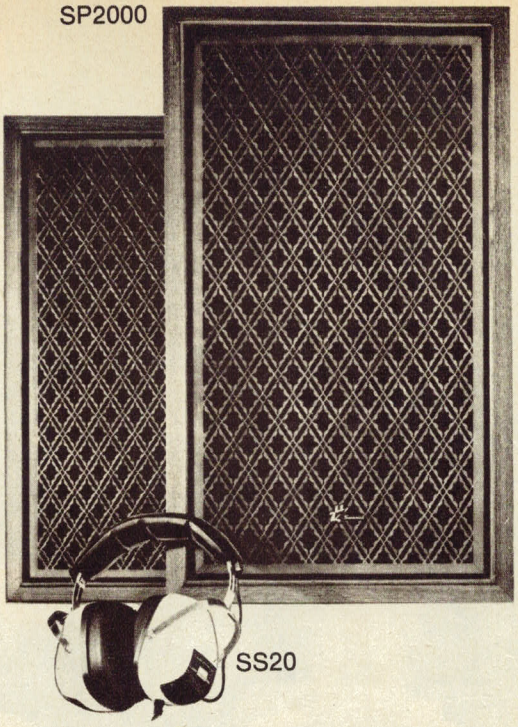
SR1050C



QS1

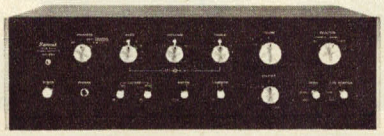


SP2000



SS20

AU666



The Sansui Model SR-1050C record sound source is common to both stereo systems.

You can start with either of these Sansui systems . . . and, if you wish, build them up to a quadphonic system by simply adding the Sansui QS-1 Quadphonic Synthesizer!

Here are brief specifications of the Sansui equipment illustrated for the technically minded.

You can see and hear Sansui stereophonic or quadphonic at your franchised Simon Gray dealer — he'll be glad to give you detailed information.

Call and see him soon. He'll help you make that important decision . . . Sansui **stereophonic** or **quadphonic!**

Sansui
Model QS-1
quadphonic synthesizer
Converts 2 channel stereo sources to four channel stereo.
Exclusive "phase modulation" electronic process, with space-age micro circuitry.
Frequency response:
Front channel —
20-20,000 Hz. ±1dB.
Rear channel: Concert Hall 1 — 20-20,000 Hz. + 1, — 2 dB.

Sansui
Model SR-1050C
stereo turntable
Two speeds. Four pole hysteresis synchronous motor.
Belt drive. Heavy alloy platter, micro-balanced.
Statically balanced tone arm, with lateral balancer and inside force cancellation device. Induced magnet cartridge with 0.5 mil. diamond stylus.
Frequency response — 20-20,000 Hz. Stylus pressure only 2½ grams.

Sansui
Model AU-666
stereo amplifier
Frequency response:
10-40,000 Hz.
Output: 35 watts R.M.S. per channel into 8 ohm speaker systems.
Sensitivity: 2-180 mV.
Sansui
Model SP2000
speaker systems
Frequency response:
30-20,000 Hz.
Power handling capacity: 35 watts.
Speaker complement: 12″ woofer, 6½″ and 5″ mid-range speakers; two 2″ horn tweeters, one 1⅜″ horn super tweeter.
Hand carved speaker grilles, selected walnut timber.

Sansui
Model AU-101
stereo amplifier
Frequency response:
25-40,000 Hz.
Output: 15 watts R.M.S. per channel into 8 ohm speaker systems.
Sensitivity: 3-200 mV.
Price: $139.
Sansui
Model SP50
speaker systems
Frequency response:
50-20,000 Hz.
Power handling capacity: 25 watts.
Speaker complement: 8″ mid-range woofer, new horn tweeter.
Hand finished cabinets of selected walnut, hand carved speaker grilles.

Sansui
Model SS-2
stereo headphones
Frequency response:
20-18,000 Hz.
Weight: 12 ozs.
Sansui
Model SS-20
stereo headphones
Frequency response:
20-20,000 Hz.
Weight: 26 ozs.

SGSQ-1471

Sansui

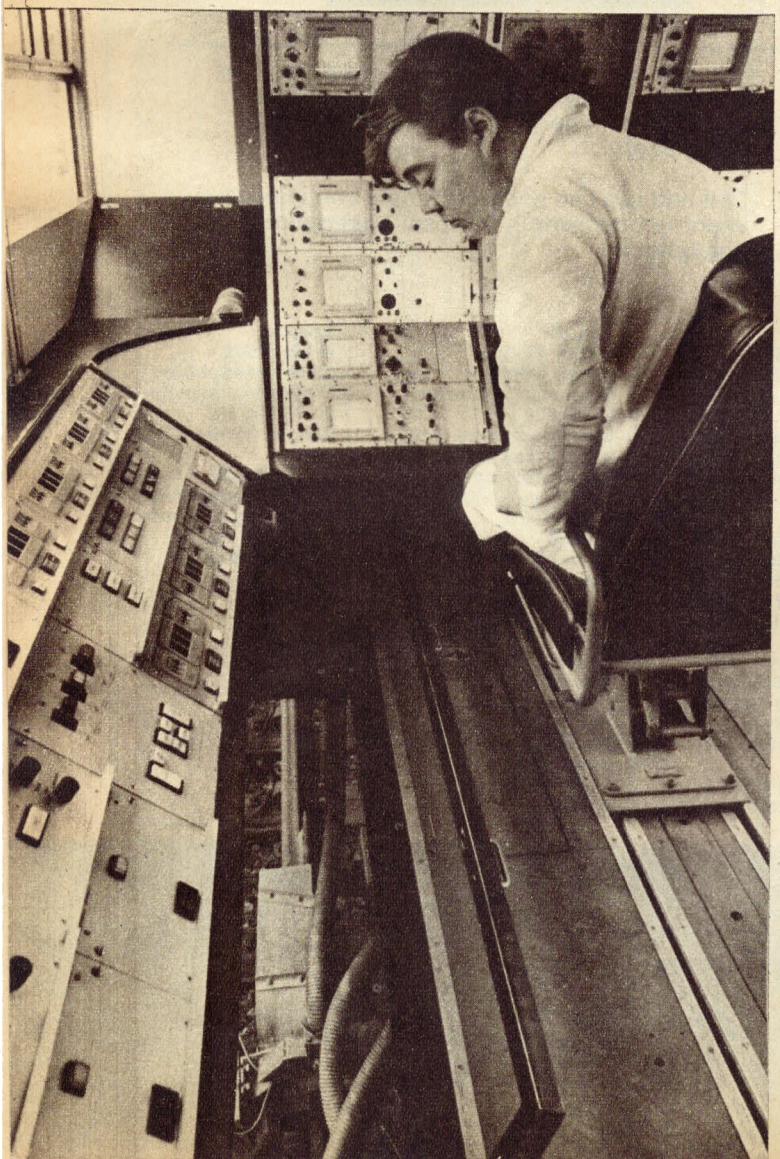
Simon Gray Pty. Ltd.

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Sansui equipment is manufactured by: *Sansui Electric Co. Ltd., 14-1, 2-chome, Izumi, Suginami-ku, Tokyo, Japan.*

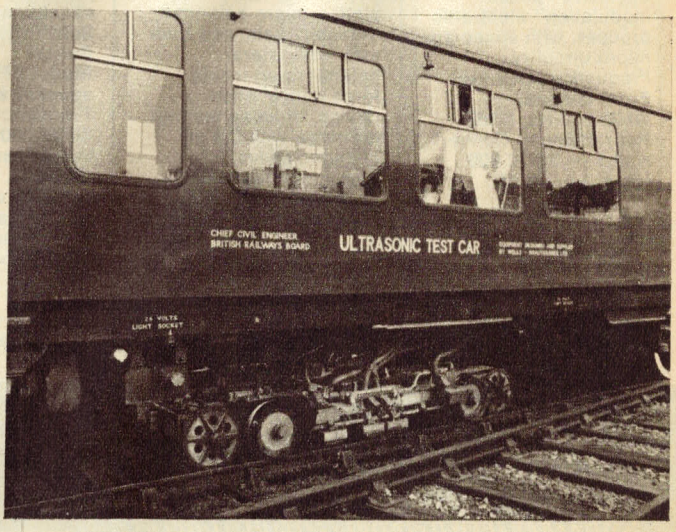
ELECTRONICS PICTORIAL



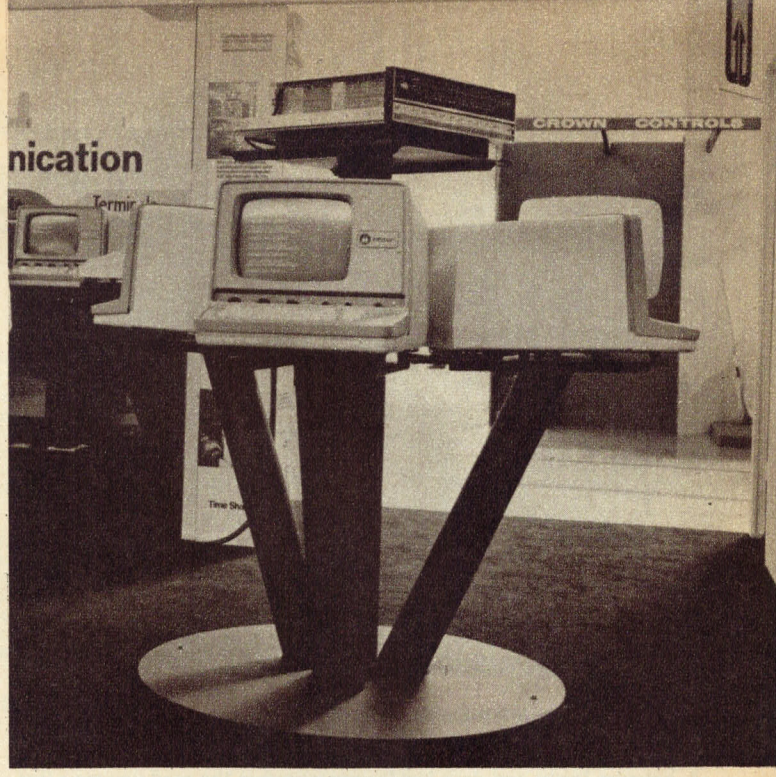
Smog smasher. (Left.) General Electric researchers in the USA have suggested a possible common solution to two environmental problems: how to dispose of thermal exhaust from power stations; and how to ventilate the smog-laden air over large cities. They discovered that a large plume of warm, moist air rising slowly from a proposed new cooling tower would penetrate smog, clouds, or inversion layers and rise to thousands of feet before dispersing. An inversion layer occurs when a layer of warm air lies over a layer of cool air. If this happens over an urban area, the cool air becomes increasingly polluted and smog-laden. The proposed tower would he hollow, about 60ft tall and 600ft in diameter. A GE engineer is shown working with a model of the proposed structure in an environmental chamber in which heat lamps are used to create an inversion layer.



Rail flaw detector. A new rail testing train (below), owned by British Rail, uses ultrasonics to detect and record hidden flaws in the metal lines while running at speeds up to 25mph. The train, which cost about $500,000 to design and build, is a two-car diesel-powered unit. It carries highly sensitive ultrasonic equipment in one vehicle and provides comfortable day and night accommodation for its five-man crew in the other. With the new train British Rail plans to test its entire main-line network at least once a year, and the busier routes up to three or four times a year. An operator (left) looks through the floor of the train at the ultrasonic probe trolley.

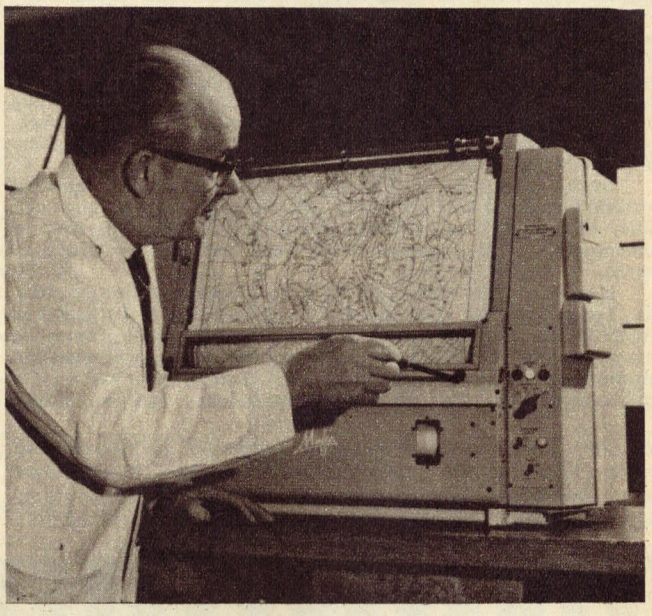


Computer display. (Right.) The main theme of the Fairchild Australia display at the recent international Instrumentation, Electronics, Computer, Control equipment, and Communications (IECCC) show was a central computer tree of knowledge. This consisted of a Nova mini-computer, using time-shared BASIC, hooked up to three Infoton display terminals. Visitors to the stand could use the Infotons for actual work situations or play games.

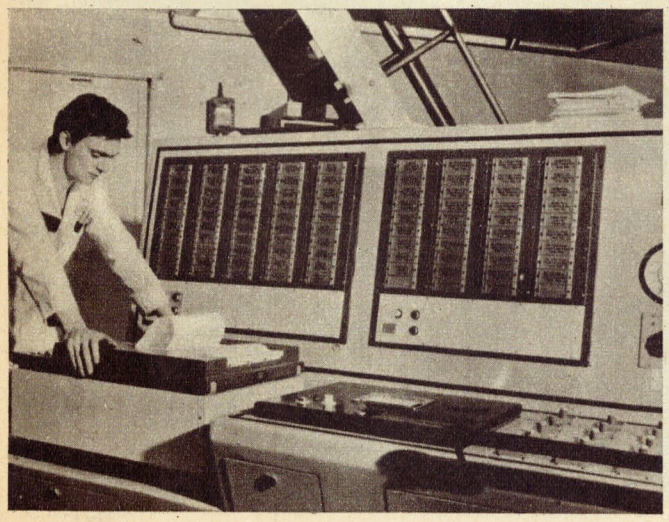


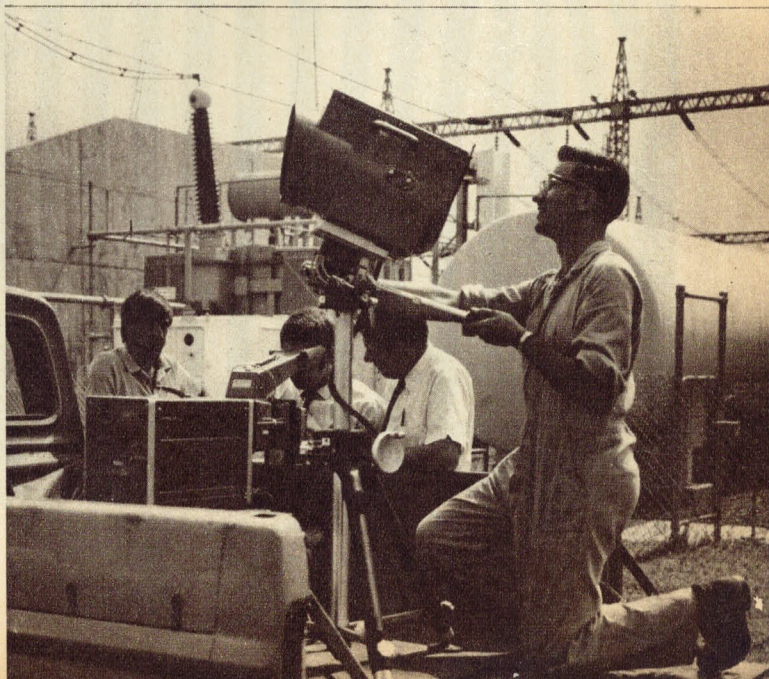
Weather recorder. (Centre.) This Muirhead Weatherchart facimile recorder can reproduce complete weather maps or data collected from information supplied by meteorological stations on land or sea or by orbiting satellites. The recorder can be switched on by a radio signal, and operated according to radioed instructions from a distant station.

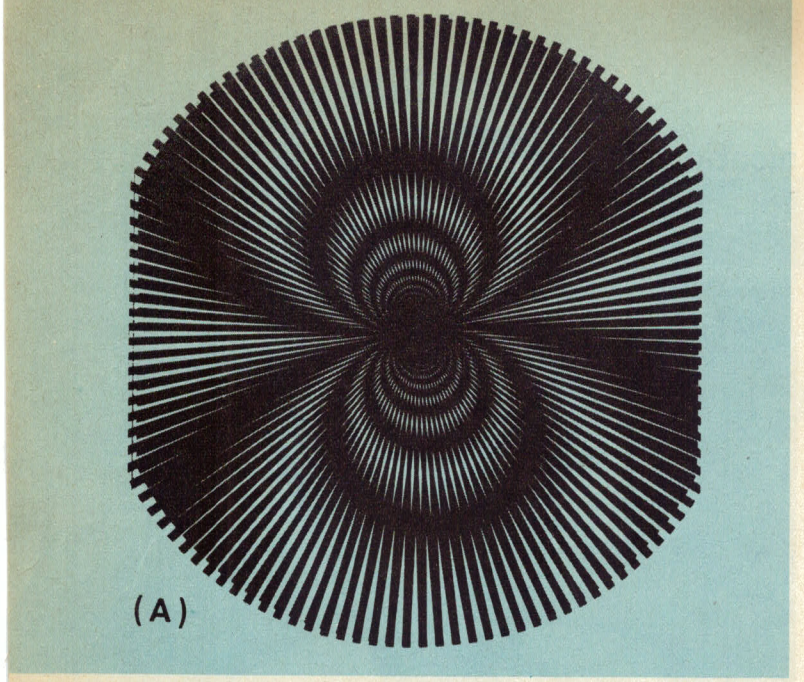
Thermovision camera. (Below right.) The NSW Electricity Commission is using a thermovision (infrared) camera in periodic inspections of all its establishments. The camera monitors an object's heat emission and displays the heat image on a screen. An isotherm built into the console can measure the heat output of any part of the target to an accuracy of one or two degrees. It can detect hot spots and enable thorough testing while equipment is still in operation. The camera is mounted on a truck and can operate from normal mains supply or a battery. To maintain internal temperature constancy, the equipment is cooled by liquid nitrogen.



Ship's instrumentation. (Below left.) An engine room monitoring and data logging system, called the ISIS 300, was described by the manufacturers, Decca Radar Ltd, during a recent trade mission to Australia. The system consists of a range of standard electronic equipment from which integrated ship instrumentation systems may be built up in various configurations to suit individual requirements. It is principally based on analogue sensors, said to be safer than switches. The installation shown is aboard the 250,000-ton Esso Ulidia, which completed its maiden voyage in December, 1970.







MOIRE

ancient craft in the service of modern technology

by Elmar Laisk

Most people see moire patterns during the course of everyday life, perhaps without realising what they are or even giving them any thought. The wind blows a nylon curtain into folds, and a series of irregular bright and dark bands appear; across the road you see a line of railings, and behind it another similar line of railings and as you walk along, peculiar optical effects are apparent; a comb sits on a mirror, and patterns of light and dark bars appear. These are but three common examples of moire fringes from among many that may be encountered almost daily. These moire fringes form fascinating patterns that seem to possess a life of their own, changing in shape, revolving, swelling and contracting continually with the slightest movement of the observer or the material observed.

Such a fascinating phenomenon is hardly likely to be neglected by those concerned with the visual arts. Moire patterns are now used widely in "op art": on television (particularly in the preparation of commercials) and in situations where weird physchedelic effects are desired.

However, moire techniques have more serious applications than this. Technology has also adaped the phenonemon to be useful in various technical applications: For example, in the digital control of program-operated machines; in non-destructive testing for stresses and deformations; for accurate determinations of small linear and angular displacements. in the science of metrology; and in optical measurements[4,9,12]. Apparatus producing moire effects has also proved to be useful in psychological examinations.

In many ways, moire patterns are helpful also in teaching; for instance demonstrating the principles of interference, phase velocity, holography, microwave propagation in waveguides, radiation pattern of dipoles, electric field configurations and flow lines in moving liquids.

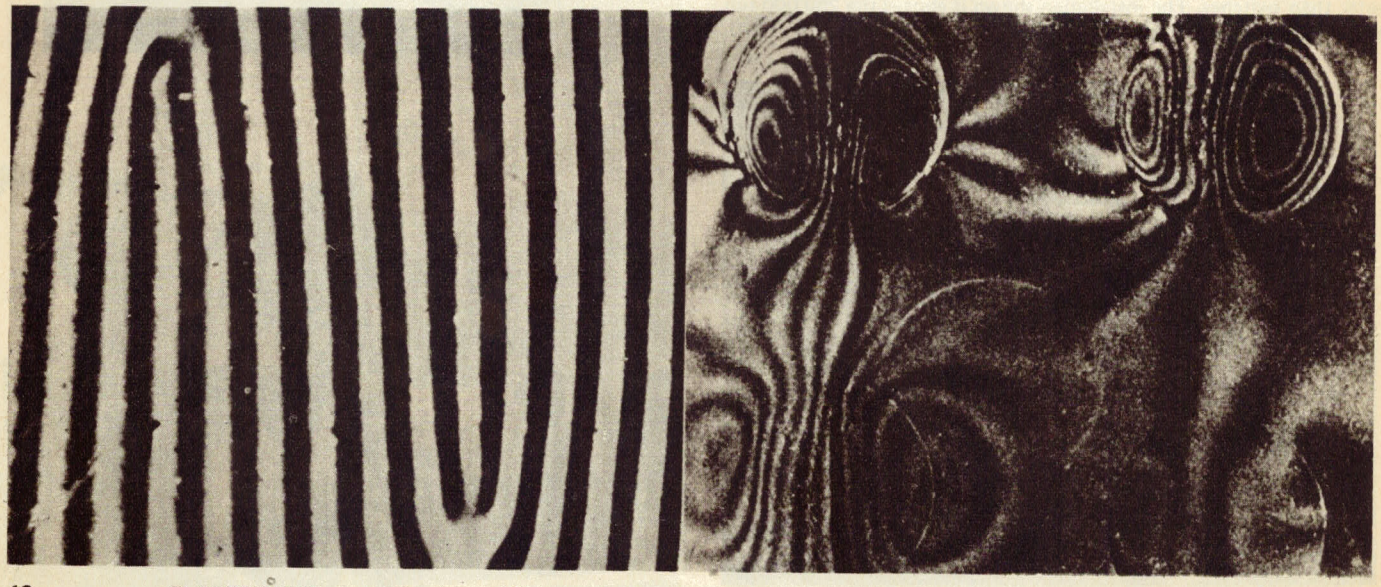
In electronics, moire pattern visual aids can simulate beating, mixing and modulation processes, the superhet principle, the radar moving target indicator, the backward wave oscillator and radiation patterns of phased arrays.

With moire techniques, one can study graphically certain differential and integral equations and solve problems in geometry and Fourier analysis.

On the other hand, moire fringes can present problems in circumstances where they are not wanted. Common instances of these problems are the appearance of moire patterns on the TV screen; the "beating" between two half-tone screens in the printing industry; and the occasions when people find irritating the moire patterns made by finely woven materials, such as nylon curtains.

The term "moire" is derived from the French name for the Chinese and Thai fabrics that shimmer mysteriously with subtle colouring effects, known to us as watered silk.

BELOW: Two rotational patterns produced by two crystal layers ("dislocations") irradiated with x-rays in a silicon interferometer. Additional interest in these pictures stems from the "beat" produced in the screening process used to prepare the picture for printing. The picture is copied directly from "Physics Today" (August, 1970) and the 130 screen of the original is interfering with the 150 screen used in the printing of this magazine.



PATTERNS

This "watered" effect of silk, mohair, and cotton fabrics is brought about by several well-kept secret trade processes originated several thousand years ago by Chinese craftsmen. The process usually involved the folding of a lattice-woven glossy fabric, combined with the application of heat, vapours, and heavy pressures. Besides the references to moire in ancient Chinese writings, there is mention of a particular dress worn by the Queen of Sheba that enhanced her vital statistics and serpentised the movements of her body and limbs.

The first really scientific description of moire fringes was given by the English physicist Lord Rayleigh in 1874, when he proposed a sensitive test of accuracy for diffraction gratings. Nearly 50 years later, the Italian V. Ronchi designed practical tests for abberations in lenses and mirrors (1922). Then in 1950 Sir Thomas Merton (UK) proposed a simple but very sensitive moire fringe counting system suitable for industrial measurement. This system was realised in the National Physical Laboratory in England by T. Guild, who developed gratings and photoelectric fringe counting methods (1956) which were immediately adopted by industry[3,4].

Various publications by Gerald Oster[2,5,6,7] and especially a moire kit devised by him[6], introduced moire techniques into art and science teaching, where they were immediately successful.

Figures 1A and C display moire fringes produced by two rulings intersecting at a small angle. The dark fringes are due to the obstruction of the light passing successively though both rulings. Since the fringes represent intensity modulation of light, the slit-and-bar rulings are also called "amplitude gratings". The appearance of the moire fringes is unrelated to the wavelength of light and depends only on the line spacing (pitch), closeness and the alignment of the two rulings.

With very fine rulings exceeding 2000 lines per inch, the diffraction and interference effects become significant. The fringe appearance then depends on whether diffused, collimated, monochromatic, polarised or coherent laser light is used for illumination. However, very fine rulings are seldom employed for moire purposes in industrial applications.

For purely geometric moire fringes, the two gratings must be in actual contact, or, if it is required that the two should be able to slide, lubricated with a thin layer of oil.

The importance of closeness is strikingly exemplified by means of gratings made from Letratone (artists shading screen), made by Letraset Ltd of the UK, and available in Australia from Letraset Australia Pty Ltd, Sydney. Gratings made from Letratone 4 and 1 negative format (white dots on a black ground) are inserted into the beam of a slide projector; if in contact, they produce moire effects whereas, if they are aligned at a distance, colour effects are produced. Almost pure colours can be produced from white light by moire filters of this type.

Figure 3 shows how fringes are formed from two rulings intersecting at an angle θ. The fringe width can be determined by the formula

$$m = P/\theta$$

where

m is the moire fringe width in inches

p is the pitch of the rulings, in inches

θ is the angle between the two rulings, in radians.

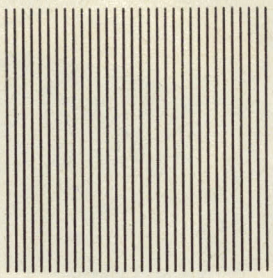
For example, if the pitch of the rulings is .01 inch (almost unresolvable by the eye) and the inclination is .0175 radian (1 degree) then the moire fringe width will work out to 0.57 inch. At an angle of only .0029 radian (10 minutes of arc) the fringe width equals 3.45 inches, a magnification of 345 times relative to the pitch.

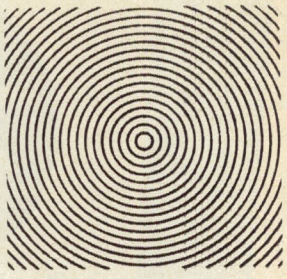
In consequence, if one ruling is moving 0.010 inch per second (3 feet per hour) horizontally, the fringes will move 3.45 inches per second (about 0.2 mile per hour) vertically. A small photocell behind the rulings will then record a sinusoidal variation of light intensity across each fringe. By counting the fringes which pass the photocell, the traversed length of the ruling can be determined numerically within a fraction of the pitch of the reference grating.

Figure 1B shows a second type of moire fringe produced by parallel alignment of two rulings with slightly different pitches, p and q respectively. Again, an inverse law holds: – the smaller the difference d between pitches, the wider the fringe width m, namely $m = pq/d \approx p^2/d$ or $p \times (p/d)$, which means that the fringe width represents a magnification of (p/d) times the pitch p.

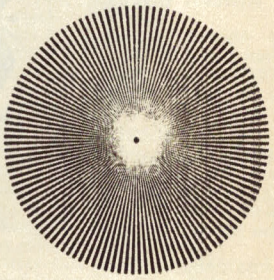
These moire fringes run parallel to the lines, and are called vernier fringes. They are analogous to the beats produced between

Typical patterns for moire experiments

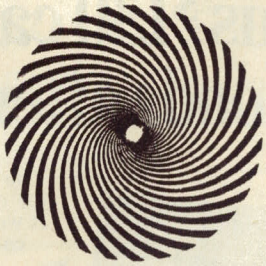




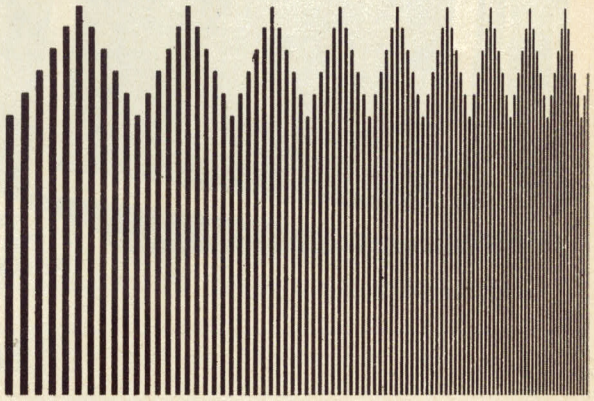
LEFT: Superposition of two line gratings, representing periodic waves, demonstrates interference and standing waves. Gratings with slightly different spacing demonstrate beats, ie, intermediate frequency in superhet receiver.
RIGHT: Equispaced concentric rings represent point source of waves. Superposition of two such ring patterns produces fringes, similar to those in Young's double-slit experiment.
Superposition of these two patterns (lines and rings) represents Fresnel diffraction at a straight edge, producing spherical waves.



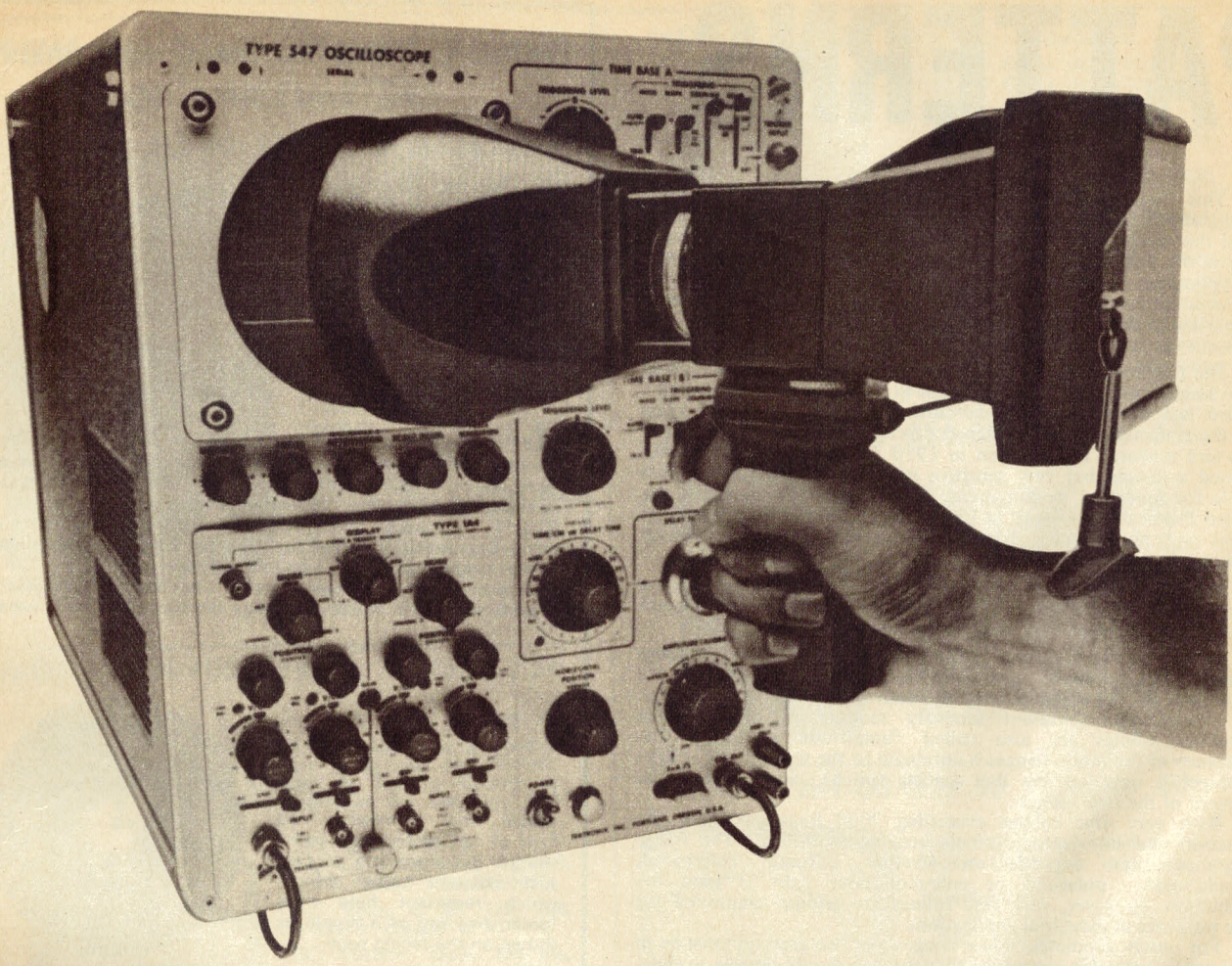
Radial lines represent field lines of central force, or point charge. Superposition of two such patterns causes fringes which represent field lines (polar diagram) of a dipole, as shown on the facing page.



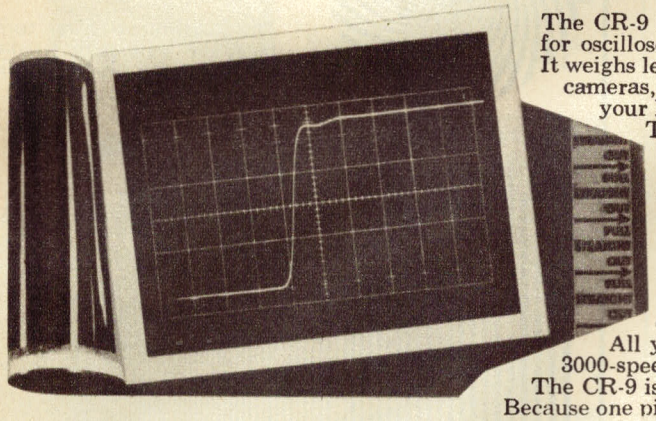
This logarithmic spiral combines the features of a radial grating and logarithmically spaced concentric grating.



Logarithmic grating. Overlapping this pattern with its copy produces fringes which represent the performance of an exponential microwave horn.



This $130 camera gives you a picture 15 seconds after you pull the trigger.



The CR-9 is a new, low-priced camera specifically designed for oscilloscope trace recording.

It weighs less than 1½ pounds. So, unlike permanently-mounted cameras, it can easily be used with more than one oscilloscope in your lab.

The Polaroid CR-9 Oscilloscope Camera is designed to take any one of 8 interchangeable light-tight hoods. These fit almost all oscilloscopes with 6 x 8, 6 x 10 and 8 x 10 cm graticules. (You specify the hood you need when you buy the camera; additional ones cost a little extra.)

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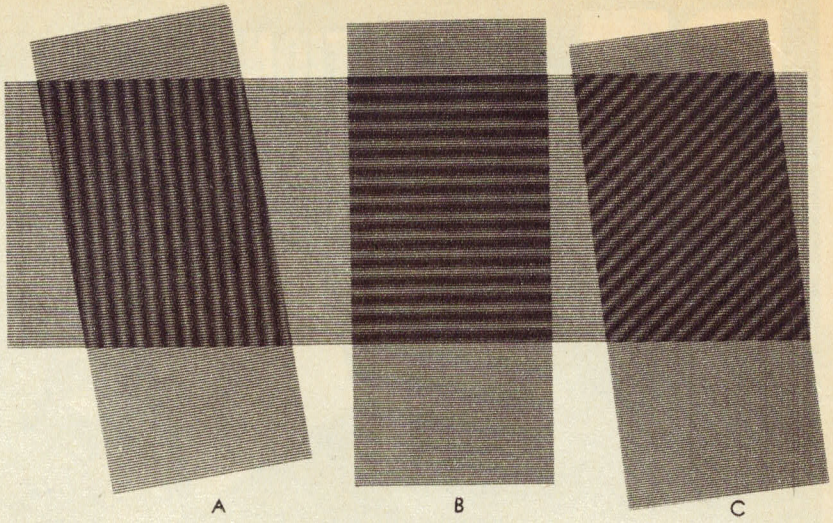
The Polaroid CR-9 Oscilloscope Camera

For information or a demonstration, write to us. Or if you can't wait, send us a purchase order and the bezel size of your oscilloscope. Polaroid Australia Pty. Ltd., P.O. Box 335, Broadway, N.S.W. 2007.

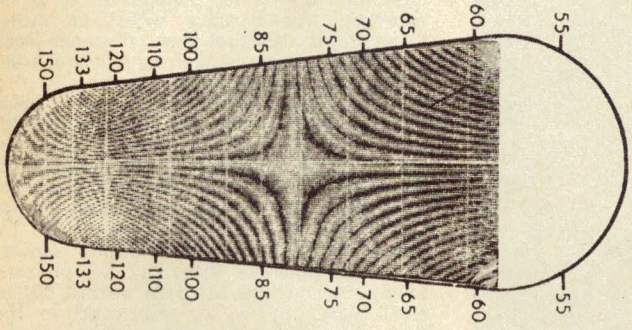
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Moire fringes from gratings

RIGHT: Figure 1. Moire fringes produced by two grating which have (A) same pitch and an angle of rotation of 10 degrees; (B) small difference in pitch and no rotation; (C) small difference in pitch and a rotation of 6 degrees combined.



BELOW: Figure 2. A "universal" type screen determiner. This is constructed by connecting equispaced points along a line to a common origin which lies on the axis to the perpendicular, to form a fan-shaped configuration. When overlaid on a half-tone picture, a four-pointed star moire pattern is formed. The screen present on the picture is indicated by the arms of the star which point to the appropriate numerals.



two tones of nearly equal pitch, or generally, between any two oscillations of slightly different frequency.

For instance, two rulings having 1000 and 1001 lines per inch, with a difference d in pitch of 10^{-6} inch, will produce beat fringes 1 inch apart. This fringe width represents a magnification of 1000 times the pitch (= 0.01in); or a million times, $(p/d)^2$, ot the error (10^{-6}in) in the pitch. At such magnification any microscopic error in the rulings will be visible to the unaided eye.

If one of the gratings is fastened to a shaft which slides, say, .01in/sec (=3ft per hour), then the fringes will travel 10in/sec (= 0.6mph), very much faster than the physical velocity involved.

It is noteworthy that the beat fringes will travel either forward or backward depending on whether the pitch ratio p/q is less than or larger than 1, where p is the pitch of the moving grating. The direction depends also on the transmission (=bright/dark spacings) ratio of the two gratings. The effect can be observed with gratings cut from Letratone LT73 ("frequency" 64 lines per inch) and LT72 ("frequency" 56lpi), which produce 8 moire fringes per inch (= "intermediate frequency").

Moire fringes will often form compound patterns if the two gratings have disparity in both pitch and angular alignment at the same time. This situation often occurs in non-destructive stress analysis. The method involves transferring an exact copy of a reference grating to the surface of the test piece, using photographic, photo-resist or transfer techniques. As the test piece is loaded, the transferred grating will deform with the surface, while the reference grating above it will not be deformed. Moire fringes will be apparent when the gratings are viewed in collimated light. These fringes are related directly to the displacement field from which can be computed cartesian strain components. The components of stress can then be determined from the strain field for the material, for which the modulus of elasticity, Poisson ration and modulus of rigidity are known.

For measurement of contour irregularities on a finished surface, a technique has been evolved which requires only one grating. Using collimated light a shadow of the test grating is projected on to the workpiece and viewed, through the grating, usually by means of a camera, from a carefully selected and controlled viewing angle. Any departure of the surface from true flatness or true curvature according to what was required, becomes immediately evident. A similar technique employs a highly reflective coating on the workpiece to provide a reflection of the grating, rather than a shadow.

In a more refined reflection moire setup ("multiple source method") it is possible to record contours of a curved surface directly. The method has been extended for solving dynamic problems – for instance, recording vibrations of plates and membranes in flexural modes (Chladni figures) so that they can be evaluated numerically.

Commercial moire gratings consist of highly accurate linear arrays with about 1000 lines per inch. The master gratings are made on high precision ruling machines. The production models are produced from these expensive master rulings by several replication methods.

Although one or two ruling devices in the world are capable of ruling a fantastic 250,000 lines per inch for diffraction purposes, such fineness would be quite useless in industry. Only in a few non-destructive testing processes is a frequency of 10,000 to 20,000 lines per inch required in order to measure strains of about 100 microinches per inch.

Moire gratings up to 15ft long with standard pitches from 10 to 1000 lines per inch are available commercially. A Ferranti counter with digital output employs 2500 lines per inch gratings. It gives four counts per fringe and an accuracy of 0.0001 inch.

The half tone screens used in the printing industry by photo-engravers have, at most, about 200 lines per inch. Beyond that, photographic or photo-resist techniques can be used to obtain inexpensive but satisfactory moire gratings up to 1000 lines per inch, or more.

For experimental purposes, commercially available Ronchi rulings, and moire sets are available from Edmund Scientific Co, Barrington, NJ 08007, USA; and from Proops Bros, 52 Tottenham Court Road, London W1. Also, as already mentioned, workable grating can be made from Letratone, from which patterns LT 71, 72, 73, 57, 920 and 171 are suitable. With some practice, it is possible to make a moire vernier from Letratone 73 (64 lines per inch) as a reference grating, and a piece of the same material carefully stretched to 63 lines per inch as the moving grating. The material is carefully fixed to pieces of clear plastic material, such as Perspex.

Moire generating patterns shown on page 13 are more useful in art and science teaching. For an op artist, they offer an almost infinite variety of fascinating patterns and forms, especially if the sets are in basic colours. In teaching maths and science, they offer facilities for a large number of analogues and demonstrations, some of which are indicated in the table.

In industry, the use of very high precision moire techniques and interference methods is impractical. The great advantage of the moire fringe method is that it can be adapted, with ease, using coarser ruling and lesser angles, to any accuracy. Moire fringes with rulings up to 1000 lines per inch (40 lines per mm) can be seen and counted without special optical equipment. Nevertheless, an accuracy of about 0.0001in can be achieved with such cheap and robust moire fringe attachment an any machine tool.

For the production of sharp moire fringes it is essential that the spacings in the two overlayed grids are nearly the same, because the contrast and the separation of the moire fringes decreases as the difference in spacing between the two generating grids increases. This effect provides, for instance, an easy method for the determination of the spacing of an unknown printing screen by means of a variable space comparison screen (figure 2).

National

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On the other hand, the rate of widening of moire fringes increases enormously as the difference either in pitch or in angular alignment of the two gratings becomes very small. The graphical expression of such an inverse law – the smaller the difference, the wider the fringes – is a hyperbola. In consequence, a linear change is pitch of inclination between the two gratings results in hyperbolic moire fringes, whereas a linear moire fringe is the focus of points of constant pitch.

Such extraordinary resolving power of moire fringes relative to small changes enables one to measure linear displacements of the order of 0.0001in and angular differences about one second of arc quite simply. With a more refined moire technique it should be possible, in theory, to measure angles of the order of 10^{-10} radians. In comparison, an optical telescope can resolve two stars when their separation exceeds 10^{-4} radians. Several high-resolution moire "optical levers" have been devised.

The theoretical limit of linear resolutions with moire techniques is predicted to be about 10^{-12} centimetres, which is about one ten-thousandth of the diameter of an atom. However, this accuracy would be rather illusory in the physical sense; at atomic level, other methods involving Bragg reflections and light interference are preferred.

As emphasised before, moire fringe methods provide extremely sensitive tests for errors and distortions in gratings and arrays. Diffraction gratings are tested by this method. The same method is now extended to provide a convenient method of testing raster distortions and scanning errors in TV monitors, TV cameras and display devices such as cathode ray tubes and X-Y plotters. Lately, the method has been worked out in much detail by W. C. Sobolevski in the Electrical Engineering Department at the University of Adelaide.

It appears that, in principle, moire methods could be applied to the detection of counterfeit money. Australian currency notes

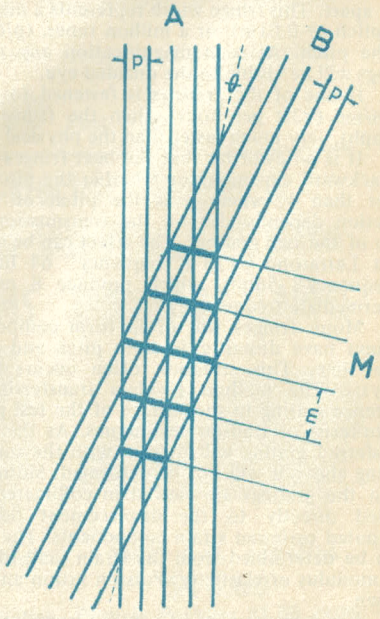


Figure 3. Showing how moire fringes are formed from two gratings. Grating A, with line pitch P, is laid over an identical grating B at a small angle θ. The moire fringes M, with pitch m, occur at the loci of the intersections.

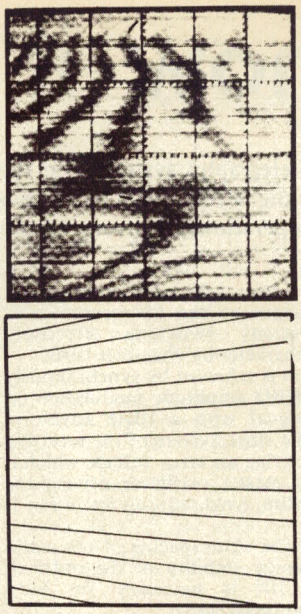
have a linear grating running through the pattern which readily forms fringes even with rough test screens devised from Letratone 49 and 56. Any variations in these rulings which might be present in counterfeit money would be apparent using more discriminating tests screens. For practical application, some kind of test jig which allowed speedy comparison could be devised.

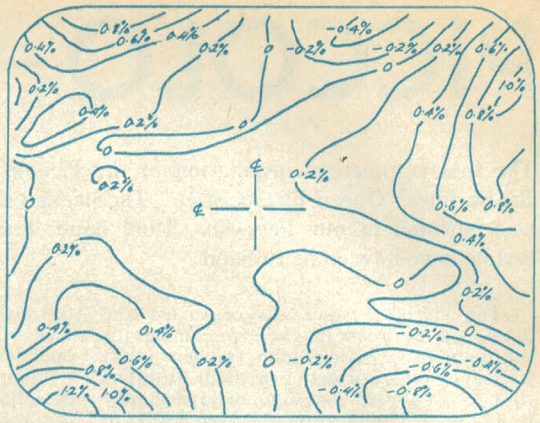
It is quite simple to build a moire fringe attachment for a vernier caliper or micrometer so that measured lengths can be displayed numerically on a relay-counter. The two gratings can be made from Letratone 71 or 73, stuck to two pieces of clear plastic. The fringe counting device consists, essentially, of a small cadmium sulphide photocel, a prefocused torch cell and a PMG counter.

The above attachment makes also an accurate indicator for linear expansion and stress. In a similar manner, an angular moire indicator made from radially ruled lines of Letraset 195, 196 or 197 can provide a numerical indicator for a sensitive torsion spring balance or electrometer.

It is possible to build many special effects devices with moire gratings: for example, a light beam modulator, a visible sound standing wave indicator (Kundt tube), a psychedelic illuminator or even a moire microscope. The latter employs two widely seperated dot gratings – one negative, the other positive, illuminated from a point source. The gratings are aligned so that, normally, they do not pass light. If a small transparent object of varying refractive index is placed near the light source, the light rays will be deflected and a contour of the object becomes visible on the screen. The same principle applied in collimated light enables one to visualise temperature gradients, variations in concentration and flow lines in liquids and gases.

Moire fringes will appear when two seemingly irregular meshes having some hidden common pattern are viewed against each other in experimentally found





The moire fringe method of testing for TV picture distortions. Moire fringes (top left) resulting from raster distortions are obtained by placing a screen grating on the face of the TV screen (lower left). The diagram at right shows typical equal-distortion contours derived from moire fringes on a TV screen.

alignment. In principle, one of the meshes could be a regular pattern or half-tone screen with either constant or variable pitch. From the appearance of the moire fringes the features of the hidden pattern (= signal in noise) can be deduced.

However, the method can also be applied in reverse. For instance, if a complex mesh, such as a fingerprint or a contour map, is viewed through a transparent overlay carrying a regular pattern, then the resulting simple moire pattern will exhibit specific features. These characteristic features can be used for classifying and referencing fingerprints, folk-weave patterns, weather maps or landscapes.

A moire fringe Fourier analyser has been proposed by A. Lohmann. The purpose of the analysis is, of course, to determine the amplitude and frequency of various sinusoidal waves which constitute an inharmonic waveform such as a square pulse. The analyser consists of two illuminated identical grids producing moire fringes whose period varies with the angle between the grids, and the light transmission varies sinusoidally with their linear shift. These moire fringes are imaged on a mask into which the square waveform is cut, and the Fourier coefficient can be determined from the transmitted light while shifting and rotating the grids.

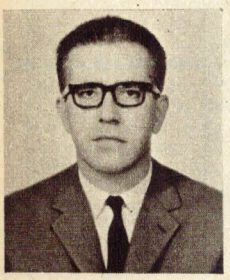
REFERENCES

1. LORD RAYLEIGH. Scientific Papers, Vol 1, p 92 (1874).
2. OSTER, G. et al. "Theoretical Interpretations of Moire Patterns",

(Continued on page 150)

Pioneers in modern moire techniques

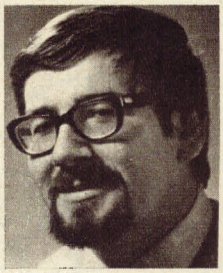
PROFESSOR P. S. THEOCARIS has written over 100 pages on various applications of moire fringes. In 1970 he published a comprehensive book on moire techniques. He has been awarded highest degrees from universities in Athens, Brussels and Paris, and has help fellowships and professorships at the Massachusetts Institute of Technology, Brown University and Pennsylvania State University. At present he is Professor of Mechanics at the National Technical University of Athens.



Professor Theocaris says that his present research involves a different moire method for the study of body and gravity forms around tunnels, real time holography to investigate crack propagation modes in metals, and a reflected shadow method for the evaluation of stress in plastics.

VICTOR C. SOBOLEWSKI, born in Cracow, Poland, received a first class honours BE degree in 1965, and is now working for a PhD degree at the University of Adelaide. His work on moire fringes was prompted by the need to determine very precisely the distortions of a TV-type display combined with an imaging lens and scanning system of a vidicon camera.

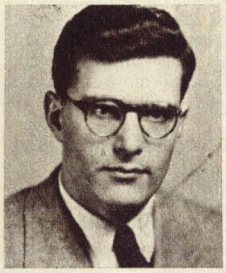
Of his work in this direction he writes: "Basically, moire fringe metrology depends on the comparison of a simple two-dimensional pattern representing the quantity to be measured with a similar accurate standard pattern, either a "hard copy" transparency or one generated electronically. The resultant moire fringes are indicative of differences between the two, greatly magnified.



"The simplicity of the method and its use results in very low cost, while the ease with which the results can be interpreted makes it possible even for amateurs to measure precisely CRT and TV display linearity.

"Scanning and display linearity of a computer-driven displays for precision graphics applications and, in military applications, of radar PPI with standard and non-standard scan patterns, have been measured with previously unobtainable accuracy. Moire methods can equally be used to measure non-linearity of images in imaging devices such as simple photographic cameras or TV cameras.

"By mixing signals requiring analysis with standard electronically generated signals and observing the displayed results, information about the signal or the signal processing hardware, otherwise not readily obtainable, can be readily seen and evaluated".



PROFESSOR GERALD OSTER is currently Professor of Biophysics at the Mount Sinai School of Medicine at the City University of New York. He graduated from Brown University and received a PhD from Cornell University in 1943. He had conducted research at the Rockefeller Institute for Medical Research, Massachussetts Institute of Technology, Princetown University, and in London, Strasbourg and Paris, prior to being appointed Professor at the Polytechnic Institute of Brooklyn.

His many published articles on moire patterns, and his book "The Science of Moire Patterns" in particular, have made moire popular as an art form all over the world. Several of his moire constructions have been exhibited in art museums, and he is currently concerned with the visual psychological effects of moire.

PICCOLO – how it works

The first commercial installation of the Piccolo radiotelegraphy system is in the British liner "Queen Elizabeth II". The background to the development of Piccolo was outlined in our February, 1969 issue. Further operational features of the system have now come to hand.

The Piccolo system was originated and developed as a means of overcoming the shortcomings of various other frequency shift telegraphy error-correcting methods. It differs from conventional two-tone radiotelegraphy in its use of 32 audio tones – from 330Hz to 640Hz (plus 650Hz for standby) with only 10Hz separation – each tone representing one character of the Murray code alphabet. Since the system operates at 100 words per minute these changing tones sound something like a piccolo, hence its name. The system does not require a return path transmitter and, as solid copy is printed without having to stop for error correction, the transmitting time is kept to a minimum.

A single tone is transmitted for the full period of each character and as the system operates at 10 characters per second in order to work with standard teleprinter equipment, each tone-burst lasts one tenth of a second. The tones are spaced by 10Hz, the reciprocal of the character duration, and this feature is important in producing a required orthogonal relationship between the responses of the multiplicity of detectors provided at the receiver. The transmitted tone frequency is amplitude-modulated to a depth of about 10 per cent with a 10Hz square wave which is required for synchronising purposes.

At the receiver the signal is applied to a bank of 33 tuned circuits which are initially quiescent. Each circuit has an amplifier applying positive feedback so as to boost its Q-factor to near infinity. The response of such a resonator to a sudden burst of tone is shown in figure 1. It can be seen that one tenth of a second after the application of the tone, the response has built up linearly if the tone is the appropriate one, and is zero to any frequency that is off-tune by a multiple of 10Hz – the orthogonal relationship referred to above. All the receiving resonators are quenched to zero at the end of each character. Thus the responses of the A and B resonators to the input signal B-A-C-K is shown in figure 2.

The output of each resonator is rectified and, at the end of a character interval, the output voltages of the 33 detectors are simultaneously examined in a voltage comparator circuit. This identifies the detector with the highest voltage and presents the information as a single pulse on the corresponding one of 33 output wires.

As a by-product of the comparator system, the triangular "build-ups" for the sequence of selected characters appear on a single wire. The peak voltage of the composite waveform is proportional to the amplitude of the input signal and is in an effective bandwidth of 10Hz. This waveform is rectified, smoothed and applied as automatic gain control to the input amplifier.

To counteract fading on high-frequency radio circuits the Piccolo receiving system is usually operated in a double diversity mode; a second set of 33 resonators, identical to the first set, being driven by the second signal. Each pair of resonators of like frequency is connected to a common detector load output. Thus the comparator circuit actually selects the highest output of the 66 resonators so that the diversity switching effectively operates on a character-by-character basis.

Synchronism is achieved by synchronously detecting the 10Hz amplitude modulation on the received signal with a 10Hz waveform generated by the clock system of the receiving Piccolo and deriving an error voltage which is applied to the master oscillator driving the motor. The entire synchronising operation is automatic.

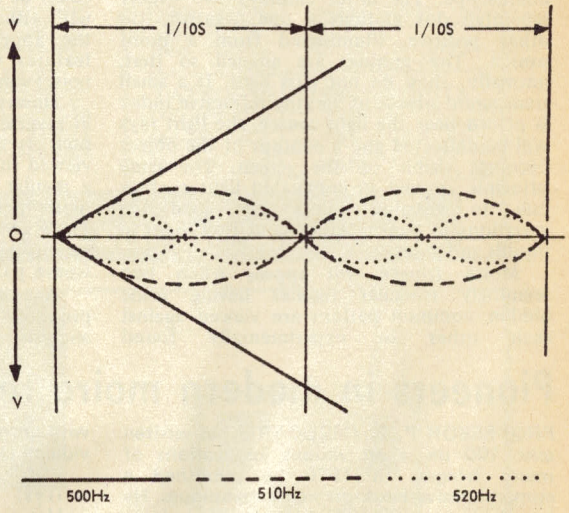
Because of the close spacing of the audio tones, a frequency stability of the order of one part in 10^8 is necessary for both transmitters and receivers.

Piccolo was developed by the UK's Diplomatic Wireless Service to provide reliable communications under adverse conditions, such as high ambient electrical noise levels, co-cited transmitters and receivers, and low transmitter power. It has been used in this role for some 20 years, without attracting much attention from commercial companies. Belated recognition came with the decision of the Marconi Company to make the system available commercially.

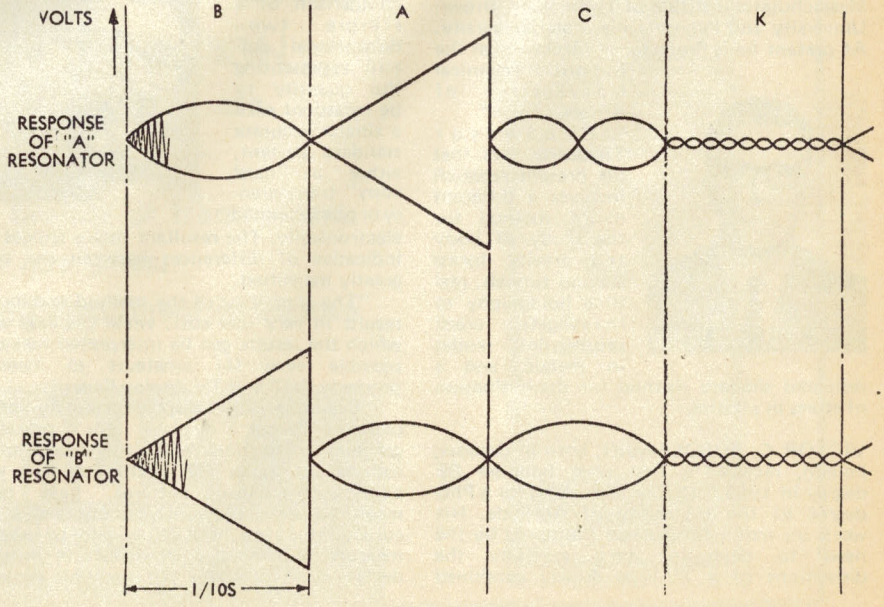
The first commercial installation is in the liner "Queen Elizabeth II" where it is used to transmit copy for a special edition of a London newspaper printed daily aboard ship. Copy for the newspaper is normally transmitted by HF radio, but under certain adverse conditions, where severe fading of the signal is experienced, Piccolo is called into service.

(Condensed from an article by V. O. Stokes, the Marconi Company, England.)

RIGHT: Figure 1. Envelopes of response to burst of 500Hz tone of tuned circuits at 500, 510 and 520Hz. One tenth of a second after the application of the tone, the response has built up linearly if the tone is the appropriate one, but is zero to any frequency that is off-tune by a multiple of 10Hz.



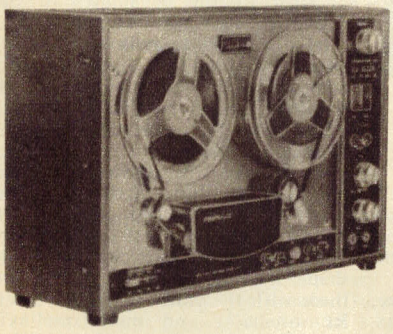
BELOW: Figure 2. The response of "A" and "B" oscillators to B-A-C-K signal

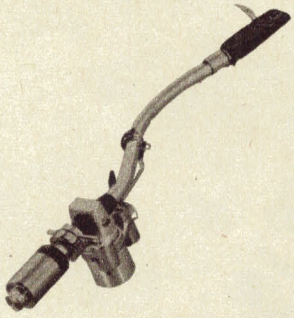


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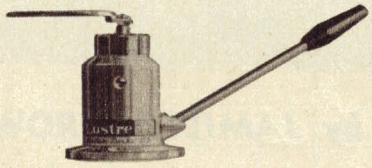
This fine unit has all the features that make a great recorder—push-button solenoid control of tape motion, hysteresis synchronous capstan motor supply and take-up reel motors for smooth tape spooling, electrical speed change, tape tension control for standard and thin base tape, etc. Four heads offer reverse play plus off-tape monitoring.
American "High Fidelity" magazine, reviewing Marlux 407, enthusiastically says, "The unit offers high performance and versatility in a well-engineered and handsomely styled open reel format aimed at the serious home tape enthusiast. Especially notable are its low wow and flutter, low distortion, excellent signal to noise ratio, absolute meter accuracy and smooth extended response. Thanks to careful engineering and construction, it is a pleasure to use and to listen to!
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New low cost has many

by JAMIESON ROWE

Closed-circuit TV systems are now widely used in such applications as industrial and commercial monitoring, advertising and promotion, and the relaying of lectures in universities and teaching hospitals. But until recently the potential of CCTV could not be fully realised in private homes, schools or the smaller stores, mainly because of the significant price barrier. A typical system with a single camera and monitor called for an outlay of around $750-$850, including camera lens and vidicon tube but not installation.

Happily this situation has now changed very much for the better, thanks to a new "mini" CCTV system recently announced by the Matsushita Electric company in Japan. The system is available in Australia carrying Matsushita's well-known "National" brand name, being distributed in all States by Haco Distributing Agencies.

In its most basic form, the National "mini" CCTV system comprises a single camera and monitor combination. The system comes in install-it-yourself kit form, and is complete with camera lens, vidicon tube, camera mounting bracket and head, and all connecting cables. The cost of the complete kit is surprisingly low, at $460 including sales tax.

But the story doesn't end there. The basic monitor unit is actually designed to accept up to three cameras, and additional cameras are available together with the necessary mounting brackets for only $184 each (again including tax). This makes it possible to expand the system at will into an elaborate three-camera setup, at a total cost of no more than was formerly required for a single-camera system.

A big advantage of the system is that when more than one camera is used, the monitor can be switched between the cameras without any trace of rolling or tearing. The monitor is provided with a rear-mounted "video output" jack delivering a standard-format video signal corresponding to the viewed picture, and this makes the system ideally suited for use with video recorders.

Until now, in order to obtain roll-free switching between multiple cameras, it has generally been necessary to use expensive studio-type cameras in conjunction with a master sync generator and a camera control unit. The cost of such a system typically runs to thousands of dollars, virtually ruling it for use with low cost video recorders. The simple but effective National system can be used to provide practically the same facilities, at a small fraction of the cost.

Another advantage of the system is its compact size. The monitor unit measures only 10.7in x 5.6in x 8.8in, while the cameras measure only 3.6in x 2.3in x 5.6in. The weights are also very modest – 8.8 pounds for the monitor, and 1.7 pounds for each camera. Power consumption is very low, being only 35W even with the full complement of three cameras.

Both the monitor and the cameras are fully solid-state except for the 6in CRT in the monitor and the 2/3in vidicon tubes used in the cameras. Both monitor and camera circuits make extensive use of modern silicon transistors and diodes. The circuitry uses discrete components, but is mounted on compact printed wiring boards.

Most of the advantages of the system derive from its novel circuit design. In fact, even a brief glance at the schematic circuit is enough to reveal that Matsushita have achieved both the low cost and the added flexibility of the new CCTV system merely by adopting the logical system-oriented approach.

Until now, the typical CCTV camera has incorporated full vertical and horizontal sweep circuits, complete with stable free-running oscillators. Together with these it has usually contained circuitry to derive and shape sync and blanking pulses, and to mix these with the video. There has often been an RF oscillator and modulator as well, to provide an output for direct connection to the aerial terminals of a normal TV receiver.

As it happens, much of this circuitry merely duplicates the function of similar circuitry inside the monitor. Thus when a camera and monitor are combined to form a basic system, there is wasteful duplication.



An ideal application for the National "mini" CCTV system is as a pool safety monitor, as demonstrated here by Mrs Dennis Lane, wife of the managing director of the Electronic Service Company. The unit is also very suitable as a security monitor for stores, banks and other applications, as shown on the opposite page. Up to three cameras can be used.

Closed Circuit TV system "Do-it-yourself" applications

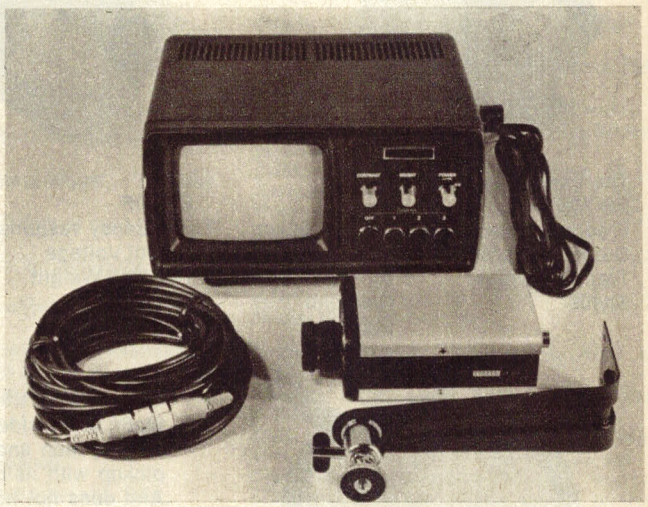
The system as a whole tends to be bulkier, more complex and more costly than it might be. And because each camera delivers a signal with its own independently-generated sweep frequencies, there are inevitable problems when a number of cameras are to be used together.

Matsushita have obviated these problems simply by designing the camera and monitor as part of an integrated system, rather than as separate and fully independent devices. This makes a lot of sense because, in general, cameras and monitors do in fact go together; even when cameras are used with other equipment such as video recorders, there are generally monitors in the system as well.

In the National "mini" CCTV there is no duplication of circuitry in the camera and monitor. Most of the circuitry is common to both, and is housed in the monitor unit. The camera consists of little more than the vidicon tube with its deflection and focusing yoke, together with a solid-state video preamp.

All sweep and blanking signals are generated in the monitor, and are simply piped to each camera as required. Thus the cameras are kept very simple. And because all cameras are driven by the monitor, there are no sync problems when switching between cameras.

By adopting this approach, Matsushita have been able to produce a system which offers marked advantages over conventional CCTV systems in terms of both cost and flexibility, without any significant sacrifice in performance. In fact the performance is very comparable with existing high quality systems: 3dB video bandwidth is 5MHz, horizontal resolution is better than 400 lines, and minimum light level for acceptable camera operation is 2 foot-candles (20 lux).



The system comes as a complete "do-it-yourself" kit, with camera vidicon and lens, mounting bracket and all cables. Further cameras are readily available to expand the system.

The camera used in the National "mini" CCTV system is designated type WV-400N, while the monitor is type WV-410N. The units shown in the photographs were kindly lent for our appraisal by the Electronic Service Company, of Beverly Hills, NSW, who are a distributor; they also supplied much helpful technical information.

The performance of the system is maintained for camera-monitor cable lengths of up to 60 metres (about 200 feet). A small adjustment in the camera is used to obtain optimum picture resolution with various cable lengths.

Operating controls for the system have been kept very simple and straightforward. There are no exposed electrical controls on the camera, only the usual lens adjustments. (Beam current and target voltage are adjustable via internal preset controls, but need little adjustment.) The main controls on the monitor are simply contrast, brightness and power on-off, together with the camera select buttons.

Because it provides high performance CCTV facilities at a lower system cost than has been possible to date, the National system should play a big part in expanding CCTV applications in the domestic, educational and commercial fields. And in the domestic field it should have particular appeal because of its suitability for "do-it-yourself" installation by the homeowner.

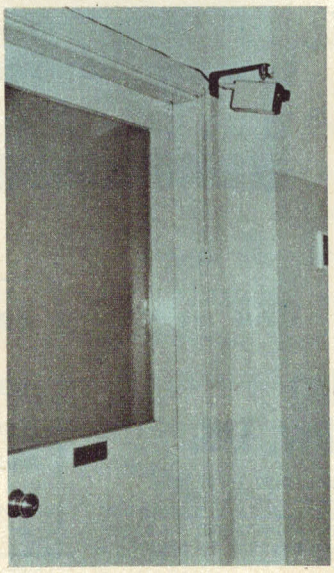
For example, it now becomes economic for the private owner of a swimming pool to fit a CCTV system for safety monitoring. Mother working in the kitchen can thus keep her eye on the children playing in the pool, and if a second camera is added she can also check the baby sleeping in the nursery. With large homes it might also be feasible to add a third camera at the front door, to allow identification of callers. This application would in fact be ideal for the National system, because provision for two-way intercom facilities is actually built into the camera, monitor and interconnecting cables.

Churches should now be able to consider the use of CCTV systems to cope with overflow congregations. Similarly clubs can install systems either to relay entertainment to various rooms, or to monitor the activities of patrons at the "poker machines".

Schools and kindergartens can now install a CCTV system at modest cost, for such purposes as playground monitoring and study of pupil behaviour. (A drip-proof camera housing is available as an optional accessory

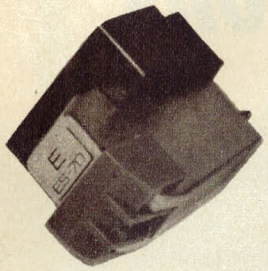
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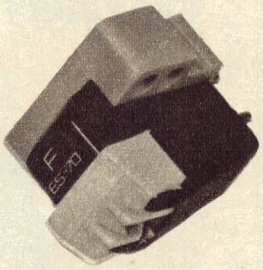


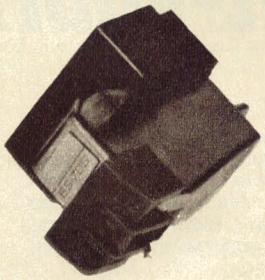


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Output Voltage	: 4MV
Tracking Weight	: 0.7 – 2GMS
Stylus	: Diamond Conical Stylus

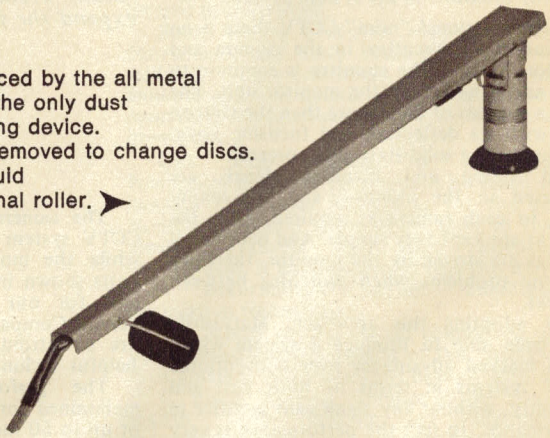
ES-70S

Frequency response	: 15cps – 25kcs
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LED DISPLAY PANELS

A new and greatly simplified process for making electronics display panels from light emitting diodes, each no larger than a grain of salt, has been announced in the USA by scientists of the General Electric Research and Development Centre, Philadelphia.

The development of a novel process for the fabrication of microelectronic devices has enabled the GE scientists to link and activate the dots of light with a minimum of interconnections and external wires. This development is expected to speed the application of flat solid-state panels in computers, datahandling terminals, and eventually even information-retrieval units for the home.

The tiny lamps used in these panels are light-emitting diodes, semiconductor devices that give off pinpoints of light when an electric current is passed through them. By clustering the diodes together and by activating them in various combinations, the dots can be lighted up to make visible the 64 standard computer characters (numerals, letters, and symbols).

At a meeting of the International Solid-State Circuits Conference, the GE scientists described their development of an advanced monolithic semiconductor process based on gallium phosphide. The process was used to fabricate and interconnect the first integrated array that eliminates the need for separate wires to each light-emitting diode.

With this technique, a panel containing 7,000 light-emitting diodes and capable of displaying 200 characters simultaneously can be fabricated with only 1,200 interconnections on the display surface. Future variations of the same technique will reduce the needed interconnections to 200, compared to the 14,000 interconnections (7,000 die bonds plus 7,000 wire bonds) required in a panel fabricated by the best competitive process. In addition, the GE panel requires only 170 external leads. By minimising interconnections and external leads, the new GE approach makes it possible to increase the reliability of solid-state display panels while simultaneously reducing manufacturing costs.

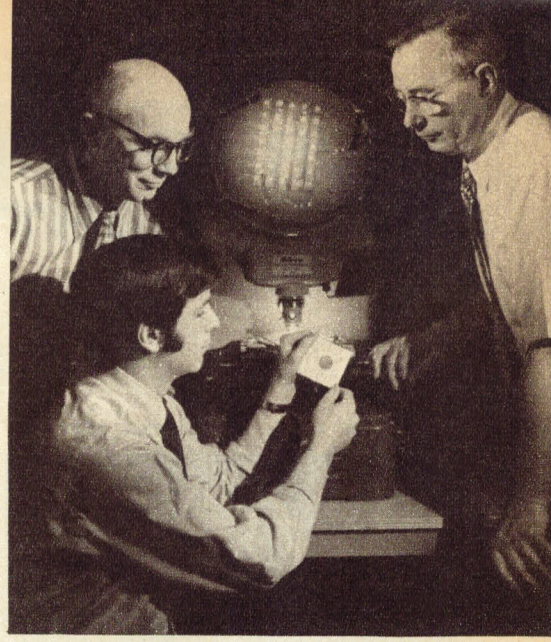
"For a number of applications, display panels fabricated from light-emitting diodes offer important advantages over conventional display devices, such as the cathode ray tube", Dr Arthur M. Bueche, GE vice-president for research and development, said recently. "A solid-state display panel is compact, rugged, long-lived, and relatively inexpensive. In the near future, we expect that panels capable of displaying 10 to 200 characters simultaneously will find applications in portable two-way communications gear, automobile and aircraft consoles, computers, and data-handling terminals.

"Ultimately, a low-cost home display unit the size of a book could function as an electronic information service, providing instant stock market reports, weather forecasts, news bulletins, and even store prices", Dr Bueche said. "Such a unit might even be connected to a central computerised library, giving access to millions of different volumes".

The development of GE's new process and its application to a complex array of light-emitting diodes was performed at the company's Research and Development Centre by Dr Allen M. Barnett, Dr Simeon V. Galginaitis, and Frederick K . Heumann.

To form a single character in a display panel, 35 of the light-emitting diodes are combined in a rectangular array five rows across by seven rows down. The resulting character is an eighth of an inch high – nearly twice the size of newspaper print. When individual diodes are activated, their light spreads out slightly to form a "solid" numeral, letter, or symbol.

In the new GE process, the light-emitting diodes and their interconnections are fabricated – as many as 2,000 at a time – on a wafer of gallium phosphide. (The number is expected to increase sharply in the near future.) Several of these wafers can be handled simultaneously in a process that requires only a few steps.



At the GE Research and Development Centre, Dr Allen M. Barnett holds a small wafer of gallium phosphide containing 2000 LEDs on its surface. A 60X enlargement of a similar device is visible on the display screen behind. Dr Simeon V. Galginaitis (left) and Frederick K. Heumann (right) worked with Dr Barnett on the development of the arrays.

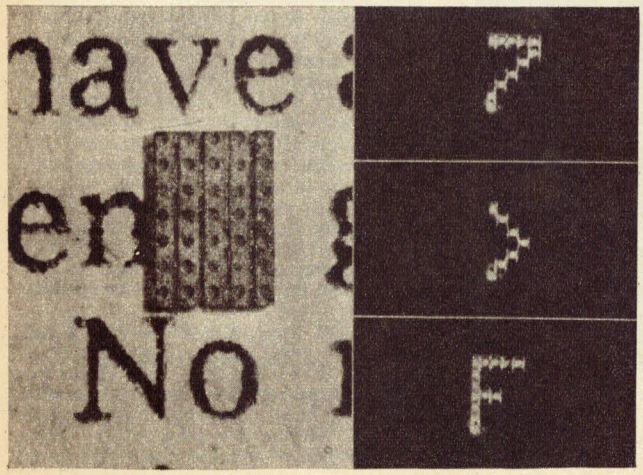
"This is the first time that any complex gallium phosphide device with electrically isolated regions of both conductivity types on the same substrate has been made with planar (flat) geometry", Dr Barnett said. "This approach solved the problem of matrix (row-and-column) addressing of diodes while at the same time minimising interconnections and external leads".

Semiconductor light-emitting diodes must have an N-type region (containing an excess of electrons) and a P-type region (containing a deficiency of electrons). These regions are formed in a typical semiconductor by diffusing precise amounts of impurities ("dopants") into it. The fabrication of a complex structure of gallium phosphide is limited by the lack of a suitable N-type diffusant. To solve this problem, the GE scientists developed a selective liquid phase epitaxial growth process. "Essentially, we etch grooves into the wafer and then grow in gallium phosphide containing an N-type dopant", Dr Barnett explained.

The first laboratory prototypes using the new GE process emit red light. Green emitting diodes are made by changing the dopant.

"Just as the advent of planar silicon technology triggered a revolution in microelectronics, we can expect that out new-found ability to fabricate matrix-addressable alphanumeric displays that are planar in geometry will have exciting and far-reaching effects – some unexpected – on display panels of the future", Dr Barnett added.

A spokesman for GE's Miniature Lamp Department in Cleveland, Ohio, which already manufactures and markets a family of gallium phosphide indicator lamps as well as a full line of infrared emitters, said today that marketing plans for gallium phosphide arrays would be announced at a future date.

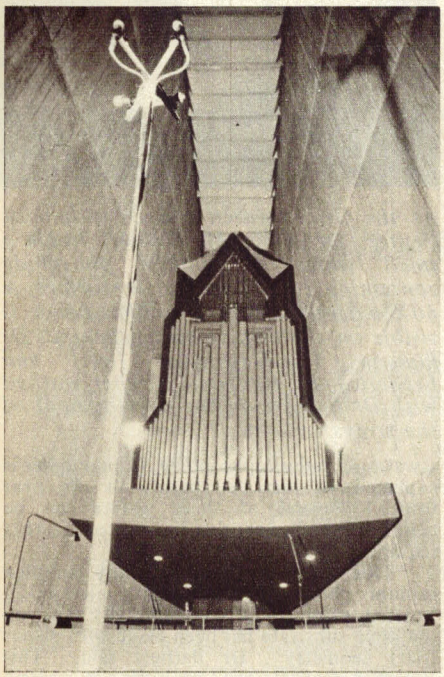


Left: A typical LED display panel on a piece of newspaper print. Right: By activating the diodes in various combinations, they can be lit to form visible images of standard computer characters.

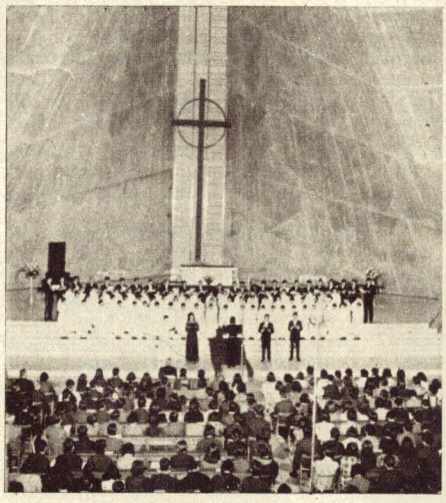
FOUR FOUR FOUR FOUR CHANNEL SOUND

Sansui and Akai probe the hi-fi market

by W. N. WILLIAMS



Will four-channel (or quadraphonic) sound be a commercial success or will it bog down and become merely the plaything of the ultra-enthusiast? Many big-name companies in the hi-fi field would dearly like to know the answer to this tantalising question.



On January 24, Sansui engineers recorded Mozart's "Mass in C Major" in Tokyo's St. Mary's Cathedral. Nine separate microphones were used and their information was "encoded" by means of two QS-1 units on to four tape tracks. Reversing the process, it was later reproduced as an eight-channel sound field at the Kyushu Audio Fair.



In Japan, the companies most concerned are those who are in business to manufacture and market hi-fi equipment. Assisted by technical knowhow and ingenuity, a not-too-expensive labour force and an active home market, Japanese manufacturers have won a large slice of the turnover in hi-fi equipment around the world. With product acceptance has come expansion, and with expansion has come the need to keep the hi-fi ball rolling. Four-channel sound could mean a huge new re-equipment market.

In the USA, manufacturers are certainly not averse to finding new market areas but, in terms of equipment for the domestic hi-fi market, they are at a big disadvantage in relation to equipment manufactured in the Asian area.

What the USA does have is a huge supply of program material. It has been broadcast on AM and FM, televised perhaps, and retailed on disc, reel-to-reel tape, cartridges of one kind or another, and Philips type cassettes. The owners would be more than delighted to reprocess and redistribute it as four-channel material in as many forms as the market will bear.

For the most part, discussion of four-channel sound has been confined to high fidelity circles and, to date, the proposition has been received with some diffidence – certainly in Australia. Enthusiasts are not overkeen to pension off high-quality stereo equipment, or to clutter their living rooms with additional loudspeakers. Mixed with this is a latent hostility born of the certain knowledge that, if quadraphonic supersedes stereophonic, they will have to be in it – whether they like it or not!

The public at large, and many of those whose money would be involved in a sonic revolution, are no more than vaguely aware of what audio engineers are up to. But how will the public react to this new technical breakthrough? Will it shrug off the marketing pressures, as it did with colour television for so many years? It was too costly, too much trouble to maintain. Will quadraphonic sound be the same – or will it be a bonanza?

The decisive answer to this question will come from the Japanese and from the citizens of the United States, who are likely to be more responsive to marketing pressures than the Australian public. This for quite different reasons.

Citizens of the United States have a high standard of living and a high degree of motivation to be the first with the latest. They have more spacious homes than most and are less likely to be deterred by extra equipment. They tend to stay indoors during the winter season and are disinclined to go

out unnecessarily during the evenings. There is strong reason, therefore, to add to home amenities and home entertainment.

While living standards in Japan generally are lower than in the USA the average income is rising to the point where luxuries are well within reach.

