ELECTRONICS Australia

January, 1971



50¢

New look for an electron microscope

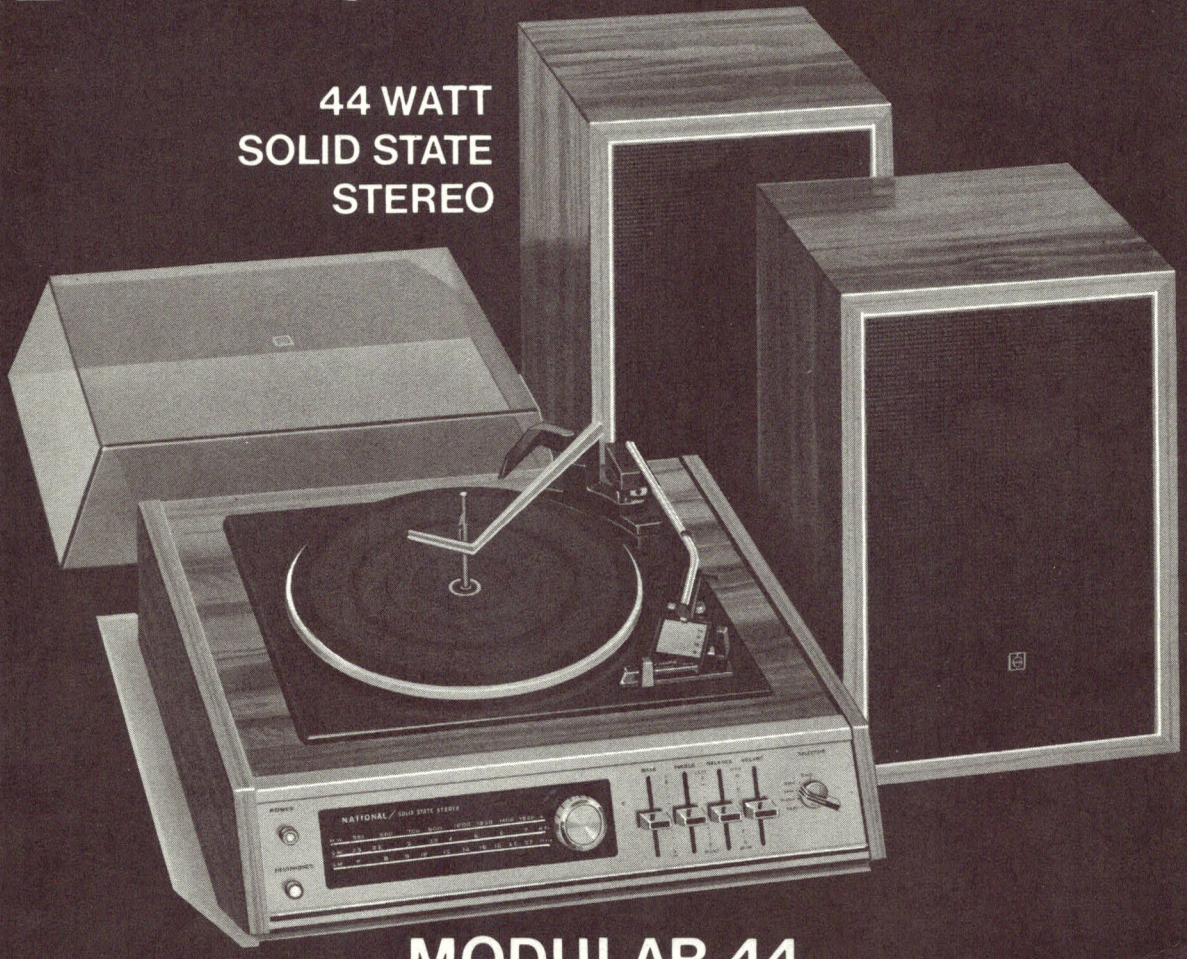
IN THIS ISSUE

"Who needs Hi-Fi?" they asked!
To computers, English is gibberish.
An amplifier for stereo headphones.
Build your own loudspeaker enclosures.

Registered for posting as a periodical — Category B

the new National party machine

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STEREO



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ELECTRONICS Australia

Incorporating "RADIO, TELEVISION and HOBBIES"

ABC certified circulation in excess of 50,000

Volume 32, number 10

THERMAL MAPPING: *All kinds of interesting things show up when aerial pictures are taken, not with ordinary photographic equipment, but with equipment sensitive to infrared radiation. Page 12.*

THE MONKEY'S PAW: *Engineers would like to teach computers to read, write and talk. The trouble is that English is full or words which have quite different meanings in different situations. Turn to page 16.*

SAVE MONEY ON LOUDSPEAKERS: *If you're handy with saw and sandpaper, the article on page 48 explains how you can make up high quality loudspeaker enclosures for a fraction of the cost of commercial units.*

HEADPHONE AMPLIFIER: *So you can't listen to records most evenings because others want to watch TV! What you need is the amplifier for stereo headphones described on page 64.*

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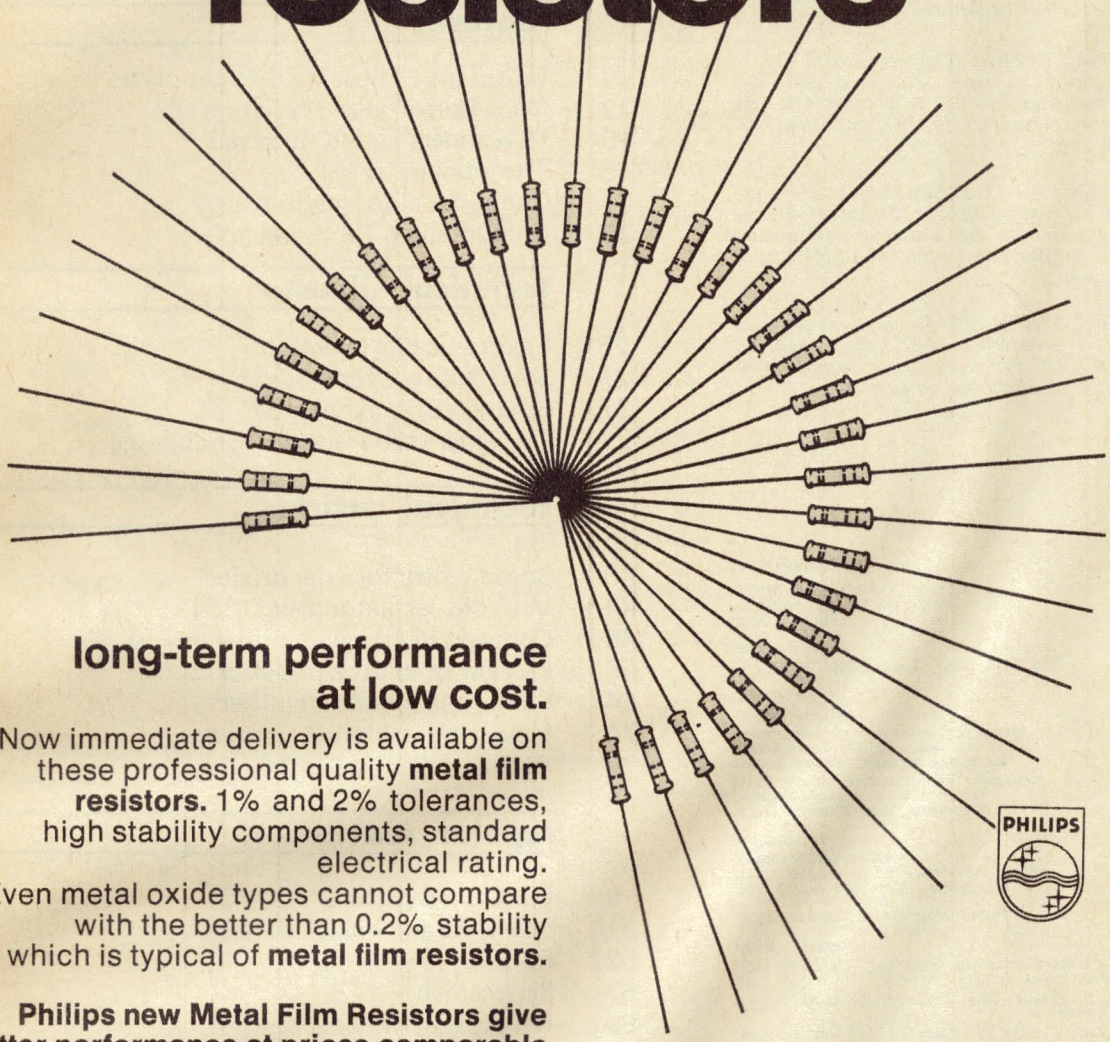
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PHILIPS

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EDITORIAL VIEWPOINT

by Neville Williams

Those hard-to-get parts . . . .

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Of necessity, a fair proportion of the projects we produce in our laboratory, these days, depend on relatively new components – a particular solid-state device, an integrated circuit, a filter element, a ceramic core, a special kind of lamp, and so on.

If it were otherwise, readers would criticise us for lagging behind current technology.

As a matter of course, before significant time is spent on a new project, the staff member concerned must check out the supply position. How many of the key components are actually in stock? How many are coming forward? Are there any alternatives? Only if the supply is commensurate with the anticipated demand, is the project committed to development.

One of the uncertainties of any such inquiry lies in the phrase "anticipated demand". How many readers of "Electronics Australia" are likely to build a "Musicolour Unit"? A dozen? A hundred? A thousand?

How many will want to fit a capacitor discharge ignition system to their car? For that matter, how long is a piece of string?

One of the things that really fouls up any estimate stems from the fact that EA is read by a lot of people other than prospective constructors. Frequently, an enterprising manufacturer sees in a project the prototype of a commercially marketable device; so he buys up most of the key devices in a single transaction.

Again, somebody in a large organisation may be alerted by an article to a new device or a new technique, which happens to meet a particular need. Not once, but many times, we have seen the entire local stock of some key component grabbed by a big company, a Government instrumentality or by one of the services – within a few hours of a particular issue appearing on the streets.

It is easy to contend that the supplier should refuse such an order and keep the parts for homebuilders. But what say you were the supplier, with a big order in hand and the prospect of business to follow? Would you really turn it down?

These remarks are prompted by the knowledge that some readers have been frustrated in their efforts to complete certain projects. Let me assure you that, unless a potential shortage is specifically mentioned, none was expected at the time when any particular article went to print. If a shortage does arise, subsequently, it is normally because we, with the suppliers, have underestimated the demand; and that is very easy to do.

If there is one consolation, it is that the supply always overtakes demand in due course but the delay can be pretty frustrating. When such a position develops, and you stir us, we stir the suppliers, in turn, on your behalf!

ON SALE
THE
FIRST MONDAY
OF EACH MONTH

On the cover

"Corinth 275" is a high resolution transmission electron miscroscope just announced by AEI Scientific Apparatus Ltd of Harlow, Essex, England. The first of its kind, it has an inverted electron column and provides viewing facilities on a large rectangular screen. A very simple system of specimen loading has been devised. The instrument uses push-button control and has inbuilt protection against incorrect operation.

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Cabinet 14½" by 8 1/8" x 8¼". Baffle is cut for Magnavox 6" plus 3" plus port.

Kit of Parts—maple $9.00
Kit of Parts—teak $10.00
Built—walnut, maple $13.50
Built—teak $15.50

POINT FOUR

Cabinet 14½" x 8 1/8" x 8¼". Baffle is cut for Philips 6½" plus Magnavox 3" Playmaster design.

Kit of Parts—maple $9.00
Kit of Parts—teak $10.00
Built—walnut, maple $14.50
Built—teak $16.50

BOOKSHELF

Cabinet 19¼" x 11⅛" x 6 1/8". Baffle is cut for Magnavox 6" plus 5". Playmaster design.

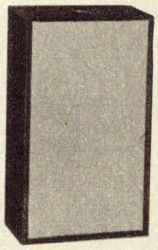
Kit of Parts—maple $11.00
Kit of Parts—teak $12.00
Built—walnut, maple $20.50
Built—teak $21.50

ONE POINT THREE

Completely sealed enclosure, of Playmaster design, 22" x 12" x 10¾". Baffle cut for 8" plus 3".

Kit of Parts—maple $19.00
Kit of Parts—teak $21.00
Built—walnut, maple $30.50
Built—teak $32.50

8" SLIMLINE



Cabinet 25¼" x 14" x 5 7/8". Distributed Port design. Baffle cut for one 8" speaker.

Kit of Parts—maple $13.00
Kit of Parts—teak $14.00
Built—walnut, maple $23.50
Built—teak $24.50

10/12 SLIMLINE

Cabinet 27¼" x 17¼" x 7". Distributed Port design. Cut for either 12", 10" or 8" speaker.

Kit of Parts—maple $16.00
Kit of Parts—teak $17.00
Built—walnut, maple $27.00
Built—teak $29.00

8" D.P.

Distributed Port, cabinet 23½" x 11" x 10¼". Cut for one 8" speaker.

Kit of Parts—maple $18.00
Kit of Parts—teak $19.00
Built—walnut, maple $31.00
Built—teak $33.00

10/12 D.P.

Cabinet 30" x 18" x 12" (3 cu ft). Distributed Port design. Cut for either a 10" or a 12" speaker.

Kit of Parts—maple $30.00
Kit of Parts—teak $32.00
Built—walnut, maple $47.50
Built—teak $49.50

All kits and enclosures are complete in every detail, and include all grille cloth and acoustic wadding (innerbond).

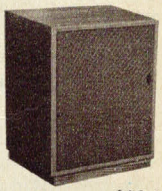
The baffle boards on the speaker enclosures outlined below are cut as outlined for each enclosure. However, baffle boards can be cut for your own requirements for an additional $1.00.

VENTED ENCLOSURE

2 cu. ft Cabinet 27¼" x 17 7/8" x 10". Cut for either one 8" or one 10" speaker.

Kit of Parts—maple $23.00
Kit of Parts—teak $25.00
Built—walnut, maple $37.00
Built—teak $39.00

MODERNE



Vented enclosure 25" x 18½" x 16". Baffle cut as requested.

Kit of Parts—maple $28.00
Kit of Parts—teak $29.00
Built—walnut, maple $49.00
Built—teak $50.00

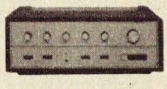
OTHER ENCLOSURES

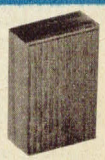
Instrol have a complete range of enclosures, the above-mentioned being a selection of the more popular ones. If one of the above does not suit your requirements, send in for our free speaker enclosure leaflet. (Models to suit Wharfedale and Peerless available.)

HI-FI EQUIPMENT

Yes, we carry a large range of imported loudspeakers, players, amplifiers and tape recorders, as well as Australian equipment. Please state your requirements and we will gladly quote. All well known brands are stocked, including the following:
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PLAYMASTER 127 CONTROL UNIT



A fully solid-state control unit incorporating a dual linear integrated circuit and providing equalisation to CCIR and RIAA specifications for tape replay and magnetic disc pick-ups (Refer Nov., 1968).

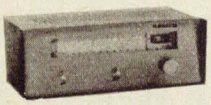
Kit of Parts **$49.00**
Built and Tested **$69.00**
Alum. knobs extra **$2.00**
Reg'd Post extra **$1.35**

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**
Built and Tested **$125.00**
Reg'd Post extra **$2.00**

PLAYMASTER 123 TUNER



A solid state Broadcast A.M. tuner incorporating narrow and wide band selectivity, whistle filter and tuning meter. Refer "E.A." Oct., 1968. 12½in x 7in x 4¾in.

Kit of Parts **$99.00**
Built and Tested **$119.00**
Reg'd Post extra **$1.35**

3-PLUS-3 STEREO AMP.



A small, modern, solid-state amplifier, housed in a metal case 8in x 6in x 3in. Refer "E.A." Aug., 1968.

Kit of Parts **$47.00**
Built and Tested **$59.50**
Reg'd Post extra **$2.00**

10-PLUS-10 STEREO AMP.



10 watts RMS per channel into 8 ohms, a perfect solid-state stereo amplifier. Refer "E.A." Nov., 1968.

Kit of Parts **$65.00**
Built and Tested **$79.50**
Reg'd Post extra **$2.00**

THE AUTODRUM

An electronic percussion instrument, which is based on the twin-T oscillator. In addition to being keyed manually, it has the facility of automatic triggering at any desired rate (Refer EA, May, 1970).

Kit of Parts **$14.00**
Built and Tested **$20.00**
Registered Post Extra **$1.35**

PLAYMASTER 129 STEREO AMPLIFIER



A high quality stereo amplifier built around just two ICs. It has bass and treble controls and music power output of 3 watts per channel into 8 ohm speakers (Refer EA, October, 1970).

Kit of Parts **$54.00**
Built and Tested **$68.50**
Registered Post extra **$2.00**

MUSICOLOUR



It will audio-modulate coloured 240V lamps to give vibrant, colourful displays, being fed from a domestic amp, guitar amp, organ amp or background music amp in a discotheque. Refer "E.A." Oct., 1969.

Kit of Parts **$47.50**
Built and Tested **$59.50**
Reg'd Post extra **$2.00**

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.

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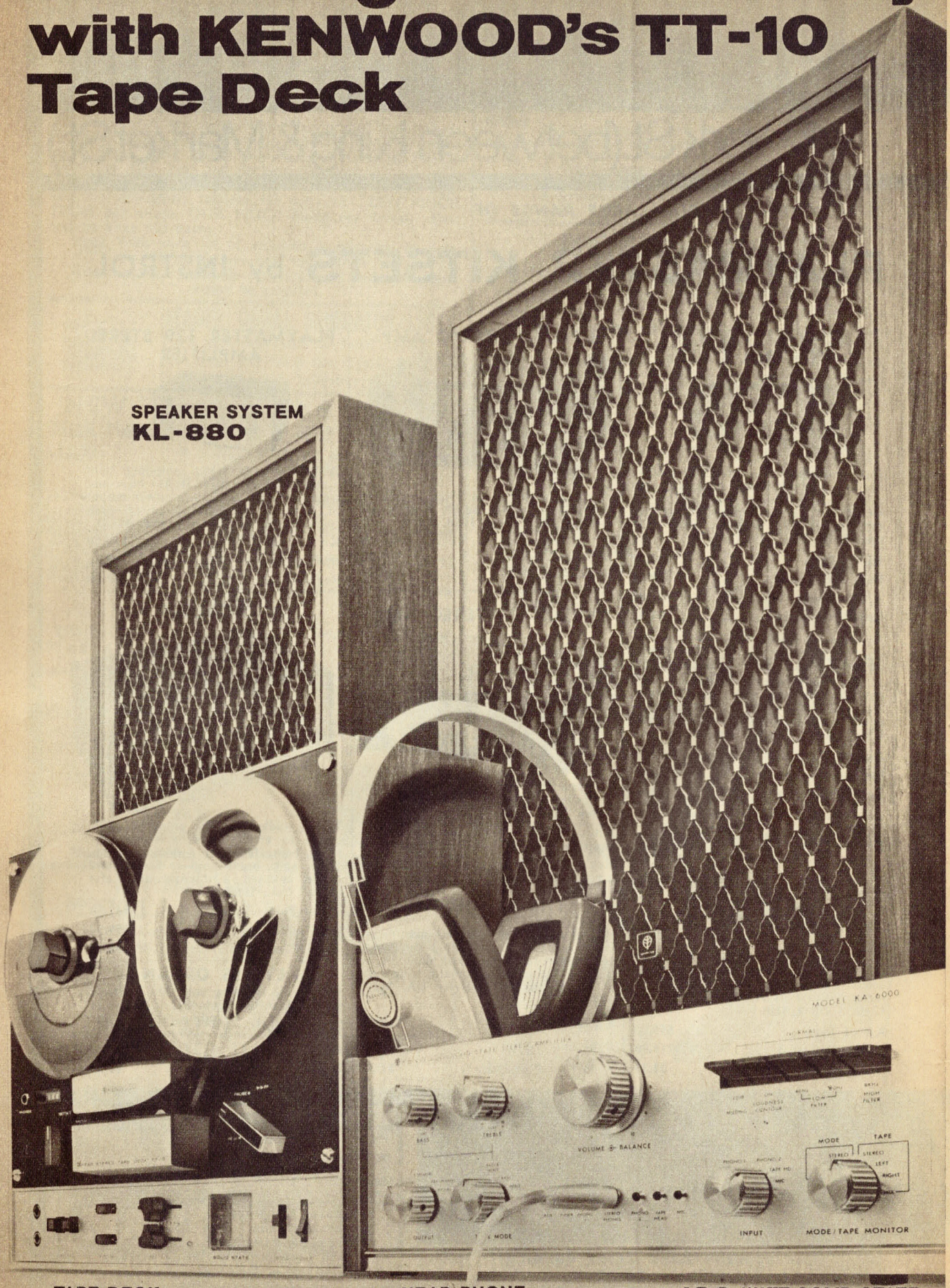
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- ☐ Playmaster kits
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Streamling Your Stereo Sy with KENWOOD's TT-10 Tape Deck

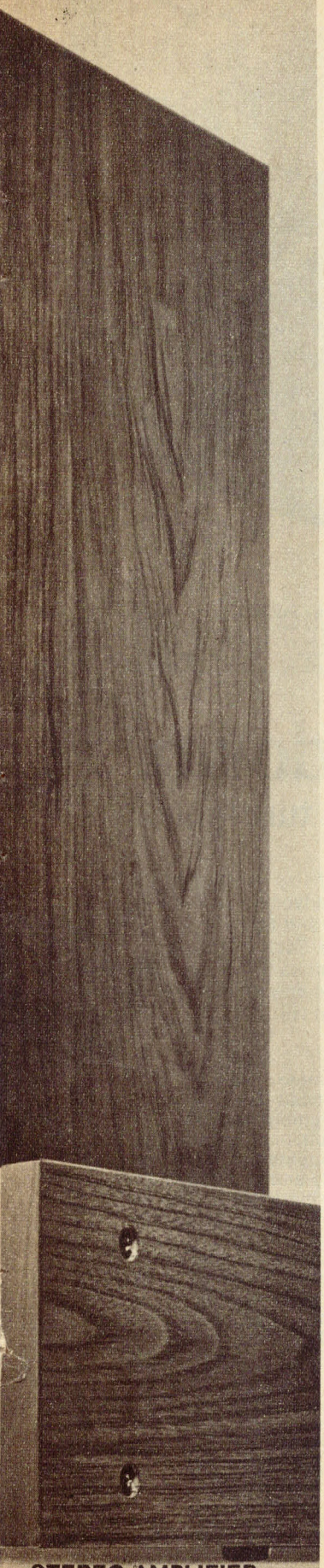


TAPE DECK
TT-10

HEAD PHONE
HS-3

180-WATT SOLID STATE
KA-6000

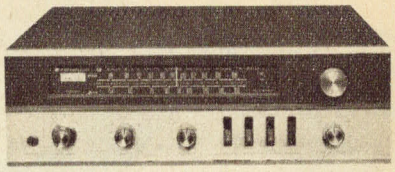
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STEREO AMPLIFIER

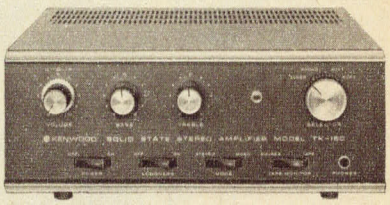
KENWOOD has the answer to the flaws that have bugged your stereo system. It's the "total circuit stereo system" – which means KENWOOD has exactly the right stereo instrument for that weak spot in your stereo system. The TT-10 tape deck is an ideal remedy. It fully minimizes recording and playback "Hiss" distortion while halting usual low frequency hum modulation. This 3-head deck has three tape speeds–7-1/2 ips and 3-3/4 ips for Hi-Fi recordings and 1-7/8 ips for speech recordings. The KL-880 4-way, 5-speaker system has a 15-inch free-edge woofer, a 5-inch cone type midrange, horn type high midrange squawkers with two tweeters. The HS-3 head phone also offers pure-tone clarity.

The KA-6000 amplifier is a dynamic 180-watt model able to drive even low efficiency speakers. Separately, as new members of your stereo system, or in a combined unit these KENWOOD instruments provide "total circuit stereo system" performance.



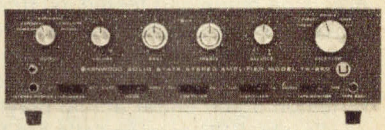
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FET SOLID STATE AM/FM STEREO RECEIVER TK-20U

* F.E.T. (Field Effect Transistor) 3-Gang Tuning Condenser frontend for superior sensitivity, image rejection and cross modulation ratio.
* Dimensions:
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40-WATT
SOLID STATE STEREO AMPLIFIER TK-150U

* 5 pairs of input terminals for MAG, AUX 1, AUX 2, TAPE REC and TAPE PLAY.
* Damping factor: 40 (at 16 ohms), 20 (at 8 ohms)
* Dimensions:
  10-1/4"(W), 4-1/8"(H), 9-3/8"(D)



60-WATT
SOLID STATE STEREO AMPLIFIER TK-250U

* 2 sets of stereo speaker terminals and front panel speaker selector switch.
* Dimensions:
  13"(W), 4-1/8"(H), 9-15/16"(D)

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ADDRESS:



Model 500 with ceramic cartridge was $103 — now $84.50
Model 500 with 850 magnetic cartridge was $114 — now $99.50
Model 600 with ceramic cartridge was $114 — now $94.00
Model 600 with 850 magnetic cartridge was $125 — now $109.
Mini-module turntable now becomes just $53.00

BSR McDonald prices down.

BSR McDonald continue to triple test every turntable.

Every BSR McDonald automatic turntable is precision made and tested in Great Britain to the most exacting specification. Upon arrival in Australia, every model is unpacked, tested and assembled in the total turntable concept, then re-tested again under actual playing conditions. That's why BSR service calls are the lowest in the industry – and perhaps that also explains why BSR sells more turntables than anyone else in the world.

The BSR McDonald 500 and 600 are complete modular units ready for use. Each unit has an ebony polystyrene base, smoke tinted dust cover, mains and audio leads – the only complete, packaged, factory tested units.

Features such as

- Dynamic anti-skate control applies continuously corrected compensation at all groove diameters.
- Cueing and pause control lever allows for exact positioning of stylus on record and permits you to interrupt listening and reposition to same groove.
- Micrometer stylus pressure adjustment permits 1/3 gram settings from 0 to 6 grams.
- Automatic lock on tone arm after last record is played.
- Dynamically balanced 4-pole induction motor has high torque, constant speed design – assuring minimum rumble and row.
- Tubular aluminium tone arm is perfectly counter-balanced both horizontally and vertically.
- Resiliently mounted, coarse and fine vernier adjustable counterweight.
- Tone arm is jam-proof even if it is held during the cycling operation.
- Clip-in cartridge holder, provides universal mounting and quick change. (Optional).



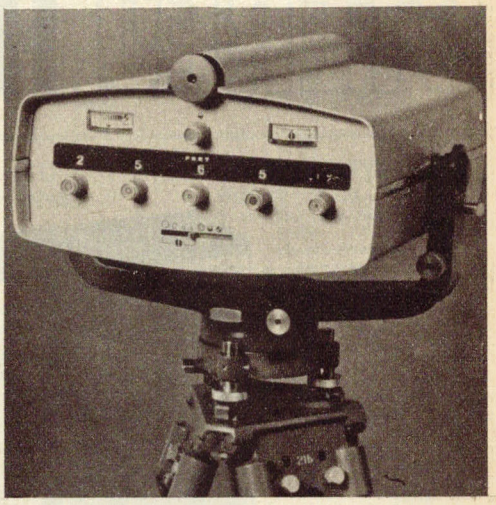
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BSR:P112

ELECTRONICS PICTORIAL





NEW INFRARED DISTANCE METER: This solid-state distance measuring system is designed for surveying and similar applications. Called the Hewlett-Packard Model 3800 Distance Meter, the instrument measures distances to 10,000ft with an accuracy of plus or minus a fraction of an inch. Preliminary aiming of the meter is done with a built-in 18 power telescope; final alignment is done electronically.

Modulated light from a solid-state infrared source is sent from the meter to a reflector. The time it takes the light to travel out and return is converted to distance, which is read directly from dials on the face of the meter.

The 17lb Model 3800 can interchange quickly and easily with a theodolite without replumbing or recentering. Momentary interruptions by heavy traffic or people moving through the line of sight do not affect the measurement.



READING LIGHT WITH A DIFFERENCE: A plastic panel that glows with its own internal illumination will solve problems for those who wish to read at night without disturbing other people. Instead of the light being transferred straight from one edge of the panel to another, it "leaks out" in a controlled manner to give uniform illumination over its entire area.

Called the "Wedgelight", it consists of a tapered plastic panel with four small bulbs at the thick end powered by "D" type batteries. The thin 8 x 5in panel should be ideal for map reading in a car or for reading in a caravan, tent or boat where others may be inconvenienced by ordinary lighting.

The Wedgelight has been developed by Cambridge Applied Physics, Ltd, St Neots, Huntingdonshire, England.

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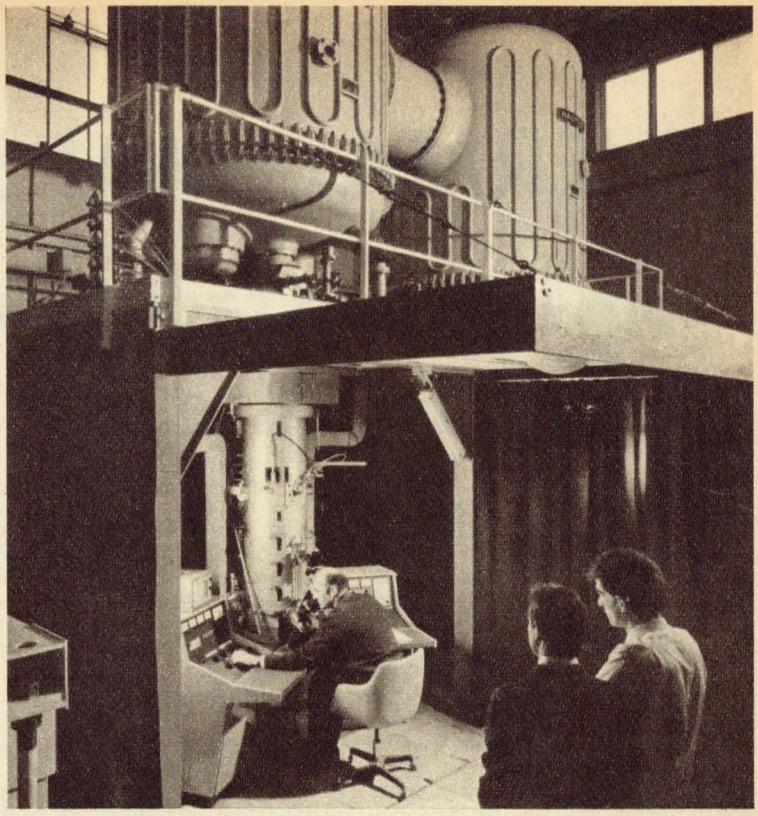
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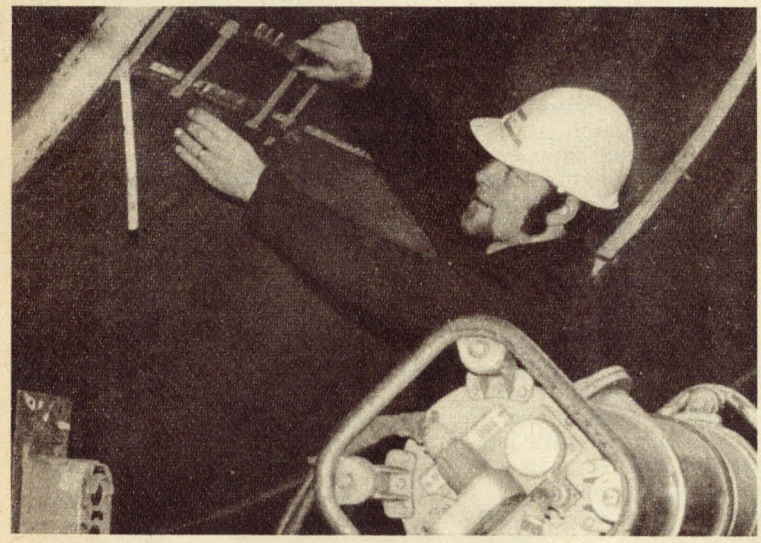
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MILLION VOLT ELECTRON MICROSCOPE: The first commercial million volt electron microscope to be built in Europe is now installed at the UK Atomic Energy Authority at Harwell. It will be used in studies of neutron radiation damage in reactor materials and in their non-nuclear program.

The high voltage makes it possible to obtain sharp images from thick specimens. This, combined with the large specimen space available, enables a wide variety of experiments such as heating and tensile testing to be performed within the microscope while the specimen is under observation.





INSIDE-OUT X-RAY: A technician of Humes Limited tapes Kodak X-ray film over a weld in an 18ft diameter, 1½in thick pipe to help ensure the safety of the last major pipeline on the Snowy Mountains Scheme. The film is strapped along the welded joins and exposed to X-rays from inside the pipe.

A complete circumferential weld is radiographed in one exposure by locating an X-ray source in the centre of the pipe. By the time Humes have completed the pipeline, they will have exposed nine miles of X-ray film.

MEASURING THE OCEANS: Britain's ocean engineering efforts in recent years have resulted in the marketing of a large number of measuring instruments, buoys and undersea navigational aids as well as equipment for echo sounding and underwater viewing.

In the photo at the right, a recording current meter, supplied by the Plessey Company Ltd of Ilford, Essex, England, is lowered overboard to measure and record ocean currents. Plessey also make a fish-shaped recorder designed primarily for sampling plankton.



THERMAL MAPS from infrared radiation

by Bill Baverstock

In a recent dramatic demonstration of scientific military equipment designed for the detection of a hidden enemy, held at Taronga Park Zoo, Sydney, the presence of such small creatures as a wombat in its lair and reptiles among rocks was revealed unmistakeably though the fauna themselves were invisible.

The radiation of their bodies within the infrared range was detected by sensitive instruments which not only revealed the presence of the animals, but made a record of it on tape.

The Taronga experiment was staged to demonstrate the use of military scientific instruments which can detect a hidden enemy at night, but the infrared portion of the electromagnetic spectrum also lends itself to exploitation by industry, and is being widely used in this role.

The presence of the animals was revealed because the infrared radiation of their bodies differed from that of their environment. The earth and everything in it, as well as most bodies in space, radiate large amounts of energy at infrared frequencies. New advances in instrumentation have resulted in ultra-sensitive detectors which record the variations in infrared radiation resulting from any temperature anomalies in an environment.

Instruments that are sensitive to infrared emissions, and not merely to variations of temperature, are daily informing us of hitherto unknown facts about our own atmosphere and those of other bodies in space; they are being increasingly used in medical diagnosis and in monitoring systems for industry, agriculture and oceanography; and they are now used to make surveys of the earth's surface by reception of infrared emissions in aircraft flying above it.

These aerial surveys are accomplished by systems such as the Bendix Thermal Mapper. This makes a record of infrared radiation, and hence temperature variations, of the surveyed scene, and produces a record of such variations as a continuous strip photograph. A typical record of this type is that reproduced at the bottom of this page.

Although at a casual glance this may appear to be a normal photograph, in fact the grey scale is a function of the "radiometric temperature", or in other words the infrared radiation, of the scene. This particular view was taken at 9 pm, in near total darkness, so there is no question of incident illumination.

Our eyes respond only to light in the restricted region between visible red and violet. If they were sensitive to infrared radiation, warmer objects would appear brighter than cold objects. Instruments developed to detect infrared radiation do not suffer from the same restrictions as human eyes, and in fact they do "see" warmer objects to be brighter. Since most objects emit infrared copiously, but in varying amounts according to their emissivity and temperature, an instrument which can "see" these variations can provide us with some extremely useful information.

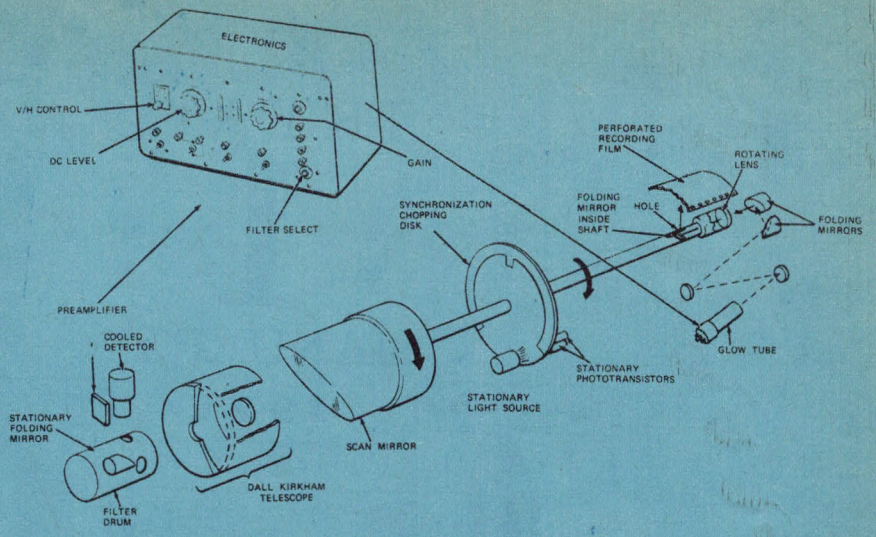
In theory any object which completely absorbs all radiation to which it is exposed is also a perfect radiator. Such a theoretical object is called a "blackbody," and its emissivity is said to be unity. However, all practical objects, which are not perfect radiators, have an emissivity which is less than unity. In the case of the theoretical perfect radiators, the emitted energy would be a precise indicator of temperature. In practice, some objects emit more than others for a given temperature, so that a measure of emission cannot be precisely related to temperature. However, such emissions have value in a relative sense, since the variations can be detected by the type of sensitive instrument referred to above. Moreover, some substances have very close to unity radiation – water for example, with an emissivity of about 98 per cent – so that in some cases a fairly accurate quantitive result can be obtained.

The exploitation of these phenomena has enabled science, aided by devices sensitive to emissions within the infrared range, to develop a fascinating variety of applications of electromagnetic radiation in such fields as missile defence, fire detection, meteorology, and medical diagnosis. But, however varied the applications, infrared systems can be broken down into four basic units: an infrared source, an optical system, a radiation



RIGHT: The basic elements of the Bendix Thermal Mapper.

BELOW: A continuous strip photograph recorded over Texas in near darkness, at 9 pm. The grey scale is a function of radiometric temperature, not of colour or incident illumination.



detector and an arrangement for presenting the data.

In most applications passive systems are used, the object of interest being the source, which is detected by its self emission. In active systems a controlled source is used to illuminate the object being observed.

Pursuing the uses of the passive system, scientists of the Bendix Aerospace Systems Division have produced the Thermal Mapper. This consists of a complex of instruments which are sensitive to and record infrared emissions of objects.

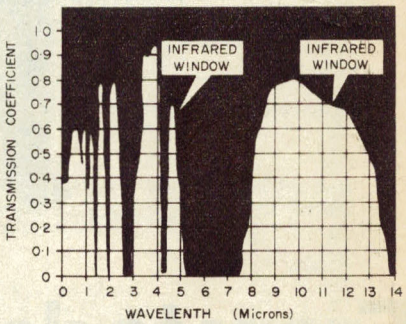
When flown over an area to be surveyed, the Bendix Thermal Mapper produces a continuous strip photograph which reveals the varying temperatures of ground objects beneath it. A tape recording of the data obtained can also be made by a recording system coupled to the mapper.

The mapper comprises, basically, an optical scanning unit with direct film recorder, a control unit and power supply. Ancillary instrumentation varies according to particular aspects of individual surveys.

Many scanning patterns have been investigated, but the one which most simply illustrates the operation of the Thermal Mapper is the line-scanning pattern which makes use of the forward motion of the aircraft over the area of interest.

The line-scanning function is performed by means of a rotating plane mirror scanner whose axis of rotation is parallel to the longitudinal axis of the aircraft As the mirror is revolved, it reflects radiation to a parabolic mirror used to focus the radiation on the infrared detector. In this way an infrared record is obtained of emissions from the objects scanned. The infrared detector senses the incoming radiation and converts it into an electrical signal.

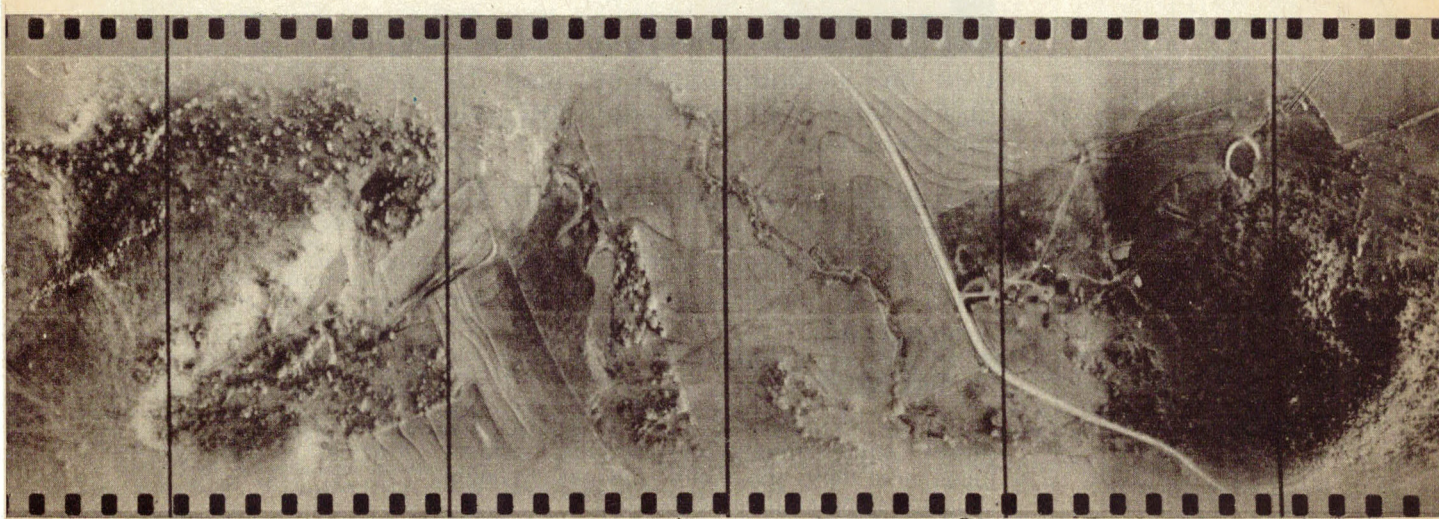
This signal is amplified and is used to modulate the current through a special type of lamp with a rapid response whose output is an intensity-modulated spot of light. An image of the lamp is focused on the surface of a photographic film and is scanned across the film in synchronism with the rotating scanner. The film moves across the exposure station at a speed

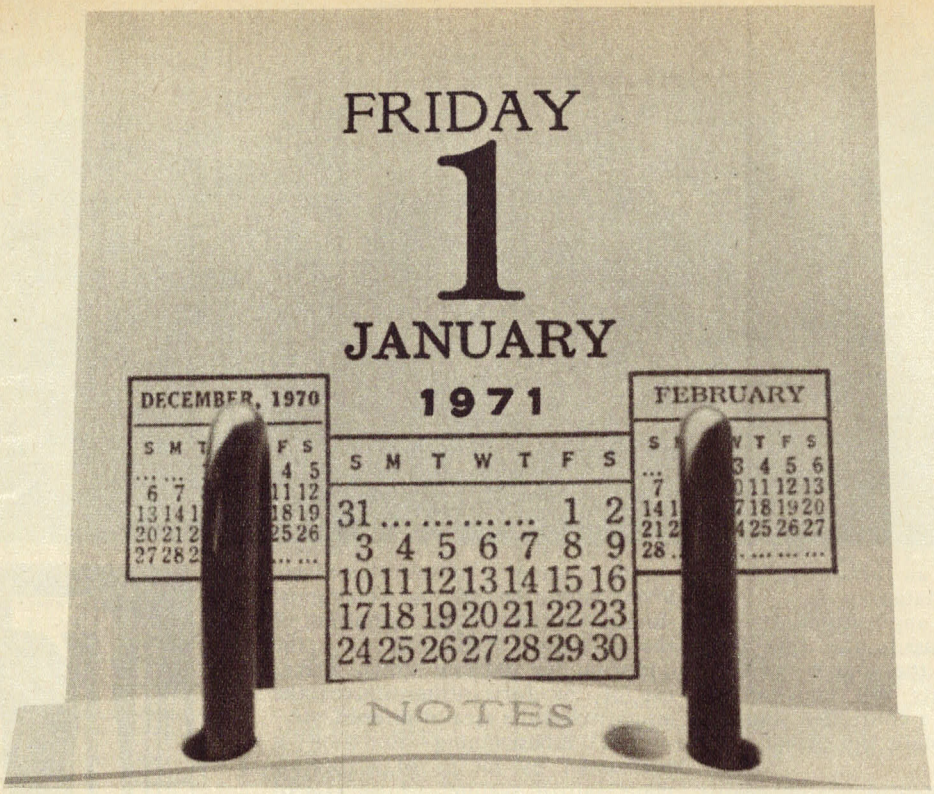


Transmission spectra of the atmosphere.

proportional to the aircraft speed-to-altitude ratio. The result after processing, is a strip thermal map of the area flown over in which film density represents effective radiation temperature.

The information so obtained differs from that of photography or radar because the source of it lies in the temperature characteristics of the scene itself. The emitted energy is a function not only of the physical characteristics of the surface but of surface temperature as well, whereas in photography and radar the image represents merely the distribution of





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reflecting surfaces revealed by some form of illumination.

Designed to be flown in light aircraft, the mapper is small, easy to install and simple to operate. The instrument scans 120° with an instantaneous field of view of 2.5 milliradians. Its sensitivity (noise equivalent) is 0.1° or better, making it a useful remote sensing instrument.

Atmospheric attenuation is negligible at certain wavelengths and high at others. At visible light wavelengths, some 25 per cent of emitted energy is absorbed into the atmosphere before it travels one mile. At 6 microns most of the energy is absorbed by water vapour, and beyond 14 microns carbon dioxide absorbs energy. The most suitable wavelengths for thermal mapping is between 8 and 14 microns, where attenuation is minimal. A similar atmospheric "window" occurs between 3.5 and 5.5 microns. Thermal mappers are therefore designed to operate in one or both of these frequency ranges. The Bendix Thermal Mapper can be supplied with four interchangeable detectors which permit coverage of the spectrum between 0.2 to 13 microns.

A device which allows analysis of results with respect to absolute temperatures is the Blackbody Reference. This provides a single point calibration reference whose temperature can be controlled over the range -10 to +30 degrees C with respect to the scanner unit ambient temperature.

It consists of (1) a blackbody cavity array, with thermoelectric modules and heat exchanger, which is installed in the scanner unit, and (2) a proportional-type controller. During a portion of each scan cycle, the cavity emittance is sensed and recorded in a narrow band on the film used for the terrain viewing. Scene temperatures can be derived by comparing the film density of the scene imagery with that of the calibration reference, whose temperature is known. To calibrate for the gamma curve of the film, a step-wedge (grey scale) is made prior to or after the mission, by recording a range of precise temperatures obtained by varying the temperature of the calibration reference.

Situations in which thermal mapping can give almost instant information otherwise obtained only by laborious and lengthy surface examination and survey are numerous.

A service now offered by Canadian Aero Service Ltd, which pioneered thermal mapping in Australia, is available to industry, mining, commerce, forestry, agriculture, engineering and building, for applications such as water pollution detection; analysis of the water content of soils; mine and bushfire detection and delineation; diseases in forests and crops: subsurface and surface water mapping; detection of geo-thermal energy sources; study of ocean currents; high tension line and pipeline surveys; glaciology and morphology.

Thermal mapping can detect such slight variations in the emission from objects as that resulting from the slight local cooling caused by a small leak in a gas pipeline.

In most cases, the facts revealed by thermal maps are sufficiently clear and unambigious as to allow easy interpretation; however, Canadian Aero Services can make available the services of fully trained technicians where fuller interpretation is required. ■

IR Scanners in UK Hospitals

The Department of Health and Social Security, in the UK, is making increasing use of thermal imaging equipment in British hospitals.

EMI has supplied a number of their "Thermoscan" equipments for trial use in selected hospitals for aiding diagnosis of a wide variety of conditions which it is difficult or impracticable to study by other means.

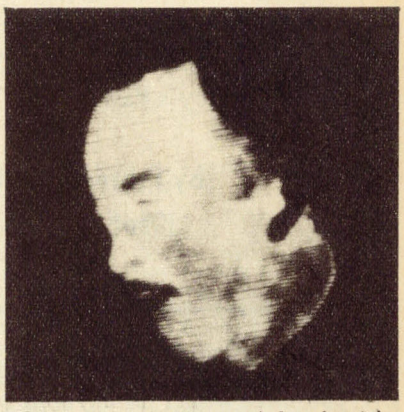
Thermoscan is an infrared thermography equipment designed for industrial as well as medical use. With this equipment, thermal pictures of the subject under examination are presented on a monitor for direct viewing or photographic recording. The equipment is a two-unit system, comprising a scanner mounted on a mobile tripod stand with pan and tilt mechanism and a separate cathode ray tube monitor. A scanning optical system is used in conjunction with an infrared detector cooled to liquid nitrogen temperature. The monitor includes controls for remote operation, and the scanner can be located up to 100ft from it.

The scanner has been designed to allow easy alteration from raster scan of a two-dimensional field to a single line scan.

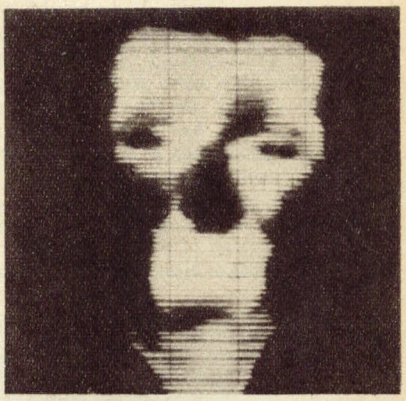
The horizontal field is scanned by means of a rotating plane mirror driven by a speed controlled DC motor. Scanning of the vertical field is achieved by means of an oscillating plane mirror driven by a gear system from the same drive motor. Two different vertical scan rates are provided. Alternatively, the vertical scan mirror can be stopped at any angle to provide a narrow angle linescan system, or it can be removed entirely to provide wide angle linescan.

Incident energy is focused by means of a parabolic mirror on to a single element indium antimonide detector cooled to liquid nitrogen temperature. A motor driven focusing system moves the parabolic mirror to accommodate subjects at different ranges. Temperature variations on the surface of the body can be caused by changes in the efficiency of circulation, inflammation, or other irregularities. Thermographic devices detect such variations without requiring external radiation or physical contact with the patient. The technique has proved useful for the early detection of breast cancer, for the investigation of circulatory disorders such as varicose veins, and the study of inflammatory conditions, among others.

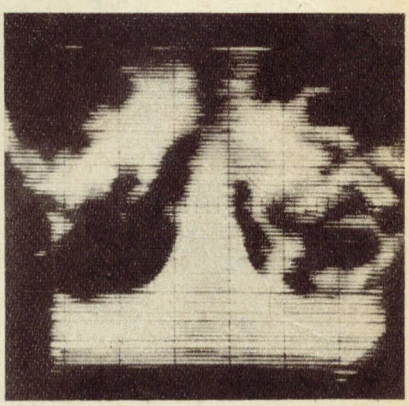
Industrial uses for the equipment are in process control, thermal contour plotting and the analysis of heating and refrigeration systems. The technique is also useful for routine inspections and fault finding of industrial machinery.



Thermograph of a man's head, with no abnormalities. High temperature areas are the brightest.



Another thermograph of a head. Note the dark patch near the left eye, caused by asymetric blood flow in the forehead region.



A breast cancer revealed by a thermograph as a dark area.

THE MONKEY'S PAW

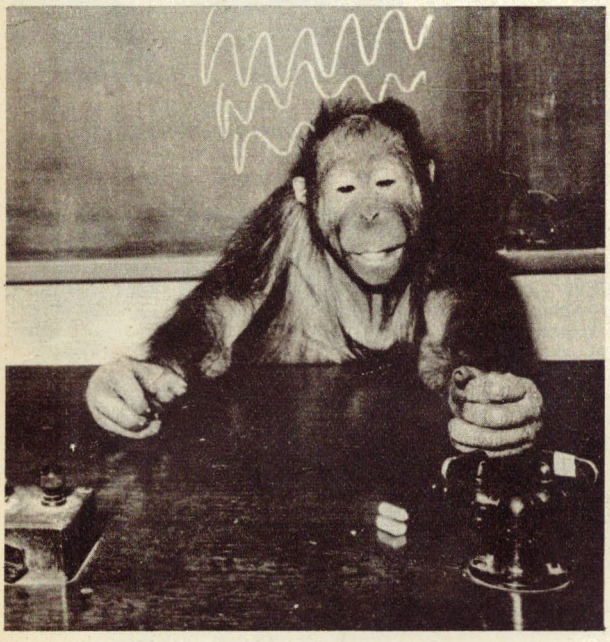
Many readers will have read the short story by W. W. Jacobs summarised so succinctly below – but what has this to do with electronics. Nothing really, but the idea of a layman being able to ask a computer to carry out certain tasks just by telling it to do so carries the same kind of implications as and risks as those which beset the users of the Monkey's Paw.

by Professor Christopher Longuet-Higgins, FRS, and Stephen Isard

(Dept of Machine Intelligence and Perception, University of Edinburgh)

Well there was this couple you see and someone gave them a mothy old monkey's paw which was supposed to give you three wishes for anything you wanted and the couple were a bit short of dough so they started by wishing for 200 quid and then someone arrives with a telegram and it says that their son who works in some factory has got wrapped up in the cogs and mangled to death and they don't think much of that as an answer to prayer but then it goes on to say that the people at the factory are very very sorry and here is 200 quid as a consolation prize so they have a quick think and wish him back to life but then there's a sound of footsteps outside the door and horrible groans and they get into a panic and wish him dead again and the noise stops but anyway they've still got the money as a souvenir.

(with apologies to W. W. Jacobs)



This is not England's answer to the teacher shortage. Tuan, an orang-outang, was borrowed from a nearby zoo by a biology teacher at Stanley Park Secondary School, Carshalton, Surrey, to add a spot of real life interest to a lecture on man's nearest relatives in the animal world. Having studied the scene closely, Tuan decided there was nothing to this teaching business and took over the teacher's desk, chalk and blackboard. (Tuan's blackboard drawing may have a familiar look. However, any resemblance to a well-known trade mark is purely co-incidental.)

The great virtue of computers, as everybody knows, is that they do exactly what they are told – like the Monkey's Paw. Fortunately, perhaps, they are still unable to do much more than type marks on paper and produce pretty pictures on screens; though computer-controlled robots are now coming into vogue and are already in service in aircraft, the telephone system and automatic factories, to name only a few instances. The reason why we don't spend many sleepless nights worrying whether our robots might get out of hand is that the jobs we set them are, in the main, safely circumscribed; they can be specified fully, down to the last detail in terms of logical operations which can be fully represented within the computer.

By and large, engineers and computer scientists are hard-headed people; they know what sort of things computers can or cannot do, and how to design computer languages such that any well-formed program in a given language represents a well-defined computation (though it may not terminate), and any – or almost any – well-defined computation can be specified in the language. To prove that a particular program evaluates a given function, or to discover a program that will evaluate a given function, is a very tough problem, but the absence of a formal theory of computation is usually made up for by a good supply of commonsense and know-how, so the practical programmer usually does not worry his head with such questions.

Serious problems arise, however, as soon as we start getting ambitious and try to "computerise" tasks which relate to the real world as opposed to the tidy model worlds of the mathematician, physicist, or engineer. Computer-controlled navigation is fine in space, where Newtonian physics says virtually all there is to be said about the motion of celestial bodies; but a flock of birds can confuse an automatic early warning system, and really complicated problems such as the automatic recognition of speech have so far defied solution. The difficulty in such cases is not merely one of translating a task into logical terms, but of specifying the task in any terms whatever. If the task is to detect an enemy missile, what counts as an enemy, and what as a missile? If a child of two is babbling in his playpen, should the automatic speech recogniser move into action or not? And if so, how are we to judge whether it has recognised an utterance correctly?

A favourite problem in advanced computer science is that of indexing, classifying and translating the scientific literature – an urgent problem in all conscience. Any automatic system for doing this would probably classify this paper under "zoology" and sub-classify it as "computational". How the Japanese translation of the first paragraph would look, we cannot begin to imagine.

Before attempting to place theoretical bounds on what is, or is not, sensible to attempt with computers, let us look at a possible line of attack on the problem of making computers accessible to untrained users,

including managers, administrators and other "operatives".

There is one skill, it is argued, which we all share, namely the ability to speak and understand our native tongue. What is more, we can teach one another, in language, how to do quite difficult things, such as reading, writing, arithmetic, learning foreign languages, winning friends and influencing people.

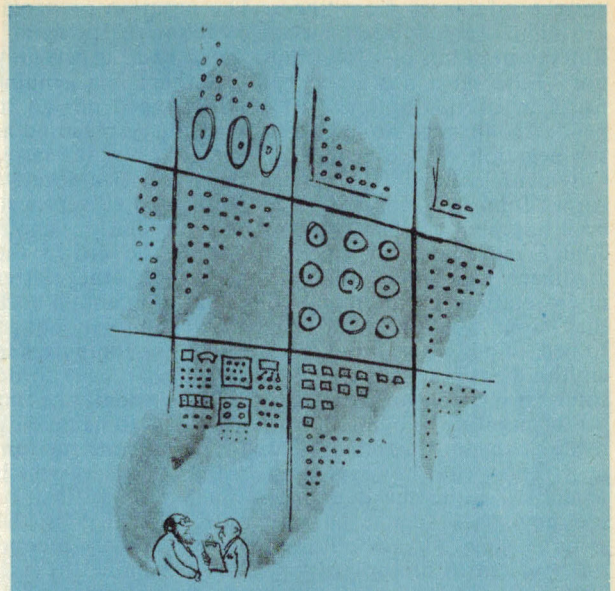
We may not yet know how to translate these lessons into computer programs (though a good start has been made with computer-aided instruction) but couldn't we solve all such problems in one fell swoop by teaching computers to understand English? After all, they can understand FORTRAN, which has a few English words in it; why not widen the vocabulary and syntax bit by bit till it included most of the words and constructions which we use in ordinary speech? It wouldn't be necessary to include them all, because any uncommon words could be explained in terms of the others, and the same with idioms and unusual constructions. So perhaps what we ought to be doing is to write compilers for English and other natural languages; then we could hand over our management, economic, and political problems to the computer.

Where is the catch? Perhaps we shouldn't beg the question because some people seem to think that all this could really be done, that any difficulties would be merely technical and would be overcome if only the linguists would come out of their ivory towers and learn about programming. Disregarding the impatience with which this view is often expressed, we believe that it is profoundly, and dangerously, mistaken. First, it is mistaken because of the disorderly syntax and semantics of existing natural languages. Here is Henry Sweet (the original Professor Higgins of Shaw's "Pygmalion" – perhaps better known nowadays as "My Fair Lady") writing in the "Encyclopaedia Britannica" about universal languages, and the difficulties which even human beings have in learning natural languages:–

"Natural languages are difficult because they are imperfect expressions of thought; because language is only partly rational. The greatest difficulty of a language is the vocabulary; and the foundation of the vocabulary of all languages is practically arbitrary: there is no connection between sound and meaning except in a few isolated words. And even that part of a language which can be brought under more or less general rules is full of irregularities and exceptions, ambiguities and redundancies of expression, and superfluous or irrational distinctions such as those of grammatical gender, so that when we have learnt one sentence we can never be sure that it will serve as a pattern for another".

In this paragraph Sweet raises the most obvious difficulties which would confront anyone trying to program a computer to understand speech, though he does not even mention the wide variability of speech sounds or the nightmare of word boundary identification. Nevertheless, it might be argued, we would be more than happy to have a computer with which we could converse on the typewriter, thereby escaping all problems of phonetics. Very well then, let us think about this more limited enterprise.

If the computer is to engage in useful discourse it must be capable of primitive reasoning. Knowing that "men" is the plural of "man", and being informed that "Men are mortal" and that "Socrates is a man" it must be able to deduce that "Socrates is mortal", regardless of who or what Socrates might be. But if we had told it that "Men are numerous" it would, by the same token, have inferred that "Socrates is numerous". All right, so we explain to it the distinction between sets and their members, so that from "Many people like caviar" it can deduce that "Some people like caviar" – a safe enough conclusion, one would think. But one morning, after digesting a few proverbs, it comes up with the startling statement "Some hands make light work". What are the managers and the operatives to make of this?



"It pains me to think that one day they'll refer to this as a crude invention".
("Electronic Age"

Such phenomena are, of course, highly instructive if one is interested, as we are, in the logic of natural languages. But one can waste a great deal of time trying to write question-answering programs for natural language if one has not first gone thoroughly into the linguistic issues involved. Some of the trickiest problems arise in connection with the most harmless-looking words, such as "want", "not", "any" and "a". Consider the sentence "Mary wants to marry a Norwegian". It might have either of two quite different meanings, according as Mary is a little girl who wants to marry a Norwegian when she grows up, or is a nubile young lady who has fallen madly in love with a blond ski instructor. In the latter event we can ask "How tall is he?", but in the former situation this question reveals a serious misunderstanding, for which a computer could scarcely be blamed.

Modal verbs (such as "can", "will", "may", "shall" for example, and their derivatives) and negations often seem to carry this sort of ambiguity with them. "I don't see a flying saucer – where is it?" is something someone might say, but not "I don't drive a car – how fast does it go?" The semantic ambiguity of the indefinite article shows up particularly well in the set of three sentences: 1. "I am looking for a wife"; 2. "I am looking for a hotel" and 3. "I am looking for a man with a scar on his left cheek". In case 3 we can ask "How tall is he?" but in cases 1 and 2 the questions "How tall is she?" and "How big is it?" would be inapposite. And whereas in case 2 we could well enquire "Is this hotel to your liking?" we could hardly ask in case 1 with both grammar and propriety, "Is this wife to your liking?"

Another kind of paradox associated with negation is to be found in our use of the word "nothing" in English – though similar paradoxes arise in other languages and were known, indeed, to Homer. If A is better than B, and B is better than C, it would be natural to conclude that A is better than C. But what conclusion follows from the premises "Nothing is better than a good square meal, but a sandwich is better than nothing?" (The answer is left as an exercise for the reader.) Similar things happen with "any". The question "Can anyone run a mile in four minutes?" was answered in the affirmative "Yes" by the news "Bannister can run a mile in four minutes", but this fact does not imply the statement "Anyone can run a mile in four minutes".

When modal verbs and negations occur together in English sentences, exceedingly complicated rules – as yet unformulated – must be followed in order to draw

This article was first used in "New Scientist", the weekly news magazine of science and technology, London.

correct inferences from them. The negation of "John can swim" is obviously (is it not?) "John can not swim". But the negation of "John must go to bed" is certainly not "John must not go to bed". If there is a genuine negation of this sentence, it is "John need not go to bed". "John must not go to bed" might be regarded as the negation of "John may go to bed"; but the latter statement is ambiguous, having the alternative negative form "John may not go to bed", which could very well be interpreted as a statement of our expectations about John's movements in the near future. To crown the argument we may note that under the latter interpretation it is perfectly consistent to maintain both that "John may go to bed" and that "John may not go to bed". So if we plan to converse with our computers in anything approaching real English, we shall have to do some very hard work first on the logic underlying our use of negation, modals and determiners – to name only three of the most commonly used types of construction.

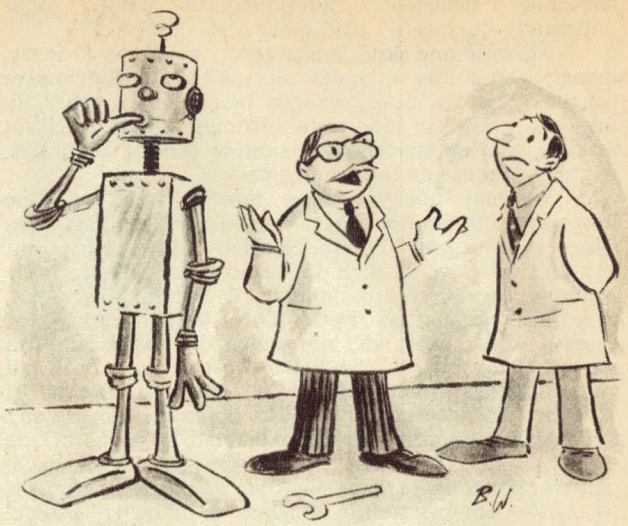
There are, however, two further obstacles which would still loom ahead, and it is much more difficult to see how these could be overcome. The first is the genuine illogicality of natural language, and the second the problem of presupposition. Let us examine these in turn.

Natural languages are known to violate the basic constraint which logicians find it necessary to impose on formal languages – that of consistency. In a logical calculus, such as the prepositional calculus or first-order predicate logic, one has three components: axioms, propositions, and rules of inference. The propositions are, essentially, the grammatical statements of the language, and include the axioms, which are assumed to be True. If any non-axiomatic proposition can be inferred from the axioms it is also said to be True, and if its negation can be inferred from them it is said to be False. If any proposition turns out to be both True and False, the system is said to be inconsistent, and all kinds of embarrassing consequences arise, such as the Truth and Falsity of every proposition.

One kind of grammar which tends to lead to just this sort of trouble is a grammar in which propositions are allowed to refer to themselves. But in English we are constantly making self-referential statements, and in a non-vacuous way. "What I am saying is true" is a perfectly reasonable statement for someone to make, but if we admit this to be grammatical we can hardly exclude as ungrammatical "What I am saying is false". The modern history of the theory of sets is strong evidence for deep-seated inconsistency in natural language. Bertrand Russell's paradox involving "the class of all classes which are not members of themselves" set the cat among the pigeons by showing that a thought expressed in the most impeccable English could nevertheless contain the seeds of its own logical destruction. Whether we should regard this as a defect of natural language is a matter of opinion. Probably not, because we could hardly discover paradoxes unless we could state them. But the fundamental inconsistency of natural language is not going to be an easy problem to deal with when it comes to writing question-answering programs in English.

The problem of presupposition has many sides. We use language to inform – and misinform – each other; to ask questions, issue commands, make promises and so forth. But for any of these speech acts to achieve its purpose the mental process of the hearer must bear a reasonably close relation to those of the speaker, and the speaker must have a pretty good idea of what the hearer believes to be the case, what he wants, and what he is prepared to do. To illustrate the importance of belief systems we may consider a game of blindfold chess. The particular hazard of playing chess without a board is that one may forget the board position and either make an illegal move or do something disastrous.

Exactly the same hazards arise in conversation, where precision of speech is no guarantee against the dropping of bricks or the risk of misunderstanding. The only way of avoiding such pitfalls in conversing with a computer would be to know exactly how the program



"Of course, our technology is still in its infancy".

("Electronic Age")

was going to interpret each remark supplied to it. Ordinary programming languages are designed with just this necessity in mind; we know the nature of the belief system of a computer which has been prepared to receive an ALGOL program, and we can operate on it without the fear of being misunderstood. But there seems to be only a minute fraction of English which is susceptible to the same precise analysis as "if x 3 then y: = 2:"; almost all the things we say to one another are dreadfully fuzzy in meaning, and it is only our common non-linguistic experience which saves us from mutual incomprehension.

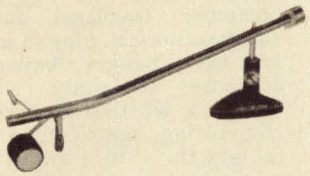
Another way in which presuppositions intrude into natural language can be illustrated by the notorious leading question "Have you stopped beating your wife yet?" The syntactic form of this sentence demands the answer "Yes" or "No", but neither word enables the accused to deny the presupposition that he has been beating his wife, let alone the implication that he is a married man. The presuppositions which underlie questions, statements and commands are far more numerous than we commonly realise; and even negative statements such as "I don't like green cheese" seem to imply the truth of closely related statements – in this case "I do like most cheese". The general point here is that in talking to each other we assume that the hearer will read into our remarks more than just the logical implications of what we say; if he did not we would regard him as a literal-minded numbskull, like the Monkey's Paw.

What is the moral of all this? Should we give up all attempts to break down the language barrier between the computer and the inexpert operator? No, of course not. Nothing but good can come from sensible attempts to simplify and streamline computer languages, and to purge them of arbitrary restrictions and unpronounceable identifiers. But not in such a way as to deceive the user as to the nature of the computer's "mind" or the processes to which any input will be subjected. The instructions which make up an ALGOL program, say, are transparent and unambiguous, and can be hand-tested on paper by following them to the letter.

But natural language is not like that; although we can understand one another quite well in conversation (or so we like to think), we have no formal rules for translating sentences into their meanings and back again. It is not merely the absence of satisfactory parsing routines – which in any case could only be applied to that rather small part of our discourse which is fully grammatical – it is the total impossibility of constructing an adequate semantic theory which did not call upon an encyclopedic knowledge of the real world, including an exhaustive account of human psychology. For these reasons we are convinced that it would be a

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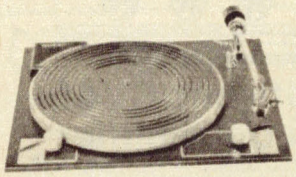
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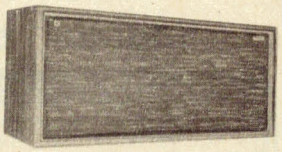
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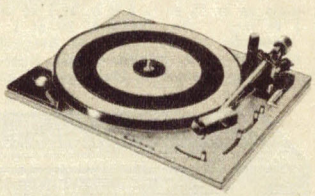
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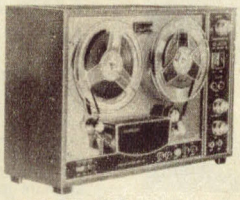
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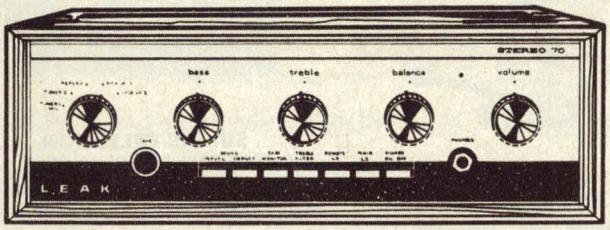
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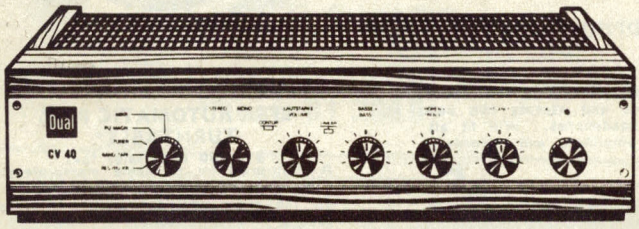
TOP NAME AMPLIFIERS
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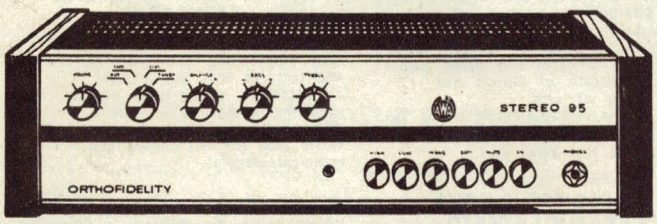
Illustrated is the Model "Stereo 70". Specifications: .1% total Harmonic Distortion. **ALL** power levels up to 25 watts R.M.S. at 1 kc into 8 or 15 ohm Loudspeakers. Damping factor, 40 at 1 kc into 8 ohm speakers, 20 at 1 kc into 15 ohm speakers. 27 transistors and diodes. Inputs for phono, Tuner tape. Bass—Treble—Volume—Balance controls. Switches for stereo or mono—tape monitor—treble filter—main and remote loudspeakers—Headphone outlets. Send for brochure on the Stereo 70 and the lower power version, the Stereo 30 plus.



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backward rather than a forward step to try to assimilate computer languages into natural languages; the resulting confusion and misunderstanding would do more than ever to justify the distrust with which computers are already regarded by the non-specialist.

No. The answer, as we see it, is to educate the managers and administrators and, of course, the operatives, to distinguish between those problems which can be adequately handled within the logical space of a computer and those which plainly can not; and to teach them, by properly organised courses of formal instruction, how to use the computer languages into whose construction has gone so much effort and hard thought. Anyone using a computer to study a particular system is, whether he likes it or not, committing himself to a theory of the system – to a model of how it works; and any language which could possibly be mistaken for English is liable to mislead the untrained user into setting up a model which will fall apart. No one should be let loose on a computer without having been made acutely aware of this fact; and the only sure way of achieving such an awareness is to set up one's models in a language which will not – unlike English – allow anyone to talk nonsense. ■

FORESTALLING AIR POLLUTION IN JAPAN

In a determined, if belated, attempt to tackle their acute problems of environmental pollution, the Japanese are using a computer to control possible air pollution resulting from the establishment of new industrial complexes.

According to a report in "New Scientist", Japanese computer scientists have developed a system which forecasts air pollution to be expected from new industrial installations. Topographical data, meteorological factors, plan design, and details of the amount and type of fuel to be used, are fed into the computer. Different programs have been developed for different areas so that the computer can predict the diffusion of waste gases in specific locations. If the prediction is that pollution will exceed acceptable limits, the organisation concerned will be asked to modify its plans.

In the past, Japan's Ministry of International Trade and Industry has carried out soot diffusion tests in a wind tunnel, and waste fluid diffusion tests using a tidal current model; but the Ministry has carried out wind tunnel tests for only 25 of the 40 industrial complexes throughout Japan, although it has been conducting the tests since 1965. Several more years will be required, and more money will have to be spent, before wind tunnel tests for the remaining complexes are completed. Not only that – plant construction plans change every year, and the raw materials and fuels to be used also change.

Because of this, anti-pollution measures have had to be revised. To cope with this situation, the Ministry has developed the computer technique to forecast industrial air pollution. It will use the new system to provide free advice to industrial enterprises and public bodies. ■

COMPUTER-AIDED MATHS COURSE

Computer-assisted mathematics instruction has proved to be effective in experimental programs, but the high cost of equipment has so far retarded its widespread use in schools. Now Hewlett-Packard, in the USA, has developed a low-cost modular system.

Hewlett-Packard's new Computer Aided Instruction (CAI) system provides mathematical drill and practice for grades one to six, at a cost of $US150,000 for a typical 32-terminal installation, compared with over one million dollars for previously available systems.

With Hewlett-Packard CAI equipment, a small installation, with perhaps one or two systems, can be started at modest cost, to serve a number of schools in an area. Later, more systems can be added in modular fashion.

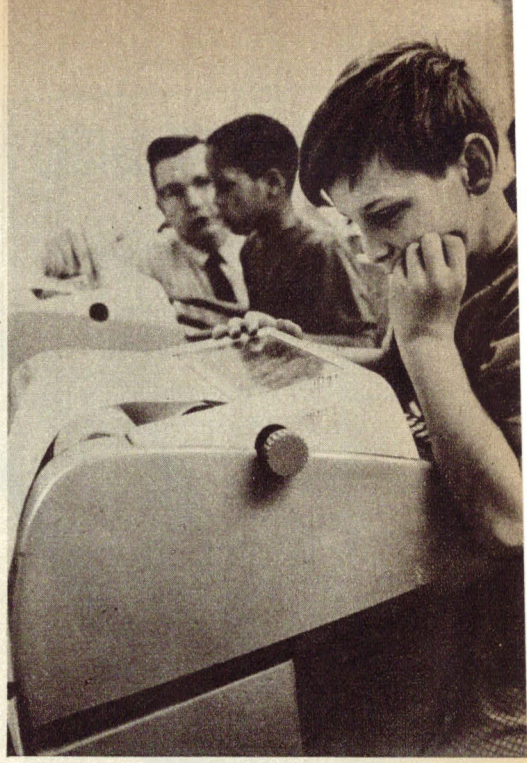
The system is a modified version of the HP 2000A time-shared computer system. The educational version is capable of operating up to 32 student-terminals simultaneously. The mathematics instruction program has been written in the BASIC language, and the system treats it like any other time-shared program. For this reason, and because the CAI program uses only part of the computer system's capacity, any terminal that is not being used for mathematics instruction is available for general problem-solving. The convenience of conversational HP BASIC facilitates its general usage by non-professional programmers.

The new system is currently installed and operating at the Willow School, Ravenswood City School District, East Palo Alto, California, and is now generally available for delivery. Teacher in-service training is available from Hewlett-Packard, as are a full complement of user aids: curriculum guides, teacher guides, proctors' guides.

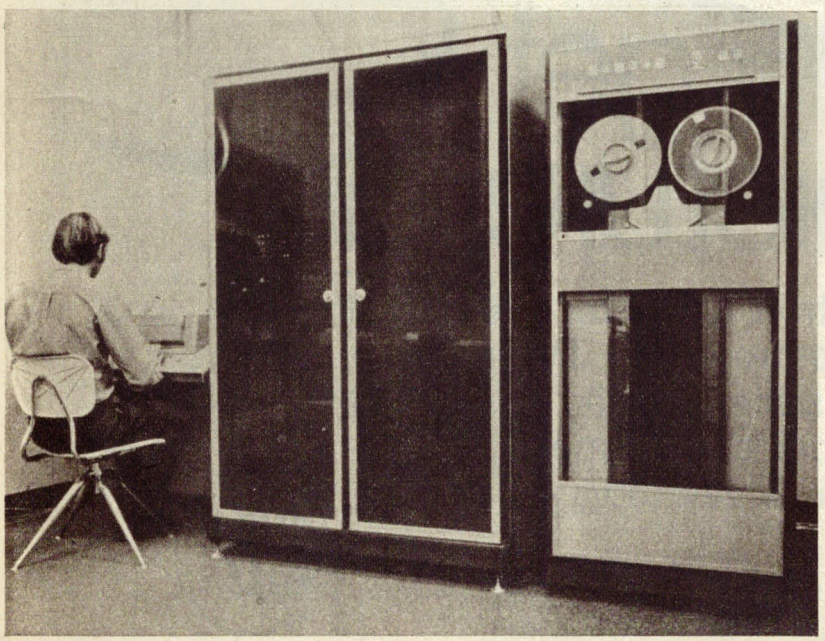
Until now, CAI systems have been based on a large centrally located computer system, connected by telephone lines to teleprinter terminals at the schools. These large and complex systems are expensive to buy and costly to operate.

By contrast, the HP/CAI System is normally entirely located right at the school. To the student, the smaller system behaves exactly like the large central computer, three to ten times more expensive. Terminals can be wired directly to the computer system within a radius of one mile, thereby reducing the reliability problems and operating costs associated with data transmission.

For schools in the larger cities, multiple systems can be installed, each system located in the district it serves. Using several small discrete systems has some advantages over the centralised system with its single large computer. For one thing, if the large computer breaks down, the entire city goes without CAI. With decentralised systems, it becomes possible to establish regional computer centres, with a multiplicity of educational uses. For example, in addition to use by elementary school children for computer-assisted instruction, the centres can be used by teachers and by advanced students for BASIC-language problem-solving in a time-sharing mode. These multiple uses can be supported without a single system change.



Young students at the Willow School, East Palo Alto, USA, get to grips with the Hewlett-Packard CAI system.



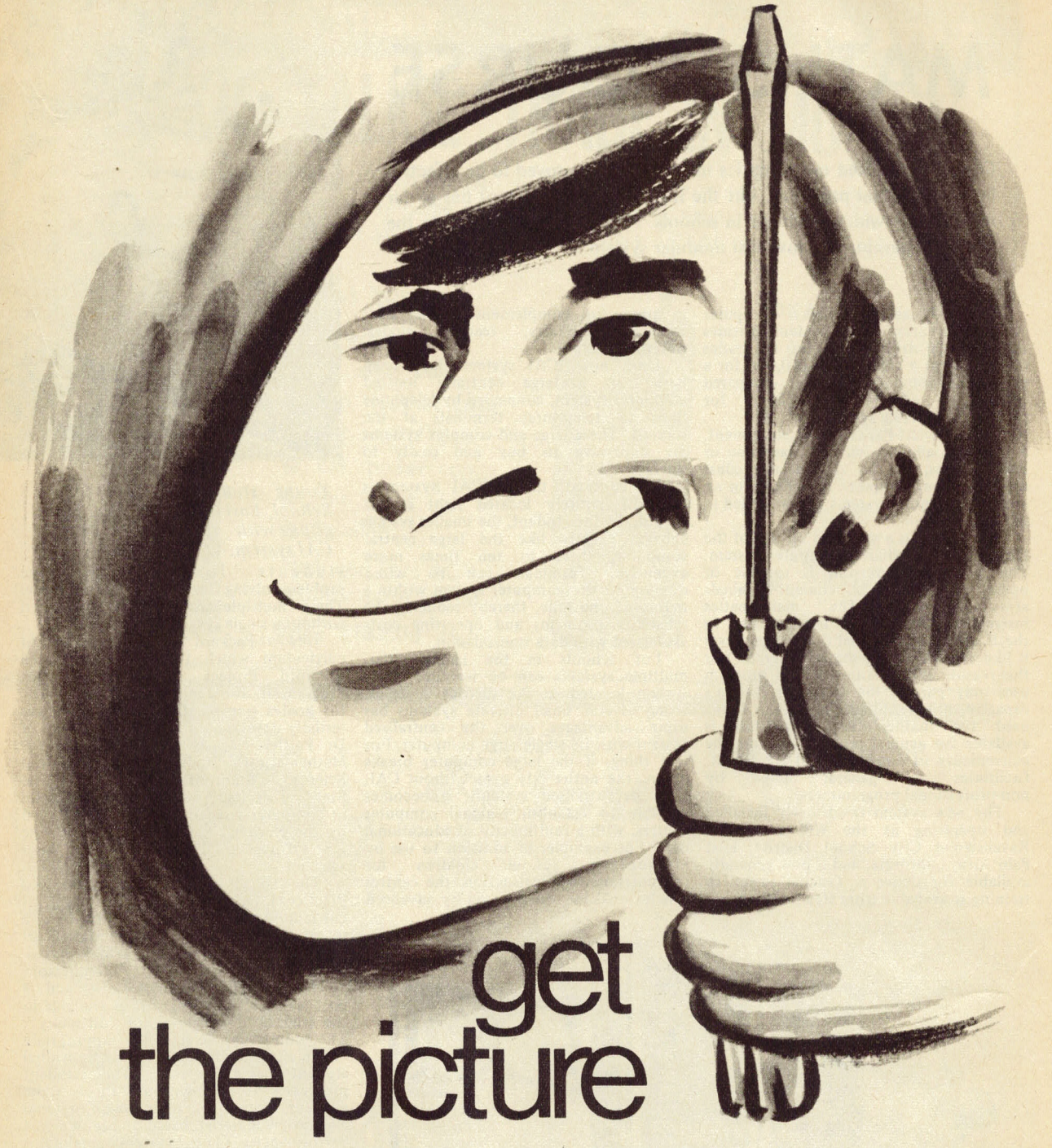
The Hewlett-Packard CAI system can be installed right in the school, and requires no air-conditioning or special facilities.

Hewlett-Packard has designed a CAI curriculum which fully implements the Stanford Project Drill and Practice Program in Fundamentals of Arithmetic for grades one to six. This program was initially developed under the leadership of Dr Patrick Suppes at the Institute for Mathematical Studies in the Social Sciences, Stanford University. "The Stanford Project" was a research program in computer-assisted instruction, financed by the National Science Foundation, the US Office of Education, and other agencies.

The HP/CAI Mathematics Drill and Practice Program provides six grades of curriculum for presentation by a teleprinter or equivalent. Each grade level contains 24 concept blocks of material. Each concept block contains seven lessons (a pre-test, five main lessons, and a post-test). Each main lesson is available to the student at five levels of "difficulty". The computer selects the appropriate "difficulty" level, based on the individual student's performance. The student progresses at his own rate through the curriculum, receiving main lesson material and review material, based on his own past performance. The system maintains complete student records and produces a range of easily-used teacher reports.

Each student receives from five to 10 minutes of drill on the teleprinter per day. Instruction may be either self-paced, with each student proceeding to the next lesson immediately after finishing a lesson, or group-paced, with each student completing only a single lesson per day. The entire mathematics program is available at any time at all "difficulty" levels, for all students in grades one to six.

The HP 2000A was the first of what has proved to be a new class of low-cost time-shared systems. It has been widely used for several years in industrial and educational applications. Cumulatively, these systems have logged over four million user-hours, with remarkable reliability records. ■



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Colour Taping TV Commercials

A fully equipped colour television studio with facilities for making colour video-tapes is operated by Video-Tape Corporation Pty Ltd, at East Roseville, Sydney.

Primarily designed for the production of television commercials, the studios are equipped for operation in both black and white and the 625-line PAL colour system.

Although the introduction of colour television transmissions is not expected in Australia for at least two years, the colour taping facilities available in Video-Tape Corporation's studio are providing advertising agencies and their clients the opportunity to gain advance experience in the electronic colour medium.

The company's premises cover four levels with a total floor area of 16,000 square feet. This provides for two studios each of approximately 1,600 square feet, video and audio control rooms, voice-over announcer's booth, client's viewing room, technical areas, make-up and wardrobe facilities, canteen, garage dock for a mobile VTR vehicle, plus reception, executive and administration offices.

The colour television cameras used in the studios are Marconi Mk VIIB, working into a specially designed and custom-built video switching and special effects system. This equipment was supplied through the Engineering Products Division of Amalgamated Wireless (Australasia) Limited who also manufactured the audio installation. The VTR equipment is Ampex throughout, comprising VR-2000B's, plus a video-disc model HS-200 Teleproduction System which makes possible new advanced forms of electronic effects and provides for fast, slow, forward, reverse and stop motion, "freeze-frame" and animation.

All the recorders are equipped for low and high-band operation, and have Amtec one-line delay drop-out compensator, electronic editor and Editec, Colortec, Auto-Chroma and Velocity Compensator.

The philosophy of Video-Tape Corporation is that all television commercials can be produced on video-tape, usually better, always faster, and sometimes for less cost, than on film. Australian advertising agencies are being introduced to the new techniques possible with video-tape, using the latest editing and teleproduction systems.

It has also been the objective to combine the best attributes of both tape and film techniques by employing single-camera multiple "take" shooting procedures, familiar to film directors, rather than follow the continuous multi-camera method of production conventionally identified with television.

Electronic photography is now capable of providing a very wide range of optical and special effects which can be called into use instantly, at will, by simple switches and push-button controls. Also, the facility available to the director to view the results of his production on the monitor screen immediately, rather than have to wait for rushes to be developed, is another advantage of the video-tape medium.

Another unique advantage possessed by video-tape is the immediate ability to make dubbings, as contrasted with the delay involved in processing film prints. This is often a deciding factor in favour of tape where advertising agencies have to meet tight air-date schedules.

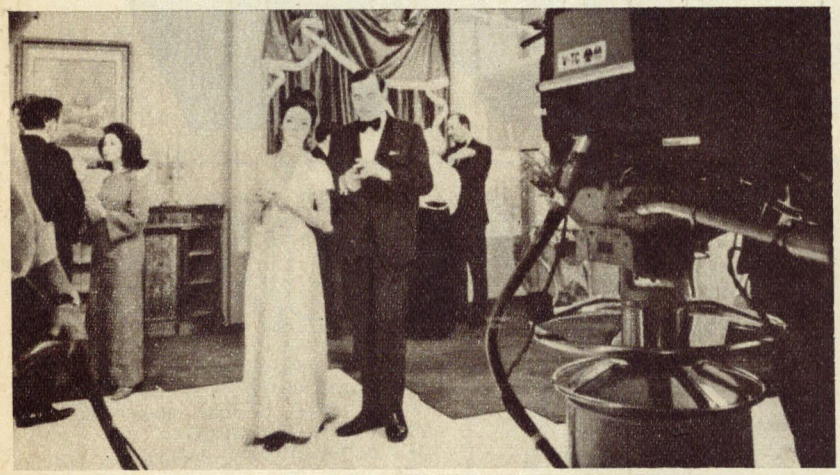
Additionally, new electronic production techniques have been evolved from the particular capabilities of colour equipment, such as the Chroma Key travelling "Matte" technique, which enables multiple juxtapositions of camera subjects, the interpolation of subjects into scenes or environments recorded separately, and other "trick" effects.

Already, in the short period during which the company has been operating, experimentation in a wide range of new techniques has evolved many novel visual and optical effects, highly creative in character. One includes the modulation of the video-tape picture by the audio track – a most striking effect whereby opticals are caused to interpret the beat and dynamics of the music.

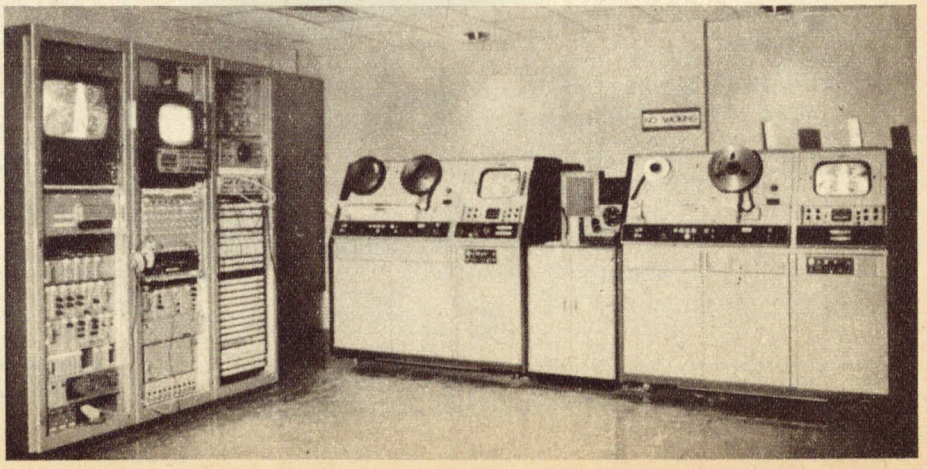
Many progressive advertising agencies are displaying keen interest in the development of tape techniques, and some of the country's leading producers and directors are working at Video-Tape Corporation with the object of exploiting the creative possibilities which video-tape offers.

Further applications for video-tape usage are continuously being explored. Apart from advertising, many other forms of television program content are produced and recorded. Also, from time to time, such varied recording assignments as sales presentations, political campaigns, medical demonstrations, trade shows, company promotions, tourism displays, fashion exhibits, and so on, are carried out.

As a new type of commercial television operation in Australia, the Video-Tape Corporation has received an encouraging reception from business generally. The future expansion of its functions and facilities in the buoyant and fast growing industry which it serves now seems to be well assured. ■



Taping a TV commercial at the East Roseville studio, using a Marconi Mk VIIB colour camera.



Part of the video-tape recording room, with the Ampex video-tape recorders.

This report is based on an article by Mr A. E. R. Fox, managing director of Video-Tape Corporation Pty Ltd, which appeared in "Sound and Vision Broadcasting", Summer, 1970, published by the Marconi Company, England.

Fairchild has the BC numbers up!

Fairchild now has the numbers up in BC series transistors: metal can transistors, BC 107, 108 and 109, as well as the new epoxy transistors, BC 207, 208 and 209.

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TECHNICAL DIGEST

Electronic fuel injection could reduce air pollution

An electronic fuel-injection system developed in the USA by Bendix Corporation is expected to make a major contribution to the reduction of air pollution from car exhaust gases.

In 1952, Bendix engineers at Elmira, New York, built an electronically controlled fuel-injection system using thermionic valves. This system gave substantially improved engine performance over systems using carburettors to meter fuel. The advent of the transistor aided in their research so that by the late 1950s the company had built about 100 electronic fuel-injection systems. Unfortunately, this system was, ahead of its time. The solid-state electronic components needed for the system were much too costly; the system was shelved.

The Bendix concepts emerged again when Robert Bosch of Germany introduced an advanced production model of the Bendix electronic fuel-injection (EFI) system on the 1968 Volkswagen 1600 Series.

The Bosch fuel-injection system, produced under Bendix licence, permitted the VW to meet exhaust-emission standards without the need for power-consuming smog-control devices. The increasing air-pollution problem and the more stringent Governmental regulations on exhaust emission require more precise fuel metering for petrol engines. With lower priced electronic components now available, the Bendix system has been revived to help meet these emission standards.The Bendix Automotive and Automation Company has an EFI system under development similar to the Bosch system, but specifically designed for US vehicles.

In the Bendix electronic fuel injection system, fuel is pumped from the petrol tank through a filter to a common line which supplies all the injectors. A regulator maintains a constant pressure to the injectors, which are located so that they spray fuel directly at the intake valve, as shown in figure 1. By controlling the time the injectors are open, the amount of fuel delivered to each cylinder can be precisely metered. Electromagnetically actuated injectors provide the means for electronic control.

An electronic control unit determines the basic engine needs from various sensors and generates a "timing pulse" signal for each injector. The sensors include a manifold pressure sensor, a full-load enrichment switch, a coolant thermistor, and an engine-speed (rpm) sensing unit. Using information from these sensors, the control unit determines the correct "pulse width" or "open time" for the injectors. A throttle transient-enrichment switch on the fuel-injection system senses how much extra fuel is needed for acceleration and varies the amount of time the injectors are open.

Grouped injection, in which fuel is injected to a group of cylinders at the same time, is used with this EFI system. For example, the injection grouping for a typical eight-cylinder American car with a firing order of 1-8-4-3-6-5-7-2 would be: Group One containing cylinders 1-8-7-2 and Group Two containing cylinders 4-3-6-5. Tests conducted by the company have shown that this method yields virtually all the advantages of a fully timed fuel-injection system, but permits the use of a much simpler and less costly control system.

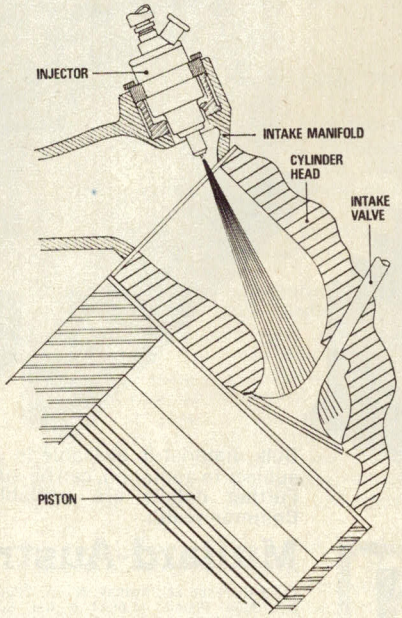


Figure 1. A cross-sectional view of the Bendix electronic fuel injection system, showing how the injectors spray fuel directly at the intake valves.

A small additional injector is mounted in the throttle body to discharge the additional fuel needed to ensure rapid cold starts. A mechanical temperature-sensitive bypass valve is used to supply the extra air required for smooth idling while the engine is cold. The electronic fuel pump is turned off by the control unit if the engine stalls or if the ignition switch is left on when the engine is not running.

The trigger unit and the electronic control unit form a single, compact package. The electronic control unit package measures only 3½ inches on each side. The trigger unit can be driven by the mechanical fuel pump eccentric or other indicator of engine phase and speed.

The pressure sensor, consisting of a variable-inductance transformer operated by an evacuated pressure-sensitive capsule, measures absolute pressure in the intake manifold and provides the primary information concerning engine load. The full-load enrichment switch, on the other hand, senses vacuum and provides enrichment for full-power operation whenever manifold vacum drops below a preset level; thus permitting enrichment for full-power operation at any altitude.

An engine equipped with carburettors might operate better if it had all of these sensing devices helping to meter the fuel. Unfortunately, a carburettor has only the air flowing through it, an approximate temperature measurement, and the driver's demands to determine the amount of fuel needed at any given time. As a result, another method of fuel metering is needed. The car correspondent of "Time" magazine, Dan Fisher, predicted in an article (January 11, 1970): "Fuel-injection will probably be adopted in most domestic passenger cars as a primary weapon against air pollution within four years."

According to Bendix, its electronic fuel-injection system offers accurate fuel metering at low engine speeds and light loads, high volume breathing at high engine speeds and heavy loads, and even distribution of fuel from cylinder to cylinder throughout the engine operating range as a result of its design characteristics. These attributes can be translated into the following benefits for vehicle manufacturers: improved horsepower per cubic inch, better economy, improved drive-ability and smoothness, and improved cold starts and drive away. Consequently, all of these benefits are available from a system that

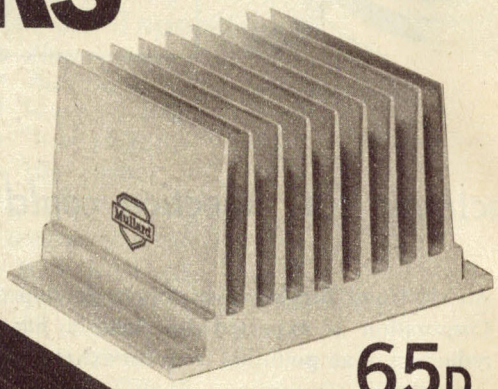
(Continued on page 150)

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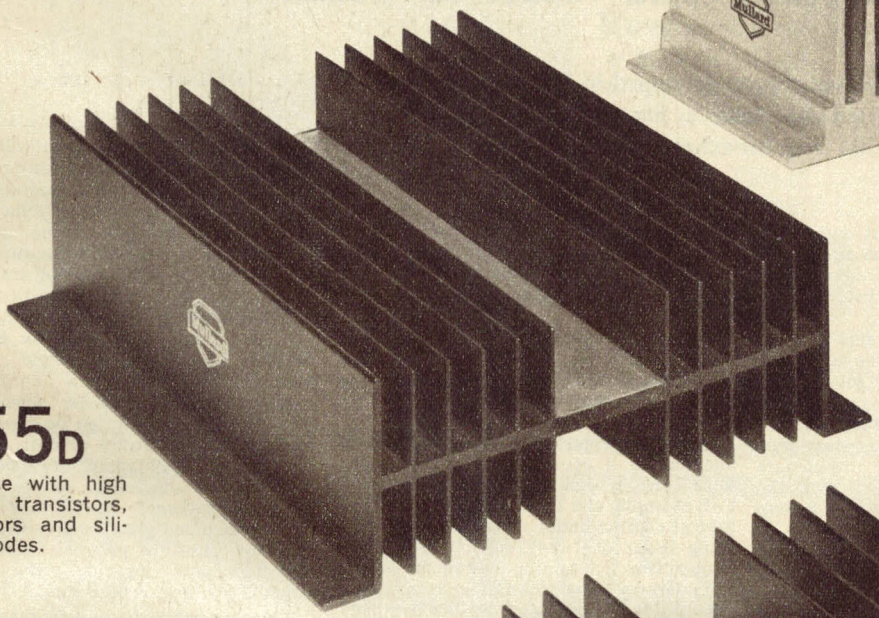
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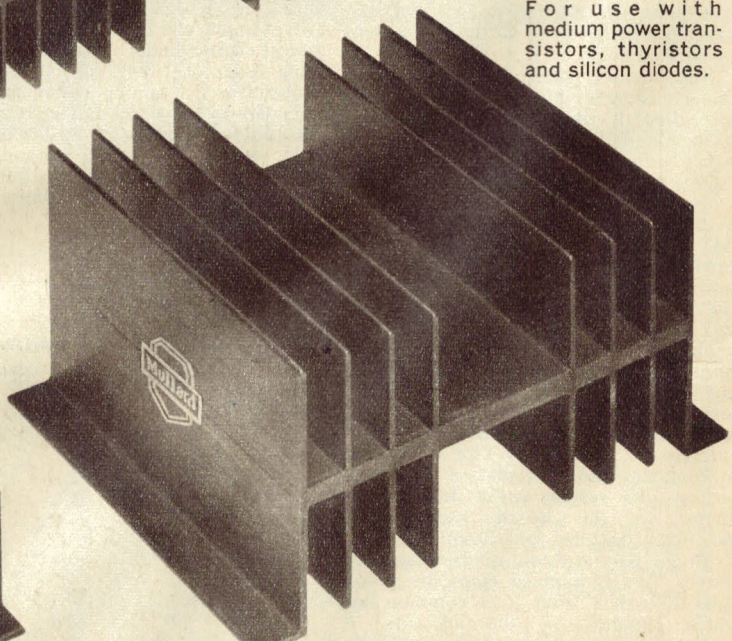


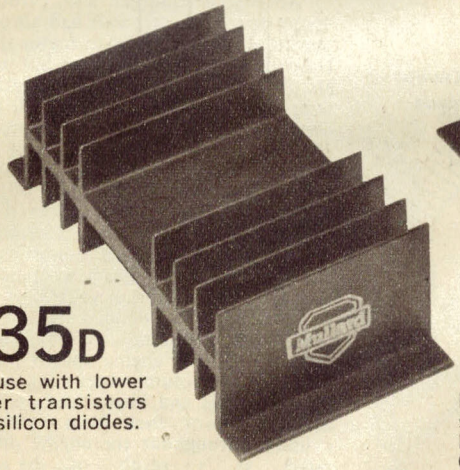
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DIGEST

SOLID-STATE COLD CATHODE DEVELOPED BY RCA

The major drawback of the thermionic valve, the hot cathode, appears to have been overcome by a practical and efficient cold cathode system developed in the USA by RCA.

In many applications, the old hotwire thermionic-cathode valve defies replacement by solid state devices. But the high temperature essential for emitting electrons from the cathode is also the chief source of valve failure.

At the David Sarnoff Research Labs in Princeton, NJ, RCA scientists under the direction of Henry Kressel have taken a unique opto-electronic approach to cold cathodes. With the aid of a double heterojunction gallium arsenide diode structure, photons are produced very efficiently and are transported to an absorbing P+ region. There, they generate electrons which, due to a specially treated (low work function) surface layer, are emitted at overall efficiencies up to 1000 times better than other solid state cathode attempts.

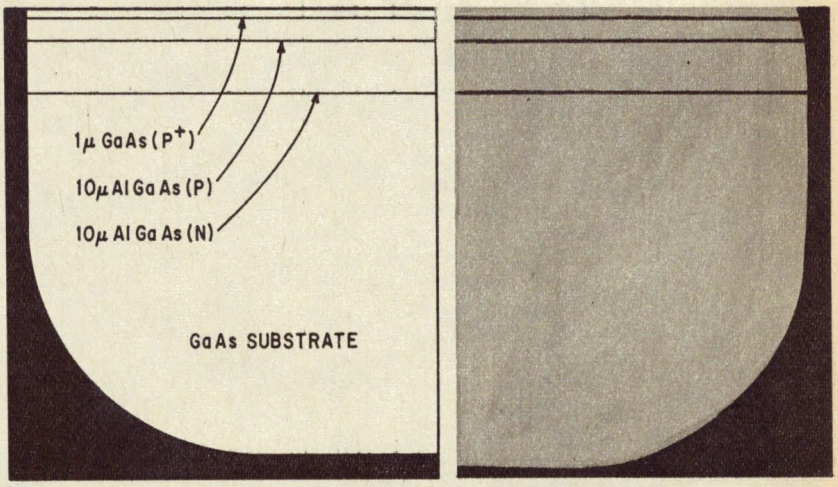
The cathode is still in the research stage. But if its efficiencies can be increased by a further factor of 10, and if its operating current densities also can be increased, valves in which it is used could start assuming many of the present functions of the hot cathode valve.

A solid-state electron source would also be a natural where the marriage of solid-state and valve technology has already been accomplished. In the silicon-target vidicon, for example, the present hot-electron scanning source could be replaced by a cold solid state source, doing away with the high temperature: the tube would be simpler in construction, last longer, and, since solid state electron beams have lower energy than thermionic ones, facilitate focusing. Moreover, electron-beam diode arrays could be used to match the silicon diode target array, eliminating the need for scanning.

The cold electron source can also be used in transistors. In fact, this approach, called an Electron Beam Injection Transistor (EBIT), could be the start of a whole new high-power, high-frequency transistor technology, for it could eliminate the emitter, the villain in frequency-limiting parasitics, substituting the electron beam for emitter functions.

There have been other attempts at solid state electron emission: forward-biased PN junctions, Schottky barriers, conventional photosurfaces illuminated by electroluminescent diodes. But overall electron-emission efficiencies were bad (as low as 10^{-5} to 10^{-10}) and current densities were also low. These approaches achieved electron emission by direct injection and electron transport to the surface of the PN diode – and this meant that the P-layer through which the transport occurs had to be very thin to prevent the electrons from being absorbed and lost in too great numbers. But then the electrode contacts on their thin P-layer surface produced high fields which crowded the current wastefully under the electrode and blocked the emission.

RCA got around this by using light transport for electron emission. The junction is forward biased so that light is generated with internal quantum efficiencies in excess of 50%. The photons are then transported with little attenuation to a highly doped light-absorbing region near the surface where they are reconverted into electrons. On the zinc-doped GaAs P region is a specially treated epitaxial layer (cadmium sulfide and oxygen under vacuum) which permits a large fraction of the electrons – potentially up to 20% – to escape into the vacuum. ("Electronics", 12/10/70.) ■



At right is a microphotograph showing a cross section through one of RCA's optoelectronic cold cathode devices, and at left is a schematic identifying the various layers. Photons are transported to the absorbing GaAs layer where recombining electrons escape into vacuum. The heterostructure allows efficient photon production, and the surface allows efficient escape.

SS "Great Britain" returns to UK

In our May, 1970 issue, we published an account of a survey to see if the historic old steamship "Great Britain" could be salvaged and returned to the UK. The outcome of this activity is recounted in the September, 1970 issue of "Dawe Digest".

The survey had concluded that "Great Britain" would break in two and roll over in approximately five years. A later check showed that three to four years would probably be all that was left to the old ship.

The ship was cracked down the starboard side from an opening that had been cut in her and this was the only major structural defect. Divers patched the crack below the waterline and structural strapping was bolted across the crack at three levels. On April 7 pumping started and some seven hours later the ship suddenly came afloat – the first time she had floated for 34 years.

A Force 10 storm blew up, with gusts up to 80 knots, but the old ship rode out the storm bravely with no trouble.

A large pontoon, or Mulus, was submerged and the "Great Britain" was floated over it. The pontoon was then pumped out, lifting the ship right out of the water. Everybody was delighted with the appearance of the ship; her graceful lines were immediately apparent. The ship left the Falkland Islands on the pontoon, as straight as the day she was built. She had been cleaned and painted, hundreds of tons of mud removed from her, barnacles and sponges and so on taken from her shell plating.

In June, she arrived in the Bristol Channel – 127 years since she first went afloat at Bristol. The original survey carried out with the help of the Dawe Sonoray Caliper undoubtedly played a major part in the salvage story, and was used again on arrival to plot in detail the thicknesses of the plating on both sides and on her bottom.

EDITORIAL NOTE: SS "Great Britain" was on a regular run between the United Kingdom and Australia before she was beached in the Falkland Islands. Many thousands of British migrants reached these shores in the ship before she was laid up in 1886. ■

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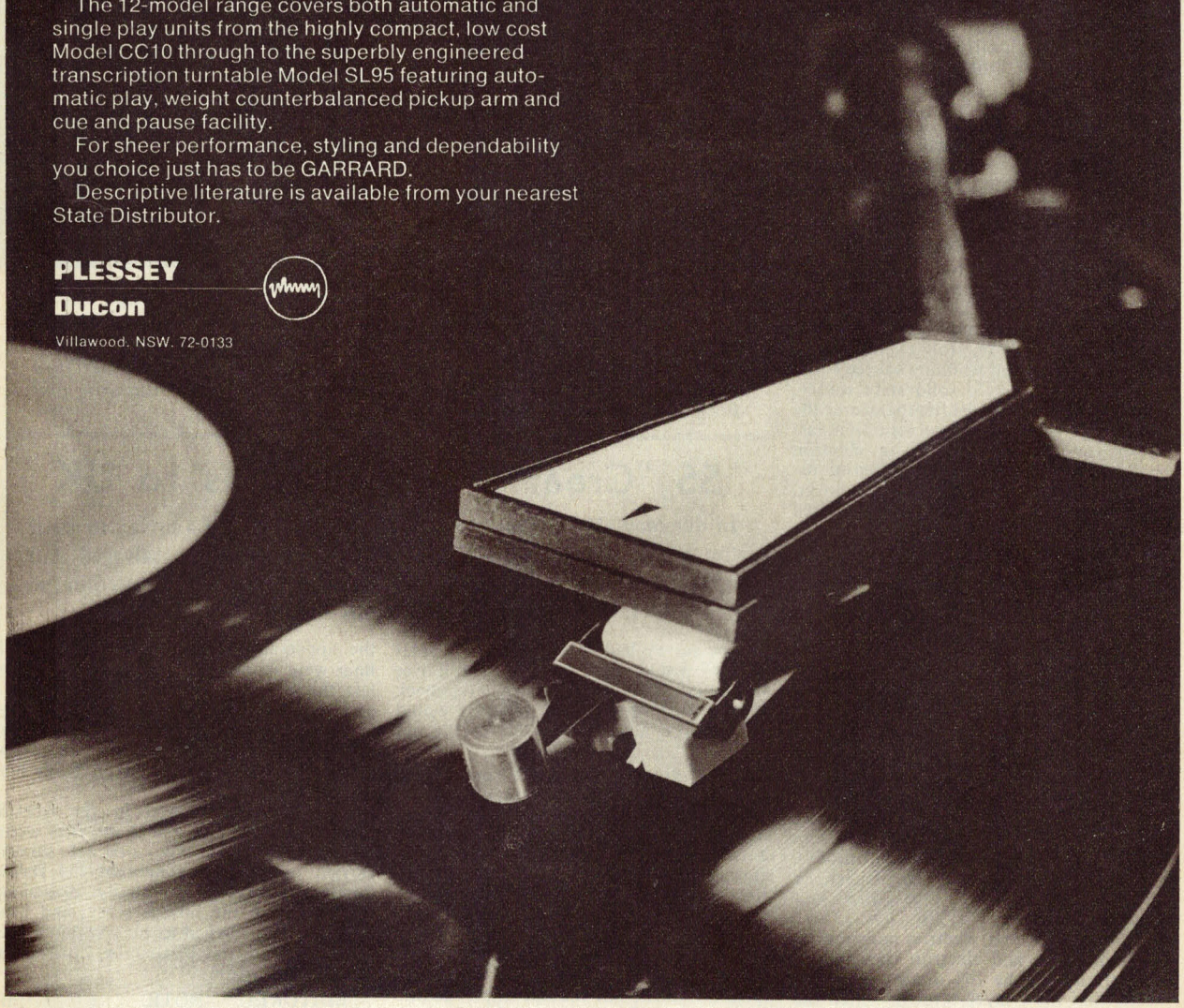
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DIGEST

NEW TV CAMERA TUBE FEATURES LIGHT BIASING

New lead-oxide tubes for colour television cameras, with special features designed to overcome certain inherent limitations of this type of tube, have been announced in the UK by English Electric Valve Company Ltd.

The new tubes are basically similar to the company's Leddicon tubes, but incorporate the following modifications:

1) Light biasing.
2) A highlight overload protection gun.
3) An anti-reflection coating on the faceplate stud.

Figure 1 is a diagrammatic representation of the new tubes, showing constructional details, and illustrating the various modifications.

LIGHT BIASING: Light biasing is a method of further reducing the already very low lag of lead-oxide camera tubes. By augmenting the extremely low natural dark current of the lead-oxide target with a fixed amount of photo-induced 'dark current', the scanning beam is able to establish a new equilibrium target potential more quickly when the illumination level changes.

The type of lag which light biasing will reduce is known usually as beam discharge lag and arises as a consequence of the finite spread of energies of the electrons in the scanning beam. It is particularly troublesome at low illumination levels, where the increase in potential of the target surface during the charge integration period is very small. In the absence of illumination, only the high energy electrons in the exponential tail of the beam energy distribution contribute to the target discharging process.

When the equilibrium light level increases slightly the target potential will increase but there will be insufficient high energy electrons to discharge the target. The target potential will therefore rise gradually on successive scans until sufficient of the lower energy electrons are able to land and establish a new equilibrium state. This will give rise to build-up lag. Similarly, if the illumination level is removed, several scans will be necessary to re-establish the original dark equilibrium potential, giving rise to decay lag.

The higher the dark current of the target, the more positive will be the equilibrium potential of the target in the absence of illumination, and the larger the proportion of electrons from the beam which will be able to contribute to the target discharging process. In deciding the optimum amount of bias current to introduce, a compromise has to be made between the desired improvement in lag, and that of dark current shading problems. It was decided that a bias current in the range 5 to 10nA gave a good compromise.

In the new Leddicon tubes the bias light is produced by a small light bulb inside the tube (figure 1) and connected in parallel with the heater. No additional controls or power supplies are therefore necessary. A ground silica disc at the base of the G3 reducing cone diffuses the light before it enters the G3 Cylinder through an array of holes in the reducing cone. By painting part of the outside surface of the tube, the amount of light channelled toward the target can be controlled. By this means it is possible to compensate for variations in target sensitivity from tube to tube, and control the bias current at 8nA. The bias current shading is slightly parabolic, being about 15% up in the centre.

HIGHLIGHT OVERLOAD PROTECTION GUN: This gun incorporates a method of overcoming blooming and comet-tailing effects arising from excessive highlight areas which cannot be discharged by the scanning beam. This type of gun is sometimes referred to as a Roosmalen gun, since the principle involved and a description of a suitable gun design was first discussed by van Roosmalen. ("Advances in Electronics and Electron Physics," Vol 28A, pages 281-288, 1969.)

During the normal "read" process, the target is scanned, as in a standard tube, with a beam current of 1 or 2μA but during the line flyback period the next line to be scanned is prescanned with a high intensity beam (100 – 200μA). During this flyback period the cathode is pulsed a few volts positive so that those target elements which have been exposed to very high illumination levels are restored to a potential which the normal scanning beam can subsequently handle. This introduces a 'knee' into the light transfer characteristic, the position of the knee being controlled by the size of the cathode pulse.

A tube with this type of gun can handle over-exposures of up to five stops without the problems associated with overloading and with the resolution capability of the tube unimpaired Above the knee the light transfer characteristic has a small finite slope so that the tube is also capable of providing information from the highlight areas.

The gun design requires an additional electrode (G5) which is situated in the middle of a split G2 anode (figure 1). During the normal scan period G5 is electrically connected to G2 at 300V, but during the line flyback period it is pulsed down to +25V; at the same time, G1 is pulsed from its normal negative operating potential up to cathode potential. The effect of this is to increase the beam entering G2 and to focus it through the G2 limiting aperture. Compared with a standard tube the gun therefore requires an additional pin connection for G5 and the registration pin is used for this purpose.

ANTI-REFLECTION COATINGS: The front surface of the faceplate stud of lead-oxide tubes reflects approximately 4.5% of the incident light. This reduces the contrast ratio and can give rise to ghosting. It also results in a small loss of tube sensitivity. Anit-reflection coatings have therefore been applied to the faceplate studs of the tubes to be used in the red, green and blue channels. ("Sound and Vision Broadcasting", Summer, 1970. Published by the Marconi Company, England.) ■

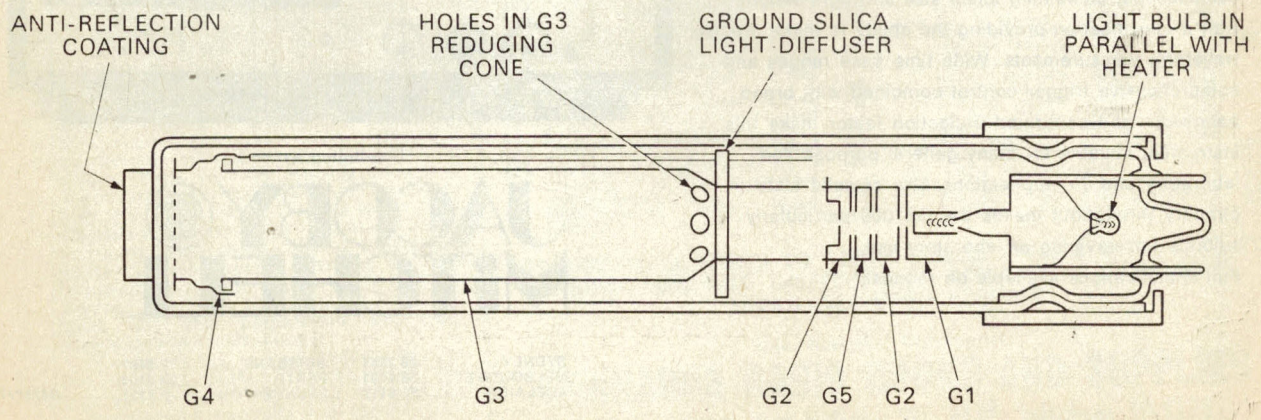


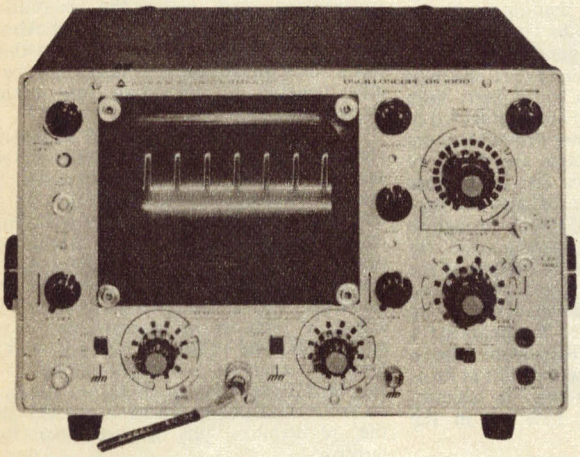
Figure 1. Major elements of the EEV lead oxide camera tubes.

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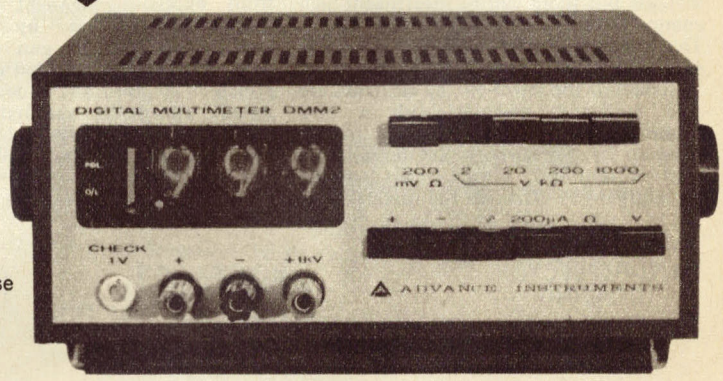
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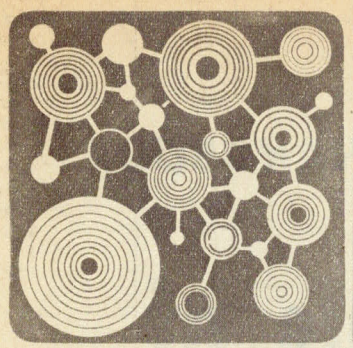


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SCIENTIFIC AND INDUSTRIAL NEWS

Computer checks pollution

The New York State Department of Environmental Conservation and Department of Health have implemented an automatic air and water monitoring system. Called the Empire State System, it provides for the automatic electronic monitoring of air and water conditions in the State, and the rapid transmission of the monitored data to an on-line Burroughs B3500 computer at the Health Department headquarters in Albany for immediate processing, evaluation and reporting.

In addition to the computer, the system includes: 12 water monitoring stations and 11 air monitoring stations located at critical sites around the State; a remote information centre at Albany and a telecommunications system. The field monitoring stations, in specially equipped trailers, have environmental sensors which measure either 10 water characteristics, including dissolved oxygen content, temperature and turbidity, or 18 air characteristics including sulphur dioxide concentration and relative humidity. The monitoring stations are fully equipped with pumping, sampling, and testing facilities.

Because of the need for special chemical analysis and testing on certain air quality values, the air monitoring stations are manned during eight hours of the day. The water monitoring stations, which are unmanned, are additionally equipped to automatically provide comprehensive information on how the monitoring equipment is functioning.

Miniature hearing aids

A spokesman for the Australian Telecommunications Development Association (ATDA) said recently that although hearing aids formed a little-publicised branch of telecommunications, astonishing progress had been made using advanced techniques developed in the main areas of communications. For example, new methods of storing energy, evolved to solve space-vehicle problems, had produced batteries about one-fourth the size of a 1-cent piece.

The industry divides hearing aids into four categories: body-worn aids, ear-level aids, in-the-ear aids, and spectacles-frame aids. The instrument worn on the body has become smaller, sometimes about the size of a cigarette lighter, and is thus more easily concealed within the clothing. A self-contained in-the-ear aid, developed in the USA less than two years ago, fits into the canal and concha of the ear and is almost unseen.

Newer than the in-the-ear hearing aid is an improved instrument built into the arms of spectacles. The latest system incorporates contra-lateral routing of the signal, which means that where the wearer has uneven loss of hearing the tiny microphone is fitted on his deafer side and what it hears is transferred to his better ear. It is directed to the other side through a wire embedded in the spectacle frame. In cases of severe loss of hearing in both ears, two microphones can be fitted, one on each side.

The ATDA spokesman said that the ideal would be a hearing aid contained wholly within the ear's inner canal and unseen except by close inspection. "We already have a microphone the size of a pinhead, we have the batteries, and we have the electronics", he said. "But we still have some things to work out – a small enough receiver and a method of regulating volume with a volume control which is small, yet capable of being adjusted by a finger".

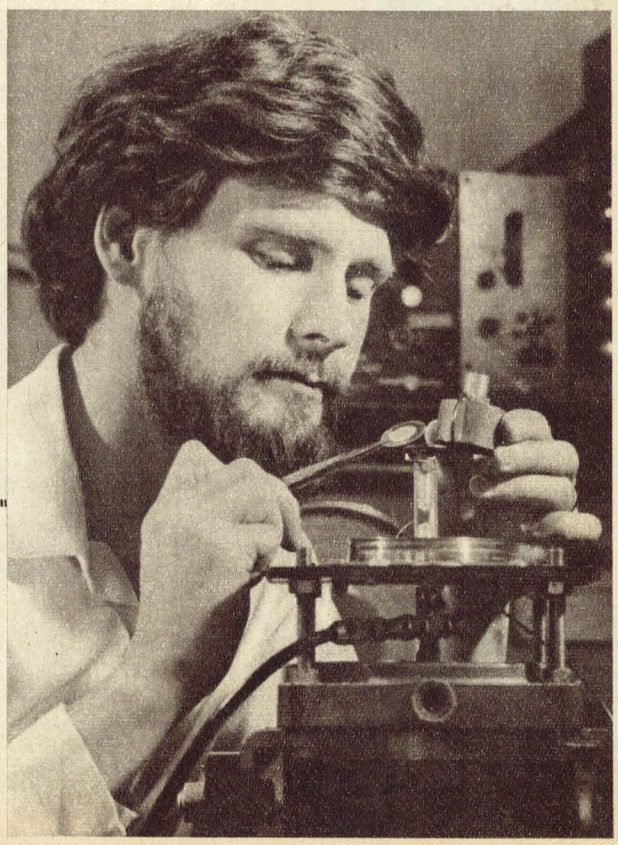
Not only people with an appreciable hearing loss use aids. Human response to higher frequencies normally diminishes with age, and the spokesman instanced a solicitor who used a hearing aid to enable him to enjoy music by amplifying the high notes which he otherwise would miss.

High efficiency klystron

An electrostatic depressed collector developed by the General Electric Company in the USA has increased the efficiency of a high-power broadcast klystron from 45 per cent to 67 per cent, according to Dr Theodore G. Mihran, a physicist at the company's research and development centre. Developed for space applications, the high efficiency klystron may help make possible communications satellites for direct and simultaneous nationwide television broadcasting, Dr Mihran said.

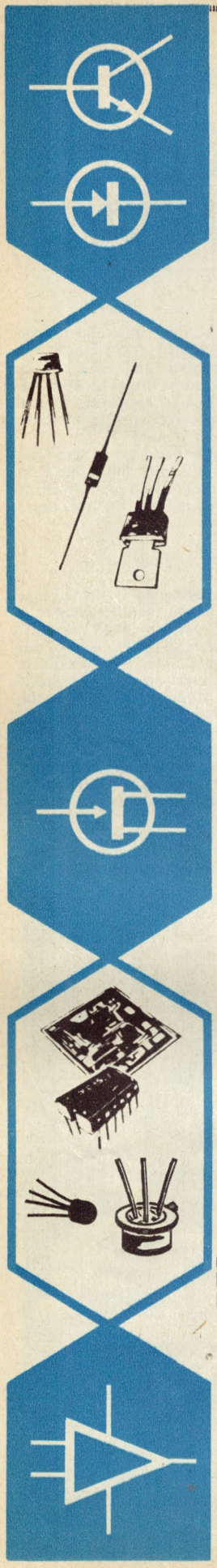
By virture of its increased efficiency, the tube's heat rejection system and the satellite's solar cells can be reduced; the former by two to three times, and the latter by more than a third. The combination of increased efficiency and size reduction is expected to permit smaller communication satellites with less power needed for launching.

The electrostatic depressed collector was developed jointly by Dr Mihran and Wendell Neugebauer of GE's Microwave Tube Operation. The research team used a computer to prove the idea



Microphony research

This scientist, at Britain's Atomic Energy Establishment, Winfrith, is measuring piezoelectric constant for a sample of PVC, with vacuum evaporated electrodes of indium. The work is part of a PhD thesis in which research is being carried out into the causes of microphony in cables used to convey small signals in reactor instrumentation. Though the main cause of microphony is triboelectric effect, a secondary cause is thought to be piezolectric effect in the polymer insulation used in the cables.



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of depressed collectors and to predict the performance over a wide range of tube efficiencies. Some 300 electron trajectories were calculated and efficiency predicted for each trial collector design. The team designed and built several types of collectors, including a 10-stage collector which recaptured 60 per cent of the energy normally wasted as heat and converted it back to electrical energy.

Although work at GE primarily involved a 3ft-long klystron at a frequency of 750MHz, the company considers there are no fundamental problems in reducing the size of the tube and collector by a scale of 20 while extending the frequency to 12GHz for TV transmission service.

Computer lectures

Infotech, the UK-based independent computer information and education organisation, has announced a greatly expanded series of lectures to be held in both the UK and Holland in 1971. The new series will involve 140 senior computing specialists from almost 100 organisations throughout the USA and Europe. It consists of 11 three-day lectures, five to be staged in London alone, and six to be staged in Amsterdam as well as in London.

The titles of the lectures are: Computer networks; High level languages; Application technique; Incompatibility; Interactive computing; Software economics; Mini computers; Operating systems; Data base management; Computing manpower; Computing economics. Details may be obtained from Infotech Ltd, Nicholson House, High Street, Maidenhead, Berkshire, England.

Laboratory exhibition

Labex International 1971, an exhibition of instrumentation, equipment and supplies for research and industrial laboratories, will be held at Earls Court, London from March 29 to April 2. There will be a number of important activities ancillary to the exhibition, including the 1971 Labex Lecture, "Electron spectroscopy for chemical analysis", to be delivered by Professor Kai Siegbahn of the Institute of Physics, University of Uppsala, Sweden.

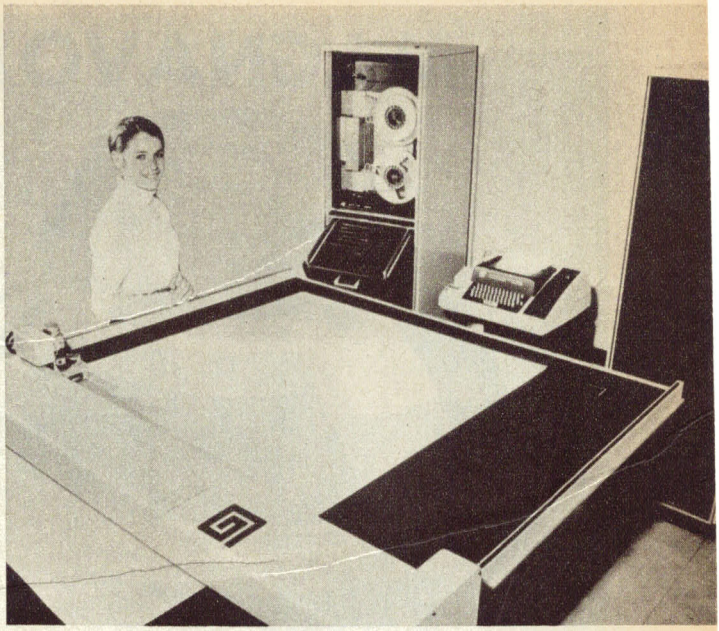
Discussion meetings will be held on the following topics: Safety and health in medical laboratories; Controlled environments for plant growth; New developments in electron microscopy; Photography in the laboratory. Further details may be obtained from UTP Exhibitions Ltd, 36-37 Furnival Street, London EC4A 1JH, England.

Millimetre waves

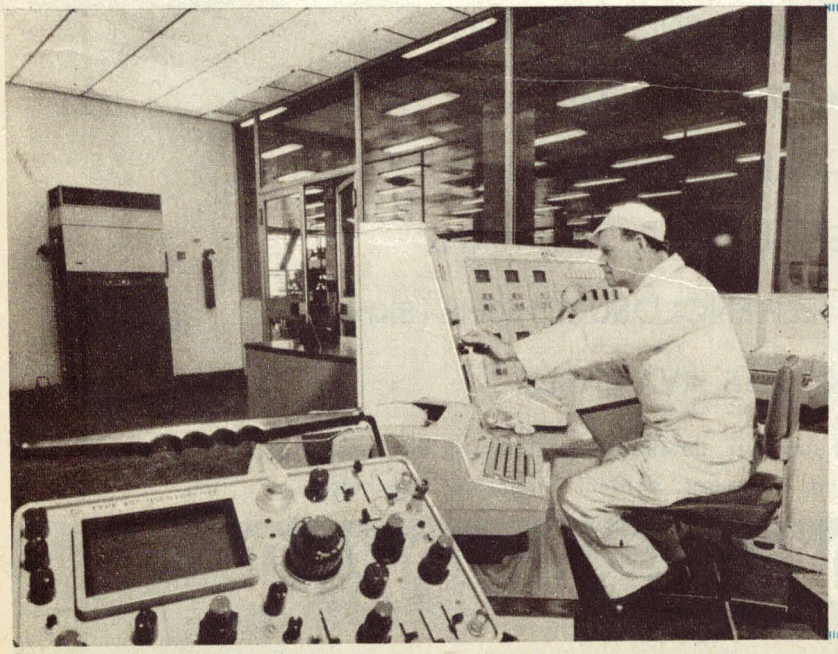
Early results from a millimetre wave experiment aboard the Applications Technology Satellite-5 (ATS-5) which is still in orbit indicate that NASA might be able to extend the microwave band to frequencies above 10GHz. To receive television signals from a communications satellite operating at about 10GHz requires a 40ft diameter antenna on the ground. By operating at 30GHz, the antenna need be only 15ft in diameter.

Before the ATS-5 was launched it was thought that rain and snow in the earth-satellite path might seriously limit the usefulness of the millimetre wave portion of the frequency spectrum. Results so far, however, indicate that only very heavy rainfall affects reliable communications and, moreover, frequency band "windows" exist where water vapour and oxygen absorption are low.

The experiment is providing amplitude and phase measurements on two independent test links at 15.3GHz (satellite-to-earth) and at 31.65GHz (earth-to-satellite) during measured and defined meterological conditions. One important answer being sought in these tests is how far apart must receiver stations be placed so that a single major storm does not block communications to both stations at the same time.



A Melbourne company has installed a Gerber automatic drafting system to be used in the preparation of maps for mineral exploration. J. K. Newman, a company mainly engaged in geophysical and geological work, is operating a Gerber 122 comprising a 1200 control with a Hewlett-Packard computer with 8K of core memory, teletypewriter, 400chars/sec photoelectric tape reader and spooler, and Model 22 drafting table with a 48in x 58in drawing surface. A Gerber GCD-1 large area co-ordinate digitiser and a 20,00chars/sec read-write magnetic tape drive has been added since this picture was taken.



Automated food production

Despite the apparent lack of activity in this picture of a UK soup manufacturing plant, production is going ahead at the fast rate of 15,000 gallons per hour. In use there is a computerised automatic materials handling system which serves five production lines with all materials required for the manufacture of some 40 different types of soup, in the required quantities and combinations, from stocks of 44 separate ingredients. The plant is staffed by only 20 men, two of whom are computer technicians. The project is a joint venture between H. J. Heinz and Co Ltd, Kitt Green, Wigan, Lancs; and GEC/Elliott Process Automation Ltd, Leicester, England.



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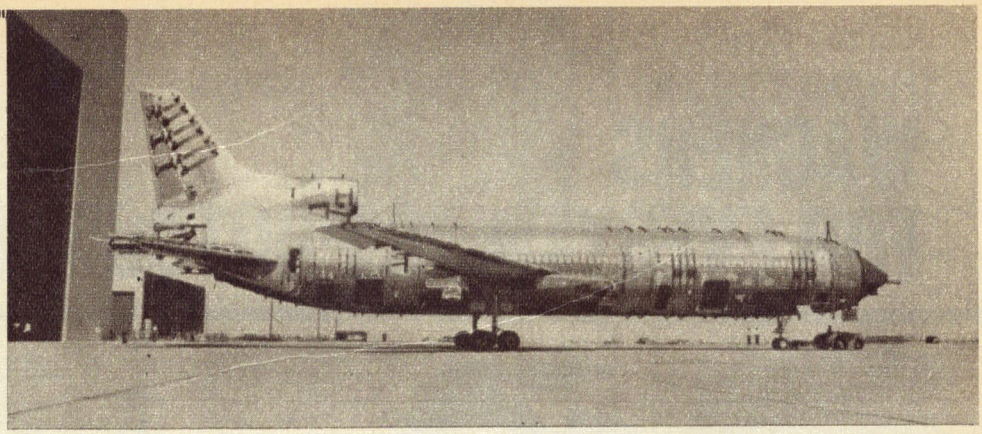
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Fatigue testing the Tristar



When the Lockheed Tristar jetliner made its maiden test flight recently, the soundness of the design had already been thoroughly tested in some 20,000 simulated flights, using this ground test version. The airframe bristles with loads frames, some 300 in number, which can be connected to hydraulic jacks to exert stresses similar to those encountered in flight. In less than two years, the test Tristar, located at Lockheed's plant at Palmdale, California, has simulated 15 years of airline service, including 36,000 takeoff, cruise and landing cycles, and unusual effects such as extreme air turbulence and hard landings. the Tristar, which is due to enter airline service late in 1971, is currently undergoing an extensive flight testing program.

Ocean science

Oceanexpo 71 (Salon International de l'Exploitation des Oceans) will be held in Paris , France from March 9 to 14. A new section of the exhibition, entitled "Electronics in Ocean Science", will demonstrate the electronics industry's concern with all aspects of ocean activity. Located in the centre of the Parc des Expositions, the electronics display will include acoustic equipment, underwater television, navigational aids, data acquisition equipment, oceanographic instrumentation, automation systems, underwater power sources, and systems for exploration and work in the oceans. (Technoexpo, Direction Generale, 8 Rue de la Michodiere, Paris 2e, France.)

Weighing in motion

The Victorian State Railways has ordered a British electronic system for weighing coupled rail waggons of up to 100-ton capacity while they are travelling at up to 5 mph. The system, designed by W & T Avery Ltd, is similar to two weighing-in-motion systems already installed in the UK. The system consists essentially of a load-cell rail-axle weighbridge together with static instrumentation to control the weighing cycle, compute actual bogie weights, operate digital indicators, and print out bogie and total waggon weights on continuous tape. (W & T Avery Ltd, Soho Foundry, Birmingham 40, England.)

Building by computer

A complete computer package announced in the UK recently will reduce the time and money spent by civil engineers on the production of their structural designs and drawings. Marconi Elliott Computer Systems, a real-time computer company, and Engineering Solutions Ltd, a computer bureau and software house, have introduced a computer hardware and software system capable of meeting a whole range of structural design and analysis applications. When incorporating a digital plotter, it will be capable of producing scale detail drawings of reinforced concrete structures.

Typical programs include the analysis of complex foundations, the design and analysis of continuous beams, soils analysis, loading on wall systems, water mains analysis, and many others. The capabilities of the computer package were demonstrated at Computer 70 held recently at the Olympia exhibition building, in London. (Marconi Elliott Computer Systems Ltd, Elstree Way, Borehamwood, Herts, England.)

Farming in the desert

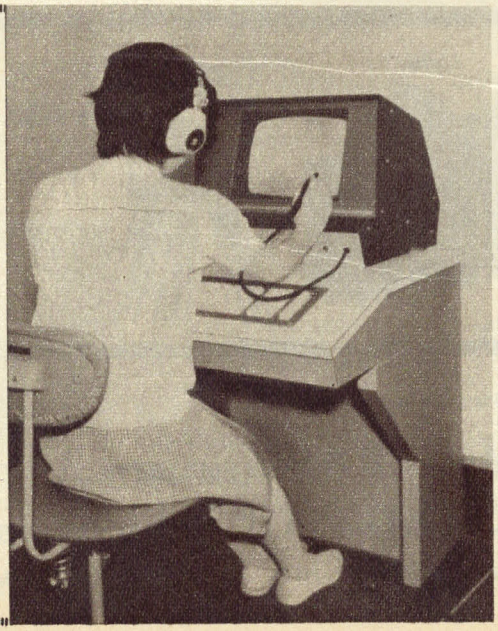
A fruit and vegetable "farm" under plastic, irrigated by desalted water, has been established on a small desert island in the Shiekdom of Abu Dhabi, on the Persian Gulf. Installed by the University of Arizona's Environmental Research Laboratory, the system uses waste heat given off by diesel-powered generators to desalt brackish well water. The fresh water is used on plants growing inside inflated plastic greenhouses. A high humidity is maintained and the heat controlled inside the greenhouses by recirculating the air through salty spray. The system is said to require about one-tenth the water required with irrigation cultivation in open air. The desalted water can be mixed with liquid plant food and delivered to the plants by tiny plastic hoses running between rows of tightly-spaced crops.

Cairns television station

The problem of getting a one-and-a-half ton four-wheel-drive front end loader to the summit of the 5,220ft Mount Bellenden Ker, in northern Queensland, was solved by using a helicopter transport. The loader was required for digging foundations for a television aerial tower and transmitter building. The transmitter will serve the Cairns region and areas west of the Great Dividing Range. The contract (worth about $1 million) for the transmitter station, a cableway for an eight passenger cabin car, and other works was awarded to McNamee Industries Pty Ltd of Sydney. The cableway will be about 3.3 miles long and rise 5,000ft up the eastern face of the mountain.

Computer-assisted instruction

A computer assisted instruction system based on tape cassettes has been developed in Japan by Hitachi. In addition to sound reproducing equipment, each student terminal has a television type display on which instructions from the associated computer can be displayed. To some types of questions, students can indicate answers with a "light pen". A class of 50 can be taught simultaneously with a maximum time of three seconds for each student to receive an instruction. Teaching programs can be compiled easily without technical knowledge of the computer.



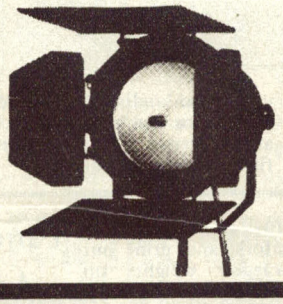
French PCM system

The first link in a PCM telephone system, a prototype exchange, was recently commissioned at Lannion, France. The telephone signals are sampled at regular intervals and a binary coded signal transmitted to line. By multiplexing, 32 telephone calls can be transmitted simultaneously on a single line. The system also offers a number of services for subscribers. A subscriber can automatically transfer a call that he receives to another telephone by dialling the number of a second subscriber. Conference circuits can be arranged by a person calling five pre-determined subscribers.

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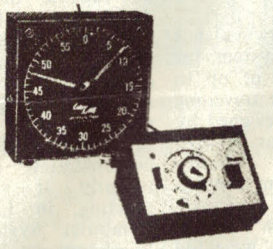
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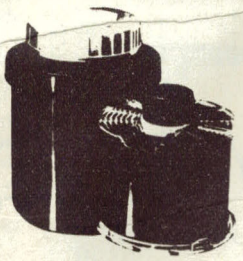


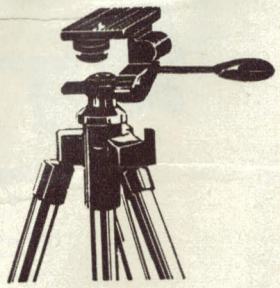
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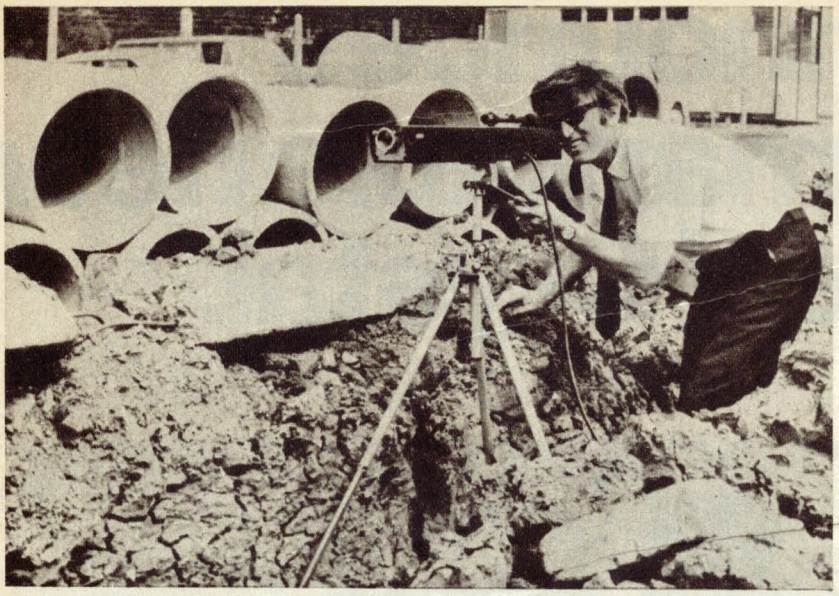
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Laser for civil engineering



A simple and safe laser projector which gives an accurate visible reference line for civil engineering construction work has been developed in the UK by Elliott Automation Radar Systems Ltd. Called Laserline, the new device (pictured above) contains a 1mW helium-neon laser light source whose beam is expwnded to a diameter of 15mm and focused to a parallel beam by an internal precision optical system. The use of an integral system improves rigidity and reduces warm-up drift. The red laser beam can be picked up with a simple reflector at up to ¼ mile even in sunlight. A telescopic aiming sight is mounted on top of the main housing. (The General Electric Co of Aust Ltd, 15 Whiting Street, Artarmon, NSW, 2064.)

Radio briefing for cars

Car-parking information will be available on private car radios under a new scheme announced for Los Angeles Airport, according to a BOAC report. The localised radio system, available on special frequencies, will tell drivers approaching the airport where parking space is available, and also inform them of any changes in flight schedules, delays or other special problems at the airport.

Distinctive signs on the roads within the radio area will tell drivers which frequency they should tune into on their car radios for the airport information. Transmission to the radios will be from cables buried alongside the road leading to the airport. The initial system will consist of a buried cable about two miles long, from which transmissions can be heard up to 200ft away. Bulletins to drivers will be recorded on automatic magnetic tape message repeaters at a central control point from which the announcer can observe traffic conditions on roads and parking spaces within the passenger teminal area.

Radio to aid new road

A contract for radio equipment to assist in the construction of a 22-mile road has been awarded by the Samoan Government to the Sydney office of International Aeradio Ltd (IAL). The company will supply and install SSB equipment for use in controlling the movement of trucks and graders. The road will be built around the northern coast of the island of Upolo from Apia to Faleolo where a new airport is planned. (International Aeradio Ltd, 283 Alfred Street, North Sydney, NSW 2060.)



Tactical radio

A new micro-miniaturised tactical radio that can be operated remotely has been developed in the USA by General Dynamics, Rockfeller Plaza, New York. It operates in the 2 to 30MHz range, and provides 280,000 channels, and its small size and lower power consumption makes it suitable for use as a manpack set or for vehicle installation. It operates with whip or doublet antennas and may be used to drive auxiliary amplifiers for base station or vehicle use. The set also has data handling capability.

Extensive use of microcircuits results in the radio being just 2.2in deep, 8.0in high and 10.0in wide. It weighs seven pounds. With battery, which adds only 4.0in to the height, the complete set weighs only 12.0 pounds. ■

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Australia isn't all that rides on the sheep's back. Radio transmitters do, too. Tiny ones strapped on their backs that 'beep' back information about body temperature, pulse rate, etc.

It's all part of a CSIRO research programme to find ways to improve sheep productivity. And every improvement in those radio transmitters helps the programme.

Pye Koldseal crystals are a major improvement because they are the first contamination free, metal encased crystal ever made. This means they will keep their frequency more precisely for a much longer time.

The secret is in the way they're sealed. Not hand soldered like other crystals. But cold welded. So dust and dirt don't get a chance. It's a new era in crystal purity.



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"Speed Sentry" For Safer Driving

There is no doubt that there exists an urgent need for greater safety on our roads and that, in the main, this is the responsibility of the individual driver. We believe that our "Speed Sentry" can contribute to greater safety by assisting responsible drivers to drive within the speed limit at all times.

By George Hughes

The combination of a well made road and a comfortable, quiet vehicle can easily create a condition of slowly increasing road speed; to the point where one is travelling a good deal faster than the prescribed speed limit and, by implication, a good deal faster than is safe on that particular road.

The rude awakening comes when we suddenly find ourselves facing an emergency: another vehicle which appears out of nowhere; a curve and road condition unsuitable for the speed at which we are travelling; or a sudden undulation which can make the vehicle airborne. Alternatively, we may suddenly become aware of a motor cycle alongside us and a curt command to "Pull over please driver".

Another situation with which most drivers will be familiar is that where one suddenly enters a 35 mph zone after travelling at 60 mph or more in a de-restricted zone. Conditioned to the higher speed, 35 mph seems like a crawl and try as one might to observe the restriction, the speed creeps up. And if, in an endeavour to avoid this, one pays more than usual attention to the speedometer, there is the real risk that proper attention is not given to the road.

At best, these situations risk the embarrassment of a fine and loss of points; at the worst a smash, with all the tragedy that this implies.