However, the average Japanese has only limited opportunity to spend this money in the environs of his home, and little space to accommodate a car, a caravan and a boat. He therefore tends to spend his money on things he can possess inside the home and, along with expensive watches and cameras and electrical appliances, he is keen to acquire a colour television receiver, a tape recorder, hi-fi equipment of other kinds, plus a liberal sprinkling of amateur radio gear.

He delights in a variety of knobs and switches. If a multiplicity of controls is the "in" thing with Australian hi-fi enthusiasts, it is as much because Japanese equipment, designed primarily for Japanese nationals, has set the style.

This huge, gadget-minded market could well be highly receptive to a new range of four-channel equipment, perhaps in a highly compact form. It also happens to be a market highly conscious of tape and therefore of the medium which lends itself most easily to multi-track recording and playback.

If the Japanese domestic market reacts favourably to quadraphonic sound, and the US market likewise, Australia, England and the rest of Europe will surely follow. Such is the universality of the language of hi-fi.

To move around among people in the hi-fi industry is to encounter diametrically opposed views. Some are quite certain in their minds that the public will reject the idea of extra amplifiers and extra loudspeakers. Others adopt the view that four-channel reproduction is as inevitable as rain in winter. Big companies in the hi-fi field are developing techniques and prototypes and looking at program sources but they are obviously much less certain of the outcome than the isolated individuals just referred to. They are striving for the compatability which will ensure a foot in both camps.

Material recently to hand from Sansui and Akai aptly illustrate this point.

Sansui are currently enthusing about their "QS-1 Quadphonic Synthesiser".

This is a signal processing control unit into which the available signals can be fed. The diagrams assume tape sources but there is presumably no reason why other signal sources should not be used, provided the appropriate levels are available.

It will accept genuine four-channel signals from a four-channel tape player and, in addition, has provision by which four channel signals may be fed out to a four-channel recorder. In effect, this is equivalent to the ordinary "tape-in" and "tape-out" provision in existing equipment, except that it accommodates four rather than two channels. Four separate level meters on the panel allow the user to monitor the level in each of the channels, while two balance knobs and a balance lever permit the relative levels to be adjusted between all channels.

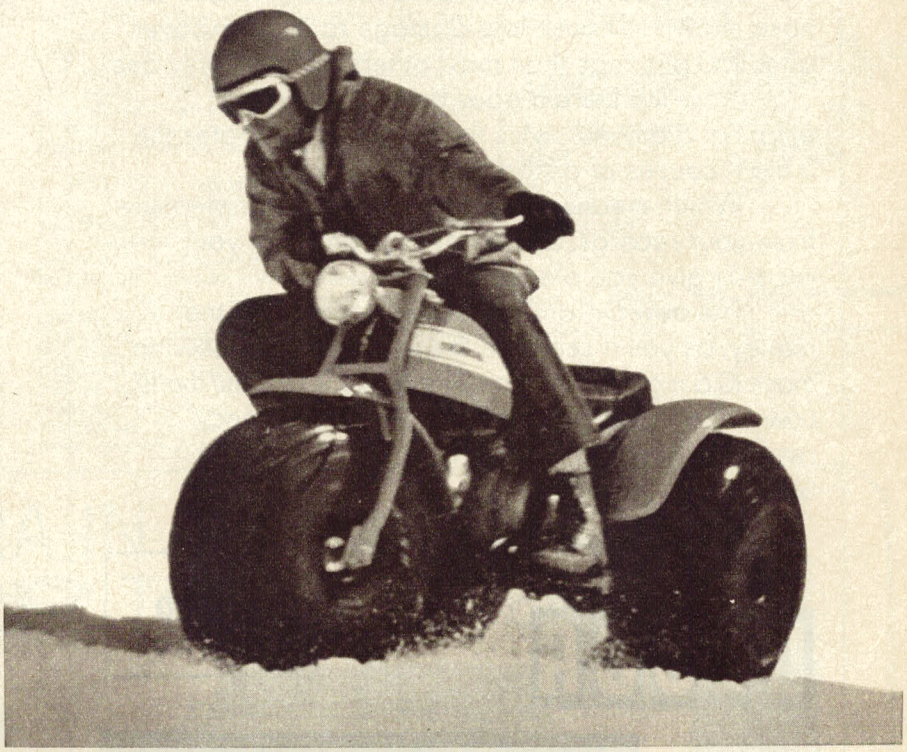
The output signals from the QS-1 are normally fed to the original front loudspeakers via the original stereo amplifier and to suitably matching rear loudspeakers via a supplementary stereo amplifier.

In this role, the QS-1 serves primarily as a merging and balancing unit between a four-channel tape player and a pair of stereo systems.

If this was its only role, the unit would probably have very limited appeal.

However, it is designed to receive and process ordinary two-channel programs to

Fun machines -the new craze



A survey of the new off-road fun vehicles with from 3 to 12 wheels. Using fat, low-pressure tyres, they negotiate mud, sand, snow or rocks with ease. Several models will soon be on sale in Australia. Full story in June issue of Modern World.

Also in June Modern World: **Uranium Enrichment.** Australia will soon have to choose which type of Uranium enrichment plant to build. Modern World describes the new gas centrifuge idea and compares it with the well-proven gas diffusion plants now in use in the USA. **Omega—A Slick New Lube** Have you ever seen a gear lubricant move toward the centre of a spinning gear? A new line of lubricant developed in Australia, have some amazing physical properties.

MODERN WORLD

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PAINTING WITH ELECTROSTATIC POWDER **Modern World** describes a new painting method that not only uses no solvents, but coats all surfaces of a product at the same time. The equipment sprays powder coatings that carry a 90,000 volt charge.

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Decca Deram, the ceramic cartridge which tests have shown to cause less damage to microgrooves after 250 playings than most others do after only one.

Now the Deram goes better still, with an elliptical diamond stylus that virtually eliminates the 3 main causes of distortion.

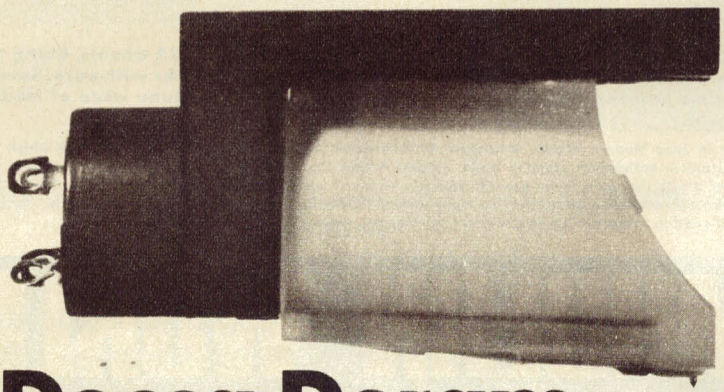
Which means you now get even more pleasure from your records, as well as ensuring that your records give you pleasure far longer.

The new Deram's a lot of cartridge for the money, as you'll see from the specifications: Low tip mass (0.6 mgm.) High compliance (9 x 10^{-6} cm/dyne). Low tracking weight (2.5 gms.) Wide frequency response (18Hz to 18KHz.) Relatively high output (200 mV per 5 cm/sec).

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AKAI: Emphasis

produce a simulated four-channel resultant which can be fed, as before, to a double stereo system. The very appealing aim of this is to protect against immediate obsolescence the considerable library of two-channel material that the average hi-fi enthusiast is almost certain to have on hand.

In essence this parallels what has already been suggested in this journal (April issue, page 89) for simulated stereo. There is, however, a large difference in degree.

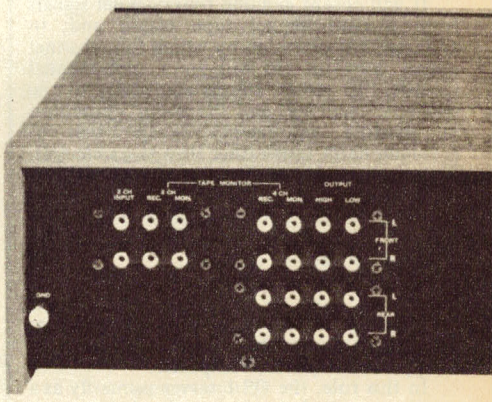
Our suggestion involves only a couple of additional small loudspeakers, without any special pretensions to high fidelity, a few feet of wire, and in some cases a resistor or inductor. The effect obtained tends to vary widely, according to the disposition of the recorded sound in the stereo tracks, some producing a more convincing result than others. Nevertheless, continuing use has confirmed our initial enthusiasm for the arrangement.

By contrast, the QS-1 unit involves quite an array of involved circuitry which processes the signal at low level and seeks to simulate four-channel sound in a more elegant fashion.

In so doing, it offers the user a means of controlling the degree and the nature of signal processing, so that it can be optimised in relation to the particular program material. Thus the user can select normal stereo ("2 Channel") or ensure that an artist is maintained at centre front ("Solo"). For concert performances ("Concert Hall") two positions are available while the remaining positions ("Surround") distribute the sounds around the listening position to a greater or less extent, as desired.

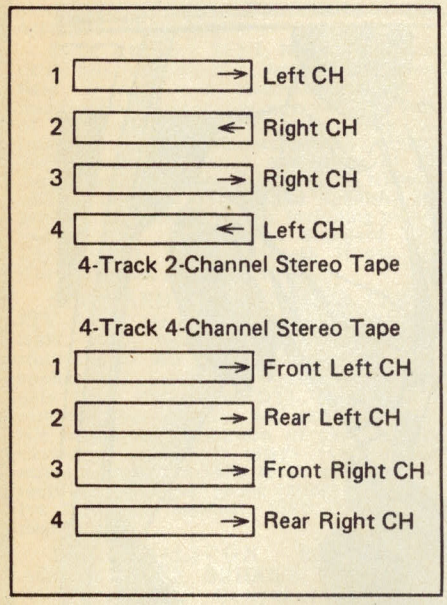
In the same literature, Sansui offers suggestions for the placement of loudspeakers in the listening room. One in each corner is recommended for a total surround effect but, for the listener who is most keen on classical orchestra, big band or jazz, the recommendation is for two loudspeakers in the normal frontal positions and two at the sides, just forward of the listening position.

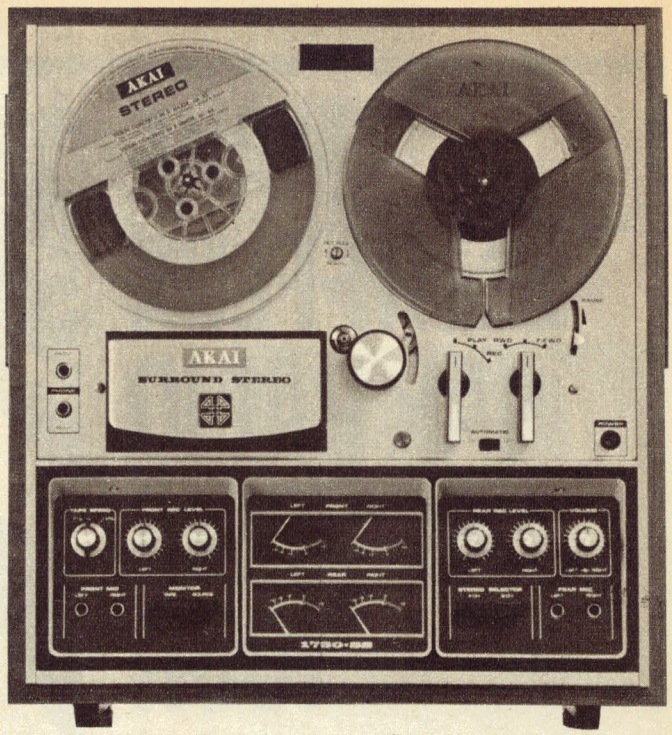
For complete versatility, a diagram shows six loudspeakers with a switch to select either the mid-room loudspeakers or the rear loudspeakers! In fact, going one better again, the QS-1 unit can be arranged to "process" four-channel signals to feed the extra loudspeakers with a simulated fifth and sixth channel!



At the rear of the Sansui Quadphonic Synthesiser is a formidable array of sockets necessary to interconnect it with signal sources and with the associated power amplifiers.

on simplicity and economy





On the right is the new Akai 1730SS tape recorder, which can be used as a normal portable stereo unit, or to record and play back four-channel tapes. At the left is the reel-to-reel track configuration which makes possible the compatibility between stereo and quadraphonic equipment.

The Sansui QS-1 unit itself is shown in the accompanying photographs. Add to this two distinct stereo amplifiers, a stereo FM tuner, a disc player and one or two tape players and one would have an array of knobs and interconnections that should keep the most gadget-minded enthusiast happy for quite a long time.

Either way, it represents a rather startling example of the point which hi-fi gadgetry has reached. The performance would doubtless be something to write home about, but . . .

The Akai Electric Co has also shown itself to be vitally interested in the four-channel market but its present emphasis differs markedly from that of Sansui. Akai is also strongly concerned with compatibility but its present emphasis is on simplicity and economy. This much was evident from a demonstration of the latest Akai release in the Sydney showrooms of Akai Aust Pty Ltd.

On show was the new Akai 1730SS tape recorder, which has been designed to record and play back either standard two-track (stereo) reel-to-reel tapes, or four-track (quadraphonic) tapes.

In its simpler role, it can be used as a standard two-speed portable stereo recorder and playback unit. It can record from two microphones or other stereo source, with separate level meters available for each channel. The signals are impressed on the tape in the normal quarter-track configuration.

For playback, the unit has the necessary preamplifiers, two power amplifiers and two in-built loudspeakers, one on either side of the case. Facilities are available for plugging in external loudspeakers. It could therefore be used as an entirely self-contained stereo system, or with external stereo loudspeakers. Yet again, it could be used as a standard stereo tape player feeding through existing stereo amplifier facilities. If the stereo system already includes provision for simulated stereo, so much the better.

To meet its second and more ambitious role, the 1730SS incorporates two additional head segments, two additional record and replay preamplifiers with input and output facilities, level meters and bias-erase circuitry. It can therefore be used with four microphones or other inputs to record four-track stereo in the normal configuration: 1 – front left; 2 – rear left; 3 – front right; 4 – rear right.

To replay the four-channel recording, the 1730SS needs to be supplemented by a standard stereo system, which may well be the one already installed in the listening room. By suitable interconnection, the two front channels can be routed through the main stereo system and benefit from its full control facilities.

With a view to economy, the rear channels could be provided by the 1730SS itself, located behind the listening position and using its own in built loudspeakers. Or, of course, external loudspeakers could be used, disposed as necessary. For that matter, there is no reason why the 1730SS should not be used purely as a four-channel signal source, supplying a full-scale four-channel power amplifier and loudspeaker system.

The obvious idea is to promote the 1730SS as a basic recorder, able to do a good job on its own, but which can be integrated with as much other equipment as the enthusiast may care to provide.

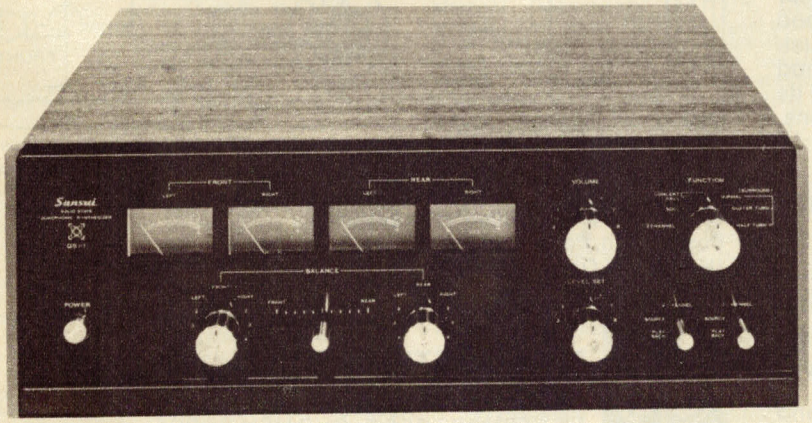
In introducing the 1730SS, Akai Australia Pty Ltd referred to the price as a "breakthrough" – $605 retail, including tax, for the basic unit.

What of program material?

Right now, in Australia, prerecorded four-channel tapes are few and far between and, even overseas, the catalogues are new and very limited. But there are something like six companies in the USA and two in Japan which can offer a limited range of tapes – say 30 or 40 titles a piece. They intend to increase the number as the demand grows.

Channels for marketing the tapes in Australia are as yet rather obscure but Akai have no intention of trying to market four-channel equipment, while leaving the program material to chance.

Something will be done to stimulate the supply of tapes in Australia but what that something is they are not yet free to say.



A front view of the QS-1 unit. The balance controls are located beneath the level meters. The volume control is just to the right of the meters while the knob below it allows the meter swing to be adjusted independently. At the top right is the switch controlling the character of the synthesised extra channels.

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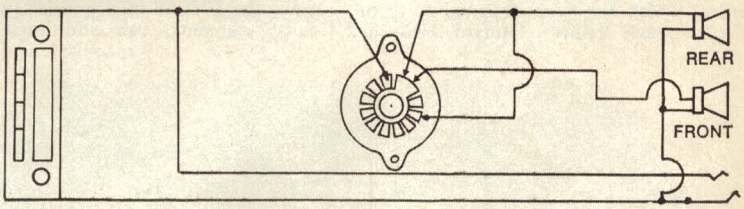
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SPECIFICATION

	8" x 4"	7" x 5"	9" x 6"
Type Number	52877/84RBCW/15	52880/75RBCW/15	52881/96RBCW/15
Voice Coil Impedance — Ohms	15	15	15
Frequency Response — HZS	100-6000	100-6000	100-6000
Power Handling — watts	6	8	8
Mounting Hole Centres — inches	3-1/8 x 5½	4-11/32 x 4-11/32	4-5/8 x 6-9/16

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SCIENTIFIC AND INDUSTRIAL NEWS

New time scale

Since 1967 the second has been defined in terms of an atomic transition while time scales in general use are based on the rotation of the earth. This has resulted in the use of a compromise time scale, known as Co-ordinated Universal Time (UTC), which presently operates with a frequency offset from the atomic scale to approximately agree with the rotation of the earth. Occasional step adjustments of 0.1 second are also made to compensate for unpredictable variations in the earth's rotation.

At 00 hours on January 1, 1972, UTC will be reset a fraction of a second, sufficient to give the new scale an initial difference of an integral number of seconds (probably 10.0 seconds late) with respect to atomic time. It will also operate without a frequency offset, thus providing time intervals that are exactly one second long. The scale will continue to keep in approximate agreement with earth time, known at UT1, by step adjustments of exactly one second occurring about once per year. The new UTC scale should not differ from UT1 by more than 0.7 second.

Semiconductor progress

Two US semiconductor companies have announced new manufacturing processes for low-cost high-speed IC transistors. Fairchild has developed a new bipolar process which it says could be price competitive with MOS devices and still retain the speed of bipolar ICs. RCA has overcome the speed disadvantages of the cheaper MOS devices by using a silicon on sapphire technique.

The new Fairchild structure, called Isoplanar, is essentially a dielectric isolation technique which reduces transistor size by 40% to give densities comparable with MOS devices. Its application will depend on how much the power dissipation has been reduced. The new structure uses a technique called oxidised isolation. Essentially, the diffused isolation region used in conventional IC transistors is replaced by a selectively grown thermal oxide. But since this oxide is an insulator, there is no need to separate it from the transistor base region, and the transistor size can be reduced accordingly.

RCA has developed silicon-gate CMOS devices which switch in less than 1nS and dissipate only a small fraction of the power consumed by bipolar devices. The circuits give nanosecond switching delays when operated at bipolar voltages, eliminating the need for buffers between high-voltage MOS and low-voltage bipolar devices. The new circuits are fabricated on one-micron films of n- and p-type single-crystal silicon grown on a sapphire substrate. Because of the insulating properties of sapphire, the thinness of the silicon, and the etching away of all silicon not needed in the circuit, essentially all junction capacitances found in conventional MOS devices can be eliminated.

Time signal service

Since September, 1964, the Australian Post Office has provided a standard frequency and time service using the short-wave station VNG situated at Lyndhurst in Victoria. The equipment now in use was built by PMG engineers and technicians over a period of two years at a cost of nearly $47,000. Similar commercially built equipment would have cost about $300,000. The service continually provides readings of the time, accurate to within 0.1mS. Tone bursts of varying lengths signify the second, the minute, and the quarter hours. There is no tone burst to mark the end of the 59th second of each minute. The first tone burst after the silence marks the start of the new minute.

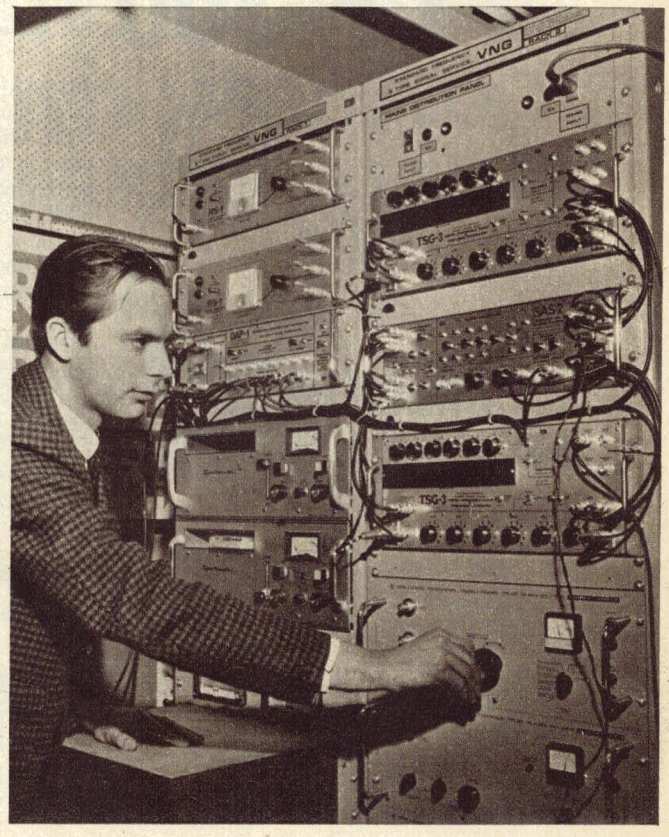
The equipment (illustrated) consists of two systems that function independently, each maintaining a check on the other. If the slightest difference in a time assessment occurs between them, an alarm sounds and the necessary adjustment is made to the inaccurate system. The Lyndhurst transmitter is 20 miles from the PMG laboratories at 59 Little Collins Street, Melbourne, where the master clocks operate. To ensure accuracy between the two points, three separate control and measurement methods are used every day by landline and VHF radio links. If any variation should occur, it can be corrected immediately. (See also "Electronics Australia", May, 1970.)

Heart action display

Doctors can watch a moving display of the beating of a diseased human heart with a computer method devised by a team of scientists and doctors from the NASA-Ames research centre and the cardiology division of the Stanford University medical centre, USA. The system projects a three-dimensional animated cartoon-like image of any desired chamber of the patient's heart on a display screen. The display is exact enough to show dead sections or scar tissue in the heart wall about 2cm in diameter, aneurysms (bubble-like projections of the heart muscle), holes between heart chambers, and other large malfunctions.

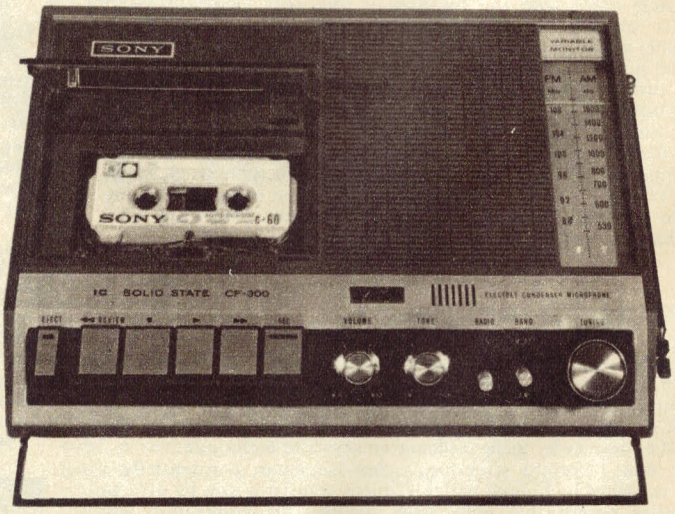
Combined with standard clinical measurements of blood-flow per heart beat, it can measure inefficient pumping by heart chambers. It will also help to identify leaky valves and show the severity of valve damage. The value of the method for doctors is that is eliminates all irrelevant details. For example, it can show the complete interior surface of the beating left ventricle (the heart's main pump) on the display screenand nothing else. The system can do the same with the right ventricle and the two auricles (intake chambers).

Cardiologists take two sets of x-ray movies, known as



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SPECIFICATIONS. Radio section. Circuit: Superheterodyne • Freq. range: FM 87.5-108 MHz (3.42-2.78m). AM 530-1650 kHz (566-187m) • Antenna: FM, telescopic. AM, built-in ferrite bar • **TC section.** Track: 2-track monaural • Freq. response: 50-10,000 Hz • Fast forward and rewind time: 1 min. 20 sec. with C-60 cassette • Input: Microphone, sensitivity—22dB (0.06V), impedance 100k ohms. Aux. sensitivity—22dB (0.06V), impedance 100k ohms • Output: Monitor, 8 ohm impedance earphone or more than 10k ohm load impedance • **General.** Semiconductors: 1 I/C and 8 transistors (radio), 5 transistors (TC), 1 FET (microphone), 11 diodes • Power: 1.5 watts • Power requirements: 220-240V, 50 or 60 Hz, 4 'C' size batteries, 6V in total, rechargeable battery BP-16 or car battery with DCC-126 car battery cord • Speaker: 4" PM dynamic • Dimensions: 11 9/16 x 2 7/16 x 8 9/16 • Weight: 7 lb 1 oz.

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angiograms, at right angles to each other at 60 frames per second. To do this, they inject an angiographic dye opaque to x-rays through a catheter into the patient's heart. The x-rays then outline the selected heart chamber in cross section as it expands and contracts. Obtaining the x-rays may be difficult since injection of the dye itself changes the function of the heart and makes data from only two heart beats acceptable for analysis. A variety of independent measurements makes sure the two beats used are exactly typical.

From the x-ray films, the computer constructs the animated display. The entire sequence of frames, each containing the heart chamber outline, is traced on a computer input screen and retained in the computer memory. The computer program then mathematically projects the two views of the chamber back into space. From these it reconstructs the chamber. This three-dimensional construction is also stored in the memory for analysis and display. The technique allows the computer to calculate the changing positions of the entire interior surface of the heart chamber in question, so the moving chamber can be seen from any angle. The two stored beats are repeated over and over by the computer, allowing doctors to study the heart in action for any desired period of time.

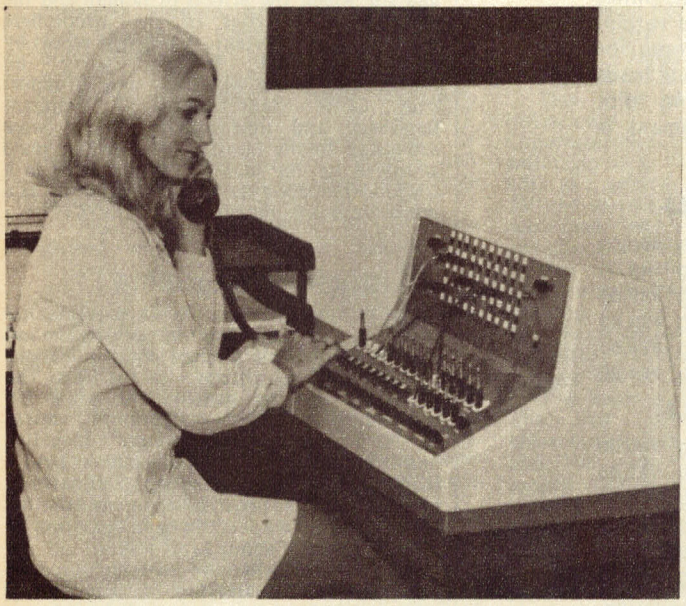
Cheap colour TV sets

Sony Corporation, Japan, has developed its own decoding system for PAL colour television signals. The system is being used in receivers developed by Sony for the European market. Patents on PAL television receivers are held exclusively by AEG Telefunken, West Germany, who collect royalties from manufacturers making PAL receivers. However, Sony's president, Dr Masaru Ibuka, has categorically stated that Sony's system does not infringe that of the German maker. Sony started exports to the UK of 13-in Trinitron colour TV receivers earlier this year. The sets sell for about $400, compared with about $600 for British 23-in models.

Sony has also obtained manufacturing rights for the SECAM receiver circuitry from Compagnie Francaise de Television, and has begun to export colour TV sets using this system to France. The first consignment of 3000 sets is selling for about $500.

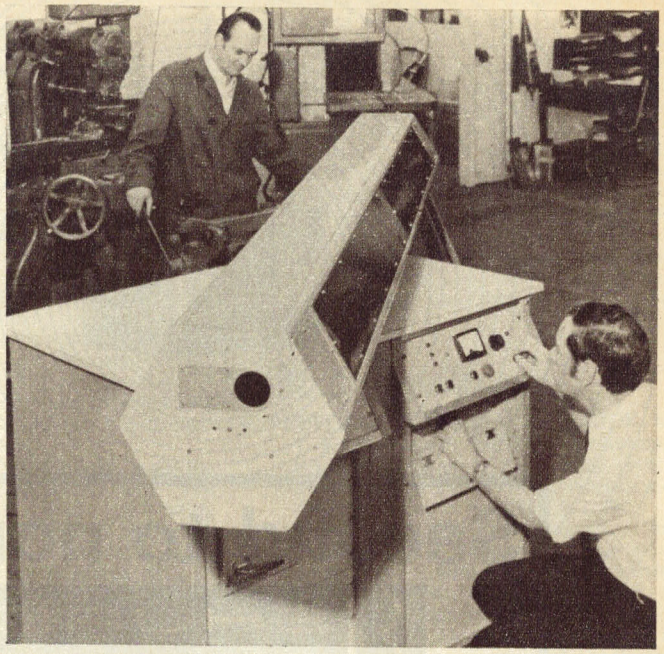
Hitachi is also to sell cheap colour TV sets in Europe. Last December it secured government sanction in Tokyo to import Telefunken's PAL technical knowledge under a cross-licensing arrangement. Hitachi will export colour TV sets to Britain, Denmark, Sweden, Norway and Finland. Hitachi feels that the demand for colour TV will climb rapidly for the 1972 Olympic Games in Munich.

Desk-top cord switchboard



This office telephone switchboard with plug-in cords has been developed by a member company of the Australian Telecommunications Development Association. It uses a spring action to retract the cords horizontally in a desk-top cabinet. Previous cord-type switchboards have been floor-standing pedestals with the bottom half containing pulleys and counterweights to retract the cord connectors when not in use. (William Love & Co Pty Ltd, 720 George Street, Sydnev. 2000.)

Industrial "Laserblade"



The neutron division of Elliott Automation Radar, in the UK, has developed a 500W carbon dioxide laser cutter for use as an industrial machine. Called Laserblade, it is in a rigid self-supporting, self-aligned housing only 9ft long. It can produce a focused cutting beam only .005in in diameter, and can cut metal, plastics, wood, paper and cloth at high speed. Thin nylon can be cut at 800ft/min and sheet metal at 20ft/min. The system uses a gas regenerating system which conserves over 90 per cent of the gases normally lost. The power supply is in a double 19in cabinet, and the gas recirculation unit and controls are in a table-height console.

A laser cutter has the advantages that it does not require physical contact with the material being cut, makes a precise cut without residue or noise, and leaves the cut edges extremely clean. The cutting beam can be optically steered to run close alongside obstacles such as holding devices or clamps. It can also follow complex outlines or profiles such as those used in the garment and carton industries. (Neutron Division, Elliott Automation Radar Systems Ltd, Elstree Way, Borehamwood, Herts, England.)

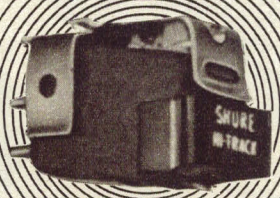
Precision thermometry

A new AC bridge for resistance thermometry has been developed by A. M. Thompson and G. W. Small, of the CSIRO division of applied physics. It was designed to meet a need for increased precision in temperature measurement and control. It is very stable and insensitive to the thermoelectric effects that cause trouble with DC systems of measurement. A paper describing the bridge and its behaviour will be presented at an international symposium being held in Washington this month.

With a resistance range of 0-111 ohms and a linearity of 20 micro-ohms, the bridge when used with a 25-ohm platinum resistance thermometer covers a temperature range from -223°C to +1000°C with a resolution of better than .001 degree. The bridge is balanced by operating five decade switches from which the resistance reading is obtained in conjunction with a direct-reading meter. There are also facilities for analog recording which makes it suitable for following small changes in temperature. (Division of Applied Physics, CSIRO, University Grounds, City Road, Chippendale, NSW 2008.)

Letter sorter

Under a US Government contract, Burroughs Corporation is developing a completely automatic system which will sort 108,000 manually pre-coded letters per hour to any of 400 destinations. Mail enters the system via one of two mail transport units, each of which contains a bar-code reader to extract destinationa data from each letter at the rate of 54,000 per hour. An input module routes letters from the transport units into any one of six conveyor levels for transfer to four sorting modules. Each of these contains 100 plug-in destination receptacles and a conveying system to transport mail stacks to an output module. The latter applies a label identifying the destination and automatically ties the mail for further processing.



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● M93E-EP	for 1½-3	grams	tracking	$39.00
● M71EB-EP	for 1½-3	grams	tracking	$29.40
● M55E-EP	for ¾-2	grams	tracking	$28.50
● 44E-EP	for 1¾-4	grams	tracking	$24.90

CARTRIDGES WITH SPHERICAL STYLI

● V15 Type II-7	for ¾-1½	grams	tracking	$90.00
● M71-6-EP	for 1½-3	grams	tracking	$21.00
● M71C-EP	for 3-5	grams	tracking	$19.50
● M73G-EP	for 1-1½	grams	tracking	$21.00
● M44-5-EP	for ¾-1½	grams	tracking	$21.00
● M44-7-EP	for 1½-3	grams	tracking	$21.00

NOTE: MODELS NOT LISTED HAVE BEEN DISCONTINUED

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Belgian CATV network

A VHF community antenna television (CATV) network is to be set up in Belgium under a contract won by EMI Electronics Ltd, of the UK. The order is for wideband TV distribution amplifiers and associated passive units. The equipment will enable 20,000 homes in a Belgian township to receive as many as 15 different TV programs using a single receiving antenna system. Up to 12 different FM radio programs will also be available through the network. CATV is a method of using one central array of antennas, mounted on a suitable mast, to cater for the needs of consumers in areas where normal reception is difficult or impossible. Homes are linked to the receiving station by a distribution network of coaxial cables. Amplifiers are spaced along the cable, up to 500 metres apart, to maintain the quality and strength of the signals throughout the system.

ITU special meeting

A special joint meeting of CCIR study groups was held in Geneva, Switzerland, from February 3 to March 3, 1971, to prepare the technical basis for the World Administrative Radio Conference for Space Telecommunications (WARC-ST) which will be convened (also in Geneva) from June 7 to July 17. Some of the topics dealt with at the meeting included: point-to-point radio services by satellite, the use of satellite techniques in aeronautical and maritime services, scientific research satellites, meteorological satellites, earth resources satellites, technical aspects of the efficient use of the geostationary orbit and possibilities of frequency sharing between space and other services. Complicated aspects of radio propagation were also studied in detail including the use of frequencies generally higher than those used at present (10GHz) and for which the effects of rainfall and the absorption properties of the atmosphere become very important. A progress report by an international working party on broadcasting from satellites, and a report from CCIR Study Group 7 (standard frequency and time signal services) were submitted to the meeting. The various texts approved by the meeting were printed in a consolidated 230-page report distributed as a preparatory document of the WARC-ST.

US domestic satellite

MCI Lockheed Satellite Corporation has requested authorisation to construct and operate a domestic satellite communications network covering all states of the USA. The proposed satellite system will offer US commercial and governmental users a variety of communications services, including business and data communications, CATV (community antenna television), and network television distribution. The company said that the satellite network could be in operation by 1975 at a cost of about $150 million.

The system will have two high-capacity communications satellites in synchronous orbit – one for primary use and the other as an in-orbit spare. Each will have 48 transponders capable of handling simultaneously more than 33,600 business or data circuits, or 48 TV channels. Access to the satellites will be provided through earth stations in 15 cities. In addition to its other services, the company has offered, without charge for five years, the use of the equivalent of five TV channels for CCTV, computer aided instruction, and other experimental

educational purposes, including the public broadcasting service. Following the initial period, educational users will pay a nominal charge, estimated at a fraction of current rates for similar services.

Reliability engineering

The Division of Postgraduate Extension Studies, University of NSW, is to present over Radio University a course dealing with methods of measuring, predicting and improving the reliability of manufactured materials, parts, assemblies and systems. Commencing in July, 1971, the course will consist of 10 two-hour lectures, with supplementary television seminars and six hours of discussion. Five viewing centres are established in the Sydney metropolitan area for the television seminars, and those participating in the course can attend at whichever centre is most conveniently situated for them. The viewing centres are linked to Radio University headquarters by closed circuit television. Details of this and other radio, TV and tape courses can be obtained from the division, at PO Box 1, Kensington, NSW 2033.

Engineering show

The 6th International Engineering Show will be staged at the Melbourne Exhibition Buildings from August 2 to 7, 1971. The products of 15 countries will be shown by 200 exhibitors. The exhibition is sponsored by the Metal Trades Industry Association of Australia, the Melbourne Chamber of Commerce, and the major industry associations. It is being organised by Industrial & Trade Fairs Pty Ltd, 77 Pacific Highway, North Sydney, NSW 2060.

Voice analysis

A sound spectrograph is being tested by a member of the Australian Telecommunications Development Association primarily for its usefulness in helping to maintain and improve the quality of telephone performance. Described as an AF spectrum analyser, it is considered capable of identifying a telephone caller by a detailed analysis of his speech. It takes samples of sound waves, from 5Hz to 16KHz, and produces a record on paper of voice strengths and other speech characteristics. The analyser could be used to confirm disputed identification of telephone pests after detection by other means, or used to identify an offender in a "line-up" of suspects.

Education exhibition

The first Australian International Educational Exhibition will be held in Melbourne's Exhibition Buildings from June 28 to July 2, 1971. It will show the incluence of technological change and development, especially in the fields of electronic mass media, and will feature a "new" classroom known as a "teaching area".

During the exhibition, there will be a series of six conferences. Among the speakers at these conferences will be: Professor Schramm, Standford University, USA, who will talk on "Audio visual communication – teaching aids or media of communication?"; Dr Rex Meyer, Macquarie University, Sydney, on "The shape of education in the year 2000"; and Mr Roger Fitzsimmons, London, whose subject is "Innovation in building leads to innovation in methods of teaching and learning". Further information may be obtained from the organsiers, Educare Exhibitions Pty Ltd, 151 Barry Street, Carlton, Victoria 3053.

Radios for railways

Commonwealth Railways, already a substantial user of Plessey Electronics two-way radio equipment, has ordered 60 additional mobile units for use on its railway network. On trains such as the Indian Pacific, Plessey mobile units provide a communications link between locomotive crews and guards, and between the trains and base stations at sidings and railway stations throughout the system.

Weather satellite

On April 8, the American weather satellite, Nimbus 4, completed a year in polar orbit. On board, and still functioning almost perfectly, is a selective chopper radiometer, developed and built by Marconi Space and Defence Systems, UK. It transmits back data that provides a complete temperature profile from ground level to more than 30 miles, repeating the process about 5,000 times a day. The system provided meteorologists with a greater quantity of regular and accurate data than previously, and now the US weather bureau is arranging to use its data operationally in weather forecasting.

In brief . . .

Volcano surveillance

The Central Volcanological Observatory in Rabaul, Territory of Papua and New Guinea, has ordered several Philips VHF FM transmitters and receivers for incorporation in a number of volcano surveillance systems to be installed in the Rabaul area. These will enable volcanologists at the observatory to obtain immediate information from seismometers installed at key points.

Broadcast stations

Commercial radio station 8HA, at Alice Springs, commenced service on March 2, 1971, on 900KHz. The operating frequency of commercial station 3YB, at Warrnambool, Qld, changed from 1210KHz to 880KHz on April 5, 1971.

Computer conference

A record attendance of 1,500 is expected at the 5th Australian Computer Conference to be held in Brisbane from May 22 to 26, 1972. Most of the sessions will be held in conjunction with the conference. Further details may be obtained from Professor G. A. Rose, Chairman, Papers Committee, c/- Computer Centre, University of Queensland, St Lucia, Qld 4067.

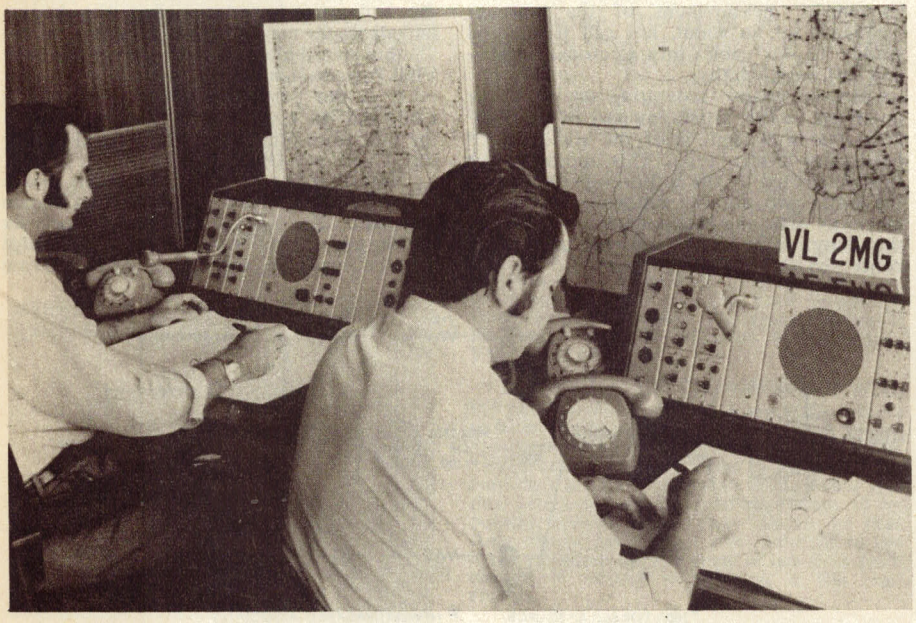
Japanese computer

Hitachi Ltd is to manufacture a giant computer system HITAC-8700 for the Tokyo Institute of Technology. The system has a maximum memory capacity of 8 M-bytes and an adding-substracting speed of 0.42uS. The system, capable of both batch processing and on-line real-time processing on a large scale, will be delivered early next year for installation in the institute's information processing centre.

Modem contract

Standard Telephone & Cables Pty Ltd has been awarded substantial contracts from the Australian Post Office for modem (modulator/demodulator) units for the Datel Service. STC will supply modems for speeds of 200 bits/sec, 2400 bits/sec, and 4800 bits/sec. The modems facilitate the rapid and accurate transmission of ditigal data over telephone type circuits.

Radio aids traffic control



The NSW Department of Motor Transport maintains a 24-hours-a-day contact with its 188 radio-equipped vehicles using a radio system designed, manufactured and installed by AWA. Apart from its registration and licensing role, the department is responsible for many services affecting the transport industry, including the establishment and maintenance of traffic signals and warning signs. The maps in front of the operators in this photograph show the locations of 696 sets of traffic lights currently installed in the Sydney metropolitan area. Reports of malfunctions are passed to the radio control and, after confirmation, to maintenance crews.

Simple RF Impedance Bridge Checks Amateur Aerials to 432MHz

Here is a further accessory for the author's VHF Powermatch measuring system. If carefully constructed, it is capable of useful measurements on all bands up to and including 432MHz. The author explains in detail how the instrument may be used not only to measure the resistance of an aerial, but also its reactance.

The most rapid and convenient way of checking the impedance matching of an aerial is to measure its SWR, using such instruments as an SWR reflectometer or a slotted line. Instruments of this type can thus be of great value to the radio amateur, and it was for this reason that a reflectometer and a slotted line were included in the VHF Powermatch system. (For those who missed the article, it was in the April issue.)

Unfortunately there are situations where the SWR-reading type of instrument is not of very much help. The most common such situation is where an aerial is known to be mismatched, and the amateur desires to improve matters. Because the SWR only indicates the degree of mismatch, and not the direction in which the impedance error lies, it can only be used to monitor the effect of "cut and try" alterations.

What is really needed in this type of situation is an instrument which can give a reasonably clear picture of the actual impedance of the aerial, ideally in terms of both its resistive and reactive components. Only with this information can the amateur analyse the mismatch and plan to correct it in a "scientific" manner, with a correspondingly higher likelihood of success.

In general, three different methods have been used by radio amateurs to measure aerial impedance. Probably the most popular way is to use an RF impedance bridge, in one of the many forms which have been described. Another method, which is growing in popularity, is to use an instrument known as an "aerial noise bridge". The third method is the so-called "triangulation" approach, where the impedance of the aerial is calculated after comparing either its RF current or voltage drop with that of a (hopefully) pure resistance connected in parallel or series, and with the total current or voltage drop associated with the combination.

All three of these methods are capable of giving much the same information and in the forms generally used by amateurs they are probably capable of giving roughly the same order of accuracy. But each tends to have its own advantages and disadvantages.

The RF impedance bridge has the useful facility that it may be used to cut co-axial cable to accurate electrical quarter-wave and half-wave lengths, at any desired test frequency. This can be very worthwhile when the amateur has to make up baluns and other matching devices. Its disadvantages are that it needs a low-power transmitter or other source of RF to supply drive, is not really suitable for use at VHF and UHF in many of the forms described, and similarly is not usually capable of giving reliable information regarding the reactive component of aerial impedance.

The aerial noise bridge or ANB is a recent variant of the conventional RF bridge which uses a generator of wide band "white" noise in place of the usual low-power transmitter. It also uses the amateur's own receiver in place of the detector and meter combination. The fact that the receiver provides the bridge with a tuneable detector makes the ANB particularly useful and convenient for finding the actual resonant frequency of an aerial.

Like the normal RF bridge, the ANB may also be used to cut cables into accurate electrical quarter-wave and half-wave lengths. However it shares two of the same disadvantages: it is not easily adapted for use at VHF and UHF, and does not easily permit measurement of aerial reactance.

While a little less convenient than the other two methods, the triangulation approach has the advantage that it does permit relatively easy calculation of aerial reactance. In fact this is its main justification. On the debit side, it is if anything even less suitable for VHF and UHF work than either of the other two methods. It does not allow convenient measurement of the resonant frequency of an aerial, nor can it be used readily to cut cables into electrical quarter- and half-wave lengths.

The impedance measuring device to be described in this article, as part of the VHF Powermatch system, is of the standard RF impedance bridge type. This approach was finally selected by the author in preference to the other two, for the following reasons: It seems to offer the best compromise as far as simplicity, low cost and usefulness are concerned, and it also seems to be the approach which lends itself most readily to adaptation for use at VHF and UHF.

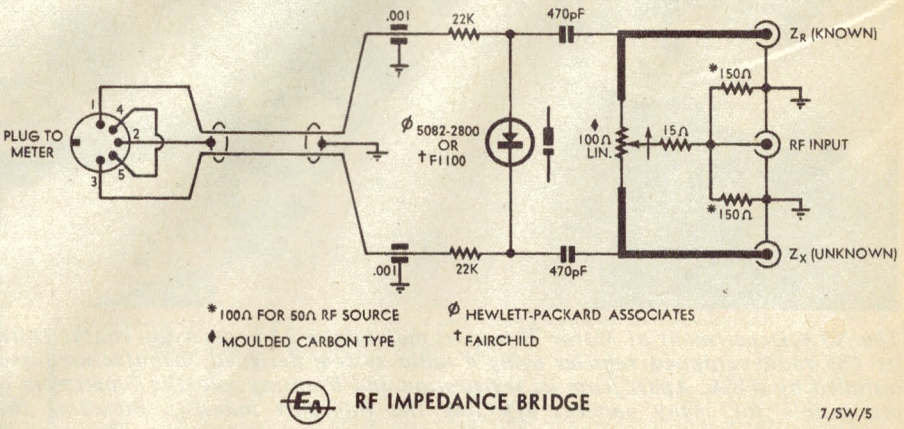
Much of the inspiration for the design of the unit has been provided by a unit described in the VHF-UHF Manual, published by the RSGB. The RSGB design is for a fixed ratio bridge which employs a very carefully planned and highly symmetrical physical layout to ensure reliable balancing of stray reactances. It is claimed to be capable of making useful measurements up to 432MHz, and there is no reason to believe otherwise. However, the fact that its bridge ratio is inherently fixed would seem likely to limit its usefulness.

In developing the present design, what the author has done is to use the same basic idea of a carefully designed and highly symmetrical bridge, but adapt it to produce a more flexible variable-ratio instrument. At the same time the physical construction has been considerably simplified, and the size reduced. The author has also developed a relatively simple way of using this type of bridge to measure aerial reactance – but more about this aspect later.

As may be seen from the circuit, the unit is electrically quite simple, using a mere handful of components. It is basically nothing more than the familiar Wheatstone, whose arms are formed by the two sections of the 100-ohm pot, the known impedance Zr, and the unknown impedance Zx. The known impedance Zr may be nothing more than the 75-ohm or 50-ohm dummy load in the basic VHF Powermatch.

It is the particular bridge configuration used, and the components, which distinguish the unit from others and make it suitable for use at VHF and UHF.

Note that the configuration of the bridge is such that the "earthy" sides of the known impedance Zr, the unknown impedance Zx (ie, the aerial), and the RF input to the bridge are all commoned, and connected to the case



The circuit of the bridge, which uses only a handful of components. If carefully constructed according to the instructions given in the article, it is capable of making reliable measurements to beyond 432MHz.

by JAMIESON ROWE

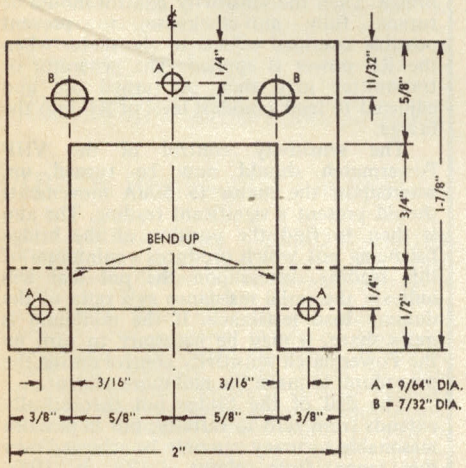
of the unit. The common "earthy" point forms the "bottom" of the bridge. This arrangement is ideal for an RF bridge because it allows co-axial cables to be used to connect both known and unknown impedances to the bridge, and also to connect the bridge to the source of RF. It also allows relatively easy balancing of the stray bridge reactances.

The RF input to the bridge is terminated, to ensure that the feed cable is relatively free from standing waves – a high SWR on the feed cable could upset measurements by disturbing earth potentials. Two 150-ohm resistors are used in parallel where the RF source has an impedance of 75 ohms, or alternatively two 100-ohm resistors where the source impedance is 50-ohms. From the termination the RF is then fed to the moving arm of the 100-ohm bridge pot via a 15-ohm isolating resistor.

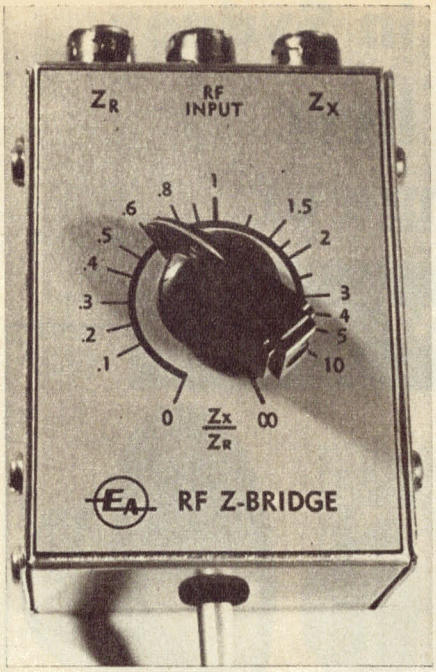
Naturally, because the bridge configuration has been arranged to permit earthing of one side of the RF input, this means that neither side of the detector may be earthed. A symmetrical diode detector circuit meets this requirement quite easily, as may be seen. The detector is basically the same as the familiar "shunt diode" half-wave detector, but has both the input capacitor and the series resistor effectively "split in two". Feedthrough capacitors are used at the output or "cold" ends of the 22K series resistors, from where the DC output of the detector is taken by cable to the VHF Powermatch.

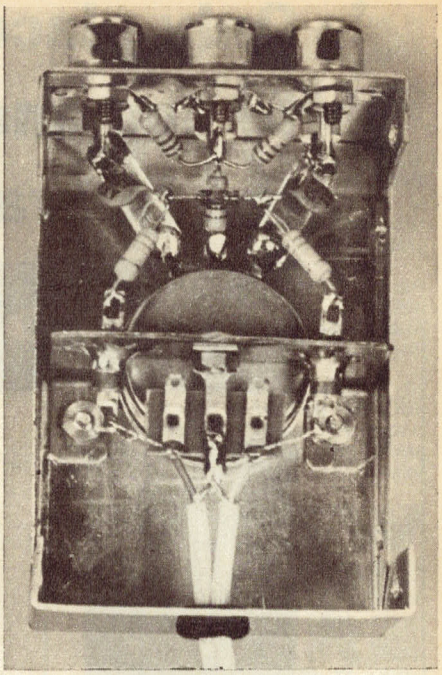
The components used in the bridge and their physical layout are almost as important as its electrical configuration in determining the performance at VHF and UHF. As may be seen from the photographs, the physical construction has been chosen to minimise the length of interconnections, and to make the layout as compact and as physically symmetrical as possible.

The unit is constructed in a low-cost aluminium utility case which measures 3¼in x 2¼in. The three co-axial connectors for the known and unknown impedances and the RF input are mounted side by side on one end of the case, with the RF input connector in the centre. The bridge ratio pot is mounted in the centre of the case, with its terminal lugs facing the co-axial connectors to ensure short connections. A cut-out bracket mounted centrally above the pot carries the feed-through capacitors and a small tagstrip to terminate the output cable.



A dimensioned drawing of the bracket which supports the feedthroughs.





Outside and inside views of the bridge, reproduced only slightly smaller than actual size. Great care must be taken to ensure accurate physical symmetry of the wiring if the unit is to give valid results at UHF.

The pot should be a low reactance moulded-track carbon type, and definitely not a wire-wound type. The prototype unit employs a high-grade moulded track pot kindly supplied by the Imported Components Division of Plessey Ducon Pty Ltd. We understand that identical units are available from this firm on order from trade suppliers.

The connections between the outer lugs of the pot and the spigots of the outer co-axial connectors should be made using metal strips, to reduce lead inductance. The strips in the prototype were ¼in wide, and were cut from 18G brass sheet. Before being soldered in place they were carefully bent into the same shape. They were also soldered in position with great care taken to ensure physical symmetry.

The RF input terminating resistors have their leads cut short and are soldered from the centre spigot of the centre co-axial connector to solder lugs clamped under the mounting screws of the two outer connectors. These lugs are connected to a similar lug clamped under the adjacent mounting screw of the centre connector, to ensure a reliable earthing bond. The RF terminating resistors are also positioned to ensure physical symmetry.

From the spigot of the centre co-axial connector, the 15-ohm RF isolating resistor connects to the centre lug of the pot. This resistor should have its leads cut to minimum length, and be positioned as centrally as possible to ensure balanced coupling to the remainder of the bridge wiring.

As may be seen, the 470pF detector input capacitors also have minimum-length leads, and connect to the bridge circuit directly at the spigots of the Zr and Zx co-axial connectors. The detector diode also has its pigtails cut to minimum length, and is soldered between the two capacitors. When soldering to the diode, a pair of long-nosed pliers or a surgical "mosquito" should be used to prevent overheating.

Although perhaps not essential, it is advisable to use a hot-carrier or Schottky-barrier diode in the unit if operation is to be maintained up to 432MHz. In the prototype unit we used the Hewlett-Packard type 5082-2800 device, as used in the other VHF Powermatch accessories, which is available by mail order from Hewlett-Packard Australia Pty Ltd. In NSW the address is 61 Alexander Street, Crows Nest, 2065, while in Victoria the address is 22-26 Weir Street, Glen Iris, 3147.

Other hot-carrier devices may also be suitable, such as the Fairchild type FH1100 or FH1200. These have lower breakdown voltages, but should be quite satisfactory at the low power levels handled by the RF bridge.

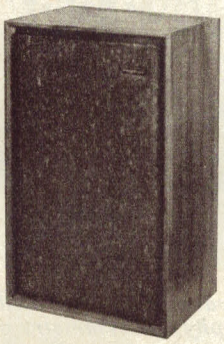
The 22K detector isolating resistors connect from each end of the diode to the nearby lugs of the .001uF feedthrough capacitors, to complete the basic wiring of the bridge. Again, care should be taken to ensure that these components are mounted symmetrically to ensure close balancing of the stray reactances. Connection of the output cable to the small tagstrip on the rear side of the feedthrough bracket then completes the unit, apart from the fitting of a top panel and knob.

Copies of the prototype front panel have been supplied to metal work manufacturers, so that these firms should have ready-made front panels available shortly. Actual-size bromide prints of the panel are also available via the Information Service, for those readers who prefer to "roll their own".

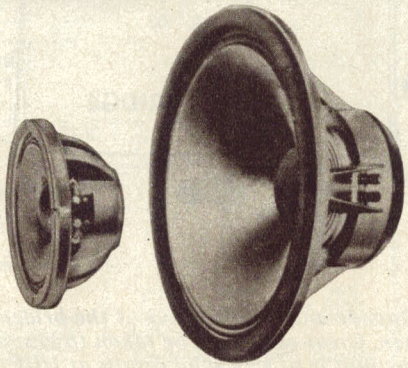
How is the bridge used? This will now be explained. The setup for measuring the resistive component of aerial impedance is

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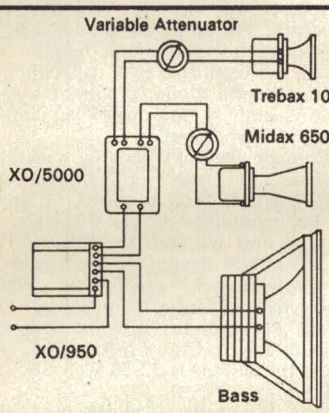
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basically the same as for any RF bridge, and is shown in figure 1. The detector output cable of the bridge is connected to the VHF Powermatch metering circuit, the Zr socket is connected to the dummy aerial of the Powermatch, and the Zx socket to the aerial to be measured – via a cable whose length should be either a half-wavelength, or a multiple of this length, allowing for the cable velocity factor.

Unless the cable between the aerial and bridge is a half-wavelength or a multiple of this length, the impedance reflected by the cable at the bridge may well be quite different from that of the aerial, making the measurement invalid. Needless to say, the cable should not involve a larger number of half-wavelengths than is necessary to permit convenient measurement with the aerial at a suitable distance from large metal objects, etc. This is because with a long cable, the cable losses will again tend to falsify the results.

The source of RF power connected to the centre socket of the bridge may be either a signal generator, or the amateur's transmitter for the band concerned. In the latter case it may be necessary to make a temporary

PARTS LIST

1 Utility case, 3¼in x 2¼in x 1½in.
1 Front panel to suit (see text).
3 Co-axial sockets.
1 100 ohm lin moulded track carbon potentiometer (see text).
1 Hot-carrier diode, type 5082-2800 or FH1100 or similar.
2 .001uF ceramic feedthrough caps.
2 470pF disc ceramic capacitors.
1 15 ohm ½ watt carbon resistor.
2 150 ohm or 100 ohm carbon resistors (see text).
2 22K ½ watt resistors.
1 5-pin DIN plug.
1 3-lug miniature tagstrip.
Length of twin shielded cable, scrap brass for bracket and connection strips, nuts, bolts, grommet, instrument knob, etc.

modification to the transmitter to reduce its output, in order to prevent damage to the bridge components. The RF power fed to the bridge should be in the order of one to two watts.

The procedure is quite straightforward. The function switch of the Powermatch should first be set to the "DIF" position, to suit the balanced detector circuit used in the bridge. Then the sensitivity control should be turned fully anti-clockwise, to prevent possible overload effects to the meter when the RF power is applied. The generator or transmitter may then be turned on, and adjusted to feed a modest level of RF into the bridge.

The sensitivity control of the VHF Powermatch should now be turned up, whereupon the meter (a 50uA movement) should present a significant reading. The aim is then to find the position of the bridge balancing pot which produces a minimum of this reading, whereupon the pot dial will indicate the aerial resistance as a ratio of the dummy load resistance. If the minimum is quite sharp, it may be necessary to turn up the Powermatch sensitivity control during the procedure, to make the null more evident.

The dial of the bridge pot theoretically extends from zero to infinity, but in practice reasonable accuracy can only be achieved over the range from about 0.1Zr to 10Zr. Accordingly the pot scale has only been calibrated over this range, as may be seen.

Nevertheless this gives a very useful range – from 7.5 ohms to 750 ohms for a 75-ohm dummy load as reference, or from 5 ohms to 500 ohms with a 50-ohm load.

When used in the foregoing way, the instrument is capable of giving quite accurate readings of the resistive component of aerial impedance. It may be used for this purpose with equal success on the VHF and UHF bands up to and including the 432MHz band, and on the lower HF bands. In fact there is no reason why it may not be used to measure the RF resistance of any aerial for any of the bands between 1.8MHz and 432MHz, providing a suitable source of RF is available, and the appropriate cables are made up.

Like all similar instruments, however, it is not in its basic form capable of dealing satisfactorily with any reactive component which may be present in the aerial impedance. If the reactive component is significant, the balancing null of this type of bridge tends to become broad and ill-defined, making measurement somewhat difficult.

Happily, there are ways of extending the use of the basic instrument which avoid this problem, although these methods are not widely known. In fact it is possible not only to arrange for the bridge to be balanced properly in the presence of significant aerial reactance, but also to make a measurement of the reactance. The methods which allow this are not complex, as the writer will now explain. They involve only a few extra cables and connectors, and one or more calibrated variable capacitors.

The basic idea is quite simple. All that is done is to balance out the aerial reactance using a variable capacitor, so that the phase angles of the known and unknown bridge impedances Zr and Zx become equal. This restores the sharpness of the bridge null, to make an accurate measurement again possible; and if the variable capacitor is calibrated, this makes it possible to obtain an accurate measure of the aerial reactance at the same time.

The variable capacitor to be used for the purpose should be mounted in a small box or "U" bracket with two co-axial connectors, as shown in the diagram of figure 2. For VHF and UHF work the capacitor need only be of low value – say 50pF or 100pF maximum. A larger value would be more appropriate for HF work, say 300pF or 400pF. The box should be of compact dimensions to ensure that the connections between the capacitor and the co-axial sockets may be as short as possible. In any case it is a good idea to make the connections with a triangular plate of brass or tinplate, if the unit is to be used at VHF and UHF.

The way in which the capacitor is connected into the circuit depends upon the form of the aerial reactance. If the aerial has a capacitive reactance component, then the connection of figure 3 will be appropriate. Here the variable capacitor is effectively connected in parallel with the dummy load, and is used to provide a capacitive reactance component for Zr, to balance that of the aerial.

If on the other hand the aerial reactance is inductive, then either of the connection methods shown in figure 4 will be appropriate. Method A is perhaps the more convenient, especially for HF use. Here the capacitor is used to effectively cancel or tune out the aerial reactance, thus converting Zx into a pure resistance as far as the bridge is concerned.

Method B is an alternative approach which becomes practical at VHF and UHF. Here the variable capacitor is connected into the dummy load or Zr side of the bridge, as in figure 3, but in this case via a quarter-wave

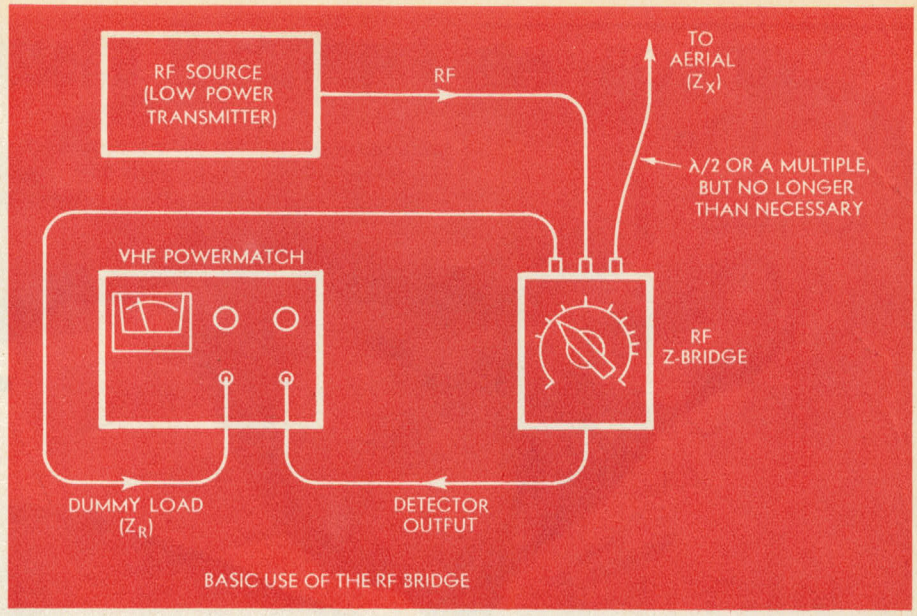


Figure 1: The way in which the bridge is connected up for measurement of the resistive component of aerial impedance. The RF source should deliver no more than about two watts, to prevent damage to the bridge components.

section of line. The action of this section of line is to effectively convert the capacitor into a complementary inductor.

It may be recalled from theory that the action of a quarter-wave section of transmission line is to cause any impedance connected at one end to appear at the other as its "complementary" impedance, whose value may be found by dividing the original impedance into the square of the characteristic impedance of the line.

When the original impedance is an essentially pure capacitor, as we have here, the impedance reflected at the other end is virtually a pure inductor, whose reactance may be found from the expression

$$X1 = \frac{Zo^2}{Xc}$$

where X1 is the effective inductive reactance,

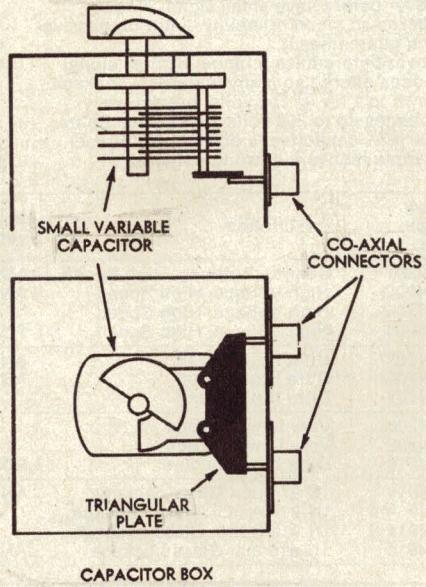


Figure 2: Construction of a variable capacitor box for reactance tests.

Zo is the characteristic impedance of the cable used, and Xc is the reactance of the variable capacitor at the frequency concerned. All three are understood to be measured in ohms.

At this stage the reader may well be asking himself the obvious question – how does one know whether the aerial reactance is capacitive or inductive, in order to select the correct position for the capacitor? The answer to this is that one does not know initially. The technique is in fact one of finding this out by trial and error, whereupon the correct position becomes evident as the one which produces a deepening of the bridge null.

The procedure is as follows: When a measurement using the basic bridge setup of figure 1 reveals that there is a significant aerial reactance, as indicated by a very broad and ill-defined null, the capacitor box is added to the system on the dummy load side, according to figure 3. It is then an easy matter to add capacitance to the dummy load, and note whether the null of the bridge becomes deeper or less deep. Some re-adjustment of the main bridge balance pot may be necessary, to ensure that the bridge "tracks" properly towards a fully balanced state (the null tends to move slightly as the reactance is balanced out).

If the null of the bridge increases in depth with the capacitor in this position, then the aerial reactance must clearly be capacitive. The procedure is then simply a matter of manipulating both the bridge pot and the capacitor to produce the deepest possible null. When this condition has been reached, the bridge dial reading will give the resistive aerial component as before, while the capacitor gives the capacitive reactance.

On the other hand if the null becomes less deep with the capacitor in the position shown in figure 3, then it is equally clear that the aerial reactance must be inductive. The procedure is then to change the setup to one of those shown in figure 4, and again manipulate both bridge and capacitor to produce the deepest null.

As before, when the deepest null position is found the bridge pot dial will give the resistive component of aerial impedance, while the inductive reactance may be



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AN204	High Voltage, High Speed	FD200	32	200 volt BV
AN205	Ultra High Speed	AN2001	20	50 volt BV
AN206	Ultra High Speed	AN2003	22	75 volt BV
AN207	Ultra High Speed		25	100 volt BV
AN208	Very Low Leakage		25	5 nA @ 75V
AN209	Very Low Leakage		30	5 nA @ 150V
AN210	Ultra Low Leakage	FD300	40	1 nA @ 100V
AN914	1N 914 in μ Glass package	AN2004	30	100 volt BV
AN914 A	1N 914 A in μ Glass package		33	100 volt BV
AN914 B	1N 914 B in μ Glass package		36	100 volt BV
AN916	1N 916 in μ Glass package	AN2006	45	100 volt BV

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calculated from the capacitor value. If method A of figure 4 is used, the inductance of the aerial is simply that value which resonates with the capacitor at the frequency being used. Alternatively if method B is used, the inductive reactance may be calculated using the simple expression given earlier.

It may have been noted that in the diagrams of figures 3 and 4 a recommended length of one half-wave is again shown for certain of the connecting cables. Unless the cables are of this length, the impedances reflected by the aerial and the capacitor at the bridge will tend to be quite different from their true values, making the measurements invalid.

Note that the half-wave length of the cables should take into account the velocity factor of the cable used – generally about 0.6. This should also be taken into account when making up quarter-wave cables for the measurement setup of "method B" of figure 4.

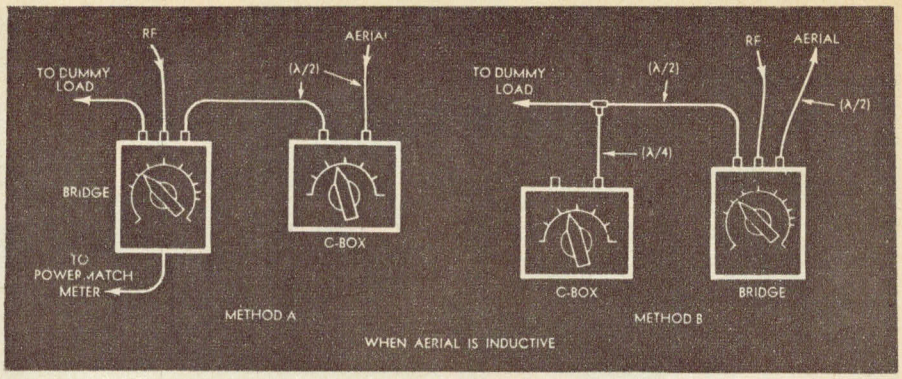


Figure 4: The alternative methods which may be used to measure aerial reactance and resistance when the aerial proves to have a significant inductance.

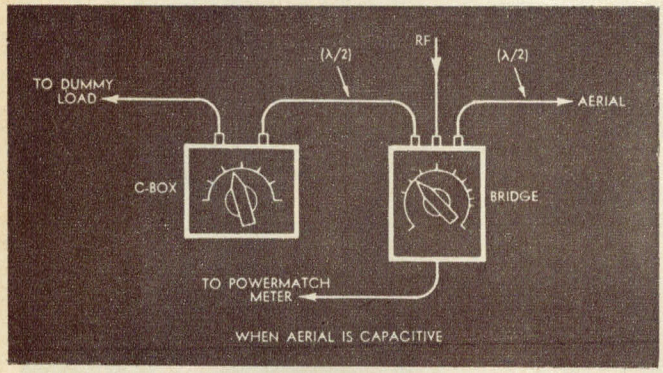


Figure 3: Method of measuring both the resistive and reactive aerial components when the aerial proves to be capacitive.

The bridge itself may be used to cut cables accurately to the quarter-wave and half-wave lengths and multiples of these lengths required for such purposes as baluns, matching stubs and transformers, and the cables used for the foregoing aerial measurements. This is done by making use of the fact that an open circuited half-wave line provides an effectively infinite load resistance, while an open circuited quarter-wave line provides an effective load resistance of zero.

The most convenient way of using the bridge for this purpose is also the most accurate. It involves setting the bridge pot carefully to the "unity" position (midscale), and balancing the cable against either an open circuit or a short circuit. In the case of a half-wave line, the "Zr" socket of the bridge is simply left unconnected, to provide an effective open circuit. For a quarter-wave line a shorting plug is fitted to the "Zr" socket, providing an effective short circuit. (See figure 5.)

The procedure is quite simple, A coaxial connector is fitted to one end of the cable to be cut to length, so that it may be connected into the bridge at the "Zx" socket. The "Zr" socket is then either left unconnected, if the cable is to be cut to a half-wave or multiple, or fitted with the shorting plug if it is to be cut to a quarter-wave or odd multiple. The RF power is then applied, and the cable length progressively reduced by means of clean cuts with a razor blade until the Powermatch meter indicates a null.

Note that in cutting the cable to length, care should be taken to make clean cuts, so that after each cut the cable effectively ends in an open circuit. Make sure that braid wires do not remain, to risk contact with the centre conductor and cause a short.

The shorting plug used as a reference when cutting quarter-wave sections was made up from a standard co-axial plug. The internal "short" was achieved using a small disc of sheet brass, to ensure a very low series inductance.

Using the foregoing technique, the author has used the prototype bridge to cut cables to accurate quarter-wave and half-wave lengths, even at 432MHz. This was easily done, as the null obtained was quite sharp and distinct. Naturally, at these frequencies the short lengths of cable involved in the connecting plugs and sockets must be taken into account when the resulting cable sections are used.

Note: There have been one or two isolated complaints from readers regarding the availability of the Comalco aluminium extrusion used in the slotted line accessory described in the April issue. In one case a reader was told that this extrusion is no longer being made.

As with all E-A projects, we checked on the availability of this extrusion before the article was published. A further call to the Comalco national office since then has confirmed that the extrusion is still very much a stock line, obtainable from any of the Comalco distributors.

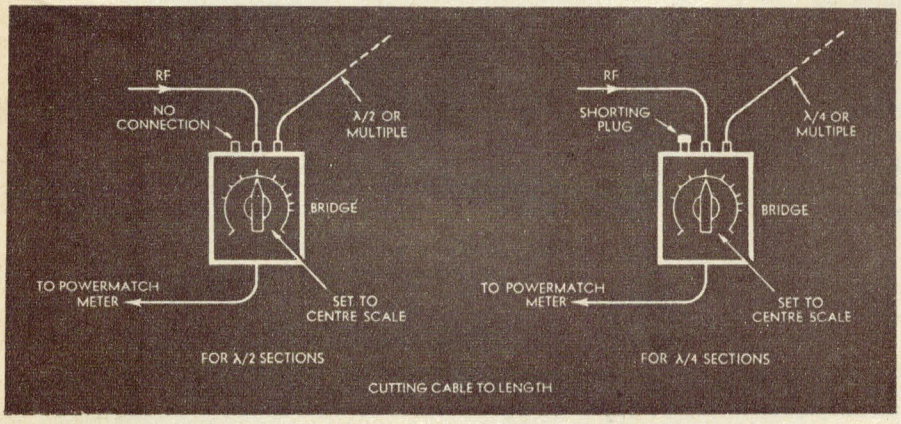


Figure 5: Using the bridge to cut cables to accurate multiples of electrical half-wave and quarter-wave lengths. The methods shown will give accurate results to beyond 432MHz, if care is taken.

REFERENCES

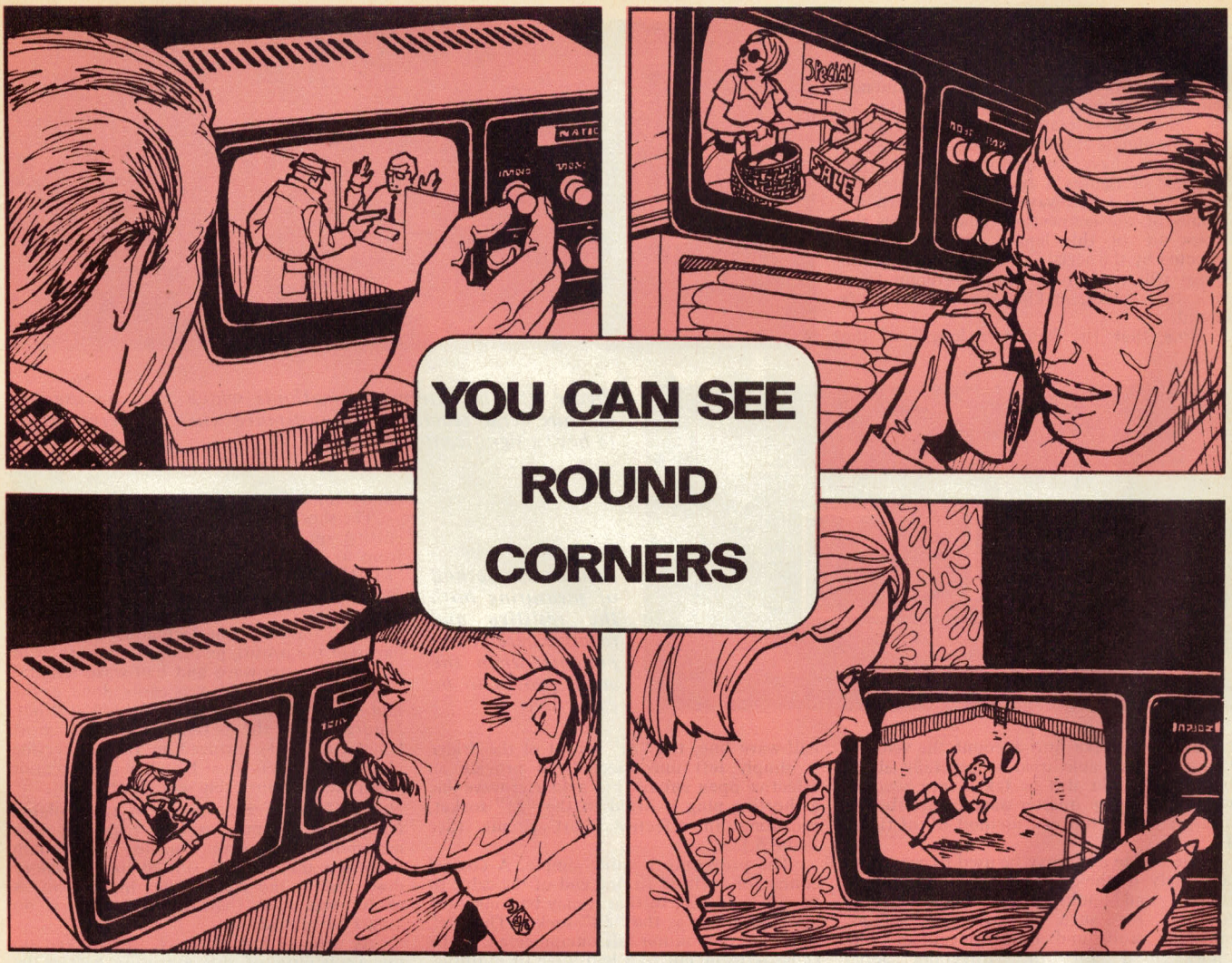
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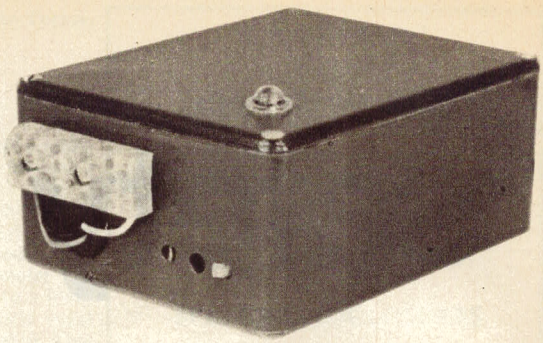
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Build this simple Proximity Switch



by LEO SIMPSON

Here is a simple and low cost project, designed especially for our beginners and junior readers, but likely to be of interest to many others. It is fully solid-state, and very suitable for both domestic and industrial use. An ideal application would be as a "touch plate" door chime.

The simple device to be described in this article has many intriguing uses around the home, in industry and in advertising displays. The basic idea is that it can ring a bell, sound a buzzer, switch on lamps or apply power to equipment whenever a person's hand is brought close to its sensor plate.

Around the home, it may be used as a novel door chime unit, or as a "surprise" gimmick for parties. Imagine the fun if a bell were to ring whenever a guest reaches into the bowl of sweets, or sits down in that mysteriously unoccupied armchair!

In the industrial field, the unit could be used to detect items moving down a production line, either for counting or to actuate machinery. This type of device is often used as the basis of the "touch buttons" fitted to some automatic elevators.

The device can be used for sales promotions. Placing a sensor plate behind a shop window allows it to be triggered by people on the footpath. In response, the unit can turn on lights over display stands, actuate slide projectors or endless loop tape machines. It can also be used as an attention alarm on shop counters. (In fact, this unit is almost identical to that used on the counter in the editorial office at "Electronics Australia".) An alternative use of a counter or display stand to actuate warning signs. A sign reading "Please do not touch" could thus be made to light when a person tries to disobey an instruction. Just think how many a museum could use!