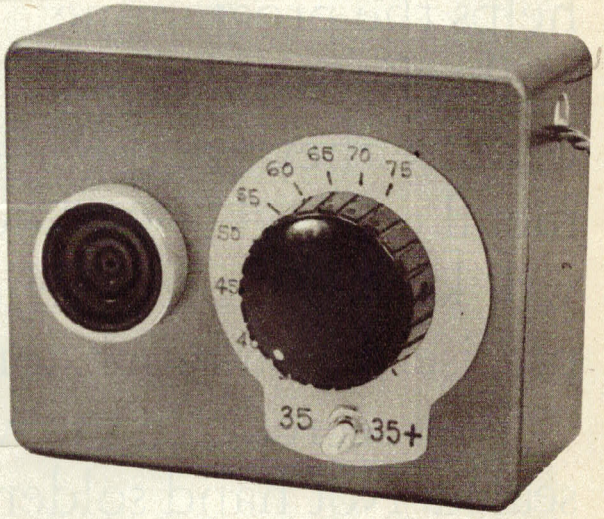
It is to avoid situations like this that we have designed the Speed Sentry. It is a simple alarm system which can be set to any maximum speed the driver cares to select, after which it will sound whenever this speed is exceeded. It may also be fitted with an additional preset position, available via a two position switch, which may be set to any commonly encountered restriction, such as 35 mph.

While such a device could be a complicated mechanical device deriving information from the speedometer, there is a lot more appeal in a simple electronic unit which derives its information from a train of electrical pulses.

A convenient place to obtain such pulses is from the ignition system. These can be applied to a circuit that is capable of triggering an alarm when a nominated pulse rate has been exceeded.

The main drawback when using ignition pulses to measure road speed is the fact that only in top gear is the reading a true one. At other gear ratios the alarm will sound when the engine speed reaches the equivalent of the setting for top gear. It may be possible to overcome this, with a manual transmission, by mounting a microswitch on the gear shift quadrant so that the alarm circuit will be active only when top gear is selected.

Vehicles with automatic transmission also present some problems. Automatic transmission systems fall into two broad categories. Two speed types usually incorporate a wide range torque converter which, because of the coarse range of only two speeds, is used continually to optimise power transfer for best performance. Consequently, its influence on engine speed due to load and throttle setting is continually varying. Unfortunately, in these circumstances the Speed Sentry's behaviour will be dictated by a varying engine speed not necessarily proportional to road speed.



The finished "Speed Sentry" housed in a diecast box. The dial is calibrated in miles per hour, commencing at 35. The switch permits the 35 mph setting to be selected without disturbing the variable setting.

The second type of automatic transmission (usually a three speed type) incorporates a torque converter with a narrower range than the two speed type. In the top speed position it has the advantage of a mechanical locking device which couples the engine drive shaft to the tail shaft. With this type of automatic transmission, engine speed is proportional to road speed, just as in a manual transmission.

In spite of the minor disadvantages which are involved, we felt a device working from the ignition system had the overwhelming advantage of simplicity. On the other hand, for those who feel so inclined, there is no reason why such a device should not be triggered from a pulse generator coupled to the tail shaft or rear axle. There are plenty of sensing devices which could be used, such as magnets and coils, magnets and reed switches, or even lamps and photocells. All one needs is the ingenuity to design it, the skill to find a suitable place to mount it, and the patience and facilities to fit it to your particular vehicle.

In the meantime you might care to build this unit anyway and connect it to the ignition system until such time as your axle driven generator is a practical reality. Our unit connects across the distributor contacts, ie, between the active distributor terminal and chassis. A brief description of how the circuit functions should assist readers to understand it.

The pulses from the ignition circuit are fed to a diode pump through a series limiting resistor. The output of the diode pump produces a DC level proportional to pulse rate. This is applied to a potentiometer circuit, connected in turn, to the input of a Schmitt trigger circuit.

The action of a diode pump circuit may be understood by referring to figure 1.

At the input to the diode pump circuit is an RC network R1, C1. The purpose of the network is to differentiate the incoming train of rectangular pulses from the ignition circuit. "Differentiation" is a process whereby the rectangular pulses fed into the circuit are converted into spikes, and, most importantly, spikes which have a constant "width" (more correctly, area) regardless of the width of the rectangular pulse from which they are derived. It is this vital difference between the original pulse, and the spike derived from it, which makes it possible to "count" the pulses, and produce a direct voltage whose value is indicative of the pulse rate.

In the February 1960 issue of this magazine, an extensive treatment of the process of diffentiation and its application in an automotive tachometer was given. Other texts, such as Television Engineering, Edition 2 by Fink (McGraw-Hill) and Basic Television by Grob (McGraw-Hill) and similar books on the subject, give a more thorough explanation, and are recommended for those who wish to pursue the subject further.

In order to generate the differentiated spikes, C1 and R1 must be of such values

that C1 charges very rapidly on the application of a pulse. It is the brief pulse of current which flows during this charging function that constitutes the spike. Since C1, once charged, cannot pass any more current, the length of the rectangular pulse has no effect.

At the end of the rectangular pulse, C1 must be discharged rapidly, before the next pulse appears. This can only take place through the input (or generator) circuit which, ideally, should have zero impedance. Since the generator is, in this case, a pair of breaker points, and they are closed during the "no voltage" period, this ideal is virtually achieved.

Under these conditions, ie, both input voltage and impedance at zero, C1 is discharged through R1, the breaker points, and D2, as indicated by the current loop Ia. When the next square pulse is applied to the input terminals, the capacitor C1 charges again via the current loop Ic.

That portion of the circuit to the right of the series diode D1 – C2 and R2 – is a " summing" or "integrating" circuit.

As each spike is generated, its current path (Ic) is via the diode D1 and C2. As a result of this current, C2 will acquire a certain amount of charge and, thus, a certain voltage will be developed across it. As each following spike or pulse of current flows, C2 will add to its charge and the voltage across it will rise.

Capacitor C2 would, in time, become fully charged, with the voltage across it equal to the spike amplitude, if some method of controlled "bleed" was not present. The load resistor R2 across C2 performs this function (Current loop Ib).

Thus, when we feed a continuous train of pulses into C2 they attempt to charge it while, at the same time, R2 attempts to discharge it. The end result is a degree of charge, and a value of voltage, which is a balance between these two. Since the discharge function is fixed by the value of R2, the actual voltage is determined by the variable factor; the rate at which spikes are fed to C2. Thus the voltage across C2 becomes a direct indication of the rate at which pulses are being generated in the ignition system.

The action of this circuit is analogous to that of a pump – say a water pump – which is delivering small bursts of liquid into a large container. Hence the coined name; "diode pump".

The Schmitt trigger circuit (figure 2) consists of two amplifiers connected so that only one stage can be fully conducting at any one time. It has the desirable characteristic of a rapid change-over from one state to another if the input voltage exceeds a certain level, and will change back to its original state when the input voltage drops below the first level by a certain amount.

The high and low input voltages are called the "upper trip point" and the "lower trip point" respectively; the difference voltage between them, is called the "hysteresis".

The upper trip point is equivalent to the sum of the two voltages Ve and Vin when the transistor TR2 is conducting. The lower trip point is equivalent to the voltage Ve when the transistor TR1 is conducting.

The value of the voltage Ve is that developed across the resistor R4 by the current flowing through the transistor TR2 when it is conducting, or TR1 when it is conducting. If the collector resistors for each transistor (R1 and R5) are identical, the voltage Ve across the resistor R4 will be constant because of identical current flow through either transistor.

If the currents through the transistors are not the same, the voltage Ve developed across R4 will not be constant, and consequently, there will be a wider hysteresis than if the resistors R1 and R5 were equal. In some applications of the Schmitt trigger, this is a very handy characteristic.

In our case, we have aimed for a width which necessitates a reasonable reduction of pulse rate at the diode pump to change state. This is equivalent to a reduction of vehicle speed to a few miles per hour below that as set up by the motorist.

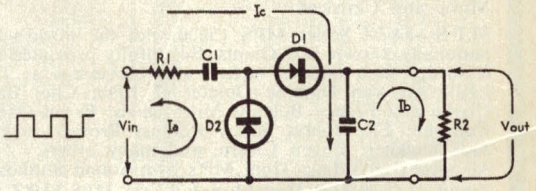
Reference to the main circuit will show that the first part of it is the combination of the diode pump and the Schmitt trigger. The output from the diode pump is fed to the Schmitt trigger via a potentiometer network, which is really R2 of figure 1. One part of this network is a preset variable resistor and one a variable pot. By suitable selection, two conditions of DC output from the pump circuit can be fed to the Schmitt trigger circuit. The first output is from the top of the preset resistor which is adjusted to correspond to the speed limit of 35 mph. The second output is from the moving contact of the variable potentiometer whose position can be set to any speed above the 35 mph limit.

When the DC input voltage is high enough for the Schmitt trigger to change state (ie TR1 conducting), the cutoff condition of TR2 allows its collector potential to rise. Current then flows in the base circuit of TR3, via a voltage divider, causes it to conduct fully, and sounds a Sonalert alarm connected as TR3's collector load.

Ignition voltage spikes are eliminated at the input to the diode pump and Schmitt trigger with small capacitors. These play no real part in the time constants of the system.

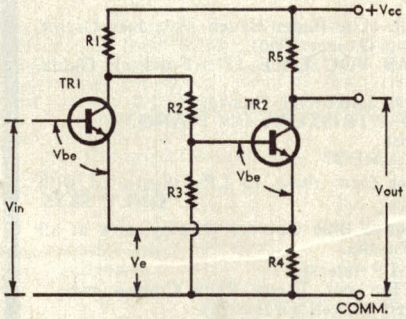
Although we have nominated a

Figure 1. How the "diode pump" works. It is a differentiating network, such as used in other tachometer circuits, plus an intregrating network producing a DC output proportional to speed.



BASIC CIRCUIT OF A DIODE PUMP

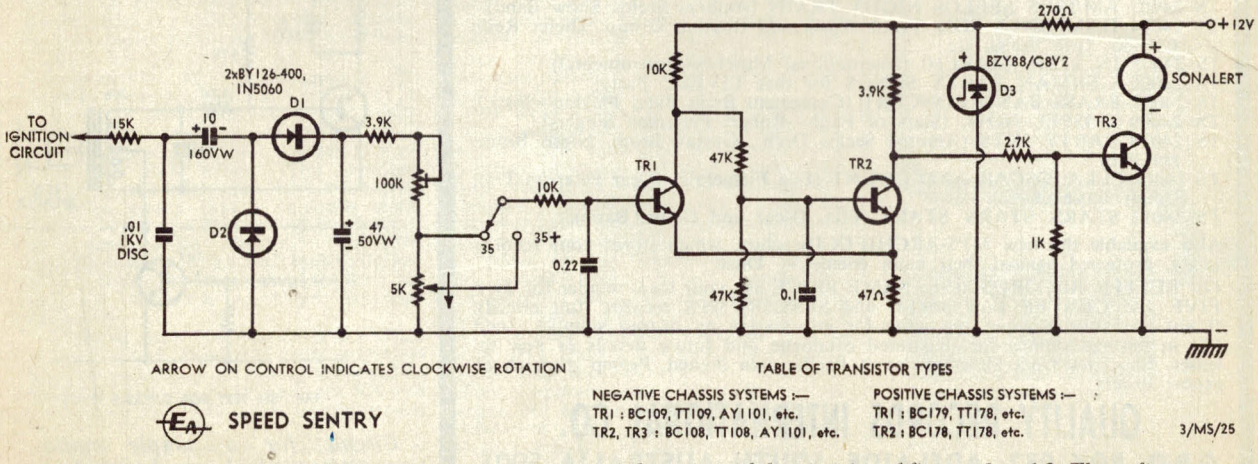
Figure 1



BASIC CIRCUIT OF A SCHMITT TRIGGER

Figure 2

Figure 2. The Schmitt trigger. Normally, TR1 conducts and TR2 is cut off. Input from the diode pump cuts off TR1 and causes TR2 to conduct.



SPEED SENTRY

The circuit diagram of the Speed Sentry, which is a combination of the circuits of figures 1 and 2. The refinement over figure 1 is the .01uF 1KV spike suppression capacitor across the input. The main addition to figure 2 is the alarm system in the output.

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Sonalert as the alarm proper, other devices could be used. The main advantage would be a saving in cost, particularly where the junk box can supply all or most of the parts required. A typical alternative is the Acoustic Signal Unit described in the November 1968 issue (File No 1/MS/5). We have provided an auxiliary circuit suggesting how this could be coupled to the Speed Sentry in place of the Sonalert.

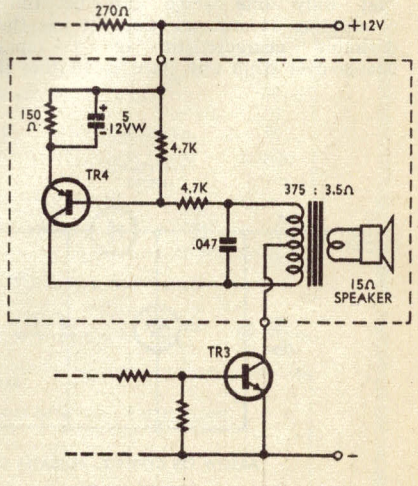
As it is drawn, the circuit of the Speed Sentry assumes a negative chassis electrical system of the vehicle. For positive chassis electrical systems, reverse the pump

PARTS LIST

1 Metal box approx 5in x 4in x 2in (eg STC type 43BOO).
1 Piece 0.15in Veroboard (see dw'g).
1 Type SC628 Sonalert, or alternative alarm device (see text).
1 5K linear potentiometer.
1 100Kpreset potentiometer.
1 Large knob.
1 Miniature single pole, 2 way toggle switch.
1 10uF 160 volt electrolytic.
1 47uF 50 volt.
1 0.22uF 100 volt polyester.
1 0.1uF 100 volt.
1 0.01uF 1KV disc ceramic.
2 BY126-400 or 1N5060 diodes, or similar.
1 BZY88-C8V2 zener diode.
3 Silicon transistors (see circuit).
1 47 ohm ½ watt resistor.
1 270 ohm.
1 1K.
1 2.7K.
2 3.9K.
2 10K.
1 15K.
2 47K.
Foam plastic, adhesive, bolts, hookup wire, scale, lacquer, etc.

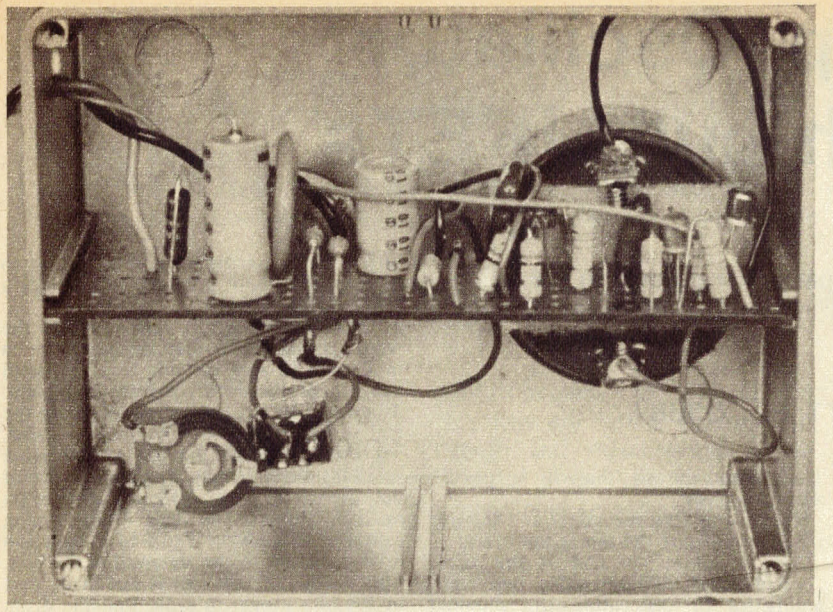
diodes, the two electrolytic capacitors, the zener regulator diode, the Sonalert connections, and replace all transistor types with their PNP equivalents. Types for both polarities are suggested in the table on the circuit diagram.

A convenient housing for the Speed Sentry is a die-cast box such as the STC 43B00. This box has slotted ribs centrally placed in each side, which form a simple

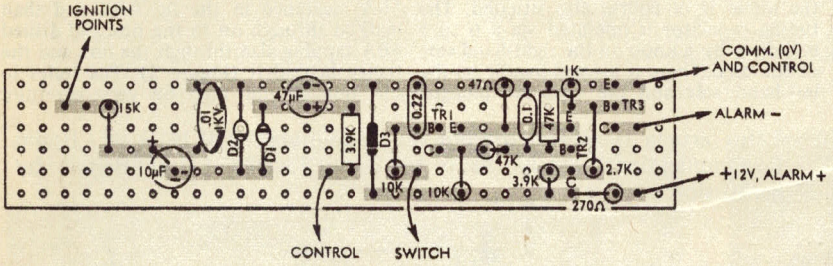


TR4 : SEE TEXT FOR SUITABLE TYPES

Circuit for a simple audio oscillator which can be used in place of the Sonalert. The method of connection into the circuit is also shown.



Internal layout of the Speed Sentry. The 35 mph preset pot (lower left corner) is mounted on the toggle switch. Note how the board is mounted in slots in the diecast case.



The layout of components of the Speed Sentry viewed from the component side of a 0.15in Veroboard. Cut and trimmed to the correct size, it should fit between the guides of the box.

and convenient anchorage for the component board.

However, such an elaborate box is not strictly necessary. Almost any metal box would do provided it has enough room for the few components. Our more ingenious and less affluent readers will doubtless think up numerous alternatives, probably involving discarded containers of one kind or another. And, with a little careful treatment and a coat of paint, there is no reason why these should not be perfectly adequate.

The variable potentiometer, the Sonalert, and the optional selector switch all mount within the box as shown in the photograph. Small strips of foam plastic, glued to the back of the Sonalert and the inside surface of the back cover press against each side of the component board.

The component board is made from Veroboard. The layout of the board with component positions is shown in the accompanying diagram.

By placing a large knob on the shaft of the variable control, an easy-to-read scale can be placed on the Sentry's box so that one can quickly set it to any prevailing limit where speed zoning applies.

It would be virtually impossible to make available a scale for the Speed Sentry, as there are so many factors influencing the calibrations. Apart from component spreads, there are the characteristaics of individual vehicles such as differential ratios, wheel and tyre sizes number of engine cylinders, etc. All have to be taken into account and each scale individually calibrated.

If a small toggle or slider switch is provided, the variable control can be left at a particular setting when operating at tne 35 mph setting. When a higher speed zone is re-entered a flick of the switch places the Sentry at the higher setting of the variable control.

When no switch is used for selection, the 35 mph condition is equivalent to the minimum position of the variable control.

The 35 mph setting should be made first by setting the preset potentiometer with the toggle switch in the "35" position or the variable control at minimum (if no toggle switch is used).

With the assistance of another person, either as driver or passenger, run the vehicle up to a steady 35 mph and adjust the preset pot from its maximum resistance setting towards low resistance until the alarm sounds.

If a calibrated scale is to be used, advance the variable control to the high side of the next desired calibration and run up to this speed. Reduce the setting of the variable control until an alarm is heard, and mark this on the scale card. Repeat the above procedure for each limit.

It is not essential to incorporate a calibrated scale. In fact, it has been suggested that using the scale may call for more diversion of one's attention from the road than is desirable, particularly at the higher speeds.

The easiest way to set the Sentry without diverting one's attention from driving is to turn the knob position above the desired limit, run up to the speed

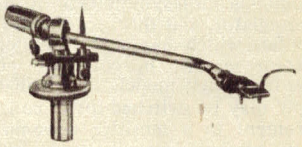
(Continued on page 151)

MADE FOR EACH OTHER...

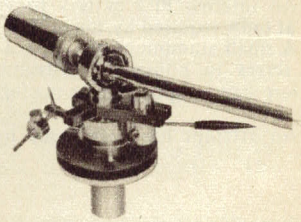
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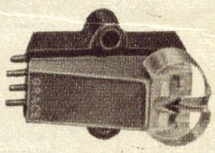
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A VHF Dip Oscillator using push-pull JFETs*

A design which should be of particular interest to the radio amateur working on the VHF bands. It is useful to beyond the 420-450MHz band.

by A. L. MYNETT, BSc, G3HBW

The dip oscillator described here covers the band from 29 to 460MHz in four overlapping ranges, with plug-in coils or loops as tuning elements. It was designed to provide, in conjunction with the HF dip oscillator featured in the April 1966 issue of the RSGB *Bulletin* (and in the *Radio Communication Handbook* and the VHF-UHF *Manual*), complete coverage from 0.6 to 460MHz.

The ranges of the two instruments overlap from 29 to 150MHz, but the new model provides more satisfactory operation than the original one from 80 to 150MHz.

The dip oscillator employs two type 2N5245 (TIS88) junction-gate FETS in a Kalitron circuit, tuned with a split-stator 43pF capacitor (Figure 1). A balanced diode detector is used, to avoid introducing non-symmetrical loading on the oscillator, and this feeds a BCY70 DC amplifier which has a 1mA meter in its collector circuit. In common with the lower-frequency model, the oscillator DC supply may be switched off to convert the instrument to a sensitive wave-meter or, when phones are plugged into the collector-circuit jack, to a modulation monitor.

An internal PP3 battery provides the 9V at 6mA required by the unit.

A small aluminium box with a flanged lid serves to house the instrument, the battery being clipped inside the lid (Figure 2).

An attempt has been made to design the instrument so that it is possible simultaneously:

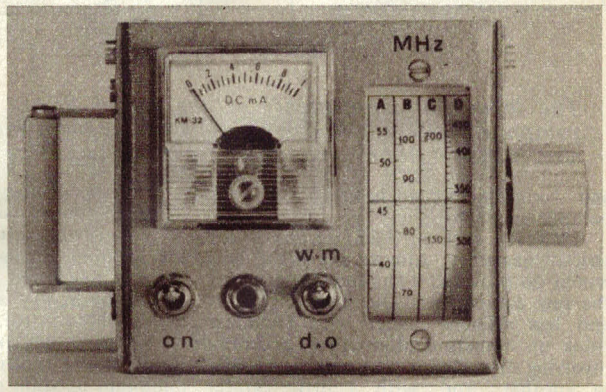
(a) to observe the meter and the dial,
(b) to operate the tuning knob, and
(c) to point the coil at the circuit under test, without either performing acrobatics or dislocating the shoulder.

This has been achieved by mounting the tuning capacitor laterally with a drum type of dial which may be viewed through a rectangular window at the front, where the meter is of course also situated. The tuning capacitor is operated via a 6 to 1 ball-drive by a knob on the right-hand side of the box. There is a small handle on the left-hand side and the coils are plugged into a socket on the back. It is possible to reverse the whole arrangement to suit a left-handed operator.

The DC amplifier transistor and the main components are mounted on a miniature 10-way ceramic tag-strip, with one tag removed to clear the dial-drum. This tag-strip is placed directly above the coil socket at the back of the unit, and, for those without the use of miniature soldering irons, it may to a certain extent be pre-wired. Two 18swg aluminium brackets support the ends of the tuning capacitor (Figure 3). The 6 to 1 reduction drive is bolted to the side-wall of the box. This particular side-wall is not made part of the box proper in order that the drum and drive may be more easily fitted to the tuning capacitor.

The four holes required for clamping the lid against the box should be drilled 6BA clearance in the lid first, and then marked through on to the box and drilled 6BA tapping size through the box and the flange behind it (Figure 2). The holes in the box should then be very carefully

*This article is reprinted from the September 1970 issue of "Radio Communication", the Journal of the Radio Society of Great Britain, by permission.



The completed dip oscillator, viewed from the operating side. The drum-type dial makes the instrument very convenient to use.

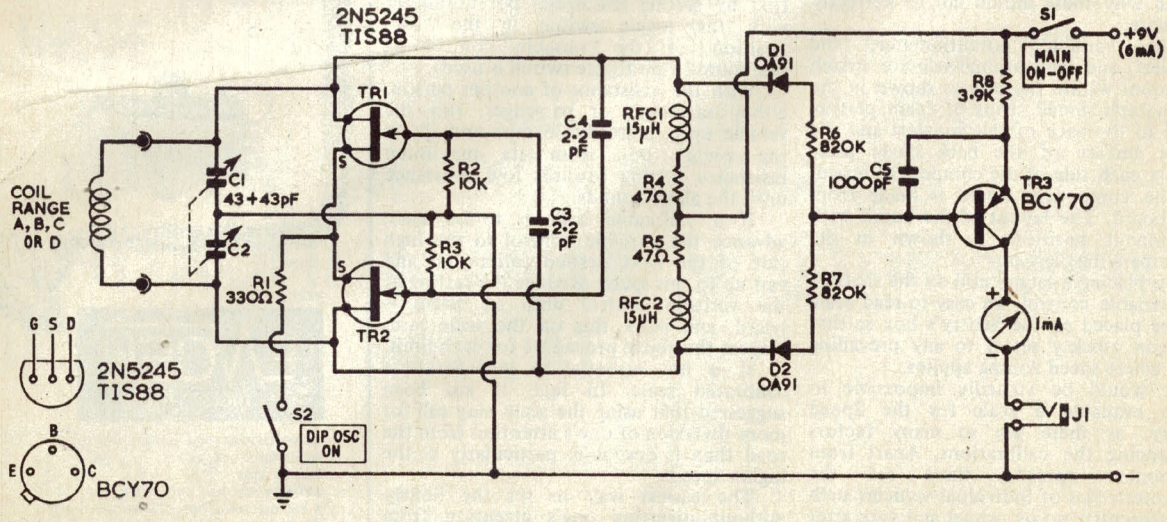


Figure 1: The circuit of the VHF dipper. Note the use of a balanced diode detector.

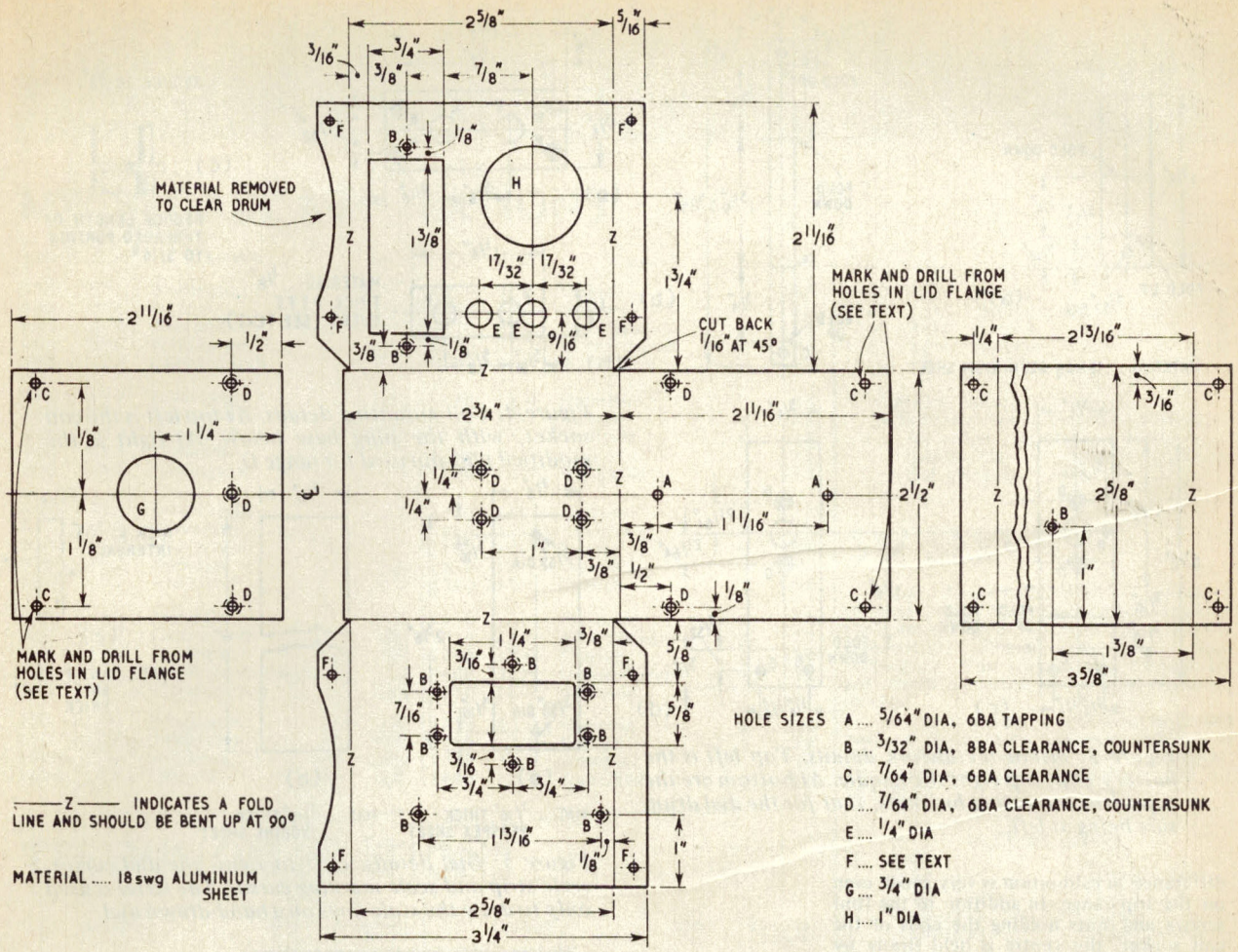
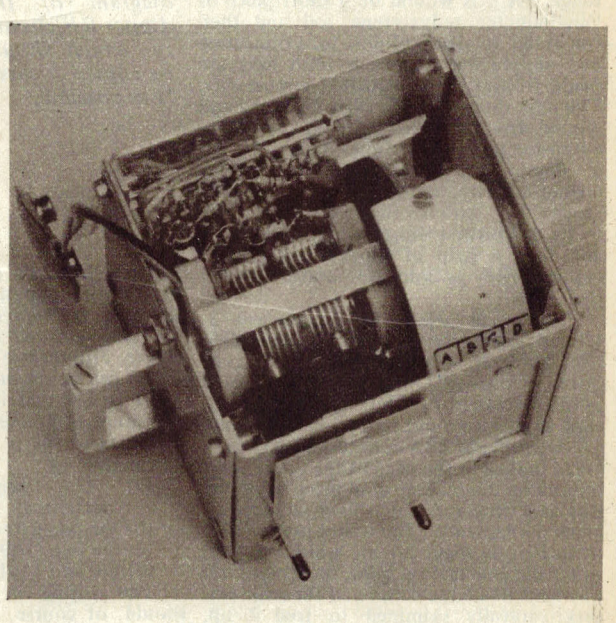


Figure 2: Metalwork details for the dipper case and lid. Note that the hole "H" is dimensioned to suit a small Japanese meter in which the barrel is threaded for a single large mounting nut.

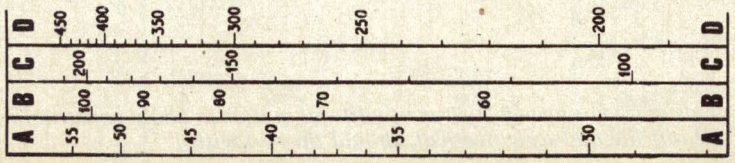
drilled for 6BA clearance, leaving the 6BA tapping size holes in the flange, which should then be tapped. A similar procedure should be followed with the holes in the bottom of the box, resulting in four 6BA clearance holes in the box and corresponding 6BA tapped holes in the flange behind each of them.

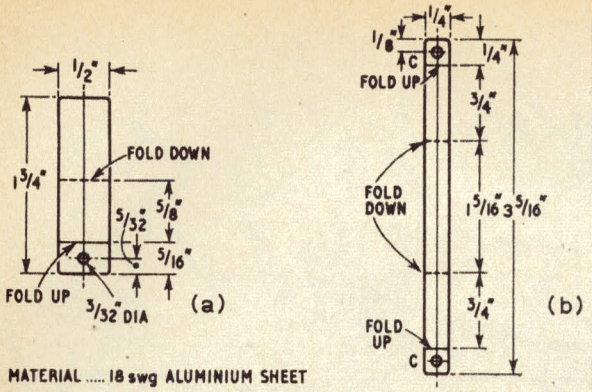
The coil socket and the coil mounting strips are made from 1/8in-thick PTFE sheet, although polythene or even polystyrene are acceptable (Figure 4). Two OZ-type wander-plug sockets are mounted on the socket strip. It is probably best to remove most of the plastic material at the open end of each socket by cutting carefully around it with a fine hacksaw and then cleaning up the remainder with a file. Two nuts will then be required per socket to fix it. The two fixing holes at the rear of the socket strip on the drum side of it should be countersunk to accommodate the 8BA nuts so that they do not foul the drum. Slightly undersized holes are drilled or reamed in the four coil-mounting bases and then the suitably-shortened OZ plugs are "self-tapped" into these holes.

In the prototype model, one 3mm and one 4mm plug and socket were used to obviate inadvertent reversal of the coils, but this precaution is not now thought to be absolutely necessary as the resulting



The dipper with its lid removed, showing the dial, split-stator capacitor and most of the RF wiring. Below is a full-size reproduction of the dial scale.





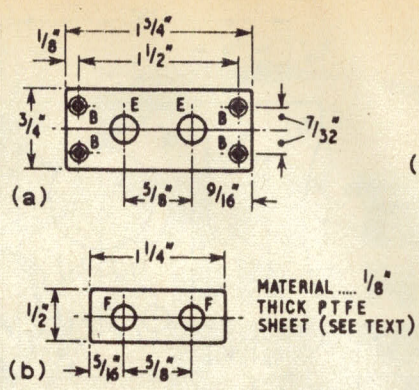


Figure 4: Coil mounting details. At top left is the coil socket, with the plug base below. At right is the modified plug pin used for range D.

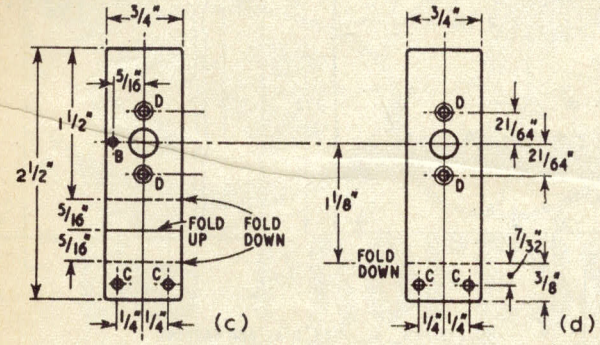


Figure 3: Minor metalwork details. Top left is the battery clip, top right the handle. At bottom are the capacitor mounting brackets, that for the dial drum side being at left.

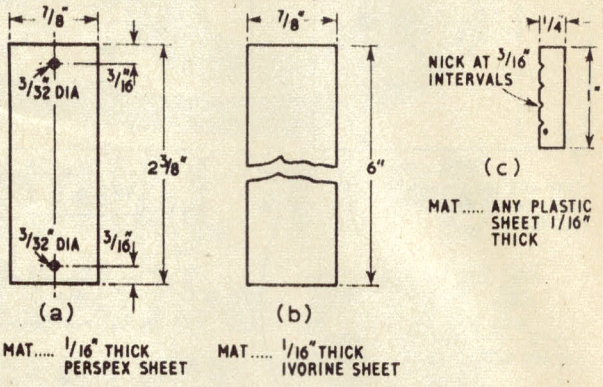


Figure 5: Dial details. Left to right, the dial cursor, scale strip and scale marking cursor. The latter is used only to draw the scale lines on a hand-drawn dial.

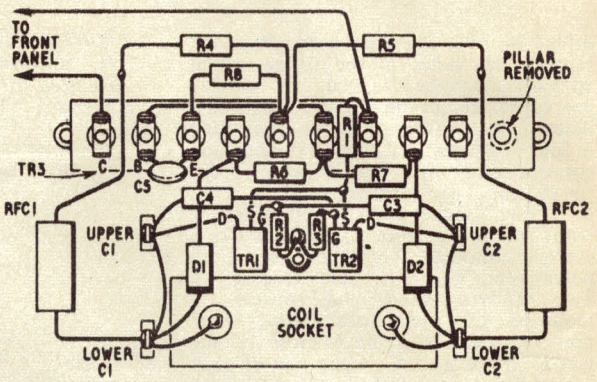


Figure 6: A wiring diagram of the dipper RF circuitry, which should be copied as closely as possible.

difference in calibration is very small, even on the top range. In addition to the four screws and nuts holding the ends of the coil socket, the centre is held firmly by stretching a length of 18swg wire between two soldering tags fixed to the box; the upper one of these is also used as an earthing point for the gate resistors.

The coil for the lowest frequency range, "A", is wound on a short piece of ½in-diameter polystyrene rod and then cemented in place (Table 1). Connecting and supporting legs each 1¾in long are made from 13swg enamelled copper wire. The next range, "B", is self-supporting and wound directly with 13swg wire, also with extension pieces 1¾in long. Range "C" has a simple rectangular loop of 13swg enamelled wire, and the highest frequency range, "D", requires the two plug sections to be still further shortened (see Figure 4), and then a strip of copper or beryllium copper sheet is soldered straight across their ends.

The scale drum is a standard 2-1/8in-diameter type, with a bush drilled ¼in diameter, and is intended for cord drives. However, for this application a 7/8in-wide strip of white plastic sheet or card is glued around its periphery (Figure 5). A couple of 8BA countersink screws in holes tapped in the edge of the drum assist in holding the scale strip in place while the glue is setting and may of course be left in place permanently. The writer used 1/16in thick Ivorine sheet for the scale and then, when the glue had set hard, the drum bush was held in a lathe collet and the scale was very carefully skimmed to true it up, which also helped to make a good surface for writing upon in Indian ink. *(A full-scale reproduction of the strip with the scale printed on it is given in this article. The reverse side carries no print so that it can be cut out by constructors.)*

It is essential in most cases that the miniature components specified should be used (see parts list). This applies particularly to

(a) the two drain-gate 2.2pF capacitors;
(b) the two gate-leak 10K resistors;
(c) the two OA91 diodes; and
(d) the two 15uF RF chokes.

The wiring in the main RF circuit should, of course, all be kept very short (Figure 6). This applies especially to the oscillator common-source lead (no more than ¼in long), the wires to the 2.2pF feedback capacitors, and the leads from the FET drain terminals to the tuning capacitor upper lugs. The upper and lower stator connections of the tuning capacitor are strapped together with a 3/16in-wide piece of copper foil. Also, the tuning capacitor main rotor terminal is connected to an 8BA soldering tag on the fixing bracket by means of a similar copper foil strap.

It cannot be too strongly emphasised that the above mentioned points and the wiring scheme shown in Figure 6 and in the photographs must be rigidly followed

(This space has been left clear of editoral matter to allow constructors to cut out the dial scale overleaf, should they so wish.)

LIST OF COMPONENTS

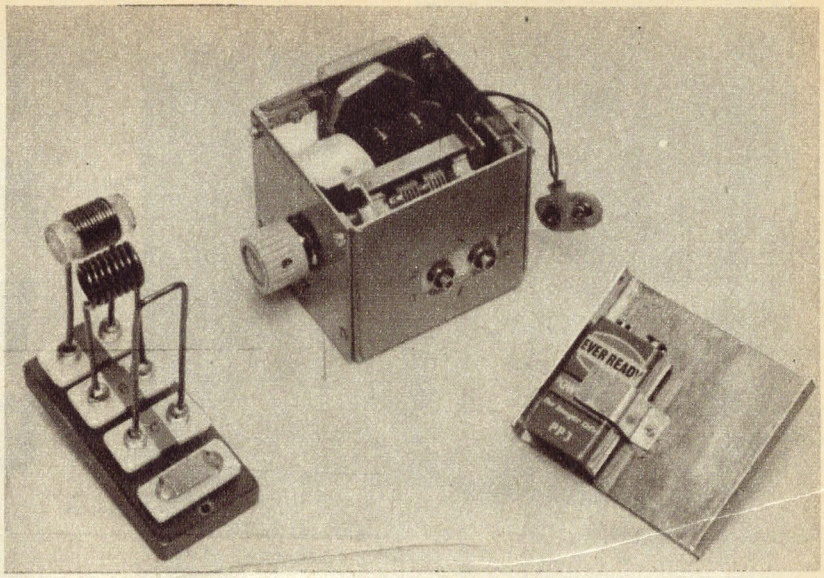
1 Metal case, 2¾in x 2-11/16in x 2½in, detail as in figure 2.
1 1mA meter, 1¼in square, single nut fixing.
1 3.5-43pF split-stator capacitor (Jackson type C808 or similar).
1 Planetary reduction drive, 6:1 ratio (Jackson type 4511 or similar).
1 2-1/8in diameter dial drim, for ¼in shaft.
2 Miniature SPST toggle switches.
1 3.5mm miniature phone socket.
1 Miniature 10-way ceramic tag strip.
1 Miniature 9V battery and connector (PP3).

SEMICONDUCTORS
2 2N5245 junction FET (TIS88).
1 BCY70 or similar silicon PNP.
2 OA91 or similar diodes.

RESISTORS
2 x 47ohm ¼ watt, 1 x 330ohm ¼ watt, 1 x 3.9K ¼ watt, 2 x 10K ¼ watt (must be miniature), 2 x 820K ¼watt.

CAPACITORS
2 2.2pF miniature ceramic.
1 .001uF ceramic.

MISCELLANEOUS
2 x 15uH peaking chokes; 4 x 4mm OZ plugs, 4 x 3mm OZ plugs; 1 x 4mm OZ socket, 1 x 3mm OZ socket; wire for coils;PTFE sheet for coil bases; connecting wire, nuts, bolts, solder, etc.



The dipper with its lid removed, showing the battery clipped to the lid underside. The plug-in coils are also shown, mounted in a storage holder.

TABLE 1: COIL DETAILS

Range A	29 to 55 MHz	12t 22swg enam c/w on ½in polystyrene rod (1in long), 1¾in drill, (13swg).
Range B	50 to 109 MHz	8t 13swg enam wound on ¾in drill, 1¾in legs.
Range C	97 to 220MHz	5/8in wide, 2 7/8in long loop of 13swg enam wire.
Range D	190 to 460MHz	5/16in wide, 11/16 long 26swg (or near) copper or beryllium copper strip soldered directly across plug ends.

if satisfactory operation up to the top of range "D" is to be obtained. The intrinsic problem of covering the top range with this type of design can perhaps better be appreciated if one thinks about making a GDO for 46MHz with a split-stator tuning capacitor 1ft 3in long. In the prototype, the top frequency could not be raised above 410MHz while simultaneously achieving satisfactory operation over the whole of the range until the strapping of the tuning capacitors stators was introduced. Incidentally, the oscillator circuit alone, without the tuning capacitor and with a fixed tuning loop, has been made to work well at over 650MHz.

The existence of spurious dips and "suck-outs" in the various ranges is, in this design, very much bound up with the quality of the two RF chokes. If troubles of this kind are experienced, other chokes should be tried. It is very difficult to find components with no strong resonances over the whole of such a wide band but, nevertheless, the prototype instrument using the chokes specified and with the two 47Ω series-damping resistors shows only a couple of very slight flickers on the top range, and no such effects lower down.

No difficulties should be experienced in getting the dip oscillator to perform satisfactorily if all of the precautions mentioned have been taken. With both switches "on", the meter deflection should be between ½ and ¾ scale at all points on all four ranges. The deflection may be accurately adjusted by changing the value of the 3.9kΩ resistor R8.

Calibration may be done by means of the usual combination of amateur band, television and short wave receivers. The author cheated and did his own instrument in about half an hour on a Polyskop! To prepare for calibration, remove the perspex cursor and fix the marking cursor inside the box in the appropriate position with sticky tape. The centres of the notches should be placed respectively 1/16in, ¼in, 7/16 and 5/8in from the left-hand side of the scale strip. Using Indian ink and a Uno "O" pen for preference, but a ball-point or even a pencil if these are not available, the four scale-marking circles may be marked on the strip. Two cross-lines should also be drawn, with the capacitor vanes respectively fully in and fully out. The actual calibration can then proceed in the normal way, being faintly pencilled in at first and then, after removing the drum, being finished in ink. When it is dry, a final spray with polyurethane varnish will protect the scale markings.

Before closing, mention should perhaps be made of possible substitutes for the components specified. If the full frequency coverage is required, the Motorola MPF106 should be capable of replacing the 2N5245 (TIS88) in the oscillator, although it has not been tested. Similarly, the TIS88A, which only differs from the TIS88 in its connections, should be satisfactory. If the 2N3823, 2N3819,MPF102 to 105 or BFW10, 11 or 61 are used, it is unlikely that correct operation will be obtained on the top range, unless exceptionally good samples of these devices are employed. However, all should be well up to 220MHz.

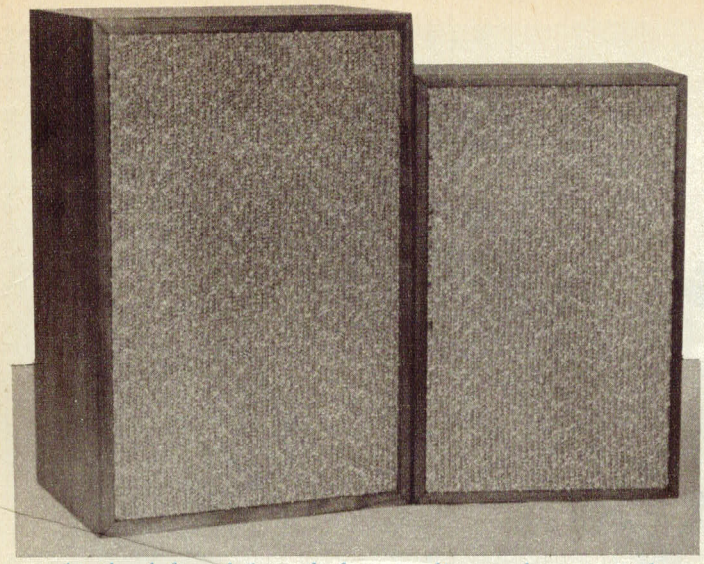
The BCY70 used in the dc amplifier may be replaced by almost any other silicon pnp device, provided, of course, that the value of the resistor R8 is adjusted to suit the gain. Suitable replacement transistors include the BCY71 and BCY72. Germanium devices are likely to exhibit excessive leakage and thermal drift, but carefully selected rf types may well work satisfactorily.

Any small point-contact germanium diode will probably work in the detector position, provided that its capacitance is sufficiently small. For this reason, gold-bonded types such as the OA7 and OA47, and whiskerless diodes like the BAX16, are to be avoided, but the OA90, GEX54 and probably the GEX34 will be acceptable. The GEX66 has rather too low a reverse impedance to perform properly in this circuit.

Sufficient comment has already been made on the subject of RF chokes and the use of miniature components in the critical positions.

Some constructors may desire to use one of the more normal sizes of miniature meters, such as the MR38P. If this is to be done, the box must be enlarged. This extension should be made in width and not in depth as, otherwise, it will probably not be possible to position the scale drum correctly. Any change in the size or shape of the box is likely to affect the ranges covered, particularly at the high frequency end.

Editor's Footnote: The 2N5245 (TIS88) is a Texas Instruments device, and should be available from Texas Instruments' distributors. In NSW the distributors are Electrobit Co, of 26-28 Kent Road, Mascot. The BCY70 should be available via trade suppliers from either Mullard-Australia or Philips Miniwatt; however the 2N3638 or TT3638 should also be suitable for the DC amplifier device. Local agents for Jackson Bros are British Merchandising Pty Ltd. ■



At the left a 1.6 cu ft free-standing enclosure; at the right a 1 cu ft enclosure, well suited to resting on its side on a shelf. Both have a power rating of 30W RMS.

TWO COMPACT HIGH POWER VENTED ENCLOSURES

A new, high performance 8-inch louspeaker recently announced by Magnavox (Aust) Pty Ltd makes it possible for hi-fi enthusiasts to build up complete loudspeaker units which exhibit an exceptionally wide and level frequency response, with a steady-tone power rating of 30 watts. Alternative enclosure designs are suggested in the following article.

The new loudspeaker, designated as Magnavox type 8-30, has been designed primarily to operate as a bass driver in small to medium-sized vented enclosures. When so mounted, it can accommodate amplifier outputs of the order of 30 watts RMS.

For a loudspeaker of this kind, it is certainly not expensive; the retail price, subject to normal trade discount, is quoted as $25.50.

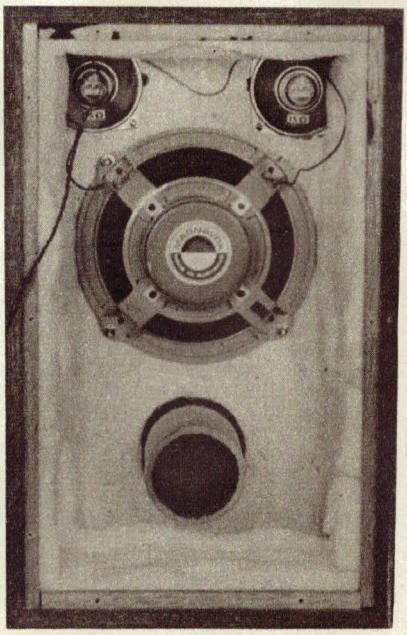
Built around a rigid diecast aluminium housing, which permits either front or back mounting, the 8-30 loudspeaker uses a 3.25lb barium ferrite magnet system and a 1.5in diameter voice coil, wound on a high tensile aluminium former.

The cone is of curvilinear configuration, to inhibit break-up at high power levels, and the edge uses viscous damping to aid suspension and to terminate standing waves which might be developed along the cone surface. The manufacturers claim that the system can "accommodate excursions of .007in, while remaining linear". The nominal system resonance is at 45Hz and the nominal frequency response 40Hz to 8000Hz. For wide-range applications, the loudspeaker should be used with a pair of Magnavox 3TC tweeters.

Three versions of the 8-30 loudspeaker are referred to in the manufacturers' literature, having minimum impedance figures of 4, 8 and 15 ohms respectively, at 350Hz.

The manufacturers claim that they have designed the 8-30 loudspeaker specifically to meet the requirements imposed by compact vented enclosures, the criteria involving both the natural resonance of the cone system and its acoustical "Q". The aim has been to take advantage of the bass-end reinforcement which a vent can offer, while avoiding or minimising the lumpiness which is so often evident in vented systems.

The accompanying composite diagram gives details of alternative enclosure designs suggested by Magnavox (Aust) Pty Ltd. Both provide for the use of two type 3TC tweeters, with a simple capacitive feed from the source, energising them at frequencies above about 5KHz. A crossover effect is achieved in part by the series capacitor and in part by the natural roll-off of the main driver.



Interior view of the smaller enclosure, showing the tweeters, the port and the Magnavox 8-30 main driver, for which the enclosures have been expressly designed.

Two 3TC tweeters are necessary to match the 30-watt power rating of the larger loudspeaker, the tweeters being selected and connected either in series or in parallel to provide the same nominal impedance as that of the main driver. The 3TC matches the 8-30 in basic sensitivity and is preferred to the 3UC on that account.

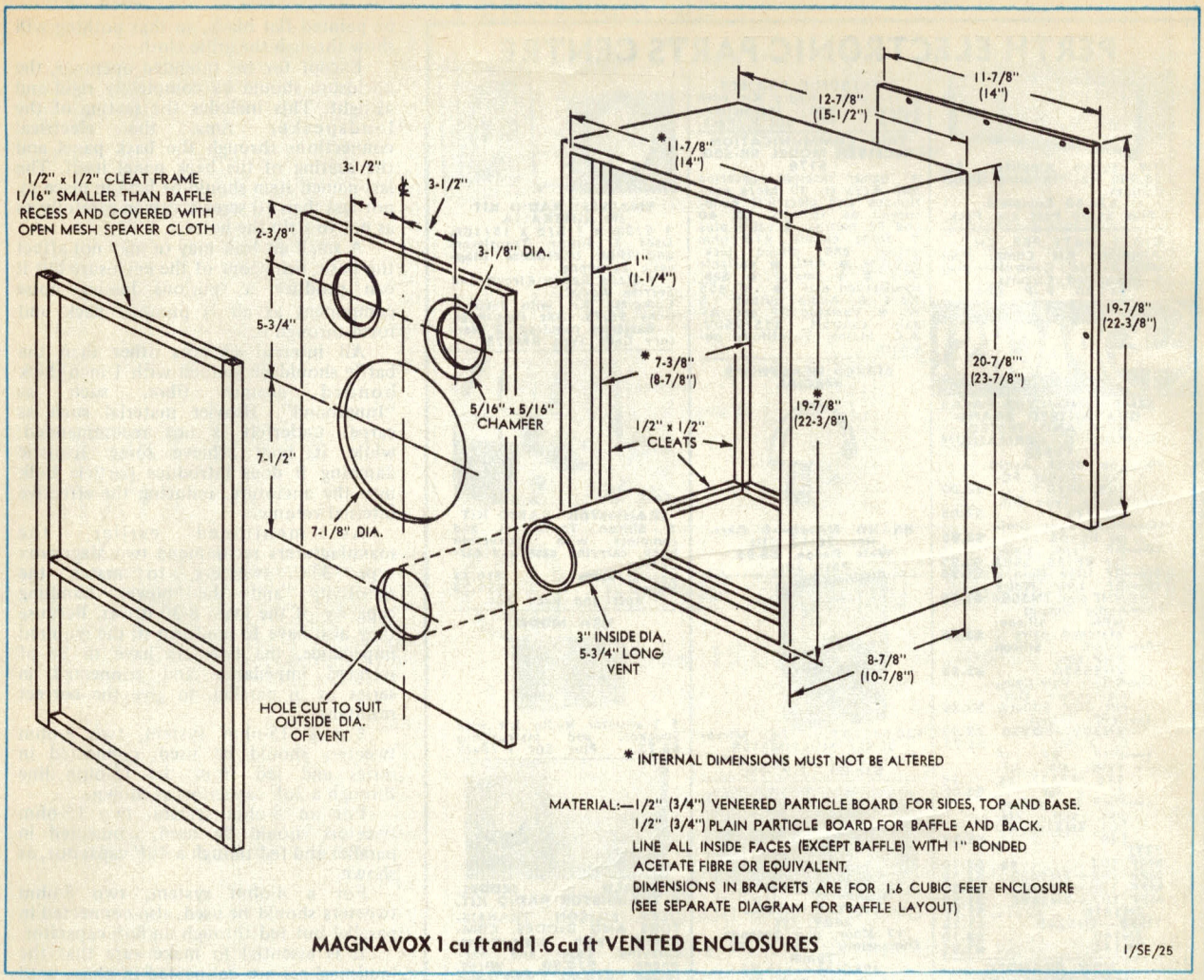
The smaller enclosure allows for an internal volume of about 1 cubic foot and, as indicated in the accompanying curve, shows a modest peak at 80Hz and a bass "corner" frequency of 50Hz, below which the response tapers at about 12dB per octave. It may be built from lighter material than the large unit and, used on its side, would qualify as a "bookshelf" system, even if a rather large one and more husky than most. Normally, a stereo pair of the enclosures would be arranged with the tweeters remote from the centre line of the room, to increase the effective stereo spacing.

At a nominal 1.6 cubic feet, the larger enclosure is more appropriate as a free-standing unit and, for this purpose, individual constructors may elect to elevate it slightly on some kind of ornamental base, in keeping with the rest of the furniture. It may be used vertically, with the tweeters to the top, or horizontally with the tweeters furthest from the stereo centre line, as before.

Magnavox suggest that the arrangement of the tweeters in the larger enclosure could be varied according to whether the box is to be positioned vertically or horizontally. If horizontally, the tweeters should ideally be as shown in the main drawing so that, with the enclosure on its side, they will be one above the other. This will give a "line source" effect for the tweeters, tending to project the higher frequencies in a broad, fan-like beam throughout the room.

If the enclosure is to be used vertically, the tweeters should ideally be mounted in a single line with the main driver. There will be no great penalty if the suggestion is not followed but it is a nicety which can easily be observed during the construction.

The composite drawing gives essential dimensional details for the alternative



MAGNAVOX 1 cu ft and 1.6 cu ft VENTED ENCLOSURES 1/SE/25

Shown above are composite plans for two enclosures. Dimensions for the larger enclosure are shown in brackets. If, as normal, the larger enclosure is to stand vertically, the loudspeakers are best mounted in line as indicated in the drawing overleaf.

enclosures. Particle board is the obvious material to use, but plywood, solid wood or rigid composition board could be substituted if a supply is ready to hand. The material may be equal to or thicker than the specifications for the respective boxes, but it should not in any circumstances be thinner. If thicker material is used, the internal dimensions should be preserved and the external dimensions increased as necessary.

The proportions represented in the drawings are in line with current enclosure practice and, with an eye to duplicating the original test results, it would be wise to adhere to the suggested dimensions. This will ensure duplication of various incidental dimensions as, for example, the distance between the rear end of the port and the back of the cabinet.

However, if circumstances dictate a change in proportions, something very close to the measured performance will probably be achieved provided that the internal volume and the port dimensions are preserved.

This means that the exact internal volume of the preferred size should be calculated, with due allowance made for cleats but not for the acoustic wadding. The new shape would have to be proportioned to have precisely the same internal volume. It could be taller, wider or thicker, or of triangular plan but extremely tall tube-like shapes should be avoided, or very thin sandwich shapes.

Furthermore, if a modified shape involves substantially larger unsupported panel areas than the original, internal stiffeners may have to be added to minimise drumming effects. These will have to be allowed for in the calculation of internal volume.

Certain other points warrant special mention.

The internal cross-sectional area of the port and its length, lip to lip, is no less critical than the cabinet volume and, in fact, interacts with the cabinet volume to establish a deliberate acoustic resonance. A composition tube has been specified because it provides a mechanically simple and rigid means of meeting the requirement.

Composition tube of the required type is often used as a winding piece for rolls of paper, and may possibly be picked up without charge from a local printery. Those not so fortunately placed need not despair, however. Magnavox have advised that they expect to be able to make suitable tube available to their distributors for a modest cost.

A rectangular port could conceivably be constructed from particle board having the same internal area and the same length as specified for the tube. However, any additional space it might occupy within the enclosure, by reason of extra bulk, would have to be allowed for in calculating the enclosure volume.

Note that the holes for the tweeter loudspeakers are shown as being tapered outwards, so as to minimise interference with the radiation from the cone. In tapering the holes, however, make sure to leave enough thickness to accept the tweeter mounting screws.

An important point to note is that the grille cloth is mounted on a frame which supports it ½-inch away from the front surface of the baffle. This is done for a very good reason.

If the grille cloth is too close to – or in contact with – the baffle, there is a very strong chance that it will flap against it and produce a spurious noise output. While this can be prevented by glueing the cloth to the baffle, the presence of cloth directly across the vent can seriously modify its behaviour.

By supporting the cloth well clear of the vent and of the loudspeaker cone, the cloth can move freely over a fairly large area, without flapping against anything and without interfering too much with the low frequency behaviour of the system. Needless to say, it should also be as transparent as possible at the higher frequencies, so as not to absorb radiation from the tweeters.

The grille cloth frame can be held in place in a number of ways. In the prototype enclosures, small nylon combs attached to the cloth frame "grabbed" small pads of nylon cloth, when the frame was pushed home.

Note that the baffle, the edges of the cutouts and the inside of the port should

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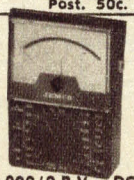
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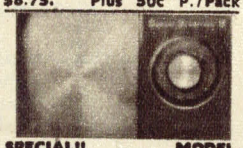


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be painted flat black, so that nothing will show through the grille cloth.

Except for the intended openings, the enclosure should be completely rigid and airtight. This includes the seating of the loudspeaker rims, the electrical connections through the back panel and the seating of the back panel itself. The last-named item should be held in place by not less than 10 screws, driven carefully so as not to strip the holes.

A small air leak may or may not affect the basic behaviour of the enclosure but it can produce a spurious hissing noise component as air is pumped back and forth through it.

All internal surfaces other than the baffle should be padded with 1-inch thick bonded acetate fibre, such as "Innerbond". Heavier material such as carpet underfelt is not recommended; while it may achieve some acoustic damping it does introduce particle bulk into the enclosure, reducing the effective internal volume.

As mentioned earlier, the manufacturers recommend two Magnavox type 3TC tweeters, to match the sensitivity and the power handling capacity of the main 8-30 driver. Because they also have to conform to the required impedance, the tweeters have to be of selected impedance and connected in series or in parallel, to give the correct resultant.

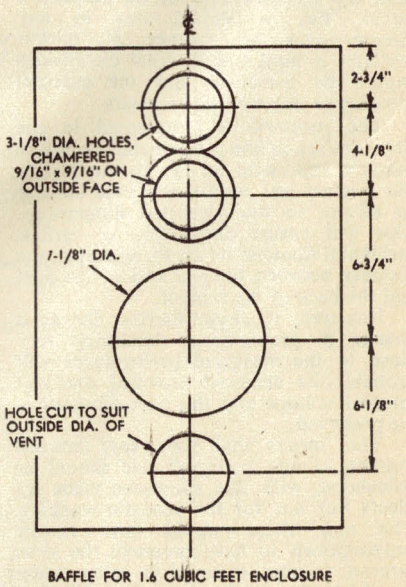
For a 15-ohm system, two 8-ohm tweeters should be used, connected in series and fed from the 15-ohm line through a 2uF capacitor, as shown.

For an 8-ohm system, two 15-ohm tweeters should be used, connected in parallel and fed though a 4uF capacitor, as shown.

For a 4-ohm system, two 8-ohm tweeters should be used, also connected in parallel but fed through an 8uF capacitor.

It is essential to make sure that the loudspeakers are connected in phase with the connections marked with a red washer connecting to (or towards) the active lead and the other connections to (or towards) the earthy lead, as shown in the accompanying diagrams.

It is necessary to observe polarity



BAFFLE FOR 1.6 CUBIC FEET ENCLOSURE

Preferred arrangement of loudspeakers for the larger enclosure, if used vertically. The line-source effect tends to project the higher frequencies as a fan-shaped horizontal beam.

within individual systems but, by treating the loudspeakers uniformly, a stereo pair of systems can be connected directly to a suitably marked amplifier, knowing that the phasing of the system as a whole will be correct.

Magnavox specifically state that the tweeter coupling capacitor should not be an electrolytic type, whether polarised or non-polarised. They specify paper, polyester or lacquered paper capacitors of not less than 50V rating.

Reproduced herewith are response curves taken of the respective systems taken on the manufacturer's automatic curve tracing equipment. As loudspeaker curves go, they show a commendable uniformity of response and, in this respect, are above average, even for high quality systems.

However, while such curves are interesting as evidence, an experienced audiophile is almost certain to ask: "Do they sound that way"?

The answer is: "Yes, they do".

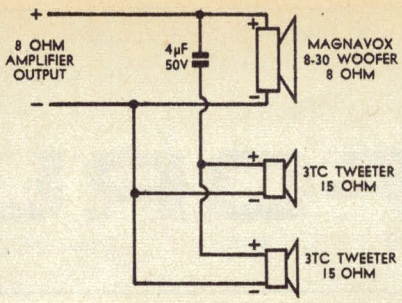
In the laboratory, we compared them at modest levels to our earlier "bookshelf" and "Point-Four" systems. We do not regard these as any kind of an ultimate but we know them pretty well and regard them as a kind of "2ft rule" – longer than some rules, shorter than others but very useful to measure things by!

We know that they are reasonably well balanced, though perhaps a trifle lacking in middle "presence", a trifle bright at the top and, being compact enclosures, in need of some bass reinforcement.

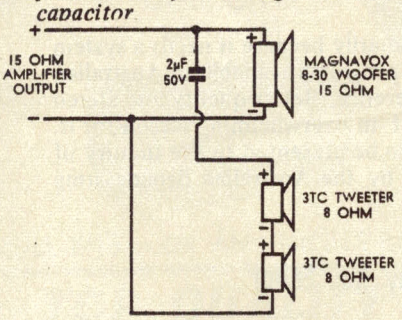
By comparison, the Magnavox enclosures had a little more "presence", a little less brightness by comparison, and more body at the bass end. In short, the differences in sound were all as we felt that they should have been, lending credibility to the claim for a level overall response.

As for power handling capability, the issue was never in doubt. In our laboratory, the two new systems combined to produce an ear shattering output from a solid-state stereo amplifier, without the slightest signs of distress.

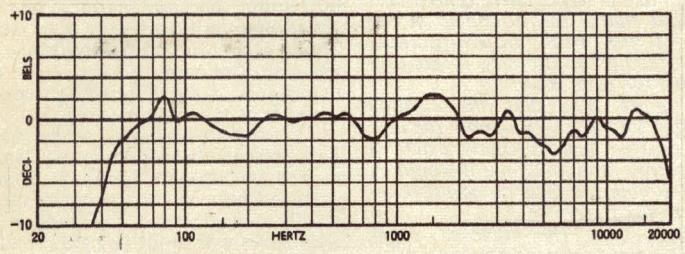
What of the difference between the two Magnavox systems, the larger and the smaller?



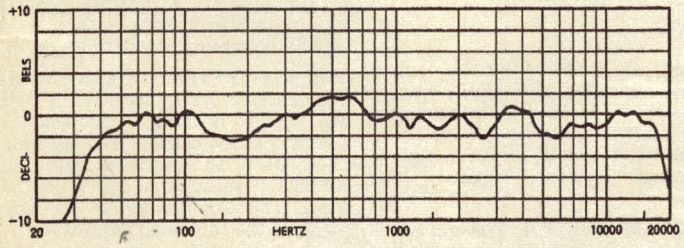
Connections for an 8-ohm system. For a 4-ohm system the 8-30 driver would be of 4 ohms impedance; 8-ohm tweeters would be used, connected in parallel and fed through an 8uF capacitor.



For a 15-ohm system, 8-ohm tweeters need to be connected in series, as shown. It is essential that correct polarity be observed in all cases.



Response curve of the 8-30/3TC system in a 1 cu ft vented enclosure. The relatively even output across the spectrum is reflected in a notable lack of colouration of the sound.



Response curve of the 8-30/3TC system in a 1.6 cu ft vented enclosure. Main difference from the curve above is an extension of the response over the 40Hz region.

Frankly, the difference is quite small. The general balance and sound is identical and the extra coverage below 50Hz is only apparent if you listen for it with music which has components in the particular region.

In short, if you face any kind of a space problem, the smaller enclosure can be selected, in the knowledge that very little will be lost by so doing, and with virtually no sacrifice in power handling capacity. However if space is no object, the larger enclosure would be the one to prefer.

In assessing the performance, however, it is necessary to observe that, because the bass is level and "tight", it tends to sound less prominent than the bass from systems where the low frequency energy is coloured by resonance peak(s) and under-damped cone movement.

In fact, in a home situation, the smaller enclosure tended to sound very like a high quality, imported but fully sealed system which is currently in use. Our tip is that the average audiophile will like the Magnavox systems best with a modest amount of bass boost in operation.

It is difficult to describe sensitivity in general terms but it is "about average" in terms of present-day concepts. The 8-30 systems could therefore be used with lower-powered amplifiers – say 2 to 3 watts – but their power handling capacity would be wasted.

As a matter of interest, we tried the systems with an electronic organ and found the bass from the pedals to be very smooth. The 8-30 would therefore seem to be a very good choice as an external loudspeaker system for an organ in homes, where space is any kind of a problem. In such an application tweeters, if used at all, would need to be controllable, because organ voicing is usually arranged on the assumption of loudspeakers with a not-too-prominent treble.

FOOTNOTE: Having read the foregoing article, readers may well be prompted to ask whether the enclosures described above could be used with some other 8-inch loudspeaker which they happened to have on hand. In fact, the enclosure designs inter-relate with the characteristics of the 8-30 loudspeaker and performance over the bass register will only be as represented with an 8-30 driver or with some other loudspeaker (if there is one) which has similar parameters affecting low frequency characteristics. Other 8-inch loudspeakers will "work" in the enclosures but only in the sense that a reasonable enclosure is better than none at all. A random combination might even work quite well but as a matter of good fortune rather than good management. ■

TWEET

A tweet is high frequency sound and to reproduce this you need a high fidelity

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FORUM

Only FM can solve problems of radio

Australia needs FM broadcasting primarily because it needs a system which will make a greater variety of programs available to Australian listeners, free from noise and interference. Better quality and stereo would be a result of the change, not an overwhelming reason for it. This is the burden of a submission to be presented to the Inquiry of FM Broadcasting, to be conducted by the Australian Broadcasting Control Board.

Conducted by the Editor

A submission along the above lines has been prepared by Mr A. G. Pither CBE, C, Eng, FIREE, FIEE, FIE (Aust). Mr Pither's name will be well known to those of our readers who were in any way associated with the RAAF and radar activities during World War II. His letter and a summary, in slightly abbreviated form, follow:

Dear Sir,

Your editorial "FM: Fact or malarky?" and your earlier discussion of the subject show that there is someone in the country who is willing to support the case for FM. But I suggest that you have covered mainly the common fallacies about the subject. It seems to me that the issue goes right to the roots of the national interest and I have not seen it presented in terms that I would call adequate.

As a member of the Committee of the Institution of Electrical Engineers, I undertook to prepare a case for evidence to be presented to the Inquiry and I enclose a copy of it. I believe that statements of the Chairman of the ABCB indicate an ignorance of the main issue and the misunderstanding that exists in the community at large. There is no doubt in my mind that a case founded on the interests of the Hi-Fi fraternity must inevitably fail. It is too easy to counter and it omits the main issue.

I am quite sure that the existing broadcasting interests will oppose the new system, simply because they enjoy a highly lucrative monopoly and it would be most undesirable for them to admit other members to the fraternity.

I believe that the enclosed paper presents the case in a more fundamental – though still incomplete – form and I suggest that you might like to publish it in support of a matter of national importance.

(sgnd) George Pither.

FREQUENCY MODULATION BROADCASTING

INTRODUCTION: The Committee of the Institution of Electrical Engineers is concerned at the problem facing the ABCB, which is required to assess the needs and the wishes of the Australian community without being able to consult the community. This situation arises from the fact that the community at large is ignorant of the facts connected with FM broadcasting. Few have any knowledge of the technique and fewer have had any experience of it.

In these circumstances, the only opinions readily forthcoming are those of a specialised section of the community . . . in this case, the professional broadcasters who have very great vested interests in the issue and who are not likely to judge the issue from the point of view of the most good for the greatest number. The Committee has therefore attempted to make an impartial assessment of the facts.

NEEDS OF COMMUNITY: It must be obvious what is needed by the community in the field of broadcasting. It might be summarised as a high quality sound system, available day and night, equally accessible to all users, and in sufficient variety to cater for a reasonable variety of listening tastes. It will be useful to analyse the present system against this requirement.

PRESENT AM SYSTEM: Several years ago the writer undertook a six months trip through central, north-west and western Australia, and during the trip he carried out an assessment of the available broadcasting service on behalf of the ABCB. This has provided him with a useful knowledge of the Australian system, both in populated areas and in the more sparsely inhabited areas of the inland. From the outset it became obvious that the population living away from the cities had to accept a service which was deficient from all the above points of view. It had highly variable quality, highly variable accessibility and its variety was generally restricted to two or even one program only. Quality was grossly affected by noise (static, man-made noise, interference from other programs) and fading. Accessibility varied enormously and was governed by the time of the day, the season and the activities of overseas stations. Variety was dependent on these same factors and, in addition, on the geography of the area. Usually only one or two programs were available and often one or both were at less than acceptable quality.

One answer to this problem is the establishment of more stations to cover the existing areas much better. Unfortunately the solution is not acceptable Even if the will existed, the frequencies do not. In an attempt to alleviate the problem, the ABCB had adopted a policy of shared frequencies. This policy carries the seeds of its own destruction because stations on shared frequencies interact and can mutually reduce each other's effective range by 50 per cent. The result is a reduction during night hours of the effective service area to a quarter of the day-time area.

In summary then, it can be said that the present broadcasting system has reached its ultimate limits. It cannot be expanded because the frequency spectrum is fully occupied and any duplication of frequencies will result in a grave reduction of night time service areas. The combination of the frequency used (MF) and the system (AM) provides no protection against the natural hazards (interference, fading and distortion). Against this limitation the Australian nation presents a growing need for an improved broadcasting system to serve a rapidly increasing population.

THE FM SYSTEM: In Australia the term FM must be synonymous with UHF. The MF band is fully occupied, HF is unsuitable, the original VHF allotment has been given to television, and the only frequency space available is in the UHF band. The combination of FM and UHF provides the following advantages:

1. A new and very wide choice of frequencies.
2. An inherent protection against interference. Protection level is about 23B . . . equivalent to an increase in power of about 14 times.
3. A guaranteed service area independent of day or night time and almost immune from interference.
4. Inherently low distortion, high quality reproduction.
5. Because of 4. above, a system eminently suitable for northern high noise tropical areas.
6. Capability to transmit stereo programs on a single frequency.

Against these advantages must be quoted the line of sight characteristics of

UHF, with the consequent reduction in range in some areas. Experience with television has provided a first class yardstick for the assessment of this disadvantage.

A further disadvantage is the inability of existing receivers to use the UHF broadcasts. A completely new complex of transmitters would be needed, together with a new receiver for every listener.

CULTURAL ASPECT: The nation is growing rapidly, both in numbers and in sophistication. In the cities its needs in the cultural and entertainment fields are met by a multiplicity of sound and picture programs. In spite of this there is a constant appeal from a small number of informed persons for channels on which better quality and more sophisticated programs can be presented. With better availability the number of listeners would increase greatly. The broadcasting services of the nation are the leaders in developing public tastes and it is a national tragedy that they should be limited by the present outmoded system which cannot be expanded to meet growing demands for better programs. The Broadcasting Control Board has an obligation to the nation to ensure that programs are provided which are in advance of the common standards. In the field of education this is particularly true.

In the country areas the situation is immeasureably worse. It is important that the national policy of developing country areas by providing the amenities of the city should be aided by the presentation of a much wider variety and quality of broadcast programs. Only an FM system can achieve this.

ECONOMICS: Other factors to be considered in the FM issue are those of economics, and these will be presented by those more closely concerned. They include the need to build a new system of broadcast stations, at very great cost to the public but with great advantage to industry, and the need for the listener to buy new receivers . . . with enormous advantage to industry.

CONCLUSION: There is clearly a need for an improvement in the national broadcasting system, both A and B class, in quality, availability and variety. The present system is fully committed and cannot be expanded. It has a number of inherent disadvantages, including variable day and night performance and high susceptibility to noise and interference. There is an increasing need to provide for the cultural needs of the community and this cannot be achieved with the present fully committed system.

The FM system offers new horizons in broadcasting. It provides an immediate and great increase in the channels available, together with a reliable cover by both day and night and a standard of quality not possible with AM.

To provide for a nation increasing in both numbers and tastes, it is essential.

★ ★ ★

Such then is the submission which the author, Mr A. G. Pither plans to put before the Australian Broadcasting Control Board, presumably as spokesman for the Institution of Electrical Engineers. Despite his convictions to the contrary, the submission will not contain material which is new to anyone who has followed the issue closely through the years. It does, however, reinforce the convictions of our correspondent L. C. Brocklesby, in the last issue, based on what happened in New Zealand.

We have a number of other letters on hand to do with radio broadcasting in general and FM broadcasting in particular. However, enough space has been devoted to the matter for one issue.

On quite another subject, we reproduce a letter above from a correspondent from the University of Queensland, relative to an item which appeared in the November issue, page 23, "Theory On Cancer Cells".

Two phrases in the letter prompt us to expand a little on the background to an article such as the one mentioned. In his first paragraph, J.A, refers to "your article". In the next says "you stated".

In one sense, both phrases are justified. We published the article; therefore it is not unreasonable to identify us with the statements made it it.

In point of fact, however, the article was written by someone within NASA and submitted to us for publication as a NASA document. It is with its un-named author that J.A. is at issue.

Did this author correctly report proceedings or did he misconstrue them, so that Cone's remarks about intercellular bridges were represented as a claim to having discovered them?

Was the report checked by Cone or by some other authority on the subject?

If it was, were they satisfied with its accuracy or did they read right over an error?

THEORY ON CANCER CELLS

Dear Sir,

It was with interest that I read your article "Theory On Cancer Cells" in the November issue. It invites criticism on several counts.

In the last paragraph you stated: "In 1969, Cone, 38, reported the discovery of intercellular bridges that may help in understanding the behaviour of certain types of cancer".

This is incorrect. Schoenberg, Mumaux, Moore and Weisberger (Science 143, 964-965) demonstrated the presence of intercellular bridges between cells in 1963 and this observation has been made repeatedly since then and long before Cone's claim in 1969.

Cone's claim that cells with a large negative membrane voltage seldon divide while those with a low potential divide rapidly would be a consequence of rapid cell division and not a cause. Relating observations and cause can lead to serious errors.

This author's approach places a great deal of emphasis on the electrical properties of the cell wall and apparently ignores all antigens — in particular histocompatibility antigens.

Some of the changes in potential recorded by Cone could be due to the action of "blocking antibody" on the cell wall rather than some change in the cell wall itself. In other words, a possibility exists that cancer cells might have a protein layer of "harmless" antibody on their walls. The charge on an antibody molecule and that on a cell are not the same, so this antibody-cell combination would cause a change in overall surface charge.

J. A. (University of Queensland).

It may seem strange to readers to see us posing questions like this but they are certainly not strange questions for anyone on the production side of a magazine like "Electronics Australia". We face them a dozen times in every issue, not only in relation to unpublished contributions but also to articles which have already been published overseas.

Time and again, in close reading of an article, prior to publication, one of our staff is struck by a statement which seems incomplete, ambiguous or at variance with their understanding of a situation. Other opinions are sought and followed, in many cases by a phone call, a letter or a cable to the author.

It is surprising how frequently these measures turn up a definite error, or a statement so ambiguous that it reads like an error. Sometimes it is due to carelessness; sometimes to single-mindedness that does not see any ambiguity; sometimes to an idea that has been accepted and never challenged.

And let's face it; we all suffer from these shortcomings.

The big worry in producing a magazine is that "howlers" will slip through undetected, to the discredit both of the author and the journal.

And the more complicated research and technology becomes, the harder it is for an editorial staff to maintain an adequate awareness sufficient to evaluate and present articles.

Which brings us to the article in question: "Theory on Cancer Cells".

No one on our staff is an expert in this field and no one would be likely to react one way or the other to a claim to have discovered or observed certain phenomena. Nor is it practical to search out an authority on all items we do not completely understand, before deciding whether or not to publish them.

So we look at the source of the article. In this case, it was an official release from NASA. It should have been authoritative.

But J.A. says it contains an error of accreditation and an error in reasoning. His objections may be valid, in whole or in part. Or they may not!

This is a case where we would prefer the experts to work it out amongst themselves and tell us later about their conclusions!

★ ★ ★

To change the subject, we have on hand a letter from a very unhappy ex-amateur operator. Having successfully faced up to the challenge of the Morse exam, he became discouraged and disgruntled, because he could not legally "fire up" his HF equipment as soon as he would have liked. But here's his letter:

Dear Sir,

I have been a reader of your magazine for some time and, until recently, an amateur for five years.

You might be interested to learn what can turn an avid "ham" operator off radio.

I passed the Morse exam in November, 1969, and, on receipt of my full AOCP, applied for full licence early in December. All the equipment for the DX bands had either been built or purchased by this time and the aerial erected. I had hoped to be operating on 14 and 21MHz SSB by Christmas Day.

I live only a quarter-mile from the local radio branch and, because they were so friendly and quick with the limited ticket in 1965 (two days) I went down to the office and lodged the application in person.

They told me rather tersely that a three month wait would be necessary; this was official policy and nothing could be done about it.

In mid-March this year, after hearing nothing from the Department, I went along to the office again. Apparently, some official had rejected my application a fortnight previously and a reply to that effect had been pending. Unsatisfactory frequency measuring equipment was the reason given.

On asking what was required, I was told that a calibrated GDO in conjunction with a calibrated receiver (both commercially built) was not good enough. I maintained that this gear, in association with a crystal calibrator would certainly indicate where the band edges were.

I found myself trying to convince those present that the regulations state: "an amateur must have in his possession equipment capable of verifying that his emissions are within the amateur bands".

They wouldn't listen at first, insisting that a heterodyne frequency meter was required capable of measuring an exact frequency anywhere within the bands. To be sure, the old handbook specified something along these lines but not the new revised handbook.

One of those present produced a regulations handbook and invited me to see for myself. Unfortunately for them, there was no such requirement. When I read the actual regulation and tried to make them read it for themselves, they took the book away and refused to discuss the matter further. That is, beyond saying "Obtain a frequency meter such as a BC221 or present your GDO for inspection". I was given to understand that, if the GDO, when checked against the digital frequency meter, was accurate to within 100Hz on all bands, they would accept it!

Actually, I obtained a BC221 and obtained a licence on the day before the Easter holidays. But after all the strain, my attitude to ham radio had changed to the extent that I handed the licence back, tore up my AOCP and disposed of all the amateur equipment.

It might be argued that the handbook makes the definition of a frequency meter too loose. On the other hand, it seems that the people who formulated the rules had something in mind other than a heterodyne frequency meter, as such, in the one box. Certainly a crystal calibrator, some kind of a variable oscillator and a detector is a "must" but not necessarily in one box.

At the outset, it might not have mattered quite so much that my equipment did not meet their interpretation of the regulations. What did matter was the amount of time spent before getting the licence about six months in all, after passing the Morse exam.

Why does the PMG take such an unco-operative attitude these days? Perhaps they have been overwhelmed with work following the change to 15KHz on VHF mobile channels. Perhaps too many amateurs have been pulling strings so that they could get special call signs. Either way, they may have come to regard amateurs as pests.

As a former amateur, who has taken part in many a 6-metre scramble, let me say that, unless the Department turns about face, things look black for amateur radio. Quite a few other people, I gather, have little sympathy for the authorities.

The letter is signed but we have deliberately omitted the writer's name and address and also deleted references which would have identified the city involved. We do this because this may well be an isolated case.

Reading between the lines, it is not hard to imagine the impatience of the writer to get going, with his Morse exam behind him and his HF equipment all ready to fire. The issuing of a licence would be so easy, if the people concerned could only be induced to drop what they were doing when he fronted the counter!

But, presumably, they had other ideas and I fancy that there can be no one quite so frustrating as an official who is determined not to be bustled. Or one who is unwilling to admit to a possible error in interpreting his own regulations!

In short, I wouldn't be at all surprised if the background to the letter is an unfortunate set of circumstances and a clash of personalities, with our correspondent as the loser.

But, on the other hand, if the letter has ventilated an area of misunderstanding, which could affect and discourage others, it will have served its intended purpose.

Just by way of conclusion, I thought you might be intrigued by the following news item clipped from "Electronics Weekly" and written by "Janus".

ECCENTRIC'S REVENGE

Computerised data banks and the necessary safeguards are a very "in" topic, particularly after the recent Workshop on the Data Bank Society. Most of the stress has been laid on providing safeguards for the individual, and the other day I heard a very good example of this, although perhaps not quite in the way normally implied.

Some time ago, a large American corporation hired a rather eccentric, but brilliant computer programmer to mastermind a particularly complex project that included handling of the company's payroll.

The eccentricities of the project leader did not go down very well with the top management, who fired him after the project was completed.

But to their absolute horror, when they tried to do a production run using the new programs – which, by the way, had been successfully and exhaustively tested – the whole lot broke down, and destroyed itself!

After considerable investigations, it was discovered that the eccentric programmer had written instructions that made the computer search the payroll list first, and if his name was not on it, the system would abort and destroy itself.

FOOTNOTE: A funny story? In some ways it is but not to the firm concerned. Nor is there any special reason why something of the sort should not happen again nd again. For all their capacity to process data, computers have no intrinsic inhibitions against following mischievous instructions. If a computer is to exhibit inhibitions, it would need to be programmed that way. (Like a human being?) ■

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The DELTAHET Mark 2: Preview of the solid state version

A solid state version of the well-known Deltahet receiver is now nearing completion in our laboratory, and next month it is hoped to begin its description. This short preliminary article explains the basic principles of this type of receiver, for those to whom they may be unfamiliar.

by IAN POGSON

In the issues for June and July 1963 the writer described in detail a communications receiver front end, which employed a signal processing system then only recently developed. This was followed in the September and October 1964 issues by a complete communications receiver, incorporating the new front end. The receiver used a total of 17 valves, and offered many of the features of a professional-grade receiver.

This receiver was a new concept to most of our readers, and in order to give it some distinctive identity, we dubbed it the "Deltahet". The unit was an immediate success, capturing the imagination of many radio amateurs, short wave listeners and even some professionals. In addition to the interest generated initially in Australia and New Zealand, Deltahets were constructed in many parts of the world – including the United Kingdom, Holland, Austria, Czechoslovakia, South Africa, Rhodesia, Malaysia, the United States and Canada.

Very soon after publication of the receiver, the author was asked if he had any plans to duplicate the design using transistors! It must be confessed that the author was initially inclined to postpone serious consideration of this possibility, because of the considerable time and effort which had been spent in the development and refinement of the first design. Yet as time went by, the question continued to be raised, and eventually it was clear that a "solid state" Deltahet would in fact make a worthwhile project. After devoting quite a lot of thought as to how a solid state version should be attempted, the author recently commenced the preliminary design and development. This was done slowly at first, but momentum gathered as time went on.

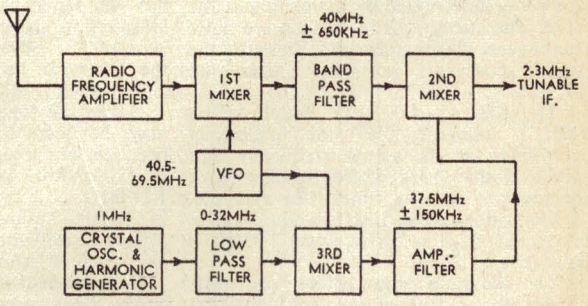
After quite a deal of effort spent by the author, both at home and in the "Electronics Australia" laboratory, a working prototype of a solid state Deltahet has emerged. This we have dubbed the "Deltahet Mark 2". At the time of writing, the major part of development has been completed. However there is still quite a bit of tidying up and other routine work to be done, to bring the unit to completion. This is expected to be done over the next few weeks, and the receiver will be described in a forthcoming series of articles.

For our newer readers who may not be aware how the Deltahet receiver originated and how it works, here is a brief description which is substantially as published in a preliminary article, under the heading "Prelude to a Communications Receiver", which was published in May and June, 1963.

When the writer was in the United Kingdom around 1959, a receiver made by the "Racal" organisation was brought to his attention at an exhibition. In common with many other receivers, this one is based on the familiar superheterodyne principle. However the actual system employed is a development of the basic superhet principle, and is so ingenious that full marks for originality must be awarded to the originator, Dr Wadley, of South Africa. The principle is now known as that of the "Wadley Loop".

The Racal receiver covers continuously from 1MHz (it is possible to go lower) to 30MHz, in steps of 1MHz, with remarkable frequency stability. Yet it uses only one crystal. In effect, the Wadley Loop principle produces the equivalent of 29 crystal-locked converters, which may be accommodated in little more space than is normally occupied by one conventional crystal-locked converter.

The system functions in the following manner, which may be understood by reference to the block diagram.



A block diagram of the Deltahet receiver front-end, based on the "Wadley Loop" principle.

Incoming signals, in the range 1-30 MHz are selected by the RF amplifier, which is switched and tuned in the same way as in a conventional full coverage receiver. The RF amplifier is designed so as to have as uniform gain as possible over the complete range to be covered. However, while the stage is normally peaked on the desired signal, adjacent signals will be passed to an extent, depending upon its selectivity.

After amplification by the RF stage, the signals are passed to the first mixer. The output from the mixer feeds into a band-pass filter having a flat top centred on 40MHz. The bandwidth of the filter is ±650KHz, the reason for which should become apparent later. The signal which passes through this filter may be considered to be the first IF of the receiver.

The other signal fed to the first mixer is the output from the VFO. The frequency of the VFO is tunable over the range which extends from 1MHz above the lower limit of the band-pass filter, to 30MHz above this frequency: from 40.5MHz to 69.5MHz. It is the VFO frequency which therefore, by heterodyne action, determines which particular 1MHz band of input RF signals is "translated" into the (40MHz ±500KHz) IF range accepted by the band-pass filter. The VFO tuning control thus becomes the "MHz" selector of the receiver.

After passing through the band-pass filter, the IF signals derived from the chosen 1MHz band are fed to one input of the second mixer. The function of this mixer will be examined in a moment. At this stage it should be noted that the operation is very similar to that of a normal superheterodyne receiver, with some change in the IF and its bandwidth.

In another part of the receiver, however, signals are produced by a 1MHz crystal oscillator and harmonic generator, and fed through a low-pass filter with cut-off at 32MHz. The resultant series of harmonics are fed to a third mixer.

The output of the VFO is also fed to this mixer, and heterodynes with the harmonics from the crystal oscillator. The heterodyne, in which interest centres, is that which happens to fall, in the course of VFO setting, within the pass-band of a second substantially flat topped band-pass filter on 37.5MHz ±150KHz.

It is the amplified signal on 37.5MHz which becomes the injection for the second mixer. This frequency, when hererodyned against the IF signals passed through the 40MHz band-pass filter, results in an output on 2.5MHz ± 500KHz, or in other words 3-2MHz.

This becomes the tunable IF, which is passed on to the rest of the receiving set-up. It is in the following tunable IF section that the individually desired signals are selected, the preceding circuitry having served only to change the incoming signals from their original frequency to within the 2-3MHz range.

And here an important point should be made in relation to the frequency stability of the system. Any frequency drift in the VFO will cause a change in the frequency of signals passing through the 40MHz band-pass filter. Simultaneously, there will be a deviation from the nominal 37.5MHz signal which is injected into the second mixer. These differences exactly cancel at the second mixer and consequently the tunable IF is not changed. In fact, no adverse effects occur, provided that the

VFO resultants stay within the pass band of the two filters.

In effect, the only independent frequency determining device in the front end is the 1MHz crystal oscillator. The net result is a system with a very high degree of stability. In a complete receiver, the overall frequency stability is virtually determined by the local oscillator used in conjunction with the tunable IF. And with careful design, it is possible to obtain good stability here as well.

Some practical examples will now be given to illustrate the foregoing description of operation. Consider that it is desired to receive a signal on exactly 21MHz. The RF stage will be set to pass this frequency. The VFO is set to 61.5MHz and this will beat with the signal on 21MHz to give a difference of 40.5MHz, which passes through to the second mixer.

The 61.5MHz from the VFO will also beat in the third mixer, with the 24th harmonic from the crystal to give a difference of 37.5MHz. This is passed through the 37.5MHz amplifier-filter, to the second mixer. The 40.5MHz and 37.5MHz produce in the output of the second mixer, a difference of 3MHz. This is acceptable to the tunable IF at one end of its range.

Now, taking a second look, assume that the same 21MHz signal is to be received, but this time, with the VFO set to 60.5MHz. Obviously enough, this time a difference frequency of 39.5MHz will be produced, which is still passed by the filter to the second mixer.

The 60.5MHz from the VFO will now beat in the third mixer, with the 23rd harmonic from the crystal to give a difference of 37.5MHz and so to the second mixer. The 39.5MHz and 37.5MHz produce, in the output of the second mixer, a difference of 2MHz.

This is also acceptable to the tunable IF, at the other end of its range.

From these two examples, it is evident that each integral megacycle point is tunable at both ends of the scale, which end being determined by the setting of the VFO. The exceptions to this are are those frequencies at the start and finish of the overall coverage, normally 1MHz and 30MHz.

The dial of the VFO, which is the "MHz" selector, is not calibrated according to its actual frequency but rather to that band of frequencies which the receiver actually tunes. For example, 41.5 is calibrated as 1MHz, when 1-2MHz is covered; 42.5 as 2MHz, when 2-3MHz is covered, and so on.

To illustrate the effect of slight missetting, or drift of the VFO, the first example will be referred to again. The 21MHz signal is to be received, but the VFO is either set to or has drifted to 61.6MHz. This gives a difference frequency of 40.6MHz from the first mixer. Now, although the band-pass filter is only required to pass 40MHz ± 500KHz, it may be recalled that it has been made slightly wider, ie, ±650KHz. This provision allows the 40.6MHz signal to pass to the second mixer.

The 61.6MHz from the VFO, beats in the third mixer, with the 24th harmonic from the crystal oscillator to produce 37.6MHz. It has been pointed out already that the amplifier-filter is on 37.5MHz ± 150Khz. Therefore, the 37.6MHz signal will still be passed to the second mixer.

The 40.6MHz and 37.6MHz signals are heterodyned together to give a difference of 3MHz at the output of the second mixer. This is exactly the same as the resultant frequency at this point as given in the first example, demonstrating the way in which drift in the VFO is automatically cancelled.

Should the VFO drift by an amount which runs the signals concerned down the skirts of the two filters, the frequency of the received signal will not be changed, but the signal strength will drop due to attenuation in the filters. This must be avoided for obvious reasons. In practice, the VFO can be made adequately stable and no such trouble is experienced.

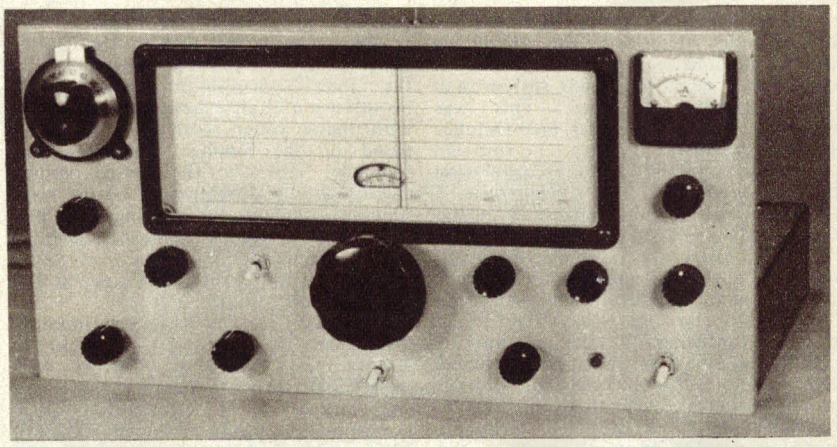
From the foregoing details, this system may be seen to offer many desirable features, which include:–

1. Continuous frequency coverage from 1-30MHz.
2. Constant tuning rate.
3. Reasonably good band spread, ie, 1MHz per sweep of the dial.
4. High order of frequency stability.
5. Excellent resetability due to electronic rather than mechanical band switching.

Many other features could be added to the list. However, another point is worthy of note. Given a high grade dial on the tunable IF, which has only to cover 1000KHz, and which effectively "interpolates" between the settings of the MHz dial, the frequency of the received signal may be read off quite accurately. This is a very good feature where it is necessary to pre-set the receiver in readiness for an expected signal.

As may be expected, a price must be paid for all the advantages which this system provides. Efficient low-pass and band-pass filters are required, in order to obtain correct operation. In addition, considerable care must be taken to shield various sections from each other, to prevent the harmonics from the 1MHz crystal from being injected and received as incoming signals. Power supply leads must also be filtered, where necessaary, for the same reason.

Be this as it may, it is a small price to pay for the facilities which are available. No amount of writing can illustrate the delightful ease with which tuning can be carried out. A few minutes at the controls is all that is necessary to convince the operator.



A preview shot of the new solid state Deltahet, which is nearing completion in our laboratory. Full constructional details will be given in the forthcoming articles.

The foregoing description only applies to the "front end" of a receiving system. It was pointed out that all incoming signals, in the range, 1-30MHz, are converted by the front end, to fall in the range 2-3MHz. What immediately follows, is the 2-3MHz tunable IF, together with all the functions which go to make up a complete communications receiver.

Our new Deltahet incorporates many new and desirable features which, we feel, will make it a worthy successor to the original Deltahet. Apart from some of the more obvious advantages of solid state techniques, such as light weight, space saving, low power consumption, lower operating temperature, some new techniques have been adopted as a result of recent developments in components, etc.

In short, we are quite enthusiastic about the prospects for Deltahet Mark 2. Frequency stability is somewhat better than the original, with an AGC system which really keeps the audio level almost constant, within a very few dB, over the whole signal handling ability of the unit. It is very similar to handle when compared with the original and we trust that it will prove as interesting to readers.

In closing this preliminary discussion on the new Deltahet, we must stress that this is not a project for beginners. While every effort has been made to keep construction and adjustment to a reasonable minimum, there is still quite a lot to cope with. However, we are confident that this unit is well within the capabilities of many of our readers. ■

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THE SERVICEMAN

Quick repair or complete overhaul

One of the problems confronting every serviceman is to decide just how far he should go in repairing a set. Should he repair only that fault concerning which he was called or should he go looking for others? And if the latter, how hard should he look?

In fact, neither extreme is a good policy. The best approach is something in between, based on a good deal of commonsense and an ability to treat each case on its merits.

The technique of repairing only the catastrophic fault which prompted the service call leaves the serviceman open to the criticism that he has not done his job properly. This is particularly so if the set should fail again shortly after the service call and perhaps be handled by another serviceman. The latter will be only too ready to make capital from the fact that obvious faults have been ignored.

At the other extreme, a policy of "complete overhaul" can be so costly, particularly with more complex devices such as TV sets, that the owner will rightly protest at the size of the bill. In fact, some organisations who, in the past, employed such a policy, earned themselves a reputation for dishonesty which was not necessarily deserved.

A reasonable policy seems to be to check, subjectively, the overall performance of any piece of equipment, after the major fault has been corrected. TV sets, in particular, can suffer from a host of minor faults involving height, width, linearity, fine tuning, sync, etc, often dating back to the day of delivery. The serviceman who, with a few simple adjustments, can make a set "better than ever" is assured of that customer's business – and his recommendation. Where more than a minor adjustment is involved, the customer should at least be given the opportunity to make his own decision on the matter.

A job I encountered recently is a typical example of what can happen. The unit was an 11in portable TV set; one of the first of this kind on the Australian market and which used valves throughout. Needless to say, it employed an extremely "compact" construction.

The customer's complaint was picture roll; just that, and nothing else. In fact, as soon as I saw the set I realised that there were several other aspects of its performance which were below par. For one thing the picture quality was extremely poor. The contrast was high – of the soot and whitewash variety – while the definition was so bad that I doubt whether if it would have resolved better than 150 lines. In addition, the height and linearity were both in obvious need of adjustment.

On top of that, the picture suffered from intermittent flickering. I had never seen anything quite like it before and could not determine exactly what the basis of it was. All I knew was that if I had had been forced to endure an evening's viewing with the picture flickering in this manner every few seconds, I would have been making tracks up the wall.

The situation was complicated by the fact that I had had very little experience with this particular model, almost nil in fact. Thus I had no clear standard by which to judge the quality of the picture. For this, and other reasons, I decided that the best thing would be to get the set back to the shop, where I could study the problems at my leisure. Being a portable set, this did not present any serious problems.

However, I did raise the matter of the flickering with the owner, mainly to determine how long it had been like that. He appeared to be quite philosophical about it. Yes, it had always been like that and was due to the fact that they lived near the railway line – "the overhead wires for the trains, y'know". He said it with such conviction that I felt sure that he had been fed the story by some serviceman or salesman who was looking for an easy excuse.

I didn't argue. Maybe it was some kind of environmental fault, in which case there might be little I could do about it. On the other hand, if it persisted in my own workshop, I could reasonably hope that I might be able to fix it.

Back at the shop I considered the rolling problem first. Somewhere in the back of my mind I recalled something about these sets having a rather critical vertical system. More specifically, it was to the effect that the ability of the vertical oscillator to lock on the sync pulses was dependent, to a significant degree, on the setting of the height and linearity controls. Presumably either of these controls could influence the free running frequency of the vertical oscillator, to the point where it was no longer capable of being effectively triggered by the sync pulses.

But since I wasn't sure, I had to confirm the theory. And who better than the makers. A phone call to the service department and a few minutes chat with the chap in charge was all I needed. He confirmed that the set was indeed critical in this regard, but added that there should be no problem once the height and linearity controls were set to a reasonable position within their range.

So, in fact, it proved to be. A few minutes work setting up the controls for optimum height and linearity not only improved the geometry of the picture, but completely cured the rolling. So much, then, for the original fault. With a little more confidence in my hunch, I could have fixed the job in the home, ignored the other problems, and been on my way in a few minutes. I might even have impressed the customer by my ability to do the job promptly and on the spot. But the customer would still have had a blurry, flickering picture.

The lack of definition proved to be a simple problem. The fine tuning control was set as far in the de-tune direction as it would go. When I adjusted it correctly the definition was extremely good. The only snag was that the contrast was now more like soot and whitewash than ever. Which seemed to suggest that this was the basic problem, the detuning being simply the customer's way of minimising it. What I had to find was the reason for the excessive contrast.

The set was not the easiest to work on that I have encountered, which is not really to be wondered at when one considers the magnitude of the task of packing a valve type TV set into a cabinet as small as this one. Partly for this reason I started with the tuner, which was both readily recognisable and reasonably easy to get at. A voltage check at the tuner input terminals revealed the interesting fact that the voltage of the AGC line was

Philips reply to The Serviceman

The Editor
"Electronics Australia"
Dear Sir,

In the November issue of "Electronics Australia" an article was published under the title "The Serviceman". This article dealt with the servicing of a TV set of modular design. The matter was referred to again in the December issue.

Readers of the articles may understand them to refer to a television set manufactured by Philips Industries Limited. A reader could also infer that Philips replacement modules and servicing accessories are not freely available, that the modular construction method is a faulty one, and that any claims made by Philips to advantages resulting from modular construction, are false and misleading.

Philips wish it to be known that they introduced the modular method of construction in their chassis production at the beginning of 1969. Apart from the initial period of two months following the introduction, replacement modules have been available from stock at any of the Company's Service Branch Departments. The construction method and the consequent servicing arrangements have proved most successful, and have fully justified any statements or claims which the Company has made.

Yours Faithfully,
Philips Industries Holdings Limited,
H. J. Brown
(Technical Director).



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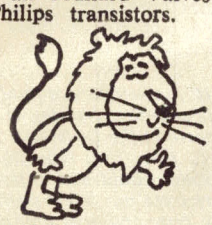
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Pittsworth TV set jumped the gun

PITTSWORTH. – A television set in Pittsworth is showing colour pictures.

The shade is a beautiful pink and the phenomenon was first thought to be the result of a picture tube that was on its last legs. But that was several months ago, and by all reasoning if that were the cause the tube should have packed it in ages ago.

At night the screen produces the conventional black and white picture, but in the afternoon there is colour – pink.

Then the theory was put forward that the set could be receiving colour television bouncing off a satellite – you know, just one of those things that happen.

So a local television technician was invited to take a look. He gazed at the pink production for some time – actually at this stage it was a children's show, and, believe it or not, pink elephants were prancing across the screen. No reflection on the technician.

He stroked his chin and finally walked over to the blue window blinds, drawn against the afternoon sun, and raised them. The picture reverted to black and white – pulled down the blinds and it was pink again.

The explanation – something to do with the phosphors in the picture tube in association with the furnishing colours in the lounge, particularly the blue blinds, with the sun behind them.

But it's still the first colour television in town!

positive rather than negative and also appeared to be constant, regardless of the channel selected.

This was the most likely reason for excessive contrast, but it was one thing to establish this point and quite another to pinpoint the reason. Still, I had to start somewhere, so I began tracing the AGC line as best I could, making voltage measurements as I went. It wasn't easy, and it took considerable time, but I did make progress.

In any AGC line it is usually possible to trace the source of foreign voltage by simply observing the voltages present at various take-off points along the line. Since these points are usually separated by decoupling resistors, the voltage will fall off as one moves away from the voltage source. Even if this does no more than indicate the stage or general area involved, it can save a lot of valuable time.

In this case the voltage values suggested the first IF stage and, while this still left a lot of components under suspicion, it had eliminated several times this number. I studied the circuit carefully at this point and came to the conclusion that the IF valve, one of the "compactron" variety, was the most likely culprit. In any case, it was relatively easy to remove and check, so it was a logical first step.

A simple replacement test proved the point. The positive voltage vanished and the picture assumed a normal contrast. Presumably the faulty compactron was suffering from leakage between a grid and one of the HT elements.

The set was behaving a good deal better now. With correctly adjusted contrast, improved definition, and correct height and linearity the picture was a far cry from the grotesque image I had first observed in the customer's lounge-room. The only thing which marred it was the erratic flicker.

A major problem concerning this fault was that I still did not know exactly what phenomena was involved. It is one thing to observe a flicker; quite another to nominate exactly what has caused it. Was it, for example, a momentary loss of video? Or a momentary loss of raster? These were just two broad possibilities, but knowing the answer would at least give some indication as to where to start looking. All I had established was that, since it occurred in my workshop just as much as in the customer's home, it was not an environmental fault.

With not much else to go on, I started off by prodding, tapping and jolting in the hope that something would show up. Fortunately it did. First, I was able to establish that the fault was quite definitely vibration sensitive. Secondly, and more importantly, I discovered its nature. For a brief moment I was able to produce a prolonged version of it and realised that it was a vertical collapse of the raster, with the characteristic bright white line across the centre of the screen.

Well, at least I was one step closer. I had a fault in the vertical deflection system. All I had to do was find out what part. This might have been relatively easy in a conventional set but in a compact unit like this it was a "fair cow" of a job. The set was constructed in a number of sections, including two printed wiring boards mounted vertically each side of the picture tube neck. Having identified the vertical output transformer and, from this, the vertical output stage generally, I realised that I would have to release one board from its mountings in order to investigate further.

Even this provided only limited access, remembering that I wanted to maintain the set in operating condition in order that I could continue to observe performance while probing for the fault. Switching the set on again I observed much the same performance as before – a matter of interest as it ultimately turned out – then commenced probing in effort to create the condition permanently.

This didn't take long, and resulted from my moving the leads to the vertical section of the yoke. Closer examination revealed that one of these leads had broken off where it was soldered to the printed wiring board but, by a strange chance, had remained in contact with the board ever since, even after I moved the board away from its mounting. Had the wire moved clear when it first broke the failure would have been complete and the owner would have been saved many years of flickering TV pictures. By the same token, had the person whom I suspect fed the owner the story about the trains,

taken a little more notice of the problem, it would have been found a good deal sooner.

Why had the wire broken? I'm not completely sure but one factor which surely helped was the fact that it was solid conductor rather than stranded. In addition, I suspect that the wiring operator who handled these wires was a little too heavy handed with his wire stripping technique and had nicked the wire in the process. Add a certain amount of vibration in subsequent assembly and handling and the stage was all set for a complete failure.

Rather more to the point right now, however, was how the customer was going to react to what I had done. I had, of necessity, spent a lot of time on the job, and would have to charge accordingly. Would he appreciate the improved performance or was he one of those, "as long as it moves he's happy" types? If the latter was the case then I might well be accused of charging far more than was justified.

When I finally set everything up in the customer's lounge-room I took special care to see that everything was just right and the picture at its best. It will be a long time before I forget that family's reaction. They sat staring at the picture, literally open-mouthed. Finally the man of the house, shaking his head in apparent disbelief, pointed to the set and said, "That set has never performed like that in its life before. What did you do to it?"

I knew he didn't really want an explanation, so I contented myself with a simple comment about "giving it a good overhaul". What was more important, I knew I would have no trouble over the bill – and that I had scored myself a customer for life.

Which is a good way to finish any job.

In lighter vein, here is a newspaper story you can chuckle over. Remember how, in the early days of TV, there were a lot of "old wives tales" about the subject; like the stories about indoor aerials putting too much strain on the receiver; or about small sets cropping the picture more than big sets (the TV stations transmit the same size picture to all sets); or picture tubes being damaged by allowing sunlight to shine on them.

Fortunately, most of these have now been pretty effectively squashed, although an odd one is still encountered now and again. But with increasing speculation about the advent of colour TV a new crop seems to be emerging. One of these was dealt with some months ago in the "Forum" pages of the magazine and concerned the term "colour compatability" which had been coined by an enterprising advertiser.

But for sheer confused thinking, the newspaper paragraph reproduced on the opposite page must qualify for some kind of a prize. It was submitted by Mr D. P. of Toowoomba, Queensland, and is from the "Toowoomba Chronicle" of 26/11/70. I suggest you read it at this point.

My first reaction on reading it was one of confusion; there are so many misconceptions in it, it is difficult to know where to begin in an effort to straighten things out.

However, let's start with the suggestion that the set was picking up colour TV transmissions from another country via a satellite. This is highly improbable. There are no active satellite repeaters operating in the VHF bands – in which our TV channels are located. This leaves only the possibility that the signals were simply being reflected, passive fashion, by the mere presence of a satellite in the appropriate part of the sky.

There are a number of technical reasons why this is unlikely, to the point of it being a virtual impossibility. In fact, the chances are far greater that freak meteorological conditions could produce such an effect. In fact, this has happened and TV signals (mono) on the lowest British channel (45MHz) have been received in Australia, on suitable receivers, on one or two occasions.

Anyway, for sake of argument, let us assume that by some mechanism colour TV signals were reaching the little town of Pittsworth and the TV receiver in question. We must also assume, of course, that the signals were on a frequency which the set was capable of receiving and having standards which the set could resolve. Again the odds are pretty long, but we'll go along with the gag.

How would the viewer of such a set know that the signals were from a colour TV transmission? Certainly not by reason of any colour on the screen, for the simple reason that the screen would not be capable of producing colour.

And, in any case, why would anyone expect the picture to have an overall colour cast, rather than distinctive colours? It would appear that those concerned are unable to differentiate between "colour TV" and "coloured" TV, even to the point of having the last word on the matter.

Nor is the explanation offered by the local TV technician – or at any rate, as reported as being offered by him – very satisfactory. As I see it, it is not nearly so profound as is represented. It has nothing to do with the phosphors in the picture tube screen. It is nothing more than a simple optical effect whereby the eyes, in a predominantly blue environment, as caused by the window blind, tend to resolve white objects as if they had a distinctly reddish cast.

It can work the other way too. On more than one occasion I have observed that the street lights, when first switched on in the early evening, had a distinct blue cast, whereas these same lamps, being filament types, appear to have – and, indeed, do have – a predominance of red in their radiation characteristic. Then how come the bluish appearance? Simply that on those occasions nature had turned on some brilliant red sunsets; so red, that the eye was tricked into seeing the street lamps as blue by comparison.

So much for colour TV in Pittsworth.

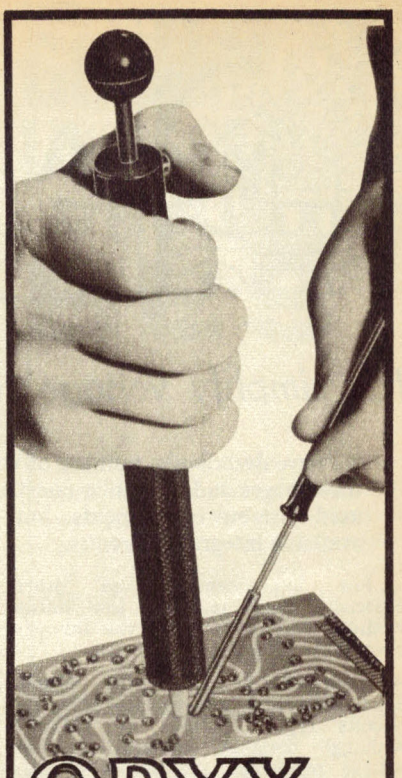
Notes & Errata

SIMPLE FLASHER FOR 240V LAMPS (November, 1970): In the text at the top of the third column of page 48 a reference is made to a 33K resistor. This should be 39K to agree with the circuit.

PLAYMASTER 129 STEREO AMPLIFIER (October, 1970): Two 3.2uF 6VW electrolytic capacitors should be added to parts list.

27MHz RADIO CONTROL RECEIVER (February, 1970): The transformer windings are shown reversed in figure 5, page 59. The 1K winding is the primary, and the 10K winding the secondary.

ELECTRONIC IGNITION SYSTEM: (October, 1970): On page 75, the text states that a series 27-ohm resistor should be used for protecting the DC-DC converter whilst testing. The value of this resistor should read 2.7 ohms instead of 27 ohms.



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AD3



A READER BUILT IT

ICs simplify voltage regulator design.

We have described a number of voltage regulators in the past, both in these pages and as regular constructional articles. Until now, all have used discrete components, but this design is built around readily available integrated circuits.

For experimenters and others, especially those requiring low voltage, medium current supplies, the following circuits should prove most useful.

They are based on the National Semiconductor 5 volt regulator integrated circuits types LM309H or LM309K. Although designed primarily as fixed voltage regulators, the output of these devices can be set above 5 volts by using the circuits shown.

The two units are similar, but the LM309H is mounted in a TO-5 package and has an output rating of 200mA, while the LM309K is mounted in a TO-3 package and has an output rating of 1A. Both these ratings can be extended if adequate heat sinking is provided.

The main feature about these devices which appealed to the writer was the virtually indestructible nature of their construction. According to the data sheets supplied with the devices the design incorporates (1) current limiting to limit the peak output current to a safe value, and (2) thermal shutdown to keep the IC from overheating.

The devices are the essence of simplicity to use, as the number of components used externally is extremely small. A number of circuits is suggested, as follows:

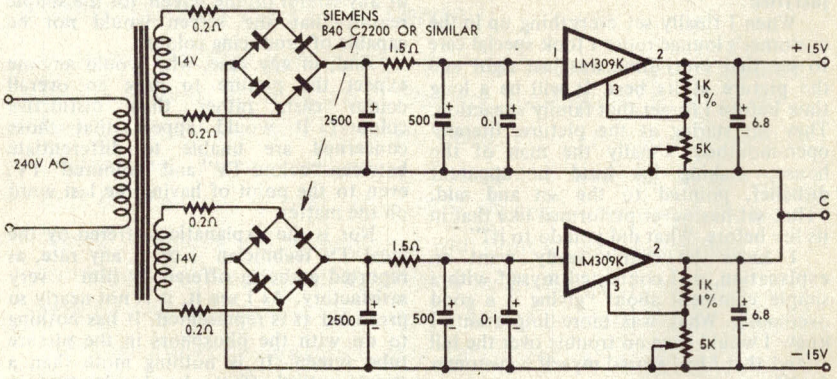


Figure 4: Although rather more complex, this configuration is still relatively simple. It provides 15-0-15 volts at one amp.

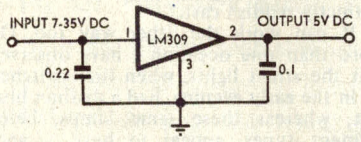


Figure 1: A simple arrangement providing a fixed 5V output.

A Fixed 5 Volt Regulator. (Figure 1): Intended mainly for those working with TTL (Transistor/Transistor Logic) which normally requires a 5 volt supply. According to the makers the input capacitor is required only if the regulator is located an appreciable distance from the power supply. Also, although no output capacitor is needed for stability, it does improve transient response.

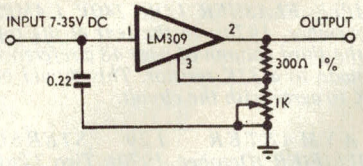


Figure 2: Modified setup gives variable output voltage.

An Adjustable Output Voltage Regulator. (Figure 2): This circuit is particularly suitable for experiments requiring varying voltages from five to about 30, or for servicing pocket radios, etc. A voltmeter could be wired across the output to facilitate voltage adjustment.

Current Regulator. (Figure 3): In this circuit the resistor wired across pins 2 and 3 of the device determines the output current.

Variable 15-0-15 Volt Power Supply. (Figure 4): This is a more complex circuit but the uses of it will be apparent to those experimenting with equipment requiring variable positive and negative power supplies.

The data sheets indicate that the line regulation and the load regulation of these devices is extremely good. For a variation between 7V and 25V input, the line regulation is typically 4mV, with a maximum of 50mV. The load regulation is typically 20 to 50mV over the full output current range.

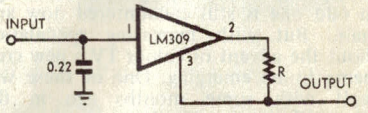


Figure 3: Current Regulator configuration.

Considering what these devices will do, and the components they replace, they are relatively cheap. The LM309H costs $8.25 and the LM309K costs $9.75. On this basis the LM309K would appear to be the better buy.

Submitted by: Mr J. W. McAllister, 16 Ramsay Avenue, Netley, South Australia, 5037.

(Editor's Footnote: "Reader Built It" projects are published for the general interest of experimenters and as a source of ideas. Based on reader's contributions, they have not been tested in our laboratory and we cannot accept responsibility for them.)

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New voices for monophonic organ

Our monophonic organ, simple though it was, aroused a lot of interest among musically minded readers. This contributor tells how he "dressed it up" with extra voices, vibrato, and larger speakers.

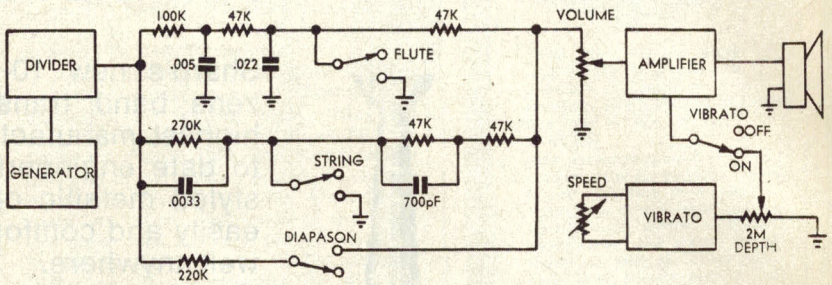
Some time ago a monophonic organ was described in "Electronics Australia". (January 1969, File No 1/EM/19.) While an interesting device, I found the musical value limited, due mainly to the absence of a keyboard. I spent many hours making a keyboard, with switches under the keys, but it was worth the effort. It makes possible a smooth legato, while keying from one note to another eliminates key clicks which are otherwise disturbing.

(A keyboard version of the monophonic organ was described in December 1967, File No 1/EM/17, Ed.)

Experiments with further voicing circuits also proved very successful and are reproduced here for the benefit of readers who may be similarly interested. Some experiments were conducted with resonant circuits to produce reed effects, but these were not so satisfactory.

The finished unit, fitted with two five inch speakers, and controls to vary vibrato speed and depth, gives very satisfying results.

Submitted by: Mr D. Jackson, 59 Prospect Rd, Summer Hill, NSW 2130.



Addition of this relatively simple circuit to the monophonic organ will provide flute, string, and diapason effects.

Digital demonstrator as music generator

Another suggestion to interest our musical readers concerns the digital demonstrator described 1966-67. One of our younger readers – still at high school – describes how this equipment can be used as a simple electronic music generator.

The digital demonstrator described by Jamieson Rowe can, with the addition of four more flip-flops, be used to make simple electronic music. The first group of flip-flops controls the selection of the note, while the second group divides the note.

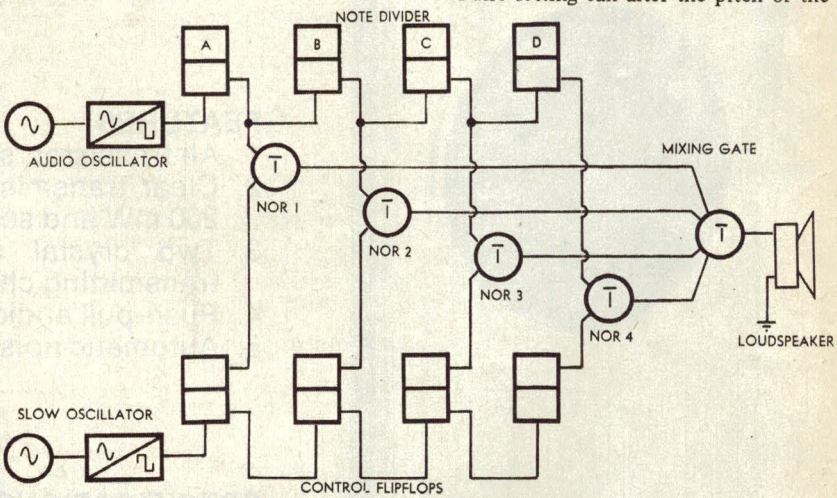
The note selector can count in binary or, if desired, a decoded twisted ring fashion. The four notes are fed into a NOR gate separately. The other control flip-flops are fed separately into each of the NOR gates into which a note is fed. The outputs of the four NOR gates are connected to the inputs on a four input NOR gate the output of which is connected to a loudspeaker.

The loudspeaker can be one of the 150 ohm types made by Philips, or an equivalent. One side of the speaker is connected to the output of the NOR gate and the other side to the common rail.

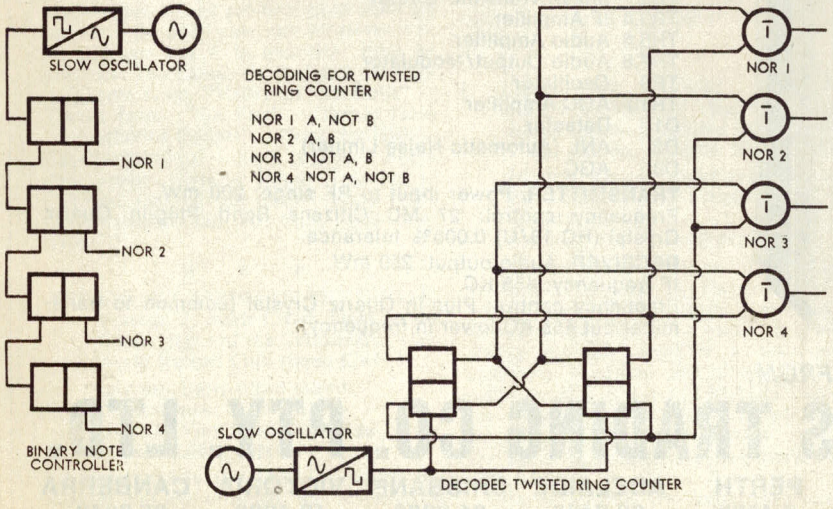
The audio oscillator provides the notes for division. This can be either a fixed type of about 4KHz or a variable type covering from about 3 to 6KHz.

Pulse setting can alter the pitch of the note. With the Y-bar output of flip-flop C on the note divider the best combination of pulse setting is to pulse set A, then A and B, and then B alone. The pulse setting can be done by holding the plug connected to the Y-bar output of the flip-flop, and touching the pulset sockets with the fingers. The oscillator to drive flip-flops needs to have an output of 9V.

Submitted by: Mr P. Hoffmann, 9 Lancia Road, Croydon Park. SA 5008.



Basic arrangement of flip-flops, NOR gates, and oscillators added to the demonstrator. Many variations would be possible.



Control circuits employing binary count and twisted ring count.

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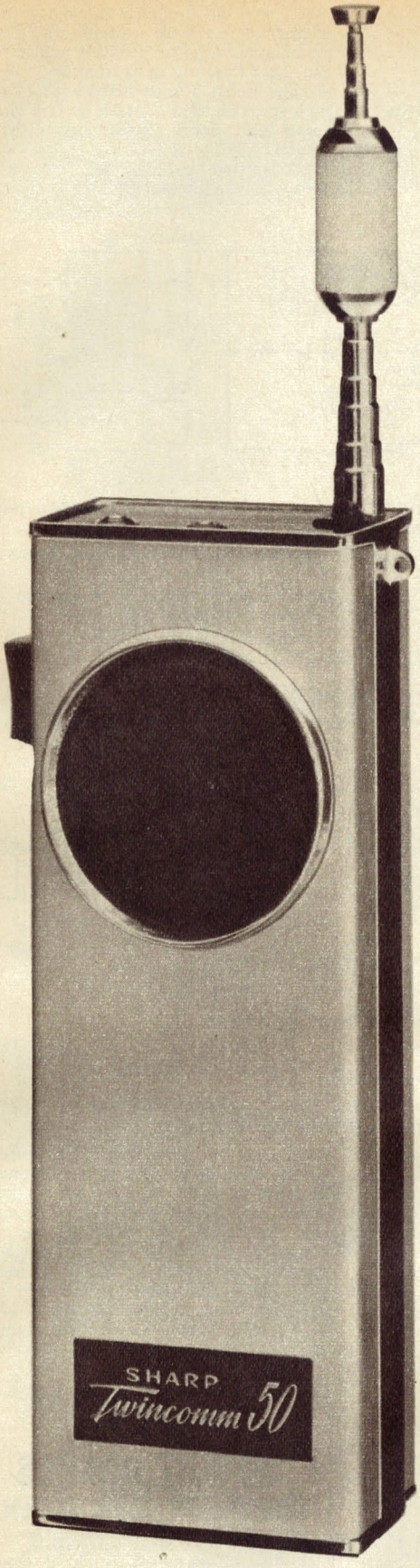
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5. Automatic noise limiter.

SPECIFICATIONS

TYPE:
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TRANSISTORS AND DIODES:

TR1	RF Amplifier
TR2	Mixer/Transmit. Output
TR3,4	IF Amplifier
TR5,6	Audio Amplifier
TR7,8	Audio Output/Modulator
TR9	Oscillator
TR10	AGC Amplifier
D1	Detector
D2	ANL (Automatic Noise Limiter)
D3	AGC

TRANSMITTER. Power input to RF stage: 200 mW.
Frequency control: 27 MC Citizens Band Plug-in Quartz Crystal (HC-18/U) 0.005% tolerance.

RECEIVER. Audio output: 250 mW.
IF frequency: 455 KC.
Frequency control: Plug-in Quartz Crystal (common to transmitter but 455 KC lower in frequency).

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A READER BUILT IT . . . continued

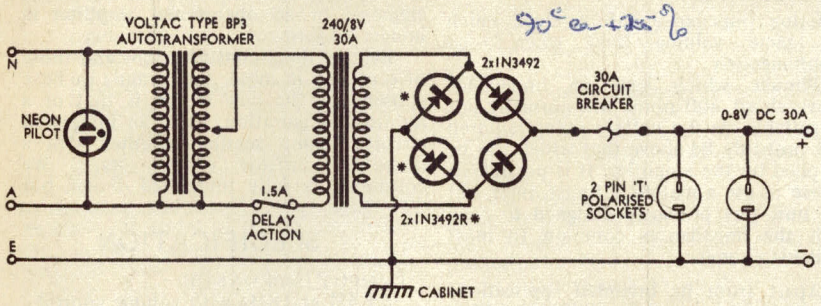
Heavy duty low voltage supply

There are many situations, ranging from the home workshop to the school science laboratory, which call for a heavy duty, low voltage, unregulated, unfiltered power supply. These include battery charging and electroplating, plus a whole range of laboratory experiments.

The unit to be described has been used very successfully at Brighton Grammar School (Victoria). It was designed and built to fill the need of the senior chemistry laboratory as a mains operated alternative to the dry cells used for electrolysis, calorimetric and similar experiments, where voltage is not critical.

providing 0-8V DC, continuously variable, at 30A continuous. Variation of the components could be used to tailor the supply to suit other requirements.

Operation of the circuit is quite straightforward. It consists of an autotransformer which varies the voltage applied to the primary of a 30A stepdown



A variable voltage autotransformer provides continuously variable voltage. A step down transformer delivers the required low voltage, as well as providing isolation from the mains.

It is far more convenient than dry cells and, at a total cost of $60 (tax exempt) very economical, considering the cost of replacing 30 large dry cells at regular intervals.

As described, the supply is capable of

transformer. A 1.5A delay action fuse was included between these two transformers to protect the autotransformer. Some may consider this precaution unnecessary.

The low AC voltage across the secondary of the stepdown transformer is rectified by a conventional bridge rectifier. A 30A circuit breaker is used to protect the diodes, which would be quickly destroyed by overload or short circuit. Cables are run from the unit to polarised "T" sockets mounted along the benches.

The supply was built in a well ventilated steel cabinet which, for safety, MUST BE EARTHED, as must one side of the DC output.

Under normal conditions, the diodes are operating well within their ratings. One three inch long fin type heatsink was used for each pair of iodes, and located in a well ventilated position inside the cabinet. Since the diodes are of the press fit type and cannot be insulated from the heatsinks, the latter must be insulated from the cabinet, using the special plastic insulators made for this purpose.

Submitted by: Mr N. W. Giles, 32 Mawby Rd, East Bentleigh, Victoria, 3165. ■

PARTS LIST

- *1 Power transformer, 240V/8V, 30A. PT5852 or similar.*
- *1 Variable voltage autotransformer, Voltac BP3 or similar.*
- *2 1N3492 diodes, or similar.*
- *2 1N3492R (reverse polarity) diodes, or similar.*
- *1 5mm fuse holder and 1.5A delay action fuse.*
- *4mm diameter hookup cable.*
- *3 core mains cord and plug.*
- *2 3in heatsinks (Mullard 45D or similar) and mounting insulators.*
- *1 Neon indicator (optional).*
- *1 Steel cabinet to suit.*

Blown fuse indicator

When the fuse blows – and they always seem to blow at the most awkward times – do you know exactly where to find it in your switchboard? If it is a large board the chances are you don't. A simple indicator across each fuse will save a lot of searching.

Here is a handy idea for anyone with a large switchboard having a large number of fuses on it. When a fuse blows a neon lamp indicates which one it is. The scheme has the advantage of being simple and inexpensive.

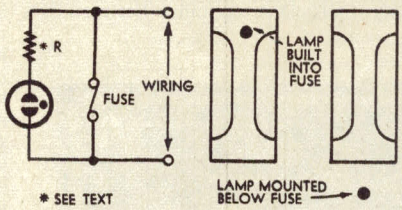
As indicated in the diagram, the lamp is connected in parallel with the fuse terminals. As with any neon lamp, a resistor must be connected in series with it to limit current to a safe value. This may be either in-built, as with most lamps mounted on a base, or fitted separately in the case of bare tubes.

(Editorial Note: Where a separate series resistor needs to be fitted, extreme care should be taken to see that all wires and components are adequately insulated in the interest of safety. The same applies to the installation as a whole.)

Before the fuse blows the lamp is shorted out and does not glow. As soon as a fuse blows the short is removed and the circuit is completed through the neon lamp and the fault which cause the fuse to blow. The presence of the lamp does not create any danger, even though the fault

remains, since its high resistance permits only a small current flow.

The lamp can be built into the fuse holder by drilling a suitable hole in the



The fuse indicator lamp may be mounted on the board near the fuse, or in the fuse holder.

porcelain or, alternatively, mounted on the board underneath or alongside the fuse.

This indicator can save a lot of time which would otherwise be spent looking for the blown fuse.

Submitted by: Mr S. Balogh, Flat 11, 10 The Avenue, Windsor, Victoria, 3181.

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by PHILIP PIK

The amplifier described here is the outcome of many requests from readers. It is capable of high quality reproduction, yet with the accent on economy. The circuit has been designed to provide wide range, low distortion reproduction from high quality crystal and ceramic cartridges, and with a variety of stereo phones.

Because of the deliberate accent on economy. only three main controls are provided: volume, channel balance, and treble cut. Fixed bass boosting is incorporated to compensate for the bass roll'off typically experienced with phones due to the difficulty in achieving complete coupling to the ears.

No provision has been made for magnetic pickups, nor for full boost and cut tone control facilities, as it was decided that these would be inappropriate in an economy design. It may be that a headphone amplifier incorporating these facilities could be justified, however, and if reader interest seems sufficient, we may well describe such a project at a later date.

The sensitivity of the present unit is high, and this together with a high input impedance makes it eminently suitable for very low output ceramic cartridges such as the Decca Deram. Higher output cartridges can also be accommodated as the volume control operates on the input before the signals reach any active circuitry.

The unit has sufficient output capability to drive two sets of stereo phones simultaneously. The phones may have any impedance up to 600ohms, and if two pairs of phones are to be used at the same time they need not be of the same impedance. The output circuitry of the unit has been designed so that the sound level produced is largely independent of impedance level, so that phones of differing impedance will produce much the same volume level when used simultaneously.

Phones which have an impedance above about 600 ohms will normally not be suitable, as the voltage swing required will probably be above that which can be supplied by the amplifier. It is possible of course to use a matching transformer, but the unit was primarily designed to cope with the impedances common to most available phones.

Apart from its intended application, the amplifier can be used as a high performance pre-amplifier, if after some time, it is decided to change over to loudspeaker reproduction. All that will be necessary in that event is to purchase or build a power amplifier. This can then be driven from the record outlet of the headphone amplifier. The output level is 1 volt RMS, which should be sufficient for almost all amplifiers. The output impedance is less than 1K, so that long lengths of cable may be used between the two units if required.

In order to obtain a better understanding of the requirements of an amplifier of this kind let us consider briefly the following.

Gain: This must be sufficient for the lowest output cartridge available, which is in the order of 40mV allowing for lightly modulated records. Now the voltage swing required for adequate loudness with a 600 ohm impedance phone is about 14V peak to peak. This gives a voltage gain requirement of approx 100 times or 40dB. However, to give adequate bass response, it is necessary to provide an additional gain of some 10dB at the lower frequencies. This is to compensate for the rather inefficient coupling between the phones and the ears at these frequencies.

Thus it can be seen that a total voltage gain of around 50dB is required, to allow operation with high impedance phones. This order of gain is substantially more than can be supplied by the conventional 4 transistor complementary symmetry arrangement such as described in the 3-Plus-3 of August, 1968. Moreover, an even greater open loop gain is required if distortion is to be kept low, necessitating the use of either a large number of discrete elements or an operational amplifier in integrated form.

Bearing these considerations and those of economy in mind, the formula we have chosen for the new design is that of a hybrid configuration, using an integrated circuit preamp section together with a discrete transistor output stage. We considered a fully integrated design, but all of the appropriate integrated devices which we investigated proved to be rather less than suitable – either by virtue of low input impedance, relatively high noise level, or high distortion. Most of the types readily available will only operate at supply voltages up to 12 volts, whereas operation from at least 18V is necessary if sufficient power is to be delivered into 600 ohm headphones.

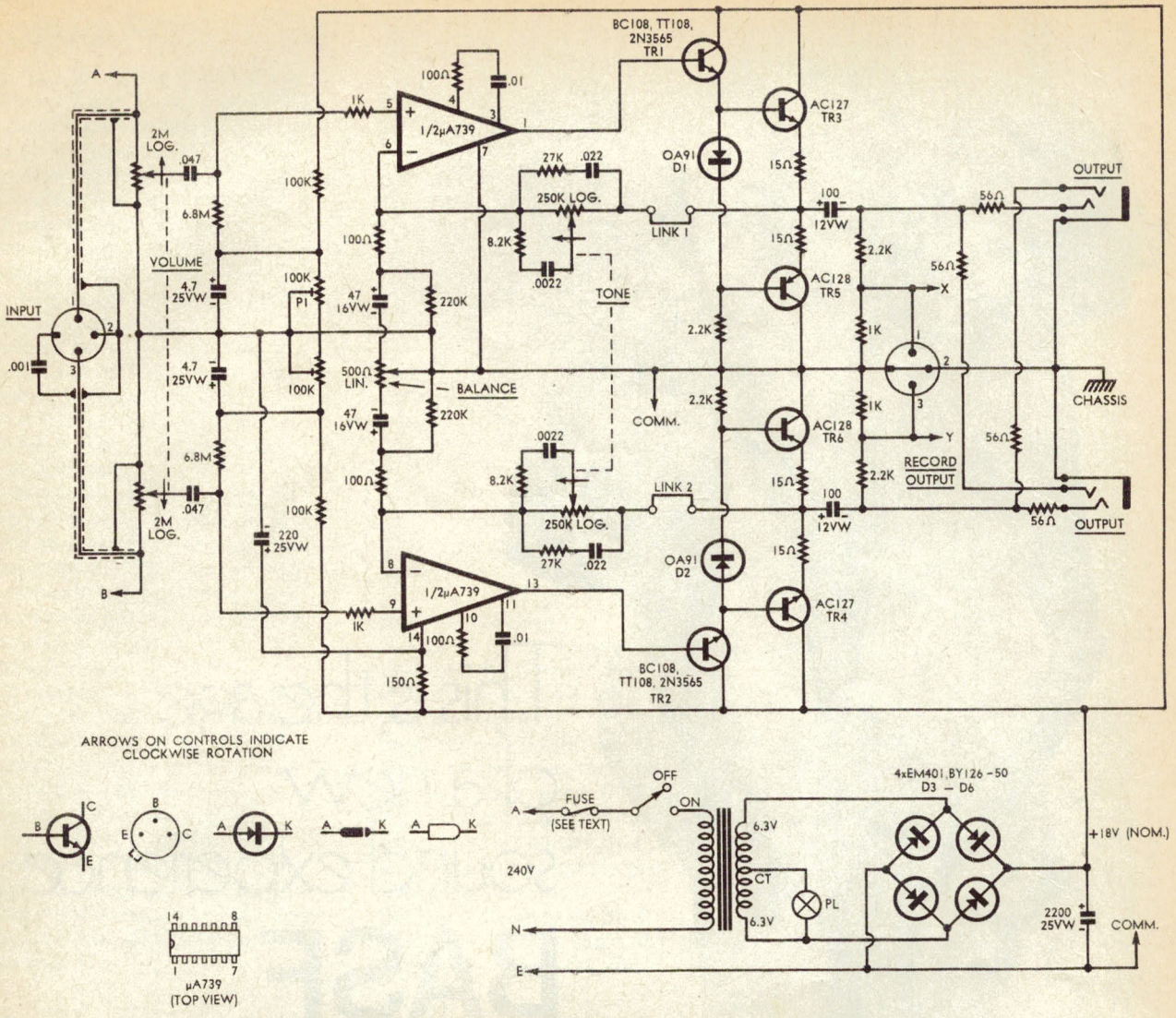
Further disadvantages of these IC amplifiers include the large number of discrete components that are generally required around them, and the fact that tone control facilities of the type required for this amplifier are often difficult to incorporate, unless a good deal of complexity is introduced. So whilst at first the choice of a complete low power IC amplifier might seem logical, the ramifications tend to make this choice unsatisfactory.

SPECIFICATION

1. INPUT IMPEDANCE:
   1.5M at 1KHz with volume control at max setting, increasing to 2M at min setting.
2. SENSITIVITY:
   40mV at 1 KHz for max output.
3. SIGNAL TO NOISE RATIO:
   -48dB with respect to max output with volume control set fully clockwise. This is independent of the impedance of the load connected and improves at lower control settings.
4. FREQUENCY RESPONSE:
   -3dB points at 5Hz and 150KHz with fixed bass boost removed. For response with bass boost in circuit see Fig 1.
5. TONE CONTROL:
   Top cut type. -10dB at 10KHz. See Fig 1 for contour of response curve.
6. DISTORTION:
   0.1% at 1 KHz under all load conditions and power levels. See Fig 2 for complete details.
7. CHANNEL SEPARATION:
   -34dB at 1KHz rising only slightly at the very low frequency end.
8. BALANCE CONTROL RANGE:
   +10dB to -4dB about centre position, giving a total range of 14dB between channels.



The completed amplifier shown slightly less than half full size. Note the facility to connect two sets of phones.



PLAYMASTER 130 STEREO HEADPHONE AMPLIFIER

1/SA/34

Shown here is the complete circuit including power supply, together with connection diagrams for the semiconductors. Note that the mains fuse is on the board itself.

Nevertheless, the final outcome is a circuit that still uses an IC, namely the Fairchild uA739 low noise dual operational amplifier. It is used here as a pre-amplifier only, having insufficient power to drive the phones direct. An intermediate stage is therefore provided, in the form of a complementary symmetry class AB power amplifier.

Starting at the output, a pair of AC127/AC128 transistors provide the necessary power to drive the phones. Short circuit protection is provided by the series resistors which limit the power delivered by the transistors to 400mW. These series resistors serve the additional purpose of delivering substantially constant power to the loads regardless of their impedance. The choice of 56 ohms for the value of these resistors was made after considerable experimentation with a variety of different types and makes of phones.

The end result is that the sound output is roughly the same from any pair of headphones, regardless of its impedance. For many of our laboratory tests we used a pair of AKG K60-75 ohms and Pioneer 8 ohm phones. Both sounded equally loud when connected either individually or both together, and it was easy to set the volume control to a mutually agreeable one when both were in use.

Drive for the output transistor pair in each channel is obtained from a BC108 transistor which is connected in the emitter follower mode. Unfortunately the uA739 is unable to drive the bases of the output transistors directly, as its current drive is insufficient.

Direct coupling is used between the IC and the BC108, and in fact all stages of the amplifier are direct coupled. This together with the DC negative feedback applied, ensures high operating point stability and compensation for component aging. Once initial setting have been made, there should be no need for any further adjustments during the life of the unit.

As may be seen from the circuit diagram, each amplifier channel has negative feedback applied between the output stage emitters and the inverting input of the uA739. The feedback operates for both DC and AC, the DC feedback being used for operating point stabilisation while the AC feedback provides gain stabilisation and reduces noise and distortion. RC networks in the AC feedback loop are also used to provide the fixed bass boost and the adjustable treble cut.

The DC feedback divider consists of the 250K tone control element, in the upper leg, with the lower leg being formed by the series 100 ohm and 220K resistors from the uA739 inverting input to ground. The divider thus has a division ratio of only 2:1, giving a high order of DC stability and a high degree of tolerance to supply voltage variations.

There are two AC negative feedback components, both of which share the lower divider leg formed by the series combination of the 100 ohm resistor and approximately one half of the balance control (the 47uF capacitor has very low impedance over most of the audio spectrum). One component is that which flows through the 27K/.022uF series combination as upper divider leg; this component is that which sets the mid-range gain and provides the fixed bass boost. As the boost is provided by the rise in reactance of the .022uF capacitor at low frequencies, it can be deleted if not required simply by replacing the capacitor with one of much higher value – say 5uF. Note that the capacitor cannot be shortcircuited, as this would upset the DC feedback.

The second AC feedback component is that which flows through the 8.2K resistor and 2200pF capacitor connected to the



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wiper of the tone control. These components are responsible for the adjustable treble cut, providing additional negative feedback at high frequencies when the control is turned fully anit-clockwise. The effect is to provide a top cut of approximately 10dB at 10KHz. As the control is turned clockwise, this additional feedback and treble cut is reduced, falling to zero at the fully clockwise position of the control. The high frequency response of the amplifier in this condition is thus quite flat. Note that the control has a so-called "logarithmic" taper, to give a smoother action.

Readers interested in calculating the actual gain of the amplifier at various frequencies may care to do so, using the familiar approximation A = (Rf + Rs)/Rs. Here A is the effective gain, Rs is the lower feedback divider leg impedance, and Rf is the upper divider leg impedance. Here Rs is approximately 350 ohms with the balance control in mid-position. At mid frequencies, for example, the gain A is approximately 27,350/350, or 78 times.

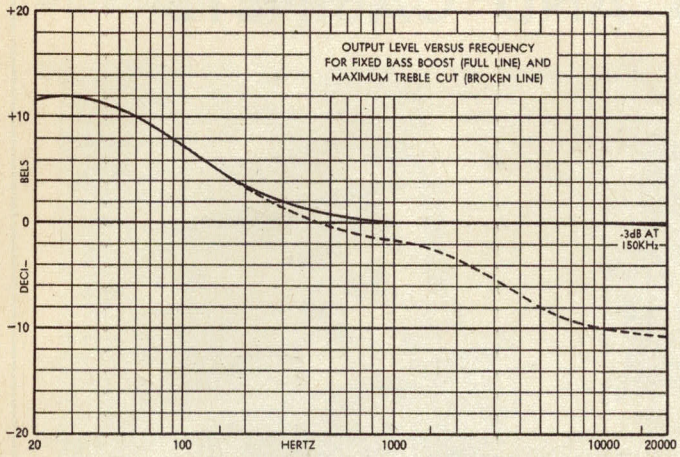
Additional to the feedback loops just described is the local current feedback in the output pair emitter circuit, furnished by the 15 ohm resistors. These resistors also serve the purpose of providing thermal stability. Because of their relatively high value, a small bias voltage is developed across them. This voltage, in conjunction with the voltage developed the OA91 diode, sets the quiescent current to approximately 10mA. This type of arrangement makes optimum bias adjustment unnecessary, and also renders the circuit relatively insensitive to parameter spreads in the transistors.

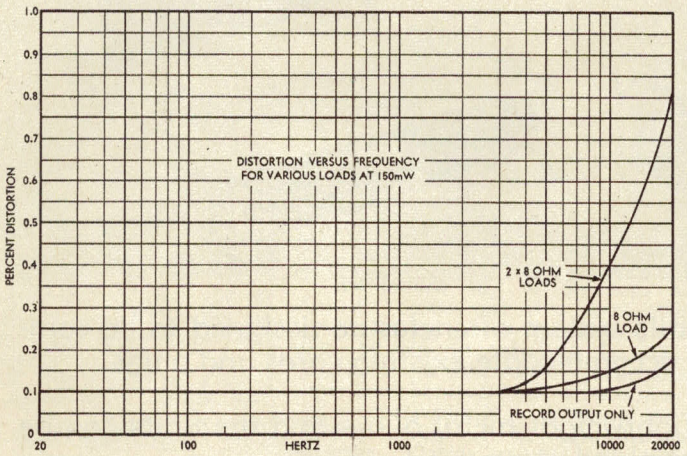
There is yet another negative feedback circuit, or more strictly a frequency compensation circuit. This consists of the series-connected 100-ohm resistor and .01uF capacitor connected between internal points in each amplifier channel of the uA739. These components are necessary to ensure stable operation; their values are determined by the operating gain of the amplifier, and should not be altered.

The only initial adjustments that have to be made to the unit are the settings of the trimpots P1 and P2. These set the half rail voltage at the junction of the 15 ohm output emitter resistors. It is interesting to note that although the two amplifiers in the IC are made on the one chip, each amplifier still requires individual bias setting for correct operation. More will be said on adjustment procedure in the section dealing with the construction of the amplifier.

The bias voltage set by P1 and P2 is shunt fed to the non-invert input of the amplifiers. Because of the high input impedance of this input, a high value resistor can be used, giving negligeable shunting across the input circuit. The input of the IC itself is taken from the 2M volume control via the 0.047uF coupling capacitor.

As the circuit diagram shows, there is only one input connection. This was done to keep cost of the basic unit to a minimum. However, provision has been made to connect a further two input sockets and an input selector switch, if required. The necessary holes have been drilled to fit two extra DIN sockets and a standard 3/8in bush rotary switch. One socket could be used to take a tuner and the other could serve as a DIN tape

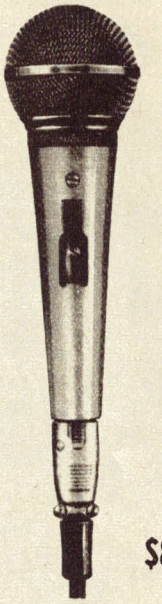




Shown immediately above are the distortion levels for various loads, and at top the response with fixed bass boost.