The unit is very simple, and uses only three semiconductor devices. These are all PNPN or "thyristor" devices: a silicon controlled-rectifier or SCR, a complementary SCR (or alternatively a controlled-switch) and a symmetrical breakover diode, otherwise known as a Diac. Before describing the circuit operation, let us briefly outline the operation of these devices.

The SCR is one of the family of semiconductor devices known as thyristors. It can be regarded as a special type of rectifier diode which conducts in one direction only. What sets it apart from a normal diode is that when it is forward-biased, it will not conduct until it is triggered into doing so by a small positive voltage applied between its third "gate" electrode and the cathode. With a sine wave voltage applied between anode and cathode, an SCR can be triggered into conduction at any instant during the positive half-cycles. At the end of each positive half-cycle, the SCR turns off as the voltage polarity reverses.

The complementary SCR is very similar to an SCR, except that it has a gate electrode which is associated with the anode rather than with the cathode. The silicon controlled switch or SCS is virtually a combination of the two, having both an "anode gate" and a "cathode gate". Either can initiate conduction.

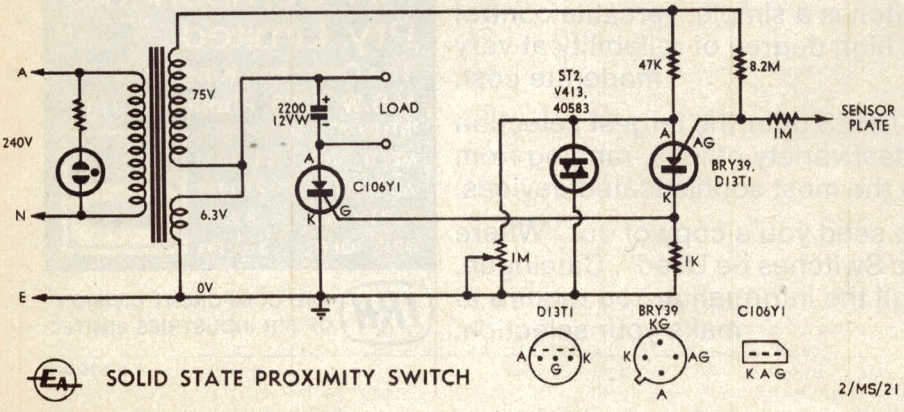
The symmetrical breakover diode is aptly named because when a voltage across it of either polarity exceeds a certain value, the diode "breaks over" or conducts with a negative resistance characteristic. Typical breakover voltage lie between 30 to 40 volts. The symmetrical breakover diode or Diac, as it is more commonly referred to, is most often used in Triac phase control circuits where it discharges a capacitor into the gate of the Triac. However, in the present circuit the Diac is used primarily for voltage limiting.

Referring now to the circuit diagram, a power transformer having a 6.3V @ 1A and a 75V winding is required. The two windings are connected so that their voltages add and the complementary SCR is connected across the total, in series with the 47K and 1K resistors. The cathode side of the winding is connected to earth. (Note that when an SCS is used, the cathode gate is not connected.)

Now for the complementary SCR to switch on during positive half-cycles of the AC waveform. the anode gate must be made negative with respect to the anode. If a person touches or brings their hand close to the sensor plate which is connected to the gate via the 1M resistor, triggering occurs because of the increase in capacitance between the gate and earth. The increase in capacitance causes the phase lag of the sinusoidal voltage appearing at the gate to increase with respect to the voltage at the anode, until the voltage difference between the anode and anode gate is sufficient to cause triggering.

PARTS LIST

1 diecast box, 4 5/8 x 3¾ x 2in.
1 mains transformer, 70V @ 30mA, 6.3V @ 1 amp
1 C106Y1 silicon controlled-rectifier
1 D13T1 complementary SCR or BRY39 SCS
1 V413, 40583 or ST2 Diac
1 2200uF/12VW electrolytic capacitor
1 1M preset potentiometer
1 x 8.2M, 1 x 1M, 1 x 47K, 1 x 1K (¼ or ½ watt resistors)
1 12-lug length of miniature tagboard
1 neon pilot bezel assembly
Plastic terminal block, mains cord, three-pin mains plug, mains cord clamp, solder lug, screws, nuts, hook-up wire, spaghetti sleeving, solder, etc.



Above is the circuit for our Proximity Switch, which can be used to ring an electric bell, light a lamp, or operate many other devices, as described in the text.

Because the Diac is connected from the anode of the complementary SCR to earth, the voltage appearing at the anode is a clipped sine wave with a peak-to-peak amplitude of 60 to 80 volts. This means that the phase shift between the anode and gate voltages can only cause the anode voltage to assume a positive differential with respect to the gate during that period of the positive half-cycles before the Diac "breaks over". This means that, because of the Diac, the triggering produced by gate circuit capacitance always tends to occur early in each positive half-cycle, to give the circuit an all-or-nothing switching characteristic.

The 1M preset potentiometer shunting the Diac forms a voltage divider with the 47K resistor, and functions as a sensitivity control. When the pot is adjusted for maximum resistance, the circuit is most sensitive to gate circuit capacitance and vice versa. If the pot is adjusted to very low resistance values, the

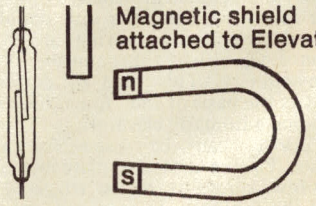
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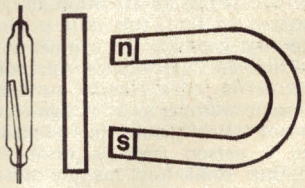


This elevator has been accurately positioned at floor level by the controlling action of a magnetic reed switch as illustrated by the following diagrams.



Magnetic shield attached to Elevator.

Switch held in operate position by magnet.



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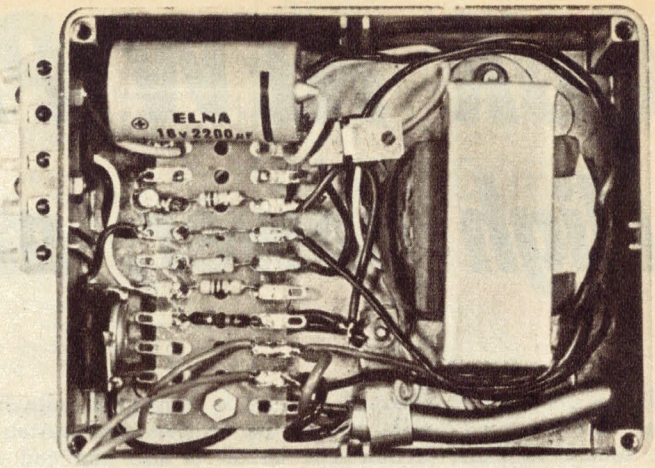
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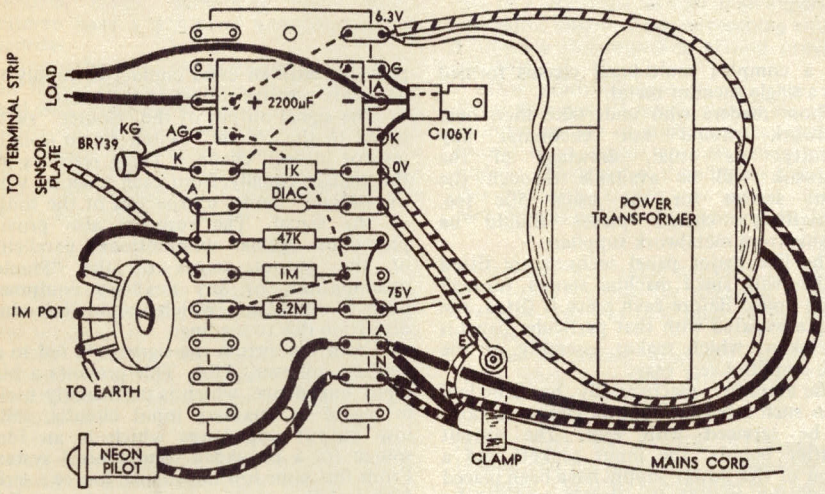
circuit will not function as the anode voltage will always be low.

Since triggering can only occur in the early part of each positive half-cycle, radio frequency interference is minimised. However, this is not the only reason for incorporating the Diac.

When the complementary SCR fires, the 47K and 1K resistors form a voltage divider across the sine wave input. The voltage appearing across the 1K resistor then forward biases the gate-cathode junction of the SCR, to trigger it on. The voltage across the 1K resistor should be as large as possible, within reason, to ensure reliable SCR triggering. Also, to ensure good sensitivity to capacitance changes, the complementary SCR gate circuit must operate at a high impedance. Both these requirements mean that the sine wave input from the transformer should be as large as possible. However, the maximum voltage ratings of the D13T1 device are plus or minus



At right is an interior view of the prototype, housed in a diecast box made by STC.



Above is the complete wiring diagram showing the BRY39 SCS installed. If a D13T1 "programmable unijunction" or complementary SCR is used instead, a small modification to the layout will be needed.

40 volts and this would be exceeded by a sine wave input voltage of 30 volts. Thus the Diac allows us to use a relatively large input voltage and still protect the complementary SCR.

While the Diac protects the complementary SCR anode from excessive voltage excursions, it does not offer similar protection for the anode gate. However, if the anode gate does go into "reverse breakdown", its dissipation is kept to negligible levels by the 8.2M series resistor.

Some readers may point out that the BRY39 device (an SCS) which is shown as an alternative to the D13T1 has much higher voltage ratings, and thus could be used with higher input voltages, without the Diac. While it is true that the BRY39 could be used with transformer input voltages up to 49 volts, a higher voltage is really necessary for good results. In any case it is the clipping action of the Diac on the anode voltage of the complementary SCR which gives the circuit its desirable all-or-nothing switching action.

If the Diac was not included in the circuit and supposing that the voltages were within the ratings of the device used, both it and the SCR could be triggered at any instant during the positive half-cycles of the AC input. This would mean that varying the stray capacitance of the sensor to earth would vary the output voltage as seen by the SCR load. However, with the Diac in circuit, the combination must fire early in the half-cycle and thus the load voltage tends to be independent of the trigger capacitance, once the latter becomes sufficient to cause triggering.

The load used for our prototype was a low voltage electric bell. Consequently, the input for the SCR is 6.3 volts AC. When the SCR fires, it applies half-wave rectified DC to the bell, and this is filtered by a 2200uF capacitor. Note that because of the AC supply the complementary SCR/SCR combination will continue to fire and apply voltage to the load only while there is sufficient capacitance in the gate circuit to cause triggering. As soon as the capacitance is reduced below a certain value the combination will revert to the non-conducting state. If the SCR was required to "latch on" it would have to be fed from a DC supply.

Note that the AC voltage at the anode of the SCR must be in phase with the voltage fed to the anode of the complementary SCR, otherwise the SCR will not be capable of conducting when triggered. To ensure that the voltages are in phase, all that is required is to connect the 6.3 volt winding and the 75V winding so that their voltages add. This may easily be determined using a multimeter.

The bell we used as the load draws an average current of 500mA at 6 volts, and is eminently suitable for the transformer shown. Any lamp, buzzer or other indicating device drawing this order of current may thus be used with the unit, without modification. Loads requiring a higher current should not be used, however, to avoid exceeding the RMS current rating of the SCR. If heavier loads are required, the C106Y1 should be used to trigger a higher-power SCR, or to operate a small relay.

The construction of the proximity switch is quite straightforward. It is housed in a diecast metal box measuring 4 5/8 x 3¾ x 2in, as made by Eddystone or STC. These are available from most parts suppliers. The transformer we used was a Ferguson type PF 2235, which has a centre-tapped 150V winding at 30mA and a 6.3V winding at 1 amp. The A & R PT 5890 is similar and would also be suitable.

The transformer in the prototype was a very snug fit in the diecast box, with about

(Continued on page 150)

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OUR NEW PLAYMASTER: High power, modern styling

This is our latest Playmaster amplifier. In styling it is quite different from anything we have produced to date: straight line controls; push-button selector switches; and a functional panel layout. The circuit is also new and offers many features, including a power output of 40W per channel.

(PART ONE)

by GEORGE HUGHES

The current trend in high fidelity stereo amplifiers is towards single unit construction. The "low-long" styling is usually supplemented with attractively finished front panels, wooden cabinets, multi-function controls; and, possibly, a radio tuner.

Equipment of this type is usually lavished with an overabundance of controls, each purporting to add to the final audible result. One often wonders, when confronted with equipment of this nature, whether (a) possession of a "driver's licence" is needed to operate it; and/or (b) if all the controls provided are absolutely necessary.

In a lot of cases, people who are fortunate enough to own such equipment do possess at least a limited knowledge of how to use it properly. Such devices can, and do, perform impressively when correctly adjusted but weird sounds can emanate from the same equipment when the owner does not operate it properly. The expense involved in such gear is wasted in these circumstances.

To minimise this problem, our new Playmaster amplifier has been equipped with only those facilities which we consider essential for adequate control. These include the volume, bass, treble, and balance controls in the form of slider potentiometers, a "Source" switch which selects one of four inputs (phono, two auxiliary and radio), a "Mode" switch which selects one of three modes (stereo normal, stereo reverse, and mono), the mains switch (push on, push off), and the radio tuning control.

The tuner is the Playmaster 131 originally described in the February 1971 issue, to which has been added a simple but effective tuning indicator.

Rear panel facilities are four DIN sockets which allow phono, two auxiliary inputs, and an auxiliary output to be connected. Speaker output sockets are 2-pin polarised types, and are located towards the left-hand side. A 1A fuse holder is located near the mains lead feed through bush. The remaining terminal is a banana type used for connection of the radio antenna lead.

We settled on a 3½ inch panel height as our criteria for the final overall size and shape, keeping in mind an acceptable proportion of not being too short, and thus appear too "stubby", or too long and thus appear overblank, when relatively few controls are involved. The 3½ inch width also allows comfortable space for the straight-line potentiometers now available.

This approach also simplified chassis construction. We can use folded sections that fit together with a few small screws, rather than a complex multi-bend chassis formed from a single sheet of metal.

Those readers who undertake their own metalwork should not encounter any difficulty. As usual, drawings of the metalwork will be available through the reprint service for the usual 50c fee. Alternatively, chassis pieces should be available from metalwork suppliers.

The five major panel sections are fitted together with small machine screws, through mating holes. Before each piece is fitted, the wiring associated with that particular panel is undertaken, which makes assembly of the whole amplifier very easy.

The amplifier, mechanically, has been laid out in such a fashion that all circuit sections can be serviced with ease. The output amplifier boards, the input sockets and a section of the power supply have been placed towards the rear of the chassis, and can be quite easily removed if necessary.

The preamplifier and stabiliser/protection circuit boards are mounted on an intermediate shield panel. This panel has been mounted in such a way that it can be loosened from its mountings and lifted bodily to provide access to either board.

So much for the mechanical aspects of the amplifier.

There are four distinct sections in the signal processing part of this amplifier; the input preamplifiers which can be wired for either magnetic or piezo (crystal or ceramic) pickups, the push-button switching section, the Baxandall tone control system, and the power amplifier "business" ends. In addition, there is a protected and stabilised power supply.

The preamplifier channel TR1, TR2, TR3 is used for pickup equalisation. By selecting suitable circuitry, either type of pickup (piezo or magnetic) can be used. This preamplifier section is an updated version of that which appeared in the Dec 1965 issue of this magazine, using currently available silicon transistors.

We chose to provide a board with the necessary wiring pattern and holes to encompass either type of pickup circuit by suitable wiring, rather than waste a switch section on the "Source" switch, as most readers will have made up their minds as to the type of pickup they intend to use. More will be said about "type" selection of pickup at a later stage.

This stage is followed by the "Source" switch, which selects signals from either this preamplifier, two auxiliary inputs, or the radio tuner. The radio tuner switch section is provided with an extra contact to supply the necessary positive voltage to the tuner.

The signal output of the "Source" switch is fed to the "Mode" switch via an isolating resistor in each channel. These resistors mix the signals equally from each channel when the "Mono" mode, irrespective of the source of the signal. The resistors also provide protection against unintentional paralleling of the output stages of the "Phono" preamplifiers, or any auxiliary equipment output amplifiers which could introduce distortion due to loading.

From the switch the signals are fed to an emitter follower, TR4. This presents a high input impedance, which is particularly useful in regard to auxiliary input circuits, and a low output impedance which is an ideal source for a Baxandall tone control system. From this same low impedance source a series 47K isolation resistor feeds signals to a DIN socket on the rear panel. External equipment such as a tape recorder, can take signals off at this point.

The balance control is connected at the input to the emitter follower. Its range is deliberately limited by means of a 47K series resistor at each end. This makes its action smoother and also ensures that it cannot place an excessive load on the preceeding circuits, even at an extreme setting.

The Baxandall tone control system (TR5) was based on another section of the Dec 1965 preamplifier. The circuit values have been modified, and two 150 ohm resistors added to the treble control circuitry to eliminate a possible oscillation problem.

The stage gain within the active tone control circuit is 20dB, but the treble boost

SPECIFICATIONS

Power Output: 45 watts continuous per channel into 8 ohm load, 23 watts continuous into 16 ohms.

Frequency Response: (Main amp): at 40W; 10Hz – 65KHz. At 1W: 10Hz – 80KHz. System, through "Aux" input, tone controls flat: at all levels: 18Hz – 45KHz. Distortion: Main amp at 1KHz: 40W: 0.1% 1W: 0.05% Through "Aux" input: 40W; 0.15% 1W; 0.2%

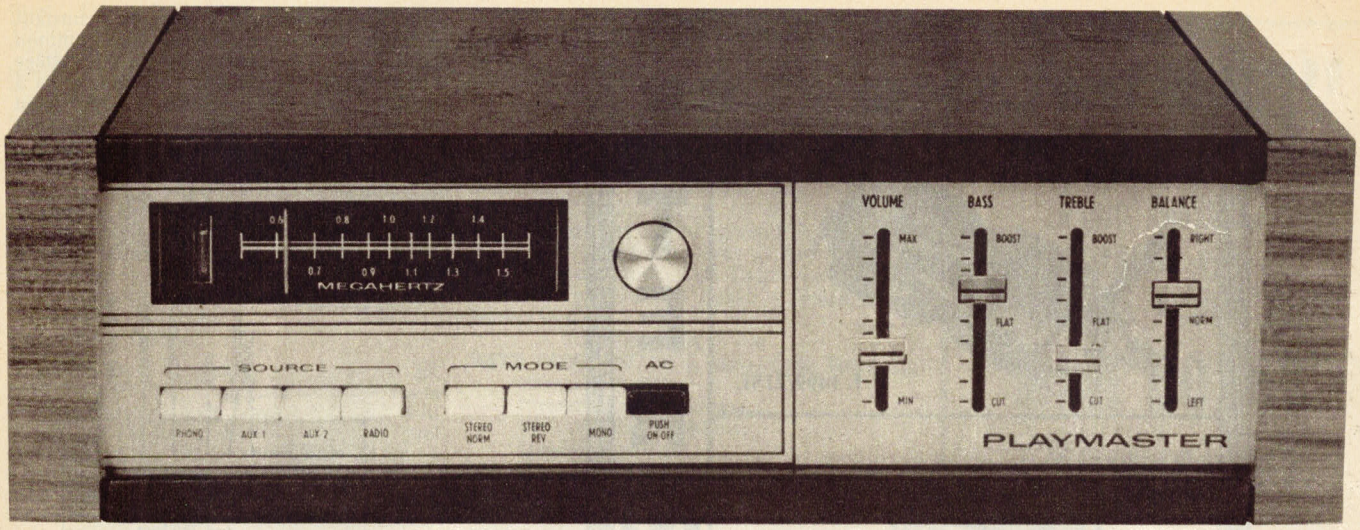
Damping factor: in excess of 56 relative to 8 ohm load.

Sensitivities and input impedances:

Main amp: approx 400mV RMS into 150K

"Aux" inputs: approx 500mV RMS into 100K

"Phono": Piezo: 60mV RMS into 2



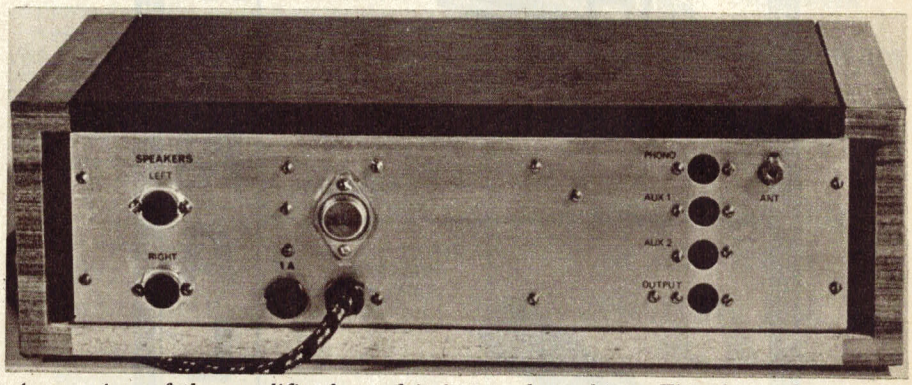
and cut figures are limited to approximately 18dB by the series 150 ohm resistors previously mentioned.

The volume control, a ganged 50K per section slider type potentiometer, is connected to the collector circuit of the active tone control stage by a blocking capacitor. The moving contact is connected to the input of the bass boost amplifier, TR6.

However, TR6 does not function as a straight amplifier stage. While this stage was necessary to provide the required overall gain, the total gain which such a stage could provide was much higher than necessary. So, since we had to throw some gain away, we decided to make use of the situation.

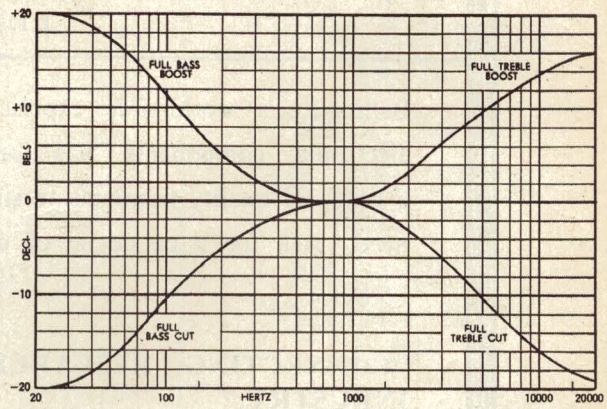
Considering that most speaker systems tend to roll off rather sharply at some point below 100Hz we felt that it would be worthwhile to provide a small fixed amount of bass boost to help offset this. The main advantage of this arrangement is that it is designed to commence its upwards roll at around 100Hz, rather than at 500Hz as in the case of the normal variable bass boost control. The latter circuit, while commonly used to offset speaker limitiations, tends to produce a "lumpy" response by the time it is providing reasonable compensation. Our additional circuit, while not a complete answer by any means, does help reduce this "lumpiness" by a useful amount.

The gain of the stage is controlled by means of a feedback loop; a frequency selective feedback loop employing both resistance and capacitance. We have deliberately restricted the maximum boost which the stage provides to about 6dB. Not only is there little to be gained by trying to "flog" most speaker systems beyond this point, there is the definite risk of driving the whole system into overload at very low, and quite useless, frequencies.



A rear view of the amplifier housed in its wooden cabinet. This shows the position of all components mounted on the rear panel. The gaps at each end of the amplifier chassis are ventilation openings.

These response curves indicate that there is ample compensation available to cope with most likely variations in program material, speaker response etc.



megohms, flat response.
Magnetic: 1.5mV RMS into 50K, RIAA response.
Noise (measured with respect to 40W into 8 ohms):
Main amp: 80dB down.
Through "Aux" inputs: better than 73dB down.
Crosstalk (through "Aux" input, referred to 40W):
at 30Hz: 50dB
at 10KHz: 40dB
"External Output" voltage and impedance:
Approx 500mV out for 500mV in at "Aux" input, or
approx 500mV out for 3mV in at Mag phono, or
approx 500mV out for 120mV in at Piezo phono;
Impedance for all output levels: 50K.

This stage is the last one on the preamplifier printed board. From here the signals are fed via a single screened lead to the power amplifier stage.

The power amplifier stage is based on a Philips report. It uses a complementary transistor pair BD139/140 (TR10, TR11) as driver and phase splitter and a pair of 2N3055s (TR12, TR13) as a conventional quasi-complementary single ended Class B push-pull system.

Two other transistors perform the functions of pre-driver and Class A driver (TR8), while a third (TR9) functions as a mid-point stabiliser and temperature compensator.

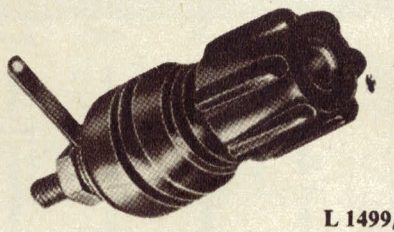
To avoid damage due to overdrive or overvoltage, the power supply is stablised. To guard against a short-circuited load, it is fitted with short circuit protection.

The power supply uses a full wave bridge rectifier consisting of four A15A diodes. These proved to be cheaper than an encaspulated bridge rectifier. With a nominal primary voltage of 240, DC voltage across the 4000uF capacitor is approximately 70.

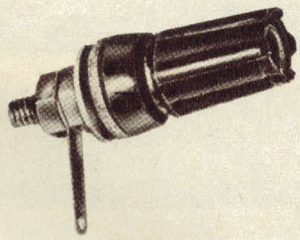
A single 2N3055 (BDY20) (TR16) is used as a series stabilising transistor which, in turn, is connected to a current amplifier (TR15) driven by a comparator amplifier (TR14).

The comparator amplifier is connected as a common emitter with its collector coupled directly to the current amplifier's base. Its reference voltage is derived from a zener

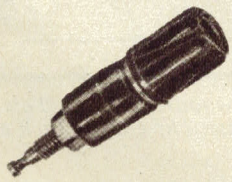
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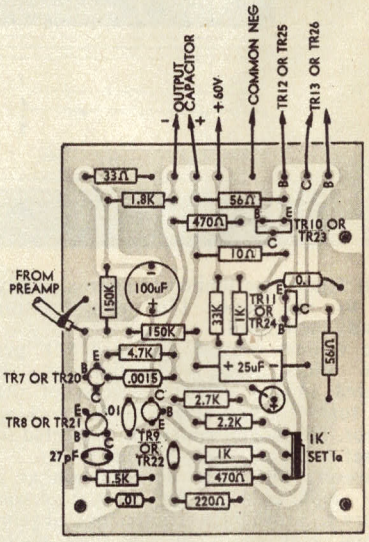
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diode which clamps its emitter at a constant potential with respect to the common negative rail. A portion of the output voltage is fed to the base of the comparator via a resistive divider. This produces a proportional indication of any fluctuation of output voltage at this point and, compared to the emitter voltage, is amplified and applied to the stabiliser as a correction voltage.

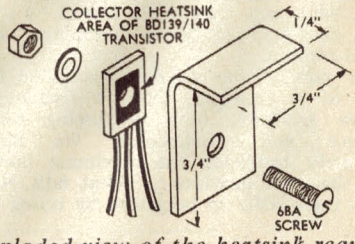
When the output voltage tends to rise, so does the base potential of the comparator amplifier. The rise in base potential causes a



Power amplifier board layout. Note orientation of BD139/140 transistors (TR10, TR23, TR11, TR24).

rise in collector current and a fall in voltage at the collector. The collector is coupled directly to the base of the current amplifier, which thus experiences a fall in base voltage. This, in turn, causes a fall in voltage at the emitter, which is directly coupled to the base of the series stabiliser.

Thus the series stabiliser experiences a reduction in base voltage, or a tendency to be turned off, whenever there is a tendency for the output voltage to rise for any reason.

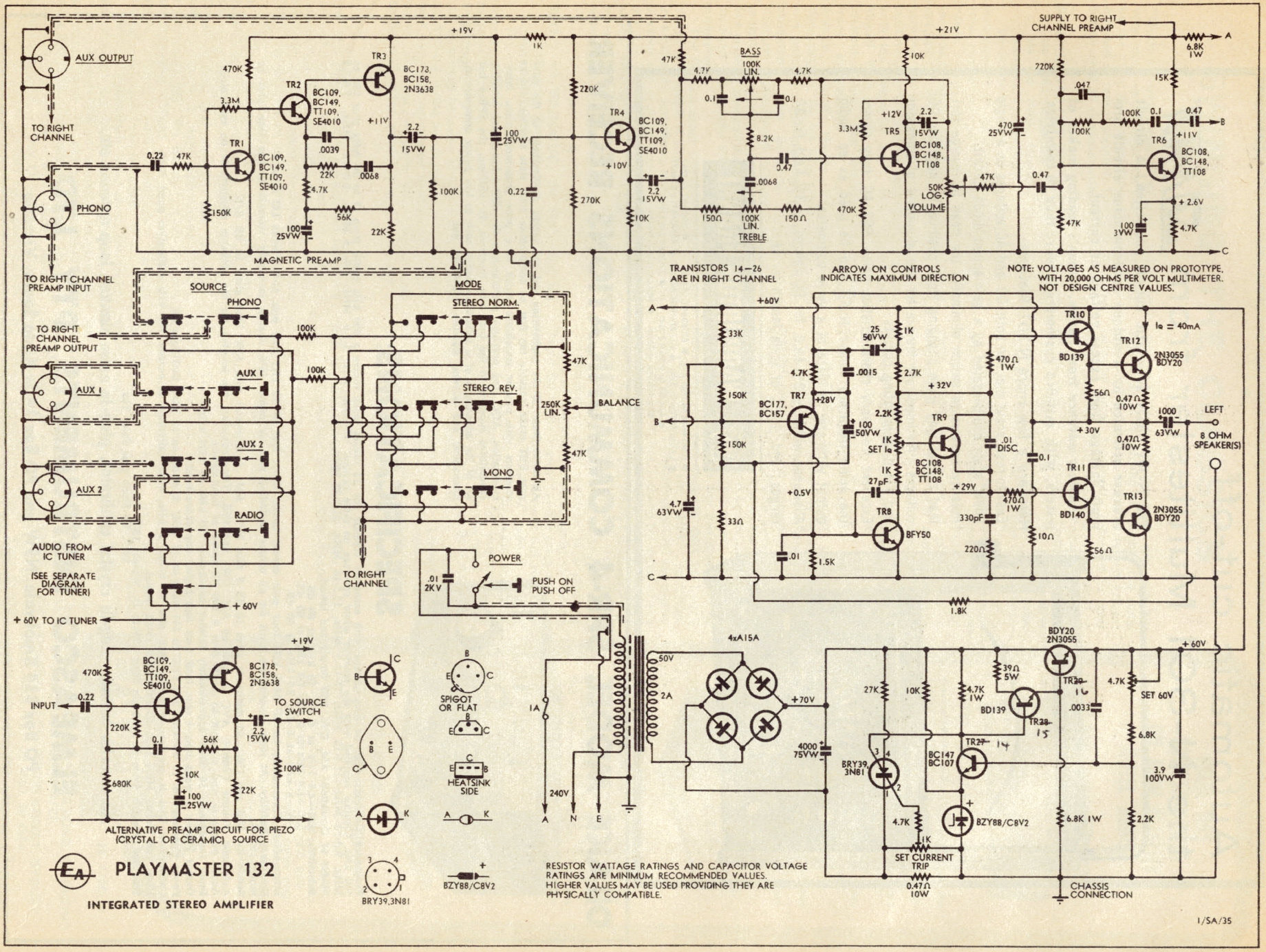


Exploded view of the heatsink required for the BD139/140 transistors. Make four from 16 gauge aluminium.

Similarly, any tendency for the output voltage fall, tends to "turn on" the stabiliser. As a result, voltage fluctuations from all causes are reduced to negligible proportions.

The stabiliser is also valuable as a filter element, because superimposed ripple is actually a rise and fall in output voltage at 100Hz.

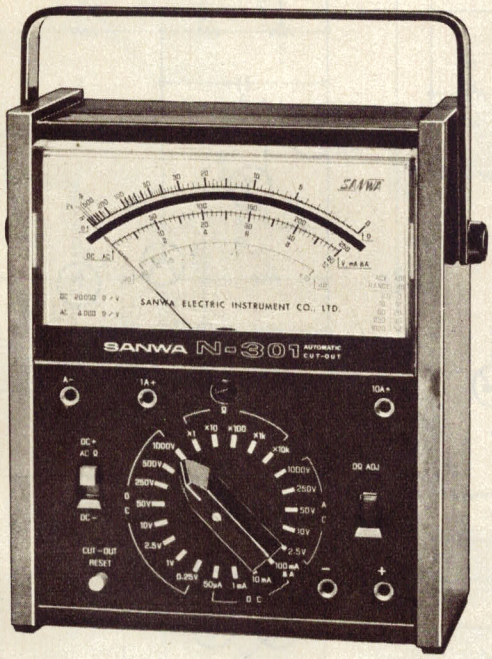
Short-circuit protection can be provided by a simple current limiting characteristic built into the stabilised power supply section, but this type of power supply can still feed sufficient power into an overloaded circuit to cause damage. The safest method is to reduce the supply rail to an almost zero potential if the current limit is exceeded even briefly.



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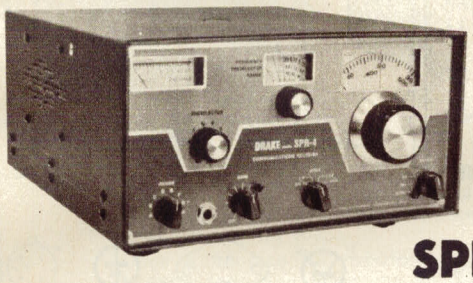
*Excellent frequency characteristics below 50V AC, fully covers the audio frequency zone. N-301 can be used as an audio output voltmeter in place of a valve voltmeter.

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Modes of Operation: AM, CW, SSB (upper and lower).

Selectivity: AM—4.8 kHz at 6 dB, 10 kHz at 60 dB.
SSB—2.4 kHz at 6 dB, 7.2 kHz at 60 dB.
CW—4 kHz at 6 dB, 2.7 kHz at 60 dB.

Intermediate Frequencies: 1st IF 5645 kHz four pole crystal lattice filter, 2nd IF 50 kHz four pole hi-Q Ferrite LC filter.

Frequency Stability: At room temperature, drift for all causes (including plus or minus 10% change in supply voltage) is less than plus or minus 100 Hz.

Sensitivity: SSB and CW: .25 microvolt gives 10 dB S plus N/N, AM: .5 microvolt with 30% Mod gives 10 dB S/N.

Automatic Volume Control: AVC is used on AM, CW, and SSB. Time constants are selected for the optimum effectiveness on each mode. Audio output is held constant to 3 dB over a 100 dB range of input signals.

Input Impedance: 50 ohms approximately (higher impedance 150 kHz to 1500 kHz).

Output Power: 3 watts into 4 ohm load (less into higher impedance loads).

Power Consumption: 18 watts on 240 VAC or 5¾ watts on 12 VDC 2 watts on 12 VDC dial light off.

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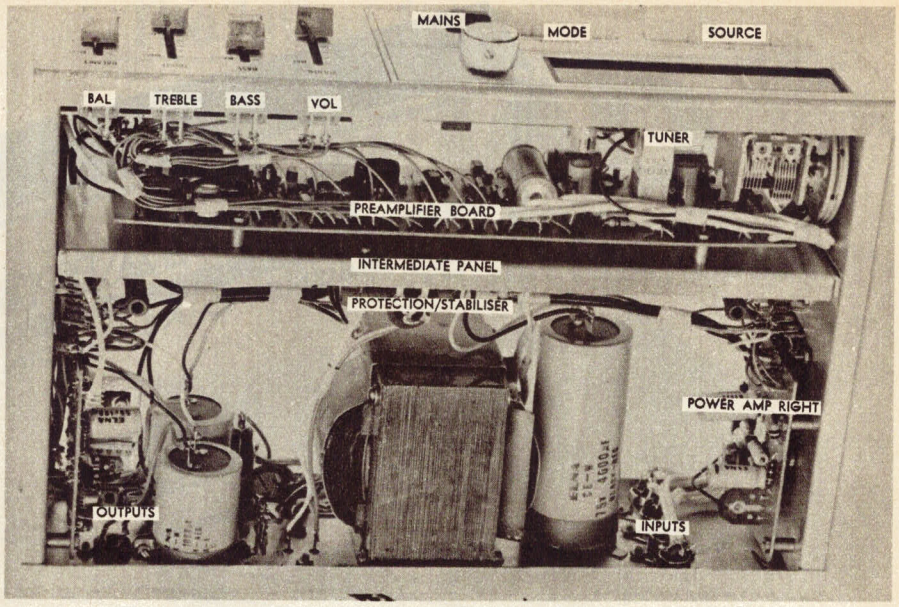
This is done by cutting off the series stabiliser transistor and its associated current amplifier by clamping the current amplifier's base to the common negative rail. In this circuit we use a small fast acting SCS (BRY39, etc) as a clamp. It is triggered from a sensing resistor (0.47 ohm) which monitors the total power supply current.

Correct trigger voltage for the SCS is obtained from a preset potentiometer connected in parallel with the current sensing resistor. The current setting procedure of this part of the circuit will be discussed in the second part of this article.

Now that we have dealt with the operation of the various sections of our amplifier, we can turn our attention to assembling it.

As mentioned earlier, the amplifier chassis is made from five separate pieces, fitted together with small machine screws. The front and rear panels are shallow "U" channels of the same dimensions, but differing in the number, sizes and positions of holes. The side panels are two identical pieces with a 3/8in fold-up all round. These four pieces fit together to make a rectangular frame. (See photograph.)

The fifth, or intermediate, panel is shorter than the front and rear panels, and is provided with 3/8in fold-ups all round. It is drilled with only 10 holes, four for mounting and six for



A topside shot of the amplifier, coded for clarity. Difficulty should not be experienced in assembly if this photograph is read in conjunction with the text. Note the accessibility of the various sections for service, if required.

PARTS LIST

- 1 Complete set of metalwork including front and rear panels, two side pieces, intermediate panel, sub panel and switch bracket.
- 1 Front panel label (see text).
- 1 Power transformer; 240V primary, electrostatic shield; secondary 50V @ 2A (Type PT7369 or PF3259).
- 2 Printed boards, 71/sa4a
- 1 Printed board, 71/sa4b
- 1 Printed board, 71/sa4c
- 1 Playmaster 131 Program Source (see February 1971 issue).
- 1 MSP Type 72000/063 switch unit.
- 1 MSP Type 72000/064 switch unit.
- 4 DIN 3-pin sockets
- 2 2-pin polarised speaker sockets.
- 1 Banana receptacle
- 1 ½in Heyco locking cable bush (Part No 6P-1).
- 2 5-lug tagstrips
- 1 3-lug tagstrip
- 1 5-lug tagstrip (miniature)
- 4 Slider control knobs (Watkin-Wynne)
- 1 Fuse holder and 1 amp fuse.
- 1 3-core power flex of desired length with 3-pin plug attached.
- 6 1/8in x ¼in long brass spacers.
- 6 1/8in whit x ¼in brass spacers.
- 2 1/8in whit x ¾in brass spacers.

The following list itemises all components used in the amplifier except certain ones in the preamplifier channels. Alternative components are presented in two separate lists and the list chosen will be determined by the particular pickup head to be used.

TRANSISTORS AND DIODES:

- 2 BC149, BC109, TT109, or similar
- 6 BC148, BC108, TT108, or similar
- 1 BC147, BC107, TT107, or similar
- 2 BC157, BC177, or similar
- 2 BFY50 or similar
- 1 BD139
- 2 BD139/140 complementary pairs.
- 2 2BDY20 or 2 pairs 2N3055 (matched) and mounting accessories.
- 1 BDY20 or 2N3055 and accessories.
- 1 BRY39 or 3N81 SCS
- 4 A15A silicon diodes
- 1 BZY88-C8V2 zener diode

RESISTORS: (½ watt, 10% unless specified):

2	3.3M	9	4.7K
2	470K	2	2.7K
2	270K	3	2.2K
4	220K	2	1.8K
4	150K	2	1.5K
8	100K	6	1K
8	47K	4	470 ohm 1 watt
2	33K	2	220 ohm
1	27K	4	150 ohm
2	15K	4	56 ohm
5	10K	1	39 ohm 5 watt
2	8.2K	2	33 ohm
2	6.8K 1W	2	10 ohm
1	4.7K 1W	5	0.47 ohm 10 watt.

POTENTIOMETERS:

- 1 250K linear slider.
- 2 100K linear stereo slider.
- 1 50K log stereo slider.
- 3 1K preset.
- 1 4.7K preset.

CAPACITORS:

- 1 4000uF 75VW (Elna RG3E).
- 2 1000uF 63VW (Elna RA2Z).
- 1 470uF 25VW
- 2 100uF 50VW (vertical mt'g).
- 2 100uF 3VW (vertical mt'g).
- 2 25 uF 50VW (vertical mt'g).
- 2 4.7uF 60VW
- 4 2.2uF 15VW
- 1 3.9uF 100VW polyester.
- 6 0.47uF 200VW polyester.
- 2 0.22uF 100VW polyester.
- 8 0.1uF 100VW polyester.
- 2 0.047uF 100VW polyester.
- 1 0.01uF 2KVW disc ceramic.
- 2 0.01uF 100VW polyester.
- 2 0.01uF 25VW disc ceramic.
- 2 0.0068uF 100VW polyester.
- 1 0.0033uF 100VW polyester.
- 2 0.0015uF 100VW polyester.
- 2 330pF 200VW polystyrene.
- 2 27pF disc ceramic.
- 4 aluminium heatsinks to suit BD139/140 transistors (see accompanying dw'g).,
- 4 1/8whit x 3/8in c'sunk screws.
- 2 1/8whit x ½in c'sunk screws.
- 2 1/8whit x 1in c'sunk screws.
- 27 1/8whit x 3/8in screws.
- 18 6BA x 3/8in screws (used in transistor bushes and BD139/140 heatsinks).
- 12 1/8whit x 5/8in screws.
- 4 6BA x 3/16in screws.
- 4 No 6 x ¼in self-tapping screws.
- 50 1/8whit hex nuts.
- 18 6BA half-nuts
- 4 1/8in flat steel washers
- 5 solder lugs.

Single screened, stereo screened, screened pair cable. 10/010 hookup wire in different colours. 5/.0076 hookup wire in different colours.

COMPONENTS FOR PIEZO PREAMPLIFIER:

- 2 BC149, BC109, or TT109 transistors
- 2 BC158, BC178 transistors

RESITORS: ½watt 10%

2	680K	2	56K
2	470K	2	22K
2	220K	2	10K

CAPACITORS:

- 2 100uF 25VW
- 2 100uF 25VW (vertical mt'g).
- 2 2.2uF 15VW
- 2 0.22uF 100VW polyester
- 2 0.1uF 100VW polyester

COMPONENTS FOR MAGNETIC PREAMPLIFIERS:

- 4 BC149, BC109, TT109 transistors
- 2 BC158, BC178 transistors

RESISTORS: ½watt 10%

2	3.3M		
2	470K	2	47K
2	150K	4	22K
2	56K	2	4.7K

CAPACITORS:

- 2 100uF 25VW
- 2 100uF 25VW (vertical mt'g).
- 2 2.2uF 50VW
- 2 0.22uF 100VW polyester
- 2 0.0068uF 100VW polyester
- 2 0.0039uF 100VW polyester



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supporting the preamplifier and stabiliser circuit boards.

To shield the amplifier against external interference, aluminium foil is fitted around the inside of the wooden cabinet. Contact is made to this when the amplifier is screwed into the cabinet. This will be dealt with in greater detail in a subsequent article on the cabinet and its construction.

Incidently, the cabinet is both simple and cheap to make. It can be made from offcuts of plywood or chipboard, yet it has an attractive professional finish.

We can now start to assemble the amplifier. Although there is no hard and fast rule as to the order of assembly, it would be wise to follow the order that we have set out.

The easiest portion to assemble is the rear panel. This carries four DIN sockets, two speaker sockets, the main reservoir capacitor (4000uF), two output coupling capacitors (1000uF each), the series stabiliser transistor, the fuse holder, the antenna receptacle, one tagstrip and the power transformer.

All these items, except the power transformer, can be mounted on the panel and wired. The transformer, being a weighty item, should be left until last.

Before mounting the stabiliser transistor, check that the panel surface around its mounting area is quite smooth to the touch, as any foreign matter or sharp edges could puncture the mica insulator between the transistor and the chassis and short-circuit the power supply. Use silicone grease on each side of the mica washer to improve heat transfer.

When wiring this section, it is wise to connect flying leads to the transistor terminals for connection to the stabiliser circuit board at a later date. Each lead should be approximately seven inches long and different colours will help identify the connections. Mark the colours on the circuit diagram if it helps.

Adequate size hookup wire (10/.010) should be used for the power supply, the two power amplifier board interconnecting leads, and ALL common returns to the power supply. Excessive resistance in these leads can lead to common coupling and low frequency instability in some circumstances.

The next two sections to fabricate are the side panel assemblies which carry the output transistors, the driver and phase splitter boards, and the tagstrips carrrying the wirewound resistors in the output transistor circuits.

Assemble the driver/phase splitter circuit boards first. Connect coloured flying leads to every point on the boards, making all but one about three inches long. The exception is the one that picks up the feedback signal from the speaker socket (negative pole of the output capacitor). It should be about 12 inches long. The two boards, one for each channel, should be colour coded identically.

To complete each board, the BD139/140 driver transistors should have a small heatsink mounted on each of them using a 3/8in 6BA screw, washer and nut. Details are shown in the small accompanying diagram. They are made from scrap 18 gauge aluminium.

Before mounting the output transistors, check the surface as before. If satisfactory, mount the transistors using mica washers and silicone grease. Place a solder lug under one of the two clamping nuts of each transistor. Be sure to use a matched pair on each panel.

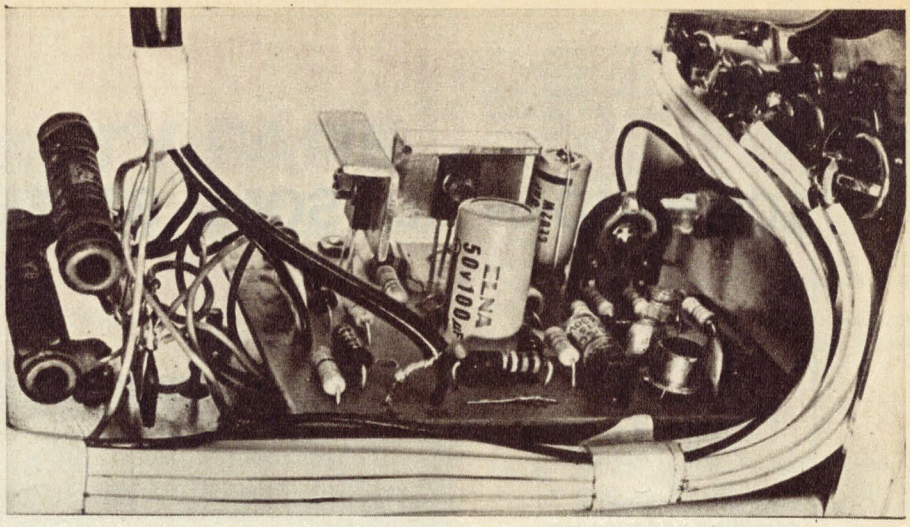
Before mounting the driver/phase splitter boards, make up the resistor tagstrip assemblies that are connected between the power transistors in each amplifier channel. Mount these strips and connect them to their correct transistor electrodes on each side panel.

Mount the finished driver/phase splitter boards on the side panels using three 3/8in long brass bushes, ½in long screws, and nuts. Connect them into circuit, being careful not to interchange connections. Wire up one panel first, check it, wire up the second independently and then compare the two. If there is any discrepancy, double check and correct. Check for fouling collector lugs also.

This is all we have space to discuss this month, but it is enough to get you well on the way with the project. Next month we will discuss the few remaining constructional points and the setting up procedure.

The power amplifiers must NOT be switched on until they are correctly set up.

Next month we also plan to present full constructional details for the attractive cabinet which houses our amplifier.



Close-up of one power amplifier/phase splitter board (see right side photo page 49). Note the heatsinks attached to the BD139/140 transistors, the power transistor stabilising resistors (left) and the DIN sockets (upper right). Connections to the power transistors are brought out from under the board.

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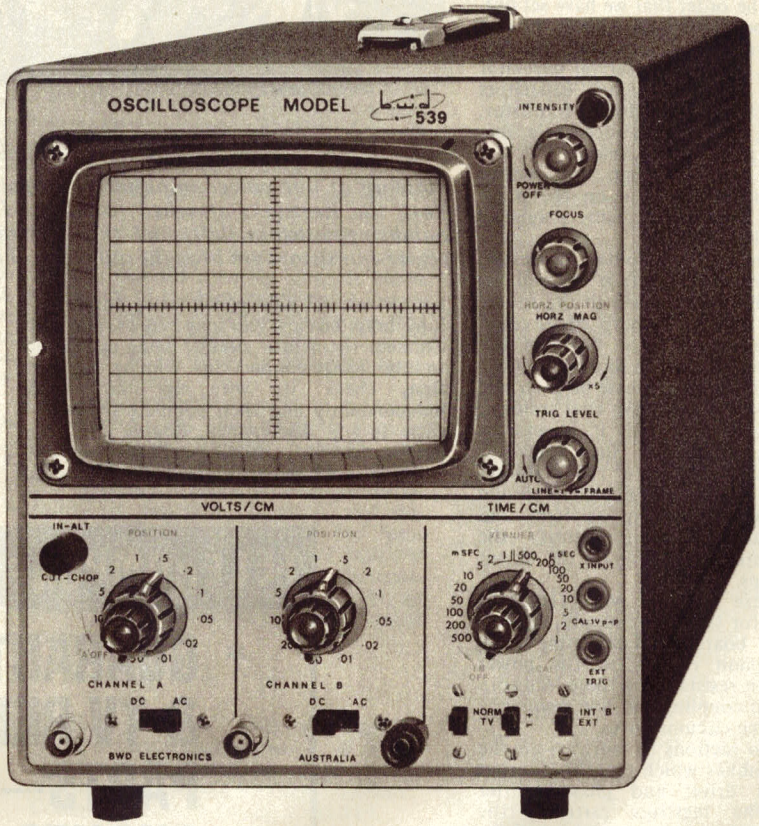
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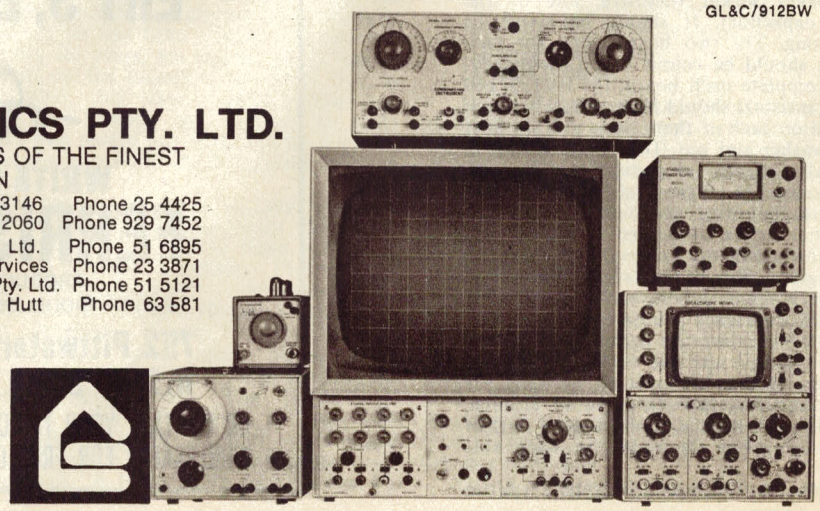
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TECHNICAL DIGEST

Catching and counting fish — the electronic way

In 1853 a certain Isham Baggs, of the London district of Islington, filed a patent for an electric fishing device containing the essential ingredients of modern systems. Almost exactly a century later Paddy Sharkey, an Irishman, formed a company which has produced electric fishing equipment now being used in many parts of the world.

It was in 1954 that an acquaintance told Paddy Sharkey about a German-built electric fishing device based on a 1KW generator. It worked by sending alternating current through two electrodes to a stretch of water, where the resulting AC field had spectacular effects on any fish in the vicinity.

Intrigued by the potential of such a system, Sharkey set out to construct one of his own, incorporating a number of fundamental technical improvements. Alternating current fishing depends on the fact that a fish's muscles are stimulated if an electric field is present in the water. If the field is strong and alternating rapidly, the muscles cannot respond quickly enough to the stimulation, and a state of "tetanus", or cramp, is induced, which stuns the fish and makes it easy to catch.

An alternative method of electric fishing uses direct current, and is based on the fact that there are two paths by which nervous currents can travel along a fish's spine. There is the "efferent" system which carries impulses from the brain along the spine to the muscles; and the "afferent" system which carries pulses from the sensory organs back up the spine to the brain. Each system is unidirectional and can be compared to two chains of diodes running in opposite directions.

If the fish is swimming in a steady electric field of sufficient intensity, the afferent system will be "fired" while the efferent is inhibited – or vice-versa, depending on the fish's orientation in the field. Since the muscles of the fish can only function when it is facing in one direction, and since its sensory system is completely overloaded when it is facing in the other direction, it is effectively forced to swim at top speed towards one of the electrodes – the positive one, in practice. And the positive electrode is the net.

The advent of the thyristor made practicable a third form of electric fishing known as "Pulsed DC", and it was on this system that Sharkey's first set of gear was based. Constructed with the backing of the Inland Fisheries Trust, it formed the basis of the commercial units he now sells. These use a transistor inverter working off a 12-volt car battery which steps up the potential to 500V DC. This is then "chopped" by a thyristor triggered by a transistor relaxation oscillator.

Provided that the delay time between pulses is less than the "synaptic lag time" of the fish's nervous system, the result is similar to that of continuous DC, except that a much more powerful effect can be realised, relative to the input power. This means that a pretty powerful portable system can be constructed, using just a car battery and a small "black box", instead of the bulky, expensive petrol generators used for AC and continuous DC fishing.

Needless to say, a common reaction to the whole idea of fishing with electricity is that it somehow isn't "cricket". And it is true that AC can damage and even kill fish if improperly used – fish in a cramped condition are prevented from breathing and must be removed from the water fairly rapidly.

But DC, pulsed or continuous, causes no appreciable harm to fish. If the current is switched off before they enter the net, they can swim quickly away, none the worse for their experience. Given these qualifications, it is difficult to see how fishing with electricity is any more cruel than fishing by conventional means.

Electrical fishing methods can serve an extremely wide range of purposes. For instance Sharkey's latest Pulsed DC model, the portable "Cybertronic Mark 12", can be used for commercial eel fishing, for the reduction of predators like pike and perch in rivers, to help in rescuing fish trapped in flooded ponds, and to assist biological researchers in the task of marking and classifying specimens.

Although electric fishing forms the backbone of Paddy Sharkey's business, it is by no means his only activity. Government authorities and commercial concerns often have a need for statistical information on fish populations, particularly in rivers and inland waters likely to be affected by, say, hydro-electric schemes. So it was to the design and marketing of fish counting apparatus that the company next turned its attention.

The traditional type of fish counter is usually built around a smallish tunnel, installed perhaps on the edge of a weir, through which the fish are forced to pass since all other avenues are blocked off. Around the tunnel's circumference are three equally spaced conducting hoops. The electrical resistances of the two current paths between the central hoop and the two outer hoops form two arms of an AC bridge circuit. Any fish passing through the tunnel then disturbs the balance of the bridge by altering the resistance of the current paths. The unbalanced condition is detected by a simple logic circuit which activates a counter.

Sharkey's company have been marketing instruments of this type for a long time. Recently, however, they brought out an entirely new system, based on completely different principles and aimed at overcoming many of the disadvantages of orthodox devices. This new model, the "Delta Vee Counter" depends for its operation on the fact that the Atlantic salmon – fish of prime interest – has a relatively high bio-electric output arising from its muscle action potentials, especially when swimming upstream against a current.

Sharkey's initial experiments involved a careful analysis of the amplitude, frequency and waveform of the whole bio-electric output of the fish's body. This showed that with appropriate filtering and amplification it would be possible to pick up the bio-electric signals some distance away from the fish, through the water. The signals could then be used to activate an electronic counter.

The practical Delta Vee system uses special electrodes laid across the entire width of the weir, and can detect fish which pass over these electrodes at any point. No special tunnels or river constrictions need be constructed, and the counter will not respond to the passage of weeds, logs or rubbish. Mains-borne noise is removed by an elaborate system of passive and active filters.

For checking the operation of the device, an "electronic fish", is provided, and consists of a battery-powered generator in a special polythene capsule, which sends out simulated bio-electric signals. ("Electronics Weekly", 24/2/71.)



THE ALTRUISTIC ALKALINE

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DIGEST

DIRECT LIQUID COOLING WITH FLUOROCARBONS

Problems of component cooling often arise in the design of electronic equipment. Recently developed fluorocarbon liquids seem to provide an attractive solution to many such problems. Tests so far conducted have produced encouraging results.

Fluorocarbon liquids have been commercially available for about four years and have made possible the attainment of a major objective in cooling – intimate contact of coolant with heat source. The properties of these liquids – chemical inertness, non-toxicity, non-flammability, thermal stability, electrical insulation and heat transfer qualities – are determined by their characteristic molecular structures, which consist only of carbon and fluorine atoms.

There are several areas within the electrical and electronics industries where these new materials have been used, with very considerable improvements in reliability, operating temperature, bulk and mass and efficiency. These include cooling of electro-mechanical/electronic equipment, cooling of micro-electronics and test procedures.

Traditionally, in the first area, ambient air has been regarded as the optimum medium. Where this proved inadequate, forced air circulation was used. As component densities have risen other fluids, such as mineral oil, silicones and chlorocarbons, have been used. All of these have serious shortcomings which must be considered when designing high reliability, compact, transportable equipment for military or commercial applications.

In the field of "power" electronics a number of items of equipment are available which use the properties of fluorocarbons to advantage. They include high voltage transformers, radar installations, klystrons, rectifiers, lasers and power amplifiers. Most of these are security classified, but two examples which can be discussed are the transformer for the GEC "Skynet" communications system and a Plessey 1KW transceiver.

The transformers for the Skynet mobile units would normally be oil-cooled and thus much too bulky to be air-transportable.

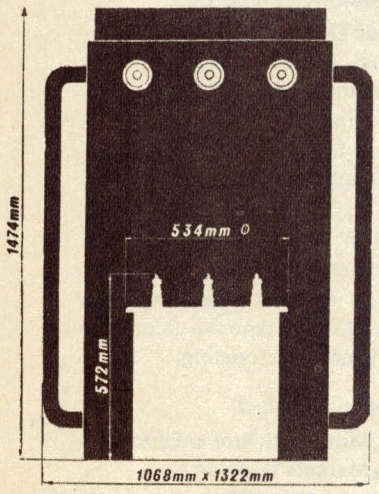


Figure 1.

However, Skynet models contain Flutec PP9, a fluorocarbon made by the Imperial Smelting Corporation (NSC) Ltd, which surrounds the core and windings. Figure 1 shows that, because of the much greater cooling capacity of fluorocarbon liquids (by convection) compared with oil, the entire transformer is remarkably compact. The equivalent oil-cooled transformer is represented by the dark silhouette.

In the Plessey 1KW RF linear amplifier, which provides the power portion of HF transmitter, the equipment is cooled by circulation and evaporation of Flutec PP3 fluorocarbon over the hot components. The heat exchange mechanism is illustrated in figure 2.

A small pump located in the base of the liquid enclosure recirculates some of the liquid to the top of the equipment and sprays the output valve, tuned circuits and other RF components requiring cooling. This technique effects a reduction in operating temperature of 100°C compared with that achieved using forced air cooling. Using evaporative cooling, equipment can be maintained at a temperature equal to the boiling point of the coolant.

With microelectronic assemblies the quantities of heat involved are much smaller, but the size of the integrated circuits is such that the problem of heat removal is a very real one. Heat flux values can be as high as 30W/cm^2.

As integrated circuits become more complex, cooling problems arise due to the development of LSI, the requirements of high packaging density for very fast gates, the use of "state of the art" interconnections and bondings and the overall trend towards greater miniaturisation and increased power output for total packages.

Currently, cooling is effected either by conduction to a heat sink, which is then itself cooled, or by circulation of a liquid over the encapsulated packages. In each of these widely used methods the cooling efficiency is reduced by the number of thermal barriers involved. The ideal solution would be to remove these barriers so that the active chip is in contact with the inert dielectric coolant. This is now possible using fluorocarbons.

The benefits of this direct liquid cooling technique can clearly be realised in the computer industry. At present, large machines require refrigeration units to generate chilled air, which is then forced over the packages so as to maintain a temperature of about 75°C. This auxiliary equipment is a further potential source of failure. Using fluorocarbon cooling it is possible to maintain a much lower constant temperature by immersing the circuits in a fluorocarbon with the appropriate boiling point. Secondary cooling would be by water or by thermoelectric means.

In order to establish the feasibility of direct liquid cooling of microcircuits it is

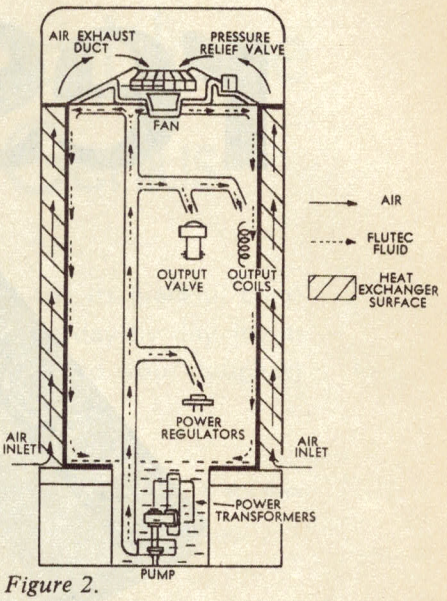


Figure 2.

essential to investigate such factors as long-term compatibility, modes of heat transfer, electrical noise generated by boiling, stability of chip-to-substrate bonds and cavitation erosion.

For over a year, work in the laboratories of Imperial Smelting Corporation has been carried out on four research chips designed by the manufacturer for heat transfer tests. Each chip is mounted on a substrate containing either a thick film or thin film circuit through a "state of the art" connection (flip chip or beam lead). These interconnections are known to have high thermal impedance, and so can thermally isolate the chip. Such devices are thus ideally suited for cooling studies.

Long-term studies are continuing on all chips in a range of boiling fluorocarbons and under forced convection in fluorocarbons. The chip temperature, while under load, is obtained by measuring the forward voltage drop of an isolated calibrated diode at a constant current of 100uA. This has been found to be a few degrees above the boiling point of the liquid.

Limitations to this technique arise when the size of the active device is similar to that of a bubble of vapour, or when the power dissipation is so great as to cause the change-over from nucleate boiling (where liquid is always in contact with the chip) to thin film boiling (when a large vapour occlusion is in contact with the active chip).

Electrical testing and microscopic examination have shown neither deterioration in the performance characteristics nor change in the appearance of the devices.

Assemblies must be designed to take full advantage of the cooling capacity of fluorocarbons. Specifically, the location of all high power devices in one liquid cooled package with the remaining circuits air-cooled should be considered. This will lead to smaller, more reliable equipment. ("Electronics Weekly", 13/1/71.)

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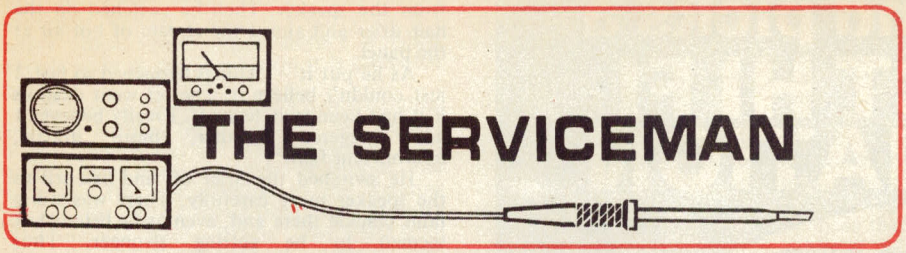


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Blowing hot and cold over a problem

Next to the straightout intermittent fault, there is probably no more time consuming problem than the heat sensitive fault. While it has the advantage of being consistent, it can often require a lot of skill, time and equipment to track it down.

This story was related to me by my amateur friend but, although it involves a piece of amateur equipment, very similar situations could just as easily occur in a more conventional appliance.

The device in this case was a VHF FM receiver. More precisely it was the receiver section of a complete mobile transceiver system, which had originally done duty in a commercial application. It had eventually been discarded when the authorities narrowed the bandwidth available for these services. Although old and bulky by modern standards, my friend was happy to acquire it for a nominal sum, and subsequently modified it to operate on 146MHz in the two-metre amateur band.

When first put into operation it performed extremely well but, significantly as it turned out, this was during the winter months. With the advent of warmer weather, strange symptoms began to appear. Superficially, the problem appeared to be loss of audio gain, accompanied by distortion. However, it was not consistent and, initially, my friend was not even sure that the trouble was in his receiver or the other fellow's transmitter.

But things came to a head one very warm day when my friend decided that his workshop battery needed charging. Significantly, the charger was located immediately underneath the receiver shelf. At the same time, since he planned to be working in and around the workshop for most of the day, he switched the radio on to take advantage of any "CQ" calls which might occur.

At first, all was well, and he listened to spasmodic amateur traffic as a background to his work, without paying a great deal of attention beyond being aware that the receiver was working normally. Then, a couple of hours later, after a period of quiet, more traffic commenced and my friend realised that the signal had become weak and distorted. What was more, each of the several stations now involved was effected, so it was most unlikely that they were at fault.

My friend immediately suspected that it was a heat-sensitive fault, and proved the point by switching everything off while he stopped for lunch. When he returned about an hour later, and switched the set on, everything appeared normal. However, it did start to pack up again late in the afternoon, after several hours' running.

When it did, he made one more step in the diagnosis; he decided that the trouble was in the "squelch" or "mute" circuit. For those not familiar with these terms, a few words of explanation may be in order.

All high-gain receivers create a lot of noise when they are not receiving any signals. While broadcast receivers are seldom switched on unless there is something to listen to, receivers operating in communication networks are, of necessity, required to operate continuously. Which means, in practice, that they are required to operate for long periods at maximum sensitivity with no signal being received. The resultant noise can be very annoying, to the point where less responsible operators will turn the equipment off, rather than put up with it. The "mute" circuit was designed to counter this problem.

While there is a large variety of circuits, all function in the same basic manner. In effect, they disconnect or disable the audio end of the receiver from the detector or discriminator until such time as the front end of the system senses the presence of an RF signal. Only then is the audio system connected or activated. Thus the receiver remains quiet until a signal is received.

One arrangement uses a valve or transistor in a switch or series configuration, and normally biased into "cut-off" condition, so that no signal can pass through it. A counter bias or bucking voltage is generated by the presence of an RF signal, sometimes as part of the AGC system, sometimes by means of a separate rectifier and filter network. This is applied to the appropriate element of the switching device in such a manner as to bring it into conduction and thus allow the audio signals to pass.

An alternative arrangement, and a popular one, is to simply bias the first audio valve into its cut-off condition, then use the bucking voltage to restore the bias to normal.

Because the precise point at which the mute should open is governed by a number of factors, this is finally determined by a variable control, such as a pot, mounted either on the main chassis or the control panel. When it is on the main chassis a switch is provided on the control panel, giving a simple "mute on" or "mute off" selection.

As can be imagined, the circuitry for all this is rather critical. A number of quite stable voltages are required if the system is to retain its original calibration and there is usually a fairly complex voltage divider system, possibly operating from a regulated power supply. So there were plenty of things that could go wrong.

The symptoms, in this case, were that prolonged operation made the mute progressively more difficult to open. Whereas, under normal conditions, opening the mute with the control pot required only a small movement, and resulted in a healthy roar from the speaker, in the "hot" condition it was necessary to rotate the pot as far as it would go, and even then the result was only a faint crackle.

My friend's first reaction was to suspect the valve used in this part of the set, a 6SN7GT twin triode. These valves have always been rather prone to run into grid current, particularly where, as in this case, the grid circuits contain resistance values of several megohms. Add to this the possibility that the valve, being very old, could be gassy, and the elevated temperature which was obviously triggering the fault, and the stage was all set for exactly the kind of symptoms which he had observed.

Unfortunately, sound as the reasoning was, it didn't stand up to a practical test. A new 6SN7GT, which he happened to have on hand, made no difference to the set's behaviour. So that was that.

At this point my friend's reaction was to give the problem away for the time being. For one thing that particular part of the chassis was not easy to work on. For another, there were practical problems in moving the set from its wall-mounted position to the work bench and keep it operational at the same time. Something to do with lengths of interconnecting cables, as I understood it.

As a result, he put off doing anything about it for a few weeks. Until, in fact, he had occasion to telephone me on another matter, and this problem came up in the course of conversation. My first reaction was that it was a classic case calling for the use of a freezer aerosol – being something of a champion of these devices. My friend agreed, but explained that he did not possess one. And, although he didn't say it, I assumed that he was hesitant about spending the money for something which he might require only occasionally.

"Well," I replied, "There is one other trick you can try. You can try heating various sections of the set, in an effort to create the fault, rather than cool them in an effort to cure it".

Then I went on to suggest that an ordinary domestic hair drier provided a very simple means of applying heat to a small localised area of a set. Granted, it is not as selective as an aerosol in regard to individual components, but it can often pinpoint the fault within a few square inches. Given that much information, it is a lot easier to find the culprit by individual testing than if the whole of the set is involved.

He thanked me for the suggestion and intimated that a hair dryer was available. All he had to do was smuggle it out of the house. First, however, he had to get the set operating on the bench. Even as we talked, he decided he would tackle this part of the problem the following weekend.

As it transpired, this problem was solved more easily than he expected. A certain amount of improvisation, and the loan of one interconnecting cable by a fellow amateur, enabled him to have the set upturned on the bench, and working, by early Saturday morning.

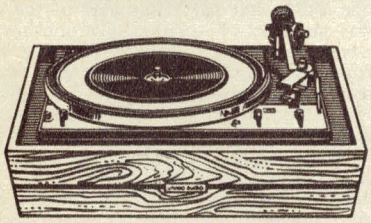
Once satisfied that the set was working he switched off to ensure that it would remain in a cool condition. Then he studied the circuit and traced out as many of the relevant components as he could. Many of these were scattered around the chassis, but about half of them were mounted on a terminal board supported on one side of the chassis. Because it was most convenient, he decided to make this his first target.

Armed with the hair drier he switched the set on, opened the mute to its fullest extent, and turned the volume right up. The result was a healthy roar, almost intolerably loud,

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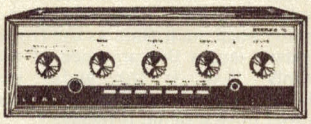
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from the speaker. Then he switched on the hair drier and aimed the stream of hot air at the panel.

As he put it – "Things happened so fast, I just couldn't believe it. The set went dead as if it had been switched off. I really believed I had triggered another, more drastic, intermittent fault".

He switched the drier off and listened to the speaker more carefully. There was still a faint crackle there and, even as he listened, it seemed to be getting stronger. Thus encouraged he switched the drier on again, but without the heating element, and directed a stream of cold air on to the panel. Again things happened faster than he expected. Not quite as rapidly as before but, within about 30 seconds the set was back to normal.

Just to make sure, he went through the cycle twice more, with identical results. Satisfied that he had located the general area he then tried directing the hot air so that it favoured one half of the panel more than the other. By comparing the response from each half he hoped to narrow the search still further. Unfortunately, results were inconclusive.

Seeking another solution my friend suddenly spied the soldering iron on the bench. Of course! If the iron could be used to heat each of the components in turn, and the faulty one was as sensitive as previous tests had suggested, it should be a simple matter to pick it out.

There were three resistors and four capacitors on the panel, three of the capacitors being mica type and one a paper type. The soldering iron was a Scope type and it was quite easy to locate the business end of the barrel on or close to the component, press the ring, and apply heat. He tried the resistors first, without result, then the mica capacitors, also without result. This left the paper capacitor.

As my friend explained it, "I left this until last because I hoped I wouldn't have to test it. It was one of those wax impregnated things and I didn't feel too confident about getting the iron close enough to do any good, without actually touching it and probably damaging it unnecessarily. But after I had tested the other components I was beginning to feel pretty sure that this was the culprit. Or at least I was thinking, 'It had better be!' "

Nevertheless, I gathered that he was not exactly prepared for the way it reacted. This time he heated the iron first, almost to red heat, then quickly placed it alongside the capacitor, approximately a quarter of an inch away. Once again the set went dead almost as though it had been switched off.

My friend repeated the experiment a couple of times, just to make sure, then pulled the capacitor out for a closer look. It was a fairly standard old-fashioned wax impregnated paper type, carrying a well-known brand. It was rated at .05uF, at 400V. (The ".05" figure gives some idea of its age.)

He quickly replaced it with a nice modern plastic type, then tested the whole thing again with a prolonged blast of hot air from the drier. When several minutes of this failed to produce any adverse effects, he considered the point proved.

Later, when he told me this story, we were able to check the capacitor on the high ohms range of the VTVM. Initially, it showed a leakage of several hundred megohms, but dropped to only a few megohms when a soldering iron was held underneath it.

At the same time he produced the circuit and we were able to make a rough assesment of its operation and the reason the faulty capacitor caused it to fail. While a detailed study of the circuit would have involved more

time and effort than either of us could afford, we quickly established that the offending capacitor was part of a decoupling network in the grid bias supply line to the audio amplifier.

Since the circuit required that both the grid and cathode of this valve be "jacked up" by quite a substantial voltage above chassis – with a suitable bias difference between them – any leakage from the grid circuit to chassis, via the faulty capacitor, would seriously upset the bias. More precisely, it would make the grid much more negative than it should have been, possibly to the point of cut-off.

At the time my friend related all this to me, we both regarded it as the end of the story. I made the necessary notes to enable me to write it up in detail when time permitted, and at a time when it appeared that a story of this length would be most appropriate. In fact, these two conditions never seemed to coincide over the next few months and the notes simply sat in my file while I processed more appropriate stories.

Which was a good thing, as it turned out, because the story had a most interesting sequel. Towards the end of the summer, my friend became aware that all was not well in the receiver. The situation and the symptoms were much the same: a warm day with the set operating continuously in the workshop; the charger running on the shelf beneath; and even the same symptoms involving the mute control and the audio gain.

My friend's first reaction was, "Oh not again!" and to wonder what had failed this time. It was unlikely to be the replacement capacitor, yet it was obviously something which was producing exactly the same effect. But would it be easy to find?

Fortunately, he was better off in two respects this time. He had organised matters so that it was now a simple matter to operate the set on the bench; and he had purchased an aerosol freezer.

So, with the set upended on the bench, and sounding very sick, he squirted freezer on each component on the resistor panel, in turn. The result was negative.

Next, he began identifying the more scattered components associated with the same stage. The first ones he identified were three resistors, connected in series, which ran across the chassis from one of the terminals on the panel. More or less "on spec", he squirted one of them. There was a second or so delay, and the set sprang into life.

My friend should have been jubilant at this, but he wasn't. As he put it, "I didn't really know why, but I wasn't convinced that I had found the fault. Perhaps it was the small time lag but, whatever it was, I didn't feel inclined to jump to a conclusion".

In an effort to clarify his thoughts, he then squirted the next resistor along the line, which produced exactly the same result. (It was also significant that the set reverted to its faulty condition after only a few minutes.) Finally he squirted the third resistor and produced a similar, but much slower, result.

Still not prepared to believe what was superficially obvious, he went through the exercise again, then a third time, with the same results each time. However, as he finished the third exercise he suddenly realised that underneath the resistor string, and hidden partly by it and partly by a bunch of cables, was a capacitor; a paper capacitor rather similar to the previous faulty one.

Pushing the thin extension tube on the aerosol nozzle down past the resistors until it was against the capacitor, he gave it a short squirt; considerably shorter than he had previously used on the resistors. There was no time lag this time. The set came good as if a switch had been thrown, and he knew he had found the real culprit.

He also realised why he had been deceived before. The overspray from the resistors had fallen on the capacitor and had been sufficient to cure its leakage – after a brief time lag.

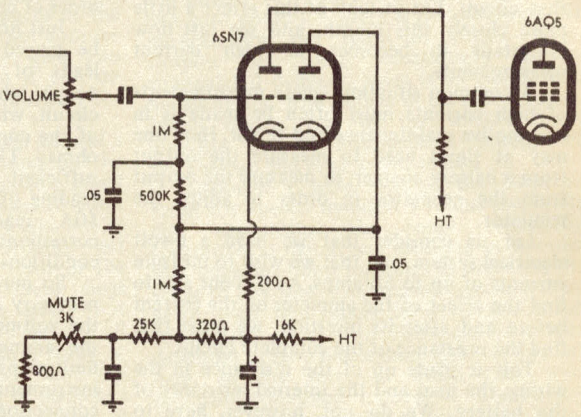
When he finally fished the capacitor out and took a closer look at it he realised that it was a twin to the previous one; same make, same value, same voltage rating and – probably – the same batch. Needless to say, a new one cured the trouble.

Once again we held a post mortem. Once again the VTVM showed a leakage which started at several hundred megohms and dropped rapidly as it was heated. And once again an analysis of the circuit revealed that the leakage would have upset the bais on the audio valve grid. In fact, although not immediately obvious from the original circuit, it was only one resistor removed, along the decoupling network, from the first faulty capacitor.

I feel that there are a couple of interesting lessons to be learned from these stories. One is that, when chasing a heat sensitive fault, it is very desirable to be able to apply heat in a localised form, as well as by means of an "oven" or by wrapping the appliance in a blanket. The latter arrangment may be useful for establishing, initially, that the fault is heat sensitive, but does little to pinpoint the faulty component, or even the area, involved. The hair drier will not only heat a small area but, with the heater switched off, can also rapidly cool the same area. This is most valuable when one wants to double check the initial observation.

The other lesson concerns the freezer aerosol. Maybe those of us who have used it for some time may not realise it, but there appears to be a certain amount of skill required to use it correctly. Or, at any rate, to interpret the results correctly. Among other things one must develop a sense of "response" by the components under test; particularly how rapidly they react to the spray.

Which raises another point. If you are used to a particular brand of freezer, and have learned how typical faulty components react to it, you may be confused if you change to another brand which freezes significantly faster or slower. Personally, I prefer one which freezes as fast as possible; it seems to make interpretation just that much easier.



Relevant portion of the audio/muting stage. The left hand triode is a straight audio amplifier but has both cathode and grid well above chassis. The two .05uF capacitors were the offending components, their leakage increasing the negative bias on the grid.

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Working With Meters – 3

To conclude our short series of articles dealing with meter movements and their use, the author describes here how to avoid some of the common pitfalls encountered in everyday measurements. He also gives a description and constructional details for a useful battery testing device.

by PHILIP PIK

We saw last month how the insertion of an ammeter into a circuit could change the magnitude of the current flowing through that circuit. Let us look at this effect a little more closely this month, and see just how important it becomes in high current measurements.

A common situation where measurements of high currents must often be made is in automotive maintenance and repair. Here one may at times need to measure the output from a battery charger, or measure the output from the generator in order to adjust the regulator.

Let us consider that we have a 6-volt electrical system, and that we wish to measure currents of up to 50 amps. As it is our aim to find the effect of the ammeter on the current before and after its insertion, we must first find the resistance of the complete circuit.

This is made up of the resistance in the wiring, the load and the internal resistance of the battery. We do not, however, have to know their individual values. All that is required is to find the total resistance which will give a current of 50A at 6V, by applying Ohm's law.

Working this out gives us a resistance of 0.12 ohms – a pretty low value. Let us see now how the ammeter resistance is likely to compare with this figure.

Assume that we have an ammeter which uses a 100mV FSD movement. This means that the terminal resistance of the ammeter will be very close to 0.002 ohms, as calculated in last month's article. Expressed as a percentage of 0.12 ohms, this is only about 1.67%. On this basis, it may seem that we could ignore the effect of the ammeter on the current in the circuit.

Unfortunately, however, the ideal case just described very rarely holds in practice. The main reason for this is that generally there are additional resistances introduced into the circuit when the ammeter is physically connected into it. There is the resistance due to the leads connecting the ammeter to the circuit, and there are the additional hidden resistances of the connections themselves. These are all effectively placed in series with the circuit, and this usually causes the current flowing to be significantly less than when the ammeter is not in circuit.

Because these additional resistances are external to the ammeter itself, they do not cause the meter to give an inaccurate reading of the current flowing when it is in circuit. But the effect of the resistances is that the current flowing with the meter in circuit, tends to be significantly less than without it. In other words, we end up with an accurate measurement of an abnormal condition, which is almost as misleading as a faulty reading of the normal current.

The remedy for this problem should be fairly clear: connect the ammeter into circuit using the shortest convenient connecting leads, and use stout cable for these leads. Also make sure that all clips, lugs, screws and washers used to make the connections are adequately sized, and scrupulously clean. There is something to be said for the popular "quik-fit" type of automotive connector, which provided it is clean offers a very low order of contact resistance.

Just how important these matters are may be gauged from the fact that even two short leads of equivalent cross-section to 10G copper wire can contribute .0012 ohms to the circuit, while modest oxidation on the surface of the connecting clips can add a further .04 ohms. This added resistance would be sufficient to cause an error of over 50% in a reading of 50A in a 6V electrical system – a 50A reading on the ammeter would correspond to about 78A under normal conditions.

So much for the ammeter, then, and the necessary care in using it. Let us next discuss the voltmeter. This has similar limitations to the ammeter, except that in this case the limitations are more associated with the instrument rather than with the physical connection of it into circuit. As an example let us examine the use of a typical 20,000 ohms per volt multimeter to measure the collector voltage on the transistor in the circuit of figure 1.

Let us assume that the DC voltage ranges we have available on the meter are 1, 10, 100 and 1000 volts. As the circuit has a supply voltage of 9V, the 10-volt range would thus appear to be the most appropriate one to use initially. On this range the 20,000 ohms/volt meter will have a loading resistance of (20,000 x 10) =200K.

As the type of amplifier stage shown is normally designed so that the quiescent voltage present at the collector is approximately half the supply voltage, this means that the effective DC resistance of the transistor will be approximately 470K. The effect of the 200K resistance of the voltmeter in parallel with the transistor will thus be quite drastic, lowering the total resistance from collector to ground to approximately 140K.

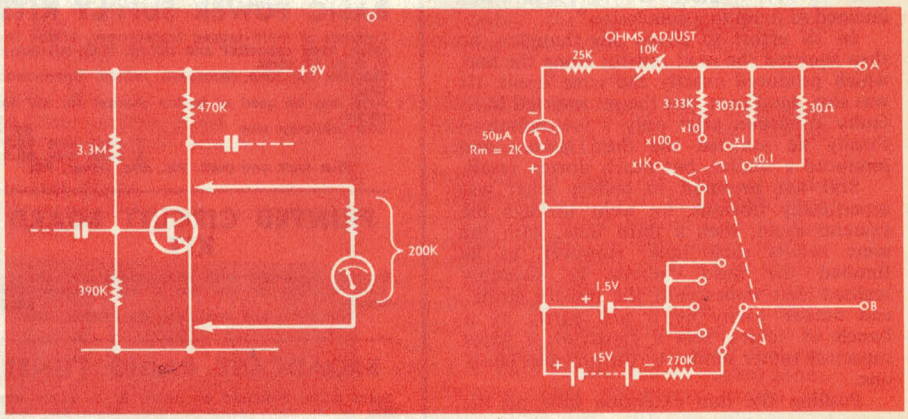
With the meter in circuit the collector voltage will thus no longer be half the supply voltage or 4.5V, but closer to 2.1V. And this voltage will be registered quite faithfully by the voltmeter. The only problem is that this is not the normal voltage at the collector when the meter is not present!

From this it may be appreciated that the use of the common multimeter is quite limited in high impedance circuits. About all that be deduced from the reading is that the transistor does not have a short circuit between collector and emitter. This leads us to the conclusion that if measurements in circuits of this kind are to have any meaning, we need a high resistance measuring device such as a VTVM or its solid-state equivalent. These instruments generally have an input impedance of 10M and consequently any errors introduced by using one of these is practically negligible.

This does not mean that there is no place at all for the multimeter in high impedance circuits. Provided care is taken in its usage, quite useful measurements may be made. In general, if reasonably reliable results are required, a rule of thumb is that the resistance of the meter be at least five times that of the circuit across which it is connected. In the circuit of figure 1 this would mean a meter resistance of about 3M, which would rule out even a 100,000 ohms/voltmeter. However there are many circuits where the resistances involved are of a much lower order, allowing accurate results to be obtained with a modest 20,000 ohms/volt multimeter.

As an example of a third type of measurement pitfall, let us look at the simple series-type ohmmeter. In particular, let us study the ohmmeter circuit of last month, reproduced here for convenience in figure 2. We will consider the effect of the "Ohms Adjust" control on the operation of the circuit in relation to its accuracy.

It may be remembered from last month's discussion that the function of this control



The effect of loading a typical transistor stage with a multimeter is illustrated in figure 1, at left. Figure 2 at right shows the basic ohmmeter reproduced from last month's article. Sources of error in this circuit are discussed in the text.

was to compensate for decaying battery voltage. Its range was made such that it could be varied from zero to 10K.

Let us consider the X100 range, and the effect of varying the control setting upon its accuracy. When the 1.5V cell is new, the control is presumably set so that the total circuit resistance between the meter terminals is 30K. Hence a 30K resistor connected to the terminal produces its correct reading – exactly half FSD. But when the battery voltage drops such that the control must be set to minimum resistance to produce FSD for shorted input, the total internal resistance will be only 27K – that of the meter and its series resistor.

In this condition a 30K resistor connected to the terminals will not read 30K, but will read approximately 33K. In fact it will be a 27K resistor which will produce the mid-scale "30K" reading, so that the readings will be approximately 10% high – a significant error.

This argument is somewhat simplified, because in practice the internal resistance of a cell increases as its voltage drops. Hence the rising cell resistance will tend to compensate

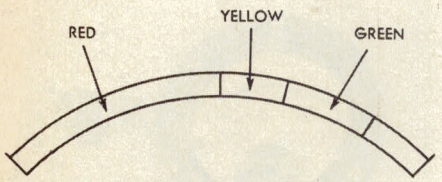


Figure 3: The meter scale of the prototype battery tester. The use of colours as indicated is recommended.

for the reduced value of the "ohms adjust" pot. But the error still tends to be quite significant.

Luckily, the X1K range does not suffer to the same degree from this problem. Here the effect of the control setting is only minimal as the total circuit resistance changes by only a small percentage. The midscale reading of 300K has a tolerance of less than + 2%.

The remaining X10, X1, and X0.1 ranges are also better off. On the X10 range the meter is shunted by a resistor at least 1/10th its own equivalent resistance. Thus the effect on the overall accuracy due to a change in control setting is minimal. The X1 and X0.1 ranges suffer even less, as the meter and control are shunted by even smaller resistors.

Before closing the discussion on this section, it should perhaps be pointed out that there are alternative, slightly more complex circuits which reduce to some extent the relatively large errors encountered on the X100 range. However, discussion of these more specialised circuits falls outside the scope of this article.

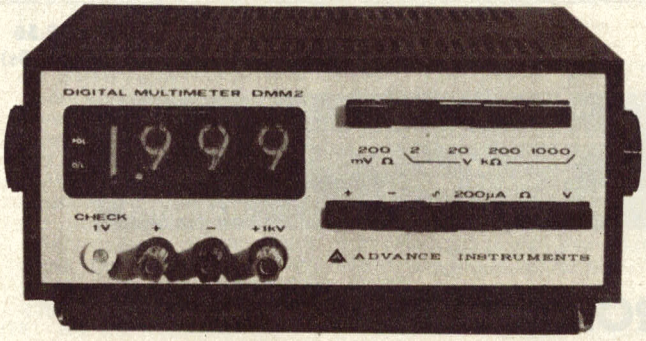
Having dealt briefly with some of the pitfalls to be avoided in measurements, we will conclude this article with constructional details for a flexible battery tester. But just before we launch into the description, let us have a brief look at the requirements for this kind of device.

The first requirement, naturally enough, is that it must measure the battery's output voltage. But measuring this alone, without regard to its output current capability, leads to incorrect conclusions.

The reason for this becomes fairly obvious if one considers the nature of a dry cell. Like most other practical power sources, a dry cell can be thought of as a series combination of a voltage source in series with a resistance. And both the voltage source and the internal resistance change in value over the useful life

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DC ranges

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200.0mV	0.1	0.15	10MΩ
2.000V	0.1	0.1	10MΩ
20.00V	0.2	0.1	10MΩ
200.0V	0.2	0.1	10MΩ
1000V*	0.2	0.1	10MΩ
200μA	0.3	0.2	1kΩ

*Using 1kV terminal. Normal input terminal may be used up to 500V.

AC ranges

Range	Accuracy (at 25±1°C) ± % rdg.	± % FS	Freq. Range	Input Impedance (typical)
200.0mV	0.3	0.15	40Hz-20kHz	1MΩ/150pF
2.000V	0.4	0.2	40Hz-20kHz	1MΩ/110pF
20.00V	0.4	0.2	40Hz-20kHz	1MΩ/110pF
200.0V	0.4	0.2	40Hz-10kHz	1MΩ/110pF
1000V*	0.4	0.2	40Hz-2kHz	10MΩ/40pF
200.0μA	0.5	0.5	40Hz-10kHz	1kΩ

*Using 1kV terminal.

Resistance ranges

Range	Accuracy (at 25±1°C) ± % rdg.	± % FS
200.0Ω	0.4	0.15
2.000kΩ	0.3	0.15
20.00kΩ	0.3	0.15
200.0kΩ	0.3	0.15
2000kΩ	0.3	0.15

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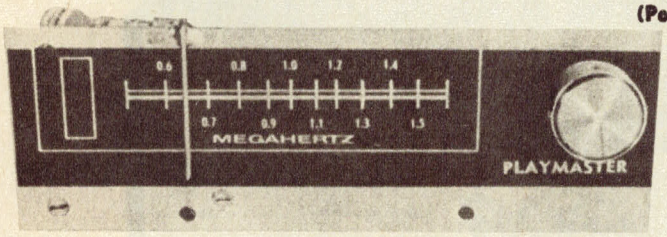
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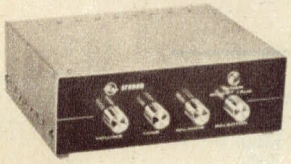


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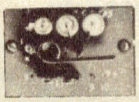
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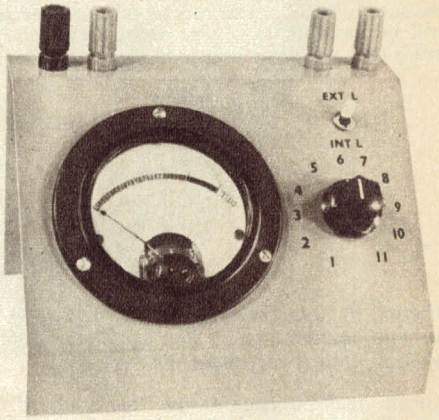
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of the battery. The voltage gradually drops, while the resistance gradually rises.

In order to obtain a true indication of the condition of a dry cell or battery it is therefore necessary to take both its voltage and internal resistance into account. And the best way to do this is to measure the terminal voltage of the cell or battery when it is being "loaded" – ie, when it is delivering a certain output current. The current is normally set at a value close to that demanded from the cell or battery under normal working conditions, as this gives the best indication as to whether it is still capable of doing the required job.

As each size and type of cell and battery is designed for a particular type of service, it is actually possible to nominate "typical" test current levels for most types. Although not usually supplied by the battery manufacturers, this information is often obtainable on request.

We have prepared a table showing the voltages and test currents for some of the



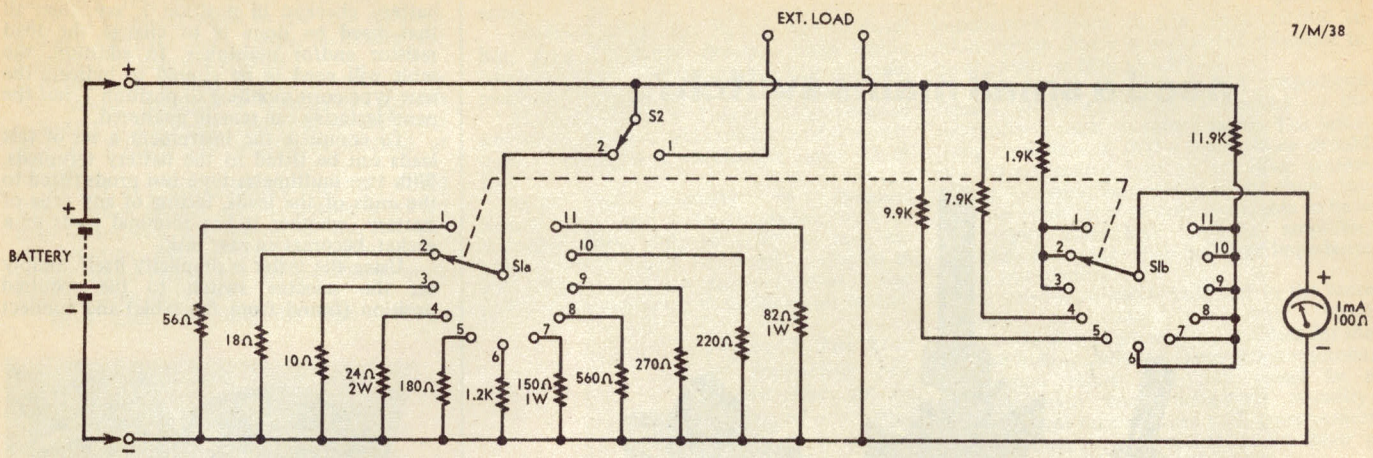
The battery tester. The terminals at left connect to the battery.

more common "Eveready" types, and this is reproduced. Note that we have grouped those having the same output voltage and test current. There are eleven groups in all, arranged in ascending order with regard to their output voltages. Sufficient space has been left alongside the Eveready type numbers to include other manufacturer's designations. The reason for this should become evident later.

Let us now look at the circuit for the battery tester unit, which is designed to test each type of battery by measuring its terminal voltage while the appropriate load current is being delivered. It may be seen that the unit consists basically of a multi-range voltmeter, combined with a series of loading resistors. A two-pole 11 position switch selects the voltmeter multiplier resistor and loading resistor required for each of the battery groups shown in table 1. Switch section S1a selects the load resistor, while S1b selects the voltmeter multiplier.

Provision has also been made to connect an external load resistor into circuit, by switching S2 to position 1. This allows the test current for any battery to be varied above or below its nominal value, and is also useful for testing batteries other than those directly catered for by the fixed ranges. Naturally the output voltage of such batteries should correspond to one of the ranges provided, ie, 1.5, 6, 7.5, or 9 volts.

To find the value of the external load resistor, simply divide the battery's voltage by the required load current. For example, if the



The complete circuit diagram of the battery tester. Note the provision for switching in external load resistors.

UNIVERSAL BATTERY TESTER						
S1 POS. No.	EVEREADY TYPE Nos.			NOTES	VOLTAGE	TEST CURRENT (mA)
1	915 1015				1.5	25
2	935 1035				1.5	80
3	950 1050				1.5	150
4	509				6	250
5	2510				7.5	40
6	216				9	8
7	286				9	60
8	2362				9	15
9	2364 276P				9	30
10	2512				9	40
11	2761				9	100

This table shows the various test currents for some of the Eveready batteries. Space has been allowed for the type numbers of other makes.

battery voltage is 1.5V and the required load current 150mA or 0.15A, then the load resistor is 1.5/0.15 which is 10 ohms. The power rating of the resistor should also be worked out and this may be found by using the relationship P=EI. For the resistor in question this is 1.5 x 0.15=0.225W. A half watt resistor would probably be the nearest available power rating. In fact, inside the unit we have used 1/2 watt resistors throughout except in three cases where a higher power rating was needed.

If a movement different from the one specified in the circuit is used, the multipliers will need to be recalculated using the equation given last month.

Construction of the tester is fairly straightforward and should present few problems. The circuitry may be built into a closed box, perhaps one with a sloping panel as we have used, or in any other suitable shape or form. Layout is not critical.

In order that the battery state can be determined at a glance, the meter scale should be marked off in three sections, as illustrated in figure 3. The "good" sector (green) indicates a basic battery cell voltage between 1.3 and 1.7 volts, the "serviceable" sector (yellow) a voltage between 1.0 and 1.3, and the "bad" sector (red) voltages below 1.0 volt.

Mounting of the various circuit components will depend on the size and shape of case in question. However, by far the most convenient way of mounting the resistors, especially the load resistors, is by spacing them between two switch wafers, one of which is inactive and acts as a support only. As is evident from the illustrations, this method saves a lot of wiring, whilst at the same time it provides rigid support for the resistors. Space did not permit us to mount the multipliers in a similar manner, but as there were only four of these it was a simple matter to mount them behind the meter on a separate length of tagstrip.

As the front view of the instrument shows the panel lettering has been kept simple, especially around the selector switch. Numerical index numbers rather than the more lengthy battery type numbers have been used, to prevent the labelling from becoming cluttered. The table mentioned earlier can by glued to the back of the tester where it is in a convenient position for reference.

In this way any additions or alterations can be made more easily. For example, if it is required to permanently change the type of

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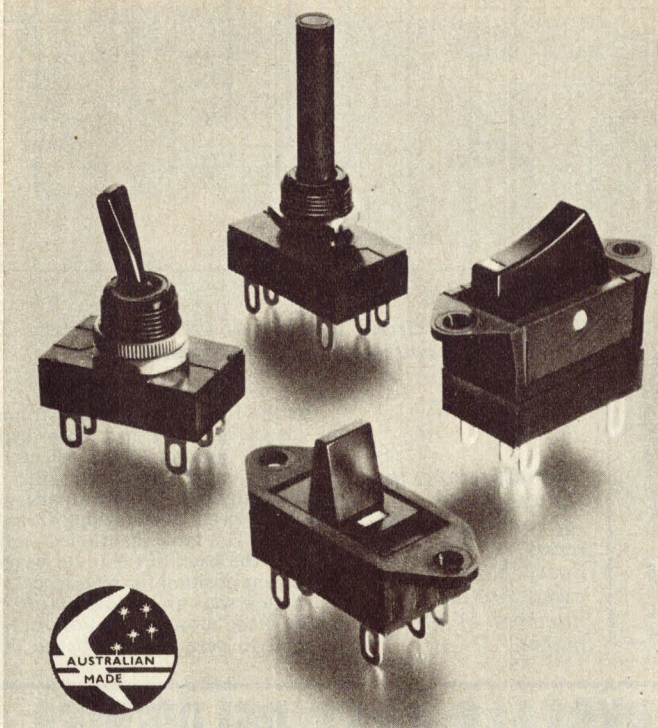
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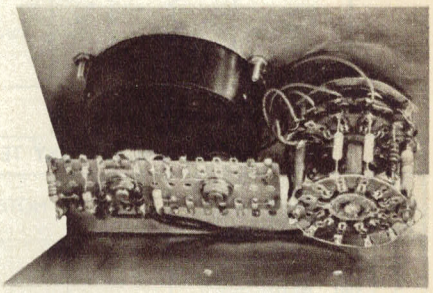
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AD12

battery checked in position 7, say, then all that need be done is to change the load resistor and/or multiplier. In addition, the table will need to be altered to indicate the new type corresponding to position 7, but the panel lettering can remain unaltered.

To complete the instrument a set of test leads can be fitted to the battery terminals. With two multimeter-type test prods fitted to the ends of the leads, testing of any type of battery, whether it has terminal posts or a socket, becomes an easy task.

Using the tester is simplicity itself. Simply set the selector switch to the required position (found from the table) and connect



This photo shows how we mounted the resistors between two switch wafers.

the test prods to the battery. If the meter reads in the green sector, the battery is in good condition; if it reads in the yellow sector, the battery is still serviceable. But if the pointer lies in the red sector, the battery can be considered "flat" as far as its use in most electronic equipment is concerned. It might still be useful in some applications, however, such as in torches and some toys.

This draws to a close our discussion on the battery tester, and indeed to this short series of articles. We hope that they have been of some help to those wishing to gain a better understanding of meter movements and their uses. Perhaps they have also given some readers the incentive needed to finish off that job planned long ago – that milliammeter in the PA stage of a transmitter, that voltmeter across the HT output of a power supply, or that battery tester the shop has been in need of for so long.

NOTES & ERRATA

EA 160 RECEIVER (December, 1970): The layout diagram of the first oscillator on page 81 shows the two .01 capacitors as ceramic types. The correct capacitors to use here are the .01uF 160V polyester type. Four of these capacitors are indicated in the parts list, the others being located in the base circuit of TR12, and connected from pin 3 of L6 to ground.

PA AMPLIFIER (Dec 1970): Three different makes of driver transformer were nominated in the parts list as suitable for this unit. The Ferguson (TRD223), the Special Transformers ST4953, and the A&R (TD19) are electrically identical, except that the A&R colour coding differs slightly from that shown on the circuit diagram. For correct connection, the "start" of each winding should be connected so that it corresponds to the dot notation on the circuit.

PLAYMASTER 131 IC TUNER (Feb. 1971): A few readers have experienced difficulty in aligning the above tuner, and some have asked as to the correct gang connections. The correct connection for the gang is for the smaller section to be connected to the oscillator circuit This should overcome any alignment difficulties.

A Power Line Filter for less noise, more music

Described in this article is a basic power line filter of compact design, which is very suitable for use with stereo systems, tape recorders and electric organs. Suppression of switching tones is also discussed.

by IAN POGSON

Recently the author came face-to-face with the problem of extraneous noises coming from a piece of audio equipment. The piece of audio equipment concerned was a large electric organ, and the noises ranged from a loud "plop" down to small clicks and plops from the refrigerator and other domestic appliances. Added to these was the control tone of 750Hz used by the local electricity supply authority for switching purposes.

An investigation revealed that when the player was sitting at the organ, intent on getting the best he could from the insturment, some other members of the household would decide that a certain fluorescent light was no longer required. Switching off the light resulted in a plop which was frightening to the player, to say the least. The particular organ concerned has three audio channels capable of about 50 watts in all, and feeding three husky loudspeakers. The noise coming up from between the player's knees has to be heard to be appreciated! Lesser clicks and plops were not as frightening or annoying, but they did consitiute a nuisance. Similarly the switching tone was not particularly objectionable, but quite noticeable.

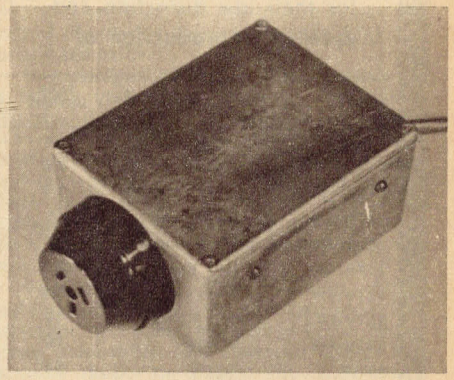
Because of the irritation of these effects, it was decided to try a line filter. A very old but trusty filter was borrowed for trial purposes. When it was put in the power lead to the organ, the results were quite dramatic. The offending plop was reduced to an acceptable level and lesser clicks and plops virtually disappeared. The tone was also reduced a little.

Thus encouraged, it was decided to make up a new filter, using modern techniques to both improve the efficiency and reduce the size as much as possible.

Before we proceed with details of the new line filter, some readers may wish to refer to earlier articles on the subject. The first references on our files date back to January and July, 1953, where a filter was described, followed by comments on combating noise in radio reception. In February, 1960 another line filter was described and this was later incorporated into a composite article in January, 1968, which gave details for aerials which were designed to combat noise in radio reception. Finally, in October, 1969, a heavy duty line filter was described and which was capable of dealing with powers of the order of 1KW.

The last named unit used inductors wound on ferrite aerial rods, and this idea was used as a starting point for our new filter. We reasoned that we could get a large amount of inductance by using ferrite rods and by virtue of the fact that we are only interested in 300 watts or so, a smaller gauge of wire could be used. This means that we could add turns to achieve extra inductance. Furthermore, by reducing the length of the rods and layer winding, we could get a high inductance into a small space.

We started with a ½in diameter ferrite broadcast-band aerial rod, 7½in long, made by Plessey Ducon. This was broken in the centre, and a coil wound on each piece. Each coil consisted of 300 turns, made up of three layers of 100 turns each of 22 B&S emanel copper wire. This results in a coil with an inductance of about 4mH and a DC resistance of 0.7 ohm.



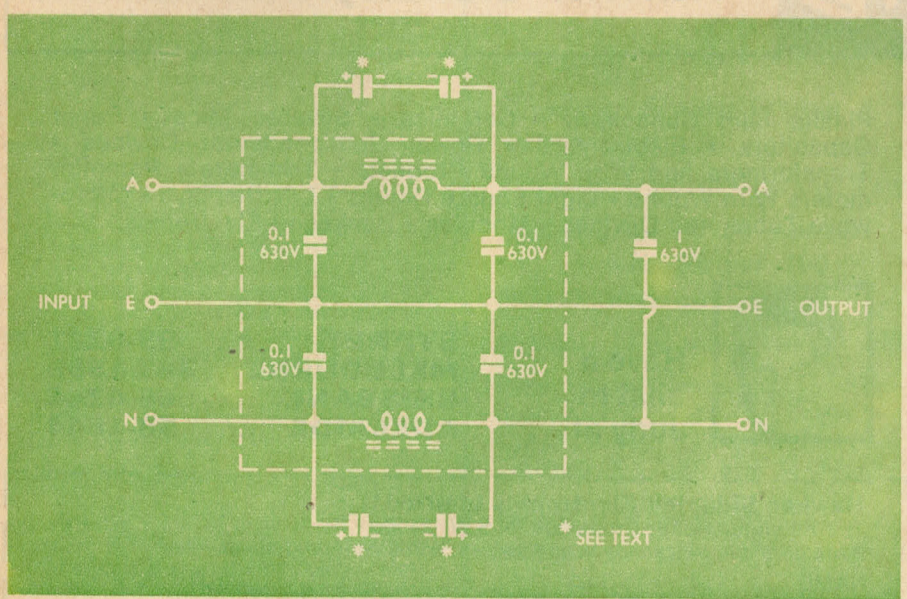
The author's filter, which is housed in a robust aluminium alloy case.

Having made the two coils, a basic line filter was mocked up, using the usual pi configuration in each leg of the line. Capacitors of 0.1uF were used for the trial. Tests soon indicated that this filter was even more effective than the one originally tried. The clicks and plops were further reduced, generally to the point where they were insignificant. The control tone was also down by a useful amount. The initial tests indicated that a line filter using these components would be worthwhile, without any further development.

However the author was not satisfied that the ultimate had been achieved in terms of reducing the control tone, and had a further look at this part of the problem.

Our thoughts turned to some of the matters which were discussed in "Forum", for December, 1969 and June, 1970. The subject of control tones was discussed at some length, and designs given for filters specifically designed for reduction of the tones. Readers who wish to check further, may refer back to these two items. Basically the circuits consist of an L filter, with a parallel resonant circuit at the frequency of interest, in series with the line. The shunt leg in its simplest form consists solely of 1uF capacitor. The more elaborate approach uses a series resonant circuit at the same frequency.

The inductor in each case should be about 30mH, for a tone frequency of 1050Hz. Our quest for a suitable inductor revealed that the Ferguson type CF435, originally made for use in our 1959 Karset, has a nominal inductance



The circuit for the filter unit, with the basic section within the dashed line rectangle. The inductors are wound on ferrite rod sections.

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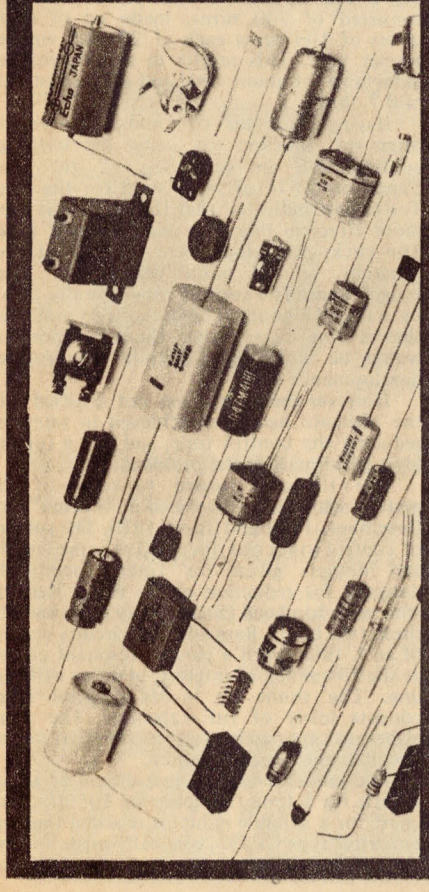
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5TV-HF	Tweeter	2	5,000-20,000	—	10	11,500	30	13	33	5.80
9TV-HFT	Tweeter	3.5	3,000-20,000	—	4	11,500	30	13	45	5.80
87H	Dome Tweeter	1.5	1,500-20,000	ohms-1,000	35	13,000	230	39	50	19.80
13TV-GM	Mid-Range	5	200-4,000	80-100	20	10,500	230	26	85	24.80
15, 11TV-2XM	Mid-Range	6 x 4	300-6,000	90-120	12	12,000	115	19-5	80	9.80
21TV-GD	Full Range Twin Cone	8.5	40-18,000	50-60	16	10,500	230	26	98	12.50
21TV-EW	Woofer	8.5	35-2,000	25-30	60	5,500	280	39	88	24.80
25TV-ED	Full Range Twin Cone	10	25-15,000	35-43	20	10,000	340	39	95	14.50
25TV-EW	Woofer	10	30-1,500	20-25	60	5,500	280	39	102	29.80
30WK	Woofer	12	45-3,000	35-40	100	11,000	570	39	150	58.50
30TV-COAX	Full Range Co-Axial	12	30-20,000	35-45	24	10,000/11,500	340/30	39-13	136	38.50
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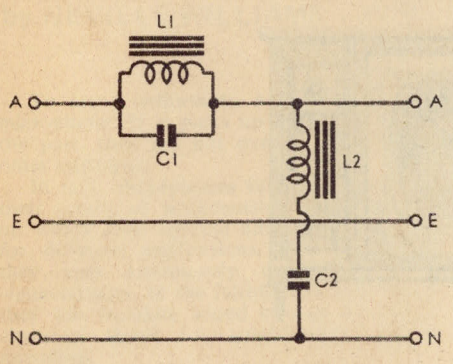
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of 30mH, a DC current carrying capacity of 1.25 amps and a DC resistance of 1.4 ohms. This seemed to be worth a trial, although the current carrying capacity would be rather restrictive.

Accordingly, a filter with parallel and series resonant elements was mocked up and tried. The tests showed that the tone was reduced quite markedly but it was still in evidence. It would appear from this and experiments other staff members have conducted along similar lines, that some of the offending tone gets into the amplifier by a route other than directly through the mains supply. Accordingly it would seem that further searching for a better filter for the line would not be worthwhile.

In spite of this relative setback, we felt that the efforts so far were worthwhile and further checks should be made. Suspicious that the inductor in series with the line would not be large enough for some heavier loads, say 300 watts or so, we actually ran the organ with the filter in circuit for some hours and



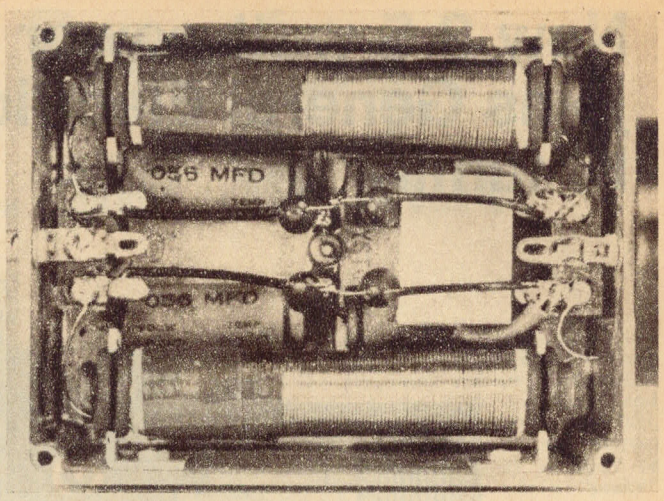
The circuit of the special L-section filter to suppress control tones.

with an ambient temperature of about 75 degrees F. This test showed that the inductor in the series resonant leg remained cool, as it should with no significant current flowing through it. However, the inductor in the parallel resonant circuit, with the full current load flowing through it, became quite warm. Although it was not overheated, we considered that this inductor was not capable of doing the job with the load we had in mind.

Although we abandoned this approach as the solution to our problem, there is no reason why readers who have a load of say, less than 200 watts, should not try it for their particular purpose. Further details will be given as a guide to capacitor values later on.

It may be noticed that the circuit of the conventional line filter is enclosed within dotted lines. We returned to this point and as we have already mentioned, this does give some attenuation of the control tone, but it leaves quite a lot to be desired. Our first addition was to place a 1uF capacitor across the output of the line filter. This effected some improvement in attenuation, but there was still room for improvement.

Earlier, we mentioned that our coils for the line filter were wound on ferrite rods and with the idea of getting as high an inductance as possible. With 4mH, we considered that this amount of inductance could be resonated to either 750 or 1050Hz. Resonance at 750Hz would be achieved with about 11uF. This means that we had to resort to electrolytic or tantalum capacitors and as these are polarised, two 22uF units placed back-to-back were required to do the job. Although the LC ratio left something to be desired, it was worth a trial.



The interior of the author's unit, which includes the 750Hz tone filter components. These may be omitted if not required, as noted in the text.

With 11uF across each of the two coils, a check with the audio generator showed that a worthwhile amount of attenuation had been gained. This arrangement under test, as near as we could judge, seemed to be as good as the special L filter tried earlier. Finally, we added a series resonant circuit using a CF435 inductor across the output. But this had little or no apparent effect.

In short, the basic line filter, with 1uF across the output and 11uF capacitor across the two coils, gave us very close to the maximum attenuation, and we decided to settle for this. However, we feel that this may be the story only for this particular case, so that the whole problem is still wide open for individual experiment. Readers may therefore wish to check the various ideas to determine the best solution for their own particular problem.

Construction of the basic filter is quite straightforward. As mentioned earlier, the two coils are wound each on half a ferrite aerial rod, made by Plessey Ducon. We used a rod ½in in diameter and it would be best to stay with this size, but if supplies should be difficult to obtain, then the 3/8in diameter rod may be used instead. This applies if only the basic filter is to be made. However, if it is desired to tune the coils to either 750 or 1050Hz, then with the smaller rod the inductance will be less and a higher value of capacitor will be needed.

Having obtained a rod, the first task is to divide it into two equal parts. The centre is marked accurately and a shallow groove is cut right around the rod, using a three cornered file. The rod is then held in a vyce, with the groove just slightly above the jaws. A sharp tap with a hammer should then break the rod in the right place, although one will be very lucky to get a clean right angle break. Fortunately, this is not important.

Before commencing to wind the coil, a layer of insulation should be placed over the rod. We used a piece of stout brown paper, sufficient to give one slightly overlapping turn around the rod, 3in long and centred on the rod. The start of the winding is held in place with a loop of insulation tape, so that the first and subsequent turns pass over the tape to hold it in place. Wind on 100 turns and then cover the winding with a layer of paper. Continue winding and then cover this layer with another piece of paper. The third layer of 100 turns is added, the finish being held in place with insulation tape.

Having wound both coils, as part of the method of mounting, we slipped a rubber grommet over each end of the rods and pushed them up close to the winding ends. The start and finish leads were anchored by running them between the rubber grommet and the rod. The flying leads, when cut to length, are connected to the appropriate terminations later on.

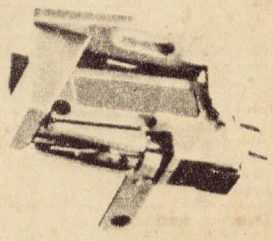
The complete filter is housed in an

(Continued on page 150)

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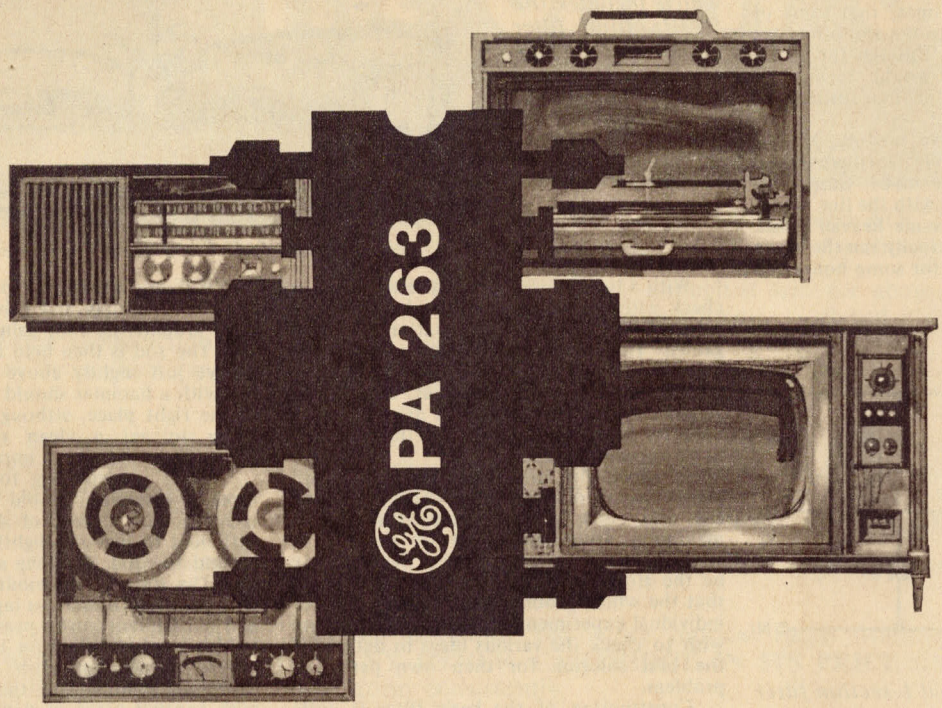


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Supply Voltage Range (Volts)	18–25	11–25	12–27	12–30	12–37
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Batteries and Cells

The electro-chemical – primary and secondary cells – the Le Clanche cell – construction and operation – series and parallel combinations – the alkaline cell – the "mercury"cell – the lead-acid accumulator – the Ni-Fe cell – the nickel-cadmium cell.

A battery may be defined as a device which, by chemical action, produces an excess of free electrons at one terminal and a large number of positive ions at the other. The first terminal is negative; the second is said to have a positive charge, because it is deficient in free electrons.

When the two terminals are joined by an external conducting path, the electron pressure or EMF of the battery causes a movement of electrons along this path. In other words, the battery initiates the flow of an electric current through the external conductor.

To be precise, a single electro-chemical unit should be referred to as a cell; it is an interconnected group of cells which makes up a battery.

Investigators have produced quite a variety of electric cells, and a lot of space could be devoted to a discussion of their chemical action and their characteristics. However, for the purpose of this chapter, it seems more appropriate to devote the necessary mental energy to a study of the types normally used with electronic equipment.

Cells fall into two broad classifications; **primary** and **secondary**. Primary cells are relatively inexpensive, and designed for use once only. When discharged they are simply discarded. Secondary cells are a lot more expensive, but, when exhausted, they may be recharged and used again. Most such cells may be cycled several hundred times, and this alone fully justifies their higher first cost. In addition, they have many other advantages.

More recently, there has been developed a cell which is not strictly either a primary or secondary cell, but falls midway between. This is the manganese-alkaline cell which, although normally sold as a primary cell, is also available in a modified form which can be recharged – within limits.

Most primary or secondary cells may be further classified as "wet" or "dry".

These terms are not strictly accurate, but are used to differentiate between those types in which the electrolyte is a free liquid and the container is not completely sealed, and those in which the electrolyte is a jelly or paste and the cell is effectively sealed.

The first really practical primary cell was produced by Georges Le Clanche in 1868. His cells used a zinc rod for the negative pole and a carbon rod, surrounded by a mixture of manganese dioxide and powdered carbon in a porous container, as the positive pole. The whole lot was housed in a glass jar containing a solution of sal-ammoniac (ammonium chloride).

The Le Clanche cell in this form, though an entirely practical arrangement, suffered from the disadvantage of having a liquid electrolyte, subject to spilling and "creeping". These problems were largely overcome when, in 1888, a "dry" cell was produced by Dr Gassner, using the basic Le Clanche principle but in a more convenient form.

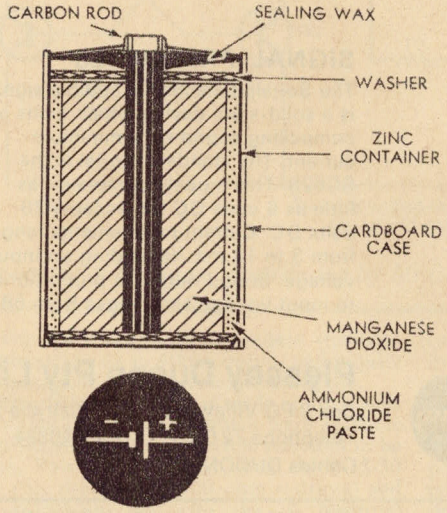


Figure 1: A cutaway view of the "dry" Le Clanche cell, showing the details of its construction; note the paste form of the electrolyte.

The modern "dry" cell is essentially similar to that produced by Gassner. The glass jar is eliminated and the negative zinc electrode becomes the container for the chemicals. The carbon rod and manganese dioxide is retained as the positive electrode, but the sal-ammoniac is thickened to a non-spillable paste. A coat of wax over the top serves to seal the whole unit.

Such a cell is not truly dry and, indeed, could not be so. However, the cell may be used in any position without danger of the electrolyte spilling or doing damage to other apparatus. Although dry cells have changed little in appearance for many years, various chemical refinements have trebled and even quadrupled their service life.

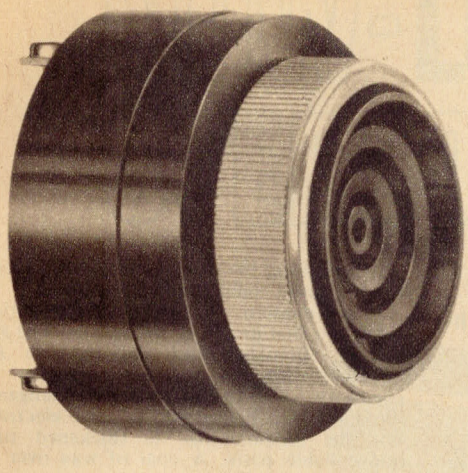
When first manufactured, the cell builds up a certain potential across its terminals and, thereafter, the chemical action becomes very slight. However, there is always a slow chemical action going on and a drying-out process, so that a cell will not remain fresh indefinitely. After a few months, its terminal voltage begins to diminish and the amount of electrical energy it can supply becomes very limited.

The ability of a cell to remain "fresh" for a long period of idleness after manufacture is expressed in terms of its shelf life. Generally speaking, large cells have a much longer shelf life than small ones.

The main factor controlling shelf life is the



A collection of modern cells and batteries. At the rear are large Le Clanche "dry" batteries used for lanterns and higher-power electronic equipment, while in front of these are smaller batteries and cells used for low power applications. The two disc-type cells are of the nickel-cadium type.



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12	TS12 30B	30	2.5	4½	3	6	4 lb.
12	TS12 60B	60	5	5	3¾	7	6½ lb.
12	TS12 125B	125	10.42	5¼	4¼	9	11¾ lb.
24	TS24 30B	30	1.25	4½	3	6	4 lb.
24	TS24 60B	60	2.5	5	3⅝	7	6½ lb.
24	TS24 125B	125	5.2	5¼	4¾	9	11¼ lb.
24	TS24 200B	200	8.33	5¼	4½	9	14½ lb.
32	TS32 30B	30	.94	4½	3	6	4 lb.
32	TS32 60B	60	1.88	5	3¾	7	6½ lb.
32	TS32 125B	125	3.9	5¼	4¼	9	11¾ lb.
32	TS32 200B	200	6.25	5¼	4¼	9	14½ lb.
32	TS32 300B	300	9.4	5¼	4¼	9	18 lb.
32	TS32 500A	500	15.6	6¼	5¼	6½	26 lb.
32	TS32 750A	750	23.44	8¼	6¼	6¼	38 lb.
32	TS32 1000A	1000	31.35	8¼	6¼	8¼	51½ lb.
115	TS115 30B	30	.26	4½	3	6	4 lb.
115	TS115 60B	60	.52	5	3¾	7	6½ lb.
115	TS115 125B	125	1.09	5¼	4¼	9	11¾ lb.
115	TS115 200B	200	1.74	5¼	4¼	9	14½ lb.
115	TS115 300B	300	2.61	5¼	4¼	9	18 lb.
115	TS115 500A	500	4.35	6¼	5¼	6½	26 lb.
115	TS115 750A	750	6.53	8¼	6¼	6¼	38 lb.
115	TS115 1000A	1000	8.7	8¼	6¼	8¼	51½ lb.
115	TS115 2000A	2000	17.4	10½	8¼	8¼	79 lb.
SOLDERING IRON TRANSFORMERS – Enclosed in pressed steel cover – suitable for Mico or Oryx Soldering Irons.							
5, 6, 7,	TS7 20	20	2.85	3¾	2¾	2¼	2½
10, 11, 12,	TS12 40	40	3.33	3¾	2¾	3¼	3½

FERGUSON

All transformers in this range are suitable for connecting to a 240 volts, 50 Cycles, Single phase supply and, where applicable, comply with Australian Standard C126 - 1950 under approved Number N158.

FUSEMASTER RANGE:—

All transformers housed in steel cases ("A" and "B") fall into the above category.

A TYPE

- Fuse protection of output
- Three core primary Flex 6'6" long
- Conduit or grommet knockouts
- Primary and Secondary Terminal Blocks
- Carrying handle
- Provision for wall mounting
- Two outlets provided on 125W rating and over.

B TYPE

- Fuse protection of output
- Three core primary Flex 6'6" long
- Carrying Handle
- Provision for wall mounting

Available from recognised electrical wholesalers

FERGUSON TRANSFORMERS PTY. LTD.

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TELEPHONE 40-0261 (8 LINES) • TELEGRAMS: "FERTRAN."

purity of the materials employed, particularly the zinc. If these were all 100 per cent pure, most of the shelf life problems would be solved. Unfortunately, this level of purity is impractical on a commercial basis and the battery manufacturer has to be content with something less. However, against this background battery manufacturers have improved shelf life significantly over the years. In addition, they can design a battery to have either a long shelf life – at the expense of some other characteristic – or minimum shelf life where other characteristics are more important and can be improved by so doing.

Again, for any one design, the temperature at which the battery is stored will have a significant effect on shelf life. High temperatures shorten it, low temperatures prolong it, so that it is customary to keep batteries in cold storage where the type of battery, kind of usage, and climatic conditions would otherwise create problems.

When, in actual service, a conducting path is provided between the terminals there is an evident electron movement from negative to positive along the path, which tends to relieve the electron pressure within the cell. However, the cell automatically tries to maintain the initial potential between its terminals, so the flow of electric current is invariably accompanied by increased chemical activity.

It is only comparatively recently that there has been general agreement on the chemical reactions in zinc-carbon cell, due to its extreme complexity. A popular concept for many years was that of a main energy producing reaction between the zinc and the ammonium chloride, with hydrogen liberated as a by-product. The formation of hydrogen bubbles on the carbon rod is responsible for a very undesirable cell characteristic called polarisation. Previously, it was assumed that the manganese dioxide overcame this by combining with the hydrogen to form water. More recently, it has been shown that the role of the manganese dioxide is much more direct, in that it prevents the formation of gas, rather than simply reducing any already formed. In addition, it is now known that the manganese dioxide is not simply a depolariser, but an active electrode which contributes more than half the energy which the cell delivers.

All dry cells which correspond to the foregoing description have an initial EMF of 1.5 volts or thereabouts between their terminals, irrespective of their physical size. However, large cells have a much longer shelf life than small cells, and, in service, can supply much heavier currents without running down.

Because of this, some care should be exercised in selecting the best size cell for a particular application. In general, larger cells are more economical than smaller ones, even though the latter have the advantage of low initial cost and, possibly, greater convenience. On the other hand, it is unwise to use a cell which is so large, relative to the current drain, that its theoretical discharge life far exceeds its shelf life. There is, therefore, an optimum size for any application.

The larger a cell, the greater is the surface area over which chemical activity can be evident. Therefore, such a cell is better able to maintain its electron pressure – or EMF – when called upon to deliver relatively high current.

The loss of EMF due to output current may be regarded very conveniently as an effective **internal resistance** of the cell itself. This internal resistance is small with large cells, and increases as the size of the cell is diminished.

The largest dry cell in common usage measures about 6in in height and 2in in diameter, and has a shelf life of two or three years – sometimes much longer. It is designed for a normal intermittent load of between 200 and 300 milliamps and is frequently used in telephone circuits.

The cells used in the larger type of "radio battery", used in the valve-type portable radios of a few years back, were designed to handle normal loads up to only 15 milliamps or so, but gave a useful life on intermittent service of 500 to 700 hours.

The cells in the "energiser" type of batteries used in transistor equipment are designed along somewhat different lines to the usual type of cell, to suit them to the type of loading conditions imposed by transistor circuitry. When used with a piece of equipment which draws the current values for

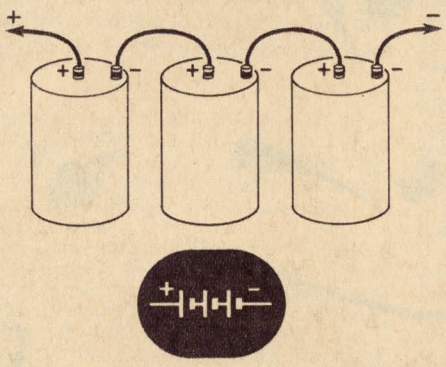


Figure 2: Series connection of cells, to deliver a higher voltage. The total voltage is equal to the number of cells times the single cell voltage.

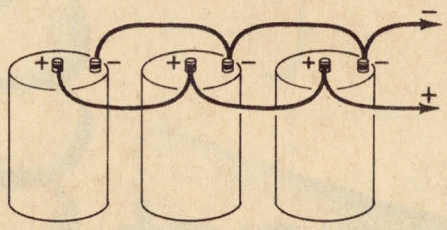


Figure 3: Cells connected in parallel, to deliver greater current without serious loss of terminal voltage.

which they are intended, such batteries have about the same useful life as the "B" batteries mentioned above.

Small single cells of the "penlight" variety will deliver only 8 or 10 milliamps comfortably and would give only a small fraction of their service life if asked to supply such currents for any length of time.

A sectional drawing of a typical dry cell is shown in figure 1, together with the usual schematic symbol. As may be seen, a single cell is represented by two parallel lines of unequal length. As a rule the longer stroke signifies the positive side of the cell, but it is occasionally found the other way round. To be on the safe side, most circuit draughtsmen clearly mark the polarity with a plus and a minus sign, as shown.

For many purposes the EMF or voltage available from a single dry cell is often inadequate and a higher voltage is obtained by connecting two or more cells in **series.** That is to say, they are linked together with the positive terminal of one cell going to the negative terminal of the next, and so on. Any number of cells may be connected in this way, and the two terminals left over are the positive and negative connections to the bank of cells – or the battery, as it is generally called.

The most familiar illustration of this principle is that afforded by the ordinary two or three-cell torch or "flashlight".

In ordinary torch cells the tip of the positive carbon rod protrudes through the wax and is fitted with a brass contact cap. The negative connection is actually the bottom of the zinc can. When the cells are pushed into the torch case they are automatically connected in series and the resultant EMF is equal to the sum of their individual voltages. For two cells it is approximately 3.0 volts, for three cells about 4.5 volts, and so on. The connection is illustrated graphically and schematically in figure 2.

For the sake of convenience, battery manufacturers often assemble a number of cells in a single package or carton, connecting the cells together internally and bringing out just the one negative and the one positive lead. The actual voltage depends mainly on the number of cells contained.

The method of representing such batteries schematically is worth noting. There is an obvious objection to drawing a large number of individual cells, so that circuit draughtsmen normally show a couple of cells at each end, with a dashed line between them and a figure signifying the total terminal voltage.

For certain applications, voltages may be required intermediate between the negative and the full positive EMF. Standard procedure, in this case, is to provide the battery with one or more intermediate terminals, connected to the appropriate point in the series network of cells.

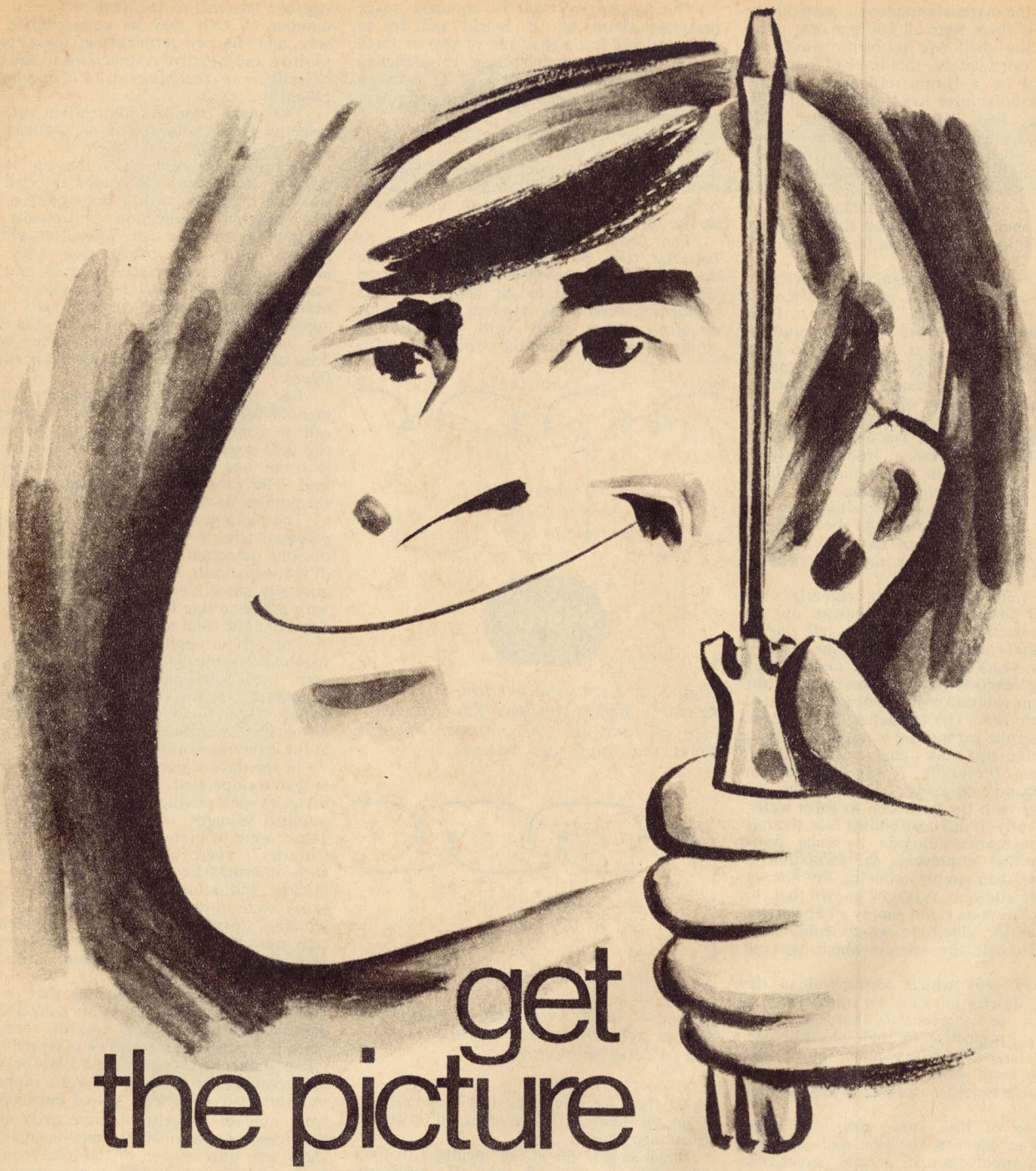
In the days when valves were widely used in battery-operated equipment, multiple-cell batteries were produced which gave quite high terminal voltages – typically 45V and 90V. These were commonly known as "radio B batteries". There were also smaller batteries with intermediate terminals used for grid biasing, and known as "C batteries". Both types were often made up using a "layer building" form of construction, in which the cells were formed by successive flat layers of zinc, carbon, electrolyte-soaked cardboard, and manganese dioxide.

It is well to note in passing that two or more cells may alternatively be connected in **parallel,** the positive and negative terminals being joined together as shown in figure 3.

With this arrangement, the EMF between the terminals remains at 1.5 volts (approx), but the load current is shared between the total number of cells. Because each cell is then called upon to deliver only one half, one third, one quarter, etc, of the total load, the bank of cells can handle a proportionately higher current than any one of the cells singly. A similar current capacity, with possibly longer shelf life, could be obtained from a single very large cell, but the parallel arrangement is sometimes used for convenience or expedience.

A modified version of the Le Clanche cell is the **alkaline cell,** which uses an alkaline electrolyte instead of the acidic ammonium chloride. This gives a better high-rate performance and a cell which can be more readily manufactured in smaller sizes. The smaller sizes are generally for low current drain applications only, although an "inside out" construction (ie, with the positive plate connected to the outer case) has been designed, with potassium hydroxide as the electrolyte, for higher current drains.

The energy volume ratio of alkaline



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manganese cells is higher than the acidic Le Clanche cell and they have a longer shelf life. They may well eventually replace the Le Clanche for general commercial use but, at present, are slightly more costly to produce.

Another type of primary cell is the so-called "mercury" cell, which has been used for some years now in hearing-aids and other continuous-use devices, and is finding use in some of the newer transistor equipment (figure 4).

The mercury cell uses zinc as the negative electrode, as before, but the positive electrode is of mercury. Mercuric oxide is used both as a source of the mercury and as a depolariser. The electrolyte is a strong solution of potassium hydroxide and zinc oxide in water.

Mercury cells are commonly made "inside out" – that is, with the negative (zinc) electrode brought to the top as a cap. This enables a steel case to be used, both to connect to the positive mercury electrode and to act as a container.

They may also be made in the "flat" variety, for stacking in series to produce voltages higher than that of a single cell. The voltage of a single mercury cell is approximately 1.35 volts, slightly lower than the Le Clanche type, but the internal resistance is generally very low in comparison, and mercury cells have a very high capacity. This makes them more suited to applications where the battery cannot be replaced very often, and to circuits which draw high currents for short periods.

In all the cells we have described so far, the electro-chemical action necessarily ceases when the chemicals have been used up, and the cells are then of no further use.

mixture to be decomposed, releasing atoms of hydrogen and oxygen at the respective plates. The hydrogen mostly escapes, but the oxygen liberated at the positive plate combines with the plate to form the dark brown peroxide of lead.

When the charging has proceeded for an adequate length of time, the battery may be removed from the charging circuit.

If a conductor is then connected between the two plates, a current is found to flow, and, as it does so, a chemical change becomes evident in both plates. The positive plate, coated with lead peroxide begins to take a coating of greyish lead sulphate, and much the same thing happens to the lead negative plate. The "sulphate" molecule comes from the acid, which is therefore progressively weakened as the discharge continues.

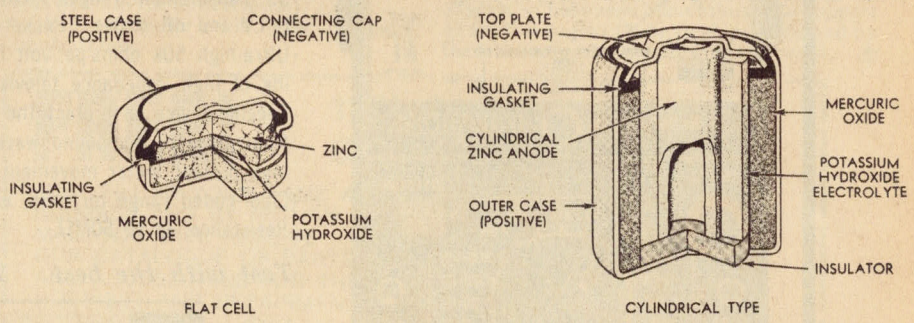


Figure 4: Basic construction of the two forms of Ruben-Mallory mercury cell, a primary cell which has a very high capacity and low internal resistance. Note the "inside out" construction, compared with the familiar Le Clanche cell. The steel outer case is the positive terminal.

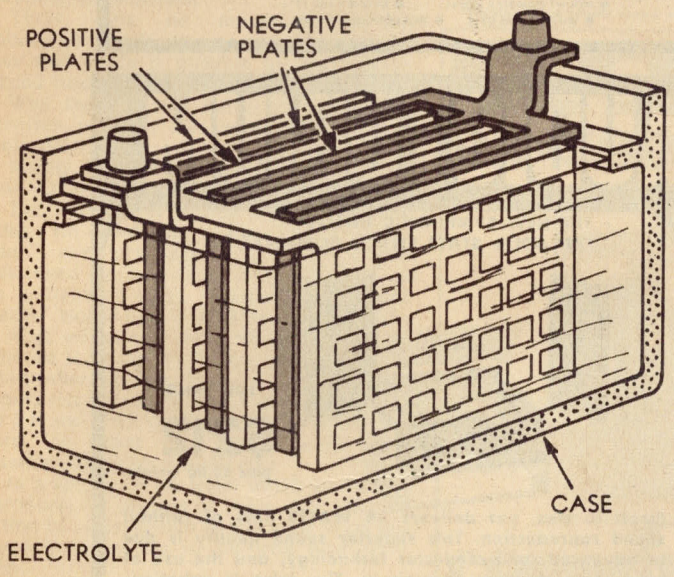


Figure 5: A single lead-acid secondary cell, showing the alternate lead plates supported in the acid electrolyte. Three or six such cells are used in the familiar automotive battery, to obtain 6 or 12 volts.

These so-called **primary cells** are distinguished from **secondary calls** by the fact that the latter can be made to deliver current afresh by a process called **recharging.**

The most common type of secondary cell or battery is the lead-acid accumulator used in motor vehicles. These were also used as filament of "A" batteries in the earliest battery radio sets.

In the lead-acid accumulator, two sets of lead plates are immersed in a mixture of sulphuric acid and water. To "charge" this type of cell the plates are connected to an external EMF in such a way that a current of up to several amperes flows through the acid via the plates.

The flow of current causes the acid-water

When next the cell is recharged, the lead sulphate on the negative plate is reduced to pure spongy lead, and the coating on the positive plate reverts to the dark coloured lead peroxide. At the same time, the strength of the acid is built up again, so that the cell is ready once more for a period of discharge. This charge and discharge cycle can be repeated hundreds of times until, after a period of perhaps several years, the active electrodes begin to disintegrate.

The EMF of a lead-acid secondarv cell is normally reckoned at 2.0 volts, irrespective of its size. the actual current handling capacity is governed largely by the number, the size, the spacing and the nature of the plates.

For voltages greater than 2.0, it is usual to mount several cells, siee by side, in the one large subdivided container. The cells are sealed across the top to prevent spilling of the acid and then connected permanently in a series arrangement, as already described for dry cells.

The current capacity of an accumulator is summed up in its AMPERE-HOUR rating, which gives a rough idea of the number of hours it will continue to deliver a specified amount of current after a full charge.

As well as the lead-acid accumulator, there are a number of other secondary cells used for special applications. One of these is the **Nickel-Iron (Ni-Fe)** cell, sometimes called the Edison cell, after Thomas Edison, who is credited with its invention.

The Ni-Fe cell is a complex structure, the positive electrodes being rows of perforated nickled-steel tubes filled with alternate layers of nickel hydroxide and thin flakes of pure nickel. The negative electrode is a grid made from nickeled sheet steel containing pockets filled with iron oxide. The electrolyte is a 21 per cent solution of potassium hydroxide in distilled water, plus a small percentage of lithium hydrate.

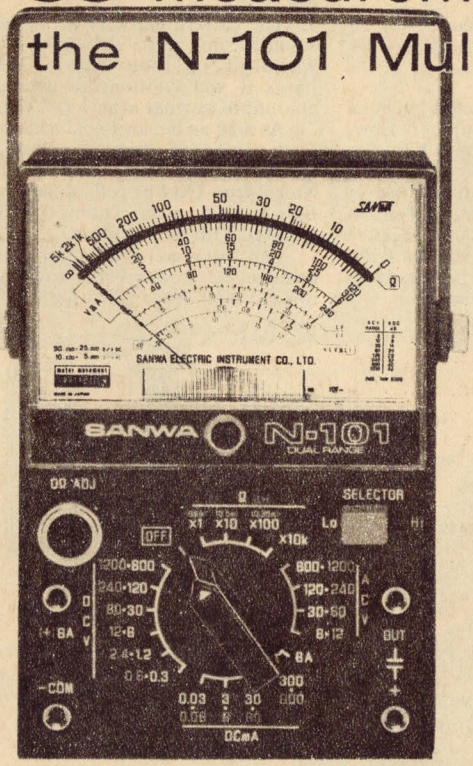
The voltage of this cell is 1.37 when fully charged, dropping to 1 volt when discharged. A greater number of cells are therefore required for a given battery voltage. The cells are a good deal more costly than the lead-acid type, but offer a number of advantages in certain applications, particularly for electric traction vehicles and similar heavy-duty service. They are a very robust cell, not easily damaged by other than optimum charging conditions – even including accidental reverse charge – which would quickly ruin a lead-acid cell. The working life may be 20 years or longer.

A more recently developed secondary cell is the **nickel cadmium type.** Although initially dearer than the lead-acid cell, it has many advantages which make it attractive for modern, compact, electronic equipment.

Among its advantages are a very favourable power to weight ratio, and a far greater tolerance to neglect than the lead-acid cell. Also, it is designed to provide a completely closed chemical cycle, whereby gas evolved during charging is re-absorved within the cell. Thus the cell can be completely sealed. It is finding increasing use in portable equipment, such as electronic photo-flash, transceivers, portable radio, etc.

Another application is in self-contained electrical appliances. Electric shavers and electric drills are two examples of this, in which these cells make possible a compact, convenient device which can be used anywhere, independently of power lines, or where the use of high voltage equipment may be dangerous.

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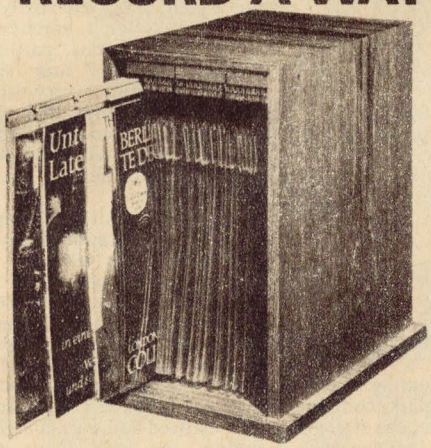
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FORUM

Conducted by Neville Williams

The literary shooting season is now open

This must surely be the season for readers who like to do more than just read; for those who are never happier than when they spot what looks to be a grammatical or technical error. With a Dagwood-like grin, they dash off a letter which may highlight what we already know: the editorial staff of "Electronics Australia" is merely human. We can miss things; we can make mistakes!

What triggered a couple of the letters was a passing reference in a recent editorial to Assistant Editor Philip Watson and his ability to sniff out "inconsistency, ambiguity and what he commonly refers to as JISP: Jumbled Interpretation of Scientific Phenomena".

The first such critical letter comes from a reader at Pendle Hill, NSW, who has this to say:

Dear Sir,

My congratulations on a fine magazine. I am pleased to note that you have not fallen into the trap that so many Australian newspapers and magazines fall into: that of English spellings and American misspellings side by side.

The editorial in your March 1971 issue mentioned in the sixth paragraph that Mr Watson takes pleasure in sniffing out inconsistencies. For the most part, your magazine uses the tried-and-true faithful English spelling system. However, there is one inconsistency in your articles in that "programme" is used in its Americanised form.

The American forms of favour and colour are used in at least two of your regular advertisements. Your policy may be not to interfere with advertisements but, for the sake of consistency, please do as you did with the conversion of Kc/s to KHz: replace those which have been carelessly retained by the advertiser.

P.W. (Pendle Hill, NSW)

This letter raises points which have been made before in these columns but which probably bear repetition, at least in brief.

Word forms in a magazine like "Electronics Australia" do not necessarily reflect in every detail, the convictions of the Editor and his staff.

The raw copy has to be set in the first instance by professional typesetters and subsequently read by professional proof readers. Typographical errors, wrong spelling and "malapropisms" are picked up and corrected (in theory anyway) before the galley proofs reach the editorial staff for further reading and page layout.

Since alterations in typeset materials involve time and cost money, it is quite unthinkable that writers, typesetters, readers and editorial staff should seek to dictate word forms according to their own individual convictions. So every publishing house tends to generate and maintain a set of conventions which come to be known as "house style".

Our house style conforms to that of the Sungravure and John Fairfax group, of which we form a part. Grafted on to it and, in a sense, adapted to it, is an array of technical words and conventions which are more or less peculiar to "Electronics Australia".

On the surface, it would seem that the setting of a house style would be a fairly straightforward procedure involving first an exchange of views and, if necessary, resort to "authorities" for a ruling on points of difference. But, alas, it doesn't work out that way.

Problems stem from the fact that language is not a static thing but is constantly changing. People with comparable education but from differing age groups and differing backgrounds find themselves diametrically opposed on matters of spelling, abbreviation, sentence construction, paragraphing, punctuation, use of upper and lower case, &c.

"Authorities" turn out to be rather like statistics: if you look long enough and hard enough, you can find support for almost any argument!

And to add to the confusion, those concerned with the "mechanics" of typesetting, page composition and general use of space are likely to come up with another set of reasons why certain practices are impossible, impractical or thoroughly uneconomic.

As if this is not enough, those of us with a technical background contribute reasons why certain things must be done in certain ways if they are to make sense, or look right, to readers of technical articles.

Out of all this, a house style issues which is a compromise between tradition, emergent practices and the role and facilities of the particular printing house. Once it has so issued, it is much easier for all concerned to conform than to invite the friction and the cost penalty of bucking the system!

This is not intended as a complaint but as an explanation of what is very much a fact of life in the publishing industry.

What of the words colour, favour and program? These are as per house style in our company. In fact, "program" was the subject of debate once before in these columns.

Various opinions were expressed on that occasion and various references were quoted.

However, the professional readers in our parent company, who are paid to come up with answers in matters of this kind, were able to produce a quite convincing argument that p-r-o-g-r-a-m was, in fact, the original English form. The ending "-mme" is a French form which has been widely adopted into the language, with some suspicion of affectation.

We have had no reason to revise that opinion since.

What word forms appear in advertisements is outside our direct control. We can advise and suggest, within the limits of diplomacy but, to actively tamper with advertisements would be to invite repercussions.

The actual wording (and spelling) in advertisements may be produced by a copywriter, by an advertising or sales executive, or by an engineer in any of the companies involved, or it may have been copied from an overseas advertisement produced by persons unknown. If they choose to use c-o-l-o-r or a-l-r-i-g-h-t, it is up to them!

And, after all, on the score of numbers of people using "our" language, Americans may have some right to an opinion on how words should be spelt!

Just two other points:

When they reach us, many (hopefully most) advertisements are fully assembled as artwork ready for camera. To change them at that stage would normally require lines to be reset in matching type and pasted over the original

Secondly, we did not oblige advertisers to use KHz, nor did we arbitrarily change their advertisements. We suggested and encouraged the change, as did most other magazines. That is all.

From a reader in Victoria come some other observations along a similar line.

Dear Sir,

Few will deny that "Electronics Australia" is the most comprehensive journal published in Australia in the particular field it represents, and it is the medium through which those of us in the electronics industry are able to keep in touch with the rapidly increasing rate of technical development.

With these facts in mind, we should be very conscious of the literary standard of this journal, which in some respects could be greatly improved. Examples of bad grammar are starting sentences with the word "and" (editorial, October 1970) and incorrect use of the past tense of the verb "to lie" in two recent technical articles.

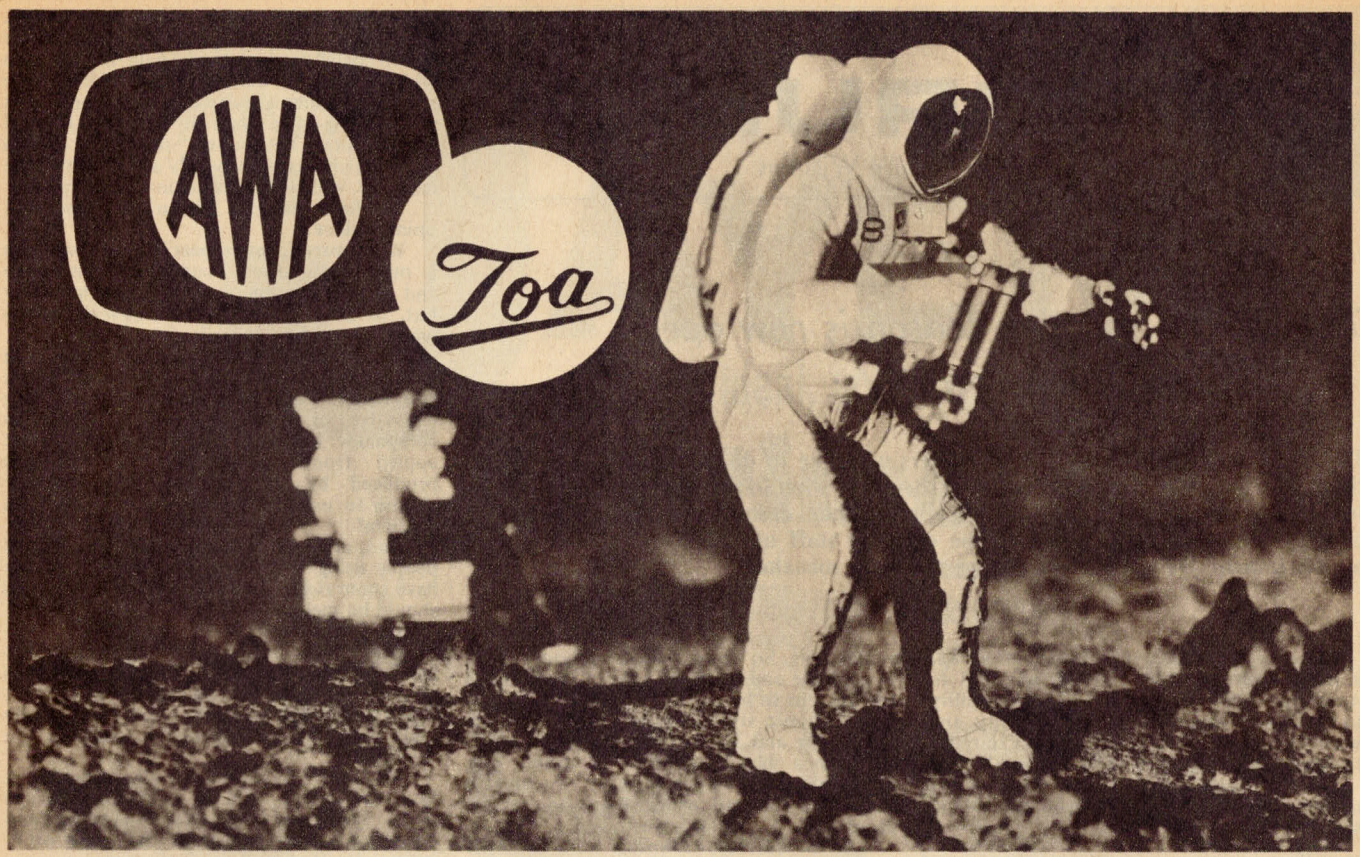
Probably the most badly written article that "Electronics Australia" publishes is "The Serviceman"...

The important series of articles, "Solid-State Fundamentals" concerns a very difficult and complex subject, but from the reader's point of view, the subject is very frustrating. Not only does he have to contend with some badly constructed sentences, which often obscure the real meaning, but he also has to decipher the effects of what is becoming an excessive number of unnecessary typographical and printing errors.

B.C. (Kew, Vic)

When I went to school, many years ago now, I had it drummed into me that one should never begin a sentence with "and" or "but". Moreover, I was told that these were major conjunctions and that commas ahead of either of them were entirely redundant.

Frequently, however, they needed to be followed by a comma and then a further comma, to separate a qualifying phrase or clause from the main theme of the sentence. In fact, I came to believe that long sentences



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PERTH—Phone 28 6400
BRISBANE—Phone 41 1631



A1465.FP

were appropriate and acceptable, provided they were well constructed and subdivided by generous punctuation.

Years later, I found myself in an environment of professional writing and I became aware of other opinions:

- Sentences should be short, even to the point of one thought, one sentence. Such prose may be more "jumpy" but it may well communicate better.

- Paragraphs should likewise be short, to avoid presenting to the eye large, unbroken blocks of type.

- Formal punctuation is not necessarily a pre-requisite to good writing copy.

- It is not automatically a cardinal sin to begin a sentence with a conjunction. A writer has every right to do so if it serves a useful purpose.

Faced with such opinions, one is likely to brush them aside as belonging to the "decadent" Press, or "Americanisms", and therefore thoroughly reprehensible departures from what our first correspondent refers to as "tried-and-true" English.

We can describe such practices how we like, but they are attitudes which are very commonly found and adopted in our present-day seats of learning. And, after all, the difference between these emergent practices and those of the 20s (and 30s) is no greater than that between the prose of the 20s and the late 19th century.

In that previous paragraph, writing as I thought, I began a sentence with "and". I simply do not believe that a detail like this, or the placement of some commas, or the length of individual sentences or paragraphs alone brands writing as "good" or "bad". It is possible to have good writing with or without any of these characteristics.

In my estimation, good magazine copy depends more on other, broader factors. Is it in character with the theme? Does it lead the reader logically from point to point? Does it produce the reaction sought by the writer? If technicalities are involved, is it accurate? Does it hold the reader's interest, or challenge to further study?

To use an "in" word: does the article communicate with those to whom it is aimed?

What of "The Serviceman" series?

Through the years, we have quite deliberately encouraged the idea of writing it in an informal, conversational style, seemingly appropriate to the image and the work of a radio serviceman.

For a serviceman to recount case histories in Oxford English would be as uncharacteristic as it would for him to turn up on the job in a blue serge suit.

What of the solid-state series?

This is much harder to read than "The Serviceman" – but so also is every other worthwhile article on the subject I have ever seen.

A problem with solid-state theory is that, unlike thermionic valve theory, it does not in general lend itself to support by mental pictures. It involves a far higher proportion of unfamiliar, abstract, and even tedious material. The writer who seeks to present a reasonably thorough coverage of the subject is stuck with this unpleasant fact – and so also is the reader and student.

I wonder whether B.C. is reacting to content rather than to composition.

What of the misprints?

Well, they embarrass us more than they embarrass our readers. However, if they were peculiar to "Electronics Australia", I would be more upset that I am.

In fact, they are not. In our reading of technical magazines, including "glossy" technical magazines, we often come across typographical errors, misplaced captions, inverted illustrations, transposed text, &c.

Their problem is the same as ours. In the course of preparing any issue, we detect and correct a very large number of individual errors. But there is a limit to the amount of time (and therefore money) we can expend on checking procedures, with the result that some errors get through – unfortunately!

Still in critical vein, a reader from Pennant Hills, NSW, has this to say:

Dear Sir,

In your March issue, in an article on recording bird songs, Mr F. N. Robinson says that the microphone is placed at the focal point, ie, the parabola is focused at infinity. Later he says that a larger parabola will give a narrower beam.

For this condition, the larger parabola will give a wider beam, not a narrower one. Sounds that occur off axis (even though not at infinity) I suspect would come in quite well, since the microphone has a finite area and is not a point. No matter what size reflector is used, the beam will be wider than the reflector's diameter.

Thanks for the article

Dear Sir,

I read with great interest your article "How to Record Bird Calls" by F. N. Robinson. What an excellent article this is. I know Mr Robinson very well and, in my opinion, he is easily the best bird recordist in Australia.

I should like to make a little constructive criticism. In the picture you show Mr Robinson recording the Noisy Scrub Bird, near Albany in WA. Mr Robinson is wearing earphones, as I would expect. In the article, nothing is said about the advantage of wearing earphones whilst recording bird calls.

In fact, wearing earphones is of great advantage:

1. You can hear the quality of the recording as it is being made. If it is not satisfactory, adjustments can be made at the time.
2. It enables one to focus the microphone very accurately on the source of sound.

I am quite sure that Mr Robinson would agree with what I have written in this regard.

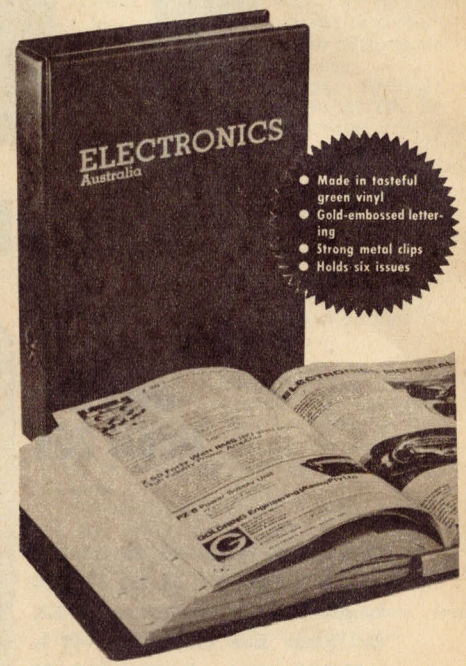
Incidentally I have produced three records which go with books on Australian birds and mammals – "Menura, the Lyrebird", "Bird and Animal Calls of Australia" and "Voices of the Australian Bush". The techniques I used in recording the bird calls are identical to those recommended by Norman Robinson, and I am sure any of your readers who wish to become bird recordists could not do better than follow the instructions given in your article.

I hope that from time to time, you can give us more articles in recording sounds of nature. Best Wishes,

Harold J. Pollock.

(Harold J. Pollock is a producer of Wildlife Films, c/- Travel Dept, Bank of NSW, George St, Sydney.)