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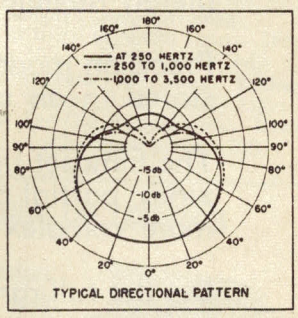
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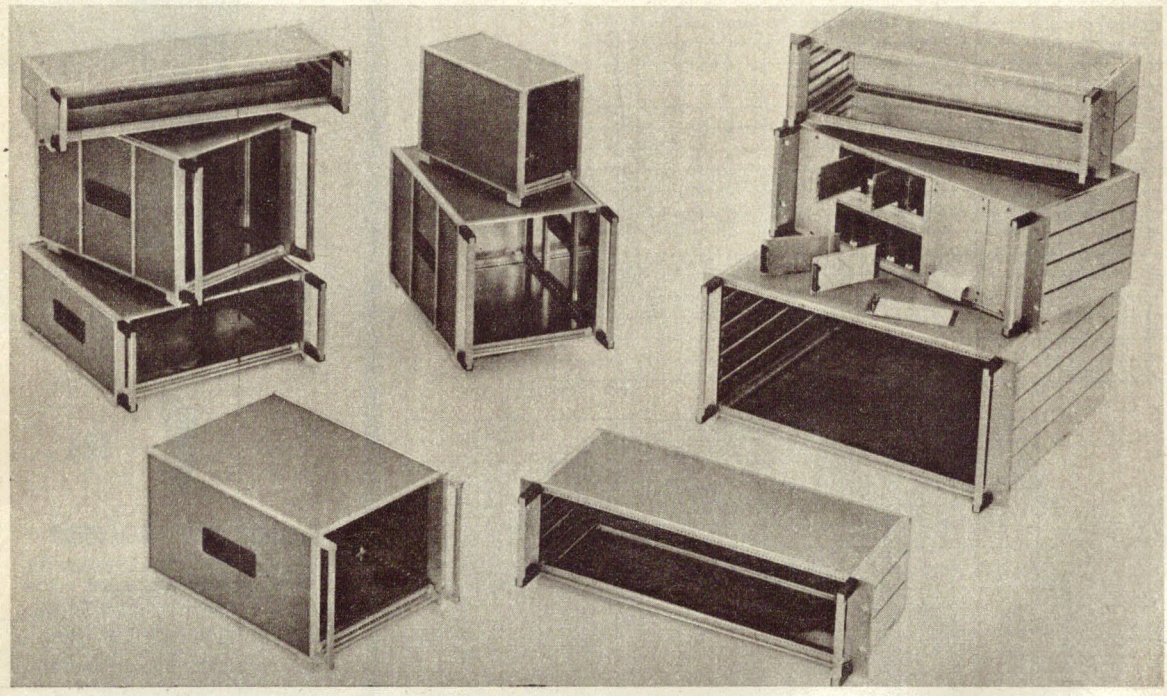
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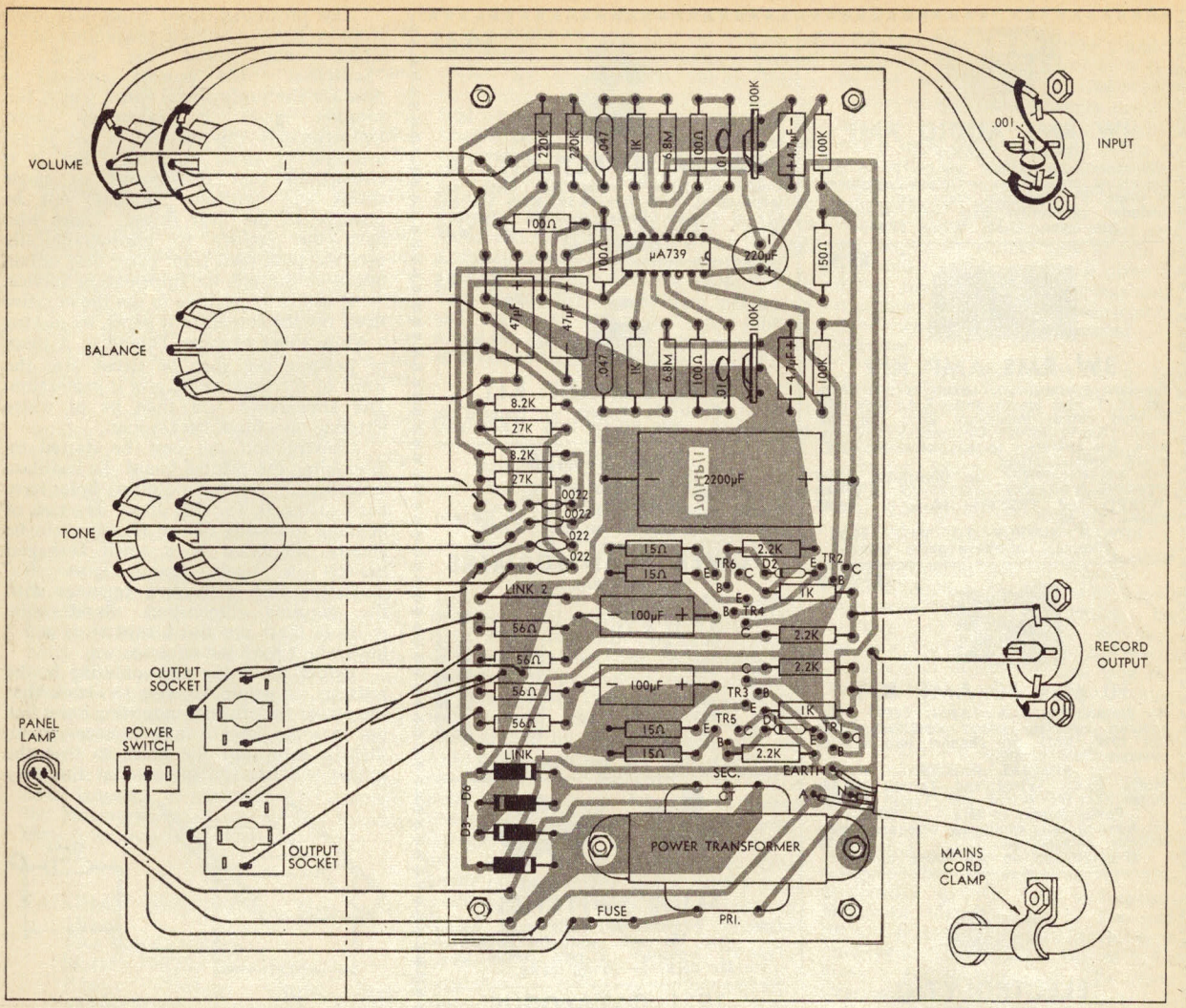
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The wiring diagram, showing the interconnections between the printed board and ancillary components. Note particularly the orientation of the diodes and IC.

recorder connection. Fig 4 illustrates such an arrangement.

Because of the output connectors used, connection of the signal earth circuit to chassis occurs unavoidably at the output of the amplifier channels. The input connector earths thus cannot be directly connected to chassis, as this would cause earth loops. In order to keep RF interference to a minimum with this arrangement, it is necessary to fit a bypass capacitor between signal ground and chassis at each input connector. This prevents any possibility of radiation within the case from the earth braid connecting the input connector to the volume control. In this way interference from radar pulses, TV framebuzz, two-way radio and other sources is kept to a minimum.

The power supply for the amplifier is a simple one, using full wave bridge rectification. Smoothing is performed by a single reservoir capacitor, this being more than adequate for the output stages employed. The decoupling components used for the uA739 (150 ohms and 220uF) provide adequate additional supply filtering for the preamp stages. Protection against accidental short-circuits is by means of a simple wire fuse on the printed wiring board.

A glance at the specification should reveal that this amplifier is capable of a performance equal to many relatively espxpensive high power units. Frequency response is particularly wide, whilst distortion is very low. Simplicity at the expense of control facilities, rather than at the expense of performance has been the aim of the design.

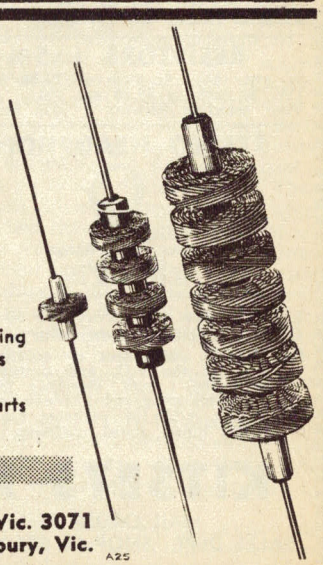
The complete amplifier is assembled in a U-shaped chassis with overall dimensions of 7 7/8in x 5½in x 3in. The prototype was made from 20-gauge steel and supplied by Heating Systems Pty Ltd, of 19-21 The Boulevarde, Caringbah, NSW. Similar metalwork should be available in due course from kitset suppliers. For those who wish to construct their own chassis, metalwork blueprints are available through the normal Information Service.

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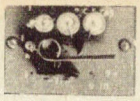
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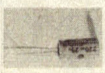
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50mf	21c	18c	30mf	15c	13c
100mf	25c	21c	50mf	17c	14c
200mf	29c	23c	100mf	19c	15c
500mf	40c	35c	200mf	25c	21c
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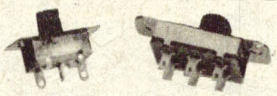
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It would be possible to use the negative itself for the actual front panel, by placing a white sheet of paper behind it. A piece of perspex can then be fitted over the front of the negative, to give it protection. The appearance will then be of white lettering on a black background.

Construction can best be started by assembling the printed board. To facilitate assembly, all resistor mounting holes have been spaced 0.7 inches apart. The task of bending the leads of the resistors can be greatly simplified if a small U-shaped bracket is made first. Figure 3(a) illustrates such a bracket, together with the required dimensions. Besides the resistors there are also 6 capacitors and 2 links which have the same spacing.

Before mounting and soldering in the resistors, it would be wise to check that the power transformer mounting holes line up. In some cases it may be necessary to slightly ream out the holes so that the screws will fit. The reason that this may

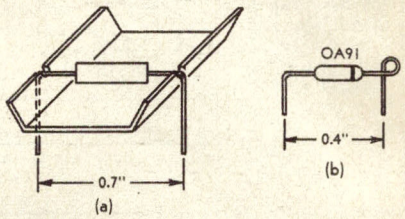


Figure 3: A lead bending jig, and the way to form diode leads.

sometimes be necessary arises from production spread in the mounting brackets of the transformers. Having ascertained that the transformer fits, the resistors may now be mounted and soldered in.

The order in which the remainder of the board is assembled is not critical, but it is usually wise to mount the smaller components first. Care should be taken when fitting electrolytic capacitors to observe polarity. The two germanium diodes require extra care in mounting and soldering. Figure 3(b) shows the recommended way in which the leads should be bent. Note that the softer lead is at the cathode end and this is the one that should be looped. (The loop is to provide for thermal expansion of the diode.) When soldering in these diodes it is advisable to apply a heatsink in the form of small nosed pliers or tweezers to the leads being soldered.

Similar precautions should be taken with the transistors. Always try to keep the time of the soldering operation to a minimum, especially when dealing with semiconductors. Overheating may not only damage the component, but also cause the copper conductor to lift from the board. This applies particularly around the IC, where of necessity the conductors are thin. However fitting the IC is perhaps best left till last, as it is the most expensive single item.

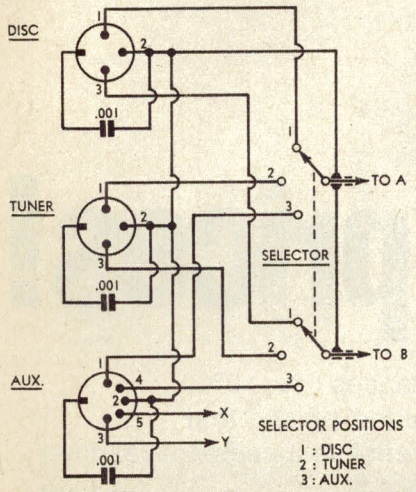
When the transformer is mounted, take care not to warp the board. This is best

done by placing one or two washers underneath each mounting lug of the transformer. The orientation should be almost self evident, the side with the 3 wires corresponding to the 3 holes provided.

Fuse protection by means of a very thin wire link is provided for on the board. A convenient source of wire is a single strand of the braid of a shielded audio cable. Although such a fuse link may not provide ideal protection, it does prevent catastrophic burnout of the amplifier. For those who wish to be precise, the current rating of the fuse should be around 200mA.

Before the IC is mounted on the board, the leads connecting the board to the controls, switches and sockets should be wired. The easiest way in which to do this is to cut up twenty-one three-inch lenghts and four four-inch lengths of stranded hoopup wire. The four-inch lengths are for the pilot light and power switch. After one end of each lead has been fitted, the other ends can be cut to suit when the board is finally mounted in position.

Having wired all the components and interconnecting leads as described, the last



An optional three input arrangement, showing how DIN tape recorder and tuner/aux. connections may be made.

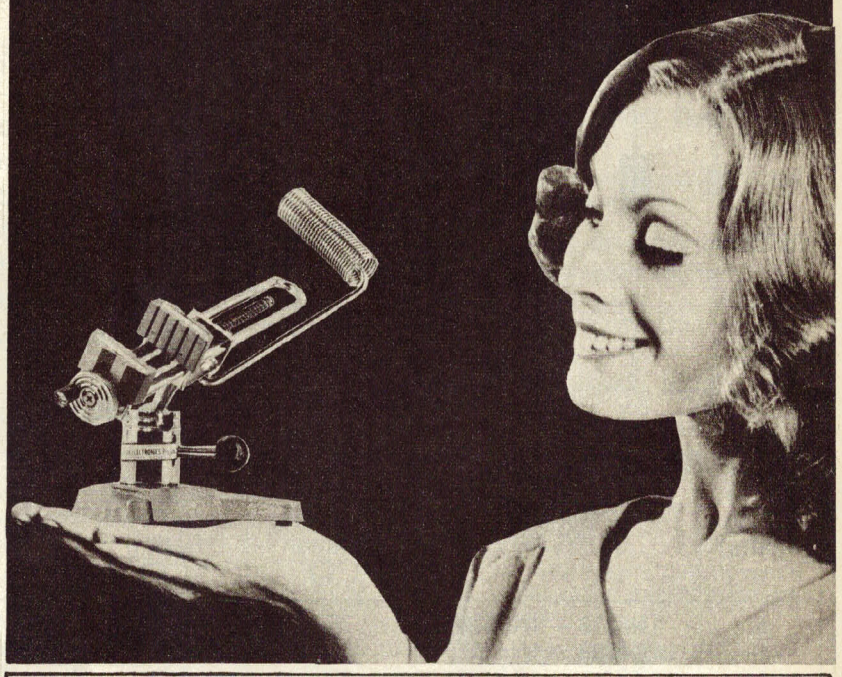
connection to the board is the mains cord. Care should be exercised to see that there are no loose strands that may cause shortcircuits. Leave connection of the plug to the cord until the assembly of the amplifier is completed. Finally, the IC should be soldered in, taking care not to bridge between pins by using excessive solder. Note that we used a socket in the prototype, as shown in the photographs, but this is by no means essential and certainly not economic.

Once assembly of the board is completed, attention can be turned to the chassis. The potentiometer shafts should be cut to a length to suit the knobs. Fitting of the controls may take a little more care than usual if it is desired to have the knobs fitting close to the front panel. In the prototype unit two nuts per control were used; one was on the inside of the chasses, whilst the other, previously filed down to fit inside the recess of the knob, was screwed on from the front of the panel. The knobs used were of the knurled aluminium variety, type 5428 manufactured by the Sato Parts Co, of Japan. This type or a similar variety should be available from most suppliers.

The stereo phone sockets we used have switchable contacts but these are of course not necessary. The only reason they were used was that at the time concerned this was the only type locally available. There are, however, some types on the market that do not easily fit and size should be kept in mind when buying these. For a flush fit, two nuts should once again be used. Similarly, the mains switch must be chosen with size in mind, and it is recommended that a miniature type be used such as the one in the prototype. This was an NKK subminiature switch type S-2102, marketed by IRH Components Pty Ltd. For neat appearance the pilot bezel should also be a miniature type. Next the input and output sockets

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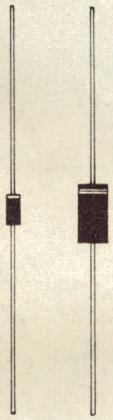
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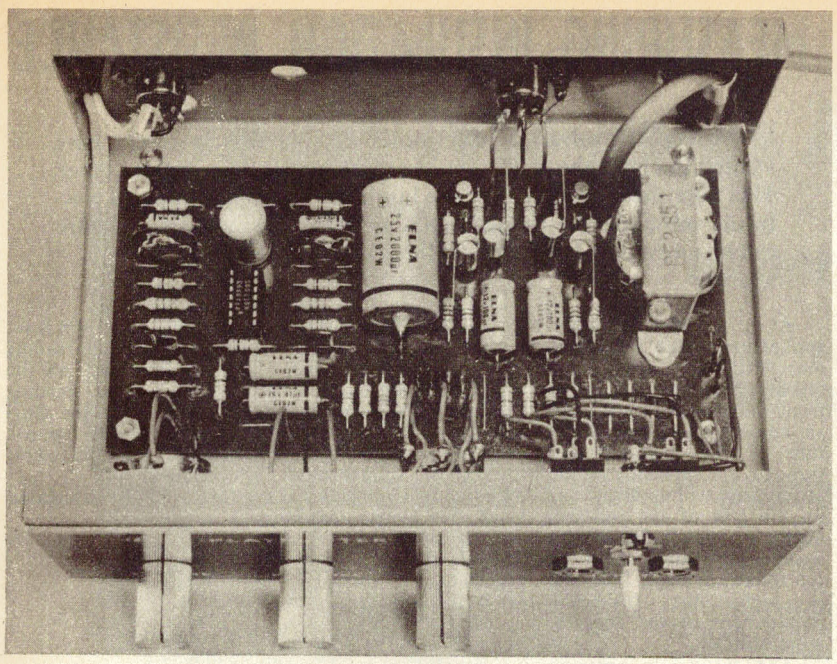
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Above is a view of the interior of the amplifier. The 1000pF RF bypass capacitor is obscured by the wiring around the input socket.

LIST OF COMPONENTS

1 Chassis, overall dimensions 7-7/8in x 5½in x 3in.
1 Cover to suit chassis.
1 Front panel or label.
1 Power transformer. Pri 240V-Sec 12.6V centretapped, at 150mA. A&R 6474 or Ferguson PF2851 or equivalent.
2 3-pin DIN sockets (more required for additional inputs).
2 Stereo phone sockets.
1 Printed board 70/HP/1.
1 2 pole 3-position rotary switch (for additional inputs only).
1 Miniature toggle switch SPDT.
3 Small knobs.
1 Pilot bezel 6.3V 50mA miniature type.

SEMICONDUCTORS
1 uA739C integrated circuit.
2 BC108 or similar transistors.
2 Pairs of AC127/AC128 transistors with 56200 heatsinks.
2 OA91 or similar germanium diodes.
4 EM401, BY126 or similar diodes.

RESISTORS (¼ or ½ watt unless specified)
2 x 6.8M, 2 x 220K, 2 x 100K, 2 x 27K, 2 x 8.2K, 4 x 2.2K, 4 x 1K, 1 x 150 ohms, 4 x 100 ohms, 4 x 56 ohms ½W, 4 x 15 ohms ½W.

POTENTIOMETERS
1 2M log dual ganged.
1 250K log dual ganged.
1 500 ohms lin.
2 100K trimpots, printed board type.

CAPACITORS
(Higher voltage ratings may be used, but physical size could prohibit exact fit. Values in uF unless specified.)
1 1000pF/50V ceramic.
2 0.0022/100V polyester film.
2 0.01/50V ceramic.
2 0.022/100V polyester film.
2 0.047/100V polyester film.
2 4.7uF/25V electrolytic pigtail.
2 47uF/16V electrolytic pigtail.
2 100uF/12V electrolytic pigtail.
1 220uF/25V electrolytic (single-ended).
1 2200uF/25V electrolytic pigtail.

SUNDRIES
4 Rubber feet, ¼in spacers.
1 5ft mains cord and plug, mains cord clamp, solder lug, grommet to suit mains cord.
1 1ft length of dual shielded cable; 15 x 1/8W x 3/8in bolts and nuts; lengths of stranded hoopup wire, solder, etc.

can be fitted. It is important that the skirts of the sockets make good electrical contact with the chassis, to allow for proper bypassing of RF signals. If more than one input is desired, two additional sockets may be fitted together with a 3 pole 3 position switch. A suitable circuit for a three input arrangement is shown in figure 4.

There is an important point to note here, with regard to earthing and RF suppression. Firstly, the earth leads of all the input signals must NOT be grounded at the input sockets. The common earth of each pair of input signals should connect to pin 2 of the DIN plugs. A common lead should then be connected between pin 2 of each socket, and finally to the braid of the shielded cable running to the volume control. Also each socket should have a 1000pF capacitor connected between pin 2 and the skirt lug of the socket, for reasons outlined earlier.

The only direct earth connections that are made to the chassis are at the record output socket, where pin 2 is linked to the earth lug, and the phone sockets which are inherently grounded.

Wiring of the leads from the board to the various controls, switches and sockets is all that remains in the way of assembly. The final step upon completion of the amplifier is the bias setting. Before plugging it into the mains, however, check for any obvious errors such as reversal of diodes or capacitors. If all appears in order, switch on and measure quickly the voltage across the 2000uF power supply capacitor. If no voltage appears across it, switch off and check the circuit.

Having established operation, the procedure for bias setting is as follows. Measure the rail voltage across the 2000uF capacitor. A reading of between 18 and 20 volts should be obtained. With the negative lead of the meter kept on the negative rail and the positive lead transferred to "link 1" on the wiring board, set P1 so that the reading is half that previously measured. This should be about 9 volts.

In a similar manner adjust P2, monitoring between link 2 and the negative rail as before. These adjustments should be done with no signal applied, and the volume control fully off. Alternatively, for those who have a CRO, the bias settings can be made using a signal generator, making adjustment for symmetrical clipping.

As these are the only adjustments required, the amplifier should now be ready for use. Remember to fit the cover when making preliminary checks, as a considerable amount of hum may otherwise be picked up. Provided care has been taken in the assembling and soldering, the amplifier should give many years of happy listening either as a headphone driver or as suggested earlier, a pre-amplifier when a power amplifier becomes available.

Just one final word of caution. Because listening to headphones can give concert hall realism, one is apt to forget that one is at home and not in the auditorium. To save broken cords and perhaps the possibility of dragging a chain of expensive equipment along the floor, it may be an idea to develop a habit to check if one is "plugged in" before moving off. ■

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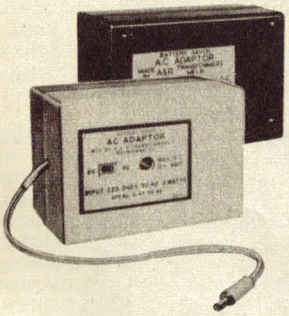
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MEASURING INSULATION RESISTANCE

Most people involved in electronics as a hobby or career have wanted to check the insulation of capacitors at some stage or other. This note shows how to measure insulation resistance using an electronic voltmeter. Resistance values up to 50,000 megohms or more can be measured, depending on the sensitivity of the meter.

As far as capacitors are concerned, the application where insulation resistance is most critical is "signal coupling" or "DC blocking". A typical case is signal coupling from the plate of a vacuum tube stage in an amplifier to the grid of the vacuum tube in the next stage. Any leakage through the capacitor of the high voltage at the plate will upset the negative DC bias on the grid of the following stage. The degree to which the bias is likely to be upset depends upon the input resistance of the following stage. If the input resistance is high, the insulation resistance requirement of the coupling capacitor is more critical.

The insulation resistance of supply decoupling and bypass capacitors is generally less critical and for this reason electrolytic capacitors are commonly used in these applications.

To check the insulation resistance of a capacitor, a DC voltage source is needed to polarise and/or to stress the capacitor at its rated working voltage. In addition, a meter is needed to monitor the leakage current through the capacitor. The DC voltage source may be a battery of suitable voltage, a regulated DC power supply, a well filtered supply derived from the HT rail of an amplifier or TV set or even the VTVM, which will be used to make the measurements.

The insulation resistance (IR) of a good paper capacitor will be of the order of thousands of megohms. A good polyester capacitor will have an IR of 50,000 megohms and a typical polystyrene capacitor will have an IR of 1 million megohms or more. This means that the currents to be monitored are of the order of nanoamps or picoamps (10^9 and 10^{12}). Fairly obviously, few people would have the means to monitor such small currents but it can be done by monitoring the voltage across a high value resistor.

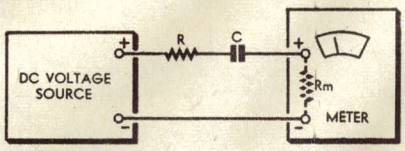


Figure 1

One of the usual characteristics of a VTVM or other electronic voltmeter is that it has a fixed high input impedance on all voltage ranges, typically 10 megohms or more. If we use this input impedance as our current monitoring resistor in conjunction with the low voltage ranges of the meter, we have the means to measure very low orders of leakage current.

The method of connection for insulation resistance measurements is shown in figure 1. The resistor R is merely to protect the DC supply against accidental short-circuit. It should be arranged to limit the short-circuit current from the supply to 1mA or less. For example if a 400-volt supply was used, a 470K resistor would be appropriate.

When first connected, the VTVM is set on a voltage range with full-scale reading greater than the supply voltage. As the capacitor charges, the meter reading should rapidly reduce so that the final reading, usually taken after one minute should be able to be taken from the lowest voltage scales on the meter.

Insulation resistance can be calculated using the following formula:

$$IR = \frac{(Vo-Vm)Rm}{Vm}$$

Where:

Vo = Supply voltage
Vm = Meter indication
Rm = Resistance of meter

If the meter indication is very small with respect to the supply voltage, the formula may be simplified:

$$IR = \frac{Vo\ Rm}{Vm}$$

As an example of a typical calculation, using the latter formula, if the supply was 400 volts, the meter reading 100mV and the meter input impedance 10 megohms, the insulation resistance of the capacitor would be 40,000 megohms. Exactly the same method can be applied to measuring the IR of transmission lines, terminal blocks, between coils of transformers and in fact any component which has high IR.

Those readers who "cut their teeth" on vacuum tube circuitry will recognise the above method of measurement as an extension of the rough and ready technique of testing blocking capacitors in situ. All that had to be done was to disconnect the grid end of the capacitor, and measure the voltage with a multimeter. If the meter gave a reading on even the lowest voltage range (typically 3V at 20,000 OPV) the capacitor was discarded.

In practical valve type circuits, the permissible insulation resistance for a coupling capacitor depends a great deal on the circuit configuration.

A typical power output valve may have a 1 megohm grid resistor coupled via a capacitor to a point 100V positive with respect to chassis; the output valve may operate at a bias level or about 10 volts. An insulation resistance of 100 megohms across the capacitor would shift the output valve grid potential by 1 volt; this may or may not be partially offset by a resulting change in cathode voltage.

If the 1-volt grid shift represented a permanent and stable condition, the effect on receiver performance might be ignored but, once the insulation resistance of a capacitor begins to fall, the process of deterioration is likely to continue to a serious and perhaps catastrophic level.

In circuits where the grid return resistor is of higher value and the valve operates with lower bias, the effect of a 1-volt potential on the grid might be quite serious in terms of linearity and distortion level. In such a case, one might think in terms of a minimum insulation resistor for a grid coupling capacitor more in the order of 1000 megohms. ■

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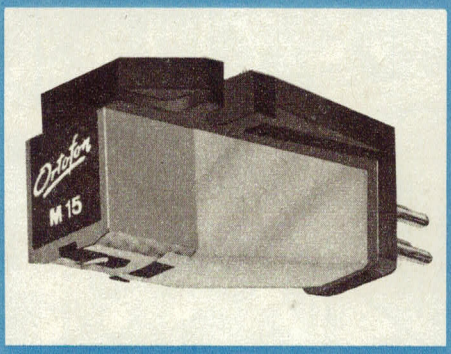
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"HI-FI! Who needs it?" said the experts in 1945—

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A "high-quality" radiogram of the 1940s.

It seems incredible today that in 1945 audio and electronics engineers were advocating that the public did not want high fidelity sound in broadcasts and gramophone records, and produced evidence that most people preferred a bandwidth of not more than 4 to 5KHz. Fortunately, some leading audio engineers were not convinced, and put forward a counter-theory to explain why people voted for narrow band sound.

by David W. Weems

By the time World War II ended in 1945, the wartime shortage of home radio and phonograph products had become acute. Even radio experimenters were hampered by the shortage of parts, but that didn't stop some of them from tinkering with a concept they called "high fidelity". What could have stopped them cold didn't happen until a month after the war ended.

That was a report[1] by Chinn and Eisenberg in the "Proceedings of the IRE", describing the results of a study to investigate the tonal spectrum preference of radio listeners. An audience had been given a choice of three frequency ranges to choose from: narrow (150-3500Hz), medium (100-5000Hz), and wide (50-10,000Hz). Surprisingly, most of the listeners chose the narrowest band. In fact, they continued to choose narrow-range sound even after they were told that it was "low fidelity".

Professional musicians listening to classical music picked the low-fi sound by an even greater margin than the average listener. Among the musicians, 73% chose narrow range, while only 5% liked the wide range and 22% were undecided.

For hi-fi fans, that report was a double whammy. The study purported to fix the "ideal" frequency range for the recording and broadcasting industries. What good was it to build wide-range hi-fi amplifiers and speaker systems if the frequency response of records and radio broadcasts were to be restricted?

However, there wasn't much to be criticised in the experiment. The qualifications of the investigators were impeccable. One, a consultant to the Office of Scientific Research and Development, with extensive experience in broadcasting, had been associated with the Massachusetts Institute of Technology and Harvard. His colleague was a professor of psychology. Their audio equipment was the best available – flat from 40 to 10,000Hz with "supposedly" low measurable distortion. The speaker system used was coaxial with a multi-cellular horn for highs; folded horn for lows.

The investigators had kept record noise to a negligible level by using original master recordings and playing each only one time. To double check the results with records, a live network broadcast of a 29-piece orchestra with a 14-voice female chorus was monitored in the listening room for some of the tests. Again, the frequency range for the medium and narrow bands was altered by an electronic (single-section band-pass) filter inserted in the system. And the listeners liked the filter.

If the study threw a wet blanket over hi-fi, it wasn't the first one. In 1944, O. J. Hanson, chief engineer for one of the major broadcasting networks questioned the desirability of high fidelity.[2] He suggested that frequencies above 10KHz were good only for sound effects: non-musical noises such as key jingling, hand-clapping, and resin squeaks. Anyway, he said, the jokes of a favourite comedian were just as funny when heard on a radio with a 200-to-3000Hz range as on a wide-range system.

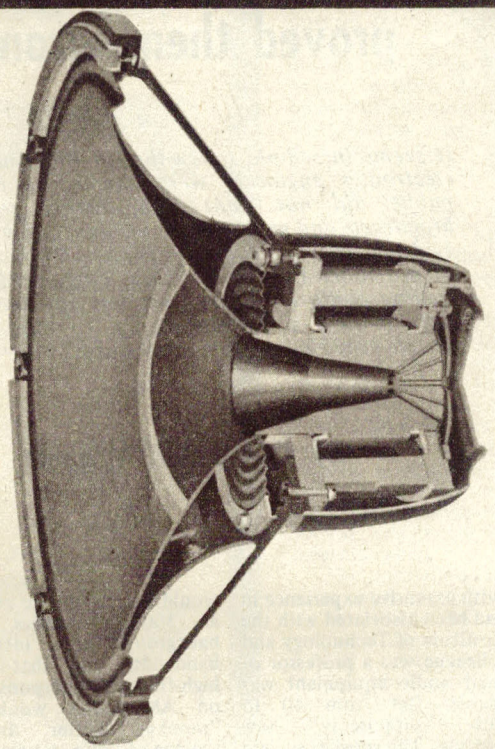
Those who argued against a wide response on the grounds that it was impractical had many reasons to cite. They said that a listener would have to sit directly in front of his speaker because if he were 45° off the axis, the response would be inadequate at frequencies as low as 3000Hz. Critics also noted that background noise increased along with bandwidth and that the extension of high-frequency response beyond 5000Hz on AM radios would only result in "monkey chatter" due to the 10KHz spacing of radio stations.

Such were the views of the "establishment". It was hardly surprising, then, that many of the first post-war radio receivers were built on the same chassis layouts as the last of the pre-war models. The economic climate of war-time price fixing and high demand was also partly to blame. But a scientific study which showed a one-sided preference for low-fi music discouraged all but the most adventurous manufacturers.

And so the console AM radio was still king of the mountain, or at least of the American living room. Eighteen million had been manufactured, the latest of them being superhets with a pair of push-pull pentodes in the output stage. The power output may have been listed in the valve manual at 8 to 10 watts, but it was usually considerably less than that, depending on how much distortion one would tolerate. A small output transformer coupled the output valves to a 10 or 12-inch electromagnetic stiffconed speaker, mounted in the lower section of the open-back cabinet. That arrangement produced a booming resonance in the 200Hz region that almost masked the absence of fundamental bass response under about 100Hz. The almost total lack of either electrical or mechanical damping on the speaker permitted the cone to vibrate after a signal had ended and added

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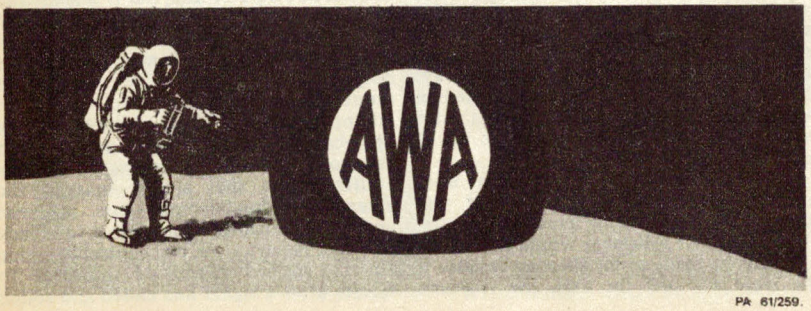
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the word "hangover" to our audio vocabulary.

Sometimes the radio amplifier was fed by a 78rpm record player whose massive tone arm carried a crystal pick-up. At the end of the cartridge was a "chuck" or set screw that held the stylus, which was called a needle but looked like a brad nail. People who were fussy about record wear could substitute a cactus needle, which killed what little high-frequency response might have escaped the other equipment.

Those were the "components" of a home music system; commercial sound systems were not much better. An investigation by Eagleson and Eagleson in 1946[3] showed that, when listeners tried to identify musical instruments heard over a PA system, the results were wild guesses. In a test involving 35 listeners, 22 of them musicians, the one who got the best score identified the instrument correctly less than 40% of the time. And he wasn't one of the musicians. In fact, he'd had no musical training at all.

The Chinn-Eisenberg study clearly backed up the engineers who had argued for a "sensible" frequency range, and against hi-fi. But when the paper was read carefully, some odd comparisons emerged. For example, when the professional musicians listened to male speech, they showed a preference for wide-range reproduction. Another curiosity: Why did listeners prefer a higher sound intensity for speech than for music? This was a suspicious reversal of the normal difference in sound intensity for live speech and live music.

Fortunately for the future of hi-fi, some readers were sceptical of the results. One of these was Harry F. Olson. Born in Mt Pleasant, Iowa, Olson had received his PhD at the University of Iowa in 1928 and had gone to work for RCA that year. Six years later he was placed in charge of acoustical research for RCA.

As Olson analysed the conclusions of the controversial paper, he decided that there could be three possible explanations for the results. The first two were: People were so conditioned to a narrow frequency range from listening to the radio that they accepted it as natural. Musical instruments are improperly designed. They should be redesigned to eliminate the undesirable overtones.

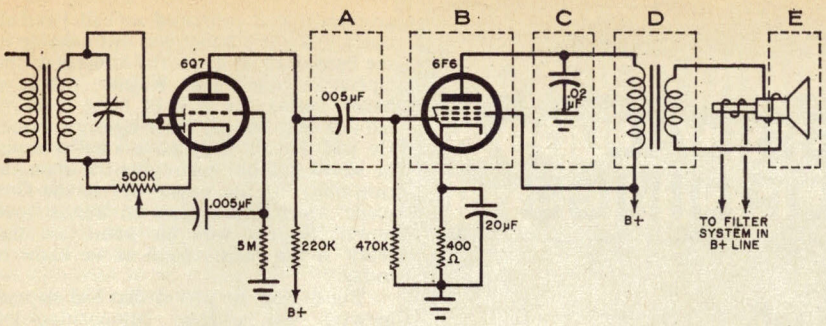
Olson was offering these suggestions to cover all the possibilities. He knew that the professional musicians should have had no difficulty choosing what was the most natural sound. And as for recognising musical instruments, stripping the overtones would rob each instrument of its individuality. A violin, for example, would lose its gutty string tone and sound somewhat like a flute. One might as well write music for a battery of sine-wave generators!

The third possibility, Olson said, was "the distortions and deviations from true reproduction of the original sound are less objectionable with a restricted frequency range".

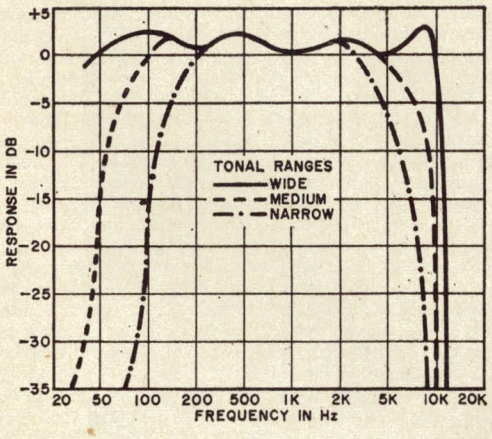
But how could he prove his suspicion? If distortion were the demon, his problem was to design an experiment that would eliminate distortion. His solution was simple.

If distortion in amplifiers and speakers could not be eliminated, he would bypass 1945 electronics and use live music. This time "live music" would mean exactly that – no microphone, no amplifiers, and no speaker system.

Olson's background in acoustics served him and the cause of high fidelity well. He and John Preston, a member of the technical staff at RCA Laboratories, designed an acoustical filter to place



Audio section of a typical radio built in the immediate post-war period. The lettered sections indicate where frequency response was restricted: A – the small coupling capacitor reduced hum by rolling off the bass. B – pentode output stage without feedback produced distortion and inadequate loudspeaker damping. C – anode capacitor maintained correct load on the output valve but cut high frequency response. D – small transformer limited low frequency response, while its leakage inductance cut highs. E – electro-magnetic loudspeaker had limited response and its stiff cone and poor baffling restricted the lows; the large straight cone gave poor high frequency response and spread.



Frequency responses used in the Chinn and Eisenburg tests. Most people preferred the narrow band which rolled off at 3500Hz.

between a live orchestra and an audience. The filter was made by properly spacing 3 sheets of perforated metal. The holes in the metal sheets provided a reactance (or inertance) to the vibrating air particles that increased with the frequency of vibration. The trapped air volumes in the two sections of the filter, on the other hand, provided a reactance that decreased with frequency, tending to absorb the vibration of the particles. By careful choice of hole size in the metal sheets and air volumes (by spacing the sheets) Olson was able to obtain a cutoff at the desired frequency. He selected the cutoff point to correspond to the high-frequency response of "very good" radios and phonographs of that time. The cutoff point was 4000Hz; however, as defined by radio and phonograph terminology, the filter was called a 5000Hz low-pass filter.

Olson designed the filter mathematically, then checked its performance by actual measurements. The result was a sharp cutoff filter that worked the way he had hoped. "A snare drum", said Olson, "seemed to be an entirely different instrument". And the cymbals, instead of having the usual shimmering resonance of thin discs, sounded as if they were "1/8 inch in thickness".

But Olson was an unusually keen listener, with years of experience in the science of acoustics. Which sound would the average buyer of records and radios prefer? To answer that question, Olson conducted an experiment involving 1000 listeners.

He installed the filter across the corner of a room that was 24ft square with a 9ft 6in high ceiling. The dimensions of the room were no accident. They were selected to approximate the size of a typical living room, since the results would be used by engineers to design equipment for use in living rooms.

Behind the filter, a small orchestra – piano, trumpet, violin, clarinet, contrabass, drums, and traps – was assembled. A sound-transparent curtain prevented the audience from seeing the position of the filter. Then Olson assembled his listeners: chemists and gardeners, doctors and farmers, secretaries and electricians – anyone who was available as worker or visitor at RCA Laboratories. The orchestra played and A-B tests were made, the filter changed every 15 seconds during each number. For different tests, the letters A and B were reversed to prevent the results from being skewed by letter preference. The listeners made their choice, and added comments if they desired.

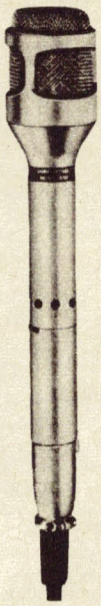
The results of the experiment produced a reversal of all previous studies. It was a striking victory for the concept of high fidelity. A strong majority, 69% of the listeners, preferred full-frequency-range hi-fi, compared to 31% who voted for the low-fi music.

But there was a suspicion that even some of the minority who didn't like the full-frequency range may have been reacting to something other than sound quality. Because of the small room, Olson could not supply classical music devotees with a full symphony orchestra. Some of them added negative remarks about

(Continued on page 150)

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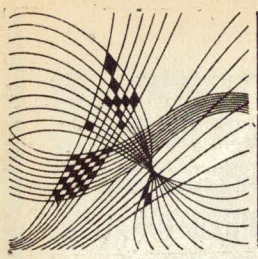
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CLASSICAL RECORDINGS

Reviewed by Julian Russell

BRITTEN – Sinfonietta.
HINDEMITH – Octet.
Members of the Vienna Octet. World Record Club S/6349.

Although Britten's Sinfonietta is marked Opus 1 it already displays the resourceful economy characteristic of his much later works. Indeed it would be safe to guess that several other compositions, never published, must have preceded it. However even in the Sinfonietta Britten's style is already individual enough to set him aside from all other English, or for that matter, all other composers. If his allegiances when he wrote it were many and varied his music is never that of a mere pasticheur. Whatever source he draws on, whether it is Stravinsky for form, Mahler for melodious orchestral effects, with traces of the great Italians, too, plus English sixteenth and seventeenth century schools, there is an astonishing maturity in all he does. Not a note is wasted in this kaleidoscopic score and it must be enormously difficult to play the music as well as do these Viennese musicians. The sound is admirable, clear yet resonant, and with exactly the right acoustic.

After the simple eloquence of the Britten work, the Hindemith, though just as skilful technically, sounds a little contrived. But then I am one of those who think this a characteristic of pretty well everything Hindemith wrote, though I am aware that many excellent judges will not agree with me. The Octet was composed some 25 years after the Sinfonietta and it certainly lacks Britten's freshness of invention. But admirers of Hindemith will find it quite worthy of a place among their collection. It is in five movements, all of them brief, so that the overall effect is reminiscent of a serenade – in the Mozartian sense. Here again the playing is faultless and the recording equally chaste.

★ ★ ★

VERDI – Macbeth. Complete Opera. Leonard Warren; Leonie Rysanek; Jerome Hines; Carlo Bergonzi and others with the Chorus and Orchestra of the New York Metropolitan Opera conducted by Erich Leinsdorf. RCA Victrola Stereo VICS6121. (Three discs with Italian/English libretto.)

This was, I think, the last operatic recording made by that fine baritone Leonard Warren before his death some 10 years ago. If it was, his performance here in the title role makes a fitting end to a great operatic career. His Macbeth is as fine dramatically as it is vocally, though it must be admitted that there are moments in the score where the composer lets him down dramatically. Verdi was a great admirer of Shakespeare and always hotly refuted the charge that he did not understand him. But it must be faced that some of the score of Macbeth is, to put it kindly, naive in terms of the subtlety of the Shakespearean original. However it is now fashionable to smile indulgently at such lapses and once you have learned to do this graciously you will find much beautiful music in the opera.

It is perhaps in the Witches' music that you will need to be most indulgent, for Verdi fails to endow them with any sense of horror, or even weirdness. But to balance this naive failure you have other really tremendous choruses. Of these, the scene of the Scottish exiles lamenting their grievous lot is as fine as anything Verdi ever did later. There is drama aplenty, too, in Lady Macbeth's "dagger" scene and the final musings are no less effective. Unfortunately Miss Rysanek sounds altogether too colourless in such scenes as the reading of Macbeth's letter and in her invocation of the spirits of hell to unsex her. You may notice here, too, that her Italian is never better than precarious. But on the other hand her duets with Macbeth are fine and the famous sleepwalking scene needs only some extra demonic quality to make it really outstanding. As it is the singing is consistently pleasing, even if one has doubts about the lady's wickedness.

Lady Macbeth is one of Verdi's finest roles for women, but it really needs someone more at home in the grand manner than Miss Rysanek to do it full justice. However all but the most hypercritical should find her performance eminently acceptable even if it is never among the greats. Of the rest of the cast a special mention must be made of Jerome Hines' Banquo, small though the part is, and Bergonzi sings, with his usual sweetness of tone and musicianly insight, the role of Macduff. The chorus is first rate and Leinsdorf's conducting vigorous if not always idiomatic. For a sample of this highly acceptable set at a budget price I suggest you play part of the banquet scene at the end of Side 3. It covers a sufficiently wide range of emotions to give you a good general idea of the quality of the rest of the set. The sound is of a good standard.

★ ★ ★

WAGNER – Overture and Venusberg Music (Paris version) from Tannhauser.
STRAUSS (Richard) – Suite from Der Rosenkavalier.
London Symphony Orchestra, conducted by Erich Leinsdorf. Decca Stereo PFS4187.

Although I nowadays find it impossible to get excited about a performance of the Tannhauser Overture, however well it is played, I never cease to be thrilled by the Paris version of the Venusberg Music which Wagner spliced on to it some 16 years later. You probably know the history of what has become known as the Paris version, but for the benefit of those who don't I will repeat it briefly. When Wagner was trying to arrange a performance of Tannhauser at the Paris Opera it was rejected chiefly on the grounds that it contained no ballet and an opera without a ballet was unthinkable in the Paris of those days. The director of the Opera suggested that Wagner include a ballet during the Hall of Song scene, a request that Wagner quite rightly refused. He said that the only place a ballet could be added without destroying the dramatic continuity of the opera was in the first scene which takes place in Venus' love bower. Wagner won his point and the result is the Paris version as we know it today.

But during the period that had elapsed between the original composition of Tannhauser and the year he wrote the new scene, Wagner's style had matured to such an extent that his treatment of the themes, most of which were used in the earlier version, was much more resourceful and his handling of the orchestra achieved a degree of incandescence that has never been matched since. In this new version Wagner interrupted the overture at the second climax of the old Venusberg music, introduced high trumpets playing in thirds, then plunged into the warm bath of eroticism that, if it takes you as unawares as it did me as a boy when I first heard it, you will find very exciting indeed. It recalls Nietzsche's remark about Wagner long after they had ceased to be friends – "That old rattlesnake who makes one forget one's manhood under a rosebush".

Leinsdorf is not, in my opinion, one of Wagner's most exciting interpreters – his reading of the Overture is, at its best, honest and accurate. But when he reaches the new part of the score he really lets himself go. The music fairly seethes until it reaches the Sirens' Song – sung here by a choir surprisingly not identified on either the label or the sleeve – which is as lusciously sensual as ever I've heard it. The voices are in perfect perspective. Listening to the whole side a second time I thought that perhaps Leinsdorf deliberately held back the Overture to make more of a contrast between the old and the new music. But whatever the reason the Paris version provides a most exhilarating experience.

The Rosenkavalier Suite on the reverse side is not to be confused with other suites of waltzes from that exquisite opera that Strauss had arranged previously. The suite recorded here is more in the manner of a symphonic synthesis of the opera. True many of the lovely waltz tunes are included, but so is much of other parts of the score. You have the whole of the Prelude until the voices take over in Act 1, and the delicious little black boy's theme, a trifle heavy handed the first time it is heard, but delivered with just the right delicacy when used in the very last bars of the score. You will hear, too, some of the Prelude to Act 3 taken at a rollicking pace, and, of course, the wonderful final trio.

The London Symphony play it all with fine swagger and rich tone. And if they don't get quite the same lilt into the accompanying figures in the waltzes as do their Viennese colleagues, well, who else can? The Phase 4 sound is first rate without any exaggerated spotlighting of the soloists. Altogether a very enjoyable disc.

★ ★ ★

ON WINGS OF SONG. Rita Streich (soprano). Songs by Schubert, Wolf, Mendelssohn, Poulenc and Mussorgsky. Accompanist Geoffrey Parsons. EMI Stereo OASD7557.

The title of this disc is misleading. True a song with that title, Mendelssohn's Opus 34, No 2, is included in the recital. But if you think the rest of this recital is in much the same sugary style you will miss some

very interesting music indeed. For while Side 1 is filled with standard German lieder, by Schubert, Wolf and Mendelssohn, Side 2 is made up of Poulenc's Airs Chantes, and the Seven Nursery Songs of Mussorgsky. Mussorgsky was one of the greatest song writers who ever lived, and the Nursery Songs are among his most original. They have the disarming innocence of super-sophistication but are quite without archness. There is no banal playing down of an adult to a child. Rather Mussorgsky's treatment is always intensely naturalistic yet consistently melodious. The Poulenc songs, too, are charming trifles of the bitter-sweet kind by which most of the music of this much underrated composer can be recognised.

The gramophone is kind to Miss Streich's voice which, in an opera house or the concert hall, though always beautifully controlled inclines to smallness of volume. This, of course, is easy to improve with judicious use of a microphone and on the whole disc her voice emerges as warm, beautifully pitched, and used with a high degree of musicianship. In all of these features she is matched by the same high degree of skill by her accompanist, Geoffrey Parsons. The disc shows signs of hasty preparation – perhaps to coincide with Miss Streich's recent Australian tour. The sleeve notes are uninspired, and what is worse, uninformative. They are, by the way, unsigned. But perhaps the more serious fault in its presentation is the absence of texts, in either English or any other language, of the songs. And although the Mussorgsky songs are sung in Russian their titles are given in German. Why?

* * *

VAUGHAN WILLIAMS – Mass in G Minor.
Five Mystical Songs.
Motet – O Clap Your Hands.
Kings College Choir; John Shirley-Quirk (baritone); English Chamber Orchestra conducted by David Willcocks. World Record Club Stereo S/4779.

For a man who confessed to having very unorthodox religious beliefs, Vaughan Williams wrote a great deal of liturgical music. This does not perhaps seem quite so strange when one recalls that one of the most beautiful of the recent requiem masses was composed by Gabriel Faure who, though organist for many years at the Church of the Madeleine in Paris, was a confessed freethinker. And Wagner's Parsifal was certainly not the brain child of a devout man. But all this is beside the point except perhaps to emphasise the deep reverence to be found in Vaughan Williams' G Minor Mass. In it you will find no lip service to the Deity. Moreover Vaughan Williams' musical language, so strongly modal in feeling, is admirably suited to the plainsong atmosphere that runs all through the music.

The Kings College Choir is too well-known – and universally admired – to need any additional praise from me. The performance here under David Willcocks is a continuing delight. The balance is always sensitively maintained between the four excellent soloists and the choir. And I cannot let this notice pass without paying my homage to the quite wonderful steadiness and purity of tone of the boy trebles. How much better they sound in this context than sopranos!

It was a happy idea to include the Five Mystical Songs on the disc. Four of these use a choir in addition to a soloist, when the orchestral version is used as it is here. And I might mention that the playing by the English Chamber Orchestra is beyond praise. So, too, is John Shirley-Quirk's contribution as soloist. I was also happy to find the texts, by the seventeenth century English poet, George Herbert, printed on the record sleeve, though such is the beautiful clarity of the diction that they should hardly be necessary to English listeners. The songs are richly varied in mood and the bracket ends with a rousing, if slightly less mystical, final Antiphon.

As a bonus you have the Motet, O Clap Your Hands, for chorus, brass, percussion and organ, to make the most jubilant sound imaginable. Highly recommended to all lovers of Vaughan Williams' music.

* * *

DEBUSSY – Music For Harp and Orchestra.
Petite Suite for Orchestra.
Dances (Sacred and Profane) for Harp and String Orchestra.
Six Epigraphes Antiques for String Orchestra. Record Society Stereo S/6345.

The title of this disc is slightly misleading, for only the Two Dances for Harp and Strings are heard, as Debussy originally intended. The Petite Suite was composed for piano duet (four hands) and so were the Six Epigraphes Antiques. On this record the former has been orchestrated by Henri Busser, and the Epigraphes arranged for string orchestra by Jean-Francios Paillard. In the Petite Suite, an early work, Debussy still showed strong influences of his teacher, Massenet, though it is never less than pleasant to listen to as it is offered here. True, Busser's arrangement bears only a faint resemblance to Debussy's inspired scoring, though it does display an occasional characteristic touch.

In the Two Dances Miss Lily Laskine's harp has a lovely crystalline quality supported by discreetly beautiful string playing. These two pieces, which cannot be separated, are true Debussy with all that composer's delicate sensuality.

Debussy had at one time intended to orchestrate the Six Epigraphes but never got around to it. This Paillard has since done, using the strings with great sensitivity. You will find these short pieces not quite so immediately accessible as the other music on the disc but I can assure you that increased familarity will soon make them highly enjoyable. Throughout the record the sound has a rather overlong reverberation period, particularly noticeable in the more fragile passages. Otherwise the engineering is good enough.

* * *

MENDELSSOHN – Symphonies for Strings. No 9 in C Minor and No 12 in D Major. Jerusalem Chamber Orchestra (Kol Israel) conducted by Mendi Rodan. Concert Hall Stereo SMS2653.

These two symphonies have an interest quite other than mere musical curiosities, early works of a yet unformed genius. For Mendelssohn was only 14-years-old when he wrote them and both are full scale synphonic works. True, his allegiances at this period were clear – Mozart, Schubert, Weber and early Beethoven. But who could have picked better, around this date? Some of his themes ring faint bells of memory, others already show great originality, and the freshness of invention seems almost inexhaustible. The development of the themes is often polyphonic, and of the most assured kind.

No 9 has a most impressive introduction marked "grave", and if the following Allegro starts off as if it might be just the work of a talented student, as it goes on one soon changes one's mind. Tonally, in this movement, I thought there was a trifle too much body in the strings even with the volume reduced. But this improves in the slow movement, an astonishingly daring one for a boy, however gifted. The outer major sections are played by violins only in four parts. The minor middle section is given to the darker tone of the lower strings only. All combine at the end of the movement. It's quite wonderfully sure-handed – and effective.

The third movement is a typical Mendelssohnian Scherzo, sent along here at the briskest possible pace. It lacks the delicacy so characteristic of the later Scherzos, but this might be due to the orchestra which sounds better in less dainty movements. It is, however, very brief. The Finale also goes at a punishing pace but here, where there is more for the players to get hold of, so to speak, it comes off better than the Scherzo.

In Symphony No 12 you have again an impressive maestro's opening, highly original and not without mystery. It makes a fine introduction to the inevitable Allegro that follows, though here there's nothing commonplace in the shaping of the themes. I thought the tone of the strings a trifle coarse in the low register. The 14-year-old again astonishes with the seriousness of the Andante which could easily have been the poetic musings of a much more mature composer. And in this movement some slightly off-target intonation can be detected in the low strings. The Minuetto is of almost landler-like quality with a surprisingly Mahlerian bit of irony in the middle section. It is very extended for this type of movement. The Finale is full of brilliant ideas – and surprises, too. The sound is clear and forward, but the acoustic does nothing to euphemise the tone.

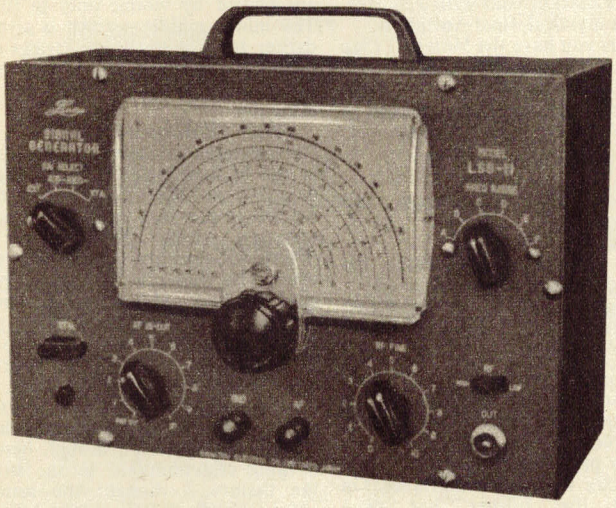
* * *

MENDELSSOHN – Double Concerto for Violin, Piano and String Orchestra in D Minor. Carroll Glenn (violin); Eugene List (piano); the Vienna Chamber Orchestra conducted by Ernst Maerzendorfer. World Record Club Stereo S/4802.

Mendelssohn was about the same age (14) when he wrote this interesting concerto. An interesting account of its rediscovery after years of neglect is given in the sleeve notes. Eugene List, who plays the solo piano part, noticed a reference in Grove to its manuscript being in the Berlin State Library (to be exact in the Prussian Library in East Berlin). But getting hold of it was to prove very difficult indeed. There was much correspondence during which List learned that the concerto would not be released until the East German Government had established a prior claim in publishing it. List followed this up by crossing into East Berlin in 1964 especially to interview the head of the music division of the Library, hoping to have a copy made of the score. "He was most courteous and sympathetic", writes List, "showing me not only the manuscript of the Double Concerto but also all the early Mendelssohn scores which had been presented by the Mendelssohn family to this famous library".

But the end result was the same – the library would not allow the score to be reproduced. List then gave up, but some time later he received from a friend a miniature score of the work published by

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Astoria in East Berlin. List, and his wife, Carroll Glenn, who plays the solo violin part in the recorded performance, studied the score and presented it successfully later that year in America. Shortly after this they learned of the existence of another score – purporting to be the only authentic one, published in Leipzig (East Germany) by the Deutscher Verlag fur Musik. This was essentially the same work but with cuts that had been made in the previous score restored. This is the edition they use in the recording.

Like the String Symphonies, this, too, reveals the composer's early influences – and again they are Mozart, Schubert, Weber and early Beethoven. But it is a double concerto in the true sense in that the different nature of the solo instruments are skilfully exploited. It starts with a longish, serious orchestral introduction and goes into a passionate dialogue between piano and violin. This movement also includes a lovely stretch that could have come straight out of Weber – and is none the worse for that reason. In form the rest of the work is conventional with only few surprises. Some of the writing is a little naive For instance Mendelssohn often uses the piano instead of the orchestra just to accompany the solo violin. But the melodic invention never flags so that the interest is held without fatigue. The sureness of the polyphony is again in evidence and there are occasional impressive orchestral tuttis. The Adagio is in the form of a long cantilena for the soloists, as sweet as any Mendelssohn ever wrote, which could well be described by one of the composer's later titles, a Song without Words. The Finale is a brilliant Rondo alla Gitana, which gives the soloists plenty of opportunity to display their virtuosity. It brings the work to a fine exhilarating end. The soloists and orchestra play the whole work with respect and no trace of condescension. The sound is clean, but without any other distinction.

★ ★ ★

BACH (J. S.) – Cantata No 211 ("Coffee" Cantata).
Cantata No 212 ("Peasant" Cantata). Dietrich Fischer-Dieskau; Lisa Otto and Josef Traxel, with the Berlin Philharmonic Orchestra conducted by Karl Forster. World Record Club Stereo S/4087.

I found both sides of this disc wholly delightful. These two cantatas – Bach wrote 212 in all, for all sorts of occasions – are in his lightest style. No 211 is a skit on the popular craze for coffee drinking that swept over Europe at the time it was composed. A grumpy old father cannot persuade his spoilt daughter to give up her daily indulgence until he threatens not to allow her to marry. She finally gives in, but adds mischievously that she'll be sure to pick a husband who likes coffee, too.

In No 212 Bach burlesques the Saxon dialect, which in terms of English is rather like a Lancashire accent, and which Richard Wagner used to the end of his life. It was composed to welcome a new squire to the district and pokes innocent fun at almost everything, including the tax collector.

An English text is given on the record sleeve – although the cantatas are sung in German – so that none can fail to get Bach's often deftly made points. The performances are splendid, sturdy in style, but with Fischer-Dieskau providing the refinements we have come always to expect of him. Lisa Otto's is another outstanding performance. I found the whole disc grand fun. ■

VARIETY FAIR

Devotional Recordings

THE ELECTRIC SYMPHONY. The Moog Synthesiser presented by Ralph Carmichael. Compatible stereo, Light Records LS-5541. (Available from Sacred Productions, Aust, 181 Clarence St, Sydney and other capitals.)

Interest: Moog in church!
Performance: You'll like it.
Quality: Very clean.
Stereo: Loads of it.

The Bible refers to timbrels. harps. psalteries, flutes, pipes, horns and so on. Since then we've enlisted the aid of every other instrument you can think of – except the Moog Synthesiser. Well, move over in your pew. Here it is!

Perhaps not surprisingly, it's been taken along to church by that very accomplished – and very dedicated – Gospel musician Ralph Carmichael. He refers to it as his "Electric Symphony" but, to my ears, quite a few synthetic groupers seem to have sneaked into the orchestra. That will make the young people happy and, indeed, Carmichael admits that he's aiming primarily at "transistorised ears". But there is plenty of diversion in it for people with "acoustic ears" like mine, which respond to techno-sonic gimmickry. To help matters along, the quality is very clean and the stereo so exploited that I'll keep this one in mind for any experiments with simulated quadrasonic.

Devotional? Well it must be! Look at the titles: All My Life – Bright New World – The New 23rd – I've Got Confidence – His Land – He's There Waiting – A Quiet place – Searching Questions – My Little World – The New Hallelujah.

If you don't have a Moog record in your collection, you could certainly do worse than settle for this one. (W.N.W.)

★ ★ ★

THOMAS EDMONDS SINGS SONGS OF FAITH. With Barry Hall at the Organ. Stereo, RCA Camden CAMS-165.

Interest: Edmonds' sacred repertoire.
Performance: Capable.
Quality: Average only.
Stereo: Not startling.

Having reacted so warmly to his first album "The Voice Of Thomas Edmonds", I looked forward with a good deal of expectation to this second album of devotional songs. In some ways, however, it turned out to be an anti-climax. Thomas Edmonds copes with the songs in the manner one would expect of a National TV Showcase winner but, with a purely routine accompaniment from solo organ, Edmonds is under pressure all the time, to hold the listener's interest. How much better the record would have been with orchestra and the arrangements that were evident in his first album. But then, it would probably not have appeared on the Camden label! The track titles:

The Lord's Prayer – The Old Rugged Cross – Ave Maria – O Perfect Love – The Holy City – Abide With Me – Beyond The Sunset – Bless This House – The Lord Is My Shepherd – I'll Walk With God.

If the review seems a little unkind, it's because an album that could have been outstanding turned out to be merely average. Having read this, have a listen for yourself. You might even be pleasantly surprised! (W.N.W.)

★ ★ ★

POPE PAUL. MASS FOR PEACE. The first visit of a Pope to the New World, October, 1965. RCA Camden, mono only, CAM-170.

Interest: History in the making.
Performance: Not applicable.
Quality: Not good, understandably.

The historic visit of the Pope to Australia comes just five years after another tradition breaking journey – the visit, by air, to the USA in 1965. Somebody in the RCA promotions department has linked the two occasions, and in consequence RCA has released their souvenir record of the USA visit in Australia. Frankly, I can see little justification for connecting one with the other. Presumably souvenir records of the Australian visit will also be on sale shortly after the conclusion of the visit:

The events covered in this record begin with the arrival of the Pope at Kennedy Airport, to the accompaniment of brass bands, cheers, applause and speeches of welcome, a sequence which is repeated in the next section, the welcome at St Patrick's Cathedral, New York City. Then comes the speech, in French with simultaneous English translation, to the General Assembly of the United Nations, containing the impassioned plea for peace. Side one ends with the departure from Kennedy Airport. The whole of side two is devoted to sections of the Mass for Peace, at the Yankee Stadium. The Introit is omitted, but the lengthy sermon in English by the Pope is covered in full. The Offertory is omitted, but the Canon and Communion sections are included, and the Benediction.

Due to difficulties which accompanied this recording assignment, the sound quality is poor throughout, but the various voices can be clearly heard at every stage. As a souvenir of a historic occasion, this disc is worth having, but I hope nobody is going to be misled into thinking that this is connected with the Australian visit. (H.A.T.)

★ ★ ★

SACRED SONGS. The Little Singers of the Wooden Cross. Conducted by John McCarthy. Organist William Davies. Stereo, Ace of Clubs series 250 SCLA-7024.

Interest: Songs, choir.
Performance: Disciplined, responsive.
Quality: Very clean.
Stereo: Normal.

The jacket gives no clue as to the identity of the Singers of the Little Wooden Cross, other than the fact that the album was originally produced in England. I can add that the Singers are a boys choir trained in the best traditions of such choirs.

Their sound is disciplined, gentle, yet convincing in its involvement. Complementing their best efforts is well known organist William Davies playing a traditionally voiced instrument.

The titles: O Perfect Love – There Is A Green Hill – O God Our Help in Ages Past – Onward Christian Soldiers – O Quam Suavis – Lead Kindly Light – Ave Maria -The Old Rugged Cross -Nearer My

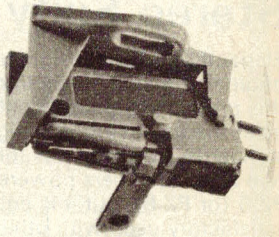
(Continued on page 89)

Reviews in this section are by Neville Williams, Harry Tyrer, Gil Wahlquist, Philip Pik.

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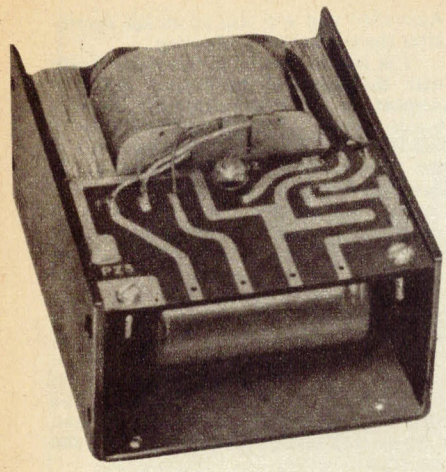
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PZ.5 and PZ.6 Power Supply Units

Two types of mains-power supply units are available for use with Sinclair high fidelity equipment. For the majority of domestic applications the PZ.5 will be found completely adequate. Where very low-efficiency loudspeakers are used, however, it will be necessary to use a PZ.6 Stabilised Power Unit. Use of the latter is also indicated where maximum outputs are required from the amplifier system under extreme operating conditions.

PZ.5
Unstabilised power supply unit recommended for two Z.30 amplifiers and Stereo 60 for all average requirements.

Specifications

Output:
30 volts/1·5 amps maximum.

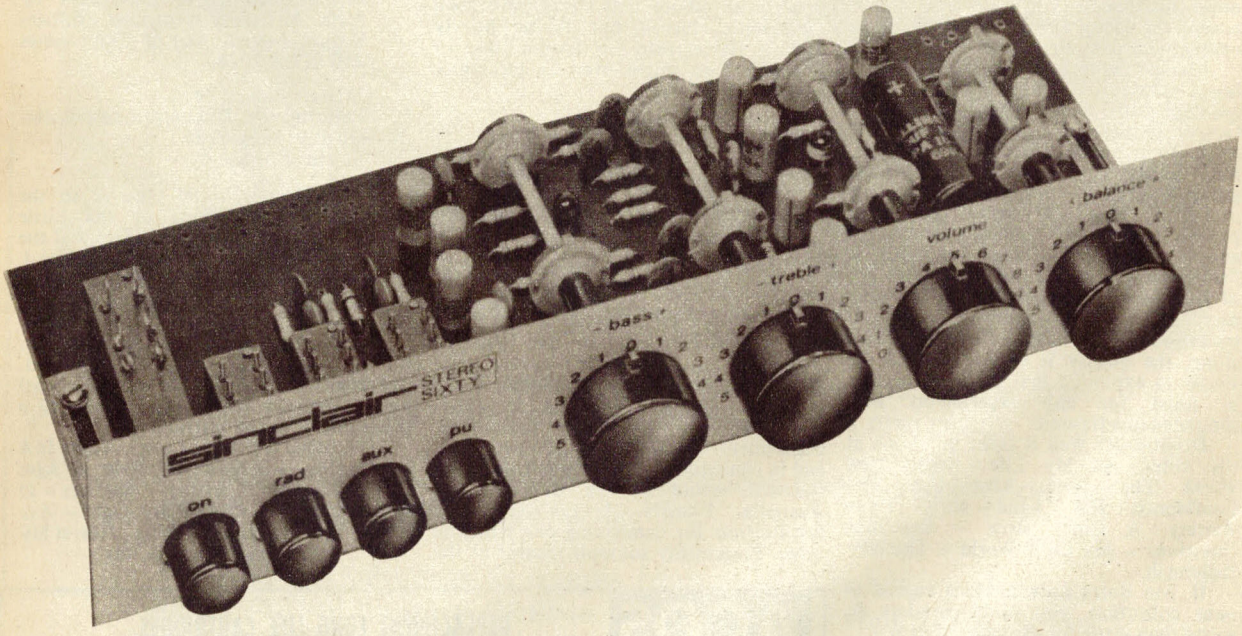
Mains input:
110-240 volts ± 20% 50/60Hz.

Size:
3·9″ × 2·8″ × 1·6″

PZ.6
Stabilised mains supply unit delivers 35 volts at 1·5 amps with ripple less than 20mV at any output up to maximum current.

Size:
3·9″ × 2·8″ × 1·6″.

SINCLAIR PRODUCTS for the ELECTRONIC CONSTRUCTOR



Stereo Sixty Pre-amplifier and control unit

Elegantly modern design with original concepts in circuitry make this pre-amp and tone control unit meet the most stringent high fidelity standards. Basically it is for use with two Z.30 amplifiers powered by a PZ.5 (or PZ.6), but it is equally satisfactory used with other good power amplifiers. Silicon epitaxial planar transistors are used throughout and a very high signal-to-noise ratio has been achieved together with excellent channel separation. The unit is very easy to mount in cabinet or modern plinth with motor and pick-up assembly.
Input selection is by means of four push buttons and accurate equalisation is provided for all the usual inputs. The tone controls are also very carefully designed and tested.

Specifications

Input sensitivities:
Radio: up to 3mV
Magnetic pick-up: 3mV
correct to R.I.A.A. curve ± 1dB
20 to 25,000Hz
Ceramic pick-up: up to 3mV
Auxiliary: up to 3mV.

Output:
250mV.

Signal-to-noise ratio:
Better than —70dB.

Channel matching:
Within 1dB.

Tone controls:
Treble +15dB to —15dB at 10kHz
Bass +15dB to —15dB at 100Hz.

Power consumption: 10mA. max.

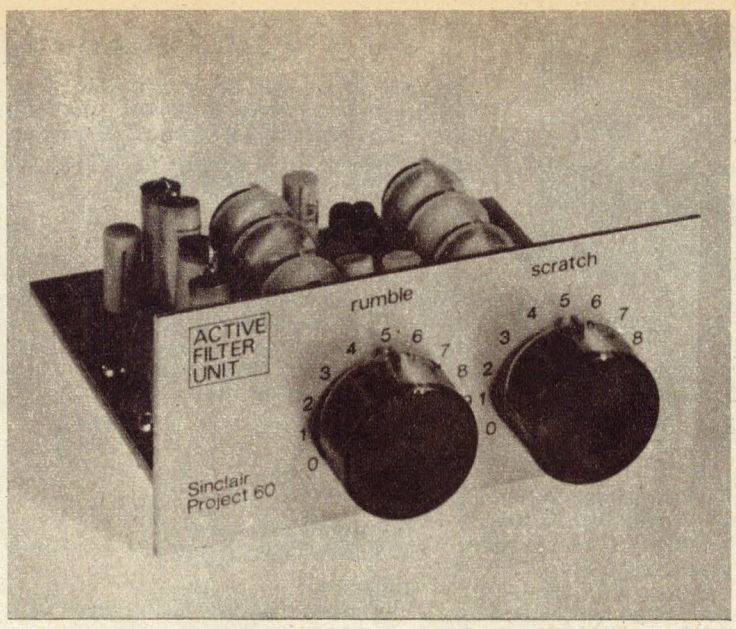
Front panel:
Brushed aluminium with black knobs and controls.

Size:
$8\frac{1}{4}$″ × $1\frac{5}{8}$″ × $3\frac{1}{2}$″.

GE P560 A

Active Filter Unit

The Sinclair Active Filter Unit is a new addition to our Project 60 range of high fidelity modules and is designed to complement the other modules in the range. Its performance is such, however, that users of other amplifier systems might well consider adding it to their assemblies.
The purpose of a filter unit is to reject frequencies above (scratch) or below (rumble) a specific cut off frequency when these frequencies contain unwanted interference. The Sinclair A.F.U. is unique in that the cut off frequency is continuously variable for both the scratch and rumble units and, as the attenuation in the rejection band is rapid (12dB per octave), the removal of interference can be achieved with less loss of the wanted signal than has previously been possible.
Each channel of the A.F.U. has an overall gain of unity and, as the input impedance is high and the output impedance is low, it may be connected between the pre-amplifier and power amplifier sections of any amplifier. Both amplitude and phase distortion have been made quite negligible by the careful design and the large amount of negative feedback employed.