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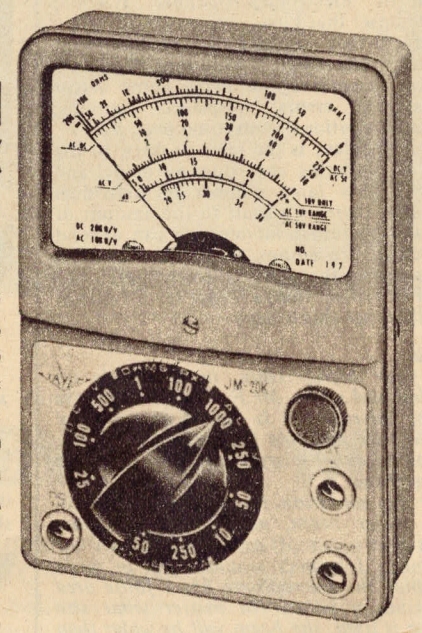
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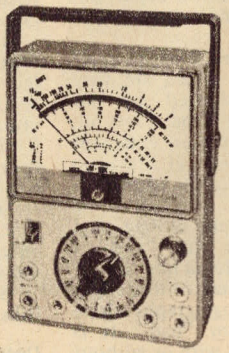
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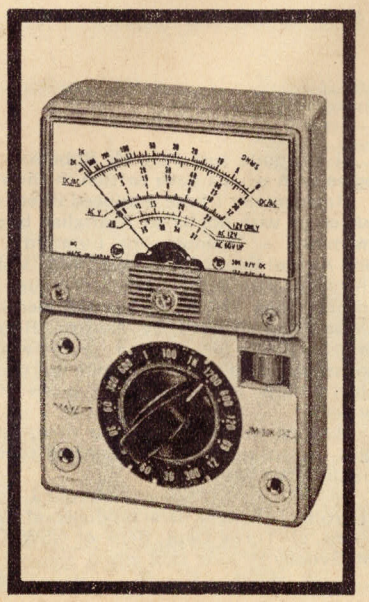
22 Ranges: DC Voltage—0-6, 30, 60, 300, 600, 1200; AC Voltage—0-12, 60, 120, 600, 1200; DC Current—0-60μA, 30mA, 300mA; Resistance—0-2K, 200K, 2mΩ (centre scale 36); Decibels—-10 to +63 (in 5 ranges) • **Accuracy:** ±3%, DC Voltage and Current; ±4%, AC Voltage • **Sensitivity:** 30,000 ohms/volt DC; 15,000 ohms/volt AC • **Meter Movement:** 3½", 27μA full scale • **Battery:** Requires one, type AA Penlight cell for ohms function • **Size:** 2" x 5½" x 3-11/16".

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JAYEM Model 50K (not illustrated)

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Perhaps Mr Robinson may have been referring to improved resolving power of a larger surface.

It would appear that a useful improvement in signal-to-noise ratio should result from having the microphone further out from the reflector than the principal focus, so that the sound source would be at one focus of the parabola and the microphone at the other.

A.F. (Pennant Hills, NSW)

In commenting on this letter, I think that it may be desirable first to disenchant any reader who may have a wrong impression about sub-editing articles prior to publication. Some may think that articles, as received, may be well planned and well written and that our sub-editors need only to read them through, make a few minor changes, but spending most of their time debating word values at the level at which the letter by A.F. is pitched.

Nothing could be further from the truth. The standard of writing in articles prepared for specialist technical journals is, in general, very poor. The main reason is that, while the authors may be expert in their own field, they have very little writing skill or experience. In reality, our task in predominantly one of having to re-organise and re-express numerous paragraphs or even whole articles.

In other words, far and away our major work effort in preparing articles for publication involves performing major "journalistic surgery" and making good major technical sins of omission and commission. If other, smaller problems pop up, we fix those, too; but, when the major problem is mountains, there isn't always the time to go searching for molehills!

There were no mountains in Mr Robinson's article; it was one of the good ones that made it possible to divert much needed time to others that were not so good!

Why then did the paragraph not attract attention when it was being read prior to publication?

Mainly because it seemed to convey the basic idea quite clearly.

The author was writing in purely general terms. He used the general term "focal point", not "principal focus", which would have raised an immediate query. Similarly, in the context of audio frequencies, the word "beam" would have a connotation more akin to what we have in mind when we say that someone is sitting "in the beam" of a tweeter loudspeaker. In fact, in a practical sense, for frequencies extending upwards from audio to the HF and VHF radio spectrum, "beam" has more the sense of "lobe", rather than situations involving parallel rays.

In a section of his letter which we did not reproduce, for reasons of space, A.F. reminds us that he raised similar points some years ago regarding an article to do with microwave radio.

Fair enough, but we are not dealing here with something that can necessarily be made to fit neo-optical laws and diagrams.

We are dealing with energy having a wide range of wavelengths straddling the physical dimensions of the reflector; we are dealing with a reflector which may or may not be a mirror-surface for those wavelengths.

It is worth bearing in mind, also that a common method of focusing sound in a particular plane is to project it from a number of loudspeakers operating in line and in phase. Within the limits most audio people would regard as practical "focusing" improves as the dimension of the line-source is increased. The converse would undoubtedly hold.

The whole picture therefore becomes rather blurred. Is the operation of this kind of reflector at microwavelengths closely related to its behaviour at sonic wavelengths? Should the thinking be related rather to the effective frontal area of the device and the geometric conditions which produce maximum response to a plane wavefront over that area? Where is the focal point for this latter condition?

There is no reason at all why anyone so inclined should not set out to resolve these questions. I doubt, however, that they would affect in the slightest the validity of what Mr Robinson had to say:

- For remote pickup of bird sounds, good results can be had by using a microwave reflector with a microphone suspended at the focal point (for audio).
- A 24-inch reflector will give about 5dB "gain" (a figure which would suggest a pronounced forward lobe but nothing like a parallel beam in the optical sense).
- A large reflector will give a more pronounced lobe.
- To minimise resonance effects and render them more suitable for audio work, the rear surface of microwave reflectors should be coated with a material such as foam rubber.

Having said this, there seems to be very little to argue about.

If Mr Robinson had been discussing optical or microwave energy, principal focus and a parallel beam, there may have been some basis for the criticism – and possibly for us to have suggested changes to the article in the first place.

But Mr Robinson was talking about audio, he used the general term focal point, and he used the word beam in the sense of a lobe. Overall, he may well be in a stronger position than his critic.

Shades of meaning notwithstanding, he appears to have won the enthusiastic support of another expert in the field, as evidenced by the letter reproduced herewith in a panel.

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A READER BUILT IT

Projects and design ideas which are published for general reader interest. Based on readers' contributions, they have not been tested in our laboratory, and responsibility cannot be accepted.

Precision Voltage Source for Meter Testing

Wherever a group of meters is used for routine measurements, there arises the problem of maintaining their accuracy. To check them requires both a standard and a source of voltage to suit each range. The device to be described here provides both, for a quite modest outlay.

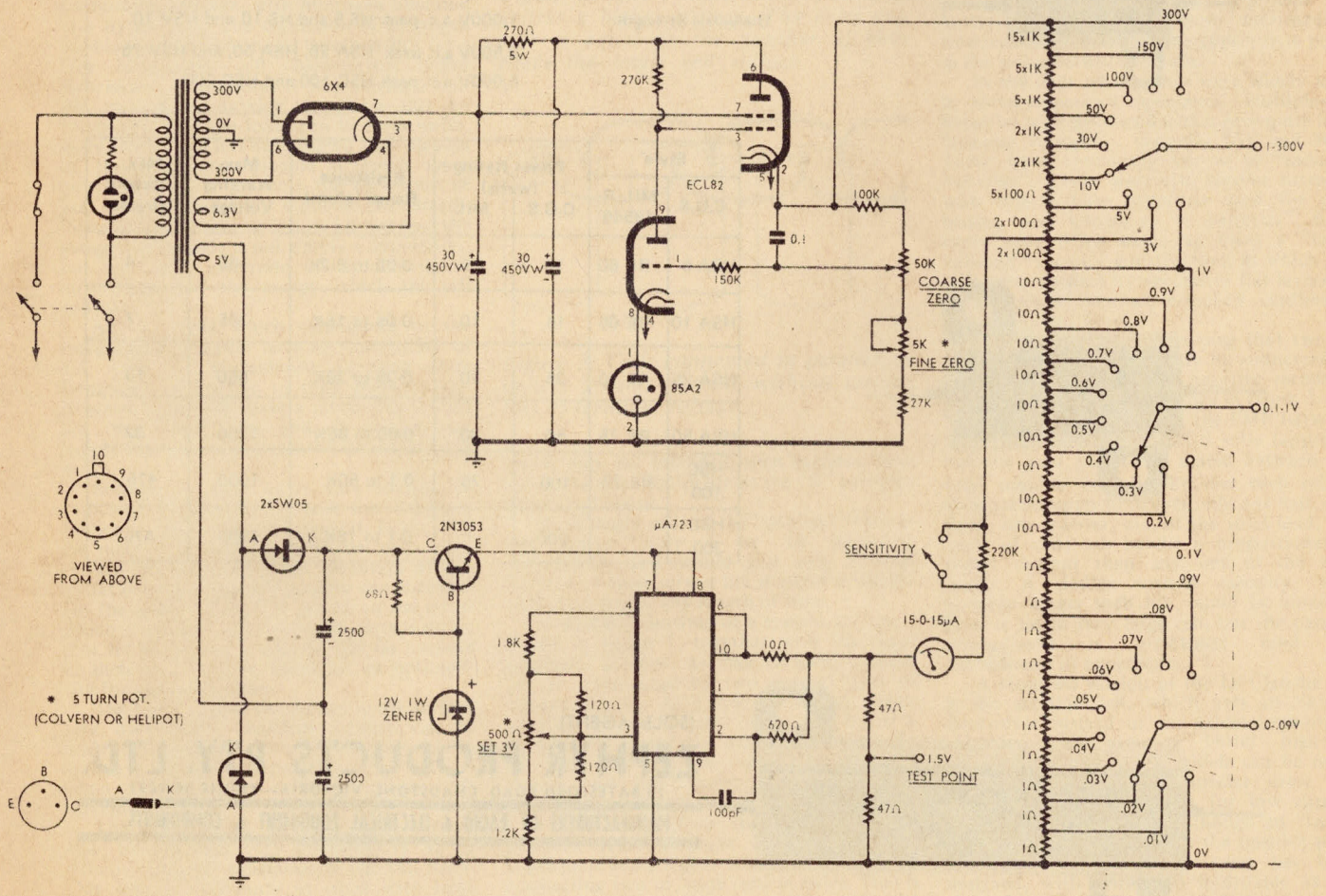
From time to time during use or after repair it becomes desirable to check or adjust voltage ranges of multimeters, VTVMs, CROs, etc. The equipment normally used for this task is often either not available or is too costly to acquire. The piece of test gear here described is certainly not very expensive and, depending on the facilities available, can be made accurate enough for most purposes. Given access, even of a temporary nature, to certain items a fair degree of ultimate accuracy can be achieved.

There are two main sections to the device. The primary reference is a highly stabilised 3V source which can be checked and, if necessary, adjusted from time to time. This source is used to adjust the calibration voltage with a centre-zero micro-ammeter as detection device.

The actual calibration voltage is provided by a stabilised but variable 300V supply across which is a resistor network designed to provide a steady 10mA drain. A series of tappings on this network provide typical voltages as likely to be required for meter checking, or as selected by the individual builder. Regardless of what other tappings are required, a 3V tap must be provided.

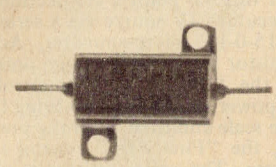
From this 3V point a connection is made to the accurate 3V source via a series resistor and a 15-0-15 micro-ammeter. Across the series resistor is a normally open press switch. In use, the "Coarse Zero" control on the variable power supply is set to bring the meter to centre scale and then, with the press switch held on, the "Fine Zero" control is set for centre zero. The series resistor is chosen to give not more than full scale deflection when either supply is off. When the instrument is first switched on, for instance, the 3V source is almost instantaneous but the 300V supply is delayed by valve heating.

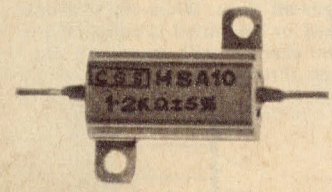
Assuming an accurate resistor chain, it follows that if the 3V point is correct, then the various points above it will have correct voltages on them. When the instrument to be checked or calibrated is connected to a point on the chain it will cause an extra drain of current through the chain above it, thereby

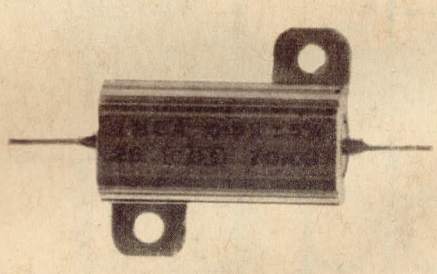


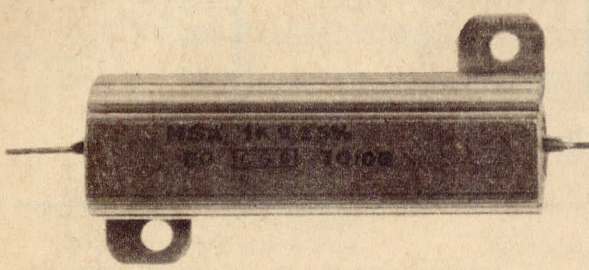
The circuit of the meter calibrator, which uses a precision 3V regulated supply as its voltage reference.

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	Below 1Ω,	90 ,, ,, ,,
HSC 100 & 200	Above 1KΩ,	30 ,, ,, ,,
	4·7Ω to 999Ω,	50 ,, ,, ,,
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Insulation Resistance (dry): 10,000 MΩ Minimum.
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HSA 5	RE 60	10	5	0·05 to 8·2K	160	4
HSA 10	RE 65	15	10	0·05 to 15K	265	7
HSA 25	RE 70	25	20	0·05 to 36K	550	14
HSA 50	RE 75	50	30	0·05 to 86K	1250	32
HSC 100	RE 77	100	75	0·1 to 50K	1900	475
HSC 200	—	200	—	0·1 to 15K	1900	475

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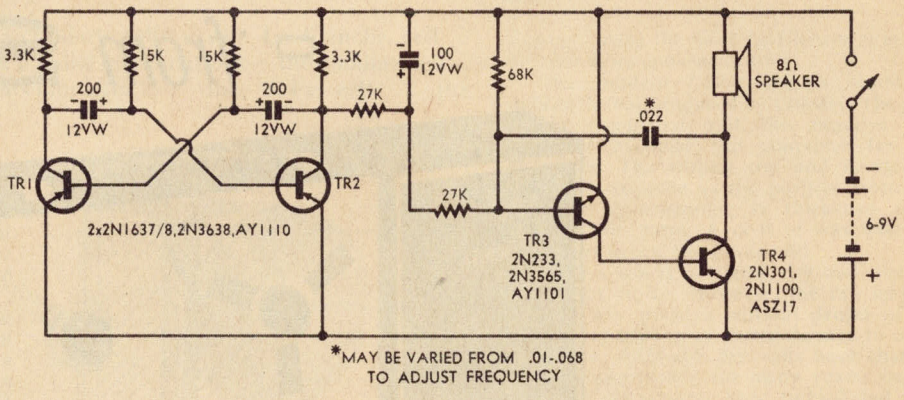
This unit is a combination of two circuits; a multivibrator (TR1, TR2) and a two transistor oscillator (TR3, TR4). The multivibrator controls the rise and fall of the oscillator frequency to provide the siren effect. It does this by feeding a rising voltage developed across the 100uF capacitor, to the base of TR3. This causes the frequency to rise.

When the multivibrator switches, the charged 100uF capacitor is allowed to discharge through the 27K and 68K resistors, producing a falling note.

The circuit can be modified slightly, if desired, to simulate the dying notes of a siren when it is finally switched off. All that is required is a switch between the collector of TR2 and the 27K resistor which, when opened, will disconnect the 100uF capacitof from the multivibrator circuit and allow it to fully discharge through the 68K and second 27K resistor.

The second circuit is the two transistor oscillator. This circuit relies on leakage current between collector and base of TR4. If the oscillator does not deliver sufficient volume, a resistor of between 1K and 10K should be placed between these two points.

Current drain is relatively large and a larger than normal battery should be used for an economical life. The eveready type 2362 is ideal, with a life of over twelve months with typical intermittent service.



The circuit of the siren, contributed by Mr C. Trevitt, 6 Gregson Place, Curtin, ACT.

PRECISION SOURCE (contd.)

lowering the voltage at the point to which it is connected. This however, will also lower the voltage at the 3V point and the micro-ammeter will move off centre. In the case of, say, a 1000 ohms/volt Avo the movement will be very definite whereas with a VTVM it would be slight.

Once again, the coarse control is used to obtain approximate zero, followed by the fine control. Once the meter reads zero then, because the 3V point is again correct, the checking point is correct. This applies to any test point from the checking point down to the 3V point.

Below the 3V point only high impedance meters can be tested. The 11 megohms of these instruments would have negligible effect on the basic 300 ohms of the calibrator.

The original meter is 15-0-15 microamps, of 2000 ohm resistance, and one division represents 2mV. Errors of as little as 500uV can easily be detected. A meter of higher FSD can be used but obviously the more sensitive the better. The series resistor must however be chosen so that 3V = FSD.

The 3V reference source uses a Fairchild uA723 voltage stabiliser. In initial tests however, it was seen that variation of the input voltage produced a measurable change on the detection meter. Further stabilisation was introduced by pre-stabilising the input with a zener diode and NPN transistor.

The standard available to set the 3V output had a maximum capability of 1.999 volts, so two accurately matched 47 ohm resistors were placed across the 3V of the IC thereby providing a 1.5V test point. This module was set up with the aid of a Cambridge Vernier Potentiometer which, in conjunction with a mirror galvo, allows accurate measure to 1uV. The voltage across each 47 ohm resistor was checked and the one giving the higher reading shunted by a resistor of the order of hundreds of K ohms to obtain two equal voltages. However, if access could be gained to, say, an accurate digital voltmeter, then the 3V point could be set directly.

The 300V supply is a standard stabilised supply giving up to 40mA output and is quite adequate since it is correctable during use.

The divider network is made up of ¼ watt 2% oxide film resistors which were available in sufficient quantity to enable selection to be made. This was done by using the 0-15-30 volt (for the 10 and 100 ohm resistors) and the 0-150-300 volt (for the 1K resistors) points of a Cambridge Voltage Divider as the bottom two arms of a Wheatstone Bridge with a .05% decade box as the measuring arm against the resistors being tested. The results were most reassuring as rarely did one of these resistors show an error greater than .5% and it is felt that, even without selection, a fair degree of accuracy would have been achieved. The 1 ohm resistors were the Philips 1% wire wound type which again were found to be very good.

The 1 to 300V points are fed to a terminal marked 1 to 300V via a ceramic low contact resistance wafer type switch. The 0-.09V points are fed via one half of a Weston two-pole ten-way switch to a terminal marked 0 to .09V, and the .1 to 1V points via the other half to a terminal marked .1 to 1V. The resistors are mounted directly on the switch in these two cases. The 100 and 1000 ohm resistors are mounted on a piece of fibreglass spot board. The 1.5V (or 3V) "Cal test" point is taken to a terminal on the panel of the instrument. The 300V supply is built directly on the chassis, and the 3V source on a piece of Veroboard.

Before using the calibrator as an accurate reference, check mechanical zero of the micro-ammeter prior to switching on. On switching on the needle will immediately deflect one way but, as the valves warm up, will move back towards zero. After a few minutes warm-up time, the meter is put to approximate centre. Depress the "Sensitivity Button" and bring to centre scale accurately. Set the selector switch to the voltage to be used, connect the instrument being checked to the correct terminal and again adjust coarse and/or fine controls as before. The instrument is now receiving the stated voltage.

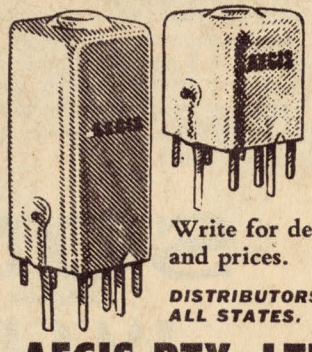
Ultimate accuracy depends very much on the accuracy with which the various stages can be checked and it may be possible to find means of having this done on equipment not regularly available to the user. Even with limited resources it was very pleasing to connect a Keithley VTVM to the calibrator and see its needle settle very close to the right points, even on the 10mV steps where the error was never more than the needle's thickness away. For anyone not requiring the ultimate of accuracy this could be a good "second best" and considerably lower in cost.

(Submitted by Mr R. V. Davies, 14 Barker Rise, Browns Bay, Auckland 10, New Zealand.)

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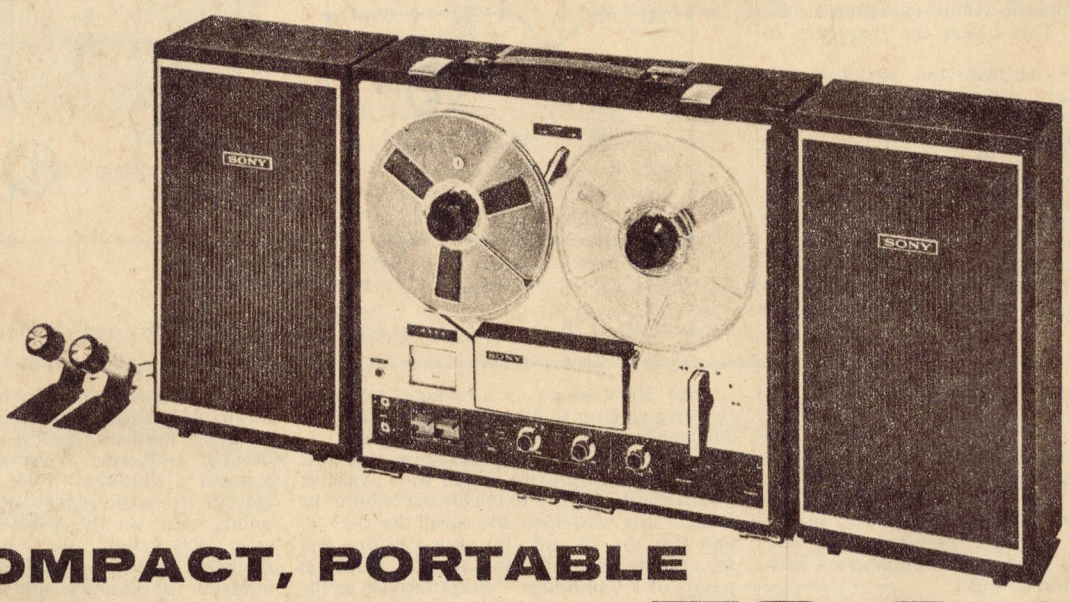


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Microphones, Tape Recorders Public Address.... and all that

These days, enthusiasts are able to choose from a wide variety of microphones for non-professional tape recording, public address, amateur radio and other such activities. Not all, however, understand the limitations of inexpensive units, nor the problems of using microphones of any description in typical situations. This article discusses the subject at enthusiast level.

by NEVILLE WILLIAMS – PART ONE

To many enthusiasts, a microphone is a microphone! If it picks up sound and looks the part, they are not overconscious of its other attributes.

In fact, microphones vary enormously in their quality of workmanship, the principles on which they operate and their suitability for different applications. More than that they vary enormously in their fidelity characteristics, or the faithfulness with which they can translate sound into an equivalent electrical signal for amplification and/or recording.

As with any other product, there is some variation in value-for-money but, by and large, the overall quality is linked with selling price.

Typically the class of microphone supplied with inexpensive tape recorders has a unit value in the region of $5 to $10. Microphones used for professional public address, or outdoor TV and radio interviews may cost several times this figure. Microphones used for broadcasting, television and recording studios are commonly priced in hundreds of dollars. Therefore the enthusiast who acquires a microphone for a few dollars must realise that, appearance and description notwithstanding, it will fall well short of true high fidelity standards.

He will face an up-hill battle in trying to make recordings which will bear any comparison with those made on expensive equipment operating in a carefully selected acoustic environment. There is certainly everything to be said for trying but some disappointment should be expected.

The overall performance of a microphone depends on a variety of characteristics of which the most important is probably its frequency response.

For a high quality microphone, the frequency response will normally be substantially flat over the entire audible spectrum. In general terms this means that, for a given sound intensity, the electrical output will not vary by more than about 20 per cent from a median value, for any frequency between the lower and upper limits of audibility. In more technical language, such a microphone would be described as flat within plus and minus 1.5 decibels between 30 and 15,000Hz.

In practice, a wide, smooth frequency response comes only with meticulous design and an order of control over quality, assembly and testing which is not easily accommodated in an ordinary mass-production line.

Where the objective is to produce a microphone which will sell cheaply and (most likely) stand up to rough handling, performance and consistency both tend to suffer.

Cheaper, poorer quality microphones may exhibit a frequency response which falls away at the low frequency end (typically below 150Hz) or at the high frequency end (typically above 5000Hz). Many, in fact, exhibit a loss at both ends of the spectrum leaving them with what may variously be described as a "rounded" or a "peaky" response curve.

If a microphone is deficient only at the bass end, speech will contain plenty of sibilants but lack "body"; music will contain normal brilliance and overtones but lack the "weight" provided by the deep notes of the piano, organ, double bass, &c.

If a microphone is deficient only at the treble end, speech will lack sibilants and music will sound muffled.

A lack of both bass and treble and a predominance of "middles" tends to produce a somewhat "metallic" quality in both speech and music; the more pronounced the middle-frequency peak, the more metallic and unnatural speech and music will sound.

A notable example of this latter effect is to be heard any day on the "open line" radio programs, where voices originate from an ordinary telephone microphone inset. The speech is usually clear enough – a prime requirement of a telephone circuit – but the voices have a quality which, for lack of a better word, has been described as "metallic".

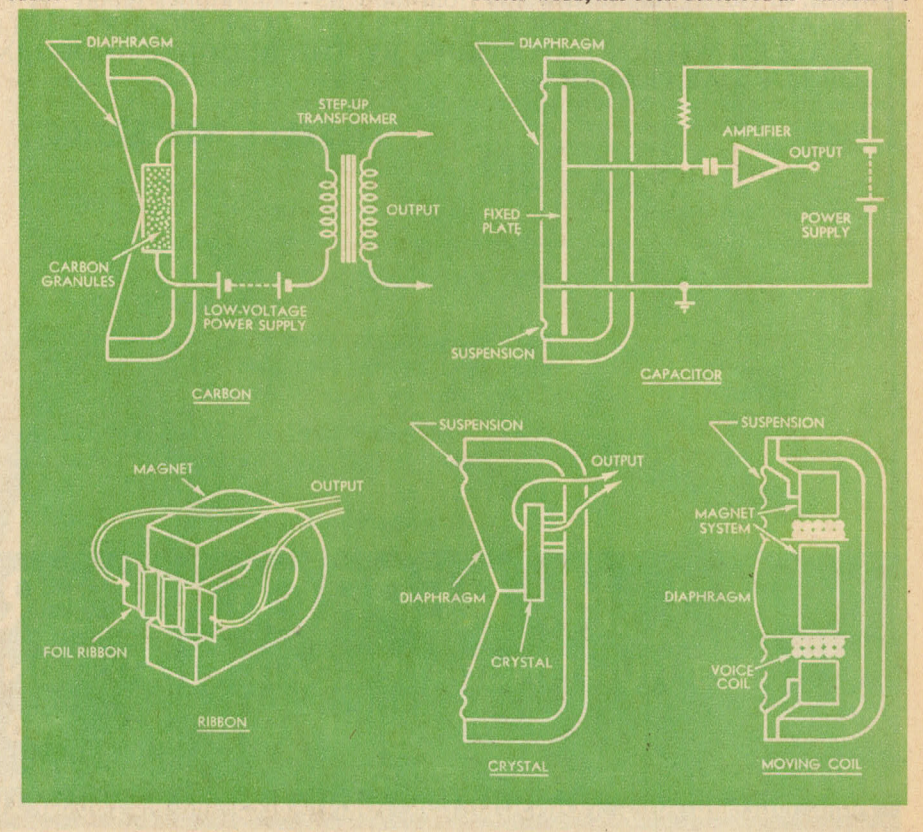


Figure 1: Basic principles of five different types of microphone. Carbon types are restricted mainly to telephone usage. Capacitor (or condenser) and ribbon microphones are widely used for professional work. Crystal (piezo) types were once very popular for non-professional applications but have now largely been displaced by moving coil (or dynamic) units.



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Another important characteristic of microphones has to do with the possible introduction of harmonic and intermodulation distortion. This is evident when the electrical output signal contains frequency components which are not present in the original sound, but which have been created within the microphone itself Good quality microphones are substantially free from this effect and the sound, as finally reproduced, has a clean, unrestricted quality.

On the other hand, when some harmonic and intermodulation distortion is present, the sound takes on a somewhat "edgy" or "rough" quality. With a higher distortion content, the sound becomes noticeably harsh, noticeably muddled and, in an extreme case, it acquires a "choking" quality. The telephone again provides a familiar example where the sound quality may range from somewhat rough to a positively "choking" sound; this is what often prompts the invitation to "give your handset a good, hard bash!"

A number of other characteristics have an important bearing on the performance of microphones and their suitability for various applications. These were, in fact, covered in a general article in our September 1970 issue, to which readers may care to refer. For the present, we shall have a look at the kinds of microphone which have been – or are – most commonly available to enthusiasts, mentioning other characteristics as we come to them.

Before tape recorders transformed microphones virtually into a mass-produced consumer product, enthusiasts who needed such an item either had to make do with some highly unsuitable unit or contrive their own. Many an amateur station went on the air with the operator calling CQ through an old telephone carbon insert, complete with peaky response curve, high distortion content and high noise from the carbon granules. More enterprising operators might have been found with a "Reiss" transverse-current carbon microphone, exhibiting rather better response, lower distortion and lower noise.

At the time, manufacturers sought to meet the obvious but limited need with a variety of commercial microphones which attempted to translate basic principles into units that would work well but (hopefully) not be unduly expensive. Ribbon, moving coil, capacitor and piezoelectric microphones all made their appearance, each with their individual advantages and limitations, but none of them really cheap.

In terms of price, a notable breakthrough came with the emergence of microphone cartridges using a slab of rochelle salt crystal to translate the sound energy into electrical signals. In itself the crystal or "piezo" idea was not new but mass-production techniques resulted in cartridges which sold for something in the region $2 to $4. Mounted in various utility or decorative housings, they became the almost universal choice for mobile radio systems, amateur radio stations, economy public address and hobbyists.

In fact, the first wave of domestic tape recorders came complete with crystal microphones of this general type and thousands of them are doubtless still in use.

How does their performance rate?

Most such inexpensive crystal cartridges (or microphones) used a diaphragm of metal or bakelised paper, coupled by a small metal rod to a slab of rochelle salt crystal. While they were undoubtedly convenient from the viewpoint of equipment design, their performance was mediocre.

In saying this, it is only fair to point out that some crystal microphones were produced offering an order of performance ranging up to professional standards. They were most commonly described as "sound cell" types. However, they enjoyed only limited popularity because their cost put them outside the enthusiast market, while their impedance characteristics complicated their use in professional situations.

Piezo-type microphones have also been produced using a ceramic element (as in ceramic pickups) instead of rochelle salt. However, they have not had a significant impact on the Australian market.

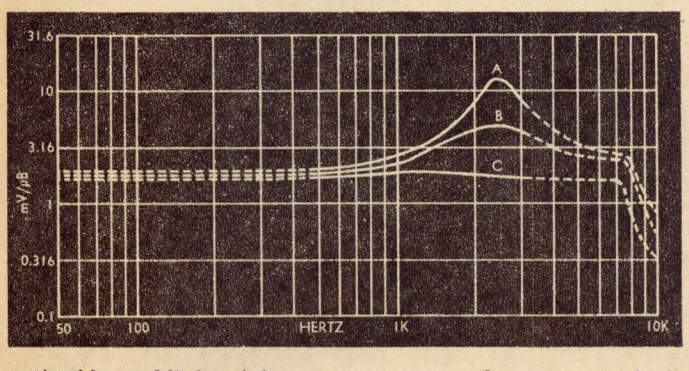


Figure 2: Frequency response curves for typical diaphragm type crystal inserts and crystal microphones. Only the more expensive units with an acoustic filter in front of the diaphragm could approach the response as in curve "C".

Figure 2 shows the frequency response curves for a range of inexpensive crystal cartridges widely distributed on the Australian market both as separate cartridges and as inserts in fully fabricated microphones. They are typical of their class.

The vertical scale is in terms of millivolts of output per microbars of sound pressure but it is so drawn that the major divisions can be interpreted as 10dB steps.

A separate rating quotes the output at 1000Hz as 2.6mV/uB, the level of 1uB being roughly equal to the sound pressure which results from conversational speech 1ft from the microphone. A 4:1 reduction in distance to 3in would increase the sound pressure by about 16:1, giving a typical output of 40mV for close talking conditions into the recommended 5-megohm load. These output figures are typical of diaphragm-type crystal microphones and are about four times the output figures for the sound cell-type crystals mentioned earlier.

In cartridge "A" the diaphragm resonance is largely undamped, producing the highest electrical output but exhibiting a pronounced peak around 2500Hz. Cartridges of this type were popular with operators of mobile radio systems and amateur radio stations because their exaggeration of "voice" frequencies concentrated the transmitter modulation in the frequency range where it would do the most good.

For public address applications, paging systems and reasonable quality tape recorders, cartridge "C" would be a much better choice giving reasonably well balanced speech and passable results on music. The curve might seem to warrant rather more generous adjectives than these but it was taken from a sales brochure and the writer's impression is that, in reality, the bass was not sustained quite as well as depicted, nor was the treble sustained quite as neatly by a plateau above the diaphragm resonance.

A point that should be made is that, in the first generation of tape recorders, it was something of an accomplishment to achieve a

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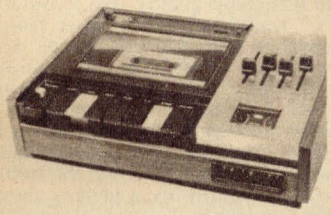
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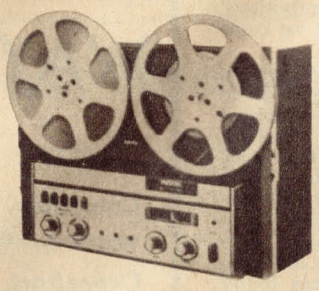
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frequency response which extended to a figure in kilohertz equal to the tape speed in inches. (7.5KHz for 7.5ips, 3.75KHz for 3.75ips, 1.75KHz for 1.75ips.)

With such a tape recorder, microphone "C" would produce a reasonably smooth recording at a tape of 7½ips, but would sound dull at 3.75ips and positively muffled at 1.75ips.

In fact, at 1.75ips, microphone "A" would give a much clearer sound because it would help counteract the roll-off in the recorder characteristic. But, at 7.5ips, microphone "A" would sound very peaky on speech and quite unacceptable on music.

In a case like this, the tape recorder manufacturer may well have decided to supply a microphone like example "B", on the grounds that it would be the best all-round compromise, brightening the recording to some extent at the lower speeds, without introducing too horrible a peak at 7.5ips!

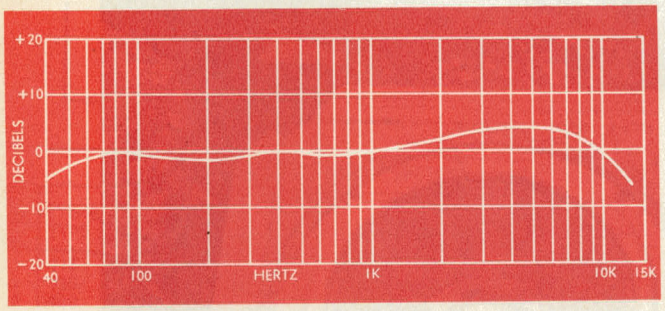


Figure 3: The kind of frequency response that can be expected from dynamic microphones in the $15-$25 bracket. More expensive units would have smoother, wider response; cheaper units, the reverse.

If you have an inexpensive crystal microphone which produces fairly natural recordings of speech and live music at a tape speed of 7½ips, its frequency response, at best, may be something like curve "C" in figure 2.

If, on the other hand, the recording has a metallic or a peaky quality, the response is more likely to resemble curves "B" or "A" – either because that is how the microphone happened to be or because the recorder manufacturer was deliberately trying to prop up the overall performance at the lower tape speeds.

During the past 10 years or so, inexpensive crystal microphones have largely been displaced by inexpensive moving coil or "dynamic" microphones – most of them manufactured in Japan. Various factors have been responsible for the change:

RELIABILITY: Rochelle salt crystals, as used in most piezo microphones, can be destroyed by excessive heat and humidity, both common hazards with portable equipment. Dynamic microphones are free from this problem.

LOAD RESISTANCE: Crystal microphones need to be terminated by a load resistance of the order 2 to 5 megohms. This requirement has presented difficulties with transistorised equipment. Dynamic microphones can operate into much lower loads, commonly of the order of 0.1 megohm.

FREQUENCY RESPONSE: By its very nature, the moving coil assembly in a modern miniature dynamic microphone is inherently more free of prominent peaks than the conventional piezo system of relatively stout diaphragm driving a relatively stiff slab of crystal. The evolution of recorders giving wider frequency response at all speeds, has further encouraged the production of microphones with a smooth response. The average, inexpensive dynamic would at least match curve "C" of figure 2, while those approaching the $20 mark would offer a marked improvement at both ends of the range.

DISTORTION: No figures are to hand but, price for price, dynamic units would compare more than favourably with crystals, particularly at high levels of input sound.

MANUFACTURE: This is straightforward enough to permit a wide selection of dynamic units to be offered within the range $5 to $20.

The vast majority of dynamic microphones are currently being sold as complete units and, as often as not, are packaged with a desk stand and an adaptor to suit a full-length floor stand. However, a few dynamic cartridges are to be found on dealers' shelves selling for between $4 and $10. These could conceivably be mounted in existing cases, although the potential savings by so doing are not great.

As with a dynamic loudspeaker, the voice coil has a relatively low impedance in itself. In the inexpensive units dynamic currently available, 50 ohms seems to be the most common impedance, although higher and lower values may be encountered. If leads from the voice coil are brought out directly, usually via a twin shielded pair, the microphone is normally marked in terms of impedance and, in general terms, described as a "low impedance" dynamic.

The signal voltage available across a coil of such relatively low impedance is insufficient for convenient application to valve or transistor amplifiers and it is common practise to pass the voice coil signal through a step-up transformer, which raises the signal voltage to a figure more appropriate to the needs of a preamplifier stage. An inevitable effect of using such a transformer is that the effective impedance is stepped up also.

In most microphones intended for non-professional use (tape recorders, paging systems, amateur radio, &c) the step-up transformer is included in the body of the microphone. The primary winding connects internally to the microphone voice coil while the secondary connects to 6ft or more of shielded output lead. One side of the secondary is common to microphone case, braid and chassis earth; the other side joins to the shielded "hot" lead.

A dynamic microphone fitted up in this way is commonly known as a "high impedance" unit; it may or may not carry some endorsement in terms of ohms.

At first glance, it might seem that the step-up transformers could be wound to give extremely high orders of voltage gain. In practise, very high ratios would necessitate secondary windings having a large number of turns of very fine wire, increasing cost, reducing reliability and emphasising problems of high frequency loss, due to internal and external shunt capacitance.

From the rather scattered evidence that is available, it would appear that the majority of step-up transformers have a ratio in the range 15:1 to 30:1. This is equivalent to an impedance step-up in the range 225:1 and 900:1. Related to a 50-ohm voice coil it would represent nominal secondary impedances falling in the range 10,000 to 50,000ohms. There is occasional reference to turns ratios as high as 45:1.

The exact significance of impedance figures, either calculated or marked on the microphone itself, is rather vague. The safest thing to assume is that a microphone should not be connected into an amplifier system having an input impedance lower than the nominal value. It is usually preferable to have the input impedance to the amplifier, recorder, &c, higher than the rated impedance of the microphone.

In valve-type equipment and in the more modern solid-state equipment, input impedance should present no problem for the average high impedance dynamic microphone.

Limited input impedance could be a problem with some solid-state circuitry, however, and microphones with transformers in the lower ratio bracket could have a potential advantage in this context.

Placing the step-up transformer inside the microphone case is undoubtedly a convenient arrangement for simple applications, since the microphone can be provided with a shielded output lead ready for direct attachment to the active input circuit of the amplifying equipment.

There is another, more subtle reason: Connected to the input of a high-gain amplifier system, a step-up transformer is likely to pick up hum from nearby power transformers, drive motors, &c. By fashioning the microphone case from ferrous metal, the transformer can be placed inside it and shielded "free"; in addition, the microphone will normally be operated several feet away from the troublesome magnetic fields.

The actual signal output voltage from a high-impedance dynamic microphone depends on many factors, including the design of the magnetic system, the ratio of the step-up transformer and, of course, the loudness and proximity of the sound source.

In general terms, the signal output from the majority of economical high-impedance dynamics appears to be only slightly less than that from the diaphragm type crystal units mentioned earlier. Therefore, dynamic microphones can usually be substituted for crystal types provided the equipment, when operated with crystal microphones did not need the level control "flat out".

In most cases the substitution of a modern dynamic microphone for an older style crystal type will make possible a much smoother type sound, whether for recording or public address. In fact, dynamic types selling in the $20-$30 bracket can provide very acceptable sound, via recorder or amplifier. They are free from obvious peaks and troughs in the frequency range and are not easily overloaded by loud sounds.

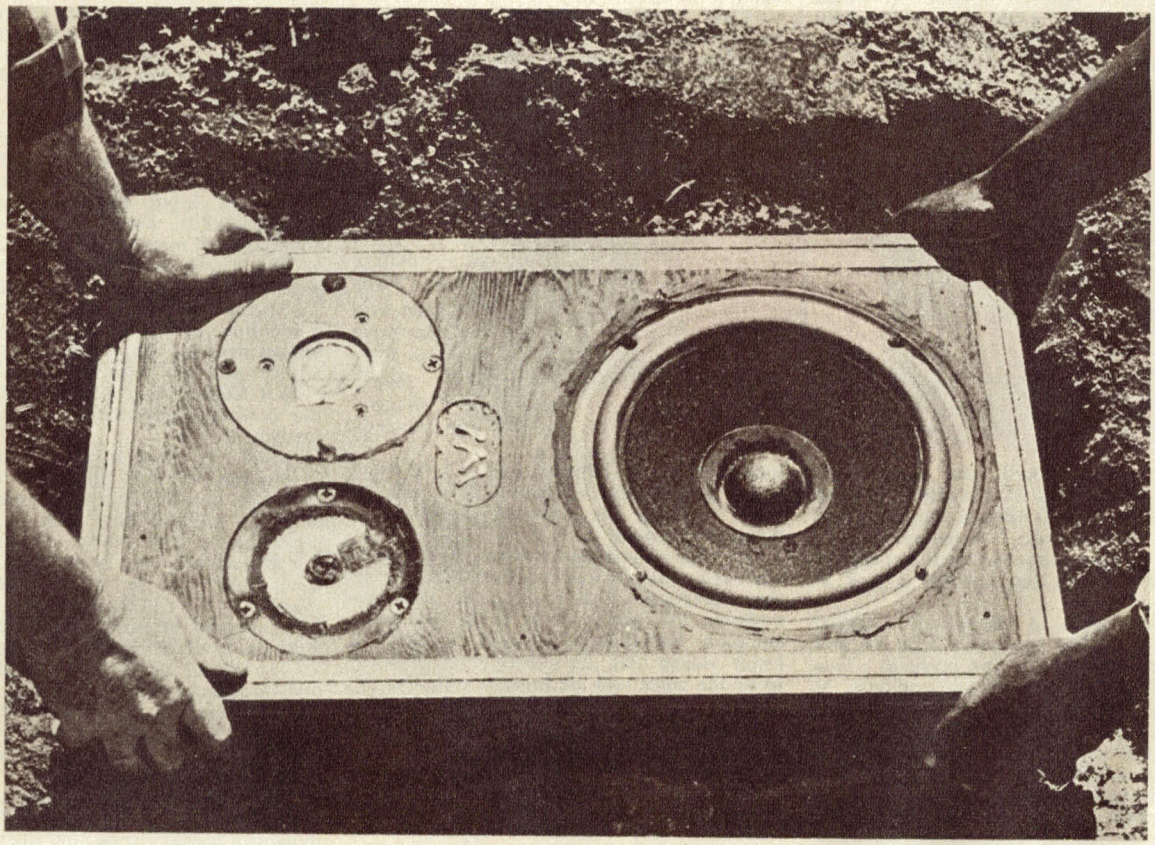
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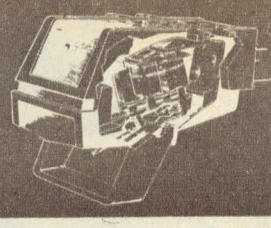
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WDS/FP

STEREO PICKUP SURVEY—addenda



The following details of stereo pickup cartridges completes our survey, the first part of which appeared in the May issue. Space limitations prevented the inclusion of these specifications with the main article.

Magnetic Cartridges

EXCEL CARTRIDGE (Excel Sound Corporation, Japan). Distributor: Goldring Engineering (A'sia) Pty Ltd, 443 Kent St, Sydney 2000.

Excel ES-70S. System: not stated. Response: 15Hz to 25KHz, dB not quoted. Separation: 20dB at 1KHz. Output: 1mV/cm/sec. Tracking force: 1 to 2.5 grams. Compliance: 10 x 10^{-6}cm/dyne. Stylus: 0.6mil spherical, user replaceable. Price: $11.

Excel ES-70F. System: not stated. Response: 10Hz to 30KHz, dB not quoted. Separation: 25dB at 1KHz. Output: 0.8mV/cm/sec. Tracking force: 0.7 to 2 grams. Compliance: 15 x 10^{-6}cm/dyne. Stylus: 0.5mil spherical, user replaceable. Price: $13.

Excel ES-70E. As above, but with 0.3 x 0.8mil elliptical stylus. Price: $24.

Excel ES-70EX. System: moving magnet. Response: 10Hz to 35KHz, dB reference not quoted. Separation: 30dB at 1KHz. Output:0.6mV/cm/sec. Tracking force: 0.7 to 2 grams. Compliance: 20 x 10^{-6} cm/dyne. Stylus: 0.2 x 0.8mil elliptical, user replaceable. Prices on application.

PHILIPS CARTRIDGES. Philips Industries Ltd, 67-77 Mars Road, Lane Cove, NSW 2066.

GP410. System: moving magnet. Response: 30Hz to 18KHz±3dB. Separation: better than 20dB at 1KHz. Output: 1mV/cm/sec. Tracking force: 2 to 4 grams. Compliance: 10 x 10^{-6}cm/sec. Stylus: 0.6mil spherical. Price: $18. Replacement stylus: Price on application.

GP412. System: moving magnet. Response: 20Hz to 20KHz±2dB. Separation: better than 25dB at 1KHz. Output: 1.2mV/cm/sec. Tracking force: 0.75 to 1.5 grams. Compliance: 30 x 10^{-6}cm/dyne Stylus: 0.3 x 0.7mil elliptical. Price: $78. Replacement stylus: Price on application.

GP400. System: moving magnet. Response: not quoted (curve available). Separation: better than 24dB at 1KHz. Output: 1.2mV/cm/sec. Tracking force: 1.5 to 3 grams. Compliance: 20 x 10^{-6}cm/dyne. Stylus: 0.6mil spherical. Price: $29. Replacement stylus: Price on application.

PICKERING CARTRIDGES (Pickering and Co, Inc, USA). Distributor: British Merchandising Pty Ltd, Shaw House, 49-51 York St, Sydney 2000.

XV-15/AM. System: moving magnet. Response: 10Hz to 25KHz, dB reference not quoted. Separation: 35dB. Output: 1.1mV/cm/sec. Tracking force: 1 to 3 grams. Compliance: not quoted. Stylus: 0.7mil spherical, user replaceable. Price: $35.55. Replacement stylus: $20.95.

XV-15/AME. System: moving magnet. Response: 10Hz to 25KHz, dB reference not quoted. Separation: 35dB. Output: 1mV/cm/sec. Tracking force: 0.75 to 1.5 grams. Compliance: not quoted. Stylus: 0.2 x 0.9mil elliptical, user replaceable. Price: $46.35. Replacement stylus: $33.15.

XV-15/AT. System: moving magnet. Response: 10Hz to 25KHz, dB reference not quoted. Separation: 35dB. Output: 1.5mV/cm/sec. Tracking force: 2 to 5 grams. Compliance: not quoted. Stylus: 0.7mil spherical, user replaceable. Price: $32.25. Replacement stylus: $17.80.

XV-15/AC. System: moving magnet. Response: 10Hz to 20KHz, dB reference not quoted. Separation: 35dB. Output: 1.5mV/cm/sec. Tracking force: 3 to 7 grams. Compliance: not quoted. Stylus: 0.7mil spherical, user replaceable. Price: $29.35. Replacement stylus: $14.65.

NOTE: All the Pickering cartridges listed above have a patented "V-Guard" floating stylus designed to protect stylus and record against damage; also a "Dustamatic" record cleaning brush, attached to the body.

Crystal and Ceramic Cartridges

ACOS CARTRIDGES (Cosmocord Ltd, UK). Distributor: Amplion (A'sia) Pty Ltd, 29 Majors Bay Rd, Concord, NSW 2137.

Acos GP93/1. System: crystal. Response: 40Hz to 18KHz (curve available). Separation: 15dB at 1KHz. Output: 250mV/cm/sec. Tracking force: 4 to 8 grams. Compliance: 2.2x10^{-6}cm/dyne. Stylus: Dual turnover type, 0.6mil spherical (LP), 2.5mil (78). Price: $8.85. Replacement stylus: $5.

Acos GP94-1. System: ceramic. Response: 40Hz to 12KHz (curve available). Separation: 18dB at 1KHz. Output: 110mV/cm/sec. Tracking force: 3 to 6 grams. Compliance: 5 x 10^{-6}cm/dyne. Stylus: as above. Price: $8.95. Replacement stylus: $5.

Acos GP 104. System: ceramic. Response: 40Hz to 15KHz (curve available). Separation: 20dB at 1KHz. Output: 100mV/cm/sec. Tracking force: 3 to 4 grams. Compliance: 20 x 10^{-6}cm/dyne. Stylus: dual turnover type, 0.5/0.7mil spherical (LP), 2.5/3mil (78). Price: $9.95. Replacement stylus: $5.

BSR CARTRIDGES (BSR Ltd, UK). Distributor: Goldring Engineering (A'sia) Pty Ltd, 443 Kent St, Sydney 2000.

BSR SC9M. System: ceramic. Response: not quoted (curve available). Separation: better than 15dB at 1KHz. Output: 77mV/cm/sec. Tracking force: 2 to 6 grams. Compliance: 5.6 x 10^{-6}cm/dyne. Stylus: LP and 78 turnover type. Prices on application.

BSR SC7M. System: ceramic. Response: not quoted (curve available). Separation: better than 15dB at 1KHz. Output: 220mV/cm/sec. Tracking force: 2 to 6 grams. Compliance: 7.5 x 10^{-6}cm/dyne. Stylus: LP and 78 turnover type. Prices on application.

BSR SC5M. System: ceramic. Response: not quoted (curve available). Separation: better than 15dB at 1KHz. Output: 110mV/cm/sec. Tracking force: 2 to 6 grams. Compliance: 6.3 x 10^{-6}cm/dyne. Stylus: LP and 78 turnover type. Prices on application.

BSR SC5H. System: ceramic. Response: not quoted (curve available). Separation: better than 15dB at 1KHz. Output: 190mV/cm/sec. Tracking force: 5 to 7 grams. Compliance: 1.95 x 10^{-6}cm/sec. Stylus: LP and 78 turnover type. Prices on application.

CONNOISSEUR (A. R. Sugden & Co (Engineers) Ltd, UK). Distributor: Encel Electronics Pty Ltd, 431 Bridge Rd, Richmond, Vic 3121.

Connoisseur SCU1. System: ceramic. Response: 30Hz to 16KHz (curve available). Separation: 25dB at 1KHz. Output: 50mV/cm/sec. Tracking force: 2 to 4 grams. Compliance: 12 x 10^{-6} cm/dyne. Stylus: 0.5mil spherical. Price: $13.50. Replacement stylus, $4.50.

DECCA CARTRIDGES (Decca Record Co Ltd, UK). Distributor: British Merchandising Pty Ltd, Shaw House, 49-52 York St, Sydney.

Decca Deram. System: ceramic. Response: 18Hz to 18KHz±3dB. Separation: better than 20dB at 1KHz. Output: 50mV/cm/sec. Tracking force: 2.5 grams. Compliance: 9 x 10^{-6} cm/dyne. Stylus: 0.5mil spherical or 0.3 x 0.7mil elliptical. Price: $14.50 with spherical stylus; $18.50 with elliptical stylus. Replacement styli: spherical $5.70; elliptical $9.60.

PHILIPS CARTRIDGES. Philips Industries Ltd, 67-77 Mars Road, Lane Cove, NSW 2066.

GP233. System: ceramic. Response: not quoted (curve available). Separation: better than 20dB at 1KHz. Output: 1mV/cm/sec. Tracking force: 1.5 to 3 grams. Compliance: 8 x 10^{-6}cm/dyne. Stylus: 0.6mil spherical. Price: $16. Replacement stylus: Price on application.

NOTE: The characteristics of this cartridge have been arranged to suit the "magnetic inputs of amplifiers"

GP200. System: ceramic. response: not quoted (curve available). Separation: better than 20dB at 1KHz. Output: 65mV/cm/sec. Tracking force: 3 to 7 grams. Compliance: 2.5 x 10^{-6}cm/dyne. Stylus: 0.7mil (LP) and 30mil (78), turnover head type. Price: $13.20. Replacement styli. Price on application.

ERRATA. Please note the following corrections to the list in the May issue:

ADC 660-XE. Frequency response 10Hz to 20KHz.

ADC 220-XE. Output 1.1mV/cm/sec.



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CLASSICAL RECORDINGS

Reviewed by Julian Russell

Barenboim, Klemperer in Beethoven concertos

BEETHOVEN – Piano Concerto No 1 in C Major. Daniel Barenboim with the New Philharmonia Orchestra, conducted by Otto Klemperer. His Master's Voice Stereo OASD 2616.

BEETHOVEN – Piano Concerto No 2 in B Flat Major. Daniel Barenboim with the New Philharmonia Orchestra, conducted by Otto Klemperer.
Choral Fantasia. The same artists, with the John Alldis Choir added. His Master's Voice Stereo OASD 2608.

There has always been some doubt about the chronology of these two concertos though it has been known for some time that the second was written before the first. The sleeve notes by Burnett James for the C Major Concerto, states categorically that: "the C Major Concerto, although put down as No 1 was in fact the second ... It was written in 1797, whereas the B Flat dates from 1795 in its original version and was revised for a performance in Prague in 1798 – hence the later opus number".

Both works still display characteristics of 18th century rococo style which was soon to give way to the romantic movement of the 19th century. But already Beethoven's own strong personality was beginning to assert itself in characteristic fashion.

Unlike the same performers' performance of the Third Concerto which I reviewed last month, these two demand that you either fall completely under the spell of the Klemperer-Barenboim collaboration or reject them althogether. An orthodox listener will find many points were he can quote the score to support his objections. Perhaps I am happily placed in being able to accept both the Klemperer-Barenboim readings at the same time as the more conventional ones by other fine present-day pianists and conductors. I don't mean by this that either Barenboim or Klemperer do anything outrageous to the music. Age (in Klemperer) meets youth (in Barenboim) half-way to adjust to the younger man's fresh examinations of the scores, and though the older's influence can often be detected in insistence on steadily paced tempos he is too fine an artist ever to be at complete odds with his soloist. There must have been many interesting discussions before the concertos were recorded and even more during the recording sessions.

Barenboim's playing in both concertos is full of the most graceful but never ingratiating nuancing. It has both sparkle and poetry. And if Klemperer's tempos are sometimes characteristically on the slow side he has Barenboim's almost mystical concentration to hold the tension. Personally I would rather acclaim this eminently fresh approach than still another irreproachable performance of works that have been repeated in the orthodox manner for just on 200 years. For the sake of comparison one might recall just how many different fine performances of the role of Hamlet have been acclaimed since the play was written – and some perhaps reviled, too. Here then are two performances of the concertos that you may or may not approve but which will most certainly give you something to think about. And if you do approve, then I expect your enthusiasm for them will be as great as my own.

While the C Major occupies both sides of a 12-inch disc, room has been found on the second side of the B Flat to include a grand performance of the Choral Fantasia. It is not one of my favourite Beethoven works but as presented here it will almost certainly "get you in". Barenboim is in top form in the piano part, the John Alldis Choir sings magnificently, and Klemperer's steely but pliant grip of the whole ensemble makes it all sound perhaps a little better than it really is. It would be trite to point out here the resemblance between the setting of Kuffner's ode in praise of the appreciation of art to Beethoven's setting of the Schiller ode in the Ninth Symphony. The first was obviously a sketch for the later work. In this section of the composition the Choir sings really joyously, and by that I don't mean with mere boisterous gaiety.

★ ★ ★

ELIZABETHAN LUTE SONGS – Peter Pears (tenor) and Julian Bream (lutenist) in a recital of songs by Dowland, Rosseter, Morley and Ford. RCA Stereo LSC3131.

There are eight songs by Dowland, three each by Morley and Rosseter, and two by Ford on this attractive disc. Although John Dowland was one of the world's greatest songwriters he is represented only scrappily in the literature of the gramophone. But it must be remembered that although his has always been a respected name among Elizabethan composers, little of his music was known until comparatively recently. Peter Warlock, in his book "The English Ayre" published in England in 1924, writes as follows in his introduction, quoting from James Joyce's "Ulysses":

> "When Mr Leopold Bloom, wandering home through the streets of Dublin in the small hours of the 16th of June, 1904, grew lyrical over the music of Meyerbeer and Mercandante, Martha and pseudo-Mozart, his companion Stephen Dedalus, 'launched out into praises of Shakespeare's songs, at least of in or about that period, the lutenist Dowland who lived in Fetter Lane near Gerard the herbalist, and Farnaby and son with the *dux* and *comes* conceits and Byrd (William), who played the virginals in the Queen's Chapel or anywhere else he found them and one Tomkins who made toys and ayres and John Bull'.
>
> "Exactly how Stephen Dedalus contrived to acquaint himself with the works of Dowland 20 years ago is not very clear; for although he would have found plenty of Byrd, Farnaby, and Tomkins in the Fitzwilliam Virginal Book ... the songs of Dowland and his fellow lutenists were still inaccessible to the general public".

Much more of Dowland's music is now accessible to the general public and it is a pity that such a treasury should have been largely ignored by the recording companies. His contributions in this recital are far above those of the other composers of his period. For the most part Dowland shared with the present generation a resentment of things as he found them. His music is, for the most part, full of harsh disillusionment although he could, and did, sometimes write in a merrier mood. He is admirably represented on the record under review. Whether or not you like the quality of Peter Pears' voice – and I am one who doesn't – there is no gainsaying his musicianship and sense of period style. Despite his tight, occasionally almost strangulated delivery, there is no questioning his authority. And he has in his accompanist, Julian Bream, one of the world's finest lutenists and a distinguished scholar of Elizabethan and later Tudor music.

Although I have selected the Dowland songs for special mention I found the whole disc enchanting, the songs beautifully contrasted in mood, and arranged in an order that does not lump together, in brackets, the songs of any one composer but presents them in an order that makes the whole recital full of diversity. And Warlock would have been delighted to have heard them given as they are here, in the form in which they were originally composed. Indeed, in "The English Ayre" he expressed with his usual vigour, his opinion on this point by quoting a "slightly

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adapted" poem by Samuel Butler, which goes:

"May he be damned for evermore
Who tampers with a printed score;
May he by poisonous snakes be bitten
Who writes more parts than we have written.
We tried to make our music clear
For those who sing and those who hear,
Not lost and muddled up and drowned
In turgid 'pianistic' sound;
So kindly leave the work alone
Or do it as we want it done".

All those who agree with these sentiments will be sure to enjoy every band on this outstanding disc.

★ ★ ★

SONGS OF CATALONIA. A recital of 13 Catalan songs by Victoria de los Angeles with the Patronato Orquesta Ciudad de Barcelona or the Lamoureux Orchestra de Paris, conducted by Antonia Ros-Marba. His Master's Voice Stereo OASD2517.

Victoria de los Angeles is a Catalan, a native of that sturdily independent province of Spain which has during the last century alone produced such world figures as Picasso and Casals, to mention only two. For this reason, if for no other – and there are plenty – I accept unquestioningly the authenticity of her interpretations of the songs offered here. She has been singing in public since 1944 yet her beautiful voice remains as fresh as a young girl's, and her sense of pitch is as secure as ever. If anything she has gained flexibility of expression since she was first heard – and immediately acclaimed. She sings here in the Catalan dialect, which is much more closely related to modern French than to Spanish.

I found all the songs, without exception, beautiful to listen to. All are richly harmonised and sumptuously scored. Some are brief, others longer, some sad, some gay. Over them all hovers the slightly sombre quality of the Spanish character even at its most vivacious. Since there are 13 songs in all I have not the space to mention them separately. But if you would like to try one as a sample, I recommend you choose "Maig", which you will find on Band 3 of Side 1. And Band 5 on the same side, "La Dama d'Arago", will reveal to you just how beautiful de los Angeles' low register has become. On Side 1 she is accompanied by the Patronato Orquesta Ciudad de Barcelona, an orchestra which plays so splendidly under Antonio Ros-Marba that you may well wish, with me, that more of its work were available on disc. On the second side the orchestra is the Lamoureux of Paris under the same conductor. The engineering of the whole disc is faultless.

★ ★ ★

PIANOFORTE RECITAL. Egon Petri plays transcriptions by Liszt. World Record Club Stereo S/3123.

Petri was 80 years old when he made this record back in 1961. It has now been reissued by the World Record Club in their Connoisseur Series. For some reason or other transcriptions are disparaged by a large section of the musical public. While some of them are patently rubbish a good composer can make a transcription a really worthwhile piece of music. It should be borne in mind that the great J. S. Bach himself had no qualms about transforming other composers' works by arranging them for solo or groups of instruments other than those for which the work was originally intended for performance. Some of the transcriptions on

this disc are worth more than casual attention, though it wouldn't worry me if I never come across Mendelssohn's Wedding March again in the banal form it is presented here.

Not often heard nowadays is the Fantasia on Two Motives from Mozart's "Marriage of Figaro" which was left uncompleted by Liszt and finished many years later by Busoni. You will also find, in addition to the Wedding March, the Elfin Chorus from Mendelssohn's "Midsummer Night's Dream", the Waltz from Goundo's arrangement of Liszt's own Mephisto Waltz. I found the record of special interest as an example of the playing of a great pianist, admittedly past his prime, but still offering much to admire and enjoy. There is occasionally some rhythmic unsteadiness – the Faust Waltz suffers worst in this respect – but the playing is still wonderful when you think how few octagenerians can write a legible hand. The recording shows evidence of its age in lack of resonance, but the piano tone, though light, is always clear and undistorted.

★ ★ ★

TORROBA – Three Nocturnes for Two Guitars and Orchestra. Graciela Pomponio and Jorge Martinez Zarate (guitars) and an unnamed orchestra conducted by Torroba. Seven Pieces for Guitar Duo, played by the same two guitarists. Record Society Stereo No S/6368.

Until recently, Federico Moreno Torroba was best known outside his native Spain by his zarzuelas, a Spanish form of short comic opera, some of which were recorded by Philips at the very beginning of the LP period. The growing popularity of the guitar has made much more of his music available nowadays in recorded form. The Three Nocturnes for Two Guitars and Orchestra are really in concerto form despite each bearing its own title: No 1, The Firesides; No 2, Shadows; and No 3, The Sorcerers. The music shows many influences from other sources at work at the early part of this century, especially that of Debussy, Falla and Granados. But despite this pastichism the first is a slumbrous, evocative piece, the second a poetic reverie, and the last a brisk and often witty finale.

The unnamed orchestra is ably conducted by the composer who is now in his 80s. Both guitarists play very excellently indeed and the difficult job of balancing their instruments against the orchestral accompaniment has been very efficiently handled.

The Seven Pieces for Guitar Duo are unaccompanied. There is a Prelude, a Romance of the Pines, a Capriccio, an Improvisation, a Bolero and a final Rondo. These, too, are beautifully played in a collaboration so sympathetic that one might well be listening to one instrument most of the time. I did not find the pieces, though never less than pleasant, anything more than mildly interesting. But the vast audience that nowadays exists for the guitar might well think otherwise.

★ ★ ★

ELGAR – Symphony No 1 in A Flat. London Philharmonic Orchestra conducted by Sir Adrian Boult. World Record Club Stereo S/4515.

I reviewed the World Record Club's reissue of Elgar's Second Symphony in the April issue of this magazine. Now the First Symphony is also available, played by the same orchestra and conductor. The reissue of these truly noble symphonies is welcome, especially at the club price to members. Many music lovers and musicians have a slight preference for the Second Symphony. I am one of the odd men out who prefer the First. It is now common knowledge that, while the reception of the first performance of the First Symphony was quite extraordinarily enthusiastic, the Second was received with much more reserve. Since then affection for the Second has grown but I still stick to my old allegiance. The only other recorded performances of the two symphonies which can be favourably compared to Boult's are Barbirolli's. In passing, I might mention that some years ago I heard Sargent give a great performance of the First in the Sydney Town Hall.

I find it difficult to plump for one conductor at the expense of the other. Each has his very great merits and each his own ideas of just how the symphonies should go, though the differences in interpretation are mostly minimal. If anything Boult follows Elgar's interpretative markings a shade more closely than Barbirolli. But then the composer himself was never consistent in the way he presented them and those who heard him conduct them noted quite wide variations in his tempos from one performance to the other. One fact is indubitable – that both Barbirolli and Boult enter fully into the spirit of the music, so much so that a detailed comparison would not, in my opinion, be profitable, even if space made this possible. It would simply boil down to an examination of metronome markings and occasional differences of expression. If you are without either sets I can recommend the Boult without hesitation. If you have only the Barbirolli I don't think the added expense of acquiring the other would be justified except in out of the ordinary circumstances. Both works are probably the finest of the last great symphonies in the 19th century dialectical style. They have true symphonic stature, something rarely encountered today, though one must always bear in mind those of Sibelius. And if you settle for the Boult recordings at the WRC's price, I can safely guarantee that you will not be disappointed. The sound is first rate, too.

★ ★ ★

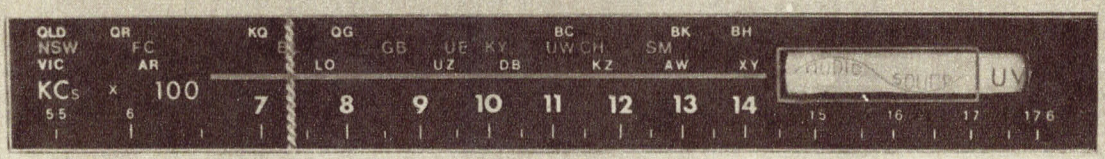
TCHAIKOVSKY – Piano Concerto No 1 in B Flat Minor. Ivan Davis and the Royal Philharmonic Orchestra conducted by Henry Lewis. Decca Phase 4 Stereo PFS4196.

Here is an exuberantly virtuoso performance of a frankly virtuoso concerto. And such is the elan with which Davis plays that it more than excuses the many small tamperings he makes with the composer's markings. The work itself can stand them, for if ever a concerto gave licence for a variety of interpretations it is this one. Davis' deviations are never of the undisciplined kind, even when he uses very widely stretched rubatos.

A very alert conductor is needed to follow such a soloist, and Henry Lewis is never at a loss to provide an exemplary accompaniment. There are times when Lewis is obviously surprised, but he is always able to cope. For instance Lewis takes the opening of the slow movement at a slower than usual tempo, but when Davis enters his tempo is slower still. Yet Lewis adjusts immediately without any hint of distress. And as a contrast I cannot recall ever having heard, in the same movement, the little French nursery tune taken quite so fast and still sound absolutely right. Davis also takes the brilliant finale at a terrific pace that extends even his colossal technique. But he gets through it all without an accident. And when you come to the coda

(Continued on page 99)

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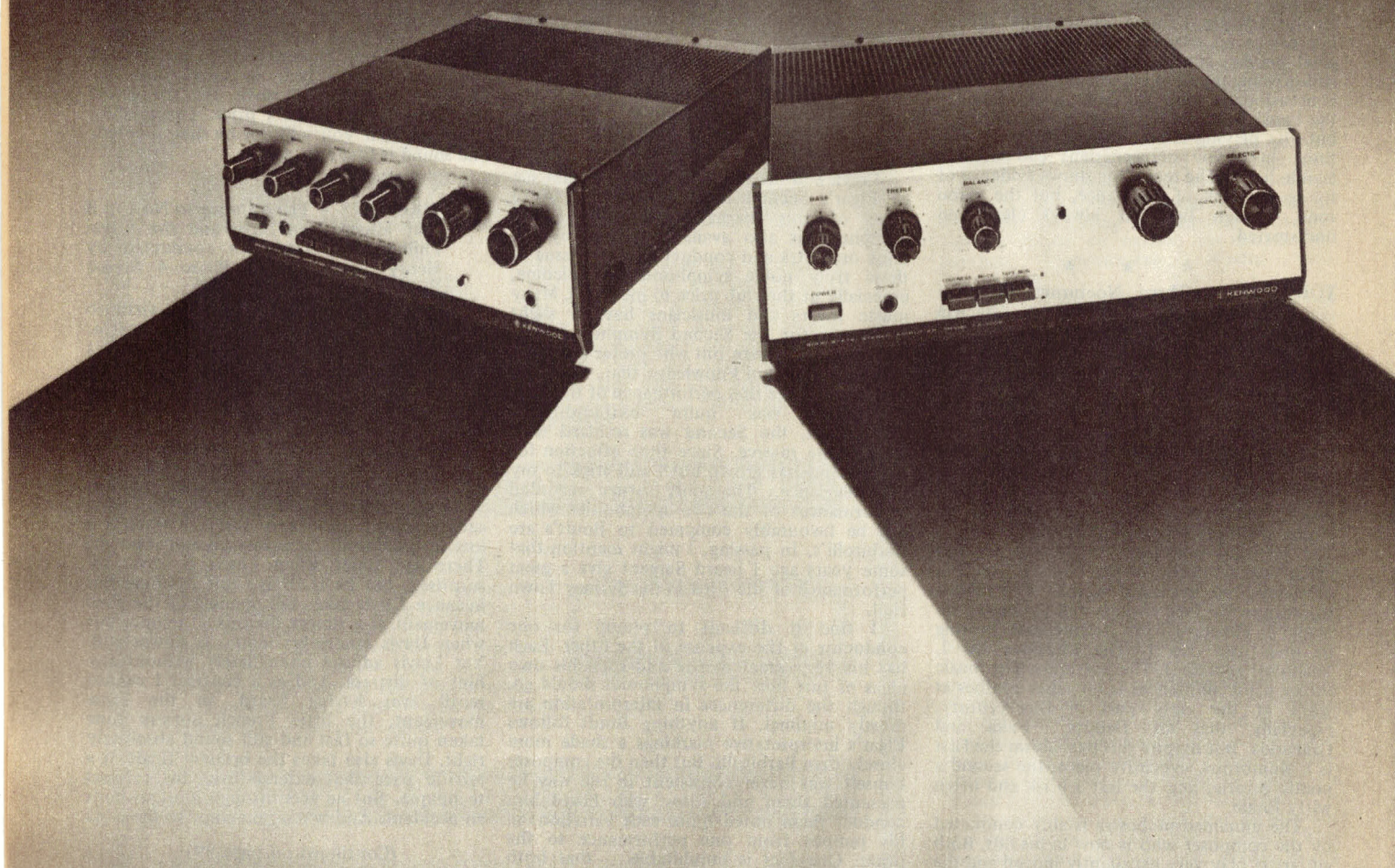
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PERCY WILSON

Manufactured by Goldring Manufacturing Company (GB) Ltd., 486-488 High Road, Leytonstone, Londo[illegible]11. Manufacturer's specifications: TURNTABLE: [illegible]ns: 200/240 V. 50Hz. Mains switch fully click[illegible] 4-pole constant velocity motor (15 VA). variable speed adjustment. Adjustable stop 45 and 78 rpm. 9 lb. non-magnetic dyn[illegible] turntable, Wow and flutter measured, ac[illegible] spec., 0.06%. Rumble measured, according [illegible] -60db. Speed variations + 0.2% for 10% m[illegible] change. Automatic disengagement of Idler whee[illegible] sions: front to back: 13in. Side to side: 15 in. TRANSCRIPTION ARM: Pickup arm with counter-ba[illegible] weight and bias compensatibn (anti-skating) adjustn[illegible] Knife-edge bearings. Stylus pressure adjustable from 0. to 5 grams., with sliding weight. Minimum stylus pressure 0.5 gram. Removable lightweight pickup headshell). Total length of pickup arm: 12.4 in. Tracking length (distance from pedestal to centre of turntable) 8.3 in. Overhang of stylus 0.675 in. Total adjustment for stylus position: ½ in. Offset angle: 23° 12'. Tracking error + 0.8°. Can accommodate any cartridge. Hydraulic lowering device.

I have now had one of these transcription units on test for over six months; and some of my professional colleagues have made independent assessments which agree with mine. So, let me not beat about the bush, but declare my verd[illegible] straight away. This is, quite simply, th[illegible] GL.75 is easily the best integrated turn[illegible] arm unit that the partnership betwe[illegible] Goldring have yet produced.

This is, of course, a mouth[illegible] ship's products have lon[illegible] in the front rank. I h[illegible] in declaring tha[illegible] reckoned with i[illegible] cumstances, any[illegible] Having made tha[illegible] not merely of fa[illegible] justify it by stati[illegible] tests. In this I s[illegible] cription that can [illegible] ifications. I shall only co[illegible] the performance.

First of all, I must refer to one[illegible] features. This is the facility of [illegible] tinuous variation of turntable speed. Fo[illegible] icians and others who have the ability to h[illegible] perfect pitch, this is a unique advantage. No other turntable I know has this facility.

It is secured by having a drive through an idler wheel which travels across the radius of the turntable. This idler wheel rotates about a horizontal axis and its plane is vertical. It is sometimes thought that any rumble vibration should not affect the mono output. But this is a too hasty and wrong opinion. In practice this type of design in which the idler wheel is at right angles to the turntable is more prone to rumble possibility of rumble all right, but I also found that the makers' recommendations had indicated the answer. In the first place, the motor plate must be mounted, as specified, on a motor board [illegible]ast ¾ inch thick. Do not on any account go [illegible]ch. If the motor board in your cabinet [illegible]this, then stick a sheet of Celotex [illegible]t any natural resonance.

[illegible]are taken in mounting; [illegible] possibility of [illegible]his report [illegible]ner-

Thu[illegible] vital, [illegible] off and [illegible] never[illegible] id[illegible]

[illegible] of acco[illegible] pro[illegible] [illegible]her vertical or [illegible]d - of the order of 2[illegible] the 300 to 400mgm. which [illegible]rd in transcription arms only a [illegible]

There is ample provision [illegible]uring the lateral balance which is so important for achieving stability in tracking and freedom from vibration

lateral effect. This latter feature has an additional advantage: it enables the centre of gravity of the whole arm system to be lowered almost to the level of the record surface.

The counterweight is also decoupled by a compliance from the tone-arm proper in order to mitigate some possible low frequency resonance effects. I have never been altogether persuaded as to the necessity of this feature, though I suppose it must be all to the good if it reduces the possibility of 'judder'. You know what I mean: the liability for the whole system to [illegible]hudder at the outer grooves at the very light [illegible]eights which some people advocate.

[illegible]laying weights below 1 to 1½ grams [illegible]w, undesirable. As an exercise, I [illegible]to ½ gram and in some circum- [illegible]¼ gram; and this arm is capable [illegible]sonably down to ½ gram. But [illegible]at to go below about 1 gram [illegible]playing conditions especially [illegible]t been scrupulously cleaned [illegible]posits which come from [illegible]d household sprays (in-

[illegible]riticism of the specif- [illegible]um operating conditions [illegible]y possible to maintain as [illegible].8° for the tracking error [illegible]in. and 6 in. with a 9 in. arm [illegible]2in. arm). An angular offset [illegible] quite the optimum value. I [illegible]matical analysis of this as long [illegible]25; and mathemtics does not

[illegible]ror of statement (which should [illegible]s not of serious importance in [illegible]s possible with a 9 in. arm (bearing [illegible]to reduce the tracking error to less [illegible]everywhere and that is adequate in re- [illegible]playing even with a bi-radial (elliptical) [illegible]us.

particularly like the lowering device. One just flicks a lever and hydraulics do the rest, placing the stylus ever so gently into the groove; and the lever is in a forward position and not tucked close to the arm bearing, as it so often is in other designs. The anti-skating device is the familiar thread and weight system which seems to have become standard nowadays. It is effective, if a little clumsy.

SUMMARY: On the whole the Goldring GL.75 turntable/arm combination is a well thought out and reliable design, capable of tracking a suitable

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you leave all anxiety behind. The brio of this movement left me literally breathless.

I am, however, not so keen on the Phase 4 engineering. The piano sometimes sounds a little larger than life size with resultant upsetting of the balance between soloist and orchestra. This was an early Phase 4 recording and the technicians were apparently not yet quite comfortable in the new medium. But I found Davis's sheer exhuberance so exhilarating – and this is not to mention some of his more refined, delicate passages, too – that I had no difficulty in forgiving such minor lapses. But then again, you may not feel quite so lenient in assessing the engineering quality of what is most certainly a very exciting performance.

★ ★ ★

DVORAK – Symphony No 1 in C Minor, "Bells of Zlonice". London Symphony Orchestra conducted by Istvan Kertesz. World Record Club Stereo S/4844.

It is not so long ago that this disc, together with all the other Dvorak symphonies played by the LSO under Kertesz, was issued in Australia by Decca at a top price. Now it can be bought by club members at the World Record Club's economy figure. It is a very early work which, only by luck, escaped destruction by its composer. It is, however, by no means insignificant for that reason. The symphony already bears evidence of the composer's later, highly individual style. You have much brilliant scoring, full of colour, for the orchestra. And if the working-out sections don't display all the resource which the composer was soon to acquire, they are still interesting in their own right.

The symphony was not performed for the first time till 1936, 32 years after Dvorak's death. As a rule he revised such early works, tightening up their construction and adding counter-themes to give the work added interest. This didn't happen to his first symphony for the simple reason that Dvorak never heard it performed. There is nothing condescending in Kertesz approach to the music. It is obvious from the splendid playing of the orchestra that every care was taken in its preparation. And Kertesz is a conductor with a quite outstanding affinity for Dvorak's music. It is to be hoped that the rest of the Decca series by the same musicians will be made available to World Record Club members at this reduced cost.

★ ★ ★

BEETHOVEN – Triple Concerto in C Major for violin, piano, cello and orchestra. David Oistrakh, violin, Sviatoslav Richter, piano, and Mstislav Rostropovich, cello, with the Berlin Philharmonic Orchestra, conducted by Herbert von Karajan. His Master's Voice Stereo ASD2582.

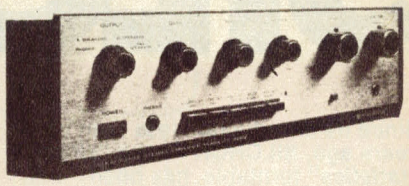
Beethoven can be said to have bent – or a least reshaped – most musical forms to his will – piano sonata, symphony, string quartet and so on. Two of his questionable failures, however, were opera ("Fidelio") with its mixture of styles and ungainly proportions, and the Triple Concerto. Despite the concerto's impressive stature, one hears too often, especially in the two outer movements, each theme stated by all three soloists in turn. The result is predictability, an unusual aspect of Beethoven's other works. However, the distinguished trio who play the work on this new recording go far to help one forget the work's formal shorthcomings. Not only are all three perhaps among the very greatest in their own special fields in Russia, the rest of the world together would be hard put to it to field such a prestigious team. And I am not forgetting the players who gave such a fine account of the concerto for CBS some years ago – Stern, Rose and Istomin.

One difference between the two recordings strikes the listener immediately. In the CBS version it was the violinist Stern who made most of the going. In the new EMI it is the cellist, Rostropovich. Now this "first among equals" situation might have happened because of the structure of the work, for Beethoven gave the initial statement of the themes in the two outer movements to the cello. And Rostropovich phrases each entry with such superb taste that his associates are quite happy to follow his lead and conform to his understanding of the music. I don't mean by this that he is slavishly followed. Oistrakh and Richter are no stooges to blindly imitate another artist. They have their own very definite opinions on how whatever they play should be made to sound. The reason here, as I see it, is that neither Oistrakh nor Richter could find any way of improving on Rostropovich's ideas. Without disrespect I might quote the old adage, "If you can't lick 'em, join 'em".

The playing throughout by all three reaches an almost unimaginable standard of perfection. Their rapport is faultless. They play as if one brain were directing six pairs of hands. The sound is good, too, except for one feature that cannot be ignored – the heavy orchestral tuttis have a congested quality more suitable to some conductors' handling of Brahms. Otherwise the HMV engineers have provided a warm, generous acoustic admirably designed to do justice to the soloists' many subtleties. However in view of the overall spendour of every other feature of this magnificent recording including Karajan's orchestral part, it seems churlish to mention this blemish. And I must admit that it did only little to impair my enjoyment of the whole production.

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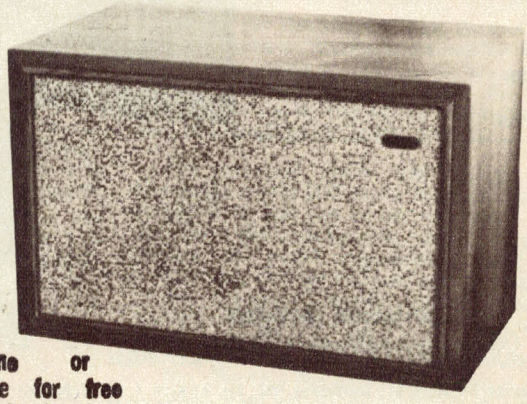
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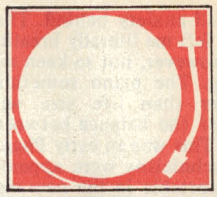
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VARIETY FARE

REVIEWS OF OTHER RECORDINGS

Devotional and Classical Organ

NEW KIND OF HAPPINESS. Vonda Van Dyke with Orchestra. Stereo, Word WST-8519-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Interest: Modern Gospel songs.
Performance: Gay, swinging.
Quality: High standard.
Stereo: Plenty of spread.

Vonda Van Dyke, a former Miss America, is nowadays devoting much of her time to Gospel music and films. A lass with a lot of talent, she presents here a program of Gospel songs in the modern idiom. In style they relate to the modern Gospel musicals being performed by young people's groups around the world. Some are presumably her own compositions; other are by Kaiser and Carmichael.

New Kind Of Happiness – It's Our World – Patches Of Sunlight – Bring Back The Springtime – Searching Questions – Happiness – The New 23rd – Gonna Love – This Little Light Of Mine – The Moment Of Truth.

How you react to these numbers will depend entirely on your background and musical tastes. If you're part of the present youth scene and like the rhythm, the beat, the directness of the modern song idiom, you'll vote the whole thing tremendous – from Vonda herself to every detail of the arrangement and backing.

But, if you belong to an older, more conservative group, you'll be as likely to dismiss it as top-of-the-charts stuff, lyrics notwithstanding! (W.N.W.)

★ ★ ★

DINNER DEVOTIONALS, Volume 2. Lorin Whitney and his Robert Morton Pipe Organ. Stereo, Sacred LPS-74048. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals.)

Interest: Gospel organ mood music.
Performance: Smooth, capable.
Quality: Clean, well balanced.
Stereo: Normal.

Having committed himself to an album of "Dinner Devotionals", Lorin Whitney fairly obviously ruled out any display of the dynamics for which cinema-style pipe organs have relied on for so much of their appeal.

However, while keeping to a fairly even level, Whitney uses the voices of the organ freely to secure a wide variety of sound. The result is a record which should fulfil its intended role very well, being useful also for church gatherings, etc, where devotional background music is required.

The track titles: This Is My Father's World – I Am Thine, O Lord – Rock Of Ages – Jesus Will Walk With Me – Peace In The Valley – Saviour Breathe An Evening Blessing – When Love Shines In – Why Should He Love Me So? – Nearer My God To Thee – The Song Of A Soul Set Free – The Cross Is Not Greater – Precious Memories.

A good album in its class. (W.N.W.)

★ ★ ★

ABOUT THAT MAN. Cliff Richard reading from the "Living New Testament", with four songs. Stereo, Columbia SCXO-6480.

Interest: Bible reading.
Performance: Excellent diction.
Quality: Clear, well balanced.
Stereo: Not important.

The deep religious convictions of Cliff Richard were apparent from his participation in the Billy Graham film "His Land", of which we recently reviewed the sound track recording.

This record is primarily a narration of the life of Jesus, compiled from readings from a modern translation or paraphrase: the Living New Testament. The prose is in modern, free-flowing style and Cliff Richard takes it at quite a brisk pace and, to borrow a phrase from David Winter's notes, the narration is almost that of a television documentary. But don't construe this to mean that the reading lacks depth or conviction. On the contrary, the narration invests the characters of this very well-known story with a freshness and a personality that is compelling. It begins with John the Baptist and finishes with the Resurrection.

Four simple and appropriate Gospel songs punctuate what is a quite lengthy reading: Sweet Little Jesus Boy – Where Is That Man? – Can It Be True? – Reflections.

Whether you have a place in your collection for this recording is a matter for personal decision but, if you can use a modern reading in home, Sunday school or church, it is well worth a hearing. (W.N.W.)

★ ★ ★

LAND OF HOPE AND GLORY. GUS (Footwear) Band and the Morriston Orpheus Choir. Stereo, Columbia SCXO-6406.

Interest: Fine band, fine choir.
Performance: As you would expect.
Quality: Good.
Stereo: Well spread.

We have reviewed and commended many records by the GUS (Footwear) Band; likewise by the Morriston Orpheus Choir. Here the band, under Stanley H. Boddington, LRAM, ARCM, joins forces with the Choir conducted by Lyn Harry, B Mus. As you would expect of such a combination, they present a program which will be a real sonic feast for those who enjoy music of this general type.

Because several of the titles are of a devotional nature, and because the likely audience will come from this listener group, we have included the album in the devotional section. The tracks: The Soldiers' Chorus – Students' Marching Song ("Student Prince") – The Pilgrims Chorus – The Lost Chord – Finlandia – Jerusalem – Mine Eyes Have Seen The Glory – Cavalry Of The Steppes – David Of The White Rock – The Anvil Chorus – Abide With Me – Land Of Hope And Glory.

A varied and thoroughly enjoyable program by two of Britain's best known musical groups. (W.N.W.)

★ ★ ★

BACH ORGAN RECITAL. Karl Richter at the organ of the Victoria Hall, Geneva. Decca Ace of Diamonds (EMI) stereo SDD 258.

Interest: Organ classics.
Performance: Rather staid.
Quality: Good.
Stereo: Restricted.

This reissue of a disc originally released 10 years ago has its moments, but they are not often enough for my taste. The program here consists of the very popular Toccata and Fugue in D minor–Fantasia and Fugue in G minor–Prelude and Fugue in E minor–Passacaglia and Fugue in C minor. Since these are among the most recorded organ works of Bach, there are numerous versions to chose from. I cannot say that I found this performance at all exciting, in fact I should be inclined to describe the playing as rather stolid. Although the organist shows here and there that he has an impressive technique, and the build up to the climaxes is satisfactory, in general the tempos chosen are on the slow side, so that any suggestion of excitement is absent.

No details are given about the organ, but it sounds like a 19th-century instrument of moderate proportions. The sound quality is clean, but non reverberant – not surprising, in view of the age of the recording. Techniques in the recording industry have come a long way in the last 10 years. (H.A.T.)

Reviews in this section are by Neville Williams, Harry Tyrer, Gil Wahlquist, Philip Pik.

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THE PLANETS (Gustav Holst). The London Philharmonic Orchestra and John Alldis Choir, conducted by Bernard Haitinck. Philips, stereo 6500 072.

Interest: Popular orchestral suite.
Performance: A good one.
Quality: Well engineered.
Stereo: Good, without gimmicks.

After the disappointment of the recent Phase Four recording of "The Planets" with this same orchestra conducted by Bernard Herrmann, I approached this new recording with some trepidation. After a few bars, I suspected the worst, and again the "Mars" section appeared to be taken at a too slow tempo. However, it soon becomes apparent that Haitinck's reading, although different from the Sargent one which has been my favourite version for some years, is still a very valid one. While perhaps not so exciting at this deliberate tempo, it conveys all the impersonal cruelty and savage futility of war. The grinding ostinato basses pound along relentlessly, and the crashing hammer blows at the end are of frightening intensity. One is never in any doubt in this performance that war is an evil thing, unlike Sargent's performance, which tends to underline some of the heroic aspects.

The remaining sections seem to me to be just about ideal. The great patriotic tune in "Jupiter" sounds suitably grand, and "Saturn" is disturbingly accurate in its portrait of senility. The utter remoteness of "Neptune" is superbly suggested, and the contribution of the sopranos of the John Alldis Choir provides the touch of mystery which was missing from the Hermann performance. The engineering is first rate, so this is a recording which can be recommended unreservedly. (H.A.T.)

★ ★ ★

FAVOURITE OPERA AND OPERETTA ARIAS. David Hughes, tenor, with the City of Birmingham Symphony Orchestra, conducted by Louis Fremaux. Columbia Studio 2 Stereo, TWO 319.

Interest: See title.
Performance: Splendid.
Quality: Good recording.
Stereo: Well spread.

I am glad to see Welsh tenor David Hughes acquiring a greater degree of recognition by recording companies, as this fine singer has unaccountably been neglected for some years. Although he has been singing in opera and operetta for years, his records so far can be counted on the fingers of one hand. Yet, to my mind, his fine ringing voice and immaculate diction are superior to some tenors who record regularly, and he does not affect the pain-laden style favoured by some of them.

The program here is an entirely "popular" one: On With The Motley, from "Pagliacci" (Leoncavallo) – Your Tiny Hand is Frozen, from "La Boheme" (Puccini) – Flower Song, from "Carmen" (Bizet) – Serenade, from "Fair Maid of Perth" (Bizet) – The Stars Were Brightly Shining, from "Tosca" (Puccini) – None Shall Sleep, from "Turandot" (Puccini) – Take A Pair Of Sparking Eyes, from "The Gondoliers" (Sullivan) – Girls Were Made To Love And Kiss, from "Paganini" (Lehar) – Serenade from "Frasquita" (Lehar) – Gondola Love Song, from "A Night in Venice" (Strauss II) – O Maiden, My Maiden, from "Frederica" (Lehar) – You Are My Heart's Delight, from "Land Of Smiles" (Lehar). The program is neatly divided, with the opera arias on side one, the operetta numbers on side two. In summary, a pleasing selection of well-known tunes, splendidly sung, and well recorded in Columbia's Studio 2 Stereo process. The orchestra is not called upon to undertake anything very ambitious, but what they do contribute is very competently executed. (H.A.T.)

★ ★ ★

TOUJOURS L'AMOUR. Sylvia Geszty, with the Berlin Philharmonic Orchestra, or the RIAS Chamber Orchestra, directed by Fried Walter. World Record Club, stereo S/4828.

Interest: Songs from operetta, ballads.
Performance: Competently sung.
Quality: Clean sound.
Stereo: Normal.

Sylvia Geszty is perhaps better know in Germany than here, where she has been a regular performer on stage in opera and operetta. World Record Club members who bought the club's release of highlights from Lehar's "Paganini" last year will already know what an accomplished singer she is. Her voice is rather lightweight, and thus more suited to the type of light operetta material presented here than for grand opera. She sings charmingly in presenting the following: Village Swallows (Josef Strauss) – Selection from "The Dubarry" (Millocker) – Once Must I Fall In Love, from "The Beautiful Galatea" (Suppe) – I Dream Of One and the Same (Grothe) – Toujours L'Amour, from "Ball In Savoy" (Abraham) – Play The Song Of Love And Trust, from "The Hungarian Wedding" (Dostal) – What Can Be As Beautiful As Love? (Brodsky) – Goodnight, from "Viktoria And Her Hussar" (Abraham).

The recording quality is competent rather than outstanding, with clean sound, but recorded at rather low level with limited dynamic range. Not an outstanding disc, but one which should give considerable pleasure to those whose taste is in the operetta field. (H.A.T.)

★ ★ ★

MUSIC FOR STRINGS. Andre Kostelanetz. CBS stereo SBR 235399.

Interest: Light music for strings.
Performance: High standard.
Quality: Very good.
Stereo: Normal.

Andre Kostelanetz has made a practice in recent years of including some lesser known, but unjustly neglected, items in his programs of light music, which he records regularly for CBS. In this case he has found two very attractive pieces in "Toreador's Prayer" by Spanish composer Joaquin Turina; and "Chrysanthemums" by Puccini. Both items were originally written for string quartet performance, and presumably have been arranged for string orchestra by Kostelanetz himself. The two items require the whole of the second side, the Turina piece lasting roughly 12 minutes, the Puccini six minutes. Both pieces are entirely melodic, and the Turina will have special appeal to those who favour Iberian style music, as its Spanish origins are obvious.

Side 1 also has a lesser known item in

"Spielerei" (Playful Games) by Carl Stix, about whom virtually nothing is known. The pleasant little number played here is based on a teasing little pizzicato melody with immediate appeal. The remaining items call for no comment at all: Sunset (Victor Herbert) – Minuet (Boccherini) – Air on the G String (Bach) – To A Water Lily (MacDowell).

A very pleasing disc, with the well-drilled strings of the Kostelanetz orchestra not encountering anything beyond their capabilities. (H.A.T.)

★ ★ ★

CARAMBA – 3. Roberto Delgado and his Orchestra. Polydor stereo 2371 044.

Interest: LA music, dancing or listening.
Performance: Worth hearing.
Quality: Excellent.
Stereo: Well spread.

Here is somebody who will need no recommendation to those with a liking for Latin American style dance music. Through his numerous recordings for Polydor, Roberto Delgado is as well-known for his work in this field as other top flight names, such as Edmundo Ros and Xavier Cugat. In this typical program he presents: El Condor Pasa – Tu Amor Mi Amor – Tabasco – Estrellita – Hurricane – Adios – Limon Limonero – Cenicienta – Es el Viento – El Relicario – Spanish Wedding – La Felicidad. These are mostly beautifully played, with the very large instrumental line-up favoured by Delgado – but I did not like his treatment of "Estrellita", which is slow and somewhat ponderous, quite unlike his normal lively style. Otherwise this is a disc which can be recommended to those with a penchant for LA music, whether for dancing or for listening. Technically, the disc is beyond criticism. (H.A.T.)

★ ★ ★

CHIANTI TIME. Fritz Schulz-Reichel and his Orchestra. Polydor stereo 2371 087.

Interest: Italian tunes, dance style.
Performance: Fine.
Quality: Excellent.
Stereo: Good spread.

There are no less than 28 well-known Italian melodies in this selection, some of them played in medley form. In these arrangements, they are obviously intended for dancing, and as such they should be fine, but unless you particularly favour the traditional romantic style of playing mostly used for this type of material, you should also find them pleasant listening, too. I gather from the sleeves note that Fritz Schulz-Reichel makes something of a speciality of adapting melodies from other lands to his own particular style. I look forward to hearing more.

Among the 28 tunes included here are: Torna a Sorriento – Volare – Quando, Quando – Santa Lucia – Ciribiribin – Il Silenzio – O Sole Mio – Three Coins in the Fountain – Funiculi, Funicula – Arriverderci Roma. The band plays them in fine style, producing a lively, happy sound. The recording, too, is fine – typical Polydor, in fact. A good one. (H.A.T.)

★ ★ ★

NON STOP EVERGREENS. James Last. Polydor, stereo 249370.

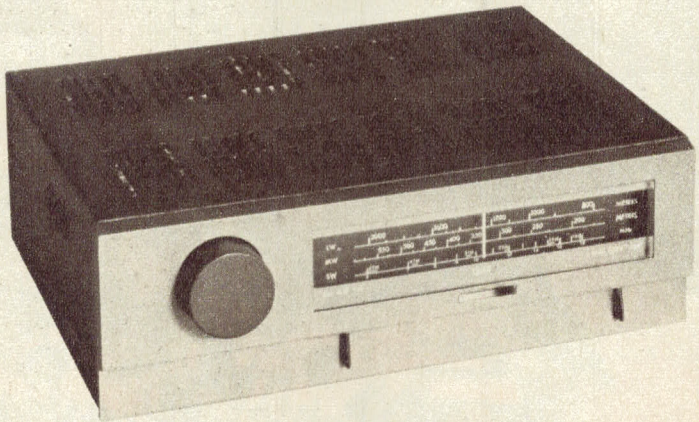
Interest: As per title.
Performance: His usual excellent standard.
Quality: The usual Polydor's.
Stereo: Fine.

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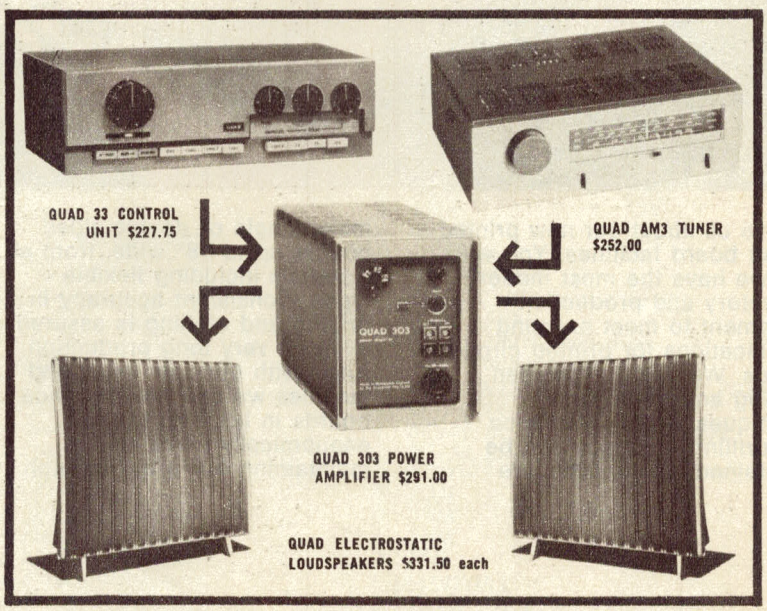
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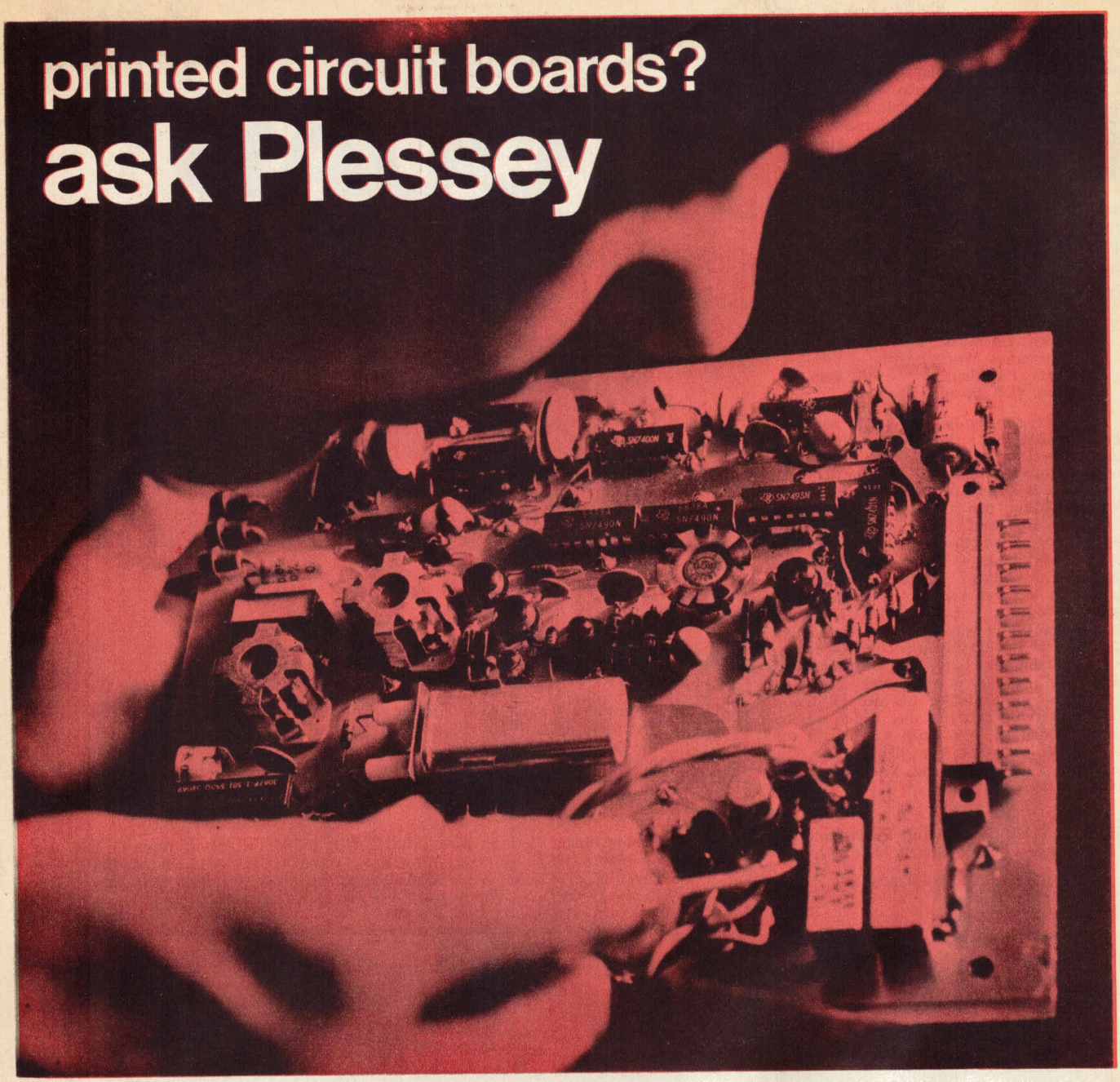


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SWINGING THE CLASSICS

"Modern interpretations" of great classics are very much in vogue at the moment, to judge by the many discs of this type of performance released in recent months. The discs reviewed below were all released within a short period.

SYMPHONIES FOR SWINGERS. The Manuel de Falla Orchestra conducted by Waldo de los Rios. Hispana Vox (Festival) stereo SIFL-934096.

Waldo de los Rios was responsible for the arrangement of Beethoven's "Song of Joy" (the choral part of the Ninth Symphony) which made Miguel Rios famous. The technique he established there, consisting virtually of the composer's own music with backing by a modern rhythm section, is continued here, and he also begins this disc with the "Song of Joy", this time without Miguel Rios, using only a choral section without soloist. The selection has extracts from symphonies by Schubert, Mozart, Brahms, Dvorak, Haydn, Tchaikovsky and Mendelssohn. De los Rios takes the melodies and patches them together, leaving out the composer's own bridging passages, and although experienced classics listeners will probably find this objectionable, those who like classical tunes without wishing to become involved too deeply will find this treatment appropriate.

The feature about this performance which makes it unusual is that the music is played by a full scale symphony orchestra, and if you omitted the rhythm section, and overlooked the cuts, you could be listening to the original works. The recording, from Spain, has rather more distortion than we are accustomed to nowadays in the best recordings. (H.A.T.)

★ ★ ★

SWING IN BAROQUE. Jef Mike and his Orchestra. Concert Hall Record Club, stereo SVS 2680.

The style is rather more refined in this recording, as it would have to be in treating baroque composers such as Vivaldi, Corelli and Scarlatti. Otherwise, much of the time the technique followed is very similar to that used above – the music played fairly straight, with bass and percussion adding the modern touch. However, in parts the orchestra cuts loose and really does swing. If you are a Jacques Loussier fan, this music will probably appeal, as it is pitched at roughly the same level. Most of the items are fairly well-known baroque items, frequently recorded in their usual context: Double Concerto (Vivaldi) – Le Coucou (Daquin) – La Follia (Corelli) – Sonata in G (D. Scarlatti) – Theme from "Te Deum" (Charpentier) – Le Tambourin (Rameau) – Arietta (Pergolesi) – Gavotte (Corelli) – Pastorale in D minor (D. Scarlatti) – Allegro (Fiocco).

The orchestra is a largish chamber group, and the arrangements place maximum emphasis on harpsichord and flute. In fact, in some tracks the piece is played as a harpsichord solo with bass and percussion backing. The quality of the recording in this case is excellent, with the instruments carefully balanced and the stereo spread well handled. (H.A.T.)

★ ★ ★

THE ROMANTIC PIANO OF NEIL RHODEN. Neil Rhoden, piano, with orchestra conducted by Nicky Webb.

Neil Rhoden is a young English classically trained musician who apparently likes the Semprini style of arranging piano pieces for piano and orchestra – but in his case he also likes to add the modern touch, with rhythm backing. As a pianist he is no more than competent – I notice for example that he shirks the difficult cadenza part of Liszt's "Liebestraum", in this selection. Unfortunately, I cannot regard him too highly as an arranger either, judging by some of the styling of these tracks. The only safe advice to offer is, if you have any liking for this style of music, and the titles attract you, try to hear a track or two before coming to any decision.

Included in this selection is a pleasing melody of Rhoden's own composition called "Hold Back the Dawn", and a track entitled "Song of Romance"; this turns out to be our old friend "Jeux Interdits" which appears regularly in recitals of guitar music. Rhoden's arrangement does nothing for this attractive melody. Also included are the well known Chopin Nocturne (No 2 of Op. 9) – Albeniz's Tango – Adagio from Beethoven's "Pathetique" Sonata (Ugh!) – Liebestraum – Claire de Lune, and so on. The quality of the Studio 2 Stereo recording is as good as ever. (H.A.T.)

and him alone. This is natural, but not quite as it should be. Equally important to Last's success has been and still is the group or band he leads. Without them there may not have been the James Last as we know him today.

This record, as indeed nearly all of his are, is a distinct example of that music that only he and his band seem to be able to produce. In this medley of international hits. Oscar-winning film melodies like "Exodus" and "Love Is A Many Splendored Thing", traditionals like "La Bamba", Cole Porter's unforgettable "Night And Day" and many more tunes with similarly famous backgrounds have been included.

What I particularly liked about the entire presentation was the "audience" participation – an undisciplined yet perfectly harmonious accompaniment. To wet your appetite here are a few more of the songs included: Deep In The Heart Of Texas – Who's Sorry Now – Quando, Quando – Day O – Goody, Goody – Night And Day. Twenty-eight great hits in all that I think you'll like. (J.P.P.)

HIT MOVIE THEMES. Enoch Light. Project 3 Total Sound. Stereo, SPJL-934071.

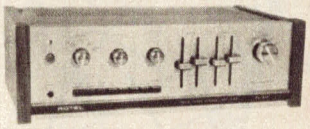
Interest: As per title.
Performance: Interesting.
Quality: Clean and crisp.
Stereo: Good spread.

Remember the films "Airport", "M*A*S*H", "Darling Lili", "Love Is A Funny Thing"? Then your memory will no doubt be pleasantly refreshed by Enoch Light and the Light Brigade, who play the themes of these and many more great movies.

What I particularly like about this "Movie" record, is that the original musical arrangements have been retained, even to the extent of lead vocalists, vocal backings – in fact the lot. And all with the superb finesse of a terrific team of artists – too numerous to list – under the production of the master Mr Enoch Light. If you'd like a sample of the merchandise before reaching for your pocket, try "Sweet Gingerbread Man". That should more than convince you. If not, try any of

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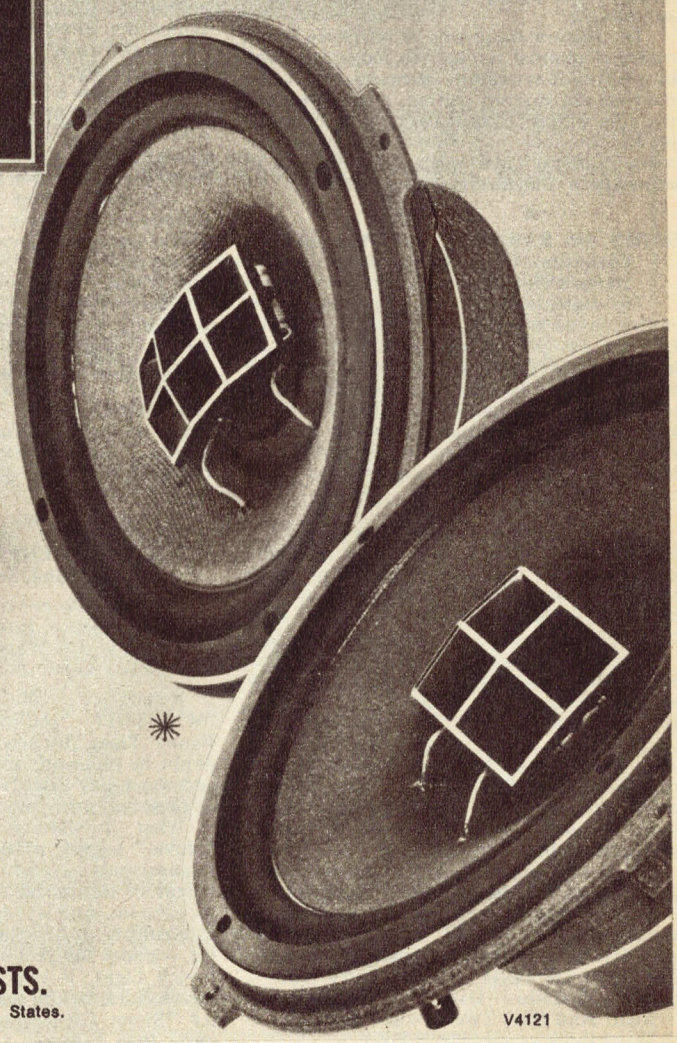


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these: Theme from "Z" – "Airport" Love Theme – "Darling Lili" – Theme from "Sunflower" – Everything A Man Could Ever Need – "Patton" Theme – Theme From "The Out Of Towners" – Pieces Of Dreams – On A Clear Day – Love Is A Funny Thing – Song from "M*A*S*H". (J.P.P.)

★ ★ ★

TANGO. Andre Silvano and his Orchestra. Compatible stereo, Concert Hall SPS-1302.

Interest: A dozen tangos.
Performance: Mostly in strict tempo.
Quality: Normal.
Stereo: Normal.

In terms of quantity, you certainly get your money's worth with six tangos per side on this Concert Hall release. Whether you would use them for dancing, for high level listening, or as a gentle background would be a matter of choice. Having to play to a fairly strict tempo leaves the orchestra little room for initiative but they certainly play cleanly and competently.

The tracks: Poema – Ole Guapa – Jalousie – Mama – Caminito – Una Lagrima Tuva – Une Derniere Fois – Violetta – Adios Muchachos – A Media Luz – Rodriguez Pena – La Cumparsita.

A record for those who like tangos – by the dozen! (W.N.W.)

★ ★ ★

RELEASE ME. The Sunset Strings & Voices. Sunset Records, stereo SLS-96-162. Released through Festival Records Pty Ltd.

Interest: Guitars, strings and voices.
Performance: Above average.
Quality: Fair.
Stereo: Well spread.

Remember "Still, Am I That Easy to Forget" and "Missing You"? Well, these are some of the evergreens presented here by the Sunset Strings and Voices, featuring the guitars of Jimmy Bryant and Glenn Keener. As one would expect, the lead throughout the record is taken by these two guitarists and very capably so I must add. Backing them are the strings and voices, both delicately balancing the instrumental lead without overpowering it. Listen to the remaining numbers and see if you agree: Release Me – Make The World Go Away – Am I Losing You – Lock Stock And Teardrops – Four Walls – Just Out Of Reach – When Two Worlds Collide.

★ ★ ★

WITH COMPLIMENTS. James Last. Polydor, stereo 2371 071.

Interest: Last at his best.
Performance: Excellent.
Quality: Excellent.
Stereo: Well balanced.

Mr Last! His name should have been Mr First. This album is a classic example of his unique talent in creating a new sound, totally different from the usual. Each number has a beautifully smooth and relaxed setting, yet at the same time is full of life, each instrument expressing its share of the total immensely varying sound. To set the mood, Last starts off with "Endless Journey" followed by "The House Of The Rising Sun". Others are: The Last Guest Is Gone – El Condor Pasa – Evie – Rainy, Rainy – Luciana – Andanca – Tango Regina – Ballad Of The Easy Rider – Jean – The Pearl Fishers.

All tremendous numbers. In short you don't have to be a Last fan to thoroughly enjoy this excellent performance. As always, the Polydor quality is impeccable. (J.P.P.)

★ ★ ★

EVERYTHING IS IN LOVE TODAY. Wayne Newton. MGM Records, stereo 2315 025.

Interest: Newton's quieter songs.
Performance: Sure to please.
Quality: Short of MGM's usual standard.
Stereo: Lacks imagination.

If you're in the mood for some quiet, romantic and sentimental songs, capably presented in the distinctive style and voice of Wayne Newton, this one should appeal to you. Listening to the whole of the album uninterrupted can't help but leave you feeling in a relaxed frame of mind. Although most of the credit must of course go to Newton himself, some must also go to the producer Bob Cullen and the arranger/conductor Albert Gorgoni, who have tastefully ordered the numbers. Some of the lyrics are interesting, some more conventional, and all in all the 10 songs should appeal to many. They are: Country – Maybe – The Lord Must Be In New York City – The Drifter – Mr Bojangles – It's Such A Lovely Time Of Year – Everything Is In Love Today – The Thought Of Loving You – For The First Time – Letter From New Orleans.

Technically this record may fail to please many hi-fi enthusiasts. Although the recording is generally clean with little to no audible distortion and low surface noise, it lacks frequency range and definition. But don't let this deter you from seriously considering this otherwise fine album. (J.P.P.)

★ ★ ★

THE JOHNNY CASH SHOW. CBS stereo SBP 2338.

Interest: Johnny live in Nashville.
Performance: Routine.
Quality: Acceptable.
Stereo: Normal.

The idea of presenting on disc extracts from television shows seems to me to have

Chopin's Nocturnes

THE CHOPIN NOCTURNES. Adam Harasiewicz, piano. Fontana Special, stereo SFL14019-20. Two disc set in fold out sleeve.

Adam Harasiewicz represents for me the ideal type of Chopin player. This young Polish pianist seems to me to have exactly the right temperament for Chopin, and although I am not one of those who subscribe to the view that only Polish musicians can play Chopin, I have to admit that Harasiewicz does seem to have a natural feel for this music. His technique is so assured that the mechanics of playing even the difficult passages do not seem to make any great demands on his intellect. He is therefore able to let his mind grapple with the more elusive problems of interpretation. Of all the different interpretations of the Nocturnes I have heard, I cannot recall any that I prefer to this one. At the Fontana Special price of $5 for the two discs, in fold out sleeve, with a fairly long notes and a large portrait of the young Chopin, this may be regarded as an exceptional bargain.

The playing is so good all through that it is virtually impossible to single out any points for special mention. However, if you want to sample before buying, try No 13 in C minor. This is inspired playing by any standards. Technically the disc is a little below standard. There is a continual background hiss that I first took to be tape hiss, but as it continues between tracks I can only assume that the original master recording has a noisy surface. On the other hand, the piano tone is very good, and Harasiewicz is obviously playing a magnificent piano, which sets off his playing to best advantage. (H.A.T.)

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Music for Recorders

MEET THE RECORDER FAMILY. The Frederick Morgan Recorder Consort. Stereo, W*G, WG/B/S/5493.

Interest: As per title.
Performance: High standard.
Quality: Natural, fine presence.
Stereo: Used to advantage.

With a history extending back to the 14th century, the recorder family was widely used until the middle of the 18th century, when it gradually lost favour. In the early 1920s, largely due to the efforts of English instrument maker Arnold Dolmetsch, its potential as a teaching instrument for schools was realised. It began to appear in Australian schools in the 1930s, due largely to the initiative of Mr Frank Higgins, of the Victorian Education Department. Now, in Victoria alone, something like 30,000 children have a first-hand knowledge of the recorder.

Inevitably, this has produced an interest in the family of instruments at a professional level and this present recording was produced by the well-known Frederick Morgan Consort, just before the players separated to pursue their separate studies. Appearing with Frederick Morgan is Robert Moore, Tim Moore and Richard Ireland.

The recorders featured include a Sopranino, Descant, two Trebles, two Tenors, a Bass and a Great Bass. They were produced variously by makers in England, Europe and Australia.

There are eight tracks in all, some accompanied by an Australian made harpsichord. Very briefly, the tracks are: Medieaval Pieces – From the Tylman Susato Collection – Le Rossignol En Amour (Couperin) – 16th Century English Dances – Trio For Recorders (Robinson, 20th century) – Partita No 2 in G Major (Telemann); Siciliano; Affetuoso – English Pieces of the 16th century – Fantasia in Four Parts (Byrd, 16th century).

To those whose concept of the recorder is founded largely on school-time efforts, the range of tone, the expression and the trills which The Consort wins from the instruments will be a revelation, as well as an experience in old-world charm. And, in teaching situations, I imagine the recording should prove most valuable.

One point of concern was that, on the Great Bass solo (track 2, side 2) my cartridge found a couple of slight surface flaws which caused it to repeat grooves unless weighted slightly above rather than below 1 gram. But this notwithstanding, I would rate the recording as well worth a hearing. (W.N.W.)

inherent drawbacks – audience noise and introductions, with correspondingly less music, for example. Nevertheless, it appears that artists of the stature of Johnny Cash are so well liked by the public that they are prepared to accept any such drawbacks for the privilege of adding another disc to their collections.

The particular show from which these tracks were extracted was recorded live at Nashville's Grand Ole Opry House theatre. The Bill Walker Orchestra which supplies the accompaniment is presumably the resident band. Additional support for Johnny's steely voiced vocals is provided by the Tennessee Three, the three serious ladies who often appear with Johnny on television, and as usual they are barely audible. If you listen carefully when playing this disc, you will also hear encouraging noises from the Statler Brothers and the Carter Family in the background. The songs are unexceptional – typical modern C&W material – such as Sunday Morning Coming Down – There Ain't No Easy Way – These Hands – I'm Gonna Try to Be That Way. Johnny also contributes two medleys, one with three of his favourite truck driving songs, the other on railway themes. The sound quality is acceptable but only just. (H.A.T)

★ ★ ★

THE 24 PRELUDES (Chopin). Rafael Orozco, piano. World Record Club stereo.

Interest: Classical piano miniatures.
Performance: Fine.
Quality: No complaints.
Stereo: Not significant.

Complete recordings of the Chopin Preludes are fairly rare occurrences, so this issue by World Record Club will be welcomed by club members with a taste for the music of Chopin. Rafael Orozco has a fluid technique and his playing has a youthful ardour which is very welcome. There is nothing worse than deadpan playing of Chopin, and I can think of a few pianists (mostly women performers) who play like that. Orozco is still very young, but is already an accomplished performer. For this reason I am somewhat at a loss to understand why there has been no follow-up disc – the Waltzes, for example – since his Preludes disc was first released by EMI two years ago.

The recording, originally issued on the HMV label, is entirely satisfactory. (H.A.T.)

★ ★ ★

HAMMOND IN SUPER STEREO. Peter Loland and his Orchestra. Compatible stereo, Karussell 535,016. Distributed in Australia by Phonogram Recordings Pty Ltd.

Interest: Hammond plus orchestra.
Performance: Well integrated group.
Quality: Clean, well balanced.
Stereo: In abundance.

This is one of several recordings in the Karussell Super Stereo series, each one featuring a different lead instrument. Here the Hammond organ is in the spotlight. However, it is essentially an orchestral sound with the organ woven into the fabric of the melody; one should add, skilfully.

The tempos range from Latin, through gentle swing to straight jazz: Riff-A-Gogo – My Prayer – Patricia – In The Mood – Jezebel – Kili-Watch – You Are My Sunshine – Day-O – Too Much Tequila – Only You – Banjo Benny – Manhattan Spiritual.

A bright selection and another one that happens to lend itself well to simulated quadrophonic. (W.N.W.)

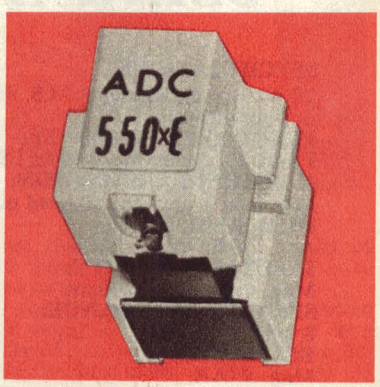
★ ★ ★

HAMMOND HITS. Pete Colley. Compatible stereo, Karussell 635,139. Distributed in Australia by Phonogram Recordings Pty Ltd.

Interest: Hammond plus percussion.
Performance: Swinging, happy.
Quality: Sparkling, clean.
Stereo: Used to advantage.

The jacket and the label are singularly uninformative, making it clear only that the original recording is German but the pressing Australian. Nothing is said of the organ but I would judge it to be one of the latest model Hammonds, with a variety of voices and,

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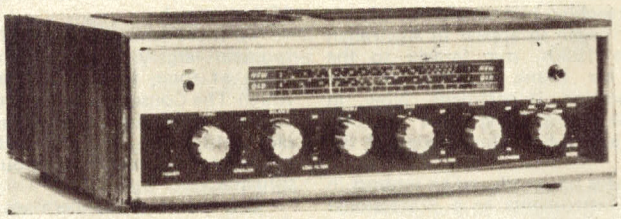
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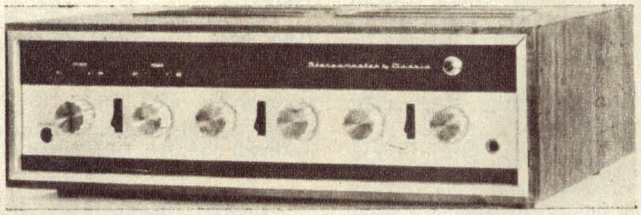
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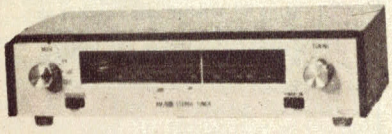
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when required, a hard attack with highs aplenty.

Pete Colley has the backing of a group, though it would be hard to be dogmatic about the source of all the sounds. But does it matter? It's a happy rhythmic sound, which you'll enjoy right through from beginning to end. The titles:

Swinging Safari – A Whiter Shade Of Pale – Hi-Lili Hi-Lo – Roses Of Picardy – A Walk In The Black Forest – Spanish Flea – Rio de Janeiro – I Was Kaiser Bill's Batman – Et Maintenant – If I Were A Rich Man – Der Letzte Walzer – The Birth Of The Blues.

The quality is very clean, which says something both for the recording and for the loudspeakers fitted to the organ. The stereo is good, too. In fact, it makes a fine gimmick record for the simulated quadraphonic described last month. (W.N.W.)

Jazz and Rock . . .

DINOSAUR SWAMPS. The Flock. CBS stereo SBP 233911.
Interest: Big band rock.
Performance: Swampy.
Quality: Excellent.
Stereo: Good.

The Flock started out on their first album as an interesting rhapsodic rock group, doing things that Chicago and Blood, Sweat and Tears didn't have a mind to do. Unfortunately, the style of their second LP is about as dated as the dodo-type bird on the cover. There are some awfully corny phrases in there. Jerry Silverman, the group's brilliant violinist, loses some of his shine.

A recurring folk tune strings the titles together as a piece of program music but it's not clear what is happening.

"Green Slice", "Mermaid", "Big Bird" are the best tracks. (G.W.)

★ ★ ★

TAKE TWO. Roberta Flack. Atlantic stereo SD 1569.
Interest: Soul singer.
Performance: Exciting.
Quality: Excellent.
Stereo: Good.

Miss Flack is one of the singing discoveries of recent times. She chooses her material well. She shades her vocals. She is undeniably black, no matter what she sings. She can take Bob Dylan's "Just Like A Woman" and make it a new song.

Gene McDaniels has written some songs for her and one of them, "Reverend Lee", about temptation, is the impressive opener to this LP. Don't be put off by the sight of "The Impossible Dream" on the label. Diana Ross switched this into a soul song a year ago. Miss Flack picks up where Miss Ross left off. The recording quality brings the voice right into the room with you – Miss Flack has that sort of timbre which survives technology. (G.W.)

★ ★ ★

RIGHT ON BE FREE. The Voices of East Harlem. Elektra stereo EKS-74080.
Interest: Street choir.
Performance: Stirring.
Quality: Good.
Stereo: Good.

The Voices are a street group fostered by one of Mayor Lindsay's cultural programs in New York City. The arrangements are based on the call and response of church music. Some of it goes back further to the style of African work songs. The improvised harmonies in the background are unique. Everybody does their own thing and somehow it comes out right.

"Proud Mary" led by James Missouri becomes a good time song. "Music In The Air", "Oh Yeah", "Let It Be Me" and "For What It's Worth" are other good titles.

WORKIN' TOGETHER. Ike and Tina Turner. Liberty stereo SLYL-934059.
Interest: Modern blues.
Performance: Spirited.
Quality: Good.
Stereo: Satisfactory.

Tina has warmed up the blues and applied them to modern themes of Women's Liberation and peace.

The backing group is basic boogooloo with a lot of noise. The pianist is superb. Good drummer and a strong brass and reed outfit. "Funkier Than A Mosquita's Tweeter" is Tina's liveliest song – a reprimand to a lover with a dirty mind. Another moralistic vocal comes out of "Game Of Love", with Tina belting out the case for equal morality between man and woman. "Get Back", "Proud Mary" and "Let It Be" are other good performances. (G.W.)

★ ★ ★

ANY WOMAN'S BLUES. Bessie Smith. CBS mono 2BP 220071.
Interest: Vintage jazz singer.
Performance: Unsurpassed.
Quality: Adequate.

CBS continues its task of reissuing all of the recordings made by the most influential blues singer of our times. This is the second two-LP set. We have been promised three more.

This contains Miss Smith's second 16 recordings and her second-to-last 16. With a few exceptions, all of the selections in the complete exercise have been taken from original shellac pressings. Pitch has been corrected in some instances where the original cutting lathe had been off speed.

Many of these numbers were first recorded on wax. As there was no immediate playback, three takes were usually made, to be pressed into metal masters. Researchers who worked on this project report that Miss Smith was not given to improvisation, like some singers who rewrite their songs between each performance. For this reason, there are no alternate takes in the series.

"Jail House Blues", "Cemetery Blues", "Mistreating Daddy" and "Keep It To Yourself" are some of the 32 titles in the set. Accompanists include Irving Johns and James P. Johnson. (G.W.)

★ ★ ★

CHAZZ! Charlie Mingus Quintet. Liberty stereo SLYL-934056.
Interest: Jazz of the 50s.
Performance: Brilliant.
Quality: Good.
Stereo: Good.

Not only did the company release a genuine 1955 performance but they threw in some 1962 liner notes for good value.

Mingus was an original bass player who developed in bop and on a parallel line to Charlie Parker. He was closer to the mainstream, as this LP shows. He does boppish things with melodies. "Septemberly" is a combination of "Tenderly" and "September In The Rain". "All The Things You Are In C Sharp Minor" combines Jerome Kern's melody with Rachmaninoff's over-worked Prelude.

Who else but Mingus would end "Serenade in Blue" with unison bowed bass and baritone bass, with trombone playing a counter melody.

Mingus was in the forefront of the baroque jazz movement which died a death in the early 60s. Yet even at this distance the music has great originality and charm.

George Barrow plays excellent tenor saxophone. Eddie Bert is on trombone. Willie Jones is drummer on all but one duet which Mingus has with Max Roach. Heartily recommended. (G.W.)

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TRADE REVIEWS AND RELEASES

Sansui SR-2050C Turntable

Simon Gray Pty Ltd recently submitted for review a Sansui SR-2050C turntable/tone arm combination fitted with a magnetic cartridge. A two speed unit featuring belt-drive, the SR-2050C has the facility of automatic arm lift-off at the end of record play.

As with most Japanese audio equipment, the Sansui SR-2050C turntable is certainly styled to "look the part". It is supplied complete with an oiled walnut plinth and smoke-tinted perspex cover. Dimensions of the complete unit are 20½ x 14¾ x 6-9/16in. The unit is mounted on pliant foam rubber feet to minimise acoustic feedback.

The SR-2050C represents a middle-of-the-road approach as far as turntables are concerned. Ordinarily, turntables are either completely automatic or very simple manual play units with perhaps a hydraulically damped arm lowering device. The Sansui, on the other hand, is a belt-driven turntable with hydraulic lowering device and an automatic switch-off/ arm lift-off facility. When the record has finished playing, the arm is lifted off the record surface and the motor switched off.

The platter is an 11¾in diameter aluminium alloy diecasting weighing 2.64lbs. A 4-pole synchronous motor drives the platter by a ¼in wide flat belt around an inner rim of 8in diameter. The stepped motor shaft provides the two turntable speeds of 33 1/3 and 45 rpm. A multi-tapped auto-transformer allows the unit to be used at voltages ranging from 80 to 260V.

The tone arm has an effective length (stylus to pivot) of 8-13/16in and is balanced in vertical and lateral planes by two counterweights. Anti-skating compensation is provided by a small hanging weight which acts on a lever attached to the arm pivot, in much the same way as the SME tone arm. Stylus tracking weight is adjustable from 0 to 3 grams by rotating the main counterweight towards the arm pivot.

The headshell has the standard EIA locking collar and will take all cartridges with ½in mounting centres; mounting holes are slotted to give a range of stylus overhang adjustment. The connecting cable to the amplifier is supplied with RCA phono plugs so that no wiring is necessary to put the turntable into use. The arm is easy to set up for balance and has very low bearing friction. We found it tracks effectively with stylus pressures as low as ½ gram.

Mechanically, the arm lift/lower control system is quite complex. Below deck, an outrigger mounted on the arm pivot shaft carries a small magnet. When the arm moves towards the centre of the record, the magnet closes a reed switch which then actuates a relay. The relay discharges a 330uF electrolytic capacitor into a solenoid which moves the main control lever to "Off"; in so doing, it moves the arm lift up and lifts the arm off the record. This happens very smoothly and quietly. When the main control lever is is the "Off" or "On" position the cartridge is shorted, which mutes the amplifier. Only when the control lever is moved to "Play", which lowers the cartridge to the record surface, is the cartridge unmuted. All this contributes to very quiet operation from amplifier and turntable.



At right is the SR-2050C turntable. It is supplied complete with walnut plinth and perspex cover.

Two pushbuttons are provided for speed selection and these are interlocked with the main control lever so that the belt cannot be shifted up and down the motor spindle unless the motor is running; this avoids any damage to the belt. An additional lever selects the record diameter so that the arm is lifted off the record at the correct time. We must point out that this lift/lower system only lifts the pickup off the record at the end of play and permits cueing at any point on the record surface. It does not return the arm to the rest position, nor does it start automatically like an automatic changer.

While the turntable operates quietly and has rumble content so low that we were unable to measure it accurately (it was masked by record surface noise) we did notice slight wow and flutter during square wave tests of the cartridge and extended piano notes. We were inclined to think that this may have been a fault with the belt – perhaps a new one may have cured the problem.

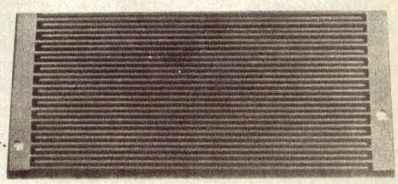
The cartridge fitted to the tone arm is made by Sansui but did not appear to have any type number. It is an induced magnet type with an easily removeable stylus assembly. It has a 0.5mil spherical diamond stylus with a compliance of 17 x 10^{-6} cm/dyne. Recommended tracking weight is 2 grams.

Frequency response and separation between channels was checked using the CBS STR-100 test record and a Hewlett-Packard HP331A distortion analyser as a precision AC millivoltmeter with a load of 47K. Frequency esponse checked out at plus or minus 4dB from 20Hz to 20KHz. Separation between channels was 31dB at 1KHz and never below 25dB down to 100Hz. It tapered gradually at higher frequencies to 13dB at 10KHz. Overall, this separation is of a high standard.

Waveform over most of the audio range was good and the balance between channels was very close – better than 1dB over most of the range. On "square waves" as recorded on the CBS STR-100 test record, moderate ringing was observed. We found that a stylus pressure of 1.5 grams was quite adequate for most records, but all the above tests were done at 2 grams. At 1.5 grams, the cartridge tracked the +12dB drum test band of the W & G 25/2434 test record comfortably, but would not track the +16dB band at 2 grams. On music, the cartridge gives sparkling reproduction and must be classed among the better magnetic cartridges from Japanese makers.

In summary, this Sansui combination fulfils well the purpose for which it is intended and deserves consideration for any high quality sound system. Retail price of the unit, including sales tax is $219. Sansui equipment is available from retail outlets throughout Australia. Trade inquiries should be directed to the Australian distributors, Simon Gray Pty Ltd, 28 Elizabeth Street, Melbourne, Victoria. Next month, we plan to review the Sansui AU-666 stereo amplifier. (L.D.S.)

MOISTURE SENSOR



RCS Radio Pty Ltd, 651 Forest Road, Bexley. NSW have available this gold-plated printed board for use as a moisture sensor for the Rain Alarm project in May 1971.

New releases from Tektronix

Among the new products recently released by Tektronix Australia Pty Ltd are a precision monochrome picture monitor, a 60MHz portable oscilloscope, a time-domain reflectometer plug-in for the 7000-series oscilloscopes, a light pen unit and a programmable power supply.

The type 630 Monochrome Picture Monitor is the first entry by Tektronix in the picture monitor field. It features instrument quality performance with silicon solid-state circuitry and a 15-inch diagonal picture tube with the most nearly rectangular aspect ratio available. Raster linearity is excellent, as the picture at right shows.

Many monitor features are offered on the model 630 as standard, which on competitive products are optional extras. Video response is flat to 6MHz at full picture drive, with stable unity interlace raster to ensure maximum vertical resolution. DC-coupled deflection circuits are used to ensure a no-bounce raster, and all power supplies are regulated. Black level and white level may be either preset or variable, and there is a switchable chroma filter to ensure correct gray-scale reproduction.

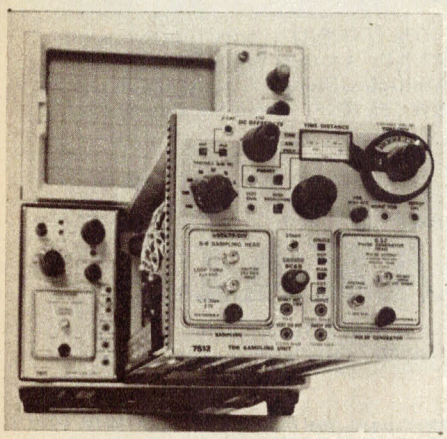
Independent pushbuttons move the vertical and/or horizontal sync pulse into the picture area for visual inspection. A pushbutton also allows a 20 per cent reduction in picture scan to allow inspection of the entire picture display, including VITS. Front panel buttons select either 525/60 or 625/50 scanning standards, including the appropriate chroma filters.

The 453A Portable 60MHz Oscilloscope is a dual-trace solid-state instrument which provides complete laboratory-standard measurement facilities in a 33-pound package. There are actually five distinct models in the 453A family, offering an unusually wide choice of performance features.

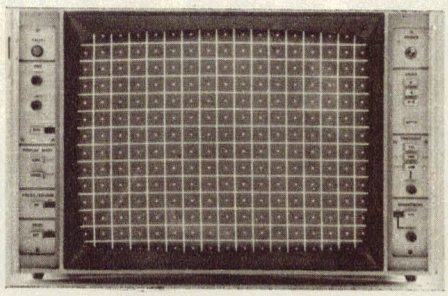
All versions offer a maximum sensitivity of 20mV/division at the full 60MHz bandwidth, with a reduced bandwidth of 40MHz at a sensitivity of 5mV/division. A sensitivity of 1mV/division may be obtained at a bandwidth of 25MHz, by cascading both vertical amplifiers. Four operating modes are available: each channel singly, alternate or chopped, and both channels added algebraically.

Calibrated sweeps extend from 5S/div to 0.1uS/div, with a 10X magnification extending the fastest sweep to 10nS/div. Horizontal display modes include main sweep, main sweep intensified with the delayed sweep, delayed sweep, calibrated X-Y and mixed sweep. The last-named is a new feature in portable CROs, in which the main sweep is displayed for a time adjusted by a front panel control, after which the rate changes to that selected by the second time/div control.

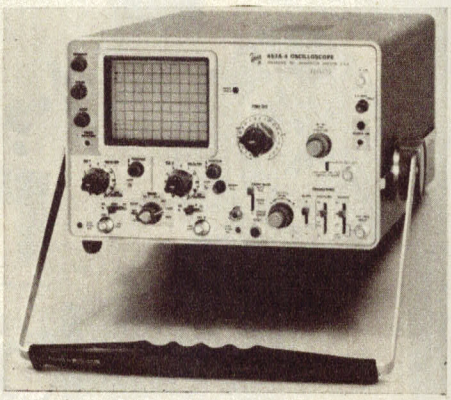
The 453A CRT has 8 x 10 divisions of display area (0.8cm/div), and 14KV accelerating potential for large bright displays



The 7S12 Time Domain Reflectometer unit.



Above is the type 630 Picture Monitor, while below is the 453A-4 Oscilloscope.



even with very fast pulses. Full bandwidth triggering facilities include automatic, single sweep and channel 1 only.

The 7S12 Time Domain Reflectometer is a double-width Series 7000 plug-in which uses Tektronix's interchangeable sampling head system to achieve application flexibility. One of the two heads in the 7S12 serves to accept and process incoming signals for display in the vertical axis; the other generates the incident pulse for TDR, or serves as a trigger recognition device for other applications.

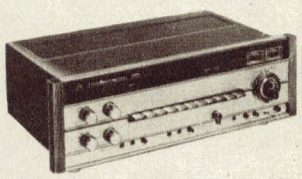
The vertical system of the 7S12 is calibrated in volts or rho, and reflection coefficients as low as .001 can be observed. System risetime is 35pS or less for the incident step and 45pS or less for the displayed reflection from a short-circuited 750pS test line. As a long line TDR the direct-reading tape dial gives calibrated one-way distances to 4,900 feet (air line) or 20uS round trip.

The type 4551 Light Pen Unit is designed to operate with TV-type raster displays to generate a movable video cursor and corresponding X and Y position information. It provides a choice of three different cursors, and is ideal for use not only in computer applications but also in TV systems for broadcasting diagrams, maps, captions, etc.

The R1140 Programmable Power Supply provides current and multiple voltage outputs for use with high-speed automated measurement and test systems. It contains three ±40V supplies, one ±100V supply and one current supply. Programming is via BCD logic input (TTL levels), with separate strobes and latching to allow independent programming of each of the five supplies.

Inquiries regarding any of these products should be directed to Tektronix Australia Pty Ltd, at 80 Waterloo Road, North Ryde, 2113, or 25-27 Alma Road, St Kilda, 3182. (J.R.)

Now Encel offers the superb new Lux SQ202 Amplifier at bedrock price!



The outstanding new Lux SQ202 solid-state amplifier combines the very latest audio developments with functional perfection and the highest possible standards of quality throughout. It's the top amplifier in the world-famous Lux range!

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The Lux SQ503 amplifier offers fine hi-fi with real economy. Built to the exacting Lux standards, this unit has a power rating of 60 watts RMS into 8 ohms, with low distortion and wide frequency response. ENCEL PRICE $369.

Note: All prices include sales tax. Write for full information on all these items. Technical reviews available on items marked *.

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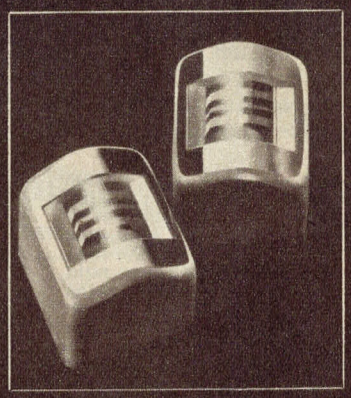
EE128A

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GX-280D

What makes AKAI's **GX-280D Stereo Tape Deck** so outstanding is that it gives you wonderful GX sound. By "GX sound" we mean sound reproduced with the AKAI-developed **glass and x'tal (single crystal) ferrite head.** We call this head the GX Head, which is the first of its kind in the world. In conventional heads, tape dust and wear greatly reduce sound quality. But our GX Head is "dust free" and "wear free" and guaranteed for over 150,000 hours of service life! **Breakdowns of this head before 150,000 hours of use will be replaced free of charge.**

This GX Head also produces a "focused field" which makes possible the recording and playback of high frequency signals without distortion.

This high performance GX-280D also features such professional specs as 3 heads, servo-control motor for direct capstan drive, automatic reverse, automatic stop/shut off and pause button with lock. The two 7-inch reels can be completely covered with an optional plastic dust cover.

The GX-280D is perfectly matched with AKAI's **AA-6600 Solid State AM/FM Multiplex Stereo Tuner Amplifier** and **SW-155 Hi-Fi Stereo Speaker System.**

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Sony Automatic Cassette Recorder

Mains-operated cassette-type tape recorders have been on the market for some time now. It has not been until recently, however, that their overall performance has improved to the point where they could be compared with conventional, open reel machines.

The SONY-O-MATIC CASSETTE-CORDER TC-180 is, in fact, the first of its kind to have been submitted to us for review and came from Jacoby Mitchell & Co Pty Ltd. It is a mono unit and, while it will accept standard stereo cassettes, it can replay – and record – only in the mono mode.

The recorder creates a very favourable first impression. Mechanically, it is well-built, using an imitation diecast top surface which, no doubt, adds to the air of sturdiness. A fully collapsible handle, makes carrying an easy task. Other worthwhile features include provision for automatic record level, full pushbutton control and public address facilities.

A common record/playback volume control is used to adjust the amplifier gain for recording and playback, as well as for the public address mode of operation. In addition a tone control of the top-cut variety is fitted to the left of the volume control.

Two switches directly above and almost in line with the volume control allow either manual or automatic gain control operation to be selected and also allow the internal speaker to be switched either full on, muted or off altogether. This latter facility is operative only in the record mode, as it is here that it is most needed. Setting the switch in the mute position allows one to monitor the recording with less danger of acoustic feedback, whilst maintaining optimum recording level.

The Cassette-Corder is also fitted with a calibrated VU meter and a digital, pushbutton reset, tape counter. The VU meter has an inbuilt red warning light which comes on when the record mode is selected.

The complete transport system is powered by a single induction motor. Drive to the flywheel, capstan and spools is by means of a number of belts and pulleys in a fairly straightforward manner.

The manufacturer's specifications are as follows:

POWER REQUIREMENT: 100, 110, 117, 125, 220 and 240 volts AC, 50/60Hz, at 20W.
TAPE REQUIREMENT: Will accept any cassette complying with the international standards, measuring 4in x 2½in with 1/7in wide tape. (More commonly known as 1/8in tape.)
TAPE SPEED: 1-7/8ips.
TRACKS: 2-track mono. (Also referred to as ½-track.)
POWER OUTPUT: 5W.
FREQUENCY RESPONSE: 50 – 12,000Hz.
WOW AND FLUTTER: 0.2%.
INPUTS: 2 Microphones – 200uV sens; 1 Auxiliary – 60mV sens with 100K input impedance.
OUTPUTS: Monitor jack – output level 775mV at 10K. Loudspeaker jack – for 8-ohm impedance.
LOUDSPEAKER: Built-in – 4 x 6in.
SEMICONDUCTORS: 10 transistors, 4 diodes.
DIMENSIONS: 12-15/16in wide, 4-11/16in high, 11-11/16in deep.
WEIGHT: 11lb 1oz.

Our findings on the above specifications were as follows.

The power output specification was adequately met; in fact, we measured 5.3W continuous at the stated 8 ohms load impedance.

The frequency response specifications are rather ambiguous. Firstly, no dB limits have been stated and, secondly, no information is given as to whether the figures apply to the overall response, or only to that obtained from a pre-recorded test tape.



The Sony TC-180 Cassette Recorder.

In our opinion the fairest way to evaluate a record-playback unit is by its overall response and we measured the response in just this way. Using the demonstration tape provided, we found the -3dB points to be at 100Hz and 5KHz. The response was 6dB down at 60Hz and 8KHz and at the stated 12KHz upper limit was 9dB down. This may seem rather poor at first sight, but it must be remembered that the tape speed involved is 1-7/8ips and not 3-3/4ips or 7-½ips.

No mention has been made in the manufacturer's specifications of the signal-to-noise performance. However, we found it to be slightly better than -40dB, which is fairly good.

The performance with regard to wow and flutter seemed to vary somewhat in the sample recorder. When it was first received there was quite an audible amount of wow present with the demonstration tape. Yet none could be detected on a number of other pre-recorded cassettes. After running the demonstration cassette a few times, however, the wow disappeared indicating, most likely, that the cassette itself needed some "freeing". This experience could possibly be repeated with some new and unused cassettes as well.

We were unable to obtain the specified input sensitivity figures. The Mic inputs measured 100uV, whilst the Aux input gave a figure of 35mV. In both instances this is about half the sensitivity specified. However, the difference may well lie in the method of measurement, as the manufacturer has not stated the "output" level to be expected. We made both measurements taking 0-VU as the reference level.

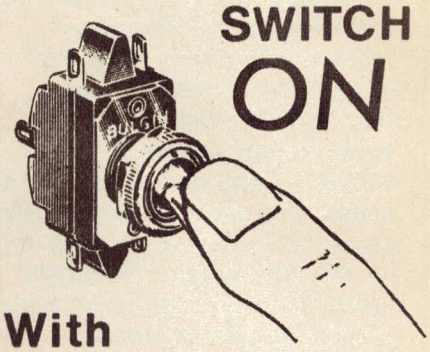
The output level from the monitor jack measured 1.2V, when the volume control was adjusted to read 0-VU, as specified. This is some 400mV above the specified level of 0.775V, but is of little consequence as the output level is fully adjustable.

We found the automatic recording facility to give satisfactory results with normal usuage. On sustained high input levels, however, the recovery time tends to be a little on the slow side. This is particularly noticeable if the "Auto" mode is selected after the level control has been adjusted for maximum recording level with the selector in the "Manual" mode. To speed up the

The AKAI advertisements which appeared in our May edition on pages 30 and 132 contained transposition of photographs. Please note that the product designated as GX365D should have been 1730-SS. Please accept our apologies for any confusion which this unfortunate error may have caused. ADVERTISING MANAGER.

Get *POSITIVE ACTION!*

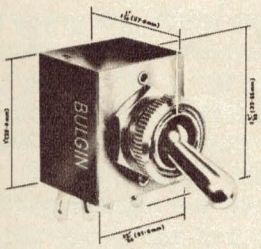
SWITCH ON



With

BULGIN

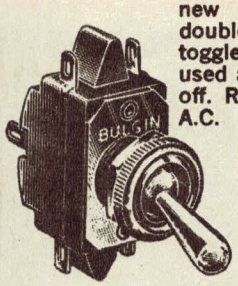
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SM.301/2/PD
D.P.C.O.
8-Contact
3A. at 250V.
A.C.

SM.277/2/PD
D.P.M.B.
4A. at 250V.
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★ FINE SILVER CONTACTS



List No. SM270/2/PD new style moulded double pole change-over toggle switch. Can be used as double pole on-off. Rating 2A @ 250V A.C.

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who needs 40 watts r.m.s.?

Obviously, from the demand for the Wharfedale "Rosedale", many music lovers have this substantial acoustic power requirement. Few speaker systems can handle 40 watts R.M.S. — and *only a handful do it well.* For sheer power handling capacity — free of colouration — the Wharfedale "Rosedale" leads this select group of high quality speaker systems.

With its 15" bass reproducer completely isolated from the 5" mid-range speaker and the 1" high pressure tweeter, the "Rosedale" has an effective frequency range of 35 — 20,000 Hz. Naturally it's a glorious piece of furniture which will grace any tasteful domestic environment. Measuring 24" x 23" x 13½", finishes available include oiled teak and polished walnut. The Wharfedale "Rosedale" will complement the highest quality amplifiers and signal sources.

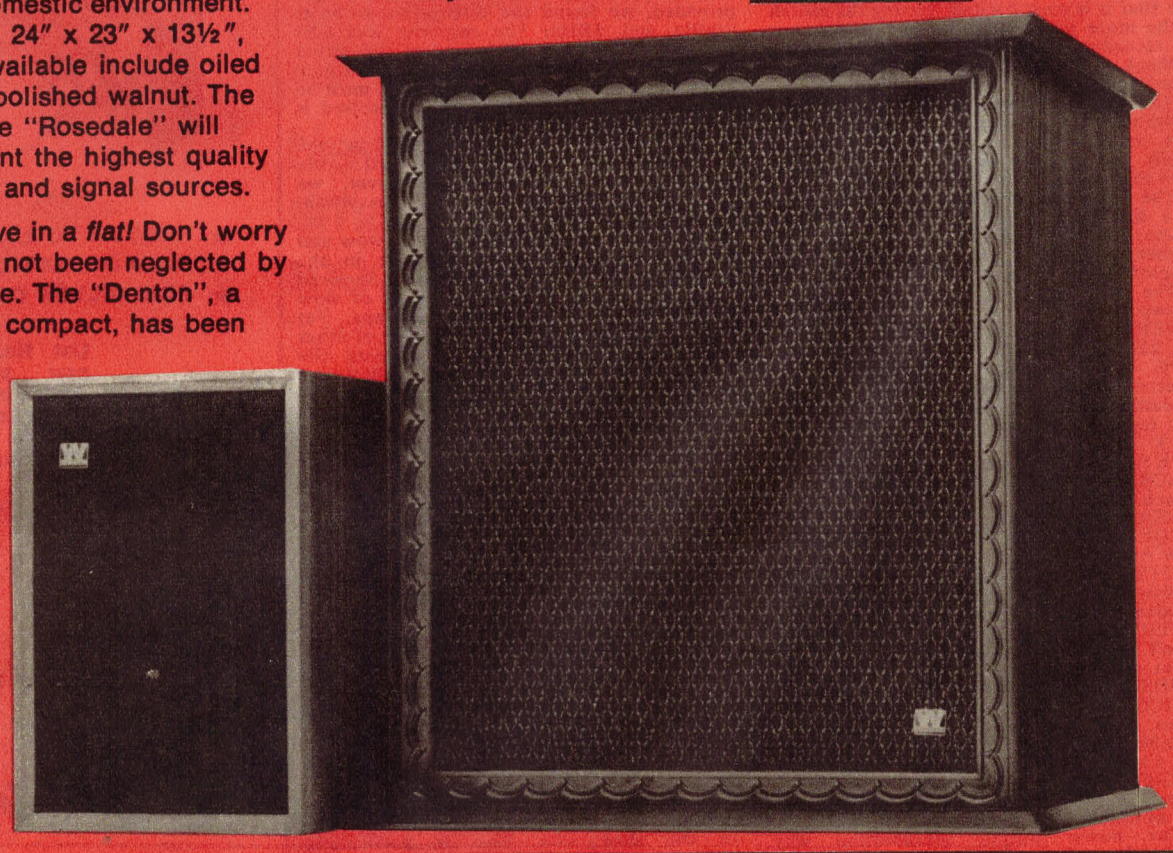
But you live in a *flat!* Don't worry — you've not been neglected by Wharfedale. The "Denton", a bookshelf compact, has been designed specifically for you. It measures only 15" x 9¾" x 9" but has a conservatively quoted frequency response of 65 — 17,000 Hz. This covers every musical instrument, every overtone.

With a specially designed "Deltaflex" surround for the 8" bass/mid-range speaker, the major problem of small enclosures . . . *cone break-up* . . . has been solved by Wharfedale sound engineers. The speaker only reproduces the signal fed to it — and the result is clean bass registers and accurate *"presence"* in the mid-range.

A separate 1" tweeter handles all notes and sounds over 1750 Hz. Power rating of the "Denton" is 15 watts R.M.S. These two fine British speaker systems are representative of the Wharfedale range; you can hear them all at your franchised Simon Gray dealer. When you do, listen for the *musical transparency* that identifies Wharfedale — for this intangible quality is the *reason* for Wharfedale's international success.

Easy sound to *live* with.

WHARFEDALE



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W.A.: Athol M. Hill Pty. Ltd., 613-615 Wellington Street, Perth. Tel. 21 7861

SONY CASSETTE RECORDER . .

recovery, we found it necessary to switch the selector back to the Manual mode for a few seconds. Provided, however, that care was taken to avoid switching the selector at high levels, the automatic recording system performed well.

We carried out one futher check, this on the overall distortion of the recorder. For a 0-VU recorded signal at 1KHz, the total harmonic distortion was 3%, which is acceptable for this type of recorder. No figures were supplied by the manufacturer on this parameter.

"Driving" the recorder was a pleasure. All transport functions are pushbutton controlled and operate very smoothly. Cassettes were easy to load and unload and not once did any malfunction arise due to rapid or careless loading. Both the rewind and fast forward modes are rapid and it is possible to go from one to the other without an intermediate stop.

The construction of the entire recorder is beyond reproach. Layout of the mechanics and electronics is up to Sony's usual high standards. The sturdy case construction should allow the recorder to stand up well to rough usage.

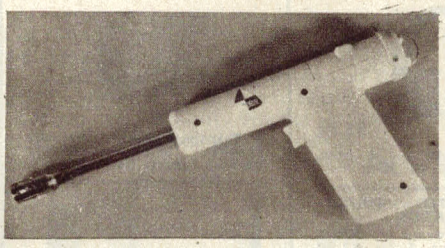
Summing up we would say that the Sony TC-180 cassette recorder represents good value at $207.75 retail. It provides a number of facilities not normally found on recorders of this type. Inquiries regarding this and other Sony recorders should be directed to Jacoby Mitchell & Co Pty Ltd, 469-475 Kent Street, Sydney or any of their interstate branches. (J.P.P.)

Aerosol Fire Extinguisher, Gas Lighter from Plessey Rola

Two new products recently announced by Plessey Rola Pty Ltd are a low cost aerosol fire extinguisher, and an electronic gas lighter pistol designed to ignite both town and natural gas.



At right, the Crown fire extinguisher. Below is the lighter.



The aerosol fire extinguisher is marketed by Plessey Rola carrying the "Crown" brand name. The brightly coloured container has a rated net capacity of one pound (454 grams), sufficient to deal with quite an appreciable domestic or automotive blaze. The container is fitted with a distinctive "fireman hat" cap, also a quick release mounting clip. Rated maximum storage temperature is 120°F.

The extinguisher carries a money back or replacement guarantee, and is claimed to be suitable for fires involving oil, grease, electrical materials, and most domestic trash. When we tried it out we found it to deliver a most powerful and effective blast, which leaves virtually no residue. At the list price of $1.89 (tax exempt) it therefore seems to offer excellent value in emergency fire protection.

The gas lighter pistol has been designed by Plessey Components in Britain. It is very attractively packaged, having in fact been selected in this regard by the Design Centre in London. It is designed for use not only with conventional town gas but also with natural gas and LP gas (propane). This is a noteworthy feature as some other types of lighter will only operate successfully with town gas.

The heart of the lighter is a transistorised DC-DC converter which operates from a single 1.5V torch cell ("C" size). The converter steps up the battery voltage to approximately 300V, which is used to charge a dump capacitor. A small gas tube discharges the capacitor into a step-up transformer to produce single 15KV pulses at a rate of approximately three per second, and it is these pulses which produce the sparks at the ignition tip. The energy in the sparks is approximately 5 millijoules, which is more than adequate to provide reliable gas ignition; yet the battery drain is sufficiently low to ensure a life in excess of one year, assuming a nominal usage of 15 operations per day, two seconds per operation.

In fact the basic electronic ignition system used in the pistol is also used by Plessey in multiple ignition units for kitchen ranges. Both battery and mains-powered versions of the multi-output units are made, with up to eight independent spark outputs.

The basic system used in the pistol is also used by Ronson in their new Electronic Pocket Lighter.

Enquiries regarding either the Crown aerosol fire extinguisher or the Plessey gas lighter pistol should be directed to Plessey Rola Pty Ltd, at either the Boulevard, Richmond, Vic., or PO Box 2, Villawood, NSW.

TRADE RELEASES — in brief

LABORATOIRE ELECTRO-ACOUSTIQUE, 5 Rue Jules Parent, 92 Rueil Malmaison, France. **Pulse noise analyser, type BAT 1.** This unit counts, over a preset adjustable time interval, the number of positive and negative pulses of amplitude exceeding a calibrated threshold. It can be used to measure pulse noise in data transmission and telegraphy circuits. Features include: 600-ohm and high impedance inputs; threshold adjustable from -50dB to 0dB in 1dB steps; incorporates two plug-in filters, one with uniform response (275Hz to 3250Hz within 1dB) the other, for data transmission (750Hz to 2300Hz within 1dB), with 18dB attenuation per octave below 600Hz and above 3000Hz; choice of four dead times, less than 100uS, 5mS, 50mS and 125mS; mains and built-in battery power supply; complies with CCITT recommendations; size 430 x 87 x 300mm, weight 6Kg.

EMI (AUSTRALIA) LTD, 14 Parramatta Road, Homebush, NSW 2140, has announced the appointment of Mr John Stannard as sales manager of the newly formed television equipment section of the commercial and advanced electronics division. A demonstration and training studio containing EMI studio cameras, telecine, links, and switching equipment will be commissioned during the coming year and kept up to date with new equipment from both the UK parent company and the Australian organisation.

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CHOOSE a career in the field of ELECTRONICS* — the Nation's most progressive and fastest expanding industry.

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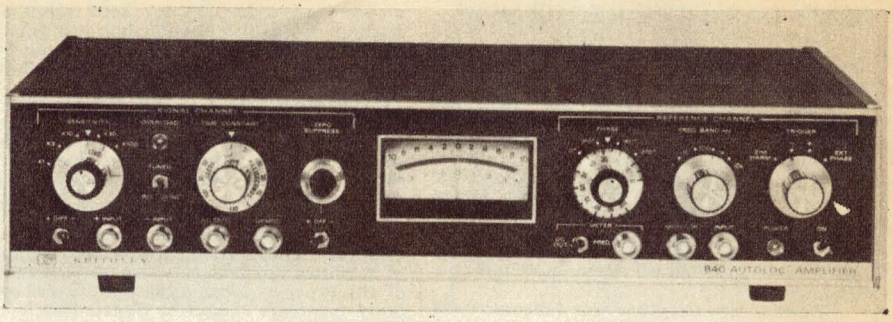
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TRADE BRIEFS . . . . contd.

PLESSEY ELECTRONICS PTY LTD, 91 Murphy Street, Richmond, Vic. 3121. Pocket two-way radio, CUB type 4B7. This is a vhf FM pocket-sized portable transmitter/receiver to provide a completely portable system or for use with a mobile/fixed station network. Two versions are available, the PB2 (low band) and PH2 (high band). The only external controls are a channel selector and a combined volume control and on/off switch. Two aerial sockets are fitted. A fixed length wire aerial and and extending rod aerial are provided. A miniature handset with a press-to-talk switch is attached by a flexible lead and may be hand-held or attached to a coat lapel. The unit is powered by an internal rechargeable battery with an average operational duration of eight hours.

WARBURTON FRANKI PTY LTD, PO Box 182, Chatswood, NSW 2067. Agent for



Keithley model 840 Autoloc amplifier

Keithley Instruments, USA. Lock-in amplifier, model 840 Autoloc. Using optional plug-in filler cards, the 840 is capable of detecting signals up to 140dB below the noise level. Features include: 0.5Hz to 15KHz frequency range; wideband or tuned operation; 25nV resolution to 1V full-scale; optional pre-amp and transformer give 75pA resolution; up to 140dB dynamic range; differential input; automatic frequency tracking.

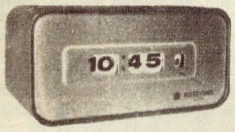
STANDARD TELEPHONES AND CABLES PTY LTD, Moorebank Avenue, Liverpool, NSW 2170. Printed circuit track switch, type ITP 7750-A, for manual make or break of part of a circuit on a printed circuit board. It consists of a moulded part, two separate contact springs, one tension spring, and a sliding knob. The unit can be fitted to a printed circuit board by direct soldering. The terminals can be cut or left as test points. The switch fits on any board with a grid spacing of 0.1in. It measures only 4mm wide and 11mm high. The switches are available as single units or as assemblies of four units, which can be cut easily into single units.

Hybrid audio power amplifiers, types TA10 (10W output), TA20 (20W), TA25 (25W) and TA50 (50W). These amplifiers have been designed for hi-fi stereo systems, sound distribution systems, musical instruments, other audio equipment, and AC servo motors. They feature: single-ended push-pull circuit; ability to withstand a 5-second short-circuit across the output terminals; no external components required; full protection and temperature compensation; harmonic distortion less than 0.5% at full power output; frequency range 20Hz to 100KHx (within about 0.5dB) at 1W output, 20Hz to 20KHz at full power output; voltage gain (typ) 30dB.

PLESSEY DUCON PTY LTD, PO Box 2, Villawood, NSW 2163. Miniature edge switch, 33 series. This range is a smaller and more advanced version of the Plessey 50 series edge switch. Intended for such applications as machine tool control, computer switching systems, and instrumentation and frequency setting arrays, this switch has smooth action and offers facilities for panel mounting from the front or rear. Illuminated versions are available if required. A wide range of switching codes includes decimal, binary and binary with complement, while multi-pole switching is achieved by coupling together a switch and up to four slaves with plain or marked drums. Terminations may be for direct wiring or for edge connectors, while extended printed boards are also available for mounting diodes and other small components. Other options include stops to limit rotation, special dial markings, and different colours (a matt black finish is standard). Other features include: contact rating 100mA at 50V DC; maximum current capacity 1A; temperature range -20 to +70 degrees C; meets H5 to DEF 5011 climatic specifications; Life is not less than one million indexing operations. Dimensions are: height 33mm, width 8mm, depth behind panel 38mm, depth with longer board 60mm.

BELLING & LEE (AUST) PTY LTD, 2-18 Canterbury Road, Kilsuth, Vic. 3137, has appointed Mr Frank Walsh as marketing manager. He was formerly manager of the NSW branch of the company. Mr Brian Keeble, formerly of the Melbourne office, has taken up the position of NNSW manager. Other appointments include Mr Jack Pluek as engineering manager and Mr John Blythman as communications sales manager (replacing Mr Pluck).

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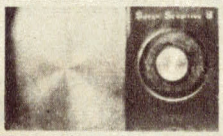


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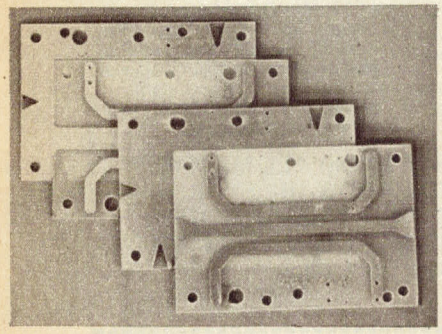
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TRADE BRIEFS . . . . . .contd

EMI (AUSTRALIA) LTD, 301 Castlereagh Street, Sydney, 2000. Agent for EMI Electronics Ltd, UK. Microwave generator, type T1001. This is a versatile compact unit intended primarily to drive microwave excited electrodeless discharge tubes such as the EMI type 9748. The T1001 has an operating frequency of 2450MHz and output power (unmodulated) is variable from 20W to 140W. Square wave modulation at frequencies variable from 40Hz to 2.5KHz is provided with control of depth of modulation. An additional feature is a variable duty cycle from 10% to 90% enabling even lower powers than 20W to be easily obtained. Metering is provided for incident and reflected powers, the reflected power meter having an expanded scale for low readings.

TOTAL ELECTRONICS, 239 Bay Street, North Brighton, Vic 3186. Distributor for Motorola Semiconductor Products Inc, USA. Silicon bidirectional thyristors, types MAC10-1 to 8, MAC11-1 to 8. Designed primarily for full-wave AC control applications, the devices are rated at 10A RMS and at 25 to 600V repetitive peak off-state voltage. High power NPN silicon transistor, type MJE 3055. Designed for use in general purpose amplifier and switching applications, the device is rated at 10A continuous collector current, 60V collector-emitter voltage and 90W total dissipation. It has a current gain-bandwidth product of 2.0MHz at 500mA. N-channel junction FET, type MPF111. A depletion mode device designed for general purpose amplifier and switching applications. It features: total dissiapation 200mW; transfer capacitance 1.5pF (typ) at 10V drain-source voltage; input capacitance 4.5pF (typ) at 10V drain-source voltage.