Specifications
Designed for connection between the Stereo 60 pre-amplifier and two Z-30 or Z-50 power amplifiers.
Employs two Sallen & Key type active filter stages, the first being a rumble (high pass) filter and the second a scratch (low pass) filter. The two stages use complementary transistors to minimise distortion.
Supply voltage 15 to 35V
Current 3mA max. Gain at 1kHz, filters flat 0.98 (—0.2dB)
H.F. cut off (—3dB) variable from 28 kHz to 5kHz
H.F. filter slope 12dB/octave
L.F. cut off (—3dB) variable from 25 Hz to 100 Hz
L.F. filter slope 12dB/octave
Distortion at 1kHz (35v supply) 0.02% at rated output (250m V R.M.S.)
Frequency response, flat position, 35 Hz to 20kHz—1dB
25 Hz to 28 kHz—3dB
Built, tested and guaranteed



IC.10 Integrated Circuit 10 watt amplifier

The Sinclair IC.10 is the world's first monolithic integrated circuit high-fidelity amplifier and pre-amp. It has 5 watts R.M.S. output (10w. peak). The circuit is a specially processed silicon chip, one-twentieth of an inch square by 0·01 inch thick, containing 13 transistors, 3 diodes and 18 resistors. This, together with its connecting pins, is bonded to the supporting heat sink which runs through the solid plastic package in which the circuit is encapsulated. The resultant product is infinitely more rugged than any amplifier ever made available before to the public. The IC.10 is a true high-fidelity amplifier possessing distinct advantages over conventional types. The most important are complete freedom from thermal runaway and very low distortion level. Thus battery operation is perfectly satisfactory. As an audio amplifier, the IC.10 requires only the addition of components such as tone and volume controls. However, it can also be used in many other applications including servo amplifiers, etc, since the circuit is d.c. coupled in both its sections. The manual provides details of an extraordinarily wide range of applications together with all necessary instructions.

Specifications

Output:
Class AB. 10 watts peak, 5 watts R.M.S. into 3 Ω with 18v. supply.

Frequency response:
5Hz to 100kHz ± 1dB.
Total harmonic distortion less than 1% at full output.

Power gain:
110dB (100,000,000,000 times) total.

Supply voltage:
8-18 volts.

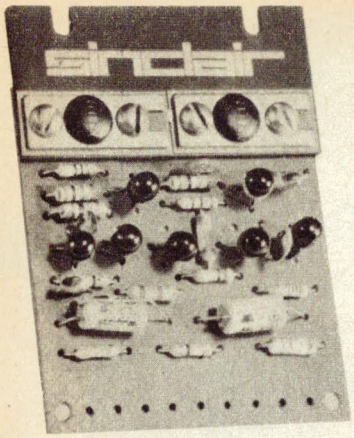
Sensitivity:
5mV.
Input impedance adjustable externally up to 2·5 MΩ for above sensitivity.

Size:
1" × 0·4" × 0·2".

Circuitry:
3 transistors in pre-amp; 10 (including two power types) in power amplifier. Both sections are d.c. coupled, and a high level of negative feedback is applied over all. With a transistor cut-off greater than 500MHz, the pre-amp can be used as an RF or IF stage and the whole IC.10 used as a radio receiver without the need to add further transistors.

Full range of Sinclair Products obtainable from Goldring Engineering (A'asia) Pty. Ltd.
See over for address details.

GE P560 B



Z.30 Twenty watt high fidelity amplifier

This is a power amplifier of advanced design, having a fantastically low distortion level of 0·02% at maximum output and all lower outputs. As far as we know, no other high fidelity amplifier made can match this specification, no matter what the price. Nine silicon epitaxial planar transistors are employed in circuitry which enables the Z.30 to operate from any voltage from 8 to 35 without adjustment and from any power supply. Essentially a high fidelity power amplifier of the very highest standards, the gain of the Z.30 is such that it can be fed directly from a crystal pick-up enabling it to be used in an economy battery operated record player for example. The versatile Z.30 has very many applications, however, ranging from high fidelity to P.A. and laboratory work and these are fully detailed in the comprehensive manual included with the unit, which is supplied built, tested and guaranteed.

Applications
Hi-fi amplifier: car radio amplifier: record player amplifier fed directly from pick-up: intercom: electronic music and instruments: P.A.: laboratory work, etc. Full details for these and many other applications are given in the manual supplied with the Z.30.

Specifications

Power output:
15 watts R.M.S. (30 watts peak) into 8 ohms using a 35 volt supply: 20 watts R.M.S. (40 watts peak) into 3 ohms using a 30 volt supply.

Output:
Class AB.

Frequency response:
30 to 300,000Hz ± 1dB.

Distortion:
0·02% total harmonic distortion at full output into 8 ohms and at all lower output levels.

Signal-to-noise ratio:
Better than −70dB unweighted.

Input sensitivity:
250mV into 100K ohms.

Damping factor:
> 500.

Loudspeaker impedances:
3 to 15 ohms.

Power requirements:
From 8 to 35 volts d.c. (the Z.30 will operate ideally from batteries if required).

Size:
$3\frac{1}{2}" \times 2\frac{1}{4}" \times \frac{1}{2}"$.

Z-50 Forty Watt RMS (80 watt peak) High Fidelity Power Amplifier

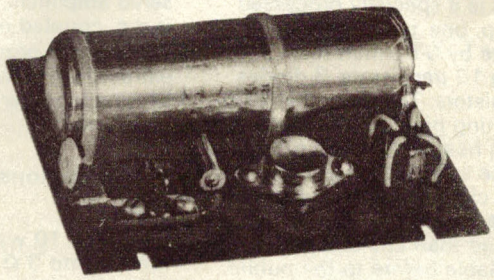
The Z-50 has been designed for applications requiring higher output power than the Z-30. The maximum supply voltage is raised to 50 Volts and the output power is 40 watts continuous R.M.S. in to 3 or 4 ohms and 30 watts continuous into 8 ohms. The Z-50 is otherwise identical to the Z-30 in design and specification, the increased power being obtained by using much higher current power transistors used well within their rated limits.

The Z-50 is, of course, compatible with the other Project 60 modules, such as the Stereo 60.

Where the full output power is not required the Z-50 may be used with the PZ-5 or PZ-6 but for the full output power the PZ-8 should be used. This unit is a stabilised power supply providing 45 volts at up to 3 amps. It is supplied without mains transformer as it is designed for use with a readily available "Radiospares" unit. Z-50 built, tested and guaranteed

PZ·8 Power Supply Unit

PZ-8 45 volts power supply unit for use with **Z-50** amplifiers Available with or without mains transformer.



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GE P560 C

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God to Thee – Jesu Joy of Man's Desiring – Eternal Father – Abide With Me.

In content, there is nothing unusual at all in this album but it is notable for the purity and quality of the performance from the first track to the last. And at the economy price I would most certainly recommend it. (W.N.W.)

★ ★ ★

THIS LITTLE BOY JESUS; The Templetones. Mono, 45rpm, Salvation Army Red Shield MX-163,144.

This 45rpm mono recording reached us too late for mention in the Christmas issue but there may be someone, even in January, who would like a copy. It will cost you $1.00 from the Salvation Army Headquarters, 140 Elizabeth St, Sydney, 2000. If ordered by post, include 25c for mailing. In exchange, you'll get this recording by the "Templetones", a capable Salvation Army pop group, which aims to communicate with teenagers outside Army ranks. I take their word for it. "Have You Any Room For Jesus?" abbreviated here to "Room" is traditionally a hymn of challenge used in after-meetings. The question: Can you really jive your way into a soul-searching experience? But then, I'm a wrinkly! (W.N.W.)

Instrumental, Vocal and Humour

MUSICAL MINIATURES (Ketelby). The Vienna State Opera Orchestra, conducted by Armando Aliberti. World Record Club stereo S/4743.

Interest: Famous salon pieces.
Performance: Slightly out of character.
Quality: Slightly dated, but clean.
Stereo: Normal.

Regular readers of these notes will probably be aware of my enthusiasm for the Ketelby salon pieces of the type included here: In a Chinese Temple Garden – Bank Holiday – In the Mystic Land of Egypt – Jungle Drums – In a Persian Market – In a Monastery Garden – Bells Across the Meadows – With Honour Crowned. It is unfortunate for World Record Club that this disc has been released shortly after the delightful Decca Phase Four version, with the Royal Philharmonic Orchestra (reviewed in the June, 1970 issue) as there is no doubt that the Decca disc is superior in every way. Apart from the excellence of the Decca sound, and the longer playing time (nine pieces instead of eight) the playing of the English orchestra seemed to find the spirit of the music better than that of the Viennese orchestra playing here.

Personally, I feel it is worth going the extra few shillings for the Decca recording, but if economy is a major consideration, this disc is still quite attractive. The orchestra is a very accomplished one, despite the qualification mentioned above, and the sound is clean, with good stereo spread, even if not quite up to the latest Decca sound. (H.A.T.)

★ ★ ★

REVERIE. Charles Groves conducting the Liverpool Philharmonic Orchestra. Stereo. World Record Club WRC-S/4799.

Interest: Mood Nocturne.
Performance: Good.
Quality: Minor reservations.
Stereo: Plenty of spread.

The title of this album might be taken to signify music to go to sleep by. In some of the tracks one might conceivably submit to the mood but it would take a desperately tired listener to sleep through the full resources of the Liverpool Philharmonic and the grand organ in the Philharmonic Hall, on the track which opens side two.

The items might all be classed as classical snippets but very pleasant snippets nevertheless: Nocturne from "Les Sylphides" (Chopin) – Meditation from "Thais" (Massenet) – Nocturne from "A Midsummer Night's Dream" (Mendelssohn) – Nocturne (Borodin) – Adagio in G Minor for Strings and Organ (Albinoni-Giazotto) – Dance Of The Blessed Spirits from "Orfeo" (Gluck) – Pavane (Faure) – Judex from "Mors et Vita" (Gounod). In keeping with World Record Club policy, the jacket notes comment upon the music generally, upon each item individually and upon the orchestra.

Less characteristic of the WRC approach is the considerable level at which the loudest passages are recorded, producing a hint of harshness is some tracks – just enough to fall short of a top quality recording. But, with a program like this, giving 45 minutes of playing time and at the Club price, it's good value, if the music appeals. (W.N.W.)

★ ★ ★

CONCERTO DE CASTILLE: CONCERTO EN FLAMENCO (Federico Moreno Torroba). World Record Club stereo S/4744.

Interest: Guitar concertos.
Performance: Fine.
Quality: Clean sound.
Stereo: Good spread.

Federico Moreno Torroba is very well known in Spain (and elsewhere) as a composer of that typical Spanish entertainment known as the zarzuela – a kind of lighthearted operetta. Of the two works presented here, I feel the Concerto de Castille, for guitar and orchestra, is the more successful. While it is not particularly enterprising, it has pleasing melodies and skilfully exploits the (let's face it) limited resources of the guitar as an instrument pitted against a full orchestra. I do not mean the above remarks to be taken as disparaging – listening to this concerto is a pleasing musical experience, featuring as it does music which is unmistakeably Spanish in character. The soloist here is Renata Tarrago, a lady of no mean ability, who reflects all the grandeur and pride and cruelty of old Spain in her performance. She is capably assisted by the Orchestre des Concerts de Madrid, under Jesus Arrambari.

The flamenco concerto on side two has as soloist Augustin Castellon, who is none other than the internationally famous flamenco guitarist Sabicas. Here Moreno and Sabicas attempt something which I regard as impossible – a concerto in which the orchestra is tied to the printed page, while the soloist improvises "en flamenco". Carlos Montoya has also tried this, with limited success. As it is virtually impossible for soloist and orchestra to integrate fully, this type of concerto becomes virtually a dialogue – first the

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- (It may interest the reader to know that the troublesome frequency is not the mains frequency of 50 cycles, but the first harmonic which occurs at 100 cycles. Mechanical rumble is at 8 cycles and, of course, cannot be reproduced.

- **CONCLUSION:** If you require the absolute optimum in signal/noise ratio, **INSIST ON A "JH" Turntable** — backed by scientific know-how.

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orchestra, then the soloist, then the orchestra, then the soloist, then . . . and so on. Again, there are some pleasing Spanish themes, and there is some typically brilliant playing by Sabicas, and both are certainly worth hearing. I think the value of this work lies more in its novelty value than in its musical qualities. The Madrid orchestra accompanies here also, and is conducted by the composer. (H.A.T.)

★ ★ ★

EXOTICA. Manuel and the Music of the mountains. World Record Club stereo S/4806.

Interest: Light orchestral.
Performance: Nicely played.
Quality: Excellent.
Stereo: Excellent.

The last disc featuring Manuel and his orchestra to come from World Record Club was entirely in the Latin American style, and I personally found it tended to become slightly tedious after the first few tracks, despite the fine musicianship of the combination. This new release also has some Latin American music, but is wider ranging, having in addition a good selection of popular film numbers and evergreens. Beautifully played throughout, and scored in the lush arrangements which have made Manuel so popular, the disc will not disappoint Manuel fans among World Record Club members. The titles: Exotica – Autumn Leaves – Sabara – Cherry Pink and Apple Blossom White – Dusk – Forget Domani – Tico Tico – La Vie en Rose – Life Goes On – The Dancers of Delphi – Two Strangers Met – Blood and Sand.

If my memory serves me well, this disc was originally released on Columbia's Studio 2 Stereo label, which would account for the excellent sound quality and stereo spread. (H.A.T.)

★ ★ ★

THE BEST OF HUGO MONTENEGRO. RCA Dynagroove stereo LSP-4361.

Interest: Film music.
Performance: Outstanding.
Quality: Excellent.
Stereo: Normal.

There have been so many routine recordings of film music released in the past few months that it is a pleasure to be able to recommend one warmly for a change. I am sure Hugo Montenegro could make "Baa Baa Black Sheep" sound like fine music, and what he can do with the selection of titles featured here should satisfy the most carping critic. What the particular magic is that enables one conductor/arranger to make pleasing music when others produce sleep inducing sounds, I do not know, but whatever it is, Montenegro has it in quantity. Here he presents: The Good, the Bad and the Ugly – Theme from "Valley of the Dolls" – Theme from "The Fox" – Theme from "A Fistfull of Dollars" – Hang 'em High – Good Vibrations – Love is Blue – For a Few Dollars More – Happy Together – Classical Gas. Those who favour film music cannot fail to enjoy this one (H.A.T.)

★ ★ ★

THE ENCYCLOPEDIA OF THE ORGAN, Volume 2. Marie-Claire Alain at the Grand Organ of the Cathedral of Uze. World Record Club stereo S/4793.

Interest: Early organ music.
Performance: Splendid.
Quality: Very good recording.
Stereo: Adds interest.

Volume 1 in this series, in which the general aim was outlined, was reviewed in the September, 1970 issue. This second volume is a direct continuation, featuring the same artist and organ, and composers who were contemporary with, or immediate successors of, those of Volume 1. The composers and their works included (classified here as "The French Organ, the Polyphonic and Decorative Age, second period: the peak") are: L. N. Clerambault: Organ Book – Suite in the First Tone (D minor); Suite in the Second Tone (G minor). Francois D'Agincour: Suite in the Second Tone(G minor); Suite in the Fifth Tone (C major).

As in the music of Volume 1, these compositions are essentially uncomplicated secular music, using the standard forms in common use at the time (Plein Jeu, Fugue, Duo, Trio, Recit, and so on). It is all very pleasing, and of course is beautifully played by Mlle Marie-Claire Alain. As before, full details of the organ and stops used for each section are given in the admirable notes on the separate leaflet which accompanies the disc. In summary, a very enjoyable disc which should have particular appeal to those interested in the early organ music literature. The recording is of excellent quality. (H.A.T.)

★ ★ ★

ORGAN CONTRASTS. Wilbur Kentwell at the Conn Theatre Organ. Stereo, RCA Camden CAMS-166.

Interest: Organ, theatre style.
Performance: Capable, but . . .
Quality: Some tape noise.
Stereo: Contributes dimension.

The distributors of Conn organs should be grateful for the wrap-up which their theatre model receives in the jacket notes for this album and for the inclusion of their electronic pipe unit in the cover picture. And there is no doubt either about the versatility of the organ or about Wilbur Kentwell's ability to win from it the sounds that he requires.

On the jacket he is referred to as the "Poet of the Organ". While, in some tracks, he does produce smooth, romantic sounds reminiscent of Jesse Crawford, the original "Poet", in other tracks he reverts very much to his own style. Notable is his tendency to emphasise individual notes with the swell pedal – a trick that I personally dislike. You may feel otherwise

The numbers: A World Of Our Own – Love Is Blue – Jeannine I Dream Of Lilac Time – I Left My Heart In San Francisco – The Nun's Chorus – The Sound Of Music – Strangers In The Night – My Kind Of Girl – Goodnight Sweetheart – Consider Yourself.

In terms of playing time, the album offers a generous 40 minutes. (W.N.W.)

★ ★ ★

I LEFT MY HEART IN SAN FRANCISCO. Bob Ralston, Electronic Organ. Presented by Lawrence Welk. Stereo. Festival SFL-933887.

Interest: Popular organ program.
Performance: Very listenable.
Quality: Clean.
Stereo: Both channels exploited.

Presumably a protege of Lawrence Welk and, to judge by the cover, still a young man, Bob Ralston demonstrates here both his skill as a musician and an ability to put together a thoroughly enjoyable program. His choice for the occasion is a Thomas "Celebrity" model for certain tracks and, for others, a three-manual Thomas "Trianon", chosen for its bells, harpsichord and vibraphone effects.

He is backed by some very nicely

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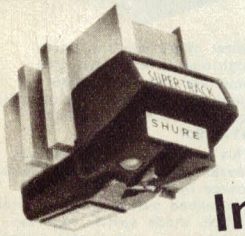
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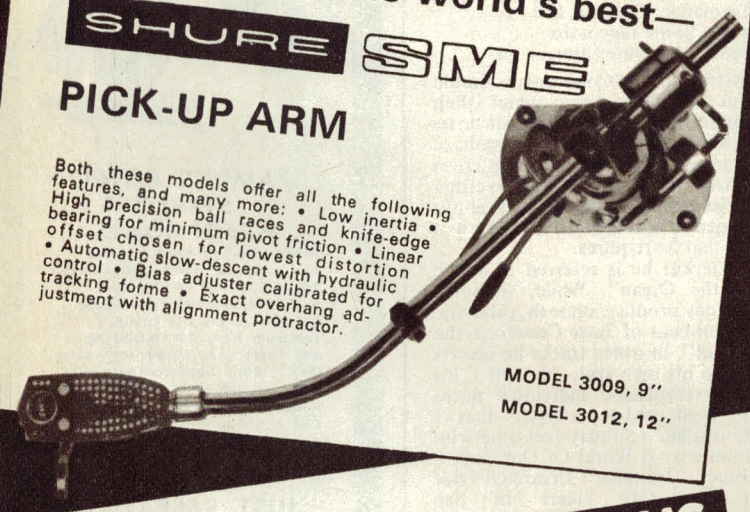
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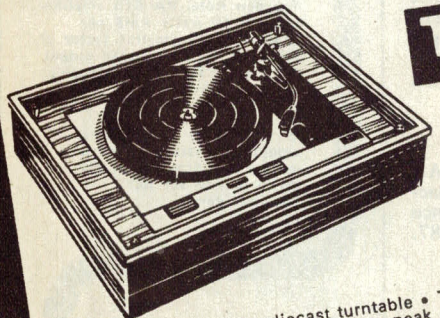
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executed rhythm, though it would be hard to decide exactly how much of it is supplied by the organ and how much by other musicians. The tempos, the voicing, and the approach is appropriately varied from number to number but, in general, the melodies are carried by solo voices rather than by full chords.

The numbers: Try to Remember – The Shadow Of Your Smile – My Cup Runneth Over – Stranger On The Shore – Petite Fleur – I Left My Heart In San Francisco – Raindrops Keep Fallin' On My Head – Moon River – Allen's Theme – Quentin's Theme.

The only thing you might not enjoy about the disc is the playing time which is only about 24 minutes. But it's a very pleasant 24 minutes. (W.N.W.)

★ ★ ★

A WORLD OF MAGIC. Eric Jupp and His Music Featuring Shirley McDonald and Neil Williams. Columbia Stereo SOEX-9660.

Interest: Pleasant orchestral, vocal.
Performance: Polished.
Quality: Clean, well balanced.
Stereo: Nicely spread.

Well known for his programs on radio and television, Eric Jupp's formula for success is a well shaped melody, whether carried by voice, piano or full orchestra. Here, he presents what is virtually a sampler of his popular session "The Magic Of Music" and very pleasant listening it makes.

Aided by the talents of vocalists Shirley McDonald and Neil Williams, Eric Jupp offers: Trundle's Theme – Once Upon A Time – Those Were the Days – By The Time I Get To Phoenix – The Two Of Us – The Last Waltz – I Loves You, Porgy – Didn't We – June Bride – Fare Thee Well.

This should be a popular one. (W.N.W.)

★ ★ ★

THE WORLD OF THE GREAT CLASSICS. Three popular piano sonatas of Beethoven, played by Wilhelm Backhaus. Decca (EMI) stereo SPA 69.

Interest: Piano classics.
Performance: Patchy.
Quality: Very dated.
Stereo: Doesn't help.

The interpretations of Wilhelm Backhaus of the Beethoven piano sonatas always have demanded respect, and very often admiration, but I was never enamoured of his treatment of the first movement of the "Moonlight" sonata with which this disc opens. From the rather superficial treatment which he accords it, I believe it is not a movement for which he had any great liking. His treatment of the second movement is also fairly commonplace, and it is not until he becomes involved with the fireworks of the last movement that he seems to become really involved. To some degree, these comments also apply to the "Pathetique" sonata which follows, where he runs through the slow movement in a rather offhand manner. However, in the "Appassionata" work on side two he shows what a great artist he is. This is a performance on the grand scale – even the second movement is not merely a theme and variations, but the middle section of a great masterpiece of music.

Despite the note on the sleeve that these tracks were "Produced 1959-60", these performances almost certainly date from the series made by Backhaus nearly 20 years ago. The peculiar "barking"

"READER'S DIGEST": MOVIE MUSIC

GREAT MUSIC FROM THE MOVIES. The RCA Symphony Orchestra. Stereo, Reader's Digest/RCA Dynagroove 4-Record Boxed Set.

Interest: As per title.
Performance: Very high standard.
Quality: Full Dynagroove quality.
Stereo: Genuine spread.

So many albums have been released in recent years of purely routine film music that reviewing this four-record set could have been a rather dreary chore. In fact, it proved to be quite the reverse, for at least two reasons.

In the first place, it is not routine music but a carefully selected program of music that not only won initial commendation from film audiences but became established in its own right. The second reason is that it is presented throughout by the RCA Symphony Orchestra, with its resources not only of full orchestral colour but of grouped and solo instrumentalists. Several different conductors are involved, identified with the individual tracks on the labels.

Because your reaction to the set will depend also on the titles, it it appropriate to list them at greater length than usual.

Record 1, side 1 contains: Love Is A Many Splendoured Thing — Laura — Again — Three Coins In A Fountain — Zorba's Dance. On side 2 under the theme "Big Songs From Abroad": More (Mondo Cane) — The Third Man Theme — Never On A Sunday — La Ronde — La Dolce Vita.

Record 2, side 1: It Can't Be Wrong — As Time Goes By — How Little We Know — As Long As I Live — King's Row. "Great Love Themes" is the key for side 2: Glen Miller Story Love Theme — Sandpiper Love Theme — Katsumi (Sayonara) — Paradise — Cleopatra Love Theme — Jezebel Love Theme.

"The Big Westerns" get their turn on Record 3, side 1 with: Magnificent Seven Theme — Green Leaves Of Summer — The Big Country — East Of Eden — Call Of The Faraway Hills (Shane) — Joanna. Side 2 takes us even further west to Hollywood for: My Foolish Heart — Hi-Lili, Hi-Lo — Moonglow — Monica — Till The End Of Time — Song From Moulin Rouge.

Record 4 opens with "The Sounds Of Adventure" as its theme: Around The World — Charade — Lawrence Of Arabia — Baia — El Cid Love Theme — Exodus. The whole of side 2 is devoted to music from "Gone With The Wind", probably the most successful movie ever made and one that involved something like three hours of music from the pen of Max Steiner. You hear: Tara's Theme — Plantation Dance — Melanie's Theme — Bonnie Blue Flag — Civil War — Scarlett O'Hara — Bonnie's Theme — Ashley and Melanie Love Theme — Return To Tara.

As noted earlier, the presentation is of a very high standard, the quality and stereo excellent and background noise non-existent. Each item is covered individually in the jacket notes and, all told, it is an excellent set, for which Reader's Digest are to be congratulated. (W.N.W.)

quality of the forte chords, which appear to result from a piano with a rather hard, clanging tone, is in evidence here, and was a feature of the series which began in the early 1950s. Presumably they were re-issued in stereo in 1959-60.

The overall sound quality is not good by modern standards, and the stereo spread is virtually non-existent, but in any case is probably the "reprocessed" variety. However, if you are looking for a bargain price disc of the popular Beethoven sonatas, this one at $2.59 is worth considering. (H.A.T.)

★ ★ ★

LOVE IS A SOFT TOUCH. Ferrante and Teicher, piano duettists, with orchestra. United Artists, (Festival) stereo SUAL-933905.

Interest: Current hits.
Performance: Very smooth.
Quality: Excellent sound.
Stereo: Good spread.

Here is the latest of the regular six-monthly dises of current hits recorded by Ferrante and Teicher, and it is distinguished from all the others only by the change in titles. This latest selection has: Magical Connection – Love is a Soft Touch – Let It Be – Jean – Smile a Little Smile for Me – Pieces of Dreams – Snowbird – Is That All There Is – I'll Never Fall in Love Again – Bridge Over Troubled Waters – Oh To Be Young Agair – Paper Mache. If you are familiar with the Ferrante and Teicher style, that is all you need to know. Otherwise you may care to know that the technique is to provide a lush orchestral background against which the two pianos play slick, but rather superficial, arrangements, with plenty of sweeping arpeggios and runs up and down the keyboard. It is quite undemanding, and it has apparently proved so successful that it would be rather pointless to knock it. If you are not sure, try to hear a bit before buying. (H.A.T.)

★ ★ ★

MUSIC FOR THE SPANISH GUITAR. Oscar Ghiglia. His Master's Voice (EMI) stereo SOELP 9490.

Interest: Modern guitar music.
Performance: Skilfully executed.
Quality: Good.
Stereo: Not significant.

In a situation where the recorded guitar music sphere is dominated by a few giants, such as Segovia, Julian Bream, John Williams and a few more, a young classical guitarist making his debut recital on records has to do something pretty special to warrant more than a passing comment. Oscar Ghiglia elects to play modern works which demand considerable virtuosity in their execution, and acquits himself very well in the process. Side one begins with the lively and charming "Tarantella" of Castelnuovo-Tedesca, followed by Turina's interesting "Fantasia Sevillana", with alternating passages of dreamy meanderings and stern, down-to-earth measures. The familiar "Six Preludes" of Manuel Ponce come next, providing plenty of opportunities to display finger dexterity. The side is completed by: Tiento Antiguo (Maurice Ohana) – Saraband (Poulenc) – Segovia (Albert Roussel).

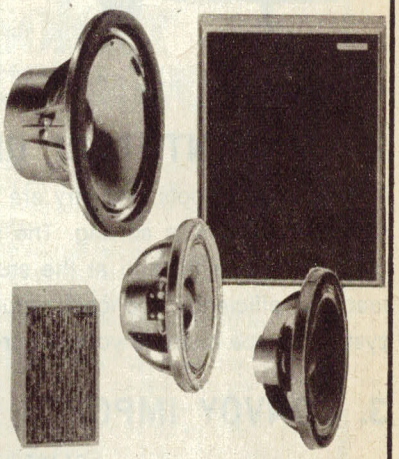
Most of side two is taken up by Mompou's "Suite Compostelana". written in 1959, shortly after he had held the chair of composer at the annual Cours

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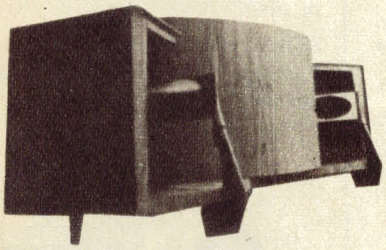
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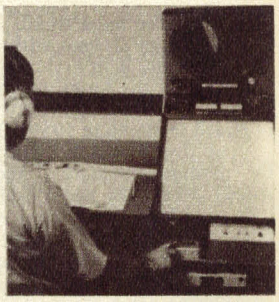
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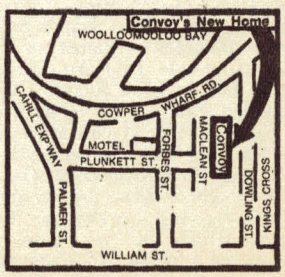


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International de Musique at St-Jacques de Compostelle, Spain, and following discussions with Segovia. A record in which Segovia himself played this work was reviewed by me in these columns in 1966. I said then that "the music if refreshingly original, yet very melodic and full of gentle cadences". I see no reason to revise my opinion. The disc ends with "Zarabanda Lejana", by Joaquin Rodrigo, the blind Spanish composer, and those familiar with his style will not be surprised at its essentially melodic nature.

There has been very little classical guitar music released lately, and at $2.59 I can warmly recommend this one. The quality of the recording is entirely satisfactory. (H.A.T.)

★ ★ ★

GOLDEN MELODIES FOR EASY LISTENING. Lowrey Bar Combo, featuring the Lowrey Holiday Organ. Stereo, AR Ad-Rhythm (Festival) SFL-933831.

Interest: Organ plus percussion.
Performance: Tuneful, happy.
Quality: Just so-so.
Stereo: Not startling.

As the title suggests, these are indeed golden melodies for easy listening, done to a toe-tapping beat supplied by a rhythm group: Slow Boat To China – On Hawaiian Shores – Zambesi – Island In The Sun – Northern Lights – Come Back To Sorrento – South Of The Border – You Are Beautiful – Rio Nights – Cruisin' – April In Paris – Tulips From Amsterdam.

But, alas, if you have an ear for quality, rather than merely for a tune, you'll be conscious that something in the system was riding perilously close to overload quite frequently during the performance. It could be the recording chain but my guess is one channel of the organ, because the percussion remains clean at all times. A pity. (W.N.W.)

★ ★ ★

HAND MADE. Mason Williams. Warner Brothers, stereo WS1838.

Interest: Different from anything else.
Performance: Comparable only to himself.
Quality: Just short off excellent.
Stereo: Used to full advantage.

I don't know what better way to start this review than by saying that this is one of the most unusual records I've yet come across. Even the jacket itself is unusual. It resembles something hand-made from ordinary packing cardboard, complete with cup-ring stains, stuck-on photo clippings and scrawly handwriting for which Mason himself is responsible. The jacket notes and commentary he writes are very cryptic and show a talent for dry humour. To quote: "All the Time – This song was on my first album, but I can sing better now, so I re-did it" and on "Classical Gas" his comment is "This is the song I'm best known for, so I thought I'd do it again, just to be sure".

My comment on these two numbers is maybe not so colourful, but, if Mason thinks he can sing better now, he still has a long way to go yet. Although technically sound, his voice has a definite nasal quality. He seems to be aware of this and does his best to control it with almost complete success in "All The Time" which to my mind is his best vocal on this album.

The instrumentals he does are good, there's no question about it. "Jose's Piece", the first track on side one, is certainly an introduction to Mason's music that can't be forgotten. Not only is the music tremendous, but the range in reproduction is extremely wide as well. The low end contains some very deep sustained bass, around the 30-40Hz and plenty of it. Most of the other tracks lack this rich bass, but good balance is nevertheless evident in all.

As if being unusual in his jacket notes and music is not enough, some of the song-titles are even more wayout. Jose's Piece – Find a Reason to Believe – I've Heard That Tear Strained Monologue You Do There By The Door Before You Go – All The Time – Saturday Night At The World – Classical Gas – The Tomato Vendetta – Manha De Carnaval – It's Over – The Exciting Accident.

Concerning this last number he writes: "I wrote this in 1965, but nobody liked it, so since I have the power now, I'm going to force it on the public." I don't think that this number, nor in fact the whole album, will have to be forced on the public. It is so unusual that it cannot help but interest a lot of people. (J.P.P.)

★ ★ ★

COME SATURDAY MORNING. The Sandpipers. A & M (Festival) stereo SAML-933892.

Interest: Folk balladeers.
Performance: Splendid.
Quality: Excellent.
Stereo: Wide and even.

For the first time, the Sandpipers are named on a record sleeve. They are Michael Piano, Jim Brady and Richard Shoff. Whether the group has remained unchanged since their first recording I should not like to hazard a guess, but there do seem to have been some changes in the intervening period. The main difference is that the counter tenor, who gave the group's singing such a distinctive character is not now evident. Either he has left the group, and has been replaced, or he no longer sings in the soprano register. I miss this aspect of the group's performances, but they still sing superbly.

A & M have provided them with a rather larger and certainly more polished orchestra than previously. I imagine one reason for this is that the group sing the "Song of Joy" in this recording, which would certainly need a larger orchestra than they have previously had in support. The other titles are: Santo Domingo – The Long and Winding Road – Free to Carry On – Where There's A Heartache – He's Got The Whole World In His Hands – The Drifter – The Sound Of Love – Autumn Afternoon – Come Saturday Morning – The Wonder Of You - Beyond The Valley Of The Dolls. Once again I feel it appropriate to comment on the entirely wholesome nature of the performance. Smut, inuendo and suggestiveness have no place in the performances of the Sandpipers. (H.A.T.)

★ ★ ★

JOIN IN THE CHORUS. A Stanley Holloway Sing Along. With Orchestra Directed by Ivor Raymonde. Stereo, World Record Club WRC S-4805.

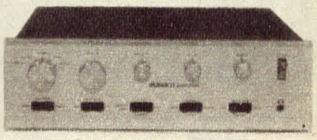
Interest: Music Hall memories.
Performance: Traditional style.
Quality: Clean.
Stereo: Normal.

In my younger days, the name of Stanley Holloway was synonymous with Sam ("Pick oop thy moosket") Small and Young Albert, of lion fame. The jacket notes, however, trace Stanley Holloway's career from his pre-Sam Small days through to his more recent successes on stage, screen and television.

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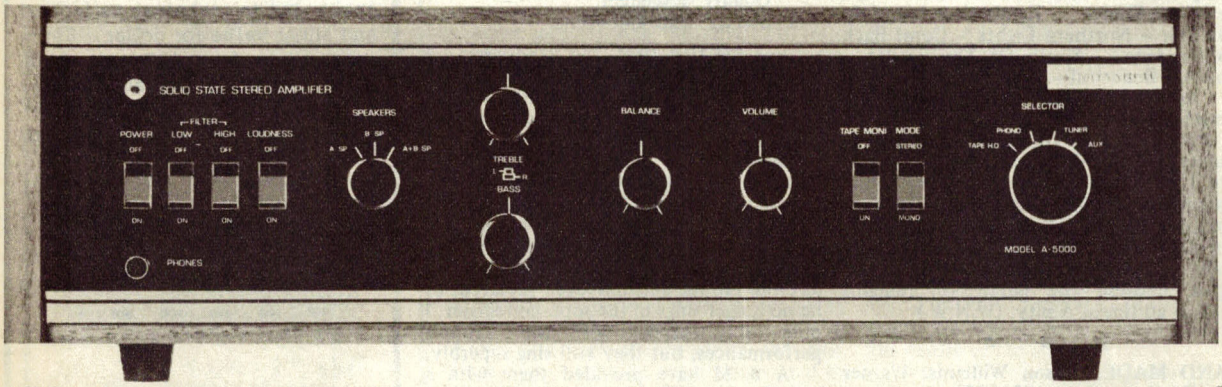
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Australian bird calls

THE BIRDS AROUND US. Bird calls introduced by Alec Chisholm, OBE, FRZS. Produced jointly by EMI and the Gould League of NSW. Mono OEX 9699.

Interest: Birds of NSW.
Performance: Not applicable.
Quality: Well recorded.

In recent weeks I have on numerous occasions been diverted and intrigued by the beautiful song of a particular bird in my garden, and have bewailed the fact that I did not know what bird it was. Now I know – it is in fact the grey thrush. I gained this knowledge from the disc under review, and at the same time I was able to identify numerous other bird calls which I frequently hear. There are something like 35 different bird calls included in this fascinating record, all recorded with admirable clarity. The birds are those to be found in the Sydney region, and although many of these will undoubtedly be common in other parts of Australia, the main appeal of the disc will be to those who dwell in Sydney and its environs.

On side one, the songs are introduced one at a time by Alec Chisholm, but on side two the birds are allowed to "speak" for themselves. The side is divided into four tracks, and a complete listing in the correct order helps the listener to identify each bird. The disc was prepared from tapes supplied by the Gould League of NSW. At $2.59, it should prove a very attractive proposition to anybody with an interest in bird life. (H.A.T.)

In this album, Stanley Holloway journeys back in time to his early years in the music hall, with its old songs, its chorus and its stylised orchestra. Try your memory on these: Lily Of Laguna – Any Old Iron? – A Bachelor Gay – The Honeysuckle And The Bee – Down At The Old Bull And Bush – If You Were The Only Girl In The World – Two Lovely Black Eyes – 12 tracks in all and a playing time of about 32 minutes. These days, Stanley Holloway wouldn't stand much of a chance at an Eisteddford on vocal talent alone but there is no mistaking his feeling for the old songs. If you share these feelings, you'll certainly enjoy the company of this famous old-time artist. (W.N.W.)

* * *

(TEN) YEARS TOGETHER – The Best of Peter, Paul and Mary. Warner Bros. Records, stereo BS-2552.

Interest: P, P and M re-issues.
Performance: Some of their best tracks.
Quality: Good throughout.
Stereo: Normal.

Peter, Paul and Mary have been singing as a group for 10 years, so Warner Bros has re-issued some of their best tracks to commemorate the occasion. Need I enlarge on this? The main interest will lie in the titles. If you are a devotee, you will probably have most or all of them already – if not, this would certainly be one of the best discs to acquire, and it concentrates in one offering a selection of some of the group's best tracks: Blowin' in the Wind – Too Much of Nothing – Lemon Tree – Stewball – Early Mornin' Rain – 500 Miles – I Dig Rock and Roll Music – Leaving on a Jet Plane – Puff (the Magic Dragon) – For Lovin' Me – Don't Think Twice, It's All Right – If I Had a Hammer – Day is Done.

As is to be expected, there is some variation in sound quality, but this is never less than satisfactory. (H.A.T.)

* * *

THE ZEMEL CHOIR. Music for Pleasure stereo MFP-A 8145.

Interest: Jewish choir, Jewish music.
Performance: Very disciplined.
Quality: Very good.
Stereo: Effective.

The Zemel Choir are a Jewish group, operating in London, which since its formation in 1955 has won innumerable awards in national and international competitions, and has toured Israel. They are a splendidly trained group, who sing with precision and verve. Not surprisingly, they sing Jewish music such as that presented in this program, much of it liturgical in origin, some of it traditional and, of course, there is the nowadays inevitable "Jerusalem the Gold", as well as the standard "Hava Nagila". The performance is permeated by the bitter-sweet quality, which is peculiar to Jewish music, but which is entirely melodic. I think it is probably true to say that, as a people, the Jews are more richly endowed with the gift of melody than any other and they have dominated the performing field for many years.

If you have any liking for Jewish music, this release at $1.99 should appeal on all counts, not only on account of its low price tag, but by virtue of its musical qualities and its good modern sound. (H.A.T.)

* * *

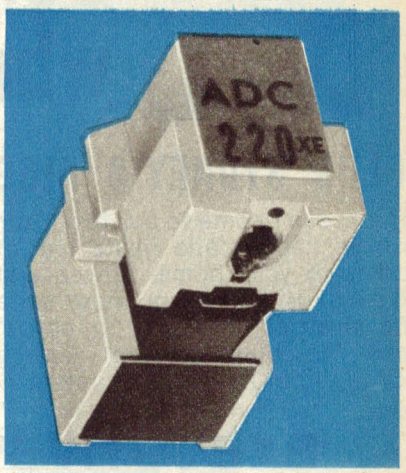
SONGS OF THE OPEN ROAD AND ORIENT. Peter Dawson, with orchestral or piano accompaniment. Columbia (EMI) mono OEX 9613.

Interest: Famous voice of yesteryear.
Performance: Rousing style.
Quality: Typical of 78rpm era.

The recent death of Peter Dawson has been the signal for a flush of LPs with collections of the numerous tracks he made during his long career. I do not know whether his recording career took in any part of the LP era, but I doubt it. These tracks appear to be all reprocessed from 78rpm discs, and I imagine the appeal will be limited to those who were Dawson fans in the past, and are prepared to accept the deficiencies in audio quality for sentimental reasons.

Side one is occupied by the erstwhile extremely popular songs of Amy Woodeford-Finden: Four Indian Love Lyrics – A Lover in Damascus (five songs). A final track is a vocal version of Ketelby's "In a Persian market", but the least said about this atrociously meretricious item the better. Side 2 has "Songs of the Open Road", with such titles as: The Winding Road – The Tramp's Song – Songs of the Tinker . . . and so on. All good rousing stuff, but little known nowadays. One song in this bracket which could still claim to be popular is Vaughan Williams's "The Vagabond". With 17 tracks in all, the disc should certainly appeal to those with memories of a fine singer at its $2.59 price. (H.A.T.)

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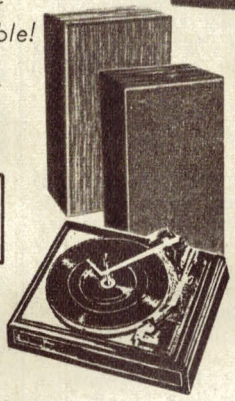
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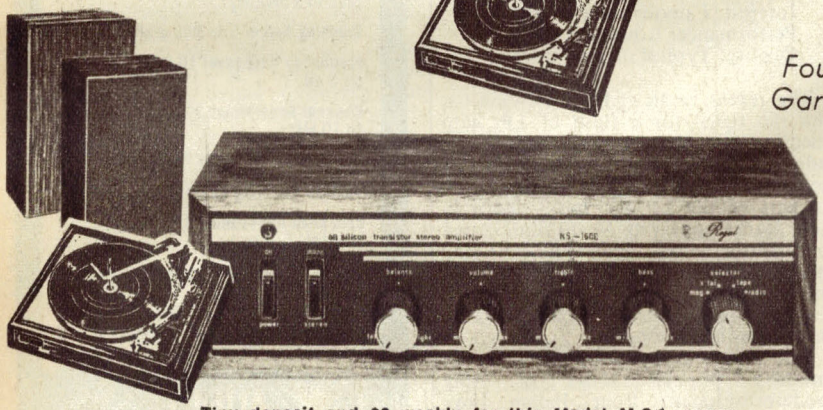
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CROMWELL. Dramatic excerpts and music from the soundtrack of the Columbia film, with Richard Harris as Cromwell, and Alec Guinness as King Charles I. Capitol (EMI) stereo ST 640.

Interest: Mainly dialogue.
Performance: Fine.
Quality: Good sound.
Stereo: Effective.

EMI are a little late bringing out this disc of excerpts from the Columbia film "Cromwell", and many who might have bought it in a flush of enthusiasm just after seeing the film may well have cooled off by now. This is not a musical theme, and consequently there is not much interesting music in the score. Consequently, a large portion of the disc is taken up with dialogue.

The action is concerned mainly with that part of Cromwell's career in which he led the Parliamentary armies against the king, and the events which led up to the execution of King Charles. Historically the screenplay appears to be accurate, and the speeches of the characters are those recorded for posterity. The main interest in this case is undoubtedly for those who require a souvenir of the film. (H.A..T.)

★ ★ ★

LOCAL GENTRY. Bobbie Gentry. Stereo, World Record Club S/48077.

Interest: Country tunes Gentry style.
Performance: Bobbie at her best.
Quality: Good.
Stereo: Highlights performance.

Bobbie Gentry has a style, a way of presentation, and a voice, all of her own. As if just singing isn't enough, she does her own composing as well. On "Local Gentry", the title of this fine album, she sings 11 numbers in all, each very much in her own style. Four she composed herself; John Lennon and Paul McCartney provided the material for a further three.

All in all, a fine recording, beautifully sung and clean to listen to, and a very worthwhile addition to any C and W collection. If I haven't already convinced you, maybe a look at the tracks will: Sweet Peony– Casket Vignette – Fool On the Hill – Papa's Medicine Show – Age Insurance Man – Recollection – Sittin' Pretty – Eleanor Rigby – Peaceful – Here There And Everywhere. (J.P.P.)

Popular Jazz

BUDDY RICH BIG BAND. Live at the Tropicana, stereo Liberty. SLYL-933916.

Interest: Big band jazz.
Performance: Excellent.
Quality: 21 microphones at a nightclub.
Stereo: Lifelike.

Rich is where he should be, driving a big band of vigorous musicians over a batch of modern charts. Buddy has recorded all sorts of albums over the years. This (taped 1970) is one of the good ones. His musicians are young college graduates, unknowns who play like stars. Lead trumpeter Mike Price is one of the surprises. The writing is new, too, with "The Juicer is Wild" and "Groovin' Hard" standing well out. (G.W.)

★ ★ ★

THE BEST OF LOUIS ARMSTRONG. Two LPs stereo, MCA DXSB 7183.

Interest: New Orleans jazz.
Performance: Good re-creations.
Quality: Adequate.
Stereo: Laboratory job on mono masters.

To celebrate Louis' 70th birthday, this double album of 24 numbers made its appearance. They come from the 1957 sessions of the All Stars, assembled to revive Armstrong classics from the Hot Five and early big band days. "King of the Zulus" is the best of them. The trumpeter who changed music in his lifetime sounded just as good in 1957 as he was in 1928. Trummy Young and Billy Kyle are with Louis. (G.W.)

★ ★ ★

LOU RAWLS. Bring it on Home. Stereo Capitol ST 479.

Interest: Soul jazz.
Performance: Strong vocals.
Quality: Good.
Stereo: Normal.

An unnamed guitarist plays an interesting obligato to Rawls' vocals on this LP of songs by Sam Cooke. Although he was killed in 1964, Cooke has had an influence on the soul end of the rock spectrum. Jazz performers have made wide use of his songs as vehicles for improvisation.

"Cool Train", "Chain Gang", "Another Saturday Night" and "Take Me For What I Am" are some of the outstanding ballads by Cooke which Rawls sings. The band is somewhat lopsided, like the Basie brass section, with the unknown guitarist. Rawls rules. (G.W.)

★ ★ ★

LES McCANN AND EDDIE HARRIS. Stereo, Atlantic SAL-933723.

Interest: Recent jazz concert.
Performance: Spontaneous.
Quality: Good.
Stereo: Normal.

Les McCann's piano trio and Eddie Harris's quartet were appearing at the Montreux Jazz Festival, Switzerland in June 1969 and had the idea of making this album. They were joined by trumpeter Benny Bailey.

Harris is superb on tenor saxophone, his forward thinking curbing Les McCann's tendency to play boogooloo to excess. McCann, in fact, plays swinging, economical piano. "The Generation Gap" is the instrumental which brings a deeply hued solo from Bailey, quite extraordinary. McCann sings on "Compared to What", a wry vocal. (G.W.)

★ ★ ★

HERBIE MANN. Big Boss Mann. Stereo. CBS SBP 233853.

Interest: Flute jazz.
Performance: Excellent.
Quality: Good.
Stereo: Normal.

Herbie Mann's treatment of "What'd I Say" on this LP is a stirring example of his versatility. Ray Charles wrote the song as a vocal for himself and Herbie's first flute chorus mimics the vocal line with phrasing and pace, then he takes off and improvises, creating a hot jazz solo.

There's a Latin influence through the rest of the album. Oliver Nelson was arranger, with other soloists Chick Corea (piano), Dave Pike (vibraharp), Jimmie Heath (Tenor saxophone) and Carmell Jones (trumpet). (G.W.) ■

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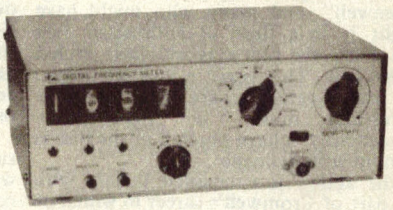
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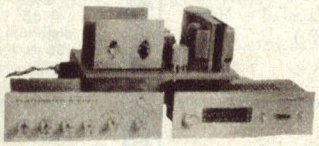
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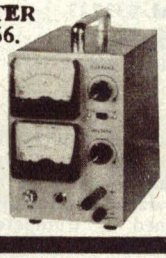


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Playmaster 122 Program Source. Electronics (Aust.), August, 1968.

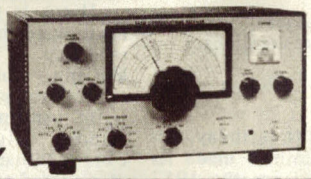
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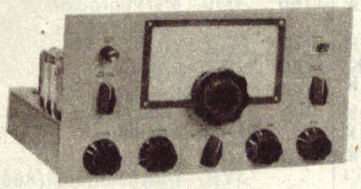
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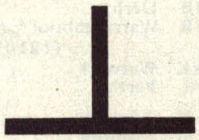
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210A. I/C TRF RX.
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218. 5 Band. S.S.B.
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AUSTRALIAN BROADCAST STATIONS

MEDIUM-WAVE STATIONS

KHz	Call	Location		Watts
530	2KM	Kempsey	d	2K
	3UL	Warragul	d	2K
	4KZ	Innisfail-Tully	d	2K
	6DL	Dalwallinu	n	10K
540	4QL	Longreach	n	10K
	7SD	Scottsdale	d	2K
550	2CR	Orange	n	50K
560	2ML	Murwillumbah	n	200
	4AM	Atherton	d	2K
	6WA	Wagin	n	50K
	7BU	Burnie		2K[1]
570	2BH	Broken Hill[4](660)		500
	4JK	Julia Creek[2]	dn	10K
580	3WV	Horsham	n	50K
590	4QR	Brisbane	n	50K
600	4AT	Atherton[3](720)	n	4K[1]
	4MS	Mossman[2]	n	1K
	6NM	Northam	n	200
	6PH	Port Hedland	n	2K
	7ZL	Hobart	n	10K
610	2FC	Sydney	n	50K
620	3AR	Melbourne	n	50K
630	4QN	Townsville	n	50K
	7QN	Queenstown	n	400
640	5CK	Port Pirie	n	10K
650	2NU	Tamworth	n	10K
	6AL	Albany	n	400
	8DR	Darwin	n	2K
660	2BH	Broken Hill[3](570)		200
	2BY	Byrock[2]	dn	–
	6GF	Kalgoorlie	n	2K
670	2CO	Albury	n	10K
	6BE	Broome	n	50
	8KN	Katherine	n	50
	9LA	Lae	n	–
680	2KP	Kempsey	n	10K
	6BS	Busselton	n	4K
	8TC	Tennant Creek	n	50
690	4KQ	Brisbane		2K
	5SY	Streaky Bay[2]	dn	2K
700	2NR	Grafton	n	50K
710	4QW	St George	dn	10K
	7NT	Launceston	dn	10K
720	2TR	Taree[3](1000)	n	200
	4AT	Atherton[4](600)	n	4K[1]
	4QA	Mackay[3](760)	n	2K
	6WF	Perth	n	50K
730	5CL	Adelaide	n	50K
740	2BL	Sydney	n	50K
750	4QS	Toowoomba	n	10K
760	2AN	Armidale	n	50
	2NB	Broken Hill[3] (1000)	n	1K
	4QA	Mackay[4](720)	n	2K
770	3LO	Melbourne	n	50K
780	2KA	Katoomba		2K
	4TO	Townsville		2K
	6VA	Albany		2K
790	4QG	Brisbane	n	10K
800	4QY	Cairns[4](940)	n	2K
	5RM	Renmark		2K
810	2BA	Bega	n	10K
	6WN	Perth	n	10K
	9RB	Rabaul	n	2K
820	2GL	Glen Innes	n	10K
830	3GI	Sale	n	10K
	6GN	Geraldton	n	2K
840	4RK	Rockhampton	n	10K
	6ED	Esperance	n	1K
	7QT	Queenstown		500
850	2CY	Canberra	n	10K
	6CA	Carnarvon	n	200
860	4GR	Toowoomba		2K
	6AM	Northam		2K
	7HO	Hobart		2K
	9MD	Madang[2]	n	–
870	2GB	Sydney		5K
	6DB	Derby	n	2K
880	3YB	Warrnambool[4] (1210)	d	2K
	4WK	Warwick		2K[1]
	6PR	Perth		2K
890	5AN	Adelaide	n	50K
900	2LM	Lismore		2K
	6BY	Bridgetown		2K
	7AD	Devonport		2K[1]
	8HA	Alice Springs		2K
	9GR	Goroka[2]	n	–
910	4QB	Maryborough	dn	10K
	4QO	Eidsvold	n	10K
920	2XL	Cooma		2K[1]
	4VL	Charleville		2K[1]
	6NA	Narrogin		2K
930	3UZ	Melbourne		5K
	4CD	Gladstone	d	2K
940	4AY	Ayr[4](960)	d	2K
	4QY	Cairns[3](800)	n	2K
	7ZR	Hobart	dn	10K
950	2UE	Sydney		5K
960	3BO	Bendigo		2K
	4AY	Ayr[3](940)		2K
	6TZ	Bunbury		2K
970	2MW	Murwillumbah[4] (1440)	d	2K
	5DN	Adelaide		2K
980	3HA	Hamilton		2K
	4RO	Rockhampton		2K
	6KG	Kalgoorlie		2K
990	2GZ	Orange		2K
1000	2NB	Broken Hill[4](760)	dn	2K
	2–	Nowra[2]	d	2K
	2TR	Taree[4](720)	dn	2K
	6PM	Perth		2K
1010	4CA	Cairns		2K
	4IP	Ipswich		2K
	6GE	Geraldton		2K
	7EX	Launceston		2K
1020	2KY	Sydney		5K
1030	3DB	Melbourne		5K
1040	2UH	Muswellbrook	dn	1K
	5PI	Crystal Brook		2K
1050	2CA	Canberra		2K
1060	4SB	Kingaroy		2K
1070	2RG	Griffith		2K[1]
	6WB	Katanning		2K
1080	2MO	Gunnedah		2K[1]
	4MI	Mount Isa	n	200
	6IX	Perth		2K
	7HT	Hobart		2K
1090	3LK	Lubeck		2K
1100	4LG	Longreach		2K
	6MD	Merredin		2K
	7LA	Launceston		2K
1110	2UW	Sydney		5K[1]
1120	4BC	Brisbane		2K
1130	2AD	Armidale	d	2K
	3CS	Colac	d	2K
	6CI	Collie		2K
1140	2HD	Newcastle		2K
1150	2WG	Wagga		2K
1160	4MB	Maryborough		2K
	5PA	Naracoorte	dn	10K
1170	2CH	Sydney		5K
1180	3KZ	Melbourne		5K
1190	2NZ	Inverell		2K
1200	4GG	Gold Coast	d	2K
	5KA	Adelaide		2K
1210	2GF	Grafton	d	2K
	3YB	Warrnambool[3](880)		2K
	6KY	Perth		2K
1220	4AK	Oakey		2K
	5EP	Port Lincoln[2]	d	2K
1230	2NC	Newcastle	n	10K
1240	3TR	Sale	d	2K
	8DN	Darwin		2K
1250	2DU	Dubbo		2K
	9PA	Port Moresby	n	2K
1260	3SR	Shepparton		2K
1270	2SM	Sydney		5K
1280	3AW	Melbourne		5K
1290	2TM	Tamworth		2K
1300	4BK	Brisbane		2K
1310	2–	Gosford[2]	d	2K
	5AD	Adelaide		2K
1320	3BA	Ballarat		2K
	4NA	Nambour	d	2K
1330	3SH	Swan Hill		2K
	4BU	Bundaberg		2K
1340	2LF	Young		2K
1350	3GL	Geelong		2K
	4GY	Gympie		2K
1360	2NX	Bolwarra		2K
1370	2LT	Lithgow		500
	4LM	Mount Isa		2K
	5SE	Mount Gambier[5]		500
1380	2GN	Goulburn		2K
	4MK	Mackay		2K
1390	4BH	Brisbane	d	2K
1400	2PK	Parkes		2K
1410	2KO	Newcastle		2K
1420	3XY	Melbourne		5K
1430	2WL	Wollongong		2K
1440	2MW	Murwillumbah[3](970)		2K
	3CV	Maryborough		2K
1450	2MG	Mudgee	d	2K
	5AU	Port Augusta	d	2K
1460	2NM	Muswellbrook		2K[1]
	5MU	Murray Bridge		2K[1]
1470	3MA	Mildura		2K
1480	2BE	Bega		2K[1]
	4ZR	Roma		2K[1]
1490	2AY	Albury		2K
1500	2BS	Bathurst	d	2K
	3AK	Melbourne	d	5K
1510	2NA	Newcastle	n	10K
1520	2QN	Deniliquin		2K
	9WK	Wewak[2]	n	–

(Continued opposite page)

All call signs commence with a number which indicates the state or territory in which the station is located. The numbers are allocated:

2 NSW including ACT
3 Victoria
4 Queensland
5 South Australia
6 Western Australia
7 Tasmania
8 Northern Territory
9 Territory of Papua and New Guinea.

d Uses directional antenna.
n National Broadcasting Service.
1 Operates at night or during specified periods on reduced (usually half) power.
2 Projected station.
3 To change to frequency in brackets.
4 Not yet operating on this frequency. The existing frequency is shown in brackets.
5 Directional antenna to be installed and power increased to 2KW. Details not yet available.

KHz	Call	Location		Watts
1530	2VM	Moree		2K[1]
	5LN	Port Lincoln	n	200
	8AL	Alice Springs	n	200
1540	2CN	Canberra	n	2K
1550	4QD	Emerald	n	50K
1560	2RE	Taree		2K
1570	2CP	Cooma	n	50
	2LG	Lithgow	n	200
	3WL	Warrnambool	n	200
	4GM	Gympie	n	200
	4HU	Hughenden[2]	n	50
	5LC	Leigh Creek[2]	n	50
1580	2WN	Wollongong	n	2K
	5MG	Mount Gambier	n	200
	5WM	Woomera	n	50
1590	4SO	Southport	n	200
	5MV	Renmark	n	2K
1600	3NE	Wangaratta		2K[1]

SHORT-WAVE STATIONS

The Australian Broadcasting Commission has short-wave broadcasting stations located in several States and in the Territory of Papua and New Guinea. These provide a service to distant sparsely populated areas of the Commonwealth and Territories. The frequencies on which they transmit are varied as necessary to obtain optimum results.

The short-wave service transmits programs obtained as follows: VLI takes NSW regional programs; VLG takes Vic regional programs and relays Radio Australia; VLH relays 3AR; VLR relays 3LO; VLM and VLQ take Qld regional programs; VLW takes WA regional programs; VLK and VLT relay 9PA.

Call	Location	Watts
VLG	Melbourne	10K
VLH	Melbourne	10K
VLI	Sydney	2K
VLK	Port Moresby	10K
VLM	Brisbane	10K
VLQ	Brisbane	10K
VLR	Melbourne	10K
VLT	Port Moresby	10K
VLW	Perth (two services on two frequencies)	10K and 50K

Radio Australia

Transmitters for the overseas service of Radio Australia are located at:

Shepparton, Vic	4 x 100KW, 2 x 50KW and 1 x 10KW
Lyndhurst, Vic	2 x 10KW
Darwin, NT	3 x 250KW

These stations are capable of operating on various frequencies and antennas as required to give best reception in the selected areas. In common with all international broadcasting stations, Radio Australia has no assigned frequencies, but is allocated certain frequencies for use during definite periods.

Overseas Stations

"Electronics Australia" does not publish, nor has available, lists of overseas stations, frequencies, broadcast schedules, etc. The only information of this type is compiled by our short-wave correspondent, Mr Arthur Cushen, and is published monthly in the "Listening Around the World" section.

For general information on short-wave and other stations, reference can be made to the "World Radio and TV Handbook". This is available through most large technical booksellers or through Mr Cushen.

TERRITORIES

Norfolk Island

A local service is provided by the Norfolk Island Administration under the technical direction of the Department of Civil Aviation.

KHz	Call	Location	Watts
1570	VL2NI	Kingston	50

Lord Howe Island

The Department of Civil Aviation provides a service to inform residents of the arrival times of aircraft and shipping. Broadcasts are made one hour before the scheduled arrival time.

KHz	Call	Location	Watts
640		Lord Howe Is	50

Papua/New Guinea

In addition to its services on medium wave (9PA and 9RB) and on short wave (VLK and VLT), the Australian Broadcasting Commission relays the programs of 9RB over the following station:

KHz	Call	Location	Watts
5985	VH9RA	Rabaul	

Short-wave stations

The Department of Information and Extension Services for the Territory also provides a number of short-wave stations, as follows:

KHz	Call	Location	Watts
2410	9CG	Goroka	250
2450	9CH	Mount Hagen	250
3235	8AS	Samarai	250
3245	8BK	Kerema	250
3305	8BD	Daru	10K
3322.5	9BA	Kieta	2K
3335	9CD	Wewak	10K
3385	9BR	Rabaul	10K

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- Tapes, pads, mylar (clear, matte, precision grid), symbols, targets, sequential reference designations, letters, numbers, words.
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N.S.W.: Circuit Components (A'asia) P/L, 460 Bexley Rd., Bexley 2207. 59 6550.
Qld.: Douglas Electronics P/L, 322 Old Cleveland Rd., Cooparoo 4151. 97 8222.
S.A.: Camden Art Centre Pty. Ltd., 210 Rundle Street, Adelaide 5000. 23 4861.
W.A.: W. J. Monhcrieff Pty. Ltd., Hay St., East Perth 6000. 23 1194.

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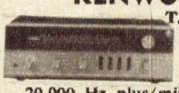
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Built in 6 Watt Amplifier. 2 Voices — Flute Strings. Vibrato switch incorporated. Can be connected to external Speaker or Amplifier. Complete with modern stand.
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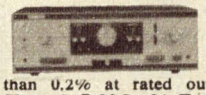
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Silicon Transistorised AM/FM TUNER — AMPLIFIER 8 Watt RMS per Channel 20/20,000 Hz plus/minus ½db.
List price $219.95 less T/I.

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Just arrived, the new AUDIO-TECHNICA 600L Automatic Disc Cleaner. Instantly fitted. Easily handled. Suitable for all types of records. Surface noise reduced. Wear of record and stylus greatly diminished. Automatically trails with rotation of record.
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WE ARE PROUD TO ANNOUNCE THAT WE HAVE NOW A COMPLETE RANGE OF ELAC TURNTABLES AND CARTRIDGES, ALSO P.E., DUAL AND MANY OTHERS

AUSTRALIAN TELEVISION STATIONS

Area	Call	Channel / Polarity
ACT		
Canberra	ABC	3-V
	CTC	7-V
New South Wales		
Sydney	ABN	2-H
	ATN	7-H
	TCN	9-H
	TEN	10-H
Bega-Cooma	ABSN	8-V
Broken Hill	ABLN	2-V
	BKN	7-V
Central Tablelands	ABCN	1-V
	CBN	8-V
Central W Slopes	ABQN	5-V
	CWN	6-V
Grafton-Kempsey	ABDN	2-H
	NRN	11-H
Illawarra	WIN	4-H
	ABWN	5A-H
Manning River	ABTN	1-V
	ECN	8-V
Mungindi	AB–1	–
Murrumbidgee	ABQN	7-H
	MTN	9-H
Newcastle-Hunter	NBN	3-H
	ABHN	5-H
SW Slopes and E Riverina	ABMN	0-H
	RVN	2-H
Upper Namoi	ABUN	7-H
	NEN	9-H
Victoria		
Melbourne	ATV	0-H
	ABV	2-H
	HSV	7-H
	GTV	9-H
Ballarat	ABRV	3-H
	BTV	6-H
Bendigo	ABEV	1-V
	BCV	8-V
Goulburn Valley	ABGV	3-V
	GMV	6-V
Latrobe Valley	ABLV	4-H
	GLV	10-H
Mildura	ABMV	4-H
	STV	8-H
Murray Valley	ABSV	2-V
Upper Murray	ABAV	1-H
	AMV	4-H
Queensland		
Brisbane	TVQ	0-H
	ABQ	2-H
	BTQ	7-H
	QTQ	9-H
Alpha	AB–1	–
Augathella	AB–1	–
Barcaldine	AB–1	–
Blackall	AB–1	–
Cairns	ABNQ[2]	9-H
	FNQ[2]	10-H
Charleville	AB–1	–
Clermont	AB–1	–
Cloncurry	AB–1	7-H
Cunnamulla	AB–1	–
Darling Downs	ABDQ	3-H
	DDQ	10-H
Dirranbandi	AB–1	–
Emerald	AB–1	–
Goondiwindi	AB–1	–
Hughenden	AB–1	9-H
Julia Creek	AB–1	10-H
Longreach	AB–1	–
Mackay	ABMQ	4-H
	MVQ	6-H
Mary Kathleen	AB–1	9-H
Miles	AB–1	–
Mitchell	AB–1	–
Morven	AB–1	–
Mount Isa	ABIQ	6-H
Richmond	AB–1	6-H
Rockhampton	ABRQ	3-H
	RTQ	7-H
Roma	AB–1	–
St George	AB–1	–
Southern Downs	ABSQ	1-H
	SDQ	4-H
Springsure	AB–1	–
Townsville	ABTQ	3-H
	TNQ	7-H
Wide Bay	ABWQ	6-V
	WBQ	8-V
Winton	AB–1	–
South Australia		
Adelaide	ABS	2-H
	ADS	7-H
	NWS	9-H
	SAS	10-H
Ceduna	AB–1	–
Central East	ABRS	3-V
South East	ABGS	1-H
	SES	8-H
Spencer Gulf N	ABNS	1-V
	GTS	4-V
Woomera	AB–1	–
Western Australia		
Perth	ABW	2-H
	TVW	7-H
	STW	9-H
Bunbury	BTW	3-H
	ABSW	5-H
Carnamah	AB–1	–
Carnarvon	AB–1	–
Central Agricultural	ABCW	4-H
Dampier	AB–1	–
Esperance	AB–1	–
Geraldton	ABGW	6-H
Kalgoorlie	ABKW	6-H
Mingenew	AB–1	–
Moora	AB–1	–
Norseman	AB–1	7-H
Port Hedland	AB–1	–
S Agricultural	ABAW	2-V
	GSW	9-V
Southern Cross-Bullfinch	AB–1	–
Three Springs	AB–1	–
Tasmania		
Hobart	ABT	2-H
	TVT	6-H
King Island	AB–1	11-H
NE Tasmania	ABNT	3-H
	TNT	9-H
Northern Territory		
Darwin	ABD[1]	6-H
Alice Springs	AB–1	–

(For notes, see opposite)

TRANSLATOR STATIONS

Area	Parent Station	Channel / Polarity
New South Wales		
Armidale	NEN-9	1-H
	ABUN-7	4-H
Batemans Bay-Moruya	ABWN-5A	9-H
	WIN-4	11-H
Bega	WIN-4[1]	6-H
Bonalbo	ABRN-6	3-V
	RTN-8	5-V
Bourke-Brewarrina	ABQN-5[1]	4-H
Cobar	ABQN-5[1]	2-V
	CWN-6	10-V
Cooma	ABSN-8	0-M
	CTC-7	10-V
Eden	WIN-4[1] (via Bega)	3-H
	ABSN-8[1]	5-H
Glen Innes	ABUN-7	0-H
	NEN-9	3-H
Gloucester	ABTN-1[1]	0-H
Goulburn	ABC-3	0-V
	CTC-7	10-V
Inverell	NEN-9[1]	10-H
Kandos-Rylstone	ABCN-1	0-V
	CBN-8	10-V
Kyogle	ABRN-6	3-V
	RTN-8	5-V
Lithgow	ABCN-1	5-V
	CBN-8	6-V[3]
Mudgee	CWN-6	9-V
	ABQN-5	11-V
Murwillumbah	RTN-8	5-H
Nyngan	ABQN-5[1]	3-V
Portland-Wallerawang	ABCN-1[1]	0-H
	CBN-8[1]	4-H
Snowy Mountains (Khancoban)	AMV-4	10-H
Upper Hunter	ABHN-5[1]	2-H
	NBN-3[1]	10-H
Walcha	NEN-9	1-H
	ABUN-7	5-H
Wollongong, NW	WIN-4[1]	3-H
Victoria		
Alexandra	ABGV-3	5-H
	GMV-6	10-H
Eildon (via Alexandra)	ABGV-3	1-H
	GMV-6	3-H
Myrtleford	ABGV-3[1]	2-H
	AMV-4	9-H
Nhill	BTV-6[1]	7-V
	ABRV-3[1]	9-V
Orbost	ABLV-4	2-V
Portland	ABRV-3	4-H
(via Warrnambool)	BTV-6	11-H
Swan Hill	BCV-8	11-V
Warrnambool-Port Fairy	ABRV-3	2-V
	BTV-6	9-V
Queensland		
Blackwater	RTQ-7	10-H
Bowen	TNQ-7[1]	1-H
	ABTQ-3[1]	5-H
Cardstone Village	TNQ-7[4]	5-V
Collinsville	ABMQ-4[1]	8-H
	MVQ-6[1]	11-H
Cracow	RTQ-7	5-H

Area	Parent Station	Channel / Polarity
Gympie	WBQ-8	1-V
	ABWQ-6	4-V
Monto	ABWQ-6	1-V
	WBQ-8[1]	5-V
North Townsville	TNQ-7	9-H
	ABTQ-3	10-H
Toowoomba	DDQ-10	5-H[5]
South Australia		
Bordertown	ABS-2	2-V
Cowell	ABNS-1	6-V
	GTS-4	8-V
Keith	ABS-2	4-V
Port Lincoln (via Cowell)	ABNS-1	3-H
	GTS-4	5-H
Western Australia		
Kambalda	ABKW-6	5-H
Katanning	— [1]	—
Wagin-Narrogin	— [1]	—
Tasmania		
Gowrie Park	TNT-9	1-H
	ABNT-3	11-H
Maydena	TVT-6	8-H
Queenstown-Zeehan	ABT-2	4-H
	TVT-6	8-H
Rosebery-Renison Bell (via Queenstown)	ABT-2	1-H
	TVT-6	10-H
St Marys-Fingal Valley	ABNT-3	1-V
	TNT-9	11-V
Savage River-Luina (via Waratah)	ABNT-3	4-H
	TNT-9	7-H
Smithton (via Stanley)	ABNT-3[1]	8-V
	TNT-9[1]	11-V
South Launceston	ABNT-3	1-H
	TNT-9	11-H
Stanley	ABNT-3	1-V
	TNT-9	6-V
Strahan (via Queenstown)	TVT-6[1]	3-H
	ABT-2	10-H
Strathgordon	ABT-2[1]	5-H
	TVT-6	8-H
Swansea-Bicheno	TVT-6	8-6
Taroona	TVT-6	8-H
Waratah	ABNT-3	2-H
	TNT-9	10-H

NOTES:

All stations with a call sign commencing with AB belong to the national television service provided by the Australian Broadcasting Commission. All others are privately owned commercial television stations operated under licences granted by the Postmaster-General.

The polarity of the antenna is indicated by the initial letters:

H Horizontal
V Vertical
M Mixed horizontal and vertical, for the national translator station at Cooma to enable viewers to obtain best reception in the most

1 Projected station.
2 Temporary station. The new installation at Bellenden Ker should be ready for use by the end of 1971.
3 Frequency is modified —1MHz.
4 Temporary station. Its operation will be reviewed after the Cairns full power station opens.
5 Will ultimately use channel 4. Channel 5 has been allocated on a temporary basis subject to withdrawal on 12 months notice.
6 H — Swansea, and V — Bicheno.
7 When the national television station to serve the Dampier area is established these repeaters will be withdrawn.

Frequencies

Channel	Frequency MHz	Channel	Frequency MHz
0	45-52	6	174-181
1	56-63	7	181-188
2	63-70	8	188-195
3	85-92	9	195-202
4	94-101	10	208-215
5	101-108	11	215-222
5A	137-144		

REPEATER STATIONS

Location	Call	Channel / Polarity
Queensland		
Weipa	WEQR	7-H
Western Australia		
Cockatoo Island (via Koolan Island)	CKWR[7]	9-H
Dampier	HDWR[7]	7-H
Karratha (via Dampier)	HDWR[7]	9-H
Koolan Island	CKWR	7-H
Mount Tom Price	HTWR	7-H
Mount Newman	NEWR	7-H
Northern Territory		
Groote Eylandt	GEMR	7-H

Definitions

A television translator station is a relatively low-priced device which receives signals from a parent station or another translator station and re-transmits those signals on a different channel without substantially altering any characteristic of the signals other than their frequencies and amplitudes.

A television repeater station is a low power station which transmits only programs recorded on magnetic tape.