NATRONICS PTY LTD, The Crescent, Kingsgrove, NSW 2208. Frequency counter, model 802. This is a precision 8-digit frequency counter with a 100MHz basic measuring range which may be extended to 500MHz by the use of plug-in heterodyne converters. It is a high stability, accurate and versatile instrument that can be used for frequency, period, period average, and frequency ratio measurements. All functions are selectable by front panel pushbuttons, or may be programmed from remote locations through a rear panel multi-way connector. An 8-digit neon indicator display, display storage, and selectable sample times are provided. A 5MHz crystal oscillator is the basic reference for the counter. The use of a double oven with proportional temperature control and automatic crystal drive control provides an oscillator stability of better than .001ppm (typically .0003ppm).



The printed wiring boards illustrated above are manufactured by RCS Radio Pty Ltd for use in the VHF Powermatch, described in our February, 1971 issue. Further information on these and other printed wiring boards for "Electronics Australia" projects, can be obtained from the company at 651 Forest Road, Bexley, NSW 2207.

PATON ELECTRICAL PTY LTD, 90-94 Victoria Street, Ashfield, NSW 2131, has announced that its range of "Demonstration" type electrical instruments has been approved by the US Federal Supply Service under the heading of "Training Aids and Devices". Developed in Australia by Paton, the instruments were initially produced for the NSW Department of Education for science and physics instruction in high schools, technical colleges, universities, etc. They are large in size and give a clear indication of electrical values in experiments. An important feature is that the entire mechanism and internal components are clearly visible for instruction in electrical instrumentation.



A display of "Demonstration" instruments.

ELECTROBITS PTY LTD, 97 Cavanagh Street, Cheltenham, Victoria, is a new company established to provide a complete source of supply for electronic components and materials. The range of products is planned to cater for the needs of every user from the hobbyist to the largest manufacturer. The company manufactures a range of electronics test equipment, audio leads, and chemicals for the industry. Electrobits holds import agencies for: dry, mercury, and alkaline batteries; shielded, coaxial, and specialised wires; and ceramic trimmers. The company is negotiating throughout the world for further agencies.

The general manager of the new company is Mr P. J. Cohen, formerly sales manager with McMurdo (Aust) Pty Ltd. He and Mr Gerry Goramder, of Swe-Check Instruments, have combined and are running both businesses from the one premises. The postal address is Electrobits Pty Ltd, PO Box 232, Clayton, Victoria 3168.

SCIENTIFIC ELECTRONICS PTY LTD, PO Box 61, Blackburn, Victoria 3168, inform us that the sample of their precision power supply reviewed in the February 1971 issue of "Electronics Australia" has been found to contain a minor component fault, and it was this which caused the load regulation to be outside specification. They assure us that their regular production units conform to the load regulation specification of less than 1mV change in output voltage for a full load change.

A & R REGULATED BATTERY ELIMINATOR SUPPLY. (Reviewed April, 1971, page 117.) It was mentioned in the review that the manufacturer's specifications did not carry a qualification on the ripple ratings. However, it has been drawn to our attention that the operating instructions do contain a detailed specifications column, in which the ripple figures are qualified with RMS ratings. On this basis, the supply will easily meet its ripple requirements.

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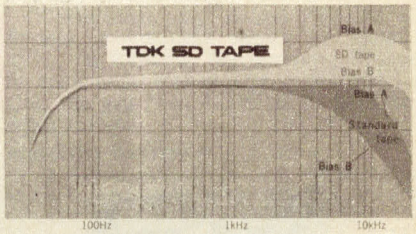
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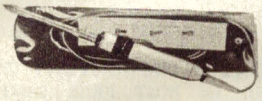
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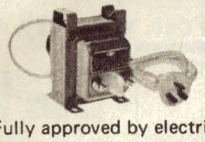
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TECHNICAL BOOKS AND PUBLICATIONS

ARRL Handbook

THE RADIO AMATEUR'S HANDBOOK. Published by the American Radio Relay League Inc, Newington, Conn, USA. Well illustrated with circuits, drawings and photographs. Soft cover, 643 pages, 9½in x 6½in. Price in Australia $6.95 plus postage 50 cents.

At about this time every year, a new edition of the ARRL Radio Amateur's Handbook makes its appearance, and we now have the 48th edition of the series. Surely only the very newest personnel in the field of electronics will need any introduction to this well established publication. Although it is specifically intended for the amateur radio fraternity, it has found its way into libraries, laboratories, industry, etc, as well as to amateurs and short-wave listeners throughout the English speaking world.

Due no doubt to production costs, and the need to keep the handbook down to a manageable size, the number of pages has remained static for many years. This means that where new material is to be added to any section, some existing material, which may be more or less obsolescent, must give way. It is interesting to note that the page number for the beginning of each chapter is the same as for the 1970 edition.

Major changes have been made to the chapters entitled Semiconductor Devices, Receiving Systems, Single-Sideband Phone, and Specialised Communications Systems. Some other chapters have been modified to a somewhat lesser extent and these include: Oscillators, Multipliers and Power Amplifiers, VHF and UHF Receiving, VHF and UHF Transmitting, and Measurements. Each of these chapters contains new material and these changes constitute the difference between this edition and the 1970 edition.

The chapters just referred to have been altered with the object of updating the material, particularly where it relates to solid-state devices and their application. This applies in the main to VHF receiving systems and mobile equipment. Also, with details of SSB techniques undergoing rapid changes, some of the new material in this section should be of interest to many readers.

The chapters dealing with fundamentals are still much the same, as may be expected, with the exception that some new information is given relative to solid-state devices, including ICs.

It always seems to have been the policy of the ARRL to provide a wealth of constructional articles, covering all aspects of amateur radio. The newcomer and old timer alike will find in this new edition much to satisfy his needs in this field. Practically all items of equipment from the microphone through the transmitter, receiver and loudspeaker are adequately covered. In addition, the chapter on test equipment gives many useful items which the amateur may build. The chapter on valve and transistor characteristics completes the volume. However, as in previous editions, the coverage of transistor types is not all it might be and it would be a step forward for the publishers to enlarge this section.

For readers who wish to join the interesting field of amateur radio, this book is a must and we can confidently recommend it. Practising amateurs who have not invested in an edition within the last five years or so, might also find it worthy of consideration. If you have a recent edition, then it would be a good idea to satisfy yourself that the changes are worth the extra outlay.

The overall quality of the book is similar to that of recent years, being very well printed, with good quality paper and binding which should last for the life of the book, given reasonable treatment. However, each previous edition has been available with an alternative hard cover, at some increase in price, and we assume that this will still apply.

Two review copies of this book were received, one direct from the publishers in the US and the other from the Technical Book and Magazine Co Pty Ltd, of 289-299 Swanston Street, Melbourne. The latter firm advises that copies are available ex stock. (I.L.P.)

CCTV Systems

TELEVISION COMMUNICATION SYSTEMS FOR BUSINESS AND INDUSTRY, by J. M. Stormes and J. P. Crumpler. Published by John Wiley and Sons Inc, New York, 1970. Hard covers, 6¼in x 9¼in, 238pp, many illustrations. Price in Australia $12.55.

This is the latest addition to the Wiley Interscience series on Human Communication, published under the general editorship of K. G. Tong. It has been written both as a general treatment of closed-circuit TV and its uses, for executives and managers concerned with communication problems, and also as a practical manual for directors of training in business, industry, research, hospitals and educational institutions who are planning to set up a CCTV facility. The authors are respectively Project Manager and Associate Director at General Behavioural Systems Inc, of California.

The book is divided into three sections. The first of these deals with the characteristics and function of CCTV systems, and their wide variety of applications. The second section then presents the planning concepts which should be considered by engineers and executives responsible for system development. Finally the third section examines CCTV production techniques and considerations, making recommendations on the basis of current scientific thinking in such relevant areas as perception and learning theory.

The text of the book appears to this reviewer to be well written, developing its subject in a methodical and concise manner. It is well illustrated with photographs and diagrams showing modern CCTV equipment and systems. As one might desire, it includes a brief history of CCTV systems and their development, and also a chapter on current technical developments and their likely future application. There is an appendix giving useful information based on a recent survey of industrial CCTV system users in the USA.

In all, a book which should be of considerable value to anyone concerned either with the setting up and planning of an industrial or educational CCTV system, or with its effective utilisation. It provides a valuable source of up-to-date and specifically CCTV-orientated information which would not be available from the established general reference works on television technology and production.

The review copy came from John Wiley and Sons A'sia Pty Ltd, and we understand that copies are available at all major bookstores. (J.R.)

Circuit Design

CIRCUIT CONSULTANT'S CASEBOOK, by T. K. Hemingway. Published by Business Books Ltd, London, 1970. Hard covers, 5½in x 8¾in, 210pp, many circuits and diagrams. Price in Australia $11.10.

As the title of this book suggests, it has been written by an experienced designer of electronic circuits, with the idea of offering his accumulated knowledge for the benefit of those less experienced. The author is Stevenage head of Electronic Technology at the Guided Weapons Division of the British Aircraft Corporation, and has been associated with the design of transistor circuits since junction transistors first became available in Britain in 1954. He has contributed widely to technical and professional journals on the

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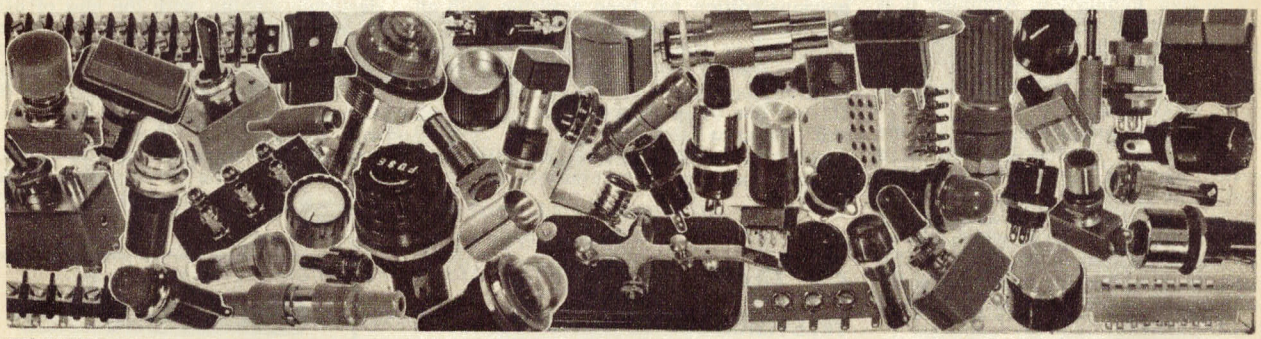


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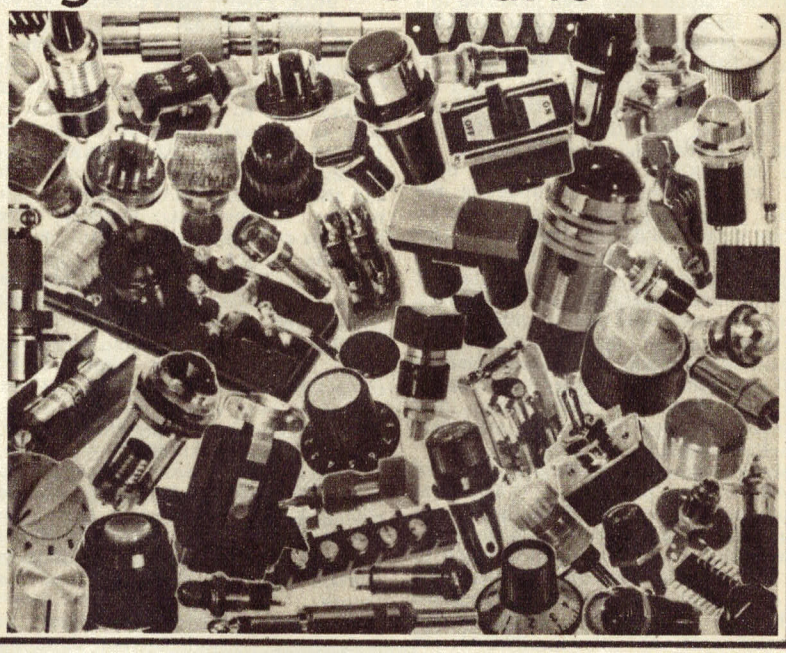
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Homecrafts, Tas P/Ltd. 199 Collins St., Hobart.

theory and practice of transistor circuit design.

It would appear that in some ways at least the present volume is intended as a sequel to the author's "Electronic Designer's Handbook", which dealt with the fundamentals of modern circuit design. In the new book the emphasis is on design pitfalls and problems, and their efficient solution. The material is all based on the author's own experiences, and the examples given are thus quite practical. They range from the type of design mistakes made by the beginner to those which occasionally trap even the best design consultants.

The book is divided into two main sections. Part 1 deals with basic design problems, including common errors and their correction. Here the topics include DC conditions, protection, microcircuit usage, dynamic effects, system defects, and errors in testing. Part 2 deals with ways of meeting specification requirements not readily achieved by standard circuit approaches. In certain cases a simple modification to a standard circuit configuration is shown to be sufficient, while in others a novel approach is examined. Among the standard circuits for which modified configurations are given are multivibrators, Schmitt triggers and time interval circuits. Special designs are also given for meter driving circuits and precise constant-current sources.

While fairly technical, by its very nature, the book is not deeply mathematical. The text is well illustrated with diagrams, and should be easily followed by anyone with a basic knowledge of circuit design who is prepared to work through the concepts systematically.

A book which should be of considerable interest and value both to practising circuit designers and to undergraduate engineering students.

The review copy came from Hicks, Smith and Sons Pty Ltd, who advise that copies are already in stock at all major bookstores. (J.R.)

TV Servicing

101 TV TROUBLES FROM SYMPTOM TO REPAIR, by Art Margolis. Published by TAB Books, USA. Stiff paper covers, 218 pages, size 8½ x 5in. Price in Australia $6.15, or $9.95 with hard covers.

The stated aim of this book is to assist those servicemen who have been in the industry for some time, but who may have not kept up to date with modern developments, notably the spread of colour television and the swing to solid state circuitry. It will be apparent therefore that some aspects of this text will have only academic interest for the Australian serviceman – those concerned with colour television, which is a large part of the total text. Quite apart from this, the examples and circuits used apply to American models and American standards, so that the book has only limited use in this country.

Some of the information included is so basic that it could be argued that any person who did not have this knowledge should not be attempting to service TV receivers.

Those who might be tempted to buy the book for technical background information should, however, be aware that this reviewer cannot give it even qualified approval, quite apart from its limitations. A cursory examination of the text brought to light a number of errors and suspect statements. Also, the author has a poor writing style which has resulted in ambiguities.

For example the reader is advised (page 42) that a signal injection instrument such as the B & K Analyst is essential for tracing high voltage. Whatever the author meant to imply, he did not succeed in putting the message over. A multimeter or electronic voltmeter is the obvious tool to use for voltage tests, not any signal injection device. Again, on page 44 the statement appears "When the horizontal output transistor *keeps failing* (our italics), check for excessive PP voltages . . ." One is tempted to speculate how many times a component has to fail before one begins to look for the cause.

There is no doubt that the author knows his subject, as is evidenced by the considerable amount of practical advice incorporated in the text. But with its other limitations, we doubt whether it is worth the purchase price in this country.

Our copy was supplied by Grenville Publishing Co Pty Ltd, 401 Pitt Street, Sydney, NSW 2000. (H.A.T.)

Solid State Physics

DIFFUSION IN SEMICONDUCTORS, by B. L. Sharma. Published by Trans Tech Publications, of Clausthal, Germany and Rocky River, Ohio USA, 1970. Soft covers, 5¾in x 8¼in, 200pp, tables and diagrams. Price in USA $9.80.

A somewhat specialised volume, written with the idea of bringing together as much as possible of the currently available theory and practical information on the diffusion technique for semiconductor impurity doping (not the carrier transport mechanism of the same name). It is intended mainly for those working in solid-state physics or concerned with semiconductor device development, but should also be of interest and value to senior undergraduate and graduate engineering students. The author has a PhD in solid-state physics from Ohio State University, and is currently undertaking research into materials and semiconductor physics at the Solid-State Physics Laboratory in Delhi, India.

The book is divided into eight chapters, the headings of which give a good idea of the material covered and its presentation: 1 – Theoretical Basis of Diffusion in Semiconductors; 2 – Experimental Diffusion Techniques; 3 – Methods for Evaluating Diffusion in Semiconductors; 4 – Diffusion in Silicon and Germanium; 5 – Diffusion in III-V Compounds; 6 – Diffusion in II-VI Compounds; 7 – Diffusion in IV-VI Compounds; 8 – Diffusion in Other Useful Compounds. Each chapter is subdivided into major topic headings, and concludes with an exhaustive reference list.

A book which should be found a very useful reference by anyone working or studying in this field.

The review copy came directly from the publisher in Germany, whose address is Adolf-Ey-Str. ld, D-3392, Clausthal-Zellerfeld. No information was supplied regarding local price and availability. (J.R.)

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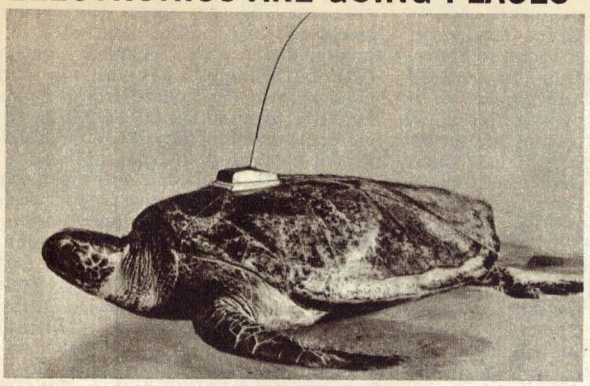
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and TV studio service are included. The catalogue also includes a complete equivalents list, phosphor guide, and translation of terms into French, German, Italian and Spanish. Inquiries to GEC-Elliott Automation Pty Ltd, Electronics Division, 15 Whiting Street, Artarmon, NSW 2064.

CCIR REPORT 252-2, New Delhi, 1970. CCIR interim method for estimating sky-wave field strength and transmission loss at frequencies between the approximate limits of 2 and 30MHz. Published by the International Telecommunication Union, Switzerland. This work, consisting of 210 pages, has been published in a trilingual edition (English, French and Spanish) at a price of eight Swiss francs, including postage and packing. Inquiries to Standard Book Suppliers Pty Ltd, Elizabeth House, 231 North Terrace, Adelaide, 5000.

STANDARD TELEPHONES & CABLES PTY LTD, Moorebank Avenue, Liverpool, NSW 2170, has published the following additions to the ITT component data and applications handbook: Integrated circuits data book 930 series DTL (56 pages of essential characteristics and ratings of these ICs including explanation of characteristics Crystal can military relays (16 pages of essential data); EM400 series epoxy silicon rectifiers (4 pages, giving ratings and curves for these 1A devices); ISEP Dilboards (2 pages).

RCA SILICON RECTIFERS, ASSEMBLIES & BRIDGES. Published by RCA Electronic Components, USA. A 12-page quick reference guide to the range of RCA components available through AWV, it gives essential data on axial-lead diodes, stud rectifiers, single-ended diodes, high voltage rectifier assemblies and bridge rectifiers. It also includes a designers' guide for rectifier circuits showing how to calculate essential parameters of single and multi-phase circuits. Inquiries to Amalgamated Wireless Valve Co Pty Ltd, Private Mail Bag, Ermington, NSW 2115.

PHILIPS MINIWATT DIVISION, 20 Herbert Street, Artarmon. NSW 2164. has a number of catalogues available free on request on company letterhead. These include: 1971 short-form catalogue of semiconductors – rectifier diodes, thyristors, and triacs; 1970 product survey of resistors and capacitors; 1970 quick-reference brochure on zener diodes; and a data sheet on metallised film capacitors 344 series. The first catalogue is intended as a selection and replacement guide for semiconductor devices used in both single and three-phase bridge configurations with resistive and inductive loads. Details are also given on transient voltage suppression, current limiting fuses, and heatsinks. The resistor and capacitor guide gives essential data on these components, and includes potentiometers, thermistors, and voltage dependent resistors in the resistor section, while the capacitor section is divided into ceramic, polyester, polycarbonate, electrolytic, and variable capacitors. The zener diode selection and replacement guide gives only abbreviated details sufficient to determine a type's suitability in a particular circuit.

THE NATIONAL BUREAU OF STANDARDS in the USA, has published the Proceedings of a Silicon Device Processing Symposium which should prove a valuable source of reference to engineers and applied scientists.

The object of the symposium was to provide engineers and applied scientists actively engaged in the silicon device technology field an opportunity to discuss the most advanced measurement methods for process control and materials characterisation.

The general session consisted of five invited tutorial papers. The remaining six sessions dealt respectively with: epitaxy, techniques and facilities (five papers); diffusion properties and characteristics (six papers); diffusion, techniques and facilities (six papers); epitaxy, properties and characteristics (eight papers); interdependance of unit processing operations (seven papers); and surface preparation (seven papers).

The publication is available from the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Remittances should be in US currency or equivalent, and include an additional 25 per cent for postage

NEW DEVELOPMENTS, issue B052, March 1971. A new products guide published by Jacoby, Mitchell & Co Pty Ltd, 469-475 Kent Street, Sydney, 2000. Contents: Advance laboratory power supplies; Sony video tape recorders; Jayem multimeters; Dynaco industrial monitoring and control instruments; Kew snap-around meters; PRD Electronics precision wavemeters; Waveline frequency meters; Levell RC oscillators; Assmann 24-channel recorder; Bell & Howell bonded strain gauge.

TECHNICALITIES, March, 1971. A new products magazine published by Tecnico Electronics, a division of Pye Industries, PO Box 12, Marrickville, NSW 2204. Contents: Editorial; Circuit Stik instant circuit boards; Signetics character generators: Bourns potentiometers; Keyswitch subminiature relays; Elite component pre-forming equipment; F. W. Bell transducers; Rustrak event recorders; North Hills DC voltage/current reference sources; Princeton electrometers, cryothermometer, and potentiostat/galvanostat; SSR Instrument photon counter; Dytronics phase angle measurements and vibration monitor; F. W. Bell magnetic instrument modules; Pacific Measurements AC log compression amplifier; Electrosil glass tin oxide resistors. This issue also contains an application note, Data collection for air pollution applications, by William M. Fleisher.

TELECOMMUNICATION JOURNAL, Vol 38, Number 4, April 1971. Published by the International Telecommunication Union, Place des Nations, 1211 Geneve 20, Switzerland. The Journal contains the following articles: Medium speed data channels over T1 carrier systems, by F. S. Boxall; The future of telecommunications and their influences on mankind, by H. Busignies. Under the heading of "Ideas and Achievements" the reader will find features on: Intelsat-IV; Telecommunications in Kuwait; Common waveguide multiplexer improves satellite transponder design. The section on "Union Activities" contains a report on the meeting of the Plan Committee for Africa and the Secretary General's visit to Nigeria, Dahomey and Upper Volta. Also included in this section are reports on meetings of CCITT Study Group IX (Telegraph transmission quality), CCITT Working Party II/4 (Sound and television program transmission), CCITT Working Party IX/1 (Telegraph transmission) and the Joint Working Party TEUR (Tariffs-Europe).

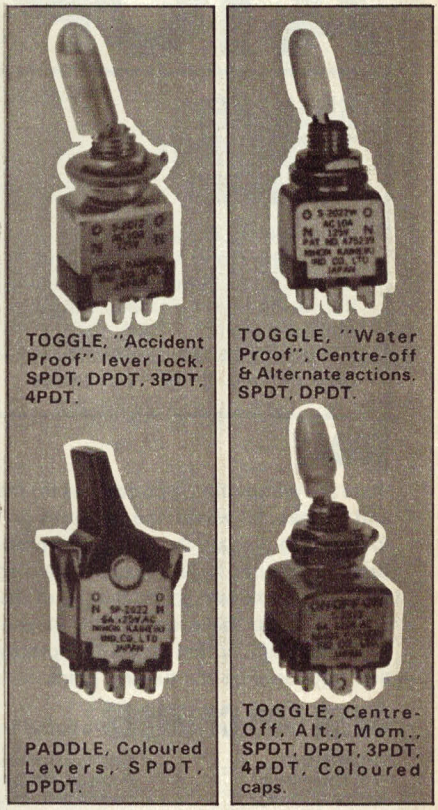
MI CONTACT, Issue 10. Published by Marconi Instruments Ltd, UK. Contents include: Low noise UHF FM signal generator; New literature available; Exhibitions; TV sweep analysis system; Autotest featured on British television; Signal generator for microwave links; Automatic distortion factor meter. Inquiries to Amalgamated Wireless (A'sia) Ltd, PO Box 96, North Ryde, NSW 2113.

EMCEE ELECTRONICS INC, 173 Old Churchman Road, New Castle, Delaware 19720, USA, has published a 2-page technical bulletin, No 100, which outlines features and describes the use of a new IC tester for design work or for maintenance testing of gates, clocks, flip-flops, counters and adders. The self-contained, self-powered IC tester with a flexible cable design, provides fast, easy in system testing of 14 and 16-pin dual-in-line TTL or DTL integrated circuits. Specifications are included.

ROYSTON ELECTRONICS PTY LTD, 22 Firth Street, Doncaster Vic 3108, have announced that brochures are available on the range of light-emitting devices manufactured by Bowmar Canada Ltd. Further information on the R1 series and the R7 series is available on request.

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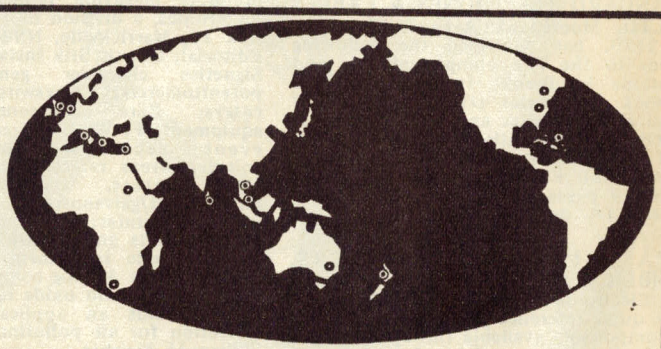
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TELECOMMUNICATION JOURNAL, Vol 38, No 3, March, 1971. Published by the International Telecommunication Union (ITU), Place des Nations, 1211 Geneve 20, Switzerland. Contains the following articles: Computer aided planning of the United Kingdom trunk network, by D. Breary; The ITU and the protection of telecommunication installations, by H. Riedel; Improvement of the program for predicting the Phi-F2 index, by M. Joachim. Under the heading of "Ideas and achievements" are features on: colour television camera for lunar surface exploration; closed circuit television links two hospitals; the inventor of radio. The section on "Union activities" carries reports on meetings of CCITT ALP Joint Working Party (use of alphabet No 5). Study Group VIII (telegraph equipment and local connecting lines), and an ITU seminar on broadcasting technology held in Kuala Lumpur.

WORKED EXAMPLES IN X-RAY SPECTROMETRY, by R. Jenkins and J. L. de Vries, of the Philips x-ray applications laboratories. Published by Macmillan & Co Ltd, it will be available in Australia at about $7. Most textbooks on x-ray spectrometry and x-ray diffractometry provide details of typical problems encountered in these fields and explanations of how to solve. However, they do not normally help the reader to judge whether or not he can really apply the knowledge to workaday problems. This latest book allows spectroscopists to check their ability to solve the type of problems experienced in practical spectrometry and diffractometry work.

This work is not intended as an independent source of information directly usable by a complete newcomer to the field. Although much basic theory can be derived through its study, it is more a supplement to existing works in the field with the emphasis on guide lines for tackling theoretical and practical problems.

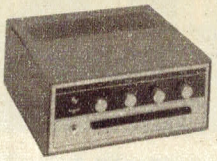
The book covers worked examples in five basic sections: spectra, instrumentation, counting statistics, quantitive analysis, and miscellaneous. Within each section the examples are further sub-divided into those dealing with x-ray spectrometry and x-ray diffractometry, and those of a general nature. It permits each example to be treated as a posed question, for which the reader provides the answer, or as a guide to the method of treating a particular class of problem. The problems have also been graded on a "difficulty" basis that allows the reader to find if he really has the in-depth knowledge he needs. Most of the examples are based on problems that the authors have encountered in their work and which they have also used in Philips' x-ray spectrometry schools and symposia held throughout Europe.

Further information may be obtained from Philips Industries Ltd, GPO Box 2703, Sydney, 2001.

HEWLETT-PACKARD AUST PTY LTD, 22-26 Weir Street, Glen Iris, Vic 3146, has available copies of the following application notes: AN 915, Threshold detection of visible and infrared radiation with PIN photodiodes (six pages); AN 917, Hewlett-Packard PIN photodiodes (two pages); AN 933, Monolithic solid-state seven-segment displays (six pages). Inquiries should be on company letterhead.

NATIONAL SEMICONDUCTOR CORP, USA, has published a 20-page brochure describing "Tri-State" logic circuits which are now available from the company. The publication describes the concept of Tri-State, its unusual characteristics, and typical uses. Also included are descriptions and specifications for National Tri-State devices, including multiplexers, demultiplexers, flip-flops, line drivers, buffers, hexidecimal counter/latch, decade counter/latch, and 256-bit read only memory. Applications, on company letterhead, should be addressed to Rutherford Electronics Pty Ltd, PO box 30, North Balwyn, Vic 3018.

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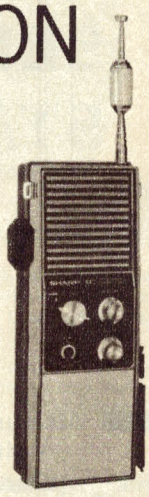
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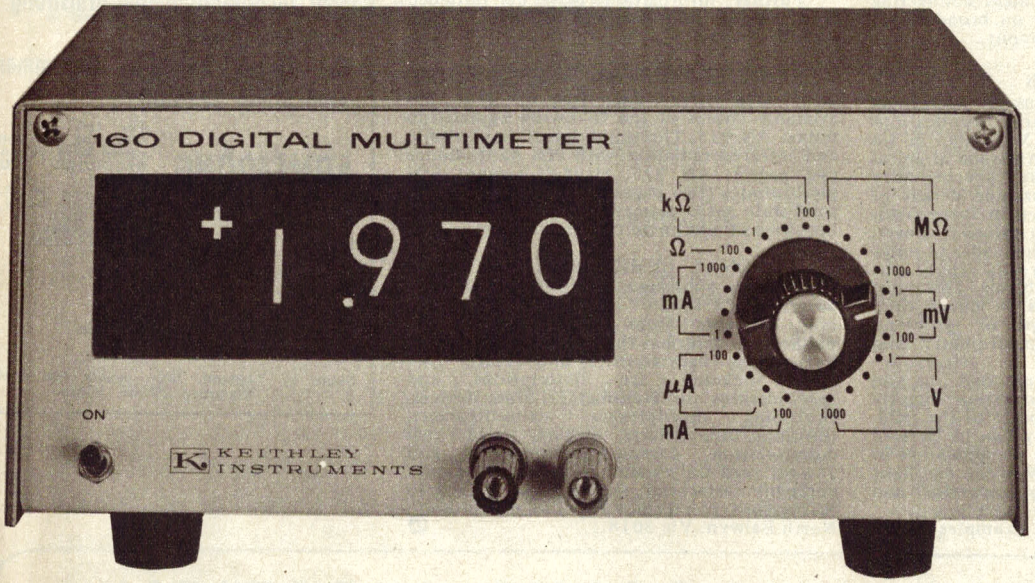
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AMATEUR BAND NEWS AND NOTES

by Pierce Healy, VK2APQ

Two Important Conferences: Region III Association, WIA Convention

Two amateur radio conferences held recently are likely to have considerable bearing on the growth and well-being of amateur radio in Australia. One was the Region III Association conference held in Tokyo, the other the 35th WIA Federal Convention held in Brisbane.

The Region III conference was of special interest because it established that Region III will be represented by the IARU delegation to the ITU World Space Frequency Conference in Geneva this year. The WIA Federal Convention was also of interest because of its recommendation in favour of a "Novice" type licence. Details of the WIA convention will be given later, as part of the notes of Institute activities.

The Region III Association Conference held in Tokyo from March 16th to 21st was the second such meeting, the inaugural meeting of the Association having been held in 1968 in Sydney. At that meeting it was decided to hold a conference in 1971, whose purpose among other things would be to adopt a constitution for the Association. The venue of the Fairmont Hotel and the Zenkyoren Building in Tokyo was at the invitation of the JARL delegates to the first conference.

At the first session of the conference the President of the Japan Amateur Radio League, Mr S. HJA1AN, as Honorary Chairman, welcomed delegates and invited nominations for the officers of the conference. Bob Denniston, W0DX, President of the International Amateur Radio Union was elected Chairman and Peter Williams, VK3IZ, elected Secretary.

In addition to the original member societies, the Japan Amateur Radio League, Wireless Institute of Australia, New Zealand Association of Radio Transmitters and the Philippine Amateur Radio Service, it was agreed that the societies of India, Ceylon, and Hong Kong would also become members. Also that the American Radio Relay League would become a member, in view of the number of members it has in Region III.

The initial discussion was to clear up some imperfections in the Interim Constitution, the main purpose being to affirm that a prerequisite to membership of the Association would be membership of the International Amateur Radio Union. This amendment was made, and as a result the Philippine Amateur Radio Association became the member society to represent the Philippines. Member societies of the Region III Association represented and eligible to vote were thus: WIA, ARRL, NZART, PARA, ARSI, JARL and HARTS.

Subjects discussed at the Conference were as follows.

The ITU World Space Conference: The situation regarding the approach to the Space Conference to be held in June, 1971 was described by Bob Denniston, W0DX, who as president of the International Amateur Radio Union, will be an official observer at the ITU Space Conference. All societies outlined the status of the negotiations that had been achieved with their Administrations, indicating the importance to amateur radio of strong representation at Geneva for the ITU Conference.

Bob Denniston informed the Conference he was enlisting the aid of all resources available and that Region I and Region II would be represented in his team. He emphasised the desirability of Region III being represented so that the team was truly representative of world amateur radio. The Conference decided on the principle that the Association should send a representative, and carefully considered the practicability of meeting the high costs involved. It was decided to seek credit for the amount needed, and to plan its repayment over several years.

On the basis that such an idea would be successful it was decided to proceed with arrangements for a representative to lead the team. The President of the IARU nominated Mr T. R. Clarkson, ZL2AZ, as Region III representative, and this was approved by the Directors.

7MHz Band: The need for more spectrum space for the amateur service on an exclusive basis was emphasised. As a General World Administrative Frequency Conference seems to be in the distant future it was agreed that the best approach would be for each society to try and get agreement from its Administration with a view to obtaining national, regional and eventually world-wide expansion of the exclusive segment.

A survey of interference on the 7MHz band was presented by the JARL, based on the results of recent automatic recordings. In a discussion on the methods of improving the situation, it was resolved that all societies make every effort to have the situation on 7MHz improved.

Radio activity in Region III: Several proposals were discussed on methods of



At the second conference of the Region III Association, which was held in Tokyo at the Zenkyoren Building from March 17-19.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.

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240 Volt, 6 Volt or 12 Volt 4 Amps Switch Over Complete with Leads, Meter, Fuse Metal Case, S.E.C. tested $21.50. Postage $1.00. Battery Charger 6 Amps $27.50.

C TYPE CASSETTE TAPES

C 60 80c
C 90 $1.50
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Postage 10c

NEW

VACUUM TUBE VOLT METER MODEL K1420 NEW

(Suitable for FM Radio Stereo T/V) and communication apparatus Meter 195 V/A DC (6") Mirror Scale DC Probe Test Lead Red and Black and Book. High input impedance, 11 Megohms DCV. Price $69.50. Postage 80c.

MASTER METERS NEW

Model S34/24F/499. 0.1M/a—0.1M/a Centre. Reading Plain Face. Face Size 4¼" x 4¼" mounting hole 3¼". Price $4.00. Postage 20c.

SPECIAL
1 WATT WALKIE TALKIE TRANSCEIVER

13 TRANSISTORS, 3-CHANNEL, AND CALL SYSTEM

Range: up to 10 miles (depending on terrain, etc.). Frequency 27.240 MHz (PMG approved). Freq. stability; plus or minus 0.005%. Transmitter: Crystal controlled, 1 watt. Receiver: Superheterodyne, crystal controlled. Antenna: 13-section telescopic. Power source: Eight UM3 1.5 v pen batts. Size: 8¼ x 3¼ x 1¾ inches. Weight: 25 ozs. Other features: Leather carrying case, battery level meter, squelch control, earphones jack, AC adaptor jack, etc.

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Model 23-126. SWR 1:1 to 1:3 Accuracy = 5%. Impedance 52 ohm. 100 V/A D/C Meter. Antenna 5/section Collapsible. Price $16.50. Postage 30c.

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150 PF with ¼" shaft $2.80. Postage 20c.

CRYSTAL RADIO KIT NEW

Model 28-207. Tunes Am.B/casts complete with all ass. Price $3.95. Postage 30c.
NEW C/X CABLE ¼" DIAM. 50 ohms. 95 yd.
NEW C/X CABLE 3/16" DIAM. 50 ohms. 45 yd.
ROLLS 100 FEET. 300 ohms. open line cable, $5.30. Postage 20c.
SINGLE CORE AND SHIELDED MIKE CABLE. NEW 20c yd.
TWO CORE AND SHIELDED CABLE. NEW 30c yd.
FIVE CORE AND SHIELDED CABLE. NEW 38c yd.
T/V RIBBON 7' YD. 300 OHM.



DH-02S—Very lightweight basic stereo-headphones with many desirable characteristics to ensure your enjoyable listening. With adjustable headband and foam earpieces.
Unit impedance 8 ohm at 800 Hz, Matching Impedance 4-16 ohm. Maximum Input 200 mW, Frequency Range 20-12,000 Hz. Weight 300g. $6.75 net. Postage 30c.



DH-03S—Our Standard Model, in comfortable single headband style. Fully adjustable and giving dynamic stereo performance.
Unit Impedance 8 ohm at 800 Hz, Matching Impedance 4-32 ohm, Maximum Input 300 mW, Frequency Range 20-18,000 Hz, Weight 350g. $9.50 Net. Postage 30c.



DH-04S—A Deluxe Model incorporating concentric but entirely separate tweeter and woofer in each earpiece. Adjustable attenuators provide clear reproduction of your finest recordings.
Unit Impedance (Tweeter 8 ohms at 2000 Hz. Woofer 8 ohm at 800 Hz).
Matching Impedance 4-32 ohm, Maximum Input 300 mW. Frequency Range 20-20,000 Hz, Weight 400g. $12.95. Postage 30c.

FIELD STRENGTH METER NEW

Model 23-135B. For checking radiation from transmitting antenna. Tuned circuit type. Freq. range (5 channel). A 1-3 MC B 3-9 MC C 9—27 MC D 27-100 M/C E 100—300 M/C Meter 200 V/A F/scale (Ass) Rod antenna crystal earphone instruction sheet. Price $15.75. Postage 30c.

NIBBLING TOOL (ABEL) NEW

Trims, notches, cuts around, square or irregular holes any shape size over 7/16". Price $7.20. Postage 20c.

promoting the development and encouragement of amateur radio activity in Region III. One such proposal was a new type of award. This would emphasise the merit of recurring QSOs in contrast to the brief single contacts in current contests. Several interested societies are giving this award consideration.

Publicity: Societies were urged to publicise amateur radio activities through the various forms of news media. Events such as the Region III conference should be used to introduce influential reports relating to the amateur service. It was suggested that societies keep each other informed of publicity received.

Directors Elected: In accordance with the adoption of the Constitution, the following directors were elected to hold office until the conclusion of the next Region III conference:

Bob Denniston W0DX
Kan Mizoguchi JA1BK
Tom Clarkson ZL2AZ
Michael Owen VK3KI
Secretary:
Peter Williams VK3IZ

Next Conference: Philippine Amateur Radio Association, Hong Kong Amateur Radio Transmitting Society and the Amateur Radio Society of India, each extended their invitations to hold the next conference in their respective countries. It was decided to accept the invitation of the Hong Kong Amateur Radio Transmitting Society and the next convention will thus be held in Hong Kong.

The decision that all expenses for delegates to attend future conferences be borne by their respective societies highlights the indebtedness of all concerned to the WIA and to the JARL for providing the accommodation expenses at the first two conferences. This was an important factor in the formative stage of the IARU Region III Association, and one which has assured its success.

Language barriers were encountered during the conference, mainly between JARL and foreign members. However, this was overcome by interpreters. Also, the existing situation of conflict between the PARA and PARS of the Philippines in relation to the IARU was recognised as a problem which must be resolved amongst themselves.

Probably the most important decision arising from the conference was that Region III will be represented by the IARU delegation to the Space Frequency Conference at Geneva in June. Tom Clarkson, ZL2AZ, is probably the amateur operator most experienced in ITU matters in the region, and is thus well qualified to represent the amateur service. Prior to his retirement he attended ITU conferences on official delegations from New Zealand.

An official cocktail party was held at which JARL officials and ex-officers, notable Japanese amateurs and JARL conference committee members entertained the delegates and high officials of the Japanese Posts and Telecommunications Bureau, sponsors for the JARL. The officials were headed by the Vice-Minister, Mr Keizo Obuchi, and the American Ambassador, Mr A. H. Meyer, W3ACE/JH1YDR (Kashiwagi Club Station in Tokyo).

Mr Meyer in return invited delegates and noted Japanese amateurs to a party at the official residence of the American Ambassador in Tokyo.

A visit to the "Ham Festival" held in Toshima Hall, Tokyo was sponsored by JARL Kanto Division (JA1 area). Delegates conferred with Japanese amateurs and examined Japanese made amateur equipment.

Also, Bob Denniston and Peter Williams addressed the audience of Japanese amateurs.

I am indebted for the foregoing information and photographs to Keigo Komuro, JA1KAB, a member of the JARL Convention Planning Committee. Keigo was unfortunately unable to attend the conference due to personal and family illness, so that his interest and assistance in supplying this information is doubly appreciated. Incidentally he apparently receives "E-A" regularly from John Adams, VK3ARJ, and finds it very helpful for his understanding of Australian amateur activities.

AN AMERICAN CONTROVERSY

In the American magazine "Electronics Illustrated" May 1971 appeared an interesting discussion of the pros and cons of a proposal that the 220MHz American amateur band be used as a Code free Hobby Band similar to the 27MHz citizen band.

The views of two controversial persons associated with amateur radio and citizen band operation, Wayne Green, W2NSD/1, (pro) and Tom Kneitel, KQD-4552, (con), provide an insight to the confusion that exists in the United States through the apparent unrestricted use of the 27MHz CB band.

The use of the 27MHz band is not allowed in Australia under the same conditions as those permitted by the Federal Communications Commission, the administrative authority in the United States. However, as the subject of Novice Licences is also mentioned, the article will be reviewed together with the current recommendations made to the WIA on a Novice type licence, in next month's notes.

TECHNICAL ARTICLES OF INTEREST

Break-in: NZART Journal March 1971; Transistor checking with an Ohmmeter.
QST: ARRL Journal April 1971; A 2.3GHz Crystal-controlled Converter. A state-of-the-art 2-metre Preamplifier.
CQ Magazine: April 1971; An R F Magnetometer and Field Strength meter. A Single Boom G4ZU Beam.

WIRELESS TELEGRAPHY REGULATION

The Wireless Telegraphy Regulation 59 and the section of the Amateur Handbook relating to frequency measuring equipment which an amateur licensee is required to have available at his station, have been reviewed.

It is no longer mandatory for the licensee or an applicant for a licence for any amateur radio station to possess a specific piece of frequency measuring equipment. It is now considered sufficient that the licensee ensure that emissions from his station are within the limits of the amateur frequency band in which he may be operating.

The Federal Secretary of the Wireless Institute of Australia has been informed of this amendment which was adopted in February 1971.

RADIO CLUB DIRECTORY

In response to the invitation for details of radio club activities as an information service to assist visitors to various centres, the following information was received:

Victoria

Name: Geelong Amateur Radio-Television Club. Call sign VK3ATL/T.
Meeting Place: 2-10 Storrer Street, off Bourke Crescent, East Geelong, Victoria.
Date and Time: Each Friday at 8.00 pm.
Contact: R. B. Wookey, VK3IC, Secretary, 158 Kilgour Street, Geelong, Victoria.
Telephone, Geelong 21 2674.
Frequency Bands: 2 metres AM and FM; 80 to 10 metres AM and SSB. An FM translator on Channel 4 is is operation in the area.
Tutorial Classes: Study Group when in session each Friday night at 7 pm.
Affiliation: Member club of the WIA.

Name: Eastern Zone (VK3) Group.
Meeting Place: No regular location.
Date and Time: General meetings four or five times each year, usually Saturday evenings.
Contact: George Francis, VK3ASV, Publicity Officer. Telephone Morwell 4 3953.
Frequency Bands: 2 metre FM Channel "B"; Translator Channel 4. Call sign VK3BEZ covering Latrobe Valley.
Tutorial Classes: LAOCP classes Wednesday and Thursday evenings, 7.30 pm, at Traralgon Town Tennis Club rooms.
Affiliation: Eastern Zone of the VK3 Division WIA.

Name: Eastern and Mountain District Radio Club.
Meeting Place: Mooroolbark Technical School.
Date and Time: Last Friday of each month at 8-10 pm.
Contact: Alex Bell, Public Relations Officer. Telephone 874 1709.
Frequency Bands: Members operate on all amateur bands.
Tutorial Classes: Pre-AOCP examination classes. "Teach-Ins" last Friday in each month 7.30 pm. Inquiries to Tony King, VK310, Telephone 870 2523.

Queensland

Name: Central Queensland Branch, WIA.
Meeting Place: Club Rooms, Quay and South Streets, Rockhampton.
Date and Time: Third Friday of each month at 7.30 pm.
Contact: F. Roden, VK4FU, Secretary. Telephone 64805.
Tutorial Classes: AOCP examination. C.Singleton, VK4UX, class manager.

Name: Townsville Amateur Radio Club.
Meeting Place: Upstairs Auditorium, Radio Station 4TO, Ogden Street, Townsville.
Date and Time: First Thursday of each month at 8 pm.
Contact: R. Sayers, VK4ZRS. Telephone 71 5348.
Tutorial Classes: AOCP examination. Bill Sebbins, VK4XZ, class organiser.
Frequency Bands: 53.032MHz AM. Sundays 8 am and 11.30 am 3580KHz Sunday evenings commencing 7.45 pm. "The Coral Coast Group", 7MHz, 0700 am each morning listen for VK4LZ.

Name: Bundaberg Amateur Radio Club. Call sign VK4BW.
Meeting Place: Club Rooms, Avoca Street, West Bundaberg.
Date and Time: First Wednesday of each month at 7.30 pm.
Contact: Lea Downing, VK4KX, Secretary. Telephone Bundaberg 71 3968, or J. McGrath, VK4JM. Telephone Elliott Heads 35.
Frequency Bands: 52.032MHz each Wednesday night 8.30 pm. Mobile VHF 146MHz FM. Individual members on all HF bands.
Tutorial Classes: AOCP examination. Signals Section of Civil Defence.
Affiliation: Queensland Division WIA.

Name: Sunshine Coast Amateur Radio Club.
Meeting Place: Kureelpa, located in the range west of Nambour.
Date and Time: Third Tuesday of each month at 8.00 pm.
Contact: Ken Chiverton, VK4VC, President. Telephone 41 1324 after hours.
Frequency Bands: Not stated.
Tutorial Classes: AOCP examination, Class manager R. Ivins, VK4ZKI.

New South Wales

Name: Hunter Branch, NSW Division, WIA.
Meeting Place: Technical College, Tighs Hill, Newcastle.
Date and Time: First Friday of each month at 8.00 pm.
Contact: Gordon Sutherland, VK2ZSG, President, 15 Marine View, Newcastle.
Frequency Bands: 2 metres FM net; 3595KHz each Monday night 7.00 pm.
Tutorial Classes: See Westlakes Radio Club.

Name: Westlakes Radio Club. Call sign VK2ATZ.
Meeting Place: Club Rooms, 7 Anzac Parade, Teralba.
Date and Time: Monday, Wednesday and Friday evenings 7.30 pm, Saturday afternoon at 2.00 pm.
Contact: Telephone Club Rooms, 58 1588; Secretary, PO Box 1 Teralba, NSW 2284.
Frequency Bands: 2 Metre FM net; 3595KHz each Monday night 7.15 pm.
Tutorial Classes: YRCS and AOCP examinations.
Affilliation: Youth Radio Club Scheme; New South Wales Division WIA.

Name: Maitland Radio Club. Call signs VK2BHV; VK2ZVM.
Meeting Place: Club Rooms, Maize Street, Penambit (East Maitland).
Date and Time: Tuesday and Friday evenings at 6.30 pm; Saturday afternoon 1.30 pm.
Contact: Mrs Margaret Watson, Secretary, telephone 33 7286 or Club Rooms, telephone 33 5680.
Frequency Bands: 2 metres FM net; 7MHz no set times.
Tutorial: YRCS and AOCP examinations.
Affiliation: Youth Radio Club Scheme; member club NSW Division WIA.

New Zealand

Name: Christchurch Branch. NZART. Call sign ZL3WS.
Meeting Place: Amateur Radio Club Rooms, Galbraith Avenue, Avonside, Christchurch. Telephone, 899 626.
Date and Time: First, second and third Wednesday of each month at 7.30 pm.
Contact: Don McKay, ZL3RW, or Terry Carrell, ZL3TAU, telephone 585 930
Frequency Bands: VHF repeater AM input

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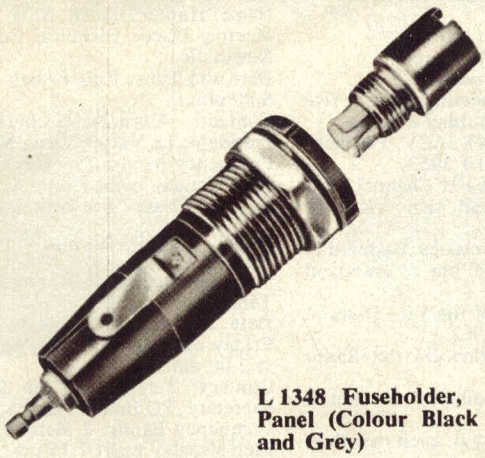
For further information write to:

THE COURSE SUPERVISOR, W.I.A.

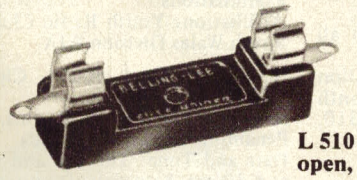
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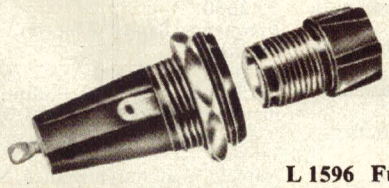
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Tutorial Classes: Amateur Operator Certificate.
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Club secretaries are reminded that updated details regarding their clubs are required for publication in the December issue. Clubs not listed in the foregoing will be included if the information is received prior to October 22nd. Those clubs which are listed here should also send current information before that date, to ensure that they are again listed.

WIA ACTIVITIES

The 35th Federal Convention of the Wireless Institute of Australia was held at Brisbane over the Easter weekend, April 9th to 12th, 1971.

The several reports presented for discussion dealt with such matters as the IARU; Region III Association; Project Australis; Novice Licensing; Repeater Installations; and Institute publications. A major administrative matter discussed was centralisation of certain records and accounting procedures common to all Divisions, and it now appears that membership records and the issue of subscription notices will be controlled through an electronic data processing system located in Melbourne.

Some of the proposals adopted at the convention have since been the subject of criticism from members, following the announcement of details of the proposals and comments about them given in divisional broadcasts.

One such proposal is that the Postmaster-General's Department be asked to increase the power limitations for the A1 mode of emission (interrupted CW) to that present available for single sideband transmission. It has been stated that this move will discriminate against amplitude modulation transmission.

The report by the special committee, set up to investigate all aspects of the "Novice" type amateur radio operators licence, with Mr R. C. Black, VK2YA, founder of the Youth Radio Club Scheme as chairman, recommended that such a licence would be of considerable benefit to the Australian amateur service and to the expanding Australian electronics industry generally. This latter aspect has been found to be the case in overseas countries such as Japan, Russia and America, and is being fostered in several developing nations.

Specific details were set out for submission to the Postmaster-General's Department and as to the WIA policy towards the introduction of such a grade for an amateur operators licence. Although a statement was made that a motion supporting the concept of a novice type licence as recommended by the committee had been unaminously carried at the convention, thus opening the way for Federal Executive to make a submission to the PMG's Department, some doubt is being expressed if the findings have really been accepted as Institute policy.

Following a report given in the Victorian Division's news broadcast over VK3WI, including the subject of novice licences, a spokesman for the Hunter Branch expressed some concern on the subject, as shown in the following extract from the Hunter Branch news broadcast:

"A motion supporting the concept of novice licensing for Australian amateurs was carried unaminously by the convention, opening the way for the submission of a claim

to the Radio Branch on the subject.

"However, although the vote was favourable regarding the plan to introduce the new type of licence, it is already meeting with opposition by members of the Victorian Division.

"In a statement made yesterday over the Victorian official station, VK3WI, Dr Dean Blackman, VK3TX, the Federal Councillor for the VK3 Division criticised Mr Black for not having submitted the report on novice licensing earlier than April 7. He went on to say that the novice licensing proposals as enumerated in the report required 'more discussion and development during the coming year'. He also stated that although the report had been accepted, there had been 'no formal alteration in institute policy'.

"This statement is thought by some observers to mean that although the rank and file of the amateur movement in Australia are in favour of the Novice Licence, elements of the Victorian Division who are known to be in close contact with the most senior officials of the Radio Branch will 'play down' the novice licence in discussion. Such an action, if taken, could further postpone the introduction of this popular piece of legislation.

"Post Office officials are known to be against the introduction of the novice licence and it was unofficially reported in 1969 that an agreement had been reached privately between the Radio Branch and the representative of the Federal Executive of the WIA to offer the reduced Morse speed of 10 words per minute in the AOCP examination if the WIA agreed to drop its claim for the introduction of the novice licence.

"Novice licensing, if introduced as planned by the Black Report, would greatly benefit all members of the community seeking to become radio amateurs. However, probably its greatest benefit would be to those amateurs who, at present, are limited to operating only on bands above 52MHz. The proposal would give these amateurs the right to operate on segments of the high frequency bands allocated to novice operators, provided that they were able to pass an elementary Morse code test at five words per minute. This would allow holders of limited licenses to work DX on the popular high frequency bands".

When referring to two proposals submitted by the Hunter Branch as agenda items that had been adopted at the convention, and mentioned in the Victorian Division broadcast, the following comments were also made by the Hunter Branch spokesman.

"The submissions forwarded by Branch members were that the Radio Branch be asked to publish a syllabus for the AOCP examination, and that the form of the examination for the Amateur Operators Certificate of Proficency be altered to conform with modern educational practice.

"In what is considered by some observers to be traditional opposition to the simplification of the AOCP examination, another statement made by Dr Blackman, VK3TX, in the official broadcast aroused indignation among local amateurs. Dr Blackman reported that there appeared to be 'considerable emotion' among some delegates on the matter of the examination form. This statement is thought to show his continuing opposition to any easing of the examination, believed to be the most difficult of any amateur exam in the world".

Other proposals adopted at the convention were:

Amateur television experimenters are to be asked to use the frequency of 426.25MHz as the vision carrier centre frequency to standardise ATV transmissions throughout Australia.

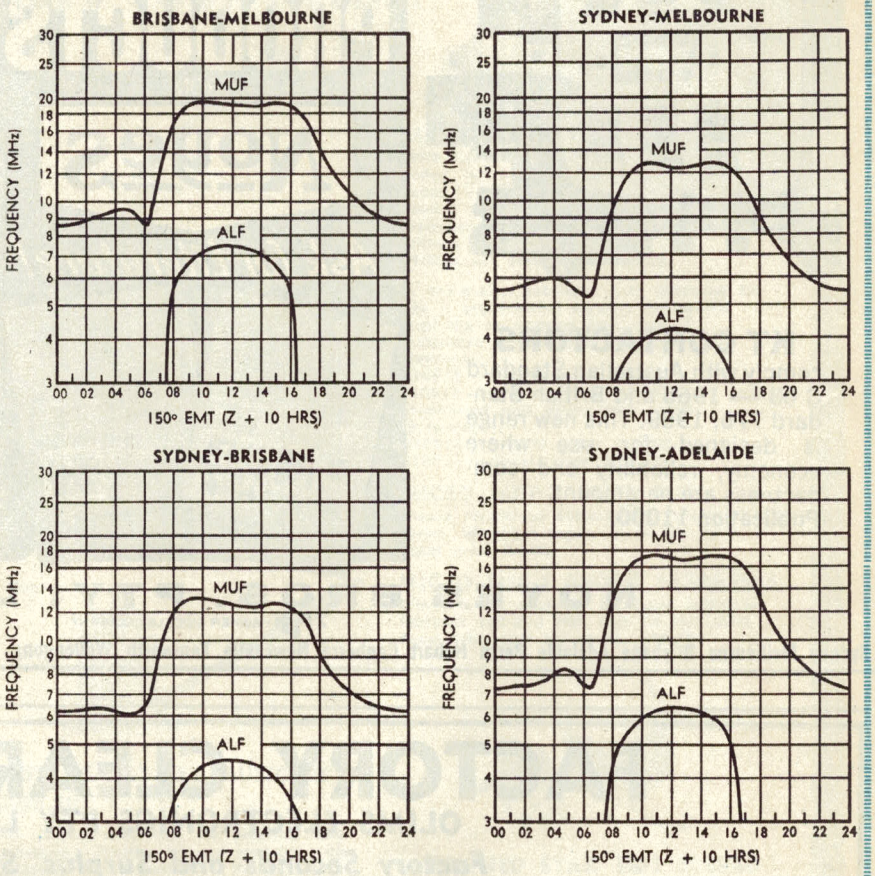
A national calling frequency of 7050KHz is to be adopted.

The Radio Branch is to be asked to allow the installation of unattended beacons on the 70 centimetre amateur band.

In view of the raising of the amateur licence renewal fee from $2 to $6, the Radio Branch is to be asked to extend anti-interference assistance to radio amateurs. This service is alreadv available to commercial

IONOSPHERIC PREDICTION CHARTS – JUNE

Reproduced below are four radio propagation prediction charts based on information supplied by the Ionospheric Prediction Service Division of the Commonwealth Bureau of Meteorology. The charts give the predictions of maximum usable frequency (MUF) and absorption limiting frequency (ALF) for four of the most widely used interstate circuits, during June, 1971.



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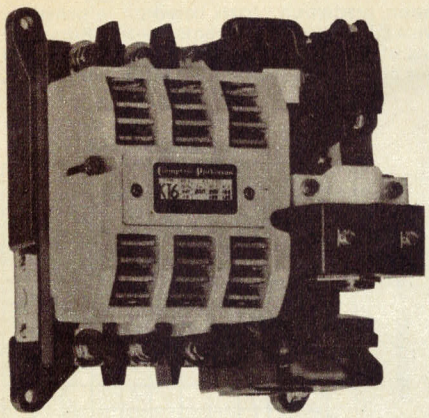
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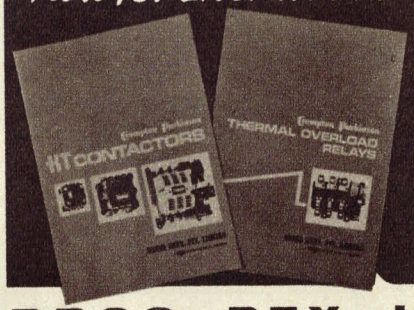
Applications in writing to

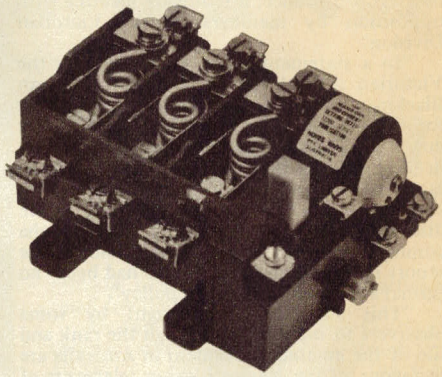
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Mr Ken Pincott, VK3AFJ, who for a number of years has been editor of the Institute's magazine, "Amateur Radio" was awarded life membership.

NEW SOUTH WALES

VHF and TV Group: At the Annual General Meeting of the NSW Division VHF and TV Group, the following members were elected to office:

Chairman	G. Wilson	VK2ZGW
Vice-chairman	I. Binnie	VK2ZIU
Secretary	M. Farrell	VK2ZNA
Treasurer	P. Wait	VK2ZZQ
Contest Manager	C. Palmer	VK2ZZG
Publicity Officer	H. Lundell	VK2ZHE

The group meets on the first Friday of each month at the Wireless Institute Centre, 14 Atchison Street, Crows Nest, at 8 pm.. Visitors are welcome.

The contest committee of the VHF and TV Group invites all amateurs and short-wave listeners with VHF and/or UHF equipment to participate in the 1971 Midwinter VHF-UHF Contest. This contest will be held during the Queen's Birthday holiday weekend in June.

Rules for the contest are very similar to those for the 1970 contest, which were published in the June 1970 issue of "E-A", and the scoring and entry forms are as shown in that issue. Further details may be obtained by listening to the broadcasts from VK2AWI at 1100 at 1930 hours each Sunday.

South West Area: Due to the popularity of the "South West Area Certificate" commemorating the Captain Cook Bi-Centenary and the Wagga Wagga Centenary, the Wagga Radio Club on behalf of the South West Area are going to reissue on a continuous basis, a further series of attractive certificates. These certificates will be awarded to any amateur operator who contacts seven South West Area stations after April 1, 1971.

To receive the award, send your logs to the Secretary, South West Area, PO Box 551, Wagga Wagga, NSW 2650.

A meeting of members of the South West Area was held at Lockhart on Febuary 27, 1971.

Harry Cuthbert, VK2AEC, was elected President. Other appointments were:

Vice-president	Sid Ward	VK2SW
Secretary/Treasurer	Phill Bowers	VK2YS

Three councillors to represent the regions not represented by the above officers were: Don Haberecht, VK2RS; Laurie Peasley, VK2BLP; Trevor Hoodless, VK2ACZ. Three alternative councillors were also elected, namely: Jim Linden, VK2BXA; Ron Everett, VK2BER; Ben Vlcek, VK2ZZV.

Other matters discussed at the meeting included the next area convention to be held at Narrandera in October, the installation of VHF repeaters in the area, and a 40 metre net to be established on a weekly basis for clubs throughout New South Wales.

For further details of activities in the South West Area join the 80 metre net on Monday evenings at 8 pm.

VICTORIA

Eastern Zone (VK3) Group: This group of 82 members extends a cordial welcome to visitors in the Gippsland area of eastern Victoria. There is an active 144MHz band Channel B FM net with 41 users, also a Channel 4 translator, VK3BEZ, repeater which covers the Latrobe Valley area.

Zone members take an active part in current amateur radio affairs and have sub-committees for such activities as: Latrobe Valley translator; AOCP course: Third class or basic licence proposal; WICEN; Zone Intruder Watch and the "Wildcat" DX Award certificate.

Full details of the club may be obtained from the Secretary, PO Box 87 Mitcham, Victoria 3132.

On Saturday May 22 to mark the proclamation of the Shire of Croydon as a City, by the Governor of Victoria, Sir Rohan Delacombe, the club's station was in operation from the Croydon Town Hall on all HF bands and the 144MHz band. A commemorative QSL card will be issued to all stations who made contact with the club station between the hours 0900 and 1700 EAST on May 22.

Eastern and Mountain Districts Radio Club: The membership of the Eastern and Mountain Districts Radio Club has a membership of 234 and caters for the many and varied activities associated with amateur radio. Membership fees are: Adult $3.00 (this includes $1.00 set aside for a building fund); Pensioners and Juniors $1.00. Joining fees are Adults. 50 cents, others 25 cents.

QUEENSLAND

Townsville Amateur Radio Club: The club is constructing a beacon transmitter to operate in the 52MHz amateur band. The transmitter. is a revamped commercial unit and will be unattended, but inspected regularly. The keyer however, is all solid state using some 90 semiconductors, and is the brain child of Lance Noseda, VK4EX.

The club newspaper "Backscatter" is a monthly publication which keeps members up to date on amateur band activities.

Visitors are welcome to club meetings and personal contact may also be made by telephoning TNQ Channel 7. 71.6161 and asking for amateur radio club members.

CHRISTMAS ISLAND

The Annual General Meeting of the Christmas Island Amateur Radio Club was held on Monday March 15th 1971.

Candidates for the Amateur Operators Certificate of Proficiency examination in August are: Craig Woodford, Agnes Gould and Jim Peace.

Mathew, VK9MV, who in 1955 as ZC3AC was the first amateur to operate from Christmas Island, will be retiring shortly to India, and has been unanimously elected as the club's first Life Member.

The club gratefully acknowledges the kindness of the British Phosphate Commissioners who made available a large unused house as club premises. The house is located on a cliff edge 600 feet above sea level. It overlooks the Indian Ocean from east to west, and has a "million dollar" view. There are two operating rooms, library, lecture rooms, kitchen, bar, shower, bath and toilet facilities, together with a large members' lounge and a workshop in a concrete building at the rear.

The grounds include stepped gardens and a barbeque. External coloured lights and a large VK9XI sign are to be erected on the roof, and should be visible for 25 miles out to sea.

Equipment at VK9XI includes a Hammarlund HQ170A receiver; FT100 transmitter; FT200 transceiver; AT13B transmitter and two communication receivers.

Aerials at present are 80 metres through to ten meters. Forward planning includes antennas for 160 metres plus six and two metres.

The old club premises at 1000ft above sea level still has antennas for use with 'fox hunt' base stations, and as a second location for local operators wishing to work through contests without disturbing the XYL.

DX and 'rag chew' contacts are welcomed by the club operators. Normal meeting night is on Monday from 1200 GMT. VK9XI constantly checks into 'SEANET' on 14320KHz daily at 1200GMT.

There is no public accommodation on Christmas Island and visitors must be sponsored and accommodated by local residents, unless proceeding by private yacht.

We like to go along hand in hand with the electronic component industry and we offer both quality components and quality service. Some of our sole and representative agencies are: **BRUEL & KJAER** — Electronic measuring equipment; **FLUKE** — Test equipment; **ANALOG DEVICES** — Operational amplifiers; **SANKEN** — Hybrid modular audio amps, semiconductors; **MALLORY** — Hearing aid, photographic and instrument batteries; **NEOSID** — Cores, formers and cans. **MURATA** — Ceramic filters, micro forks, capacitors; **N.E.C.** — Tantalum capacitors; **DANAVOX** — Hearing aids; **JERMYN** — Heatsink, semiconductor sockets; **RAYCHEM** — Heat shrink tubing; **LUMOLITE** — Indicators; **McMURDO** — Valve holders, plugs, sockets; **LESA** — Potentiometers; **ELECTROSIL** — Metal oxide resistors; **IRH** — Carbon and wirewound resistors; **HAMLIN** — Reed relays; **LITESOLD** and **BIRKO** — Soldering irons; **RICHARD ALLAN** and **DAVRED** — Speakers; **SUFLEX** — Capacitors; **ISOSTAT**—Push button switches; **JACKSON** — Tuning and trimmer capacitors; **B.S.R.** — Record changers; **FAIRCHILD** — Semiconductors. There are many, many more. All enquiries welcome.

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NEW ZEALAND



New All Silicon 30/60 WATT P.A. PORTABLE AMPLIFIER

12-16 volts, 2 inputs. 5MV and 100MV. Dimensions 6¹₂in W x 3¹₄in H x 8¹₂in D. 15 ohm output No. 763D. . . $62 For 125,250,500 ohm output $92D. $62. For 240v op.. $33 extra. 10 watt P.A. amp. similar to above, 4 ohm output, 240v. op. No. 485, $40. Freight extra.

C.D. IGNITION COIL

For E.A. (Fraser) circuit. Mounted on strong fibreglass printed circuit coded for all other components. Polyester film layer insulation. Connected and tested layer insulation. Connected and tested. For photo cell distributor No. 786, $8. No. 787, $8. Postage, 20c.



R.C.S. COMPLETE DO-IT-YOURSELF KITS

Peak reception, low price. No expensive test equipment. Everything fits. 1964 RF Transports 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
Postage $1
(Write for booklet on 640 and $42.)

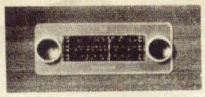
NEW TRANSISTOR PREAMP KIT

SIZE 3 x 2 x 1in. 2 req. for Stereo.
LOW IMP. Input 2 trans. 672C $6.50
Wired ready for use 672D $8.00
HIGH IMP. 2 tran. 680C $6.50
Wired ready for use, 680D $8.00
HIGH IMP silicon 3 tran. 682C $8.00
Wired ready for use, 682D $9.50
Postage 10c each. Write for data.

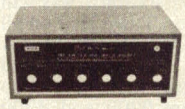
COILS and IF's 455 Kc

Aer. R.F., OSC. and IF's $2.00
Ferrite Aer. $2.40
No. 265 Universal tape OSC. Coil, $6
Postage 10c. Write for details and price.

HI-FI BROADCAST TUNER UNIT 4 TRANSISTORS — HI SENSITIVITY



R.F. mixer, I.F., pwr. dectr. stages, adjustable aerial coupling. Complete as illust., wired and tested with 461 dial, knobs and switch pot No. 474D, $31. Freight extra.
WHISTLE FILTER for above set for 8kc bandwidth (can be altered to 9, 10 or 11Kc). No. 128, $4. Post 10c.



10W STEREO

MULLARD 10 x 10 watts R.M.S.

With output transistor PROTECTION. Frequency response 40cy to 30KC. Distortion 0.5%. Treble, bass, boost 20DB.

Complete kit of parts No. 480C $74.00
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Cabinet as illustrated . . . . . extra $10.00
Magnetic pick-up pre-amp. No. 762D extra $11.50
Inbuilt b/c tuner with w/filter . . . . extra $35.00
Plus freight. Write for brochure. For special Sat. demo. ring 59 6550.

R & H and E.A. PRINTED CIRCUITS

Clearly coded for easy assembly. With blueprint parts list. Immediate dispatch. Add 20c postage for each. Specials to your drawings — write for particulars and drafting aids.

578—61.9.C	686—65.P.12B	726—68.A.8	$2.80
585—61.11P	594—66.R.2	753—69.F.10	$1.80
587—61.11P1	704—67.P.2	771—70.P.6	$2.00
577—52.1.C	707—67.P.3	772—70.G.7	$2.00
576—53.A.10	708—67.A.3	776—70.A.2	$4.00
563—64.M.7	709—67.P.4		
579—64.A.8	711—67.A4		
683—64.A.9	723—68.S.T		
678—65.O.9	731—68.M.12		
679—65.M.9	736—69.S.T		
684—65.P.10	750—70.A.1		
685—65.P.12A	756—70.R.1		
769—70.K60	758—10P.1		
All above $2.50			

717—68.P.1	639—65.T.3	734—59.O.1	742—69.C.9
741—69.P.5	727—68.8.T	728—68.S.3	748—69.D.10
747—69.C.10	728—68.O.9	740—	754—69.C.11
746—69.P.9		68.10.CL	749—69.C.12
$3.00	$3.20	759—70.C.1	751—70.TX.1
		$5.00	



TRANSFORMER

Tap 6v and 9v D.C. at 100 milliamps
Filter, condensers, rectifier, resistor, case, etc. $6.50. Post 20c.

NEW STEREO MAGNETIC PRE-AMP

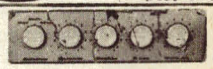
$11.50

Hum free. 5MV input. 250MV out. Size 3" x 2" x 1". Wired ready for use. No. 762D. Post 10c



NOISE FILTER for radio and TV

No. 27 line filter, 2 amp. $6.50
No. 29 10 amp. No. 29B 20 amp. line filter $35
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Order direct. Pack. and post 50c.



MAGNETIC STEREO PRE-AMP

In 5MC out 250 Mv. Bass and treble 20DB, No. 724C $29
Wired ready for use $31
Postage 30c each.
For crystal ceramic No. 722D . . $27

NEW BASE BOOST 4-TRANSISTOR STEREO AMP.

UNITY GAIN:

400cy.	0 db	Connect between your
100cy.	5 db	pre-amp. and main
50cy.	9 db	amp.
30cy.	14 db	No. 791 D $10.80

Postage 20c.

LATEST PRINTED CIRCUITS

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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., 587 3491, 587 5385

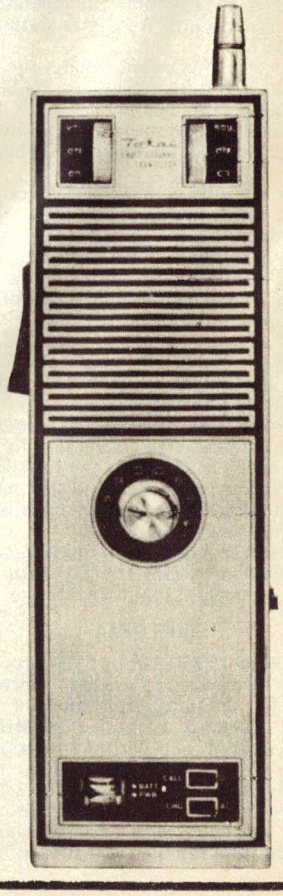
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LISTENING AROUND THE WORLD

by Arthur Cushen, MBE

Art Cushen's 2000th BC-band verification

A significant event in the listening career of the writer occurred in April, when the 2,000th verification from a broadcast station was received. These verifications date back to 1937 and have come from 132 countries.

Our first verification on the medium-wave band came from the private station 3ZR Greymouth, New Zealand and confirmed reception of a report on January 18, 1937. The 1,000 verification was received in May 1953 and came from a 250-watt station in Baltimore, Maryland, USA, operating on 1400KHz with the call sign WWIN. The 2,000th verification was from Radio Tahiti on 740KHz, a new station which went into operation in February with 20KW.

It is interesting to note that over 1,500 of these stations came from points on the globe at least 6,000 miles from Invercargill. All States in the USA have been verified except Maine, New Hampshire, Rhode Island and Vermont. The total of verifications for North America is 1,109 and this includes 180 from California, 78 from Texas, 50 from Washington, and 37 from Florida. From other parts of the world, verifications were received from 372 stations in Asia, 114 in Europe, 22 in Africa, 18 in South America, 79 in Oceania and 286 in Australia and New Zealand.

I am often asked what is my best verification. This is a difficult question to answer, because of the different factors which have to be taken into account. For example, on medium-wave what one would take to be a relative easy station to verify, because of its power, might in fact be a difficult one to hear, because of the many other stations using the same frequency. I have verified every station operating in Australia, but I regard Alice Springs, operating with only 30 watts, as my best Australian verification.

Some of the best from Japan are from 100-watt stations. From India, VUS, with 50 watts is the best. Where Europe is concerned, the 400-watt transmitters of the British Forces stations in Italy could be considered the best from that continent. Every country in Europe has been confirmed on the broadcast band. Some of the territories verified have now disappeared from the map – the Saar and Triest, for example. Dozens of 250-watt stations operating on the East Coast of the USA have been verified, as well as some from Puerto Rico using the same power.

Invercargill is ideally situated for this type of reception and as New Zealand has relatively few stations, during the hours of darkness all continents can be heard, but South America and Africa are the difficult areas to hear. Signals from Europe are best during March and September when equinoctal conditions exist over the 12,000 mile. transmission path.

In New Zealand, DXing on the broadcast band has had a long history, going back to the 1920s. Many old timers made outstanding loggings of distant stations, much lower in power than those in operation today, but interference was much less prevalent. Mr Albert Stanton of Dunedin had verified 1,427 stations when he retired in July 1953; Ken Mackey who listened at Long Beach, outside Dunedin, verified 2,271 stations up to September, 1968. Both listened exclusively on the broadcast band.

The writer has verified over 3,600 stations on short-wave, as well as the 2,000 on the broadcast band.

RADIO TAHITI NOW 20KW

Radio Tahiti has confirmed our reception of their broadcast band transmissions on 740KHz with the information that the power of this new transmitter is 20KW. The old frequency of 1400KHz is still in use with 4KW. On short-wave their frequencies are 11825, with 20KW; and 6135KHz with 4KW. The programs are broadcast 1615-1830, 2100-2330 and 0300-0800GMT. Best reception has been on 740KHz, but is also good on the two short-wave outlets when closing at 0800GMT. The station's closing announcement, in French and Tahitian, is followed by an island melody and the French National Anthem. Verification, in the form of a card showing a mermaid, came by airmail, with the station schedule.

The recent installation of a new 20KW short-wave transmitter by Radio Tahiti has resulted in its use of additional frequencies. A new channel, 15170KHz, has been observed from sign-on at 2100GMT. The frequency varies, and has been noted as low as 15165KHz. Transmission commences with the usual drum beat, and then announcements in Tahitian, and at 2145 the program continues in French to close down at 2330GMT. Signals are very good in New Zealand with little interference on the frequency, though in Australia interference from Radio Australia on 15160KHz may be troublesome.

IBRA RADIO AGAIN ACTIVE

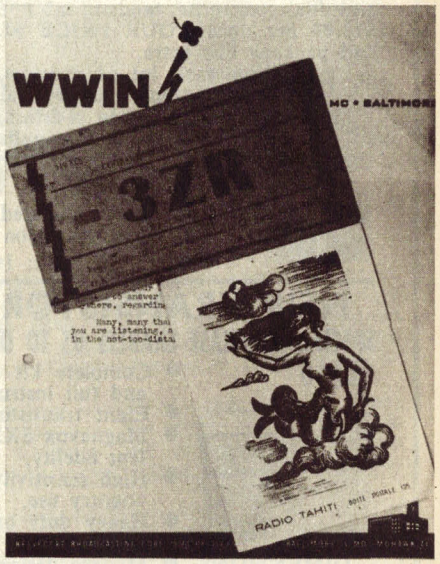
After many years of silence the gospel programs of IBRA Radio are again being heard on short-wave radio. The station is broadcasting to Europe for the first time since December 1959, using a 250KW transmitter owned by Radio Trans Europe in Portugal. The transmissions, on 9575KHz, are broadcast in 21 different languages between 1800 and 2200GMT.

English can be heard on Saturdays 2130-2200 and Thursdays 2145-2200GMT. Finnish is broadcast on Fridays 2000-2015, French on Mondays and Thursdays 2130-2145. German broadcasts are daily 2115-2130, but on Monday, Tuesday and Wednesday they commence at 2100 and are extended to 2145 on Sunday and Tuesday.

Russian transmissions are as follows: Monday, Thursday, Friday, Sunday, 1900-1945; Wednesday, 1900-1930; Tuesday, Saturday, 1900-2000GMT. Swedish programs are Sunday, Tuesday, Wednesday, 2145-2200GMT. "Sweden Calling DXers" gives the station address as IBRA Radio, Box 821, S 101-31, Stockholm 1, Sweden.

From our verification files we have found several verifications from IBRA Radio when they operated from Tangier using two 10KW transmitters with directional aerials beamed towards Northern Europe. At the same time they used a 100KW transmitter on medium-wave intended for the Mediterranean countries and mid-Euroupe The short-wave frequencies were 17950, 15020 and 11516KHz, according to one verification issued in December 1956.

At the same time another gospel station, WTAN, was operating from Tangiers. WTAN subsequently became Trans-World Radio at Monte Carlo. The ending of the International Zone at Tangiers resulted in the territory being given to Morocco, and the closure of these stations in 1959. Another station in Tangiers was Panamerican Radio, which we verified in 1951; this also was forced to close.



The verification card from Radio Tahiti was the 2,000th card to be received by Art Cushen from a broadcast-band station. Also shown are cards from 3ZR, his first broadcast-band verification of 34 years ago, and WWIN, his 1,000th station.

RADIO JAPAN CLOSES SITE

Radio Japan has announced the closing of their transmitting site of Nazaki, and all transmissions are now initiated at the Yamata transmitting centre, NE of Tokyo, which took over the full operation of Radio Japan on May 2. The main changes to Radio Japan schedule are for the North American, Latin American and Hawaiian Services, which will be heard on 17825, 17745, 17725 and 15235KHz from 0100 to 0300GMT. The Middle East and North African Services, 1745-1915GMT, will be on 9670KHz, also on the new frequency of 11965KHz. The Latin American Service will be 0930-1130GMT, 30 minutes later than formerly. The service to Australia and New Zealand continues at 0930-1030GMT on 11875 and 15235KHz.

INDONESIA ON BC

We have heard Radio Republic Indonesia, at Djarkata, operating on the broadcast band with 1335KHz. It had been reported that this band was being used by Indonesia, but this was the first time we had heard a station from

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, New Zealand. All times are GMT. Add 8 hours for WAST, 10 for EAST, and 12 hours for NZ.

NEW RANGE OF RESISTORS, CONDENSERS & POTENTIOMETERS

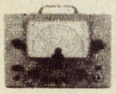
The resistors are mainly I.R.C. and Morganite and are in a wide range of values from 100 ohms to 3 meg. in ¼, 1 and 2 watt and include wire wound. LIST PRICE **$9.00** per 100. OUR PRICE $2.00 per 100. Post and packing 35c extra.

The condensers are in most popular brands and include Polyester, Paper, Mica, Ceramic and Electrolytic in values up to 8mfd. LIST PRICE **$11.00** per 100. OUR PRICE **$2.00** per 100. Post and packing 65c.

The pots, are all current types and include switch pots, and dual concentric, tandem, tab pots. etc. LIST PRICE **$12.00** per dozen. OUR PRICE **$2.50** per dozen. Post and package 60c extra.

FREE With each lot of resistors, condensers or pots. we will supply one new valve. Type 6U7G, 1T4.

Regret special values in resistors, pots and condensers cannot be supplied.



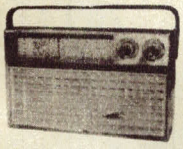
LEADER SIGNAL GENERATOR LSG11

240V A.C. operated, 6 band 120KC to 390 Megs. Provision for crystal. **$49.50**

Post N.S.W., 75c; Interstate, $1.25.

NEW TRANSISTOR 8 KIT SET

SPECIAL PURCHASE ENABLES US TO OFFER THIS KIT SET AT $24.00



DIMENSIONS 9" x 5" x 3" deep

- Complete kit of parts with circuit and full instructions.
- Eight transistors.
- Magnavox 5X3 speaker gives excellent fidelity.
- High sensitivity, suitable for city or country use.
- Heavy duty battery for economical operation.
- Modern design, plastic cabinet with gold trim.
- Dial calibrated for all States.
- Available in colours of off-white, red, black.

Post N.S.W., $1.25; Interstate, $1.75.

A TRANSISTOR PREAMP FOR MAGNETIC PICK-UP OR TAPE HEAD

Using 3 transistors per channel as featured in Electronics Aust. Complete kit of parts including transistors. P.C. board and resistors and condensers. Circuit and full details supplied.



Stereo Kit **$8.50.**

Mono Kit **$4.50.**

240V Power Supply **$4.50.**

State if required for Pick-up or Tape Head.

NEW HIGH STABILITY CARBON RESISTORS 1 p.c. and 2 p.c. TOLERANCE

These imported resistors are in ½ and ¼ watt with values from 50ohm. to 1 meg. 1% and 2%. In packets of 50 mixed values. LIST PRICE 20c each.

OUR PRICE $2.00 per packet of 50.

Post and packing, 20c extra.

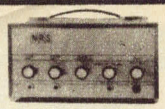
(Regret special values cannot be supplied.)

NEW IMPORTED SLOT CAR KITS AT LESS THAN HALF PRICE



Complete kit of parts, including 12V motor and full instructions.

$1.90 post 25c



NEW 25 WATT P. A. AMPLIFIERS

These amplifiers are suitable for installation in clubs, schools, restaurants, factories, etc. Wherever the amplification of speech or music is required.

$63 Freight extra

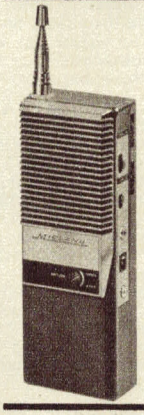
SPECIFICATIONS

Nominal power 25 watts. ● Inputs two microphone and pick-up radio with separate controls and mixing facilities. ● Tone control. ● Frequency response 30 to 18,000 CPS. ● Output impedance Line output (100, 166, 250, 500 ohms) or can be supplied with V.C. output (2, 3, 7, 8, 15 ohms). ● Dimensions 11in x 6in x 8in. Weight 25W 23lb. Freight extra.

NEW COLUMN SPEAKERS

Suitable for above Amplifier in walnut finished cabinet containing four 8" Rola Speakers Imp. 8 ohms.

$37.50. NO MAIL ORDERS



At last a breakthrough in the cost for high quality portable radio transceivers of the walkie-talkie hand-held type. We are introducing and offering for sale a fully PMG approved

MIDLAND 1 WATT TRANSCEIVER

for 27,240 kHz operation with switch provision for two additional channels, tone call signal, background noise squelsh control, battery voltage indicator, steel case with separate cover, good for five miles distance communication under average field conditions, with penlite cell-batteries for

ONLY $37.50 PER UNIT, FULLY GUARANTEED.

Postage extra.

NEW POWER SUPPLY KIT

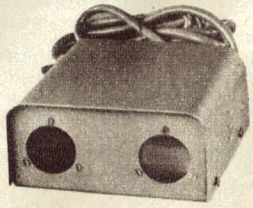
Ideal for small amplifiers, stereo or mono, test equipment, etc. Input 240v. A.C. Output 20v. D.C. at 1 amp.

Kit contains transformer, rectifiers, filter, condenser and circuit.

$4.50 Post 75c.

New Photo-Electric Burglar & Door Alarms at less than half price

DOOR ALARMS



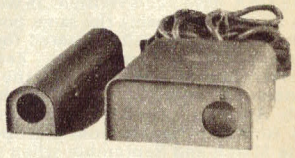
240V A.C. operation

$12.00

Post & Packing $1.25 extra.

Buzzer $1.25 extra.

BURGLAR ALARMS



240V A.C. operation

$16.00

Post & Packing $1.50 extra.

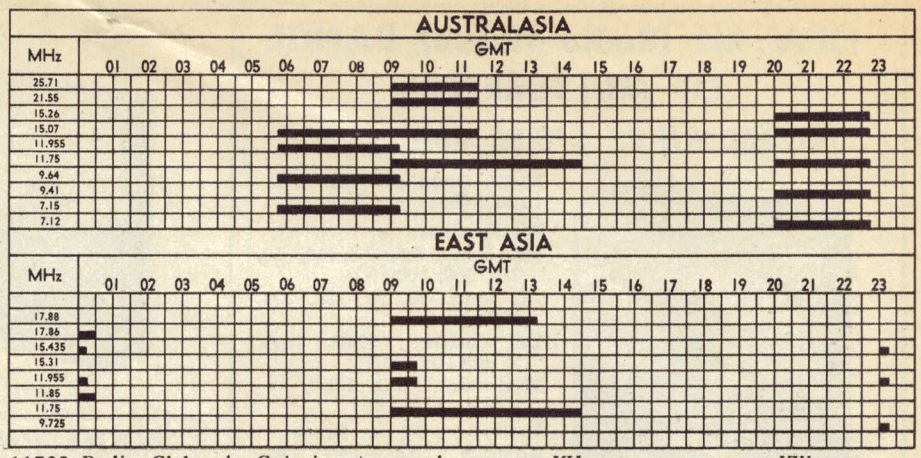
Buzzer $1.25 extra.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

WORLD SERVICE SCHEDULE

This chart shows the regular BBC World Service frequencies and schedules for June, 1971. (Published by arrangement with the BBC.)



this country since before the 1939-45 war, when the NIROM operated stations for the Dutch East Indies Government. These stations operated in the section of the band from 1500 to 1600KHz and ranged in power from 10 to 150 watts. Our verification of YDB7 was one we received from this part of the world. After 30 years, it is a memorable occasion to hear Indonesian stations again in operation on the broadcast band.

RRI Djarkarta was heard on 1335KHz with a classical music program up to 1600GMT, and at that time full identification in Indonesian was made. The station then played light music until close down at 1700GMT.

FM FOR FIJI

While Australia and New Zealand debate the use of FM radio in their respective countries Fiji has already commenced a service for reception in Suva. From a recent letter from the Engineer, Fiji Broadcasting Commission, it is learnt that the Commission has been granted a licence to operate an FM service in the band 90-100MHz. Experiments have been carried out on two low-power units on 90.6 and 94.5MHz. It is proposed to establish a service using 250-watt transmitters and high-gain vertically polarised antennas. Good results have been achieved in the Suva area.

SIGNALS FROM BRAZIL

Elsewhere in these pages we have reviewed reception on the lower frequencies, but signals in the 31- and 25-metre bands are still being received at 0800GMT. In the main these come from Brazil.

Some of the following information has been supplied by Bob Padula of Melbourne and has been completed by our own listening.

KHz

9585 Radio Excelsior, Sao Paulo in Portuguese and Japanese between 0800 and 0900GMT.

9629 ZYR97 is one of the best signals from Brazil. Opens at 0800GMT with a short announcement in Portuguese. A program in Japanese follows at 0805 and a devotional service has been observed at 0900.

9675 ZYT29 heard with test music at 0830GMT. Opens at 0845 with announcements in Portuguese.

09695 Radio Rio Mar, Manaus, with theatre organ music at 1015GMT, then advertisements.

11735 Radio Clube de Goiania, at around 0930GMT, with popular music.

11785 Radio Guiba, Porto Alegre, at 0920GMT; also between 0200 and 0300GMT.

11785 Radio Guiaba, Porto Alegre, at 0920GMT; also between 0200 and 0300GMT, until sign off at 0340GMT.

11855 PRE7 Radio America at Sao Paulo opens 0755GMT. Reception is fair at that time, but is blocked out at 0830GMT.

11865 Radio Clube de Pernambuco, Recife, at around 0900GMT: Some interference from a Radio Moscow Chinese transmission on 11870KHz.

11925 Radio Bandeirantes, Sao Paulo, popular music at 0900GMT. Interference from Emissora Nacional, Lisbon, on the same frequency.

15105 Radio Rural Brasileira, Rio de Janeiro; excellent reception at 2250GMT, with a political commentary until sign off at 2330GMT.

15225 Radio Cultura da Bahia, Salvador; piano accordion music at 0845 with signals fading out at 0940GMT.

15415 Radio Clube de Ribeirao Preto, from around 0000GMT until sign of 0400GMT.

This station is currently providing one of the best signals from Brazilian high frequency transmitters.

RECENT VERIFICATIONS

SUDAN: Our verification from Radio Omdurman came in the form of a letter together with two travel folders and a postcard. Our report was for reception on 7200KHz and the letter says the power on this frequency is 120KW. The schedule from the station reads:

KHz	KW
4994	20
6150	20
7200	120
9505	50
11835	120
15170	50

ECUADOR: Radiodifusora de Ecuador, Guayaquil verified Bob Padula, Melbourne, for a report on 4765KHz. Verification was in the form of a letter signed by Alicia de Blacio, Secretary, plus a splendid multi-coloured pennant. The verification was received by airmail in two weeks.

POLAND: Radio Warsaw confirmed the reception by Bob Padula of its newly introduced short-wave relay on 9570KHz with a letter, signed by the Editor of the English Language Section.

KGEI NOW 250KW

We have mentioned in these pages over the past few months the installation of a new 250KW transmitter for KGEI at San Francisco, to replace the old 50KW transmitter, which has been on the air with gospel programs since the late 1940s.

The transmitter has been installed and is undergoing initial tests. Tests are being made between 1600 and 2000GMT, and for test purposes the Federal Communications Commission has assigned the frequencies 17730, 15375, 11940, 9510 and 6100KHz.

The transmitting schedule with the old transmitter used at present is as follows: 2230-0400GMT on 15280KHz; 0400-0520GMT on 11955.

OLYMPIC GAMES CONTEST

Deutsche Welle, the Voice of Germany, at Cologne, is conducting a contest for young artists. The major prize is a free air trip to Munich and the 1972 Olympic Games. This

Registered Trade Mark

ELECTROLUBE 2A-X

IMPROVES ELECTRICAL CONTACTS
INCREASES RELIABILITY AND
LOWERS MAINTENANCE COSTS

SAFE ON POLYSTYRENE, P.V.C. MAKROLON, PAINTS, NATURAL AND SYNTHETIC RUBBER NON-HAZARDOUS VAPOUR

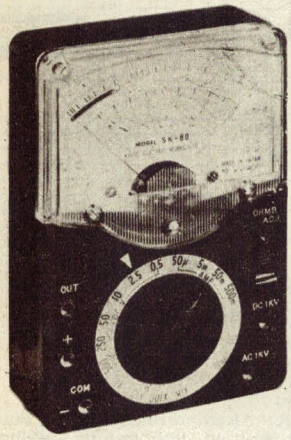
Write for free Products Summary on the range of electrical and mechanical oils and greases

RICHARD FOOT (AUSTRALIA) PTY. LTD.
63 HUME STREET, CROWS NEST, N.S.W. 2065. Phone: 43-0326.

Available from leading electrical wholesalers.

NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-80 $18.00 Postage 50c



20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts. 0.5, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current: 50uA, 5mA, 50 mA, 500 mA

Resistance. 5 kΩ, 50kΩ, 500kΩ, 5 MegΩ

Decibels. —10 + 62 ib

Accuracy. DC±3%, AC ±4% (of full scale)

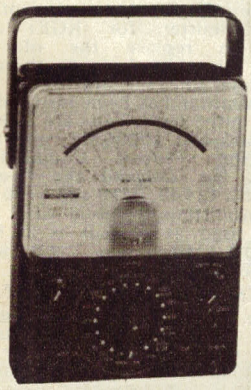
Batteries. Two 1.5V dry cells. Size AA, "Eveready" 915

● Overload-protected by dual silicon diodes. ● Mirror scale. ● Double-jewelled ±2% meter. ● ± 1% temperature-stabilized film resistors.

MODEL RH-100 $39.75. Postage 75c

100,000 Ohms per Volt DC 10,000 Ohms per Volt AC

● Overload Protected by Dual Silicondiodes ● Double-jewelled ± 2 per cent Meter ● ±1 per cent Temperature-stabilised Film Resistors ● Polarity Changeover Switch ● Mirror scale, instruction for operation with circuit diagram.



SPECIFICATIONS:

DC Volts: 0.6, 3, 12, 60, 300, 600, 1200V (100,000Ω/V)

AC Volts: 6, 30, 120, 300, 1200V (10,000 Ω/V)

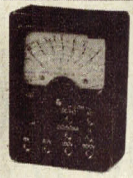
DC Current: 12μA, 300 μA, 6mA, 60mA, 600mA, 12 amps DC and AC Current 12 amps.

Resistance: 20KΩ, 200KΩ, 2MΩ, 20MΩ

Decibels: —20 to + 17, 31, 43, 51, 63.

Accuracy: DC±3 per cent, AC± 4 per cent (of full scale)

Batteries: Two 1.5V dry cells, size AA, "Eveready" 915

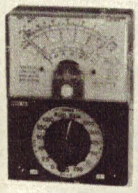


NEW TYPE Y-3 MULTI-METER

MEASURING RANGE: D.C. Voltage: 6V, 30V, 150V, 600V (2000 ohms/V). A.C. Voltage: 6V, 30V, 150V, 600V (2000 ohms/V). D.C. Current: 150 mA. Resistance: 0-100,000 ohms. Complete with 1.5 volt battery and test leads. Size: 3¾" x 2¾" x 1⅜".

Checked, Packed and Posted — $9.50. Limited Stocks.

"HANDYMAN" RH 150 $11.50



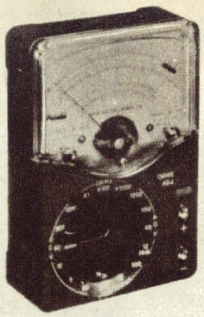
CHECKED PACKED & POSTED FREE

Pocket-size 3¼" x 4½" x 1¼". Instruction sheet and circuit.

SPECIFICATIONS

DC Volts 2½, 10, 50, 250, 1000.
AC Volts 10, 50, 250, 500, 1000.
DC Current, .1, 25, 250 M/amps.
Resistance, 20K and 2 megohms.
Decibels, —20db = +62db .7K/c.
Capacitance, .0001, .01, .0025, .25 mfd.

MODEL RH-20 $13.95. Postage 50c



20,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 1000 (20,000/V)

AC Volts: 10, 50, 250, 500, 1000 (10,000/V)

DC Current. 50 uA, 25mA, 250mA

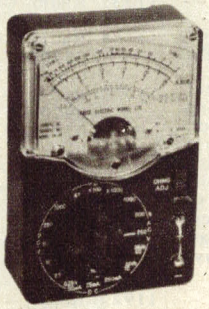
Resistance. 7kΩ, 700kΩ, 7MΩ

Decibels. —10 +22 (at AC/10V) +20 +36 (at AC/50V). Upper frequency limit 7kc.

Batteries: Two 1.5V dry cells.

With Meter Protection $15.00

MODEL RH-55 $20.00 Postage 50c



30,000 Ohms per Volt DC
14,000 Ohms per Volt AC

SPECIFICATIONS:

*DC Volts: 0.6, 3V, 12V, 60V, 300V, 1200V (30,000 ohms/V.

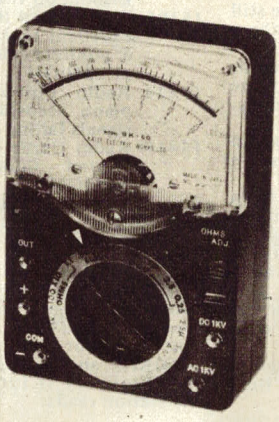
*AC Volts: 12V, 60V, 300V, 1200V (14,000 ohms/V).

*DC Current: 60 A, 12mA, 300mA.

*Resistance: 10K ohm, 1Meg ohm, 10Meg ohm.

*Decibels: -10 db +23 db.

MODEL RH-60 $25.00 Postage 50c



50,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:

DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000 V

AC Volts. 10, 50, 250, 500, 1000 V

DC Current. 25 uA, 5 mA, 50 mA, 500 mA

Resistance: 10 kΩ, 100 kΩ, 1 MegΩ, 10 MegΩ

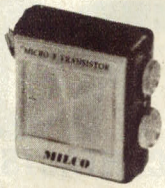
Decibels. —10 +62 db

Accuracy: DC±3%, AC± 4% (of full scale)

Batteries. Two 1.5 V dry cells.

Models RH-80, -55, -60 are:—

● Overload-protected by dual silicon diodes ● Mirror scale ● Double-jewelled ±2% meter ● ±1% temperature-stabilised film resistors.



LATEST MODEL MICRO RADIO

7 transistors, uses 1 standard Penlite battery size 2½in x 2½in. The only miniature radio using standard batteries (refill battery 10c). Complete with instruction leaflets.

Pack and post $39.75.

FLASHLIGHT BALL POINT PEN S-88

Lights up automatically when pen cover is in position for writing. **$2.00 posted.**

Bright illumination. Modern shape with silver finish. You can write when it is dark. Spare parts available. Two batteries 30c. Pen refill 15c. Globes 15c.

RADIO HOUSE PTY. LTD.

306-308 PITT STREET 61-3832 26-2817 760 GEORGE STREET SYDNEY. 211-0171

NEW SCHEDULES OPERATING

The present schedule of Radio Norway in Oslo, valid until September 4, list some new frequencies. An English transmission is heard on Sunday for the last 30 minutes of the program. This transmission also includes the program to North America, received on Monday GMT day up to 0630GMT. The program "DX Radio Norway" is broadcast on the first Sunday of each month.

GMT	KHz	Area Served
0700-0830	15175, 17800, 21655, 21730, 25730	New Zealand, Australia
1100-1230	6130, 17825, 21655, 21730, 25730	New Zealand, Australia
1300-1430	17795, 21655, 21670, 21730, 25730	Asia, Africa
1500-1630	17795, 17825, 21655, 21730, 25730	North and South America
1700-1830	7210, 21655, 21670, 21730, 25730	Europe, Middle East
1900-2030	11850, 17795, 21655, 21730, 25730	Africa
2100-2230	17795, 21655, 21730, 25730	Europe
2300-0030	15175, 15345, 17795, 21655,	South America
2300-0030	15175, 15345, 17795, 21655	South America
0300-0430	9610, 11735, 11850	Eastern North America
0500-0630	11735, 11850, 21655, 21730	Western North America

SCHEDULE OF RADIO NEW ZEALAND

The present schedule of Radio New Zealand, Wellington, is as follows:

GMT	KHz	Area Served
1700-1945	6080, 9755	Pacific
2000-0545	15110	Pacific
0600-0845	6080, 9540	Australia
2000-0545	17770	Australia
0900-1145	11705, 9520	Antarticia (Sunday)
0815-0845	9520	

RADIO PORTUGAL'S OVERSEAS SERVICE

Radio Portugal in Lisbon, which has transmissions directed to all areas of the world, is broadcasting as follows:

GMT	KHz	Language	
0100-0145	21495, 15315, 11840	South America	Spanish
0200-0245	15125, 11935, 6025	United States (Atlantic)	English
0345-0430	15125, 11935, 6025	United States (Pacific)	English
0215-0300	11840	Canada	French
0300-0345	11840	Canada	English
0700-0745	9740, 6025	Europe	French
1830-1915	6025	Europe	French
1915-2000	6025	Italy	Italian
2000-2045	6025	Germany, Austria	German
2045-2130	6025	Great Britain, Holland	English
0730-0900	21495, 17880	Australasia	English
1345-1430	21495, 17895	South-East Asia	English
1730-1815	11935	Malgache	French
1815-1915	21495	East and South Africa	English
1815-1915	21495	Nigeria, Gabon, Congo	French
		Nigeria, Ghana, Liberia	English

world-wide competition is sponsored by several German organisations and the Olympic Committee. Other prizes are: 16 journeys by air to Munich with 10 days stay in the Federal Republic of Germany; 150 transistor radios.

All young people from 15 to 25 years of age are elligible, and are invited to send pictures on the subject of "My Favourite Sport". The pictures should not be larger than 12in x 9in and should be inscribed with the name, address and age of the sender on the back. They must arrive at Deutsche Welle by December 31, and in January an independent jury will award prizes for the best entries. The pictures become the property of Deutsche Welle and will be shown in exhibitions.

LATIN AMERICAN RECEPTION

During the afternoons in our winter, listeners in Australia and New Zealand can receive South American stations in the 49 and 60-metre bands around 0500 and again for late evening listening at 100GMT. Signals on the higher frequencies from South Africa are also being observed at the same time. A review of some signals received by Chris Davis, Featherston, NZ, and at our own listening post, appear below.

KHz

3995 HCJA5 "La Voz del Rio Tarqui" has been hear at 0700GMT on Sunday.
4955 ZYR61 "Radio Jornal do Brasil", sign on at 0830.
4875 ZYZ30 "Radio Jornal do Brasil", sign on at 0830.
4875 HCHE4 "La Voz de Esmeralds", Ecuador, heard at 0630.
4875 CP75 "La Cruz del Sur", signs on at 1000.
4900 YVNK "Radio Juventud", Venezeula, heard at 0900.
4910 HCMJ1 "Emisora Gran Colombia", Ecuador, heard at 0430.
4940 YVPA "Radio Yaracuy", sign on 1000.
4945 HJDH "Radio Colosal" operates all night, best at 0800.
4965 HJAF "Radio Santa Fe", all night and best at 0700.
4980 YVOC "Ecos del Torbes" announces in English occasionally at 0730.
4990 YVMQ "Radio Barguismeto", heard at 1000.
5015 HJFW "Trans Caldas", all night and best at 0800.
5075 "Radio Sutatenza" opens at 0900.
5980 OBX4M "Radio Panamericana" heard at 1200.
5985 LRS2 "Radio Splendid" opens 0900.
6006 TIHBG "Radio Reloj" good signal at 0730.
6015 ZPA10 Paraguay sign on 1000.
6045 OCY4H "Radio Santa Rosa" heard at 1100.
6055 HJEX "Radio Pacifico" heard at 0630.
6075 HJCT "Radio Sutatenza" opens 0900.
6115 OBZ40 "Radio Union" heard at 0500 and 1100.
6135 PRC21 "Radio TV Gaucha" sign on 0800.
6135 CE613 "Radio Universidad" sign on 1200.
6180 LRA34 "Radio Nacional Mendoza" heard at 1000.
6185 ZYR77 "Radio Bandeirantes" heard at 0900.
6205 OAX5U "Radio La Voz De Huamanga" heard at 0500 and 1100.

ENGLISH LANGUAGE DOMINATES

The amount of English broadcasts by foreign stations is increasing rapidly. Recently Radio Japan released some figures showing the time devoted to its main languages. With different broadcasts being carried

(continued on page 150)

UNITED TRADE SALES
PTY. LTD.

TRANSISTOR V.H.F. CONVERTER
Tunable 108-136 Mhz Aircraft Band 1F-600Kc to 1,000Kc. No connecting wires needed, 9V Battery, self-contained, just place alongside broadcast radio. Price only **$14.40,** plus **45c** postage.

PIANO, 5-key Switches, **$1** ea. P. and P., **25c.**

3,000 TYPE RELAYS
Large range. **Only 50c ea.** Post 15c. No specific coil resistance or contact arrangements supplied.

POWER SUPPLY BOARDS.
Bridge Rectifier 2 450UF. 35 volt capacitors and resistors. **$1.50** each. P. and P., 20c.

FERGUSON TAPE RECORDER CABINETS.
Small **$4** each. P. and P., $1.
Large **$6.50** each. P. and P., $1.25.

SPECIAL
Resistors. Mixed values. **$1.50** per 100. P. and P., 25c.
Simplex N750 10.120 PF Trimmers. **50 for $1.50.** P. and P. 25c.

CAPACITORS
47 PF 5KV Disc ceramic.
5c ea. Postage 10c per dozen.

MULTIMETERS
C 1000 Pocket Multimeter. 1000 ohms per volt. **$6.50.** P. and P. 25c.

KITS.
Denshi Board. Electronic Kits. 16 different projects including Germanium Radio Transistor Radio. Transistor amplifier, morse code, osc. and key. All components in plastic cases. No soldering. Only **$11.50.** P. and P., 40c.

E/co. 20 in-1 Electronic Kit, using solar cell. 20 different circuits, including wireless microphone. Telegraph transmitter. Signal Tracer. Kit includes XTAL. Microphone plug in units, no soldering. Limited number available at this price, **$16.50,** P. and P. 60c.

All prices subject to alteration without notice. All items PLUS POSTAGE.

WANTED TO BUY
RECEIVERS, TRANSMITTERS, TEST EQUIPMENT.

280 LONSDALE STREET,
(Opposite Myers)
Melbourne, Phone 663 3815

A.C.E. RADIO

AMPLIFICATION COMMUNICATION ELECTRONICS

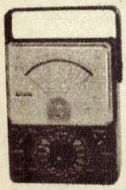
★★★★★★★★★★★★★★★★★★★★

PHONE 51-3845
51-7008

37 VICTORIA AVENUE, MIDDLE COVE
WEEKENDS & AFTER HOURS 40-5391

136 VICTORIA ROAD MARRICKVILLE — 51-3845

KAISE
MODEL SK-100



VOLT-OHM-MILLIAMMETER

HIGH SENSITIVITY
100,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS:
- DC Volts: 0.6, 3, 12, 60, 300, 600, 1200V.
- AC Volts: 6, 30, 120, 300, 1200V.
- DC Current: 12uA, 300uA, 6mA, 60mA, 600mA, 12A.
- AC Current: 12A.
- Resistance: 20K ohms, 200K ohms, 2M ohms, 20M ohms.
- Decibels: Minus 20 to plus 17, 31, 43, 51, 63.
- Accuracy: DC plus minus 3%, AC plus minus 4% (of full scale).
- Overload Protected by Dual Silicondiodes.
- Double-jewelled plus minus 2% Meter.
- Plus minus 1% Temperature-stabilised Film Resistors.
- Polarity Changeover Switch.
- Scale with Mirror.

Price $34.75. Post 75c. Interstate $1.00.

MODEL SK-44
30K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.
SPECIFICATIONS:
D.C. Volts: 0.6, 3, 12, 60, 300, 600, 1200, 3000.
A.C. Volts: 6, 30, 120, 300, 1200.
D.C. Current: 30uA, 6mA, 60mA, 600mA.
Resistance: 10K ohms, 1 M ohms, 10 M ohms, 100 M.
Decibels 20 cps plus 17, 31, 43, 57, 63.
OVERLOAD PROTECTION.
SPECIFICATIONS
Post 50c, Interstate 75c.
$19.25

MODEL SK-20
20K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.
SPECIFICATIONS:
D.C. Volts: 0.25, 2.5, 10, 50, 250, 1000.
A.C. Volts: 10, 50, 250, 1000.
D.C. Current: 50aU, 25mA, 250mA.
Resistance: 7K, 700K, 7 Meg.
Decibels: Minus 10 cps plus 22 (at A.C./10V) plus 20 cps plus 36 (at A.C./50V). Upper freq. limit 7 Kc.
OVERLOAD PROTECTION.
$13.50.

MODEL SK-70
30K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.
D.C. Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
A.C. Volts: 10, 50, 250, 500, 1000.
D.C. Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 7K, 70K, 700K, 7 Meg.
Decibels: Minus 10 cps plus 62 db.
OVERLOAD PROTECTION
$19.95.
Post 50c, Interstate 75c.

MODEL SK-60
50K OHMS PER VOLT D.C.
10K OHMS PER VOLT A.C.
SPECIFICATIONS:
D.C. Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
A.C. Volts: 10, 50, 250, 500, 1000.
D.C. Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1 Meg. 10 Meg.
Decibels: Minus 10 cps plus 62 db.
OVERLOAD PROTECTION.
$22.75.
Post 50c, Interstate 75c.

MODEL SK-55
30K OHMS PER VOLT D.C.
14K OHMS PER VOLT A.C.
SPECIFICATIONS:
D.C. Volts: 0.6, 3, 12, 60, 300, 1200.
A.C. Volts: 12, 60, 300, 1200.
D.C. Current: 60uA, 12mA, 300mA.
Resistance: 10K Ohms, 1 M ohm, 10 M ohms.
Decibels: Minus 10 cps plus 23 db.
$19.95

PANEL METERS



Clear Plastic Flush Mounting
1¾ins, 2ins, 3ins, 4ins.
Full range available.
From 50uA—10A DC, 15 VDC, 500 VDC, 300 VAC, VU and S.
Also
Edge Mtrs,
VU—Stereo Balance.
Send for price list. S.A.E.

PANEL LAMPS
6.3V. .3A. Pkt. of 10, 75c

NEW SPEAKER SPECIALS
8-16 OHMS

5¼ins	$3.35
6ins	$4.15
8ins	$4.85
4ins x 2ins	$3.45
5ins x 3ins	$3.45
6ins x 4ins	$4.25
7ins x 5ins	$4.85
9ins x 6ins	$6.25
3in Pillow Phone 8 ohm	$2.45

S.W.R. METERS
0-100MCS.
1KW. POWER OUTPUT.
$14.75
Pack and post 75c.

MODEL SE-405
0-150 MHZ 75 Ohms, 2 K.W.
$27.50

SIGNAL INJECTOR
MODEL 250-B.
TRANSISTORISED.
$7.95

SIGNAL TRACER
Operates in conjunction with 250-B
$4.95

AMPLIFIERS PUBLIC ADDRESS RANGE 240V-AC



MINIATURE P.A. AMPLIFIER
15 WATTS OUTPUT

Multi Match Ferguson O.P. transformer input for crystal mike and pick-up with electronic mixing
P.P. EL-84 output .. **$42.50**
30 Watt. As above, EL-34
P.P. **$57.50**

Public Address Range.
All models available with either multi-tapped 600 ohm line or 15 ohm Voice Coil.
Solid State 240V A.C.
20 Watt $59.50
50 Watt $79.50
50 Watt 240 A.C. plus
12v. D.C. $99.50
All have input for 2 microphones or 2 Magnetic or Crystal P.U. With Mixing.



P.A. SPEAKERS
8 WATT.
8in Units in Waterproof Projection Horns.
15 Ohm Voice Coils.
Price $16.75
Line Output Transformers to suit.
$1.75 extra.

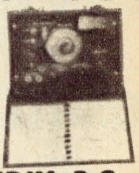
SPEAKER COLUMN
VINYL COVERED—BLACK
33in x 10in x 10in. Complete with 4 heavy duty 6in Speakers. 25 watts— 4, 8, or 16 ohms.
$32.50

70 WATTS R.M.S. P.A. AMPLIFIER
70 Volt Line and Voice Coil. Inputs for Hi-Imp. Mic. and 600 ohm line $65.00

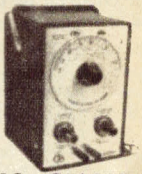
HI-FI STEREO HEAD PHONES



20-15,000 CPS **$6.65**
Post. 35c.
$43.75.



BENDIX B.C. 221
Frequency Meter. 125 KC—20 MCS. Complete Calibration book —100 KC crystal. 240 V AC supply.
BRAND NEW .. .. $75.
USED GOOD ORDER .. $49.50



AUDIO GENERATOR
De Luxe Model TE—22D.
Freq. range, Sine 20 cps—200KC. SQ. 20 cps—25KC. Output Voltage Sine 7V, SQ. TV P.-P. Output Impedance 1000 ohms Acc. 5 per cent. 4-range attenuation. 1/1, 1/10, 1/100, 1/1K. Printed circuit. 240V A.C.
$42.95

SIGNAL GENERATOR
De Luxe Model TE20D.
Freq. Range 120 KC—500 Msc 7 Bands. Accuracy 2 per cent Output 8V. Provision for Xtal. Suitable for self-calibration Marker generator. Printed circuit. 240 V.A.C.

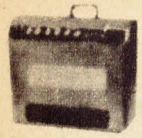
MODEL TE-65 V.T.V.M.
D.C. V 0-1.5-5-15-50 150-500-1,500 V. Rms. A.C.V. 0-1.5, 5.5-15-50-150-500-1,500 V. Rms. 0-1.4-4-14-400-1,400-1,400-4,000 V. P.P. Resistance: RX10, 100.1K, .10K, .100K, 1M, 10M, Decibel—100dB minus-plus 65db.
240 V.A.C.
$43.75
TECH. P.V. 58, $40.50.

NEW GRAMMO MOTORS
240V, A.C.
3 Speeds, $2.75.
Post: 40c.

TAPE CASSETTES
TENSILISED MYLAR

C 60	$1.25
C 90	$2.00
C120	$2.75
Head Cleaners	$1.75

HIGH-FIDELITY TWIN CONE SPEAKERS
Aust. made. 8 to 16 ohms.
6in .. $.900 10in .. $10.75
8in .. $9.50 12in .. $12.75
Postage:
Interstate 80c.
N.S.W., 50c.



GUITAR AMPLIFIERS

14-watt, 4 Inputs. Base and Treble Boost. 2 Twin-cone Speakers.
17-Watt 4-Channel. Base and Treble Boost. Two Twin-cone Speakers $83.85

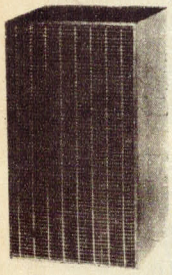
35 WATT

4-Channel, Bass and Treble Boost 4 Twin-cone Speakers, $119.00. Vibrato with foot control and 2 preset controls for frequency and intensity. $16.50 extra on above models.

14 watt, etc $69.50
17 watt $83.85
35 watt $119.00

3 WAY HI-FI SPEAKER SYSTEM

Famous Onkyo Imp. 8 ohms.
20 watt 8" woofer
30-3000 cps $17.50
30 watt Mid Range 6"
600-10,000 cps $9.50
40 watt horn tweeter
5000-22000 cps $7.95
Oiled Teak Cabinets
to suit $26.75
0—150MHZ 75 Ohms



MULLARD MAGNAVOX

Designed bookshelf enclosure with 6WR twin cone and 3TC tweeter $26.75 ea.
Super bookshelf enclosure with 2 x 6 WR .. .. .. $36.75 ea.
Hi-Fi enclosures with Magnavox 8WR or Rola C8MX .. 8 watts RMS .. .. $36.75 ea.
With 2 x 8WR or 2 x 8CMX 15 watts .. .. .. $48.00 ea.
With 12WR—10 Watts $49.00 ea.
8 or 15 ohms available.
All cabinets are constructed of Pineboard and Veneered with Oiled Teak Formica and are complete with crossover network — Tweeter — Innerbond packing.

PLAYMASTER 127 STEREO CONTROL UNIT

For tape replay, Magnetic, disc. and crystal cartridge input. Radio fully described Nov. 69 issue E.A.



KIT SET $49.50

Wired and Tested $59.50.
Pack and Post 75c.

128 STEREO AMPLIFIER

64 Watts per channel
Kit set $89.00
Wired and Tested $109.00

50 WATT SOLID STATE GUITAR AMPLIFIER

E.A. July and August Issue
Kitset, including Cabinet.
$98.00
Wired and Tested.
$114.00

COMPACT HI POWER ENCLOSURE

E.A. Jan. 71.
30 watt, complete as described.
$51.50
Magnavox 8-30 Speaker .. $17.50

GUITAR AMPLIFIER 150 WATT SOLID STATE

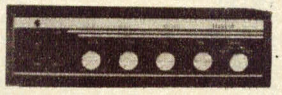
Multi-purpose wide range frequency response. 2 Channels. 4 inputs, separate Bass and Treble Controls, also separate volume controls. Can be operated Mono or Stereo. Black Vynex covered
Carry Cabinet 175.00

WAH WAH

MULTI EFFECT FOOT PEDAL

Siren-Surf-Hurricane. Separate volume controls. Transistorised, 9v battery operated.
$36.75
Pack and Post 75c.

ALL SILICON TRANSISTOR SOLID STATE STEREO AMPLIFIER



240V AC powered, 8 watts RMS per channel inputs for magnetic ceramic, and crystal cartridge, also recorder and radio tuner. Hi-Fi frequency response speaker matching 4-16 ohms. Size 10½in x 6½in x 3½in. Attractive oiled teak cabinet.
$54.00

Rotating Distress Emergency Beam



Red, Blue, Amber
—Visibility ½ mile.
12V D.C. operation. Waterproof. Complete with heavy duty suction Cap. Size 3½in dia. x 5½in.
$5.75.
Pack and Post. 35c

PLATFORMS

Teak Platforms, suit above changers, $9.00. Fully moulded tinted perspex covers, suit platforms 17¼in x 13½in x 4in

BLANK PLATFORMS
$8.50.

ORGAN KEYBOARDS

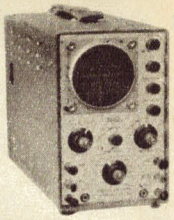
49-Note. Complete with Switching System.
$72.00
13-note. Pedal Claviers. Complete with Switches.
$39.50

WIDE BAND OSCILLOSCOPES

VERTICAL AXIS
Deflection sensitivity (at 1 kc) 0.1 V p-p/cm.
Frequency Characteristics. 1.5 cps —1.5 MC.
Input Impedance, 2 M ohms 25pF. Calibration Voltage IV p-p/cm.

HORIZONTAL AXIS
Deflection Sensitivity 0.9V p.p /cm
Frequency Characteristics 1.5 cps —800 KC.
Input Impedance 2 M ohms 20 pF.
Sweep Oscillator (5 Range) 10 cps —300 KC.
Synchronisation Devices Internal (Positive and Negative, External).
Power 240v AC 50/60 cps.
Cathode Ray Tube 3KFIF.

3-inch $102.75



TV BOOSTER

240 V.A.C. Especially designed for fringe area reception. Also up to 3 TV sets can be operated off common aerial for improved signal strength.
$15.95
Post Free

SONATA

MODEL 600 SOLID STATE STEREO AMPLIFIER

Output transistor protection fuse. Speaker Imp. 4-8-16 OHMS. Inputs for microphones, ceramic, crystal, magnetic cartridges, Aux. tape in. Tape out. Tuner. Stereo headphones. Tape monitoring switch. Tone def. switch. Hi. freq. scratch filter switch. 20 freq. scratch filter switch. 2 v.u. meters. Loudness control. Separate bass, treble balance and volume controls.
Specifications: Sensitivity, Mag. 2.5 Mv; Ceramic 50 Mv; Aux 100 Mv. Output Power: 20 watts R.M.S. per channel. Tone Control: Bass +12 DB. −12 DB at 50 HZ. Treble +12 DB. −12 DB at 10 KHZ. Loudness Control: +12 DB at 50 HZ +4 DB at 10 KHZ. Cross Talk −50 DB. Residue Noise: Less than 1Mv. Dimensions: 19½" x 11" x 5½".

PRICE $133.50

STEREO RECORD CHANGER

C109 — MA65 — MA70 — MA75



Current models, 4 speeds, automatic or manual operation.
Standard model $28.50
Ceramic cartridge, Sapphire Stylus Standard model with 12in turntable $34.00
Deluxe model with 12in turntable. Cueing device, Ceramic cartridge Diamond Stylus $40.00
Deluxe model as above with — adjustable counter balance, 2 spindles, calibrated stylus pressure control added $46.50
Deluxe model as above with 12in Diecast Heavyweight Turntable, 4-pole Shielded motor. Suitable for Magnetic cartridge $56.50

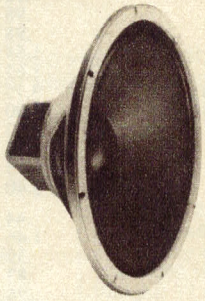
The latter two record-changers can be supplied with magnetic cartridge and diamond stylus at $10 extra.

AUTO-RHYTHM UNIT

240 WAC operation.
Hi and low imp. output. Matt finish teak cabinet. 12in x 5in x 11in.
20 Rhythms.
9 percussion instrument sounds, controls, balance, sustain tempo, volume. Ideal for operation with stereo sound system—electronic organ—guitar amp. Complete with foot pedal cables, book.
$145.00.
Also Available:
Unit with 16 rhythms: 9 percussion instrument sounds. 240 WAC —teak cabinet.
$125.00

B.S.R. 4 TRACK

STEREO TAPE DECK.
3 speeds, 7in spools. 3-digit counter Fast forward—fast rewind.
$48.50.
Fitted with third head for monitoring. $55.50.



15" PIONEER

15in Pioneer Low Frequency Speaker. Imp. 8 ohms. Power, 30 Watts. R.M.S. Designed especially for use with Bass Guitar or Electric Organ. Also ideal for Stereo Woofer Speaker.
$30.00

T.E. 46 RESISTANCE CAPACITANCE

Bridge and Analyser.
Capacity 20pf to 2000mfd
Resistance 2 ohms to 200 megs.
Also tests power factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs, at 600V.
Indications by eye and meter.
$53.75

VOLT A.C.

VARIABLE TRANSFORMER.
0-260V, 10 amp $49.50
0-260V, 5 amp $37.50
0-260V, 2½ amp $25.50

IMPORTED COMPONENTS

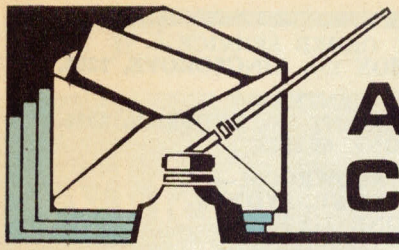
PO BOX 1683P, MELBOURNE 3001

ALL PRICES INCLUDE TAX AND POSTAGE

AS216	3.03
AS217	2.59
AS218	2.91
AS220	.98
AS221	2.16
AT316	.68
AT318	.68
AT319	.69
AT321	.69
AT322	.63
AT323	.68
AT324	.68
AT325	.83
AT331	.12
AT337	.69
AT338	.70
AT341	.70
AT350	1.14
AT1138	2.66
AX1101	1.53
AX1103	1.70
AX1104	1.86
AX1108	1.86
AX1127	1.50
AX1130	1.50
AX1131	1.77
AX1132	1.50
AX1142	1.20
AX1143	1.58
AX1144	1.44
AX1166	1.37
AX1284	1.41
AY1101	.68
AY1102	1.04
AY1103	1.35
AY1104	1.35
AY1108	1.65
AY1110	1.50
AY1112	.69
AY1113	.69
AY1115	.60
AY1116	.68
AY1117	.68
AY1119	.60
AY1120	.98
AY1121	.98
AY6108	1.65
AY6109	1.65
AY8108(8103)	3.75
AY8109(8104)	3.00
AY8110	6.22
AY8111	6.75
AY8112	6.75
AY8135	5.40
BA100	.44
BA102	1.46
BA114	.39
BC107	.83
BC108	.76
BC109	.91
BC147	.76
BC148	.68
BC149	.79
BC157	.89
BC158	.76
BC159	.89
BC177	.91
BC178	.84
BC179	.92
BC186	.79
BCY10	2.59
BCY11	3.24
BCY12	3.14
BCY39	5.19
BCY71	2.05
BC210	1.95
BC211	2.37
BC212	2.16
BDY20	2.63
BDY38*	2.62
BF115	.87
BF145	.64
BF173	1.14
BF177	1.63
BF178	1.80
BF179	2.04
BF184	.72
BF185	.72
BF194	.67
BF200	1.32
BFY51	5.19
BSX19	2.16
BSX20	2.39
BT100A/500R	3.00
BTY79/100R	2.70
BTY79/300R	3.45
BTY79/500R	5.19
BY126/200	.48
BY126/400	.56
BY126/500	.63
BY127/800	.78
BYX21L/200R	1.35
BYX38/300+R	1.32
BYX38/600+R	1.62
BYX38/900+R	2.08
BYX38/1200+R	3.03
BYX39/600+R	3.14
BYX39/800+R	3.88
BYX39/1000+R	4.53
B2X70Scvies	1.95
B2Y88C303toC11	.83
B2Y88C12toC30	.98
BZY95 Scvies	2.16
BZY96 Scvies	2.16
BZZ15to29	2.37
C20D*	6.60
C106/Y1	2.10
C122D	3.78
D13TI	1.95
DTG110B	6.96
DTG1010	15.16
EM402	.45
EM404	.63
EM408	.80
EM410	1.40
1N645	.84
1N914	.51
1N3491+R	1.75
1N3492+R	1.83
1N3493+R	2.36
1N3660+R	1.99
2N174	6.09
2N217	1.24
2N277	2.32
2N301	2.66
2N301A	3.84
2N384	2.88
2N404	.78
2N406	1.01
2N417	1.77
2N441	1.80
2N443	3.22
2N456A	4.20
2N489B	14.76
2N591	2.20
2N649	2.12
2N696	1.13
2N697	1.17
2N706A	1.08
2N930	1.80
2N1038	3.92
2N1046	17.94
2N1073B	7.59
2N1302	1.01
2N1303	1.01
2N1305	1.13
2N1306	1.32
2N1307	1.32
2N1308	1.64
2N1309	1.64
2N1546	5.85
2N1639	1.20
2N1908	27.74
2N2147	3.60
2N2148	3.60
2N2160	2.40
2N2188	2.79
2N2270	2.40
2N2646	2.19
2N2669	6.53
2N2996	3.15
2N3005	5.32
2N3053	2.48
2N3054	2.63
2N3055	2.63
2N3525	3.70
2N3563	.90
2N3564	1.08
2N3565	.86
2N3566	1.01
2N3567	1.08
2N3568	1.08
2N3569	1.23
2N3638	.90
2N3638A	1.13
2N3641	1.13
2N3642	1.26
2N3643	1.26
2N3644	1.13
2N3645	1.44
2N3646	.90
2N3691	.86
2N3692	.90
2N3693	.86
2N3694	.90
2N3702	1.01
2N3703	.96
2N3704	1.77
2N3705	1.73
2N3706	1.65
2N3707	1.14
2N3708	.80
2N3731	3.17
2N3819	1.77
2N3826	1.68
2N4121	1.04
2N4250	1.17
2N4354	1.28
2N4355	1.65
2N4356	1.65
2N4360	1.58
2SB186	1.50
2SB407	3.30
2SB474	3.30
3N140	2.55
3N141	2.34
20A2	.78
20A4	.92
20A6	1.04
20A8	1.22
AA119	.36
AB1101	1.20
AB1102	.87
AC107	2.28
AC125	.96
AC126	.96
AC18/188	2.36
AC128	1.05
AC132	1.01
AC172	1.20
AC187188	2.36
AD149	2.45
AN1102	.68
AN1103	.60
AN1104	.60
AN1105	.60
AN2001	.45
AN7102	.90
AN7105	.68
AS147	.80
AS148	.76
AS208	1.46
AS301	.81
AS306	.84
AS307	.84
AS308	.84
AS310	.99
AS311	.96
AS312	.93
AS313	.92
ASY73	2.12
ASY76	2.10
ASY77	1.68
FPT100	1.80
H35	8.07
MBI	2.03
MB3	2.65
MB6	3.40
MB8	4.30
MJE2955	4.55
MJE3055	3.06
OA5	0.65
OA10	0.87
OA47	0.65
OA90	0.32
OA91	0.33
OA95	0.39
OA202	0.75
OC20	6.38
OC22	3.03
OC23	3.80
OC24	3.45
OC44N	1.11
OC45N	1.11
OC74N	0.96
20C74N	1.92
OC140	1.95
OC141	2.60
OC201	3.80
OC202	3.70
OCP70	2.60
OCP71	4.32
ORP12	0.95
ORP60	1.75
PA40	4.83
PB40	7.26
SC40D	8.55
SC50D	13.00
SE1001	1.13
SE1002	1.20
E1010	1.80
SE2001	0.98
SE2002	1.20
SE3001	1.12
SE4001	1.05
SE4002	1.13
SE4010	1.20
SE5001	2.10
SE5002	2.10
SE5003	2.48
SE5020	4.05
SE5023	3.15
SE5025	1.35
ST2	1.50
T1/40/A2	3.30
T13027	2.61
TIC44	1.68
TIC45	1.88
TIC46	2.05
TIC47	2.30
TIP31A	2.10
TIP32A	2.70
TIP33A	2.98
TIS34	2.46
TIS43	2.36
ZD Series	1.98
40360	2.48
40361	2.70
40362	3.20
40407	2.52
40408	2.98
40409	3.15
40410	3.30
40411	9.70
FETS	
2N4889	2.70
2N5245	2.62
2N5458	1.77
2N5459	1.77
2N5485	1.77
MPF102	1.75
I.C.'S.	
FUL709	2.25
FUL723	4.50
FUL739	5.20
FUL900	1.20
FUL914	1.20
FUL923	2.25
LM370	6.75
LM372	5.62
MC1303	5.20
PA230	4.30
PA246	13.60
TAA840	5.30

SPECIALS

AY1001 pkts 10	4.25
SE1001 pkts 10	7.50
2N3693 pkts 10	5.70
EM404	0.22
TT4010	0.40
2N3055	1.58



ANSWERS TO CORRESPONDENTS

SWL HANDBOOK: As I have become very interested in listening to short-wave broadcasts, I am anxious to obtain a list showing the names of world stations together with their operating times, wavelengths, etc. Is such a list available and, if so, what is the cost of same? (H.C., Glenorchy, Tas.)

The standard work in this field, recognised throughout the world, is the "World Radio and Television Handbook". Published in Denmark, this book provides all the information you require and more. It is available through technical booksellers or direct from our short-wave correspondent, Mr Arthur Cushen in New Zealand. The price is $4.60 for the 1971 edition, which we reviewed in our March issue.

LARGE-SCREEN CRO: I would like to congratulate you on a truly excellent magazine, which to me far outranks any of the leading magazines from Britain, USA or France. You may care to know that I am at present building a large-screen CRO using a 23in TV picture tube. I am using integrated circuit amplifiers, a unijunction relaxation oscillator timebase, and a car ignition coil EHT generator with a 1S2 rectifier and output filtering using home-made Leyden jars. This is a most interesting project, and I am finding it very enjoyable. I would be happy to supply details of the unit for your "Reader Built It" columns, but in the meantime could you please print my name and address so that others interested in this type of project could contact me (Mr A. M. Adams, 3 Fernleigh Gardens, Rose Bay, NSW 2029.)

Your compliments regarding the magazine are much appreciated, A.M.A., and we hope it continues to be of interest. Your large-screen CRO project is undoubtedly an interesting one, although one which may be a little too complex and costly for many of our readers. Nevertheless if you care to send further details of the unit when it is completed, we will be happy to consider it for publication. We published your name and address, as requested.

PROJECTS: I am a young reader of your magazine, which I find very interesting. I would like to know if you have described, or are intending to describe, any of the following: a radar set, a transceiver for the UHF & SHF bands or one for either band, an oscilloscope, a geiger counter, and a pulse generator. (A.W., Millswood, SA.)

We have not described, and have no plans to describe, a radar set or any transceivers for the UHF or SHF bands. There is little or no demand for such projects. We have described the other items requested, however. A number of oscilloscopes have been described, but to choose one most suited to your requires more information. A geiger counter was described in July 1962 (File No 3/GC/2), and a pulse generator appeared in December 1967 (File No 7/AO/12). These articles may be obtained through the information service.

CONICAL Vs ELLIPTICAL STYLUS. I should like to register my compliments on your most readable magazine, in particular for the record review section. If possible I should like to see this expanded. Can you advise me of the respective merits of conical, elliptical and spherical styli? (A.P., Werris Creek, NSW.)

Thank you for your compliments, A.P. However, we must point out that the amount of space devoted to record reviews must be determined in the first instance by the overall size of the respective issues, and by the need to accommodate a wide range of material to cater for all the interests of our reader. A stylus needs to have a certain minimum tip radius so that it will ride part way up the groove and clear of the groove bottom. With such a radius (typically 0.7mil), a normal conical stylus cannot track the finest undulations (highest frequencies) as well as it should. An elliptical stylus, viewed along the groove, has a major radius such that it will ride in the groove as required. However, the radius as viewed from the side is very much smaller, allowing it to trace the fine undulations more accurately. Conical styli are sometimes referred to as "spherical". Elliptical styli are sometimes called "bi-radial" – a fine shade in meaning which does not add up to much as far as the user is concerned. Elliptical (or bi-radial) styli are most suited for use in pickups having a tracking weight of not more than 2 grams. While the narrow shoulders are fine for groove tracing, they are also subject to greater wear, and this becomes a problem if the tracking weight is increased.

TUNER: I wish to build a Playmaster 131 IC Tuner. Have you published details of a suitable amplifier to suit a low budget? I would prefer a transistorised, fairly compact model which could operate from the same batteries as the tuner. It would also require a volume control. You suggested a DM70 tuning indicator. Would this fit into a window of 3/16in by ¾in? (J.S., Sans Souci, NSW.)

As we have mentioned in these columns, the IC was originally intended to be the front end of a portable radio, with its own amplifier. This involved only two transistors, and a number of other parts. We suggest you get in touch with the technical dept of Philips and see if this original design is suitable.

BABY MOOG SYNTHESISER. At your invitation I would like to express my thoughts on a project of this kind. Firstly I think that anyone wishing to undertake a project of this complexity must realise the tremendous amount of work and cost involved. But if a project of this nature was to be put forth on a monthly basis, it may cut costs down to a bearable monthly amount. Also such intervals would give constructors time to cope with the

"ELECTRONICS AUSTRALIA" INFORMATION SERVICES

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

PROJECT REPRINTS: For a 20c fee, we will supply data, as available from our files. The amount of data available varies but in no case does it include material 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 project data will be answered more speedily if the projects are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c per page.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to six months old the cost is the face value, plus 5c surcharge. From seven to 12 months, 10c surcharge; over 12 months, 20c surcharge. Package and postage is 10c extra per issue. Please indicate whether a PROJECT REPRINT may be substituted if the complete issue is not available.

REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design.

"ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia", Box 2728 GPO, Sydney, NSW 2001. 4/71

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more technical matters of construction. I for one would like to indulge in such a project and I am sure many others feel the way I do. (J.A., Richards, Dandenong, Vic.)

Thank you J.A.R. for your comments. We are pleased to note that you realise the complexity of this type of project, but we doubt very much whether many other readers really do. Your letter may help to enlighten many would-be constructors on this point.

SURPLUS PARTS: I have a boxful of parts comprising transformers, motor generators, mantel cabinets, some valves and a 6ft rack. I am prepared to give the lot to one taker, who can dispose of what he does not want personally. Please, no letters or phone calls. Some time ago I gave a telephone switchboard to some students but asked that they return to me some lamp sockets from the panels. They never reappeared. (P.W. Butler, 1 Darley Rd. Randwick, NSW.)

Thank you for your offer. Maybe the students who overlooked your request will come good with some of the lamps and sockets you need.

AMPLIFIER PROBLEM: I have built the Playmaster 127 IC stereo control unit and teamed it with the amplifier section from the Playmaster 115. While the control unit worked well with a valve amplifier, it does not seem well matched to the Playmaster 115. The volume control has only to be moved very slightly from the zero setting and the sound level is unbearable. There is also some distortion on very loud passages. I am using a BSR C1 cartridge. There also seems to be a problem with the balance control – even if the balance control is rotated fully in one direction it does not completely silence one channel. Is there any remedy for my problem, such as fitting a different volume control? (G.O., Cannon Hill, Qld.)

Your problem is one of excessive sensitivity in the control unit and amplifier, in relation to the cartridge you are using. The amplifier has a basic sensitivity of 100mV for full power, while the high level input on the control unit has a sensitivity of 100mV in for 250mV output. Clearly, the nominal 300mV or so from your ceramic cartridge is overdriving the input stage of the control unit. We suggest you reduce the sensitivity of the Radio 2 input from 100mV to around 300mV by reducing the 1.8K feedback resistor in both channels to 680 ohms.

TUNED SIGNAL TRACER: Have you published a circuit for a tuned signal tracer? If not, could the IC superhet tuner featured in your February, 1971 issue be modified for use as one? If so, what modifications would be needed, apart from an amplifier? (D.M., Orbost, Vic.)

None of the signal tracers we have described in recent years are tunable. While it would be feasible to modify the IC superhet tuner as a signal tracer by the use of a suitable probe, we cannot undertake to advise how this would be accomplished. But we admit that it is an interesting idea.

AUTOMATIC LEVEL CONTROL: Have you ever published an article on a sound fluctuation level control for a DC operated tape recorder? The device is intended to replace a level meter by an automatic control system. I do not know what is the correct technical name for it. (A.R.. Hobart. Tas.)

The device you describe is usually called an "automatic level control". We have not described one of these, neither have we incorporated such a device in the various tape recorders we have described. Opinions are very much divided as to the usefulness and effectiveness of this type of control; it is perhaps significant that many recorders fitted with them provide a disabling function so that the user can revert to manual control.

RMS: Could you please tell me what RMS is and how can it be calculated? Could you, say, use a 10 watt speaker in place of one that was 10 watts RMS. (K.M., Albany, NSW.)

RMS stands for root means square, and basically, it refers to the "work value" of the waveform. It can be worked out mathematically, being dependent on the shape of the wave (sine, square, etc). It is a subject you could look up in an electrical textbook. If the speaker is quoted as 10 watts maximum, chances are that the rating is already in "RMS" or effective power.

INCREASED SENSITIVITY: Is it possible to increase the sensitivity of a multimeter from 20,000 ohms/volt to 100,000 ohms/volt or better by external means, such as a solid-state amplifier? (R.A., Penshurst, NSW.)

An article entitled "DC Amplifier from a low cost Digital IC" published in the July 1970 issue of "Electronics Australia" shows how to increase the sensitivity of a meter movement using a Fairchild FuL914 integrated circuit. Copies of this article are available in tearsheet form from our Information Service. (File No 7/M/35.)

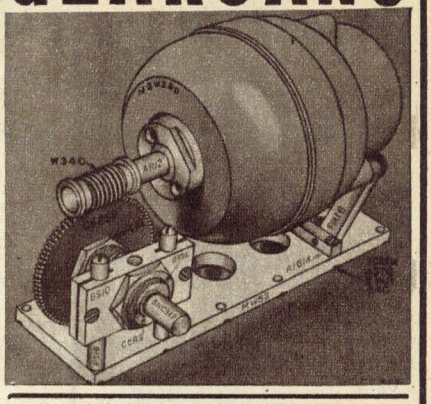
LICENSING WALKIE–TALKIES: I would like some information on how to go about licensing walkie-talkies, as my parents gave me a pair for a birthday present without the knowledge that they had to be licensed. I understand that until they are licensed to transmit I run the risk of incurring heavy fines, is this correct? I would think that a number of readers would be interested in this also. (T.M., Eleeband, NSW.)

Thank you, T.M., for bringing this subject up again. Although we have published quite a number of articles in the past on this topic, we do not seem to be able to give enough information on it. Let us state quite clearly for the benefit of those readers still in doubt on the subject, that no one may operate any piece of equipment capable of transmitting over any distance, no matter how small, and operating on any frequency you care to name, unless it is licensed with the Postmaster-General's Department. Failure to do so will only result in fines and may also lead to the confiscation of the equipment. Application forms setting out the conditions can be obtained from the Radio Branch, PMG's Department in the capital city of each State.

NEW ELECTRONICS CLUB: We recently started an electronics club at Lara, and as we have very little finance available we shall have to build our own equipment. We should like to know in which issues of "Electronics Australia" you published circuits for a CRO, a VTVM, regulated power supply, frequency generator, transistor tester and any other circuits you think we may require. Can you advise whether a PMG licence is required for a receiver only? (C.H., Lara, Vic.)

In view of the rather general nature of your query, we feel you should obtain reprints of our annual indices, say for a period of 10 years, in which all projects are listed. These indices, as well as project reprint material for the projects listed, can be obtained through the Information Service for 20c each. We are not sure what type of receiver you refer to in your letter, but presumably you mean a communications receiver. Most likely your club will need a broadcast listener's licence for the receiver. If you want to check up, however, you should

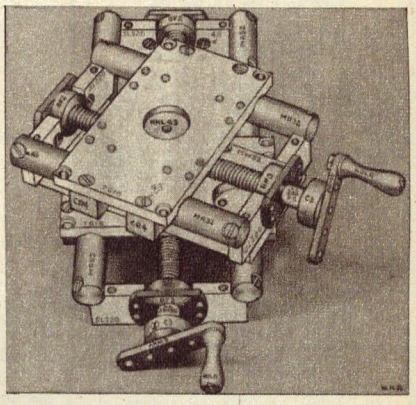
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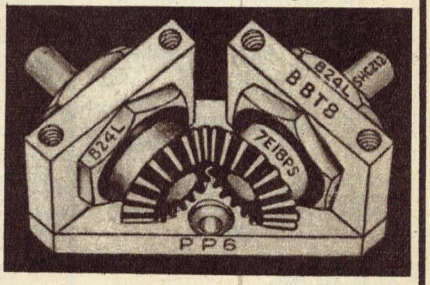
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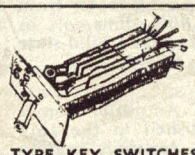
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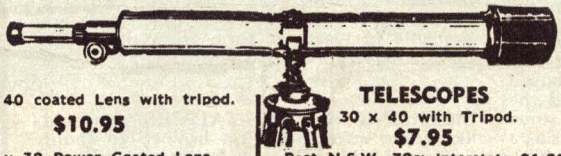
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address your inquiry to the Radio Branch of the Postmaster-General's Department in the capital city of your state.

SOUND ON FILM: I was wondering if it would be possible for you to run an article or series dealing with the reproduction of sound on to movie film, and the reproduction of this back into sound. I am studying electronics at school, and my friends and I are interested in this topic. (A.B., Doveton, Vic.)

This topic was fully covered in two articles entitled "A Short History of the Talkies", published in September and October, 1968. (File Nos 8/H/4 and 5.) Reprints are available from this office for 20c each article.

MAN IN SPACE: What use is space travel? The human being is burdened with problems he cannot solve. Fast running out of fossil fuels. Environment pollution. Yet reaching out for the stars. And lots more ... (E.J., Dalby, Qld.)

This would be a good one to argue during a long plane journey – or a space flight! But it's not a question we can get involved in here. We suggest that you buy copies of "Modern World" for May and June and have a look at the article "What Good Is Man In Space?"

SOLID STATE FREMODYNE: I have built the Solid State Fremodyne, described in May, 1970 and so far I have not been able to get it to work. The power supply and the audio amplifier both appear to be working properly but I am unable to receive any signals. Could you please give me the address or telephone number of anyone able to help? (K.T., Strathfield, NSW.)

We do not record names and addresses of individual constructors, whether their efforts are successful or otherwise. It is therefore not possible to meet your request. Like most super-regenerative receivers, the Fremodyne can be cantankerous. We can only suggest that details of the adjustments be carefully studied again, with a thorough check of all wiring and components, for any errors or faults. It is also necessary to use an efficient aerial system, as pointed out in the article.

DYNAMIC LOUDSPEAKER: I have an old dynamic loudspeaker, but do not know much about them, or what voltage to apply. Can you tell me where to find such data, or just tell me the voltage? Have you ever published a circuit for an FM tuner? (B.K., Canberra, ACT.)

Your loudspeaker question is about as difficult to answer as the well-known one concerning the length of a piece of string. There are no set figures applicable to all dynamic loudspeakers, and we should say the chances of obtaining data today for a loudspeaker of this type are remote. In fact, old dynamic loudspeakers, removed from their original setting, are likely to qualify as junk and do not warrant the expenditure of undue time and energy to get them going. We last published a circuit for an FM tuner in the January, 1957 issue, at which time the ABC's experimental FM service was still operating. The circuit is now out-dated.

TRAIN DRAIN: I wish to construct two model train control units as described in the April issue. I am having trouble determining their current drain, and I wish to operate both controllers from a common power supply. What rating should the transformer have? Can you suggest suitable diodes for the bridge circuit? (M.M., Kotara Sth, NSW.)

The drain of the controllers will depend on the load placed on it – in other words, the current drawn by the model trains used. However, we can tell you that the maximum permissible current drain of the controller is 5A. Suitable diodes for a full wave rectifier configuration would by BXY 21L/200. We draw your attention to the article in the April, 1968 issue, entitled "Power Supply for Model Railways", (File No 2/PS/19) which could assist you. Project reprint material is available through the Information Service for 20c.

POTENTIAL AMATEUR: Please could you tell me where I can obtain information about the amateur transmitting licence examination. Also, is there a book which explains how electronic components work and what they do? If so, could you please tell me the name and author of the book? (M.F., Kew, Vic.)

You can obtain a copy of the regulations concerning the amateur licence from the Radio Branch, PMG's Department in your State. We would also suggest that you contact the WIA for assistance in this respect. We would recommend our "Basic Electronics" as a suitable text for a beginner to the subject. This was compiled by our editorial staff and is available through the Information Service for $2.30 including postage. Alternatively, the book is presently being revised, and will appear in "Electronics Australia" in monthly parts. You could follow it each month in the magazine, and then afterwards buy the revised book as a reference work.

TRANSCEIVERS: I am thinking of building a solid-state transceiver of reasonably low cost, and would like to know if you have ever published such a device. If so, could you please give me the File No and date? Also, have you published a small solid-state transmitter? (J.O., Ballarat, Vic.)

The only solid-state transceivers we have described are our VHF handset series, for 6 and 2 metres, published from May and July, 1970 (File Nos 3/TC/5, 6, 7). We have not described a small fully solid-state transmitter. The fairly large SSB transmitter described in January, February and March, 1967 (File Nos 2/TR/41-43) was hybrid, using valves for the driver and power amplifier, and solid-state components elsewhere. Copies are available from this office for the usual fee.

GUITAR AMPLIFIER: I have been receiving your interesting magazine for over two years and lately I have become interested in guitar amplifiers. I have searched through the books I have, as well as a few earlier ones, but have not seen a design which satisfied me. I thought about the solid-state amplifier published in July and August, 1969, but it is too expensive for me. Could you please refer me to a cheaper design, possibly valve, and one for which parts are easily obtained? Here is Perth it is difficult to get a lot of parts. (M.F., Doubleview, WA.)

The Playmaster 116 guitar amplifier published in June, 1967 (File No 1/GA/8) appears to come closest to your requirements, M.F. While it is not "cheap", it is economical considering the power output – 40 watts continuous. It is a valve amplifier, and all the valves are readily available types (they are all used extensively in television receivers). You should have no trouble obtaining the rest of the components.

RADIO: Unofficial history

During the thirties, radio announcers and artists were circumspect about what they said over the air. "Damn" was daring and the great Australian adjective was completely taboo.

That was until Stanley Holloway recorded his song detailing the ghostly habits of Anne Boleyn. Apparently, with 'er 'ead toocked oonderneath 'er arm, she was given to walking "ther bloodee touwer"!

This was really something to those of us who worked in a small radio factory-cum-showroom in the central city. Little we knew or cared that there was a structure in London called the Bloody Tower. Stanley Holloway was using the great Australian adjective and that was all there was to it!

It seemed quite natural, the first few times it was aired, for anyone who was near a receiver to turn up the volume for the adjective. And out of this there very soon emerged a ritual.

At any one time, there would be a couple of sets on preliminary test at the end of the assembly line. There would be a couple more in the final test rooms, a number of them "soaking" on the racks before fitting into cabinets, and still more awaiting delivery. As well, there would be a few in the service section.

As soon as the tower song was heard, there was a concerted rush to tune all the sets to the particular station. They would all be kept low until the right moment when all the volume controls would go up simultaneously. The one, isolated word would be shouted throughout the factory to the full capacity of a dozen loudspeakers and a dozen type 59 output valves.

If the effect in the factory was startling, downstairs in the showroom it was shattering! Normally the only sounds that drifted downstairs were no more than enough to demonstrate that "we make our own radios on the premises". But imagine the discomfort of the "gentlemen type" salesmen when their spiel was interrupted by a huge, amplified shout: a single word – "bloodee".

It took a certain amount of "persuasion" to put an end to the ritual but, in those days, management had the upper hand. To have fun was one thing; to get the sack was another! (W.W., Parramatta, NSW).

Readers are invited to submit contributions to "RADIO: Unofficial History" and a publication fee will be paid for those used. Stories must be humorous and they must be true. Letters must be signed and the locale of the story indicated as a mark of good faith. The Editor reserves the right to rephrase contributions as necessary to preserve uniformity of style.

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LISTENING ... from p 141

simultaneously, they have 37 program-hours every day. Although they are a Japanese station they broadcast longer in English than in Japanese. In January they broadcast 5,145 minutes a week in English and only 3,454 minutes a week in Japanese. This is from a total 15,540 minutes of broadcasting each week.

BROADCAST BAND NEWS

FIJI: The Fiji Broadcasting Commission is expanding its service on the broadcast band, and will shortly have 10 transmitters in operation from five transmitting sites. This will enable the FBC to give a two-program service, with English on one network and Fiji-Hindi on the other.

New transmitters are being installed at Sigatoka using 1210KHz; at Rakiraki, 1320KHz; and Labasa, 680KHz. The complete list of transmitters in operation will then be as follows:

KHz	Location
560	Suva
640	Lautoka
680	Labasa
710	Suva
810	Labasa
890	Lautoka
930	Sigatoka
1210	Sigatoka
1320	Rakiraki
1470	Rakiraki

PROXIMITY ... from p 43

1/16in clearance between the top of the transformer and the lid. Readers using transformers other than those specified should therefore check that components fit their case before buying.

The preset sensitivity potentiometer is mounted at one end of the case, which is drilled to allow screwdriver access. All the other components are mounted on a 12-lug length of miniature tagboard. The SCR is soldered directly into circuit and does not require any additional heatsink. The pigtails of the 1000uF capacitor should be sleeved with spaghetti to avoid the possibility of shorts. The layout shown in the diagram shows a BRY39 in circuit. If a D13T1 is used, the layout will have to be rearranged slightly to accomodate the different lead configuration.

The mains cord should be passed through a grommeted hole in the case and securely anchored with a mains cord clamp. Note that the case and the circuit **must be earthed** via the mains cord, otherwise the device may fail to work. A neon light assembly incorporating a limiting resistor is mounted on the case lid to indicate that the unit is functioning.

The output leads to the load and the lead to the sensor plate are terminated on a short length of plastic terminal block. Note that shielded cable cannot be used for the sensing lead otherwise the complementary SCR and SCR will remain continuously turned on due to cable capacitance. Similarly the sensor lead should not be too long, otherwise there will again be excessive stray capacitance.

When the unit is completed and ready for installation choose a location which required a minimum of lead length to the sensor plate. The leads to the bell are not critical. The sensor plate should be kept as far away as possible from earthed objects, otherwise sensitivity will have to be compromised. It may either be concealed or left visible. Note that the sensor plate may be touched directly, with no danger of electric shock, because of the high values of resistor used in the gate circuit.

With the unit installed and the sensor plate connected, it is only necessary to adjust the preset potentiometer to the point where the bell just fails to ring in the quiescent state. If the user now places his hand in the close vicinity of the sensor plate, the bell should ring.

MOIRE FRINGES ... from p 17

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★ ★ ★ ★

(The author of this article is Senior Lecturer in Physics at Macquarie University, North Ryde, NSW.)

MAINS FILTER ... from p 67

Eddystone diecast box 4-5/8in x 3-5/8 in x 2 3/16in. The disposition of the various components may be seen from the picture. The two coils are held with a bracket at each end. We made up brackets from 16 guage aluminium, each measuring 5/8in x 1-1/8in, with a ½in foot. Each bracket has a hole in the foot for mounting to the box and a "U" shaped slot of a size such that the rubber grommet is a neat fit into it.

Instead of a 0.1uF capacitor for each of the four positions shown in the circuit, we used two .056uF 1,000V working paper capacitors. These happened to be on hand but standard plastic capacitors rated at between 630 and 1,000 volts working, are quite suitable.

At each end of the box, we provided a three tag strip for input and output terminations. The input cable, with a 3-pin plug attached, is brought through a grommeted hole at one end. The output at the other end of the box is via a standard 3-pin outlet socket. The socket is screwed to the end of the box and three clearance holes are provided for leads between the socket and inside the box. The four 0.1uF capacitors are fitted under the coils and near the bottom of the box. Line terminations are to the tag strips and the earth connections are to two solder lugs under a screw at the centre of the bottom of the box.

This is all that is necessary for the basic filter and the job is complete if you have no problem with control tones. For the full unit, the 1uF capacitor across the output actually consists of two 0.47uF 630V working plastic capacitors in parallel. The 11uF units across each coil which may also be seen in the picture, consist of two 22uF, 25VW tantalum capacitors wired back-to-back. Care should be taken to ensure that the correct polarity is observed, as shown in the circuit. Although we used and show 25 VW capacitors, these are actually pre-production samples and 22uF 3VW units will do the job.

Having added these capacitors to the basic circuit, it may seem that we have introduced an anomaly. The purpose of the inductors is to offer as high an impedance as possible to high frequency components, and so combat noise pulses. We have subsequently added a high value of capacitance in shunt with each of these coils, and it may seem that this would pass the high frequency components and so defeat the purpose of the filter. In practice however, there is sufficient capacitance across the line, so that the noise is still effectively attenuated.

Although many readers should be interested in the control frequency of 750Hz, others may be interested in the alternative frequency often used, which is 1050Hz. Whereas 11uF is required across each coil to resonate at 750Hz, a value of 5.6uF is required for 1050Hz. This latter value is not so readily obtainable, with two units connected back-to-back. However a pair of 12uF 3VW tantalum capacitors should be close enough. Readers with a capacitance bridge available may be able to select the correct values, but in practice, the resonance point is fairly broad and no problem should arise.

We have shown the circuit for the special L filter specifically for use in combating the control tone problem. As we mentioned earlier, we tried an iron cored inductor of approximately 30mH, type No CF435, which is made by Ferguson Transformers. These are used for both L1 and L2. C1 and C2 should be 1.5uF for 750Hz and 0.765uF for 1050Hz. These values may be made up by connecting suitable values in parallel. C2 must be rated at least to 630V DC working, but C1 may be rated somewhat lower, as the line voltage does not appear across it. Plastic types may be used for each of these positions.

CCTV SYSTEM ... from p21

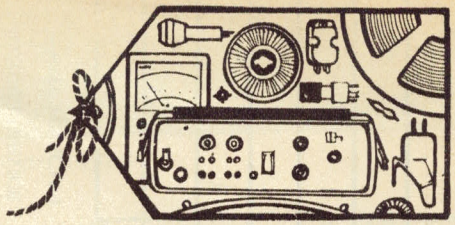
for outdoor camera installation; there is also a remote-controlled panning unit.) The system would also be ideal in teacher training colleges and demonstration schools for study of teaching methods.

The National system should also allow even small stores and companies to take advantage of CCTV, both for security monitoring and promotional display. Small supermarkets, record stores, bookstores, cosmetic stores, jewellers and photographic retailers have now the opportunity to gain as much from CCTV as has already been realised by their larger counterparts. Small restaurants, car sales yards and service stations now also have a means of providing improved customer service without adding further personnel.

The ability to provide multiple-camera facilities at low cost should make the National system of particular interest to advertising agencies, educational institutions, drama schools and other training bodies. It should now be possible for these groups to make professionally-assembled video tape programs without outlaying many thousands of dollars on studio type cameras and associated equipment.

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AWA Pressmatic tape-recorder, 5in reel, AC-DC, 2-speed, aux input-output, as new, $65 o.n.o. Also tapes $1 ea. AWA Trans 6 pocket radio, $3. E. J. Nicholls, C/o Post-Office, Tintinara, SA. 5266.

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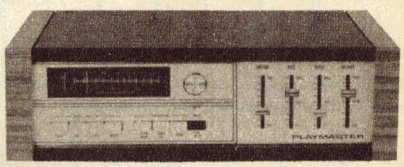
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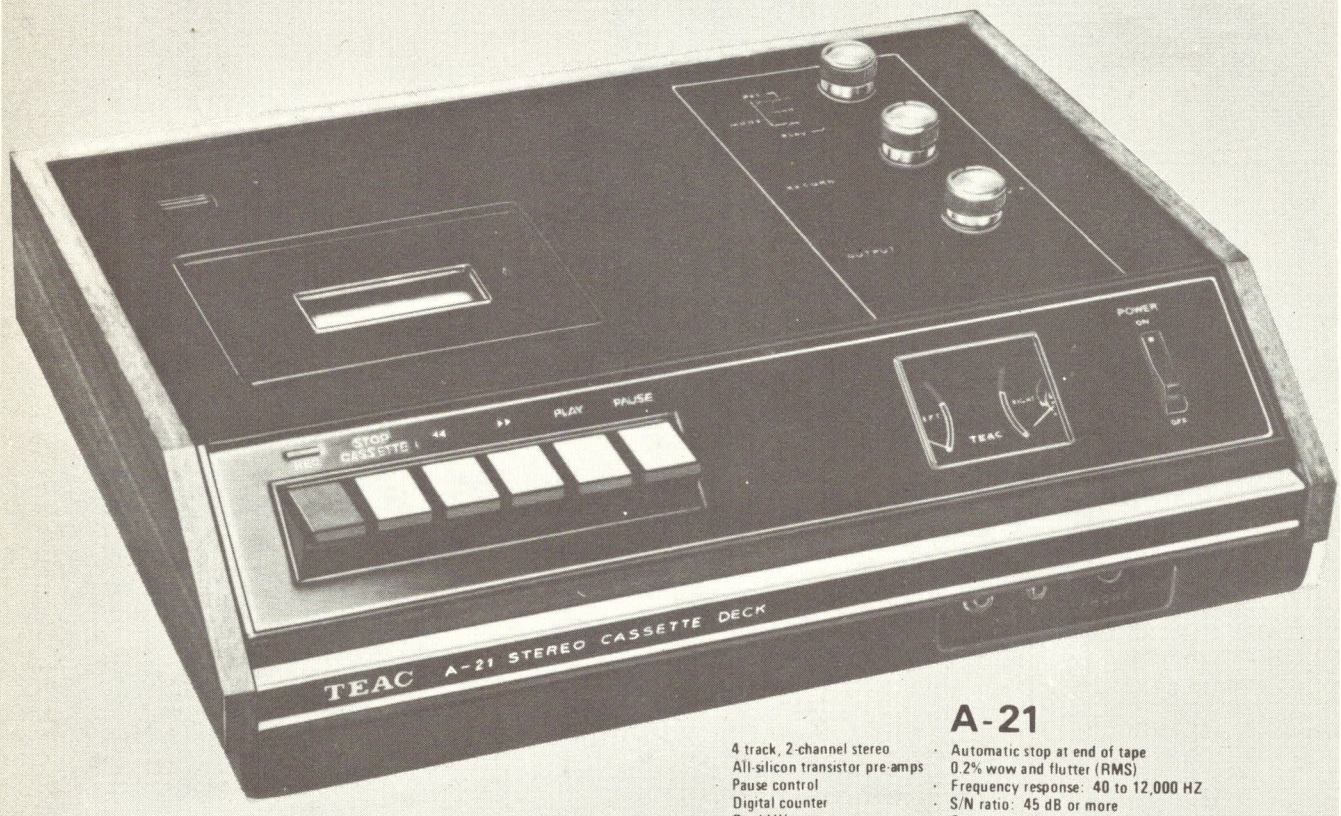
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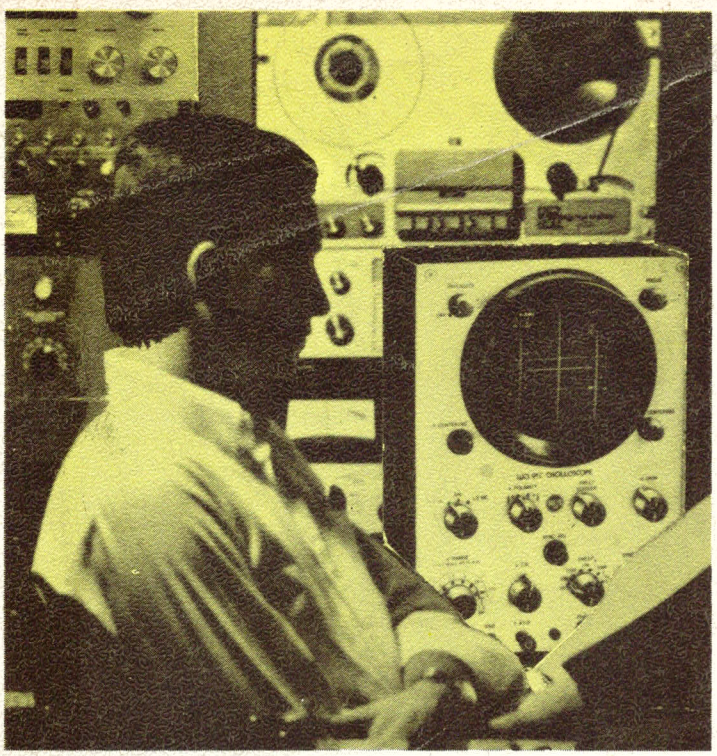
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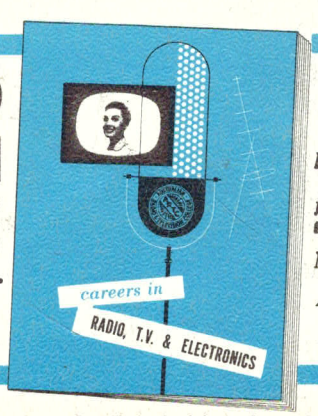
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