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NEW ZEALAND RADIO, TELEVISION

MW BROADCAST STATIONS

KHz	Call	Location		Watts
570	2YA	Wellington		100K
630	2YZ	Napier		20K
640	4YW	Alexandria		2K
660	2YC	Wellington		60K
690	3YA	Christchurch		20K
720	4YZ	Invercargill		20K
750	3ZA	Greymouth	c	2K
760	1YA	Auckland		20K
780	4YA	Dunedin		20K
800	2YB	Wellington		20K
820	4ZA	Invercargill	c	10K
830	1YX	Whangarei		2K
840	2ZD	Masterton	c	2K
860	1YZ	Rotorua		10K
880	1YC	Auckland		10K
900	4YC	Dunedin		10K
920	3YZ	Greymouth		10K
930	1XW	Hamilton	p	2K
940	2ZA	Palmerston North	c	2K
960	3YC	Christchurch		10K
970	1ZN	Whangarei	c	2K
980	2ZB	Wellington	c	20K
1000	1ZD	Tauranga	c	10K
1020	1XP	Thames	p	1K
1040	4ZB	Dunedin	c	10K
1060	2ZG	Gisborne	c	2K
1070	1ZB	Auckland	c	10K
1100	3ZB	Christchurch	c	10K
1130	2ZM	Wellington	c	2K
1140	1YW	Hamilton		2K
1160	3ZC	Timaru	c	2K
1170	1XK	Te Kuiti	p	1K
1180	2YW	Gisborne		2K
1200	2ZW	Wanganui	c	2K
1220	1ZE	Kaikohe	c	2K
1250	1ZM	Auckland	c	2K
1280	2ZC	Napier	c	2K
1310	1ZH	Hamilton	c	2K
1340	2ZN	Nelson	c	2K
1350	1ZC	Rotorua	c	2K
1370	2ZP	New Plymouth	c	2K
1390	1ZT	Turangi	c	100
1400	3ZM	Christchurch	c	2K
1420	1ZO	Tokoroa	c	2K
1430	4XD	Dunedin	p	250
1440	1ZK	Kaitaia	c	2K
1460	3YW	Westport		2K
1480	1XA	Auckland	p	5K
1500	1ZA	Taupo	c	2K
1520	1ZU	Taumarunui	c	1K
1560	2ZH	Hawera	c	1K
1560	2ZH	Hawera	c	1K
1590	1XI	Auckland	p	5K

c NZBC commercial station.
p Privately owned commercial station.
All other stations are NZBC non-commercial or part-time commercial stations.

SW SERVICE

Radio New Zealand is a short-wave division of the New Zealand Broadcasting Corporation and operates two 7.5KW transmitters located at Titahi Bay, Wellington. The transmitting frequencies are varied as necessary to give optimum results.

The service relays programs from the national program on weekdays and part of the 2ZB program on Sundays. Transmissions are currently on the air as follows.

to Pacific Islands

GMT	KHz
1700-1945	11780, 9755
2000-2230	15110
2245-0545	15280
0600-0845	11780, 9540

to Australia

2000-0545	17770
0900-1145	11705, 9520

to Antarctica (Sundays only)

0815-0845	9520

TELEVISION STATIONS

Location	Call	Channel / Polarity
Auckland		
Waiatarua	AKTV	2-H
Translators and Repeaters		
Ahipara	AKTV	4-H
Hikurangi	AKTV	3-H
Horokaka	AKTV	5-H
Kaeo	AKTV	4-H
Manawahe	AKTV	6-V
Mangonui	AKTV	4-H
Maungataniwha	AKTV	6-V
Mt Maunganui	AKTV	6-H
Ngunguru	AKTV	6-V
Parahaki	AKTV	7-V
Russell	AKTV	6-H
Te Aroha	AKTV	1-V
Taupo	AKTV	6-H
Whangaruru	AKTV	6-H
Wellington		
Kaukau	WNTV	1-H
Translators and Repeaters		
Akatarawa	WNTV	7-V
Dawson Falls	WNTV	9-V
Fort Dorset	WNTV	7-V
Grampians	WNTV	3-H
Grain Silo	WNTV	8-V
Hicks Bay	WNTV	6-H
Karori	WNTV	8-H
Mangatarata	WNTV	2-V
Matawai	WNTV	4-H
Mt Egmont	WNTV	6-H
Mt Erin	WNTV	6-V
Muriwai	WNTV	4-V
Northland FS	WNTV	8-V
Opunake	WNTV	5-V
Otahoua	WNTV	7-H
Paekakariki	WNTV	7-V
Paraparaumu	WNTV	8-H
Poutoko	WNTV	4-V
Pukeiti	WNTV	7-H
Takaka Hill	WNTV	4-H
Te Puia	WNTV	5-V
Thorndon	WNTV	7-H
Titahi Bay	WNTV	7-H
Titirangi	WNTV	5-H
Tokomaru Bay	WNTV	4-H
Tua Marina	WNTV	6-H
Tutara	WNTV	4-H
Wainuimoata	WNTV	7-H
Wainuiomata	WNTV	8-V
Waipiro Bay	WNTV	4-V
Wanganui	WNTV	8-V
Whakapunake	WNTV	1-H
Wharite	WNTV	2-V
Christchurch		
Sugar Loaf	CHTV	3-H
Translators		
Alymers Hill	CHTV	4-H
Blackball	CHTV	6-H
Cobden Hill	CHTV	7-H
Heathcote	CHTV	4-H
Hill Top	CHTV	6-H
Hokitika	CHTV	5-H
Kaikoura	CHTV	7-H
Le Bons Bay	CHTV	5-H
Lyttelton	CHTV	4-H
Mt Studholme	CHTV	4-V
Sumner	CHTV	4-V
Dunedin		
Cargill	DNTV	2-H
Translators and Repeaters		
Hedgehope	DNTV	1-H
Kuriwao	DNTV	5-H
Middlemarch	DNTV	4-H
North East Valley	DNTV	6-H

Frequencies

Channel	Frequency MHz	Channel	Frequency MHz
1	44-51	6	188-195
2	54-61	7	195-202
3	61-68	8	202-209
4	174-181	9	209-216
5	181-188		



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2400'	5D7MT	.5 TENSIL MYLAR	11.90	5.25
3600'	3D7MT	.33 TENSIL MYLAR	14.80	7.25
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1200'	10D57	1.0 ACETATE	5.50	2.55
1200'	10D57M	1.0 MYLAR	6.00	2.95
1800'	5D57M	.5 MYLAR	8.90	3.75
5" REELS				
600'	15D5	1.5 ACETATE	3.40	1.60
900'	10SDM	1.0 MYLAR	5.32	1.99
1200'	5D5MT	.5 TENSIL MYLAR	8.70	2.50
1800'	3D5MT	.33 TENSIL MYLAR	9.60	3.75

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3¼" REELS				
900'	3D32Ms	.33 MYLAR	3.90	1.95
3" REELS				
150'	15D3	1.5 ACETATE	.95	.50
225'	10D3M	1.0 MYLAR	1.65	.65
300'	5D3M	.5 MYLAR	1.95	.70
600'	3D3MS	.33 MYLAR	3.30	1.35
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	C90		4.75	1.65
	C120		6.50	2.25

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TRADE REVIEWS AND RELEASES

Two New Rotel Stereo Amplifiers

Manufactured by the Roland Electronic Company Ltd, of Japan, the two Rotel stereo amplifiers reviewed here are further examples of the high quality of Japanese design and workmanship. Both amplifiers are particularly good value for money. Rotel amplifiers are distributed in Australia by International Dynamics (Agencies) Pty Ltd. through HiFi retailers.

The two Rotel amplifiers submitted for review are the RA-610 and the RA-310. The RA-310 is rated at 15 watts rms per channel into 8-ohm loads while the RA-610 is rated at 25 watts per channel into 8-ohm loads. Particular features of both amplifiers are very wide frequency response and output facilities for two sets of loudspeakers. The RA-610 measures 15¾ x 9½ x 5¼in while the RA-310 measures 13 5/8 x 9½ x 4¼in.

six transistors per channel. All transistors are silicon. An interesting feature is the use of the new plastic encapsulated power transistors, which are soldered directly into the printed wiring board and mounted on a common heatsink with a single screw and nut.

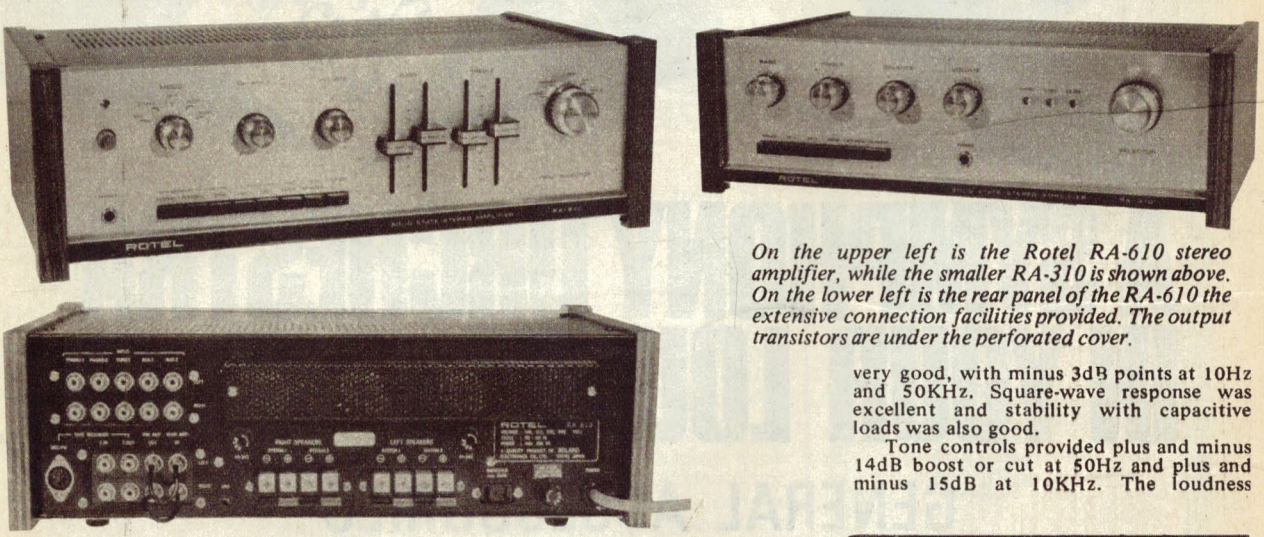
The larger of the amplifiers, the RA-610, is more ambitious in its concept, both in terms of power output and in the facilities provided. Major feature of the

output coupling capacitors, namely 4700uF. This is to allow the maximum power bandwidth even with 4-ohm loads. Unfortunately, an owner's manual was not provided with this amplifier so that we cannot comment in detail on the circuit. The power output stages employ the familiar quasi-complementary configuration however.

Time did not permit a complete test of both units, so we decided to base our overall evaluation on the performance of the larger RA-610. On test, this amplifier performed impeccably. Using a high-quality magnetic cartridge and a pair of compact wide-range loudspeaker systems, the amplifier gave a completely neutral account of itself. That is to say that the sound quality was not determined by the amplifier at all but by the ancillary equipment. This should be the case with all good quality amplifiers. All controls operated very smoothly and background noise was low, even at advanced control settings.

Continuous power output into 16-ohm loads was 18 watts per channel with both channels driven simultaneously or 20 watts with one channel driven. Into 8-ohm loads, continuous power was 25 watts per channel with both channels driven or 32 watts with one channel driven. Similarly, into 4-ohm loads, power was 30 watts per channel with both driven or 39 watts from one channel driven singly.

Harmonic distortion was less than 0.1 per cent at 25 watts into 8-ohm loads at 1KHz. At no power level observed did harmonic distortion rise above 0.3 per cent and no cross-over distortion was evident. Frequency response was exceptional, with minus 3dB points at 6Hz and 200KHz. Power bandwidth was also



On the upper left is the Rotel RA-610 stereo amplifier, while the smaller RA-310 is shown above. On the lower left is the rear panel of the RA-610 the extensive connection facilities provided. The output transistors are under the perforated cover.

very good, with minus 3dB points at 10Hz and 50KHz. Square-wave response was excellent and stability with capacitive loads was also good.

Tone controls provided plus and minus 14dB boost or cut at 50Hz and plus and minus 15dB at 10KHz. The loudness

The more modest of the two amplifiers, the RA-310, has simple styling while providing all essential facilities. Five knobs serve in the following roles: Input selector, Volume, Balance, Treble and Bass. Push-button selection is provided for Loudness, Tape monitor, Mode (stereo or mono), Power, and either of two sets of loudspeakers. Other features of the front panel include three lights, which indicate the input selected, and a stereo jack socket for low impedance headphones.

On the rear panel, phono sockets provide for the following facilities: Magnetic cartridge or crystal cartridge input; tuner and auxiliary input; tape recorder inputs and outputs. Screw terminals are provided for the two sets of loudspeakers.

Inside, the layout is clean and uncluttered, although the vertically mounted preamplifier board could ideally be more accessible. Circuit design is conventional which, in itself, is no disadvantage. The preamplifier and compensation stage is a direct coupled feedback pair; the tone control stage has two transistors per channel and the quasi-complementary amplifier stages have

control layout is the use of vertical slider potentiometers to give individual bass and treble controls for each channel. Four knobs function as Volume and Balance controls and as selectors for Mode and Inputs. Push-button selection is provided for two loudspeaker systems, muting (-20dB), low and high filters, "tone defeat" to remove the tone controls from the circuit, tape monitor, and loudness compensation. A separate red push-button for power is the only incongruous note in the styling.

The rear panel has spring-loaded terminals for loudspeaker connection and a DIN socket for connection of a tape recorder. In addition to the normal inputs for pickup cartridges, etc, sockets are provided for preamplifier outputs and power amplifier inputs. The four power transistors are also mounted on the rear panel under a protective grille to eliminate the possibility of shorting the transistor cases to chassis.

Inside, the layout is similar to the smaller model except that more printed boards are used to accommodate the additional circuitry. An interesting feature of the circuit is the use of very large value

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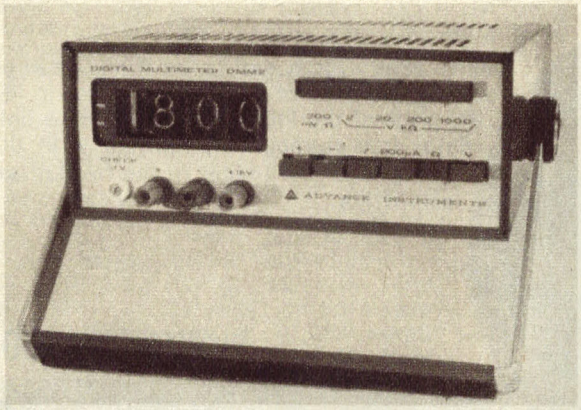
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ADVANCE DIGITAL MULTIMETER

A new low-cost digital multimeter from Advance Instruments, of the UK, uses three integrated circuits, including a MOSLSI (metal oxide semiconductor large scale integrated circuit) which performs counting and storage functions.



The instrument, the Advance Type DMM2, is housed in a compact high-impact plastic case size 8 x 3¼ x 7-1/8in, fitted with a metal carrying handle which doubles as a tilting bracket for bench use, in which role it is adjustable to a number of fixed positions. As a laboratory instrument the DMM2 compares favourably with more elaborate and expensive types. With its light weight of only 3½lb, it is also a most useful instrument for field work.

Readout is from a "3½ digit" (so called because the left-hand digit reads only 0 and 1) in line numerical display with decimal point, overload and reverse polarity indication. All functions are selected by push buttons, as are all ranges. The functions are AC and DC volts, AC and DC current, and resistance.

The instrument uses dual slope integration in the measuring circuitry. The maker's literature indicates that this feature, in combination with the instrument's automatic zero system, provides a very high degree of stability and freedom from zero drift. This was verified by our tests.

Display storage is incorporated, and readout changes only when the input changes. This gives a flicker free readout, but, if the input function changes rapidly, the instrument will tend to follow, and when this occurs the display is sometimes difficult to read. However, in general this type of readout may be regarded as preferable, not only in terms of economy but also for operational convenience, as in practice steady input functions are mostly encountered.

The instrument provides the following facilities:

DC voltage ranges:	199.9mV, 1.999V, 19.99V 199.9V, 1999V (FS).
AC voltage ranges:	As above.
Current ranges:	One current range of 200uA is provided and operates on DC or AC. An optional shunt to extend the range is available.
Resistance ranges:	199.9, 1.999K, 19.99K, 199.9K, 1999K ohms (FS).

Rated accuracy on the DC voltage ranges is from 0.1 per cent of reading at the lowest range, to 0.2 per cent of reading at the highest range, or approximately 0.1 per cent of full scale value, whichever is the greater. Input resistance is 10M ohms on all ranges. Accuracy on the AC ranges is somewhat less, but never falls below 0.4 per cent of reading, or 0.2 per cent of full scale value. Accuracy of the resistance ranges is never less than 0.4 per cent of reading, or 0.15 per cent of full scale reading. These figures are valid for temperatures from 10° to 40°C.

The instrument is fully solid state (apart from the display tubes) and has three integrated circuits as well as a number of discrete components. The entire circuitry is assembled on two fibre-glass printed wiring boards which open out for ease of servicing.

We were somewhat surprised to note the extremely thin conductor tracks used on the board, as it seemed to us to open up the possibility to annoying intermittent faults should the boards be overstressed. However, presumably the designers considered this possibility and appropriate tests have been applied.

Tested in our laboratory the sample unit sent for review performed impressively, its performance matching closely the maker's specifications. The controls were straightforward and easy to drive. One feature we found particularly useful was the indication of overflow, which is operative not only on the voltage ranges, but also on the resistance ranges. Resistances too large for the range selected trigger the overflow indicator.

Price of the DMM2 is quoted as $250 plus sales tax where applicable. Inquiries should be directed to Jacoby Mitchell & Co Pty Ltd, 469 Kent St, Sydney, 2000. (J.P.P.)

Rotel Amplifiers

control provided 9dB bass boost at the 9 o'clock setting of the volume control which tapered to nil as the control was advanced. However, it does not provide complete loudness compensation, as there is no treble boost. Low and high filters were little more than selective tone controls, as their rate of attenuation was only 6dB/octave, which is not steep enough to provide really effective filtering.

Separation between channels was minus 43dB with respect to 25 watts into 8-ohms at 100Hz and 1KHz, tapering to minus 25dB at 10KHz, which is adequate. Signal-to-noise ratio was minus 66dB with respect to 25 watts. All the above measurements were made using the Auxiliary input which has a sensitivity of 110mV for full power into 8-ohm loads.

The two magnetic cartridge inputs were identical and had a sensitivity of 2mV for full power. The overload capability was very good, with a factor of 40. This means that a cartridge could deliver 80mV at 1KHz before overload of the preamplifier occurs. Too few manufacturers provide high sensitivity and good overload factor; generally the overload factor is sacrificed for high sensitivity.

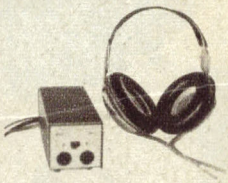
Judging from the overall performance of the RA-610, these two Rotel amplifiers are very good value for money indeed. The RA-310 retails for $129 while the RA-610 retails for $209, both prices including sales tax.

Rotel high fidelity equipment is available from retail outlets throughout Australia. Trade inquiries should be addressed to International Dynamics (Agencies) Pty Ltd, 4 Duke Street, Abbotsford, Victoria, 3067. (L.D.S.)

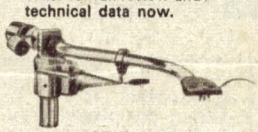
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Cambridge P40 Amplifier — Encel price, **$298.00** (inc. sales tax). The latest outstanding product from Cambridge Audio Laboratories Ltd, England. It inspired Reg. Williamson in his technical review in Hi-Fi News earlier this year to report — "I have been completely won over by this amplifier. The P40 is sheer pleasure to use and, most unusual for this reviewer, I shall be sorry when the time comes to return it. Bravo, Cambridge Audio, you have restored some of my faith in the British audio industry." Write now for full technical details and a copy of this review.



Stax SR-3 Stereo Headphones and SRD-5 Adaptor — Encel price, **$76.50** (inc. sales tax). World's finest electrostatic headset, with a frequency range of 30 — 25,000 Hz and maximum sound level of 115 dB. Adaptor suits any amplifier of more than 5 W outputs at 4 — 16 ohms. Some experts say they are better than the best speakers! Write for full review and technical data now.



Lustre ST 510D Tonearm — Encel price, **$26.50** (inc. sales tax). A high precision, universal arm, which will accept all standard ½" mounting cartridges. Lightweight, removable headshell. Tracking is effortless and stable. Stylus pressure is adjusted by calibrated counterweight. Oil damped cueing lift is inbuilt. Encel will send you reviews on request.

Sonics Demagnetiser — Encel price, **$4.90** (inc. sales tax). Restores tape recorder heads quickly and efficiently to their original characteristics. Complete with power-cord and plug. A 'must' for top tape quality at this low Encel price!

EE29

ENCEL ELECTRONICS PTY. LTD.

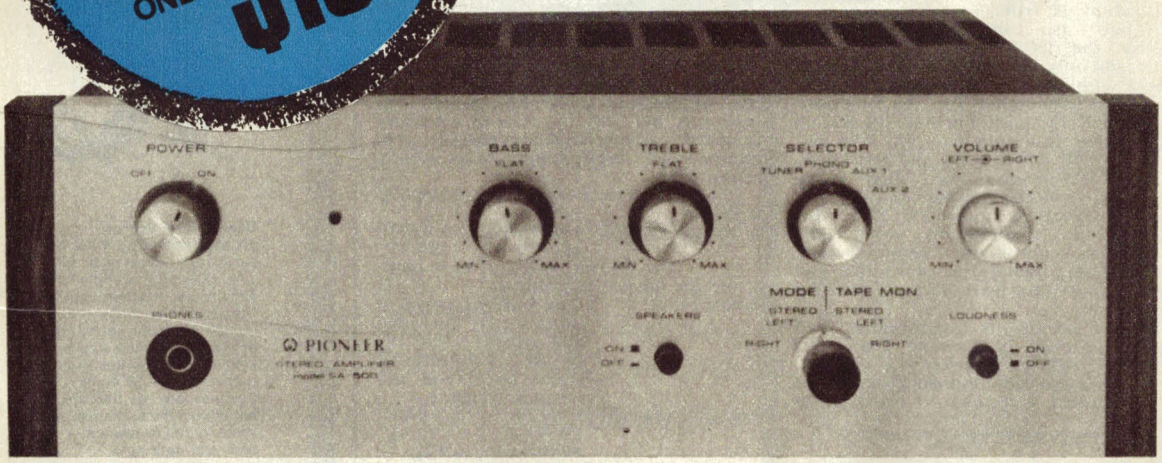
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SYDNEY STORE: GROUND FLOOR, 2 SM BUILDING, 257 CLARENCE STREET, SYDNEY, N.S.W. 2000
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NEW LOW PRICE NOW ONLY $134

Due to vastly increased sales it has been possible, even in the days of spiralling prices, to REDUCE the price of the PIONEER SA 500– now only $134. Enjoy true stereophonic realism with this power performer – the leader in the field of stereo amplifiers.

PIONEER SA500



Circuitry:
Quasi-complementary single ended push-pull circuitry
Continuous Power Output: (R.M.S.) (both channels driven)
12W+12W at 4Ω (distortion below 0.5% at 1 kHz)
Frequency Response:
20 Hz to 50 kHz ±1 dB (AUX)
Power Bandwidth:
20 Hz to 40 kHz (distortion below 0.5% constant/IHF)
S/N Ratio:
PHONO 75 dB (volume; maximum, tone; AUX 90 dB flat, at the rated output)
Inputs and Gain, Input Impedance (at 1 kHz):

PHONO	2.5 mV	47 kΩ
TUNER	200 mV	100 kΩ
TAPE MONITOR	200 mV	100 kΩ
AUX	200 mV	100 kΩ

Damping Factor:
Better than 40 at 8 ohms (at 1 kHz)
Simultaneous tape recording jack
Tape recording/playback connector (DIN standards
Equalization Curve:
PHONO NFB type RIAA
Tone Controls:
BASS –13.5 dB to +13 dB (at 50 Hz)
TREBLE –11 dB to+ 8 dB (at 10 kHz)
Loudness Contour:
Switchable to ON-OFF; 12 dB at 50 Hz; 5.5 dB at 10 kHz (at the volume level of -40dB)
Residual Noise:
Less than 0.7 mV at 8Ω (volume: minimum, tone: flat).

ASTRONICS
AUSTRALASIA PTY. LTD

A MEMBER OF ELECTRONIC INDUSTRIES LIMITED GROUP OF COMPANIES

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THE WORLD'S FINEST RANGE OF HI FI STEREO EQUIPMENT.

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PIONEER STEREO SOUND SYSTEMS BROCHURE.

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..... **POST CODE** .....

OCCUPATION .....

Logic trainer at PO Engineering College

Supervisory Control Systems Pty Ltd has developed a logic trainer which will be used by the Postmaster-General's Dept to train its technicians in digital fundamentals and logic.

The device, called the TL101 Logic Trainer, has been installed in PMG schools as an aid to trainees. The makers say that with the trainer, the trainee is able to conduct elementary experiments in logic, progressing to more complex experiments as his knowledge develops.



Second year students work out problems on logic trainers at the PO Engineering College, Annandale, NSW.

The trainer consists of a base plug board unit and a series of plug-in modules. The plug board unit is basically a sturdy metal case containing its own power supply to power the modules and lamp circuits. The modules range from the basic "and" and "or" circuits to more complex shift registers and clock generators. Each module has its logic configuration clearly etched on the top, and has lamps to indicate the module output state. Double contact plugs are used to guard against intermittent connections.

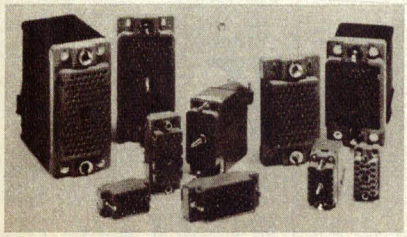
Interconnection of modules for various experiments is accomplished by stacking plugs. Over-voltage and over-current cutouts are incorporated to guard against student error or malpractice. Module covers are easily removed for servicing, or to allow instructors to simulate a fault for students to find and rectify.

The makers point out that although the system was designed for Post Office use in the first instance, it can be used in industry generally for the training of personnel in logic and digital functions. and is expected to prove valuable in secondary schools, technical colleges and universities to provide instructions for students who are given a grounding, or who are taking courses in, computer operation.

TRADE RELEASES — in brief

ROYSTON ELECTRONICS PTY LTD, 22 Firth Street, Doncaster, Vic 3108. Agent for the Tung-Sol division of Wagner Electric Corp, USA. **"Optimum Contrast" digital displays,** for use where reliability and legibility in difficult environments are required. The displays are available in three types of character presentation: seven segment characters; 16 segment characters to allow complete alpha-numeric representation; special characters to suit customers requirements. To make possible a very light-weight display of small size, two low voltage, low heat lamps were developed. One of these, a 20mA lamp, provides 500 foot-lamberts at 4.5V and can be driven directly by IC logic devices.

FAIRCHILD AUSTRALIA PTY LTD, 420 Mount Dandenong Road, Croydon, Vic 3136. Australasian distributors for the Elco Corporation, USA. **Rack and panel connectors.** These feature the patented Varicon contact that fully meets the requirements of MIL-E-5400. The four mating surfaces of this contact are coined to an exceptional hardness and wipe clean with each mate. Once the contacts are joined, the inherent springiness of the gold/nickel plated phosphor bronze and the fork-like design ensure a gas-tight fit. Contact terminations can be wire-wrapped, crimped or soldered.



Elco connectors.

PLESSEY DUCON PTY LTD, PO Box 2, Villawood, NSW 2163. **Encapsulated reed relays,** types CRD, CRE, CRF, CRG, CRH, and CRJ. Manufactured by the professional components division of the Plessey Components Group, in the UK, the relays are suitable for applications in monitoring and check-out equipment, instrumentation, and line switching where isolation is required. There are two sizes, both giving switching contact arrangements of 1, 2 and 3-make, controlled by a common coil. Electromagnetic screening is fitted as standard.

Types CRD, CRE and CRF incorporate a standard 28mm reed switch and provide sensitivities from as low as 50mW for the 1-make action, 100mW for the 2-make, and 175mW for the 3-make action, at 20°C. The contact material is gold and suitable for switching from low level up to 7.5VA resistive load.

Types CRG, CRH and CRJ incorporate a 21mm reed switch. Contact materials are gold and tungsten, giving switching capabilities from low level to 10VA and 20VA (resistive load) respectively.

Coil voltage ranges for all types are 4.8V DC, for logic switching, and 6, 12 and 24V DC. Pin centres are suitable for printed circuit board mounting. The devices comply with BS2011 for dimensions and environmental classification.

GENERAL RESISTANCE INC, 500 Nuber Avenue, Mt Vernon, NY 10550, USA. **Low-cost precision wirewound resistors,** type Econistor. Six new values have been added to this line of resistors. The new standard values are: 200 ohms, 400 ohms, 800 ohms, 4K, 8K and 80K. All are available in 0.1, 0.025, 0.01 and 0.005% tolerances. The new values are expected to be of particular value in BCD circuit design. Features include: temperature coefficient +5ppm/°C max

"INNERBOND"

(Regd.)

BONDED ACETATE FIBRES

FOR PACKING IN

SPEAKER ENCLOSURES

A new resilient Bonded Wadding made from ultra fine Cellulose Acetate Fibres that gives high efficency for Sound Absorption.

"INNERBOND" is light, clean, dust-free and easy to handle. Because al the fibres are bonded "INNERBOND' will hang as a "curtain" and will not fracture or break down due to vibration.

"INNERBOND" is odourless, highly resistant to attack by bacteria or fungus and is vermin repellant; "INNERBOND" at 16oz sq. yd. has a normal thickness of 1" and at this density is recommended as a packing in Speaker Enclosures for Sound Absorption.

STOCKISTS:

SYDNEY: Arrow Electronics Pty. Ltd. 342 Kent St.; Instrol Hi-Fi Pty. Ltd., 91a York St.; Convoy International Pty. Ltd., 449 Kent St.; Encel Electronics Pty Ltd., 257 Clarence St. Kent Hi-Fi 432 Kent St.; Mastersound Sales Pty. Ltd., 400 Kent St.; Rad o Despatch Service, 869 George St.; Peter Shalley Electronics Pty. Ltd., 127 York St.; Stereo Music Systems, 193 Clarence St.; Circuit Components (A/sia) Pty. Ltd., 460 Bexley Rd., BEXLEY: Classic Radio, 245 Parramatta Rd., HABERFIELD: Dyna Stereo Pty. Ltd., 331 Prince's H'way, ST. PETERS: Albert Wright Radio Service, 795 New Canterbury Road, HURLSTONE PARK: H. B Radio Products, 103-105 Catherine St., LEICHHARDT; Semicon Electronics, 172 Carlingford Rd., EPPING.

CANBERRA: Kitchen and Hi-Fi Specialists. Cnr. Giles and Kennedy Sts., Kingston.

NEWCASTLE: Martin de Launay Pty. Ltd., King and Darby Streets; Dynamic Sound, 587 Hunter Street.

WOLLONGONG: Dapto TV Service. 156 Prince's Hwy., Dapto.

MELBOURNE: J. H. Magrath and Co. Pty. Ltd., 208 Little Lonsdale Street.

BRISBANE: Chandler's Pty. Ltd., cnr. Albert and Charlotte Streets; Brisbane Agencies, 78 Wickham Street, Fortitude Valley. Stereo Supplies, 100 Turbot St.

IPSWICH: Robert N. Smallwood, 205 Brisbane Road, Booval.

NORTH QUEENSLAND: Alvin Communications and Electronics. 38 Pegnall St., Pimlico, Townsville.

ADELAIDE: Duncan Agencies, 57 Woodville Road, Woodville; General Accessories, 81 Flinders Street; Trustcott Electronics, 62-64 Hindmarsh Square.

PERTH: Atkins (W.A.) Ltd., 894 Hay Street; Carlyle and Co. Pty. Ltd., 1 Milligan Street; General Accessories, 46 Milligan Street.

HOBART: Homecrafts-Tasmania, 199 Collins Street.

If unobtainable

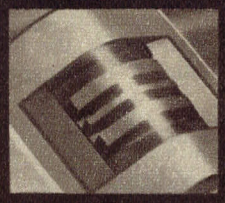
For 1 sq. yd. as above send $2.00
For 2 sq. yds. as above send $3.75
For 4 sq. yds. as above send $6.50

Postage paid in Australia and Territories to the manufacturers.

WONDER WOOL PTY. LTD.

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Phone: 56-2780.

glass & x'tal ferrite head





Model GX-365

150,000 hours service life!

Dust Free / Wear Free / Preeminent Recording

The AKAI **GX-365 Professional Stereo Tape Recorder** is the world's only recorder with AKAI's revolutionary GLASS and X'TAL (crystal) FERRITE HEAD which we call the GX-Head. This GX-Head gives over 150,000 hours of service life! Other features of this high grade completely professional tape recorder: automatic continuous reverse, automatic volume control, magnetic brake, sensing tape reverse, 3 heads, 3 motors, automatic stop/shut-off, sound on sound, sound with sound and sound over sound. The **GX-365D Professional Stereo Tape Deck** model is also available.

Glass and Crystal Ferrite Head
The head core is made of pure crystal ferrite, and the inner circumference of the head shield is mounted and set in glass. This unique design makes the head "dust free" and "wear free" and produces the "focused bias field" which completely eliminates distortion in recording/playback of high frequency signals. Frequency response is 30 to 28,000 Hz at 7½ ips.

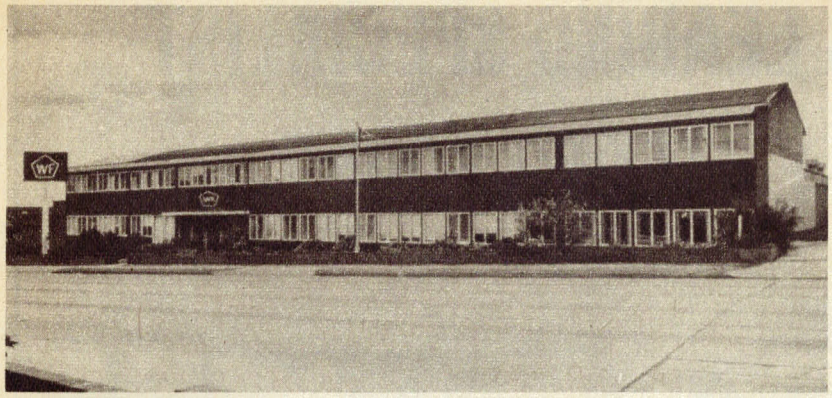
Automatic Continuous Reverse (Reverse-O-Matic)
This device automatically reverses the tape as per setting. Continuous reverse is possible between any two given points on a tape.

Automatic Volume Control (Comput-O-Matic)
This device provides automatically adjusted sound levels for perfect high fidelity recording.

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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: 81-0574 / 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

New Sydney premises for Warburton Franki



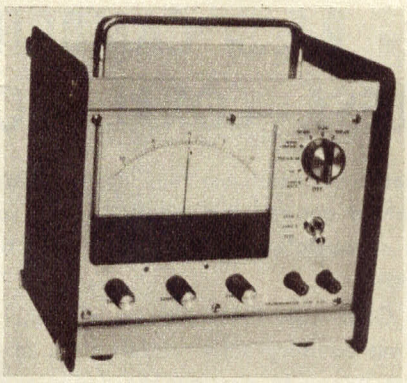
Warburton Franki Pty Ltd has transferred its Sydney operation to new premises located at 199 Parramatta Road, Auburn (corner of Skarratt Street). The company's sales and service operations in electronics, electric motors and control, process control, instrumentation, lamps, power tools, refrigeration and air-conditioning, are now all housed in the one modern building, shown above. For the convenience of customers, parking and drive-in trade sales facilities have been provided. The company's marine and electrical workshop division will continue its operations in a new near-city location (not yet named). The coolroom manufacturing facility will continue to be a separate operation. The instrument factory at Chatswood will also not be affected by the change.

from -55° C to +125° C and +3ppm/year typical from 0° C to +85° C; stability ±35ppm/year, ±50ppm/3-years; power rating 0.25W at +125° C, 0.33W at +85° C; maximum voltage 200V DC or AC peak; dimensions 0.25in od x 0.5in long; encapsulation, moulded epoxy.

HAWKER SIDDELEY ELECTRONICS LTD, 752 Pittwater Road, Brookvale, NSW 2100. Agent for Raytheon Co, USA. **Photovoltaic infrared detector**, model 1R101. A single-crystal lead-tin-telluride unit for operation in the far infrared spectrum, the 1R101 has detection characterisitics comparable with copper or mercury-doped germanium photoconductive units without the need for cooling to the liquid helium temperature required by such devices. Lead-tin-telluride operates at the temperature of liquid nitrogen.

The peak spectral response is dependent on the alloy composition of the basic unit. The 1R101 is peaked for operation at 10-11 microns. Custom versions are available in the 8-12 microns region with a variety of aperture sizes and shapes and acceptance angles. When packaged in a Raytheon standard dewar, the units provide unattended operation up to one hour. They can be mounted in large dewars or in closed cycle coolers if the application requires it. The Raytheon standard dewar package uses coaxial connectors to simplify connections to auxiliary equipment. A right angle mirror and adaptor is available for horizontal viewing.

WESTEELS INDUSTRIES LTD, PO Box 14, Lidcombe, NSW 2141. Agents for J. J. Lloyd, UK. **DC galvanometer.** This is intended primarily as a sensitive null detector for use with precision DC bridges and potentiometers, but may also be used as a microvoltmeter or microammeter.



Features: completely portable, powered by two small batteries; will withstand overloads of 100,000 times; has a non-linear range for obtaining an initial bridge balance; has a 4in dial meter with mirrored centre zero scale; an incremental sensitivity control enables the instrument to be set to indicate predetermined limits for inspection purposes; five ranges from 100uV to 1V, FSD.

RUTHERFORD ELECTRONICS PTY LTD, PO Box 30, North Balwyn, Victoria 3108. Agent for National Semiconductor Corp, USA. **Low cost IC voltage regulator**, type LM376. An economical and reliable regulator intended to compete with discrete devices in TV sets, radios and other consumer product applications. Features:

CDI Transformers

Two suppliers, one in Victoria and one in NSW, have available converter transformers for the CDI systems described in our August, 1970, and October, 1970 issues.

The transformer from the Victorian supplier, F. Mihai, is wound on a Philips' "E" core and terminated on a tag panel mounted at the top of the transformer with each tag numbered to a corresponding code. It is encapsulated against moisture with silicone rubber. Although of a different winding specification to the original, the maker claims that the performance of this redesigned transformer is identical to the original specification. At the time of writing, the transformer is available by mail order only for $5.00 inc tax plus postage. The address is F. Mihai, 48 Chapel Road, Moorabbin, Victoria,3189.

A glass fibre printed board and transformer assembly, suitable for either version of the CDI systems, is available wired and tested from RCS Radio, 651 Forest Road, Bexley, NSW, 2207. The assembly is priced at $8.00 inc 15% sales tax, plus 20c postage. If desired, transformers are available as separate items at $6.00 each inc sales tax. The board is intended to carry the rectifiers, thyristor and associated trigger circuit, apart from the transformer.

"OXFORD"

RADIO CHASSIS—
INSTRUMENT CASE—
ENGRAVE & PRINTED PANEL

"MINI BOXES"
(Aluminium)

Any kind of metalwork

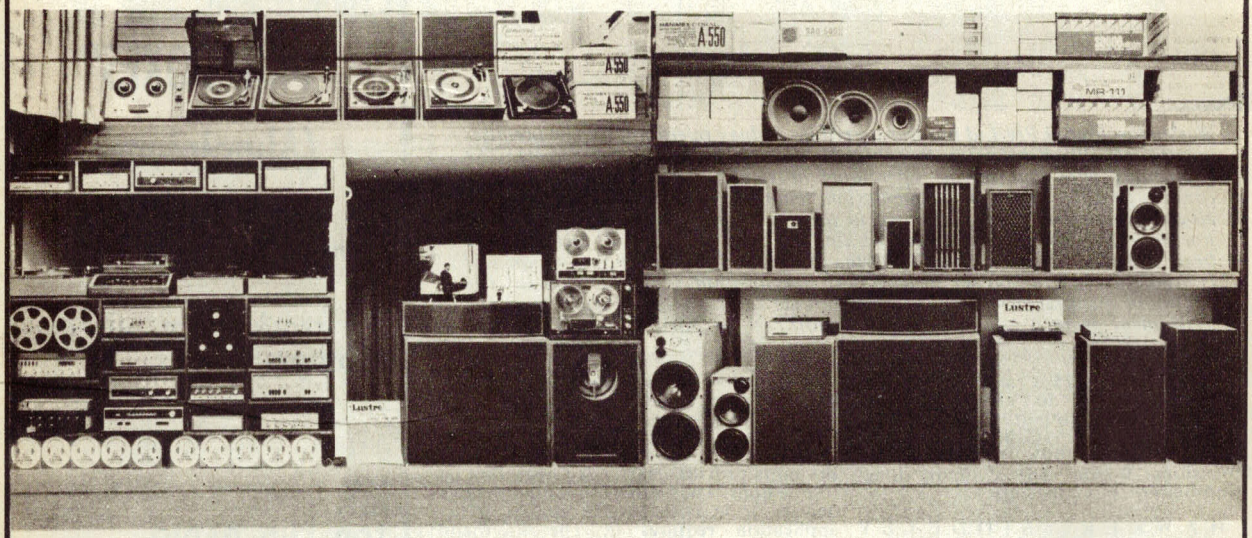
All stock from our distributors:

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TOP END RADIO
P.O. Box 2059
Darwin

N.S.W. (NEWCASTLE)
MARTIN DE LAUNAY P/L
Darby Street,
Newcastle. Phone 2 4741

HEATING SYSTEMS
PTY. LTD.
19-21 The Boulevarde,
Caringbah 2229
Phone 525-5222
5 lines

ADELAIDE'S LEADING SPECIALIST IN HI-F STEREO SOUND



LUX - CONNOISSEUR - EMPIRE - RICHARD ALLAN - RADFORD - REVOX - S.E.A.S. - ROGERS - SUGDEN - CELESTION - GRACE - JANSZEN ELECTROSTATIC - STAX - MICRO - P.E. - CAMBRIDGE - KOSS - AKAI - SOUND - LESA - CORAL - ROTEL - GARRARD

Why? Because we are always prepared to search just that little bit harder to ensure our customers get the best value for their money. Behind our recommendation is the sure knowledge that the product has been evaluated not only from an objective technical viewpoint, but also within the context of the all-important subjective listening test.

Service is another big aspect at Challenge. Naturally, we offer full servicing facilities for our products, but of equal importance is our advisory activity. Just think of all those difficult questions you can throw at us! No sweat! We are happy to pass our knowledge and experience on to the customer. Before you make your decision in sound come and talk it over at Challenge. No high pressure . . . we just tell it like it is! You decide!

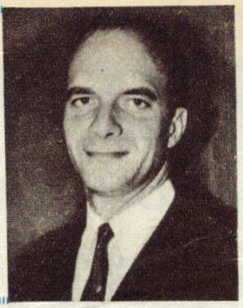
GET THE BEST DEAL IN ADELAIDE!

Challenge RECORDING CO.

HI-FI STEREO CENTRE

6 GAYS ARCADE, ADELAIDE.
(off Adelaide Arcade)
Phone 23-2203.

PHILIPS INDUSTRIES HOLDINGS LTD has announced that Mr G. A. Warner has retired as chairman of directors and managing director of Electronic Industries Ltd (EIL) and from the boards of subsidiary companies but has retained his position on the boards of three EIL associate companies – Neutrodyne Pty Ltd, Rotomotive Industries (A'sia) Pty Ltd, and Astor Agencies Ltd (of Japan). Mr J. Hans Went, aged 39, has succeeded Mr Warner as chairman and managing director of EIL. He was until recently commercial adviser to the main board of directors of Pye of Cambridge, in Britain.



Mr Hans Went

output voltage 5V to 25V; output current to 25mA; load regulation to 1%; series pass transistors can be added for output currents to 10A; eight-pin silicone moulded package; two LM376s will fit into a standard 16-pin dual-in-line socket. Price in small quantities $2.25.

FAIRCHILD AUSTRALIA PTY LTD, PO Box 151, Croydon, Victoria 3136. **Double balanced modulator/demodulator,** type uA796. A low-cost monolithic linear IC with precisely matched transistor components at inputs and outputs, the uA796 is available in both military and industrial grades. Chief uses are in transmitters and receivers, and as fast differentiators in computer input/output systems. Features include: typical carrier suppression -65dB at 0.5MHz and -50dB at 10MHz; input offset current 0.7uA; drift 2nA/°C; differential output swing 8V, peak to peak; transadmittance bandwidth 300MHz at carrier port and 80MHz at signal port; signal port common mode rejection -85dB typically.

DIGITAL EQUIPMENT AUSTRALIA PTY LTD, 75 Alexander Street, Crows Nest, NSW 2065. **Programs development system, PS/8.** A programming system for small computers, such as the PDP-8 family, which enables them to operate like a much larger machine. Hardware that may be used with the system includes DECtape and disc units, teletypes, readers, printers, and punches. The minimum configuration comprises a single DECtape, a teletype and 8K words of core memory.

The PS/8 system's software comprises five main parts. The first is a keyboard monitor which runs programs and performs other tasks on receipt of keyboard commands. A library of system programs constitutes the second part; this includes an editor, a peripheral interchange program, and several loaders, assemblers and compilers, including Fortran. The third part is a command decoder for controlling input and output files. The fourth contains device handlers for linking programs with the appropriate peripheral devices. The fifth part is a user service routine which controls such directory operations as creating and closing output files.

DUFF STEEL INDUSTRIES PTY LTD, Flinders Street, Port Kembla, NSW 2505. **Tool storage system.** A system of drawer dividers has been developed to form special compartments for individual tools. Although developed for the company's own range of tool cabinets, the dividers can be used in any drawer or tray more than 2½in high internally. The slotted strips are simply cut to the required length and interlocked in a drawer. A sloping index flange enables



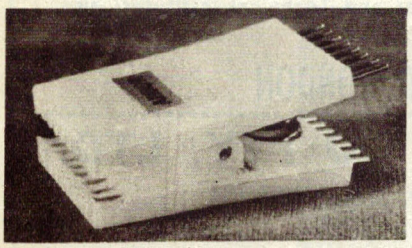
clear identification of each compartment's contents. Components are durably finished in light green oven-baked enamel. Inquiries should be addressed to the company's distributors in all States.

SOCIEDADE ANONIMA DE MATERIAIS ELETRICOS (SAME), Caixa Postal 1552, Sao Paulo, Brazil, informs that it can supply electric wires and cables; wiring sets and harnesses fitted with terminals, connectors and plugs for radio, television, domestic appliances and vehicle wiring; and telephone cords, connecting leads, etc. The company states that its factory is the largest of its kind in Latin America, and that it has a tradition in the manufacture and export of its products.

DIGITAL EQUIPMENT AUSTRALIA PTY LTD, 75 Alexander Street, Crows Nest, NSW 2065, has formed a new engineering group with the object of designing and building special systems. The company had previously confined itself to selling to customers the modules required for the interfaces between their equipment and the computer. Special-purpose interfaces were designed and built by the company's American parent. The special systems will now be built in Sydney, enabling the user to be more closely associated with the design. The manager of the new group is Mr Peter Bennett. ■

IC Test Clip

Illustrated is an integrated circuit test clip designed to allow convenient in-circuit testing of ICs. The design provides for reliable connections to IC leads through a wiping contact action. A helical spring provides correct tension. A dual purpose "contact comb" prevents the shorting of adjacent IC leads and also functions as an



attachment guide. The body of the clip is moulded from high density acetal homopolymer dielectric and the contactors are spring temper, gold plated phosphor bronze. The price is $5.75 each. Further details can be obtained from Arbor Pty Ltd, 282 Bell Street, Coburg, Victoria, 3058.

LANTHUR ELECTRONICS

BASIC POWER SUPPLY KIT

Consists of transformer—240/6.3, 7.5, 8.5, 9.5, 12.5 and 15 volts. Sel. bridge rectifier and 1000/16 filter capacitor. Will give D.C. voltages from 6 to 12 at 600 mA. Wiring diagram and instructions supplied. Suitable for transistor radios, tape recorders, record players, etc., **$4.95**
2 amp. version of above **$6.95**
Plus pack. and post., Vic., 40c. Other, 70c.

MULTIMETER CT-500

Range Selection by Rotary Switch
20,000 ohms per volt D.C.
10,000 ohms per volt A.C.
D.C. VOLTS: 0-2.5, 10, 50, 250, 500, 5000.
A.C. VOLTS: 0-10, 50, 250, 500, 1000.
D.C. CURRENT: 0-0.05, 5, 50, 500 ma.
RESISTANCE: 0-12K, 120K, 1.2 Meg, 12-Meg. (60, 600, 6K, 60K midscale).
DECIBELS: Minus 20 to Plus 62 db. Complete with battery and test leads.
SPECIAL PRICE WHILE THEY LAST **$13.95**, including sales tax.
Plus postage, Vic., 40c; Other, 70c.

CADET SPEED CONTROLLER

Will control speed of electric hand tools down to stop, without loss of torque. Complete with flex and plug.
2 amp rating **$11.00**
10 amp rating **$18.50**
Plus pack. and post., Vic., 40c; Other, 70c.

MAKE YOUR OWN PRINTED CIRCUIT BOARDS

Kit consisting of one 12in x 12in copper-backed board, etching materials and instructions **$3.00**
Plus pack. and post., Vic., 40c; Other, 70c.

INSTRUMENT CABINET

Plastic, with sloping aluminium panel. Ideal for test gear, intercomms, ext. speakers, etc. 7½in x 4½in x 4½in approx size .. **$3.50**
Plus pack. and post., Vic., 40c; Other, 70c.

AMPLIFIER MODULE KIT

1.3 watts with 12 volt supply. 3.5 watts with 20 volt supply. Consists of printed board, 3¼in x 2¼in. 4 Fairchild transistors, 6 resistors and 5 capacitors. Circuit supplied. **$5.95**, plus pack. and postage, 15c.

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TECHNICAL BOOKS AND PUBLICATIONS

Single sideband

SINGLE SIDEBAND FOR THE RADIO AMATEUR, Fifth Edition. Published by The American Radio Relay League, Inc, Newington, Connecticut, 1970. Soft covers, 6½in x 9½in, 256pp, many diagrams, pictures and tables. Price in Australia $4.20 plus 40c (approx) postage.

At first sight, this new fifth edition of a now well known publication by the ARRL, looks much the same as its predecessors. In fact, the general format is the same, with the same cover colouring and even the same number of pages. However, most similarities stop at this point. Whereas the earlier editions were divided up into sections dealing with specific subjects, this edition is divided into chapters.

Something like 40 per cent of the old material has been retained, which means that there is about 60 per cent new material. Such fundamentals as required for the understanding of the principles of SSB have been retained, together with some valuable articles on crystal filters, interpreting the linear amplifier meter reading, etc.

As may well be imagined, all the new material serves to up-date the information available to the amateur, in relation to SSB transmission and reception. Apart from much useful and interesting theory, there is an impressive array of constructional articles. These apply particularly to transceivers, receivers, with a very large section devoted to linear amplifiers.

To give the reader some idea of the contents, here is a digest of the nine chapters: 1 – PRINCIPLES. This includes an introduction to SSB, with articles on the phasing method and crystal filters. 2 – EXCITERS. A phasing and a filter type transmitter are described. 3 – TRANSCEIVERS. There are eight articles covering various types of transceivers in this chapter. 4 – LINEAR AMPLIFIERS. This chapter is devoted mainly to the design and theoretical aspects of linear amplifiers. 5 – AMPLIFIER CONSTRUCTION. No less than six linear amplifiers are described. 6 – ADJUSTMENT AND TESTING. As the title suggests, methods of testing and adjusting transmitters and linear amplifiers are described. 7 – RECEIVERS. Two large receivers and one small unit are described, together with an article on product detectors. 8 – VHF TECHNIQUES. Constructional details are given for transmitting converters for use on 50MHz and 144MHz, together with an RF attenuator to be put between the HF transmitter and a transmitting converter. 9 – ACCESSORIES. An electronic T-R switch and clippers, etc are dealt with in this chapter.

In common with many American amateur publications, there is still a tendency to stay with valve technology. However, it would not be true to say that solid state techniques and applications have been neglected and there is a fair sprinkling of material on transistor equipment. Even if you have a copy of the Fourth Edition, as there is so much new material and for the need to keep up with the rapidly advancing techniques used in SSB transmission and reception, I commend this book to all with an interest in this subject.

Review copies came direct from the publishers and from the Technical Book and Magazine Co Pty Ltd, 289-299 Swanston St, Melbourne 3000. (I.L.P.)

Short-wave antennas

SWL ANTENNA CONSTRUCTION PROJECTS, by Edward M. Noll. Published by W. Foulsham & Co Ltd, Slough, Bucks, England. Hard covers, 128 pages 8½ x 5½ inches, illustrated by photographs and diagrams. Price in Australia $4.25.

When one sets out to design an antenna for an amateur band, the procedures are well established. Knowing the intended frequency for operation, use can be made of formulas, tables and graphs to determine configuration, dimensions, impedance, feedline and matching requirements.

But how does a short-wave listener get on who, in all likelihood, will want to listen to stations operating anywhere between 3MHz and 30MHz? Without a firm specification for frequency, most of the concepts and calculations to do with antenna design become meaningless and little more than lip service can be paid to them.

Edward Noll faces this problem in the present volume. He is obviously aware of it because his consideration of half-wave and quarter-wave antennas is based on an assumption that they will be resonant over certain nominated regions of the short-wave spectrum. He gives figures for simple dipoles, beams, vertical antennas and slant arrays intended for the major international bands.

But while the dimensions are quoted to the precise inch, a reader au fait with antenna design cannot help but be aware that the suggested constructional projects are not nearly as precise as they might seem. A Yagi array to cover three bands: 13, 16 and 19 metres? Coaxial cable hooked straight into the centre of a dipole? Little real attention paid to impedance matching? A tacit assumption that short-wave listeners might erect a whole batch of antennas?

A purist could probably have a real field day finding faults with the text on this basis – but to no great purpose. The author is probably counting on the fact that, for a reasonable receiver, an antenna will pick up useable signals almost in spite of its dimensions. But if, by selecting a particular configuration, the antenna can do a better than expected job on the most wanted band or bands, then the constructor is that much ahead.

On this basis the author suggests designs for dipole antennas, vertical antennas, horizontal beams, long-wire antennas and antennas which can be strung up indoors. Considering the pathetic pieces of wire that commonly pass for antennas nowadays, the hopeful short-wave listener could hardly fail to find suggestions in this book that would permit a vast improvement in short-wave reception. And, after all, that is manifestly the need which the author has set out to meet.

Our copy from Grenville Publishing Co Pty Ltd, 401 Pitt St, Sydney 2000. (W.N.W.)

Not recommended

DESCRIPTIVE ELECTRONICS. By Ralph R. Huffsey and Charlotte Aull Huffsey. Published 1970 by Holt, Rinehart and Winston Inc. Hard covers, 365 pages, 9 x 6 inches, illustrated by circuits and diagrams. Price in Australia $10.55.

In reviewing this book, we were in for two distinct surprises. The first had to do with the technical level of its contents.

From the rather formal title and the quality of the volume itself, we had expected it to be a reasonably ambitious work. In fact, it deals with electronics from a quite elementary level.

The authors explain that it was, in fact, assembled from material which was aimed at imparting some appreciation of electronics to college students who might not otherwise encounter the subject in their studies.

Fair enough.

The second surprise, in scanning the text, was to encounter concepts and/or expressions which are alien to normal electronic conversation. On page 261, for example, the Authors state that "AF is *felt* on the grid". Phrases like this inevitably raise the question as to whether the authors are as close to their subject as one might wish.

It certainly rendered sample reading necessary and, the more we read, the more dubious we became about the authority of the text.

On page 228, the reader is told that a negative space charge between the grid and plate of a triode is responsible for interelectrode capacitance. Then on page 230 he learns that "the reduction of distances between electrodes by the insertion of extra grids reduces interelectrode capacitance".

On page 229 the function of the screen bypass is explained in the strange terms that we referred to earlier: "Any AC signal that *might be attracted to* the screen grid . . . is shunted to ground via capacitor C".

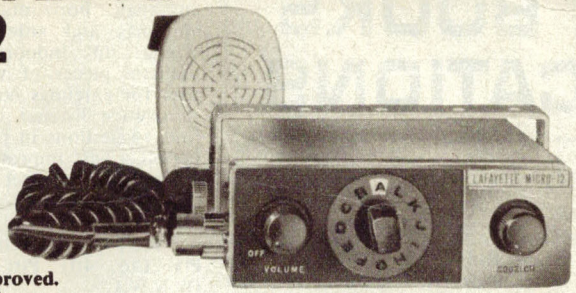
On page 232 is another odd statement about the capacitance in grounded grid amplifier stages.

Under the heading "Pulse Modulation" on page 260, the reader is told that ability to send and receive Morse Code is a pre-requisite to permission to transmit over long distances. For further information he can apply to the ARRL. Almost certainly, this piece of information was gleaned from an amateur radio situation but it is presented in the book as a purely general and unqualified statement.

On page 262, regarding modulation, a firm statement is made that a positive-going audio signal results in an increase in carrier amplitude. In fact, the

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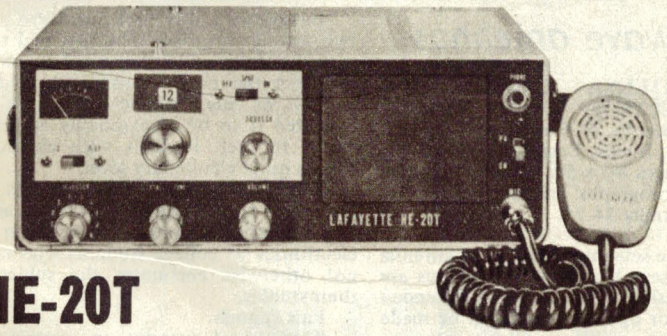


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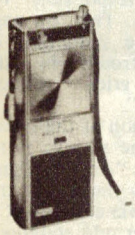
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phase of the audio signal is likely to change from stage to stage through the audio system; the relationship to the final modulation envelope will depend also on the phasing of the modulation transformer.

On the same subject, on page 262, the reader is told that, for grid modulation the modulated amplifier must operate under class A conditions. In fact, pure class A would be the one condition where modulation could not occurr!

In the following chapter on transmission lines, some of the statements looked highly dubious; others I could not understand at all – and at this point I gave up.

But before writing this review I asked Technical Editor Jim Rowe to look over the book, just in case I might do it an injustice. His reaction confirmed my own; in fact he found a number of other statements of dubious validity. The most glaring of these was a claim on page 114 that the current drawn by a forward biased P-N diode is self-limiting, due supposedly to the finite number of impurity-derived carriers present. Jim's only comment at this statement was "Good grief! Would that it were so . . ."

If textbooks providing an introduction to electronics were at a premium, it might have been worthwhile to evaluate this one further to discover whether its merits outweighed it shortcomings. But such books are not by any means scarce and my advice to a student needing a basic text would be to invest in one that was less open to criticism.

Our review copy came from Holt, Rinehart & Winston (Aust) Pty Ltd, 79 Whiting St, Artarmon, NSW 2064. (W.N.W.)

Tuners, amplifiers

TUNERS AND AMPLIFIERS, by John Earl. Published 1970 by Fountain Press, London. Hard covers, 187 pages 8½ x 5½ inches, illustrated by photographs and circuits. Price in Australia not quoted.

Although the title of the book is as quoted above, it is referred to in the dust cover as the first of a "How to Choose and Use" series. The idea is apparently that a person, aiming to set up a comprehensive audio system, should pourchase and study books like this one, covering tuners, amplifiers, tape equipment, loudspeakers, etc. One's immediate reaction is that the reader would be presented with so much information that he would die from mental indigestion before he had a chance to enjoy the fruits of his labour!

This is more a criticism of the dust jacket, however, and of the sales promotion theme which it follows.

The book itself is true to its title. It deals at length with tuners and amplifiers and it contains a lot of helpful information for the person who is prepared to study and who wants to gain a good insight into the design and operation of modern equipment. And it is certainly up to date, with only passing reference to valve type equipment.

Chapter headings are as follows: Modern Equipment – State Of The Art – Choice Of Equipment – Use Of The Amplifier – Use Of The Tuner – The Tuner-Amplifier – Systems and Compacts – Specifications.

Sample reading suggests that the text is well written and it is freely illustrated by photographs of equipment, snippets of circuits from typical commercial

amplifiers and tuners, oscillograms and curves.

Not surprisingly, the book strongly reflects the hi-fi situation in Britain and a market dominated by British made equipment. In general, such equipment is less pretentious and less powerful than most of the Japanese units on offer in this country. And, of course, the space devoted to FM tuners will be largely wasted on Australian readers.

However, there is still a lot of useful information between the two covers and the book can be commended to the serious would-be audiophile. Our copy came direct from the publishers but it should be available through local booksellers in due course. (W.N.W.)

TV troubleshooting

TV TROUBLESHOOTER'S HANDBOOK by the Editors of "Electronic Technician/Dealer." Second edition, 1969. Published by TAB Books, Blue Ridge Summit, Pa., USA. Stiff paper covers, 288 pages 7½ x 4½ inches, illustrated by photographs, circuits and diagrams. Price in Australia $3.70 or $9.95 for the hard cover edition.

It is rather difficult to understand how a book like this came to be offered to Australian readers.

Developed from items which have been published in the periodical "Electronic Technician/Dealer", it is primarily a listing of faults, procedures and servicing tips relative to current television receivers in the US.

For the ease of reference, the sets are listed in alphabetical order. Admiral comes first and the book opens with observations about AGC Control Adjustment on Admiral TV chassis stamped "Run 11, C21A1-1A ... " etc. So it goes through the alphabet and makes to Zenith, covering the mononchrome receivers in about two-thirds of the volume. Then it starts back at "A" for colour sets.

The material may be fine for US TV servicemen, for whom it is intended. But since it relates purely to US receivers, with theory incidental only to the main troubleshooting aim, the book will be of little value to people outside the US market.

Undoubtedly a practicing servicemen who read it through would pick up a certain amount of background and "atmosphere" and it might even be worth the $3.70 for the paper covered edition. But $9.95? Ugh! Our copy came from Grenville Publishing Co Pty Ltd, 401 Pitt St, Sydney. (W.N.W.)

IC data book

IC HANDBOOK. Published by De Muiderkring NV, Bussum, Netherlands, 1st edition, April, 1970. Soft covers, 4½in x 8½in, 182 pages. Australian price $4.10 plus approx 30c postage.

This is a companion volume to De Muiderkring's Handbooks on Electronic Tubes and Transistors reviewed in our October, 1968 issue. Its purpose is to present comprehensive information on voltages, currents and other parameters of integrated circuits. Where possible, maximum ratings are given. Details of the type of package and the pin connections are included for each IC.

The book is separated into two main sections: digital circuits and analog circuits. The digital section is further subdivided into: gates; flip-flops; and miscellaneous. The analog section is divided into: AF circuits; RF circuits; operational and differential amplifiers; miscellaneous. The book also includes details of IC packages, equivalents (with observations where no exact equivalent exists) and an index.

Presenting data on nearly 200 different ICs, this handbook should be of most value to hobbyists and others with access to a miscellaneous assortment of ICs from various manufacturers. However, the book was prepared for European markets and includes only ICs readily available there about 12 months ago. For example, the SL403A used in our Playmaster 129 Stereo Amplifier is not included. The value of this book may increase as dealers make older types of ICs available to the market as they do valves and transistors at present.

We received our review copy from the Technical Book and Magazine Co Pty Ltd, 289-299 Swanston Street Melbourne, 3000. The company has copies of this book available from stock. (J.H.)

LITERATURE—in brief

TELECOMMUNICATION JOURNAL, Vol 37, No 10, October 1970. Published by the International Telecommunication Union (ITU), Place des Nations, 1211 Geneve 20, Switzerland. Contains the following articles: Basic trends in automatic monitoring and control of television, by M. I. Krivosheiev; Computer program to predict long-term operation parameters for high-frequency radio services, by J. W. Herbstreit, M. Joachim and C. Glinz; Development of television in Pakistan, by Z. Ali.

Under the heading "Ideas and Achievements" reports are included on: AEROS, the new German research satellite project; Long distance waveguides, plans for field trial; Ten years of weather satellites. The section on "Union Activities" carries reports of meetings of CCITT Study Group XII (Telephone transmission quality) and CCITT Joint Working Party PAR (Protective devices).

INVENTUS, Vol 7, Issue 4, September 1970. The journal of the Inventors' Association of Australia Ltd, Box 3400, GPO, Sydney, 2001. Contents include: A putt-putt fisherman; An invention with potential; Hovercraft inventor finds himself on the scrap heap; Peace-time use of war inventions body; New and associate members; At head office, and around the branches; Undersea explorer on trial; Meet an associate member, Siddons Industries Ltd; Australian Innovation Corporation Ltd; Inventions available for licence or sale; Technical and design news.

MODERN MICROWAVE ABSORBERS AND APPLICATIONS, by Elery F. Buckley, ScD, chief electronic engineer, Emerson & Cuming Inc. A reprint of a paper originally published in the British magazine "Design Electronics." Major topics discussed are: absorber design including absorbers for anechoic chambers and other special types: anechoic caps for antennas; absorber reflectivity measurements; latest ideas in anechoic chamber design. Inquiries to Emerson & Cuming Inc, Canton, Mass 02021, USA.

HEWLETT-PACKARD AUSTRALIA PTY LTD, 22-26 Weir Street, Glen Iris, Vic 3147. Application Note AN 124. An eight-page booklet tells why true RMS techniques accurately measure signals containing very high distortion, such as square waves. It shows the effects of distortion on measurements by average responding instruments. Measuring speed is also discussed.

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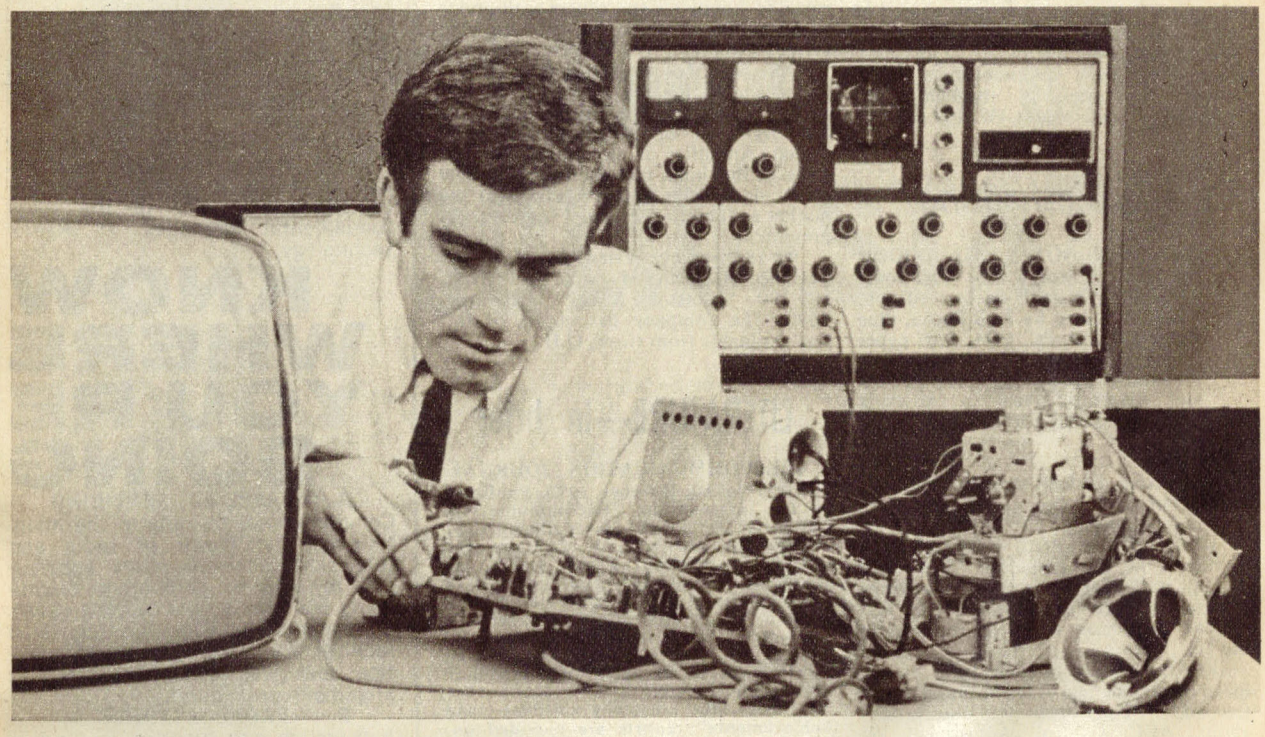
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TECHNICAL NEWS BULLETIN, Vol 54, No 9, September, 1970. Published by the US National Bureau of Standards. Inquiries to the Superintendent of Documents, US Government Printing Office, Washington, DC 20402, USA. Contents: The psychophysical side of sound; NBS provides random tables for use in draft lottery; Improved semiconductor resistivity measurements; Separation of polymer molecules by flow; Measurement analysis program in mass; Standards and calibration; Hazardous noise levels in computer labs; NBS measurement seminars 1971 series; Clearinghouse for Federal scientific and technical information; Colour temperature; luminous efficacy and the International Practical Temperature Scale of 1968; National Standard Reference Data System news; Federal Information Processing Standards notes; Conference briefs; Publications of the National Bureau of Standards.

STANDARDS ASSOCIATION OF AUSTRALIA, 80 Arthur Street, North Sydney, NSW 2060, is seeking comment on a number of draft Australian standards and an amendment to a standard. Comment on the provisions of the drafts is invited from persons or organisations experienced in the relevant fields.

Doc. 1623. A draft amendment to the "approval and test" specification for appliance plugs and appliance inlet-sockets. It is to form part of AS C109-1964 Ap, one of a series issued under Part II of the SAA Wiring Rules. Doc. 1623 specifies requirements for several new forms of appliance plugs and inlet-sockets of the type recommended in a draft International Electrotechnical Commission specification for "Appliance Couplers for Domestic and similar general purposes". The amendment also provides for the eventual non-recognition of appliance plugs which incorporate external earthing plates.

Doc. 1624. Draft Australian standard specification for shunt capacitors for connection to power frequency systems. It is based mainly on the recommendations of the International Electrotechnical Commission Publication 70 (1967), with reference to US and British standards. The draft applies to both capacitor units and assemblies of capacitor units with accessories to form complete capacitor banks, for connection to a low voltage, medium voltage, or high voltage power system having a frequency up to and including 100Hz, which are intended to be used particularly for power factor correction and/or voltage regulation.

Doc. 1631. A draft Australian standard specification for an alphanumeric character set for optical recognition. It is based on the character set OCR-B specified in R1073, published by the International Organisation for Standardisation (ISO). It defines the shapes of 113 alphanumeric characters suitable for both human and machine reading. The font establishes a common basis for printing equipment and optical scanning equipment for OCR interchange applications. The font is also suitable for use as a typewritten or microfilm font.

Doc. 1632. A draft Australian standard code for the safe use and maintenance of electronic equipment. It lists rules for the safe working practice to be adopted by personnel using or maintaining electronic equipment and associated electrical equipment. Its purpose is to provide a general basis for the drafting of safety requirements for such personnel to ensure that they are not even exposed to the least possible degree of danger. Adequate safety measures, such as the use of enclosures, protective interlocking systems, etc, are required to prevent dangerous situations arising. The rules listed are to form the basis for the preparation of more comprehensive instructions.

Copies of the various documents may be obtained, without charge, from the various offices of the Standards Association of Australia in all capital cities and Newcastle. Comment should reach the head office or any branch office not later than January 31, 1971.

Basic Transistor Course on Videotape

A new series of video tapes prepared in the USA by Hewlett-Packard forms a very practical course of instruction on transistors and transistor applications. Titled "Practical Transistors", the video tape course is a clear presentation of transistor and other solid-state devices without going to equivalent circuit explanations and advanced mathematics.

The basis for the series is the text "Transistor Basics: A Short Course" by George Stanley, published by the Hayden Book Company, New York. The tape, however, goes beyond the text, particularly in the area of troubleshooting of transistor circuits.

The tapes may be ordered separately or as the complete series. With the tapes are included a copy of the text and a set of homework questions and answers. Homework is designed to be used in conjunction with the showing of each tape.

Tapes in the series (with their running times and reference numbers) are: I, Transistors vs vacuum tubes, 30 min, 800330; II, Transistors and temperature, 41 min, 800316; III, Current drive vs voltage drive, 41 min, 800317; IV, Answers by inspection, part 1, 43 min, 800318; V, Answers by inspection, part 2, 40 min, 800319; VI, Answers by inspection, part 3, 37 min, 800331; VII, Multistage amplifiers, 44 min, 800322; VIII, Troubleshooting tips, part 1, 43 min, 800323; IX, Feedback amplifiers, 27 min, 800324; X, Why a transistor amplifier, 27 min, 800325; XI, Troubleshooting tips, part 2, 33 min, 800326; XII, FETs and unijunction transistors, 34 min, 800327; XIII, Breakdown diodes, 37 min, 800328; XIV, SCRs and tunnel diodes, 28 min, 800329; XV, PIN, SRD and HCDs, 28 min, 800332.

Hewlett-Packard video tapes are available in Ampex format and in Sony formats on both 1in and ½in tapes. Other formats can be produced. Video tapes can be ordered or further information obtained from Hewlett-Packard Australia Pty Ltd, 22-26 Weir Street, Glen Iris, Victoria 3147.

MULLARD TECHNICAL COMMUNICATIONS, Vol 11, Number 106, July, 1970. Published by Mullard Ltd, UK. Contents: High grade, long life, electrolytic capacitors – the 106/107 series in power supply design, by D. Mason – outlines the history of "wet" electrolytic capacitors and the successive structural, manufacturing, performance, quality and reliability improvements that have been achieved: TTL interfacing with GRL111 and GRL101, by D. R. Armstrong – principles, circuit design and performance are discussed for TTL-TTL, TTL-CML and CML-TTL. Inquiries to Mullard-Australia Pty Ltd, 35-43 Clarence Street, Sydney, 2000.

MI CONTACT, Issue 18, Published by Marconi Instruments Ltd, UK. Contents include: Autotest wins design award; New literature available; Sine-squared pulse and bar generators; New sweeper units on display; New mobile radio test set; Inexpensive X-Y display unit; Marconi Instruments at Kensington Close. ■

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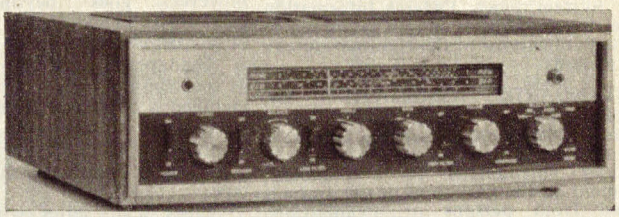
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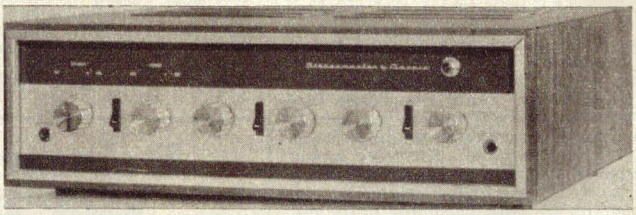
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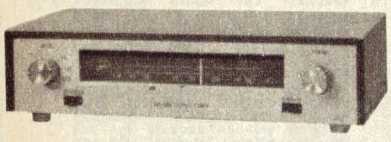
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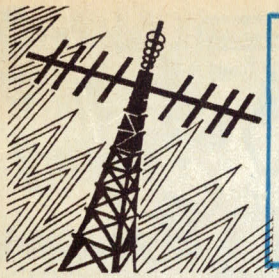
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AMATEUR BAND NEWS AND NOTES

WIA Youth Radio Club Scheme

The Wireless Institute of Australia's Youth Radio Club Scheme, formed to provide technical instruction for young people interested in radio and electronics, continues to make very satisfactory progress.

by Pierce Healy, VK2APQ

Those associated with the YRCS say there has been a gratifying expansion of the scheme during 1970. Indications are that 1971 will see a still further increase in the number of students who wish to avail themselves of the benefits they may obtain by becoming active members of an affiliated club. Some details of the objectives and administration of the YRCS may assist in the establishment of new school clubs.

The objectives of the scheme are:–

(a) To develop in young people an interest in radio and electronics as a vocation or as a hobby throughout life.

(b) To provide school students with a hobby activity to reinforce their school activities in science and mathematics.

(c) To assist present and future leaders and instructors of youth radio clubs and non-club participants by providing ready made programs of activity.

(d) To co-ordinate the activities of present and future youth radio clubs and non-club participants and to promote co-operation and exchange of ideas among club leaders.

(e) To co-operate with schools and youth organisations in fostering youth radio clubs.

(f) To give encouragement and recognition to youth radio club members and non-club participants who attain certain specified standards of skill and knowledge in the field of radio.

To give due recognition to members who demonstrate specified skills and knowledge, there has been developed a basic series of Radio Proficiency Certificates on a graded basis at the following levels:–

(i) Elementary. (ii) Junior. (iii) Intermediate. (iv) Senior. (v) Advanced.

Radio Proficiency Certificates may be awarded to the following classes of candidates:–

(i) Associate members of the Wireless Institute of Australia.

(ii) Financial members of affiliated Branches, Sections and Clubs.

(iii) Registered members of the Youth Radio Club Scheme.

(iv) Registered non-club participants in the Youth Radio Club Scheme.

Radio Proficiency Certificates are awarded in three grades, based on the results obtained by candidates in the written examination. "Pass Grade" certificates are awarded to candidates who gain from 70 per cent to 79 per cent. "Credit Grade" certificates are awarded to candidates who gain from 80 per cent to 89 per cent. "Honours Grade" certificates are awarded to candidates who gain 90 per cent to 100 per cent.

Practical Work: For each certificate of the basic series, candidates must construct various equipments to satisfactory standards of workmanship and efficiency. Kit sets, commercial or assembled by club leaders from donated components, are a very useful aid in this aspect. However, with the latter it is essential that modern components are used. The method of financing the purchase of components is for each individual club to decide.

Safety First; This aspect is stressed very strongly right from the outset. The dangers of uninformed tinkering with power mains operated units is emphasised at all times. Practical projects submitted for the Elementary and Junior certificate levels must not be mains operated. Only after written permission has been received from candidates' parents prior to the commencement of construction will mains operated projects be accepted for Intermediate and higher standard certificates.

Club Organisation: As most clubs are formed within the framework of an existing organisation, such as secondary schools and youth organisations, the Wireless Institute of Australia does not stipulate how a Youth Radio Club should be controlled. Rather, the institute functions as an advisory body and to provide help wherever possible in the development of interest in radio and electronics.

However it is necessary to have some form of regular club organisation and it is recommended that Youth Radio Clubs should have presidents, secretaries, treasurers, instructors and equipment officers. These functions may be combined to suit the number of members but it is considered desirable that the responsibilities of the various functions should be spread wherever possible. The encouragement of competent club members to undertake specific duties and responsibilities, instead of merely receiving benefits, has some obvious value.

In most school clubs supervision is undertaken by one staff member only. Due to frequent staff changes this method has disadvantages so if possible several teachers should assist in the operation of the radio club. In non-school clubs the trend is towards committee control by interested adults, radio amateurs and enthusiasts who undertake the organisation and instruction.

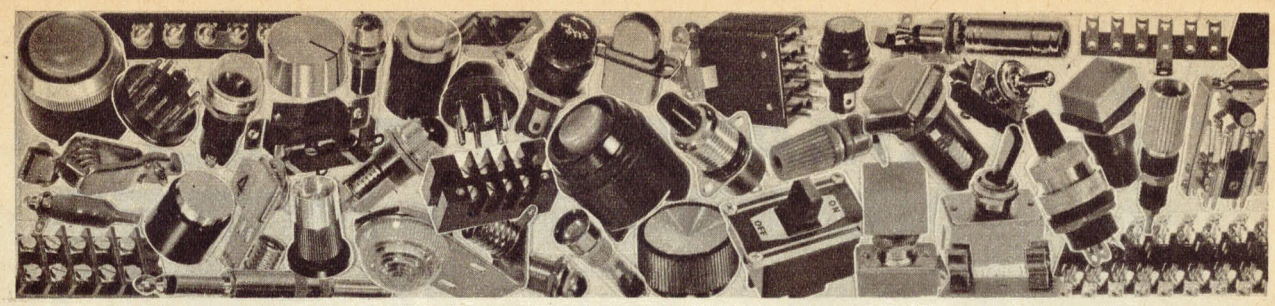
Where the assistance of a licensed amateur operator is available, the aim should be to set up a club station where members can be given instruction and gain experience in station operation. Operating experience may be a reward to students who have made satisfactory progress in the certificate courses. For this aspect of efficiency Radio Telephone and Wireless Telegraphy operators awards are available to club members who achieve the required standard of proficiency.

By having their own club station, members may gain additional experience by being able to make contact with other YRCS stations and exchange ideas on technical and administrative skills. Training and experience in radio telephony has enabled members to attain a high level of competence in oral expression and is of assistance in speech training.

Correspondence Course: For non-club participants there is a correspondence section through which students may participate in the various YRCS certificate examinations and in any of the general YRCS activities. Through Group Leaders, such members receive instruction and have

News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St, Bankstown, NSW 2200.



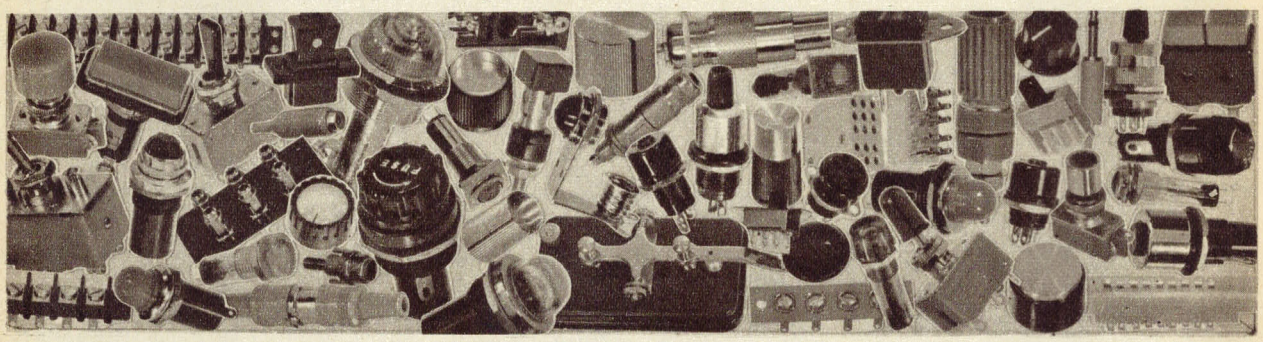


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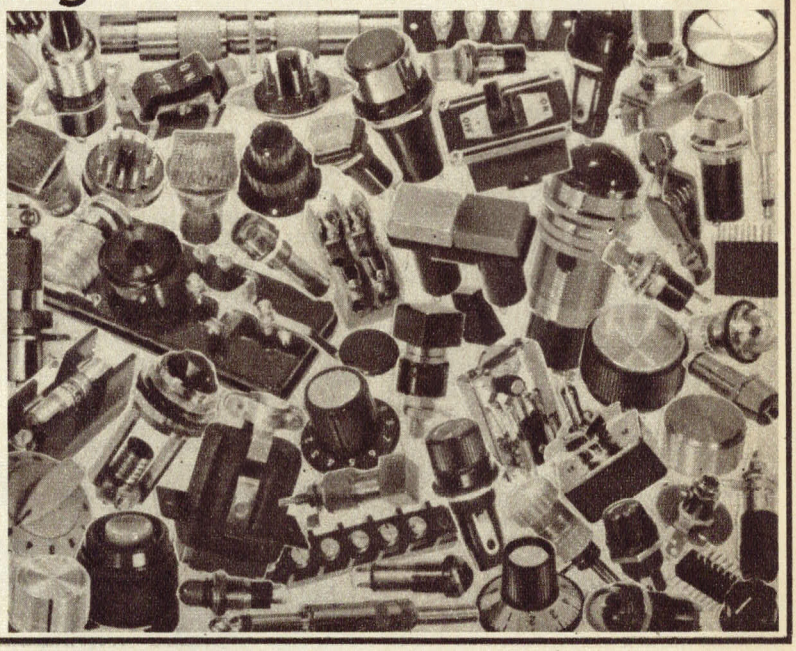
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their assignments set and corrected by means of personal correspondence between student and Group Leader.

Details of this facility may be obtained from: The Supervisor, Correspondence Section, YRCS, 34 Flower Street, Fern Tree Gully, Victoria, 3156.

While the YRCS certificates cannot be regarded as evidence of trade compentency, nevertheless, they do serve a useful function for a student on leaving school by indicating to a prospective employer that the applicant has certain standards of skills in the field of radio and electronics.

Many Government organisations and commercial undertakings have shown a keen interest in the scheme and the progress that members have made. Many students have gained positions in the Postmaster-General's Department, the Department of Civil Aviation, and the Overseas Telecommunications Commission, during the past 10 years.

The "Information Manual on the Youth Radio Club Scheme", prepared by the New South Wales Division, sets out in detail the aims and objects, and the syllabuses for the various grades of certificates. This is a most useful publication for anyone interested in forming a club and affiliating with the scheme.

Further details may be obtained from the following officers in each state of the Commonwealth:–

Federal Co-ordinator: J. Webster, 25 Bayview Avenue, Earlwood, NSW, 2206.
New South Wales Supervisor: D. Jeanes, Villa Maria, Ayr Street, Rockdale, NSW, 2216. Secretary: J. Flynn, 30 Sharp Street, Belmore, NSW, 2192.
Victorian Supervisor: D. Reid, 355 O'Heas Street, Pascoe Vale, Victoria, 3044.
South Australian Supervisor: R. Guthberlet, 3 Hay Street, Kadina, SA, 5554. Secretary; A. Dunn, 18 McKinlay Street, Elizabeth Downs, SA, 5113.
Western Australian Supervisor: YRCS, Box N1002, GPO Perth, WA, 6001.
Queensland Supervisor: R. Everingham, 30 Hunter Street, Everton Park, Brisbane, Queensland, 4053.
Tasmanian Supervisor: R. Emmett, PO Box 49, South Launceston, Tasmania, 7250.

Appreciation: The WIA Federal Council and YRCS officers have expressed appreciation of the publicity the scheme has received in "Electronics Australia", which has helped considerably to make the YRCS the success it is.

NEW SOUTH WALES

From State supervisor Dave Jeanes, the comments: 35 clubs registered during 1970, 12 being new clubs. Awards of the Elementary Certificate are estimated to reach the 1,000 mark early in 1971. Two hundred were issued in 1970 taking the total to 930 at the end of the year. There is certainly no shortage of boys who wish to study electronics in our state. Rather there is a shortage of capable persons to operate radio clubs in high schools and other outside youth organisations.

If you would like to start a radio club along YRCS lines, write to Mr J. Flynn, 30 Sharp Street, Belmore, NSW, 2192, and he will send you the YRCS information manual. The scheme will give you assistance in getting the project started. A training and examination syllabus will be provided and the Wireless Institute YRCS certificates will be issued to your successful candidates.

The NSW section of the YRCS operates a radio club at the Wireless Institute Centre, 14 Atchison Street, Crows Nest. Twenty-five boys are currently studying at the club. A YRCS broadcast is made monthly from the centre one Saturday afternoon each month. You can tune in to the YRCS news by listening on 7050KHz at 3 pm EST. Because of the Christmas break the next broadcast will be made on February 27.

Westlakes Radio Club: The Cook Bi-Centenary Year has been a year of expansion for the Westlakes Radio Club. After moving to larger premises in Anzac Parade, Teralba, normal club classes were suspended until lecture and practical workshop areas were constructed and fitted out. However, towards the end of 1970 activities were back to normal; Elementary and Junior classes were held, and work benches, store and canteen were completed. The club station, VK2ATZ, was installed in a new transmitting room, and antennas erected on a 60ft pole.

An examination at the YRCS Elementary Certificate level was held in October by lecturer Ken Hargreaves, VK2ZIL. The YRCS Junior Certificate lecturer, Lionell Doolan, VK2ATY, had completed instruction for that course in December. The larger premises, previously a picture theatre, has made it possible to accommodate a substantial increase in junior membership of the club. The club secretary Eric Brockbank, reports that the number is still rising and the Westlakes Radio Club is the largest Youth Radio Club in the Newcastle area.

During the last quarter of 1970 the club president, Keith Howard, VK2AKX, made an extensive tour of Asia and Europe, when he met amateur radio operators in Japan, USSR, England and a number of other European countries, and South Africa. Keith's experiences and knowledge of the current trends in relation to amateur radio in the countries he visited will be of great interest and value to the club.

Examination results to hand for the Elementary Certificate show that club members gained five Honours, two Credits and four Passes. Successful candidates were:–

Honours:
Mark Adams; David Griffiths; David Crofts; Gregory Kelly; Paul Lorger.
Credit:
John Gale; Glendo Bagley.
Pass:
Steven Dove; Jamie Campbell; Peter Gravie.

Arthur Day, VK2ZDE, now has the full call VK2BBI, and Paul Lorentzen, VK2ZQI, the full call VK2ATR. Philip Brown gained the LAOCP. Several of the members successful in the Junior Certificate examination will be sitting for the February AOCP examination.

Maitland Radio Club: During 1970 the Maitland Radio Club undertook an expansion program. An office and entrance patio has been erected at the front of the main club building, and steps have been built at the rear of the building for ease of access to the workshop. In addition a 50ft by 20ft theatrette has been built. This will provide additional facilities for lectures, visual aid training, amateur television, motion pictures and general social activities.

Club president, Kev Watson, VK2BLW, says that with the fitting out of the theatrette and other improvements and additions in 1971, they will be four years ahead of what was originally planned by the club.

During 1970 the club participated in the Boy Scout Jamboree-on-the-Air, and 70 scouts and clubs visited the club rooms

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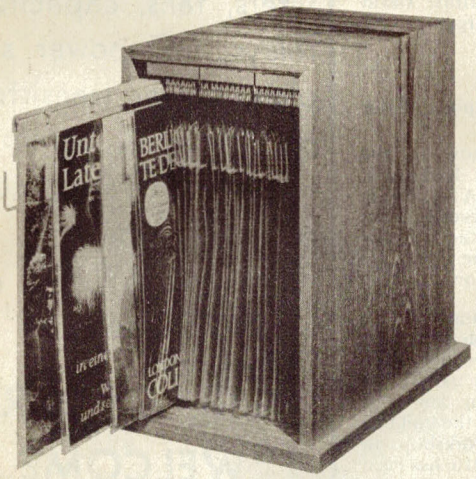
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to speak to scout groups throughout Australia, New Zealand and the Solomon Islands.

The club was the winner of the Institution of Radio and Electrical Engineers' Pennant Award for 1970. This is awarded to the YRCS club judged to be the most successful during the year. The club also won the award in 1968.

Classes currently being conducted at the club are: three Junior; two Elementary; one Intermediate; Elementary and Advanced classes in Morse code practice; and an Amateur Operator's Certificate of Proficiency class.

A member, Reverend Father Geoff Mulhearn, was successful recently in gaining the LAOCP and is now attending the Morse code class in preparation for the AOCP examination.

"MRC News", the journal of the Maitland Radio Club, is published each month and has a wide circulation among Australian and overseas amateur operators and radio clubs. Subscription rates are $1 per year in Australia; $2 per year overseas, paid in advance. All inquiries regarding the MRC News should be addressed to the Editor, MRC News, Box 54 PO, East Maitland, NSW. 2323.

Cowra High School Radio Club: This club is in its third year of operation and at present has 16 members. In 1969 the club had 100 per cent success in all exams members sat for. Two members also passed the AOCP examination: Ross Tester, VK2ZVO, now a member of the staff of "Electronics Australia"; and Geoff Smith, VK2BGR.

The club leader, Mr Stan Mason, VK2JP, reports that the club concentrated on practical work during 1970, in which excellent progress was made. The highlight of the year was the acquisition of a Heathkit DX400 transmitter and HRO receiver through the YRCS. Special thanks are extended to the State supervisor, Dave Jeanes, for his assistance in this matter.

The club station VK2BAV was on the air all day on Education Day, making a number of contacts with other high school clubs in NSW, Victoria and Queensland.

The activities of the club were featured in the local newspaper, the "Cowra Guardian", in August. An article titled "School's Radio Progress" with a photograph of members of the club and equipment was featured on the front page. Mr Mason was also interviewed on the ABC radio.

The club station is on the air every Friday afternoon on the 7.00MHz band. During 1971 a 3.5MHz band antenna will be erected and club meetings will be changed to evening lectures when the period will be extended from two to three hours. Classes will be held for the Elementary, Junior and Intermediate YRCS certificates, including Morse code instruction. Two of the boys have indicated that they would like coaching for the AOCP examination.

TASMANIA

Reg Emmett, State supervisor, reports eight groups affiliated during 1970. The most active school groups were Queechy High and Kings Meadows High in Launceston, Murray High at Queenstown and Scottsdale High.

For the first time, non-school groups operated in 1970. A Saturday morning group in Hobart operated by the WIA, with Ted Cruise as Group Leader, and a Davenport Boys Brigade Club, both operated successfully during the year.

The only significant on-air activity by a Tasmanian YRCS club during 1970 was from Kings Meadows High. The club station VK2MK could be heard most lunch times operating on the 40, 20 and 15 metre amateur bands, using SSB.

The most recent candidates successful in gaining Elementary Certificates were:
Queechy High School: Christian Dingemanst; Jess Thomson; Marcel Schoppers; Marlene Thompson.
Kings Meadows High School: Victor Coombe; Gregory Kerfoot; Peter Hodge; Charles Moss; Brent Kennedy; David Warren.

All inquiries regarding YRCS activities in Tasmania should be directed to R. Emmett, Kings Meadows High School, PO Box 49, South Launceston, Tasmania, 7250.

QUEENSLAND

State supervisor, Ron Everingham, writes that 1970 has been a most successful year for the YRCS activities in Queensland. The following clubs were registered during 1970:–
Everton Park High School Radio Club.
Technicians School Radio Club.
Church of England Grammar School Radio Club.
Sunshine Coast Amateur Radio Club.
Indooroopilly and District Youth Club-Radio Club.
Maryborough State High School Radio Club.

Certificates issued during 1970 were:–

Elementary Certificates	52
Junior Certificates	16
Intermediate Certificates	3

Congratulations go to all who were successful in gaining YRCS certificates in 1970 and sincere thanks to all club leaders who co-operated to make the YRCS so successful.

During 1970 the Queensland Division reprinted the YRCS notes. These have been very popular with members, and are available from the State supervisor. The cost of the notes, which contain the theory and practical projects for the three certificates issued to successful candidates, are:–

Elementary Notes	60 cents
Junior Notes	70 cents
Intermediate Notes	80 cents

Inquiries will be welcome from clubs or persons interested in the YRCS. Correspondence should be addressed to:– R. Everingham, State Supervisor YRCS, 30 Hunter Street, Everton Park, Brisbane, Qld, 4053.

SOUTH AUSTRALIA

There were 12 clubs registered with the YRCS in South Australia during 1970. Of these four were school clubs. The total membership of all YRCS clubs was 246. Active clubs registered during 1970 were:

School clubs:
Prince Alfred College
Minlation High School
Unley High School
Mitchell Boys Technical High School

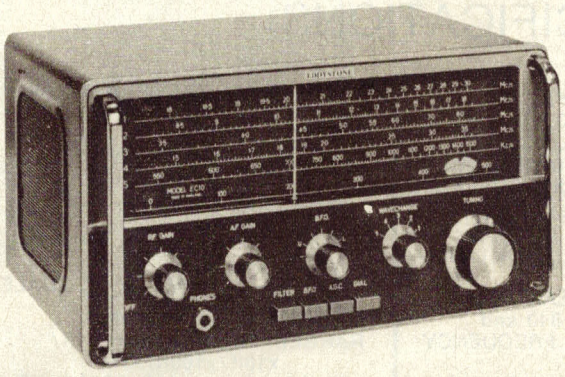
Other clubs:
Port Pirie Youth Radio Club
Port Augusta Youth Radio Club
Barossa Valley Youth Radio Club
Elizabeth Youth Radio Club
Woomera Youth Amateur Radio Club
YMCA Electronics Club
St Marys Boy Scouts
Third Adelaide Boys Brigade Company

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INPUT RESISTANCE: 10 MEGOHMS.
ACCURACY: ± 3% FULL SCALE.

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RANGES: Rx1/x10/x100/x1K/x10K/x100K/x1M
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RANGES: 0 TO 30μA/300μA/1/3/10/30/100/300mA
ACCURACY: ± 3% FULL SCALE

AC CURRENT (8 ranges)
RANGES: 0 TO 30μA/300μA/1/3/10/30/100/300mA
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JM/58-70

the activities of some clubs. Two clubs held visitors sessions when parents, friends and prospective members were invited to inspect the work of club members. At these meetings certificates were presented to successful members.

Certificates issued up to the end of November 1970 to successful YRCS members in SA were: Elementary Stage, 30; Junior Stage, 9; Intermediate Stage, 2. To encourage club members to do well in the certificate exams a prize of a technical book is awarded each year to the most successful student, donated by Philips Electrical.

There is also keen competition between clubs endeavouring to become the "most progressive club." Each year a specially endorsed certificate is issued to the successful club. Details of this award have been supplied to the Institute of Radio and Electronic Engineers, and it is hoped that they may decide to extend their pennant award outside NSW.

In 1970 the annual general meeting of the YRCS was held in June. This was the most representative meeting yet held of all clubs associated with the scheme. A decision of the meeting was to produce a brochure and circulate it to all science teachers in South Australia and Northern Territory, to foster interest in school clubs in 1971.

The current YRCS South Australia division is administered by an executive committee headed by Rev Robert Guthberlet, VK5D, 3 Hay St, Kadina, South Australia, 5554.

All enquiries from prospective members or club leaders in South Australia should be directed to the State secretary, Mr Allen Dunn, VK5FD, 18 McKinlay St, Elizabeth Downs, South Australia 4113, who supplied this report.

WESTERN AUSTRALIA

There are five active clubs associated with the YRCS in Western Australia – Aquinas College Radio Club, Modern School Radio Club, Wesley College Radio Club, Southern Electronics Club, and Ockley Radio Club Group. The Wesley College and Modern School clubs have equipment operating on the 52MHz band.

At the present time the administration of the YRCS in Western Australia is being re-organised and Mr L. Jessop, VK6LO, science master at the Wesley College has been appointed State Supervisor. Mr Jessop has had the headmaster of Wesley College agree to run a course in radio using the YRCS syllabus. Subject to the Achievement Certificate Board agreeing, it is proposed to commence the course early in 1971.

Inquiries from prospective club leaders should be addressed to State Supervisor, WIA YRCS, Box N1002, GPO, Perth WA 6001.

WIA ACTIVITIES

The resignation of Ken Pincott, VK3AFJ, editor of the Wireless Institute's magazine "Amateur Radio", after many years of voluntary service, has probably brought to an end the era when the administration of institute activities has been carried out on a spare time basis by a few members. In October, members of the Victorian Division council accompanied by the Federal secretary visited Sydney to discuss the matter with the New South Wales Division council. The meeting was held at Wireless Institute Centre, Crows Nest.

The purpose of the discussion was to assess some of the problems and possible ways of continuing publication of the magazine and reducing the duplication of administrative tasks which appears to be common within each division of the institute; also, to endeavour to reach some agreement as to the direction in which institute affairs should be guided.

Briefly, the recommendations agreed to were: That the Victorian Division, as the division publishing the magazine, employ a person full time as Editorial Manager. That a portion of the salary be met out of Federal Executive funds in return for administrative assistance from the person so appointed.

That on the appointment of an Editor Manager, all divisions cease publication of their individual monthly bulletins and that material now published in the bulletins become a feature of the magazine. It is envisaged that the saving in producing the bulletins would substantially defray the additional cost of the magazine.

The advantage of computerising administrative records and functions which are common to all divisions was also discussed. Anticipated savings in voluntary effort and time were considered sufficient to warrant such a move.

Before any action can be taken to implement the recommendations decided by the meeting, agreement must be obtained from all other divisions.

NEW SOUTH WALES

Lecture classes for the Amateur Operator's Certificate of Proficiency examination will commence at Wireless Institute Centre, 14 Atchison Street, Crows Nest, early in February. For further details, write to the AOCP Class Manager, at the above address. The classes include instruction in Morse code.

For those unable to attend the personal instruction classes, there is a correspondence course available. This course, in conjunction with the Morse code practice transmissions from VK2BWI at 7.30 pm each night on 3550KHz, and the Morse code practice tape service, provide an excellent opportunity for those living out of town to obtain their amateur operator's licence.

Blue Mountains Branch: Despite inclement weather, the Blue Mountains Branch's Annual Field Day, held in the parkland of the Lawson Swimming Pool, was a success. Forty-five amateurs registered and 90 attended. The thanks of the organisers and those attending were extended to associate member, Ted Hart, who did an excellent job with the catering.

Result of the Field events:–

All Band Scramble:

HF section VK2AWZ
VHF section VK2AWZ with VK2ZGX and VK2BDN a tie for second place.

Sniffer Hunt: Roger Haberfield, 1st; VK2ZGX, 2nd.

144MHz Mobile Fox Hunts:

First event – VK2BDN, 1st; VK2AWZ, 2nd.

Second event – VK2AWZ, 1st; VK2ZQX, 2nd.

Mobile 146MHz Talk-in Hunt: VK2BDC, 1st; VK2ZQG, 2nd.

The officers and members of the Branch thank the following companies who donated prizes for the competitions: Hy-Q Electronics Pty Ltd; Mullard-Aust Pty Ltd; Manufacturers Special Products.

Central Coast Branch: Commencing December 1, 1970, a new award to be known as the "Central Coast Award" is available to amateur radio operators throughout Australia and the world. The award is being sponsored by the Central Coast Tourist Authority through the

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MULTIMETERS, 200H, 20K ohms per volt, **$11.25,** inc. tax. CT 500 20K ohms per volt, **$15** inc. tax. CT 330 20,00 ohms per volt, **$17.25** P. & P. 45c.

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6SL7	$1.00	807 (ATS25)	50c
6U7	60c	QVO4/7	$1.00
6G8	$1.50	5B254M	$1.00
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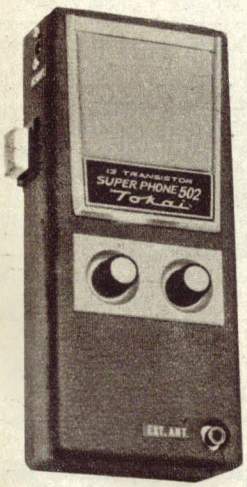
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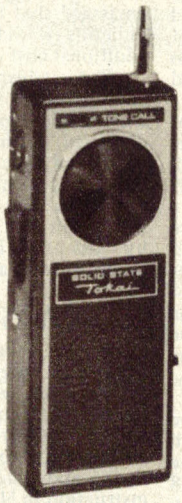


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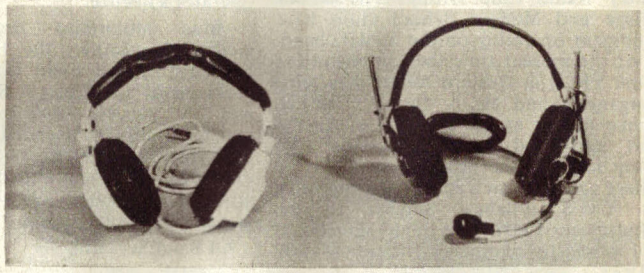
Price $70.00 ea.

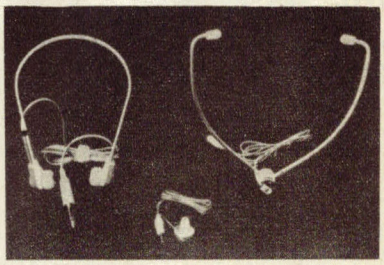
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Central Coast Branch of the WIA.

To obtain the award the following conditions apply:

1. Operators of overseas stations may qualify by making radio contact with any two stations located in the Central Coast area of NSW, which is centered around Gosford, between Sudney and Newcastle.
2. Overseas applications should be accompanied by log details of contacts made, together with two IRCs for return postage by surface mail.
3. Australian operators (excluding Central Coast operators) may qualify by contacting four stations located in the Central Coast area plus a contact with the Branch station VK2AFY.
4. Applications from Australian operators must be accompanied by log details, and 10 cents in stamps.
5. Central Coast operators may qualify for the award by contacting 10 stations in the Central Coast area, plus the Branch station VK2AFY, and submitting a log and 10 cents in stamps.
6. The award is available as an HF or VHF award. Operators must qualify on either HF or VHF bands.
7. Applications for the "Central Coast Award" accompanied by log details should be sent to: Awards Manager, Central Coast Branch, PO Box 238, Gosford, NSW, 2250.

Illawarra Branch: During the weekend November 28-29, 1970, to commemorate the Captain Cook Bi-Centenary, members of the Illawarra Branch operated the club station VK2AMW/P from Bass Point, located on the coast about 15 miles from Port Kembla. Despite the usual problems that seem to appear on such occasions, many contacts were made, although the DX band conditions were disappointing.

Probably the local contacts that created the greatest interest were those made on 432MHz. During the evening of November 28, contact was made with Sydney stations with readibility 5, strength 9 signal reports each way. The distance is approximately 50 miles. Contacts were made with VK2BDN. VK2HO; VK2ZAC; VK2ZKP.

Other bands used included the 52MHz and 146MHz net frequencies and high frequencies 3.5MHz; 7.0MHz; 14MHz; 21MHz; 28MHz.

The Illawarra Branch moon-bounce project at Dapto is making good progress. The receiving system is working and the transmitter and power supply are in advanced stages of construction. It should not be long before tests are carried out.

Full information of Branch activities and monthly meetings may be obtained from the Secretary, Hank Laauw, VK2BHL, Lot 443, William Beach Road, Dapto, NSW, 2530.

QUEENSLAND

From the Townsville Amateur Radio Club's news bulletin comes this interesting note on VHF activity in that area. Ross Ramm, VK4RO, located in Ayr, has had several contacts on the six-metre band with Bill Boykin, HL9WI, located in Korea. Bill runs a beacon on 50.1MHz each day from 2200GMT. Ross has also made contact with KR6RS on Okinawa. It is presumed that these stations look for Australian contacts on the Australian frequency allocation of 52MHz to 54MHz.

WESTERN AUSTRALIA

The November issue of the Western Australian Division's bulletin contained a separate brochure on the WICEN organisation in that State. This emergency service net is open to all amateur operators whether members of the WIA or not. Those wishing to join the organisation may obtain further details by writing to the WICEN Co-ordinator, Box N1002, GPO, Perth, WA, 6001.

VHF Group: With the six-metre DX season in progress the VHF Group in WA draws the attention of VHF operators in the eastern states to the location of the VK6 beacons:

Location	Callsign	MHz
Perth	VK6VF	52.06
		145.00
Mt Barker, 200 miles SE of Perth	VK6VE	144.50
Carnavon 550 miles N of Perth	VK6TS	52.90

There is also a beacon on Christmas Island, in the Indian Ocean, operating on 146.00MHz, callsign VK9XI. Net frequencies used in Western Australia are: 52.586MHz AM; 52.656MHz FM; 146.00MHz FM. All beacon stations operate CW.

Quarter Century Wireless Association

The officers of the Sydney Chapter of the QCWA for 1971 are:
President: Harry Caldecott, VK2DA
Treasurer: Brian Anderson, VK2AND
Secretary: Pierce Healy, VK2APQ

Any amateur radio operator who has been licensed for 25 years or more is eligible to join the QCWA.

The Sydney Chapter meets for dinner and a social get-together on the second Wednesday of each month at the Combined Services Club, Barrack Street, Sydney.

At the November meeting, members were pleased to have as their guest, Neville Williams, VK2XV, editor of "Electronics Australia".

Further details of the QCWA may be obtained from any of the officers.

JOHN MOYLE MEMORIAL FIELD DAY

The Federal Contest Committee of the Wireless Institute of Australia invites all Australian amateurs and short-wave listeners to participate in this annual contest, which is held to perpetuate the memory of John Moyle, whose efforts advanced the amateur radio service.

There are two divisions of this contest, one of 24 hours' continuous duration, and one of six hours' continuous duration. The six-hour period has been included to encourage the operator who is unable to participate for the full 24-hour period. The 24-hour continuous operation is to be chosen by each operator from the 26-hour period.

Operators using 25 watts or less input to the final stage will be considered for a certificate where his activity warrants its issue.

DATE: From 0600GMT, February 13, 1971, to 0800GMT, February 14, 1971.

OBJECTS: The operators of portable and mobile stations within all VK call areas will endeavour to contact other

(Continued overleaf)

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portable/mobile and fixed stations in VK call areas and foreign call areas.

RULES

1. There are two divisions, one of six hours, and one of 24 hours duration. The six-hour period for operating may be chosen from any time during the contest, but the six-hour period so chosen must be continuous. In each division, there are six sections:—

(a) portable/mobile transmitting, phone.
(b) portable/mobile transmitting, CW.
(c) portable/mobile transmitting, open.
(d) portable/mobile transmitting, multiple operation, open only.
(e) fixed transmitting stations working portable/mobile stations, open only.
(f) reception of portable/mobile stations.

2. All Australian amateurs are encouraged to take part. Operators will be limited to their licensed power. For portable entries power shall be derived from a self-contained and fully portable source.

Portable/mobile stations shall not be situated in any occupied dwelling or building. Portable/mobile stations may be moved from place to place during the contest.

No apparatus shall be set up on the site earlier than 24 hours prior to the contest.

All amateur bands may be used, but no cross-band operating is permitted. Cross mode operation is permitted.

Entrants in section (d) for multiple operator stations can set up separate transmitters to work on different bands at the same time. All such units of a multiple operator station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.

For each transmitter of a multiple operator station a separate log shall be kept with serial numbers starting from

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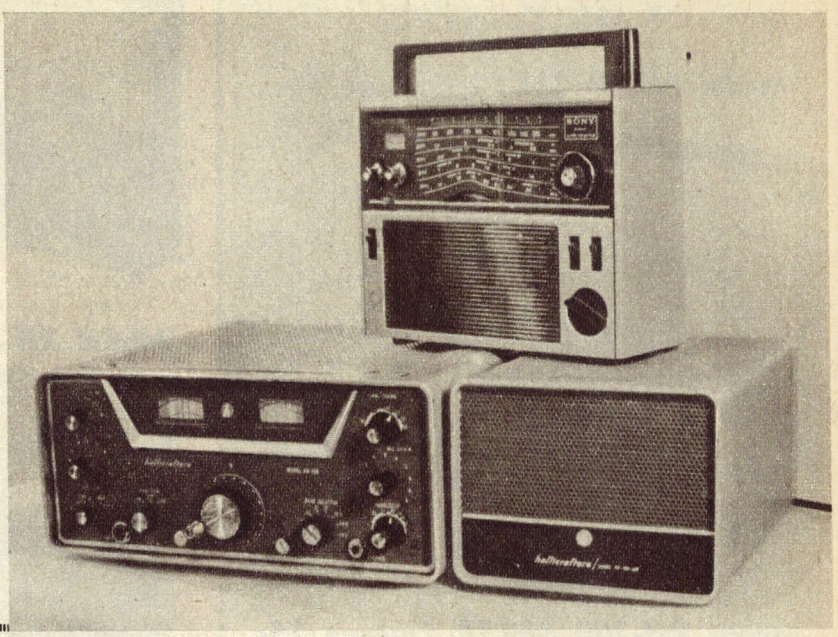
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Sound House: 106 Wellington Parade, East Melbourne. 3002.

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243 Elizabeth Street,
SYDNEY, 2000.
Phone:

RADIO EQUIPMENT FROM 'LA BALSA'

The radio communication equipment used aboard the raft "La Balsa" during its momentous 8,564-mile voyage across the Pacific was examined with great interest by the staff of "Electronics Australia" when it was entrusted to our care shortly after the arrival of the raft in Australia. The main item of equipment was a Hallicrafters 150W CW/SSB amateur band fixed-mobile transceiver, Type SR-150, providing coverage of the 80, 40, 20, 15 and 10 metre bands, operated from a 117V power supply fed from a small generator. This was supplemented by a Sony TR-1300 mains/portable solid-state five-band general coverage receiver, tunable from 530KHz to 26.1MHz. The faulty microphone, which gave rise to a loss of communication with the Mexican base station over a large part of the voyage, was not available for our inspection.



001, and increasing by one for each successive contact. All logs of a multiple operator station shall be submitted by the operator under whose call sign the transmitters are working. No two transmitters of a multiple operator station are permitted to operate on the same band at any time.

3. Amateurs may enter for any section.

4. One contact per station for phone to phone, also one for CW to CW per band is permitted. Cross mode operation will be accepted for scoring.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regard to portable operation.

6. For VK stations contacting VK stations, the exchange of serial numbers, consisting of RS or RST report plus three figures commencing with 001 and increasing by one for each successive contact by the VK station, shall be proof of contact.

The exchange of RS or RST reports only with non-VK stations shall be sufficient proof of contact for this contest.

7. SCORING:
(a) Portable/Mobile Stations:
Contacts with portable/mobile stations outside entrant's call area ..... 15 points
Contacts with portable/mobile stations within entrant's call area ..... 10 points
Contacts with fixed stations outside entrant's call area ..... 5 points
Contacts with fixed stations within entrant's call area ..... 2 points
(b) Fixed Stations:
Contacts with portable/mobile stations outside entrant's call area ..... 15 points
Contacts with portable/mobile stations within entrant's call area ..... 10 points

Operation via active repeaters or translators is not allowed for scoring purposes.

8. The following shall constitute Call Areas: VK1, VK2, VK3, VK4, VK5, VK6, VK7, VK8, VK9 and VK0.

9. All logs shall be set out under the following headings: Date/Time (GMT), Band, Emission, Call Sign, RST/No Sent, RST/No Received, Points Claimed. Contacts must be listed in numerical order.

In addition, there shall be a front sheet showing the following information:—

Name .....
Address .....
Call Sign .....
Section .....
Division .....
(Six-hour or 24-hour) .....
Points Claimed .....
Call Sign of other op(s) (if any) .....
Location of portable/mobile station .....
From ..... hours
to ..... hours.

A brief description of equipment used, and points claimed, followed by the declaration:

"I hereby certify that I have operated in accordance with the rules and spirit of the contest." Signed
Date .....

10. The right is reserved to disqualify any entrant who, during the contest, has not observed the regulations and the rules of this contest, or who has consistently departed from the accepted code of operating ethics.

11. The decision of the Federal Contest Manager of the Wireless Institute of Australia is final and no dispute will be entered into.

12. Certificates will be awarded to the highest scorer of each section of each division. Additional certificates may be issued at the discretion of the FCC. The six-hour certificates cannot be won by a 24-hour entrant.

13. RETURN OF LOGS: All entries must be postmarked not later than March 7, 1971, and be clearly marked "John Moyle Memorial National Field Day Contest, 1971" and addressed to:—

Federal Contest Manager, WIA,
Box N1002, GPO,
Perth, WA 6001.

RECEIVING SECTION

14. This section is open to all short wave listeners in VK call areas. The rules shall be the same as for the transmitting stations, but may omit the serial numbers received.

Logs must show the call sign of the portable/mobile station heard, the serial number sent by it, and the call sign of the station being worked.

Scoring will be on the same basis as for transmitting stations. It will not be sufficient to log a station calling CQ. A portable/mobile station may be logged once only for phone and once only for CW in each band.

Awards: Certificates will be awarded for the highest scorer for the six-hour and the 24-hour divisions. ■

EXAMPLE OF VICTORIAN SWL's LOG

Date Time (GMT)	Band	Call Sign Heard	RST No Sent	Station Worked	Points Claim
13/2/71					
0600	80M	VK2AAH/P	59001	VK3ATL/P	15
0610	80M	VK3ATL/P	59006	VK3QV	10
0620	40M	VK2AAH/P	599004	VK6VF/P	15
0640	20M	VK3QV	59010	VK5QX/P	*
0900	20M	VK4QF/P	59040	VK4QX/P	15

*No claim, fixed station

CALLING ALL PROSPECTIVE AMATEURS

The 1971 series of Personal Classes will commence on 16th February. Classes limited. Applications accepted in order of receipt. Correspondence classes available at any time.

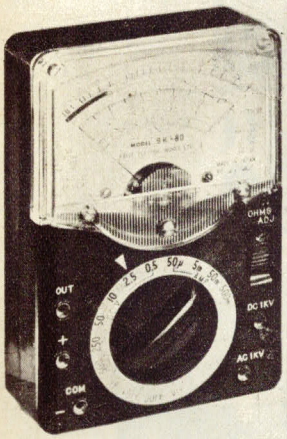
Apply:

WIRELESS INSTITUTE CENTRE

14 ATCHISON STREET,
CROW'S NEST, N.S.W. 2065.
TELEPHONE: 43 5795

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 lb

Accuracy. DC±3%, AC ±4% (of full scale)

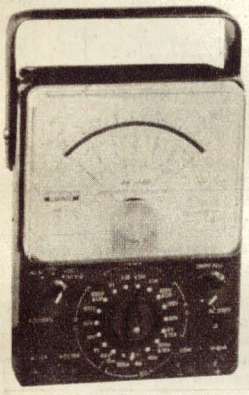
Batteries. Two 1.5V dry cells. Size AA, "Eveready" 915

● 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

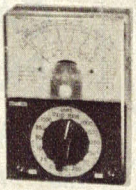
NEW TYPE Y-3 MULTIMETER



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



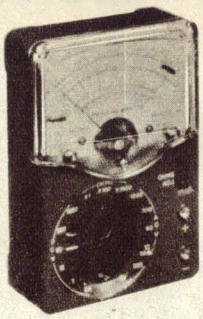
CHECKED PACKED & POSTED FREE

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

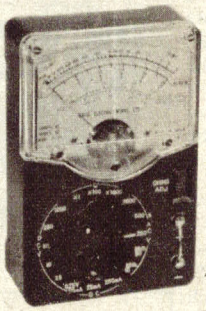
Resistance. 7kΩ, 700kΩ, 7MΩ

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.

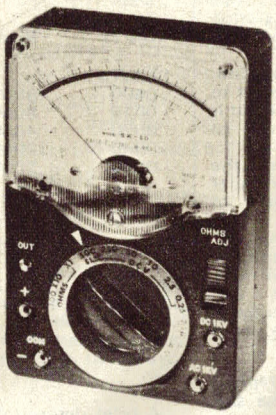
*AC Volts: 12V, 60V, 300V, 1200V (14,000 ohms/V).

*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

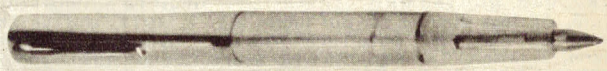
7 transistors, uses 1 standard Penlite battery size 2½in x 2½in. The only miniature radio using standard batteries (refill battery 10c). Complete with instruction leaflets.

Pack and post $39.75.

FLASHLIGHT BALL POINT PEN S-88

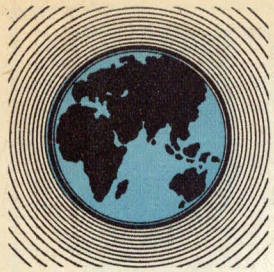
Lights up automatically when pen cover is in position for writing. **$2.00 posted.**

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



LISTENING AROUND THE WORLD

Six-monthly review of European signals

Our six-monthly survey of signals from Europe indicates strongly that most programs are best received during the hours of darkness, and that best reception is on the higher frequencies.

by Arthur Cushen

ALBANIA: Radio Tirana has many transmissions in English, but the two most suitable for this area are at 0630 and 2000GMT on 7085 and 9505KHz.

AUSTRIA: Vienna has a service for Australasia from 1000 to 1200GMT on 17785KHz. Reception has not been very good and other transmissions provide better listening. An English transmission at 0530GMT is being received on 6155, 7245 and 17740KHz. Another service in English is at 0730GMT, and reception is best on 7245 and 21670KHz.

BELGIUM: Brussells is heard in English transmissions at 2305 and 0050GMT on 15420 and 15335KHz. Reception during our summer months is poor, but the normal overseas service can be heard on several frequencies, including 21460, at 1000GMT; and at 1230GMT on 17860 and 21555KHz. A relay of the Home Service is heard from 0530GMT on 17780 and 17860KHz.

BULGARIA: Radio Sofia gives best reception in our winter months in the service to North America, but their transmissions to Europe at 1930-2000GMT can be received on 6070 and 9700KHz. A service to Africa in English is also heard at fair strength from 1905-1930GMT on 15310 and 17825KHz.

CZECHOSLOVAKIA: Radio Prague's transmission to Australia and New Zealand is from 0700-0800GMT on 15310, and 21690KHz. Additional frequencies used are 6055, 9505, 11800 and 21700KHz. From 0800-0830 a program is carried in Czech.

DENMARK: Radio Denmark discontinued its English transmissions a year ago, but when opening its services still has a short announcement in English. Reception has been at 2200GMT on 15165KHz. Transmissions at 0730, 0945 and 1830GMT, have been heard on the same frequency.

FINLAND: Helsinki is received at 0555GMT on weekdays and 0625GMT on Sundays with a short English announcement on 9555KHz. At 0955 the same announcement can be heard on 15185 prior to the opening of transmission.

FRANCE: ORTF Paris is received well in its 15-minute transmission in English at 0515GMT. This is broadcast on 7155, 9700, 11920, 11930, 15295 and 17730KHz. English programs are beamed to Africa at 1100 and 2015, and French programs at 1115 and 1930GMT, on 17720, and 21580KHz.

GERMANY (East): Radio Berlin International, in its service to East Asia, provides very good reception from 1200GMT onwards, on 17770 and 21540KHz. Another transmission at 0645-0730 on 17770KHz also provides fair reception. During our afternoons the programs to North America can also be heard 0330-0415GMT on 9560, 9650 and 11970KHz.

GERMANY (West): Deutsche Welle at Cologne has two English transmissions for Australasia. They broadcast 0920-1020GMT on 11795, 15275, 17845 and 21560KHz and again 2100-2200 on 7130, 9765 and 15275KHz. Transmissions in German to this area are on the air 0700-0910 on 9650, 11795, 17845 and 21560KHz.

GREAT BRITAIN: The BBC World Service is on the air 24 hours a day in English. Transmission periods beamed to the Pacific are as follows:

GMT	KHz
0545-0915	7150, 9640, 11955
0900-1115	11750, 15070, 21550
2000-2245	7120, 9410, 11750

London can be received on many other frequencies at this time of the year, during the hours of darkness.

HOLLAND: Radio Nederland has three transmissions in English for listeners in Australia and New Zealand. Two of these are relayed via Bonaire.

GMT	KHz
0630-0750	11730,
0800-0920	9715
0930-1050	17810, 21480

Transmissions in Dutch from Holland are at the same time as the English service, but are carried on different frequencies.

GMT	KHz
0630-0750	9715
0800-0920	11730
0930-1050	21570
1100-1220	21690

HUNGARY: Radio Budapest is best received in its North American service, but it also has programs for the Pacific and Europe. Best reception is 0400-0430GMT on 9833 and 11910KHz. The service to Europe 1930-2000GMT, is broadcast on 6110, 7100, 7220, 9833, 11910 and 17980KHz.

ITALY: Rome has a program in English to the Far East from 2200-2225GMT, on 9710, 11905 and 15340KHz. A program in Italian for Australia is broadcast from Rome 0600-0645GMT on 11810, 15340, 17795, 17815, 21560KHz.

NORWAY: Radio Norway at Oslo has a 30-minute program in English on Sundays, for the last half hour of the transmission. Two services in Norwegian are beamed to Australia and New Zealand. The first is 0700-0830GMT on 17795, 21655, 21730, 25730 and 25900KHz; the second program is 1100-1230GMT on 21655, 21730, 25730 and 2590KHz.

POLAND: Radio Warsaw is best received in a transmission to Europe 0630-0700GMT, on 7145KHz. A further service from 1900-1957GMT is on 7125 and 9525KHz.

PORTUGAL: Lisbon has programs for the Pacific on 17880 and 21495KHz from 0730-0900GMT' but this is actually one 45-minute transmission broadcast twice in succession. English to North America is received 0345-0430GMT on 11935 and 15125KHz.

ROMANIA: Radio Bucharest has English to Asia 1500-1530GMT on 17760KHz. From 1930 to 2030 a program is broadcast for Europe on 9510 and 11940KHz. From 0430 to 0500 a service to North America in English is on 9510, 9570, 11810, 11885, 11940, 15250 and 15285KHz.

SPAIN: Madrid is not heard in English as well as in former years, due to a retiming of the transmissions. The broadcasts are now at 0300-0345 on 9760KHz. Two further transmissions in English are beamed to North America, but reception of these is possible only in winter.

SWEDEN: Radio Sweden recently commenced a transmission to Australia and New Zealand 0515-0545GMT on 11895KHz. Programs beamed to the Far East can be heard 1230-1300GMT on 9715KHz, 2045-2115GMT on 9715KHz and 0330-0400GMT on 9725KHz, the latter beamed to North America.

SWITZERLAND: Berne altered its programs recently, and now broadcasts two 30-minute programs in English to Australia and New Zealand. All broadcasts are on 9590, 11775 and 15305KHz, and the languages are as follows:

GMT	Language
0700-0730	English
0730-0800	German
0800-0830	French
0830-0845	Italian
0845-0915	English

USSR: Radio Moscow transmissions to Australia and New Zealand are on the air daily from 1100GMT, and are relayed from a station in Siberia on both medium and short-wave. The transmissions best received are as follows:

GMT	KHz
1100-1130	629, 9730
1130-1200	629, 1250, 9730

VATICAN: Vatican Radio has two services to Australia and New Zealand in English at the following times, and frequencies:

GMT	KHz
1125-1140	17835, 21485
2210-2225	9645, 11745, 15155

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST, 12 hours for NZ.

SOUND PROJECTORS

Cinevox Prefect and Harmour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.

from $115.00

CIRCULAR SLIDE RULE

3¼in diameter. Will do the same work as the conventional slide rule. Instruction book included.

$1.25 each

Post 10 cents.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$25.00

(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

Please note we are now able to include ½ mile of telephone cable FREE with each set of Phones.

BATTERY CHARGERS

240 volt A.C. Input.

Each battery Charger will charge either 6 or 12 volt batteries.

2 amp without meter. **$15.75**

2 amp with meter. **$17.75**

Post N.S.W. 70c; Interstate 95c.

MINIATURE ELECTRIC MOTORS

1½ to 3 volts D.C Ideal for model boats, cars, planes, etc. Strong torque. Only

65 cents each or 10 for $4.00.

(Post 7c).

TRANSCEIVER

(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38-54 megacycles F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100 K/cs: step 10 channel per meg/cycle with power supply. Leads, mike and headphones $45, 60c cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER

(2-way radio) 62 set ideal small ships, Hams, etc. 1.6 to 10 megs. Crystal locked or V.F.O. controlled 5 watt output. Complete with antenna, headphones and mike $60. 60c cartage to rail. Freight payable at nearest attended Railway Station.

HEAD PHONES

Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphones. Ideal for use with all types of transceivers. $3.50 pair. Same with black felt muffler, $4.50 pair.

Post N.S.W 25c; Interstate 30c.

COLLINS TRANSCEIVERS

Auto-tuned 100-150 megacycles, 10 channels .. ..

$65.00

MICROSCOPE

500 x magnification, 3 turret.

$6.50.

Post., N.S.W., 55c; Interstate, 85c.

AVO MULTI METER

Type CT 38

$75.00

COLLINS IF STRIP

455 KG with 4 mechanical filter, band width 2-4-8, and 16 K/Cs, and Collins termeability tuned BFO and product deducor and audio stage.

$75.00

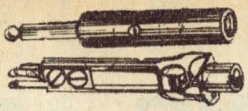
LAVOIE HETERODYNE FREQUENCY METERS

10-100 Megs. LA5. $250.00.

100-500 M/cs. $350.00.

ADLER FREQUENCY METER

100Kc-20 M/cs. $175.00.



P.M.G. Phone Jack and plugs, 25c each, 45c the pair.

Post 7c.

NIFE CELLS

1.2 Volt fully charged, 4in x 3in x 1in 4 AH.

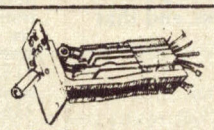
$1.00 each

Post, N.S.W., 25c; Interstate 35c.

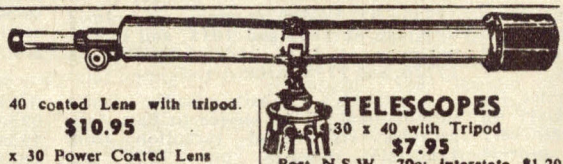
3.6V 10AH, set of 3 batteries in wooden holder. $7.50 per set. Post. N.S.W., $1.10; Interstate, $2.72.

WALKIE TALKIE TWO-WAY RADIOS

P.M.G Approved Citizen Band. 9 Transistor $57.00 per set of 2. Post, N.S.W. 50c; Interstate, 60c.



P.M.G. TYPE KEY SWITCHES. 45c each. Post, 15c.



45 x 40 coated Lens with tripod.

$10.95

30 x 30 Power Coated Lens Brand new.

$3.75

60 magnification with a 60mm coated objective lens. With tripod.

$23.00

As illustrated.

Postage, 95c; Interstate $1.20.

BC 221

Frequency Meters

$55.00

SMALL COMPUTOR PANELS

3in x 2in containing 2 valves, qty. of resistors, etc.

only 75c

Post 21c.

STEREO headphones, brand new, $7.50, post N.S.W. 60c. Interstate 85c.

TYPE S POWER SUPPLY

(240 Vac supply for AT 5-ARB) suit most types of Disposal transmitters and receivers outputs 250 volt, 10ma 550 volt 200ma, 300 volt 100ma. **$30.00**

TELEPHONE WIRE

21 gauge copper, plastic covered. Ideal telephone or bell wire. 1.320ft coil of twin (equal ½ mile) $7 per coil.

Post, N.S.W. 70c; Interstate $1.20.

SCOOP PURCHASE

Gramo Motors. New. Made in U.S.A. 4-speed 240 volt A.C. 50 cyc. Only $2.75 each.

Post, N.S.W. 30c; interstate, 40c.

CO-AXIAL SWITCH

70 ohms 4 positions, can be motor driven completely waterproof 70 ohms type connectors. Housed in metal case 9in x 8in x 8in $5.00 each. Post N.S.W 70c. Interstate $1.20.

ELECTRONIC COUNTER

(Austronic) 0-100 K/cs. 240V operated. **$150.00**

Cossor Double Beam Oscilloscope 1035. Tested. **$150.00**

Kleinschmidt 5 Unit Punch Reader and Tape Printer with Key Board. **$95.00.**

VALVES

BRAND NEW

IN CARTONS

Special discount for quantity

807	75c	CV850	$1.50
6SN7GT	95c	1H6G	30c
8989	$1.00	832	$5.00
5U4G	95c	6AK5	$1.50
EF50	35c	6X4	$1.00
5Y3	$1.75	12SK7	60c
6C4	50c	VR65	25c
2 x 2	75c	VT4C	75c
6AG5	80c	AU5	$1.00
12AU7	$1.00	80	$1.25
X61M	$2.20	6AK5W	$1.50

CATHODE RAY TUBES

3FP7	$2.95	5BP1	$3.50
3JP1	$2.95		
V1669 4/1	$2.95	CY2184	$2.95

PLEASE ADD POSTAGE ON ALL ARTICLES

TELESCOPES

30 x 40 with Tripod

$7.95

Post N.S.W., 70c; Interstate $1.20

PETROL MOTOR GENERATOR SET

BRAND NEW EX-ARMY

300 watt, 15 volts, 20 amps. Made in Canada. Complete with tools, instruction book, spares, etc. Only **$75.00**

$1 cartage to rail, freight payable at nearest attended railway station.

SELSYN MOTORS MAGSLIP Mk. II .. .. **$5.25 ea.**

No. 19 TWO-WAY RADIOS

Sold as is without power supply, leads, accessories, etc. Only $15. Or complete with above gear, $35.

BINOCULARS

PRISMATIC. Coated Lenses Brand new. Complete with case.

6 x 30	$12.50
8 x 30	$18.75
7 x 25, wide angle	$29.50
7 x 50	$22.15
10 x 50	$23.07
12 x 50	$23.95
20 x 50	$29.50

Post, N.S.W., 70c; Interstate, $1.20

3000 TYPE RELAYS

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7" x 2400' ..	$4.45 ...	46c
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C60 $1.15, C90 $1.75, C120 $2.25.

Post 13c.

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Rack Mounting Tape Recorder, ex A.B.C. 7½-15 I.P.S. Full track tested. **$150.00.**

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SORRY, NO C.O.D.

YUGOSLAVIA: Radio Belgrade is best received in English at 1830GMT on 6100KHz and 2000GMT on 9620KHz. There is a further transmission at 2200GMT on 9620KHz.

CRICKET RELAYS

Radio Australia is using two new frequencies for the relays of the cricket tests between England and Australia; 17760KHz will be used to New Zealand and the South Pacific, and 21605KHz will be beamed to Asia.

The hours for broadcasting of the ball-by-ball commentaries are 0100 to 0800GMT, in the Eastern States, and for the Adelaide game half an hour later.

Radio Australia has introduced two new frequencies for the service to Europe and New Zealand. The transmission is on the air 0645-0915GMT, and the frequencies are 11880 and 15330KHz. These channels replace 9730 and 11710KHz.

GALAPAGOS HEARD ON 6255KHz.

The first reception of the new country of Galapagos, in the South Pacific, is reported by John Mainland, of Wellington, NZ, who heard their programs to sign-off at 0450GMT. It is not normally possible to hear this signal in New Zealand at this hour until April, but it is reported that reception has been observed around 1230GMT.

According to verification letters, Galapagos has been on the air since July 20, 1969, and output is 1KW to a simple horizontal antenna. Its assigned frequency is 6175KHz, but this has been changed to 6255KHz. The schedule is 1230-1400, 1800-2000 and 2400-0400GMT. The address of the station is La Voz de Galapagos, Puerto Baquerizo, Isla San Cristobal, Galapagos, Ecuador.

BEIRUT USING 11780KHz.

Signals from Radio Lebanon are well received during their transmission to North and Central America on the new frequency of 11780KHz. Our reception has been during the English language period, 0230-0300GMT, but the transmission is on the air 0130-0400. Beirut has been using the 25M band for some years for this transmission, and has been heard on several frequencies, all at good level. The present schedule for their overseas broadcast is as follows.

GMT	KHz
1830-2030	15383
2300-0100	17715
0130-0400	11780

The first transmission is beamed to Europe and Africa, the second to South America, and the third to North and Central America.

ENGLISH FROM YVOC.

The Venezuelan station YVOC "Ecos del Torbes" has been heard by Chris Davis in Featherson, NZ. It would appear that the station has increased power on 4980KHz, and now has announcements in English, French and Italian about every 30 minutes. According to the announcement they also operate YVOA 4830, YVOD 780 and YVAC 9620. YVOC is on the air 24 hours a day, and has been heard widely in the South Pacific area around this time.

RECENT VERIFICATIONS.

HOLLAND: Radio Nederland has issued a new verification card of interest to short-wave listeners. It shows a map of the world and the various time zones. Hour zones are shown in alternate sections of light and dark blue, and the card enables one to tell the time in most parts of the world. The card does not cope with deviations of time, made for local use, but as a rough guide it is very useful. Across the bottom, the GMT 24-hour clock is shown, so it is easy to calculate GMT and local time. A report on a transmission of Radio Nederland, PO Box 222, Hilversum, Holland will be answered with this new card. Our copy was a preview, but the card should be in regular use this month.

ECUADOR: A verification received by Bob Padula of Melbourne came from "Canal Manabita" 4823KHz, Portoviejo, with a long, personal letter in Spanish from Lauro G. Fernandez G., via registered airmail, in four weeks. A very attractive blue and white pennant, and postcards of station and the city were included. They were most interested in the report, and indicated that this was the first ever received from Australia. Bob reported in Spanish with mint stamps. The station call sign is HCRF4, and the address is Cas 69, Portoviejo, Manabita, Ecuador.

HONDURAS: Station HRQ confirmed reception of a report from Bob Padula with a long personal letter in Spanish from the station manager, Francisco Elortegui. The station call is "Radio Suyapa, San Pedro Sula" and it operates on 6125KHz. The verification was received in nine weeks, and included with the letter was a multi-coloured pennant.

THAILAND: Verification from Thai TV Company on 6012KHz came in the form of a registered airmail letter from Mr Choo Na Lampans, Director. Two IRCs was sent with the report.

CHANGES FROM DJAKARTA.

Radio Republik Indonesia has been received with new programs, we have been informed by several readers. The station has been heard signing on at 0600GMT instead of 0500GMT on 11770KHz and this frequency gives good reception in New Zealand around 0900GMT. A frequency change has recently been made, and 11770KHz has been replaced by 11795 for the English program broadcast 0900-0930GMT.

Radio Angkatan Udara at Djakarta, operated by the Indonesian Air Force, is reported as still using 11325KHz, and heard at an additional time of 0800GMT. Last month we reported fair reception of this station around 1200GMT.

NEW SCHEDULES OPERATING

Radio Afghanistan at Kabaul has a new schedule in operation up to March 7 as follows.

GMT	KHz	Language
1200-1300	17780,15415,21585,	Pashtu/Dari
1730-1800	11790,15265,9530,7200,	German
1800-1830	11790,15265,9530,7200,	English
1300-1745	3390	Pashtu/Dari
1300-1400	4775	Urdu
1400-1430	4775	English
1430-1730	4775	Pashtu/Dari
1700-1730	7200	Russian

ENGLISH FROM PRAGUE

Radio Prague, Czechoslovakia, has introduced a new frequency, 21690KHz, in its service to Australia and New Zealand. The following schedule of English programs is valid up to May 2, 1971.

GMT	KHz	Area
1500-1530	6055,9505	Europe
1630-1700	5930,7345	Europe
1900-1930	5930,7345	Europe
1530-1630	6055,9605,11990,15240, 17840, 21735	Africa
1730-1830	5930,7345,9605,11990, 15240, 17840	Africa
1400-1500 (Sun)	15445.17840,21735	North America
0100-0200	5930,7345,9540,9630, 11990,	North America
0300-0400	5930,7345,9540,9630, 11990	North America
0700-0800	6055,9505,11800,15310, 21690,21700	Australia, New Zealand

FEBC REGIONAL STATIONS

As well as operating DZAS 680KHz and DZFE 1030KHz in Manila, the Far East Broadcasting Company have four regional stations in operation, and four further stations are planned. The transmitters now in operation are:

KHz	Call	Location	KW
650	DYFL	Borongan, Eastern Samar	1
1060	DXKI	Koronadal, South Cotabato	1
1300	DYGS	Guimaras Island, Iloilo	1
1430	DXAS	Jolo, Sulu	1

Construction of a new station in Davao City was commenced on July 19, 1970. The station is expected to commence operation in March and use 5KW. Other stations planned for the Gospel Network include one at Legaspi, Cauayan and Cebu.

CANADA'S INTERNATIONAL SERVICE

Radio Canada, in the period to March 7, plans to test two 50KW transmitters beamed to Europe. They will operate on 11850, 1230-2000GMT; on 15365, 1200-1600GMT and on 15375, 1600-2000GMT. From March 7 the tests will be carried on two frequencies only, 11850 and 15365 from 1200 to 2000GMT.

The daily transmissions from Montreal will continue on the 50KW transmitters on the following schedule.

GMT	KHz
0710-0805	9625, 5990
0825-0935	9630, 5970
1055-1215	17820,15325,9625
1217-1313	15325,11720,9625
1315-1343	21595,15325,11720
1345-1514	21595,17820,15320
1514-1515	21595,17820
1516-1956	21595,17820,15325
1956-1958	17820,15325
2000-2152	15325,11720,9610
2158-2230	15190,11720,9610
2230-2250	15190,9625
2258-0046	15190,11945,5970
0058-0400	11720,9625,5970
0400-0557	9625, 5970
0557-0558	5970
0558-0630	9625, 5990,5970
0630-0631	5970
0631-0706	9625, 5970.

ARDXC CONVENTION

The Australian Radio DX Club is planning a Convention in Melbourne over Australia Day Weekend, January 30-February 1. This will be the first Convention held by the Club, and members are expected from all states except West Australia. The Convention will be associated with the Annual General Meeting of the Club. Information about the

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COMPUTER BOARDS
At least four transistors on each board, plus many other parts.

	Price	Post
100 Boards	20c ea	50c
25-99	35c ea	25c
10-24	30c ea	25c
1-9	35c ea	10c

POWER SUPPLY KITS
P.S.E Regulated, variable, **$27.50**
P.S.3 7 volt, 15 Volt, 1A .. **$5.95**
P.S.4. 20 volt, 32 volt, 1A .. **$7.90**
P.S.5 18 volt, 1A .. **$6.40**
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STEREO AMPLIFIER KIT
3 x 3 Watts R.M.S.
Complete in every detail, **$46.00**
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ACTIVE FILTER UNIT
Designed to complete your System .. .. ..$
Post 50c.
Pz5 Power Supply For Z30's **$17.60**
Pz6 Regulated Power Supply **$32.45**
Post $1.00.

SPECIAL CLUB PRICES AND TRADE PRICES ON APPLICATION

"NATURAL SOUND" Magnetic Cartridges
HT 66. Good Channel Separation, 20-20,000 Hz. **$10.30**
AT 33. Exceptional Separation **$16.00**
AT21S Wide Range, Superb Tracking. Freq. Res., 10-25,000Hz **$17.85**
Post 25c

SPECIALS FOR CLUB MEMBERS

BC108 Transistor	40c
BC109 Transistor	45c
2N3055 Transistor	$1.90
2N3054 Transistor	$1.90
EM404	25c
OA91	20c
2N4443 6A 400V S.C.R.,	$1.90
2N2160	$1.50
2N5459	$1.50

Post 10c.

FOR MORE POWER!

G.T.S. CAPACITOR
Discharge Ignition.
Guaranteed 6 Months

Delux	$39.95
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Build It Yourself And Save With PRE-PAK KITS.

Capacitor Discharge IGNITION KIT
Contains all parts and simple instructions.
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HIGH PERFORMANCE AUDIO OSCILLATOR KIT



All parts, including battery. **$14.50.** Post 25c.

AUDIO AMPLIFIER KITS
Based on SL403/A
3 Watt R.M.S. **1c**
AMPLIFIER KIT
With base and treble controls **$15.90**

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As above, with power supply **$23.90**
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STEREO SIXTY
Pre-Amp and Control Unit. To suit above amplifiers, **$34.25**

SINCLAIR BUILT AND TESTED MODULES

Z30 Twenty Watt Hi-Fi Amplifier	$14.90
Z50 Forty Watt Hi-Fi Amplifier	$18.75

MAGNETIC PRE-AMP KITS
For Stereo Magnetic Cartridges **$9.00**

TECHNICAL PUBLICATIONS
Mullard Interchangeability List **1.00**
All other Mullard books Available From Stock.
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PEAK CROSSOVER NETWORKS

NT-2C 2-way Crossover 3.5KHz, 8 or 16 ohms, 30W	$7.75
NT-3B 3-way Crossover, 300Hz, 3.5KHz, 8 or 16 ohms, 30W	$9.90
NT-3E 2 or 3-way Crossover, 500Hz, 4KHz, 8 or 16 ohms, 30W	$9.90

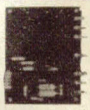
ALPHA STEREO HEADPHONES
Freq. response 25Hz—17KHz all models.

SDH-7 standard padded earphone	$7.50
SDH-7D deluxe, padded headband with 10ft spiral flexi-cord	$9.95
SDH-7DV as above, with volume control	$12.95

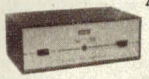
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Standard top cowl type	$2.75
Lock-down extends to 3ft 4in	$3.30
Motorised aerial 12V only	$19.00

MAGNETIC PRE-AMPLIFIER
Peak MTP-41 for tape or cartridge, with mains power supply — very attractive **$19.50**



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3.5W per channel. RMS freq. 50-20KHz ± 2.5db. Input 200mV dist 2%. Special price .. **$34.50**
Model NA1600 8W RMS per channel. Freq. response 30-25KHz, dist 1%. Inputs for magnetic ceramic, crystal, radio and tape recorder. Controls — volume, base, treble, balance, selector. **Price** **$55.00**

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Model BD-50 belt drive turntable with automatic switch-off and arm return. Complete with magnetic cartridge.
SPECIAL PRICE **$69.50.**

BSR model MA-65 Changer	$43.00
BSR model UA-50 Changer	$39.00
Peak STP-69 with base and lid, and magnetic cartridge, superb performance	$79.00

TEST EQUIPMENT

Audio Generator TE-22D. Special	$42.00
RF and IF Generator TE-20D. Special	$41.00
Jemco US-100 Multimeter 20K/Volt 0-1KV, AC and DC, res. 0-50 megohms.	$29.90
Model 200H Meter. Special	$10.50

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Pioneer PAX 20A 8in, 8W 40-20KHz	$18.25
Pioneer PAX 30M 12in 30W 43-20KHz	$33.90
Pioneer AS-200 8in Speaker Kit 25W 40-20KHz with Tweeter, Crossover, etc.	$26.00
Poly-Planar P-5 7in x 5in 60-20KHz	$9.90
Poly-Planar P-20 14in x 12in 40-20KHz	$23.00

WORLD SERVICE SCHEDULE

The BBC World Service frequencies and times for January, 1971 are unchanged from those of December, 1970. These were published in our December issue, page 177.

Convention can be obtained from the Australian Radio DX Club, PO Box 227, Box Hill, Victoria, 3128, Australia.

TANZANIA EXTENDS SCHEDULE.

Radio Tanzania at Dar-es-Salaam has extended its English programming, and now has three transmissions each day. In the past the only service on short-wave was the External Program, 1700-1900GMT on 15435KHz. The service in English, and this External Service, have now been combined to be broadcast as follows:

GMT	KHz
345-0445	4785, 6105
0900-1030	7280
1600-1945	4785, 15435

The address of Radio Tanzania is PO Box 9191, Dar-es-Salaam.

GOSPEL RADIO FROM SA

From its recording studios in Johannesburg the South African General Mission distributes programs which are used by the South African Broadcasting Corporation and also by stations in Swaziland and Botswana.

The Mission is spending $120,000 for aerials on Seychelles to enable the program of the Far East Broadcasting Association to be beamed to Africa. At present the programs of FEBA are beamed to India and Pakistan, and these have been heard in our area since they increased power to 40KW. The new aerials will be located on the side of the Seychelles closest to the African mainland, and should serve most of central and southern Africa.

EXPANSION OF RADIO PAKISTAN

"Sweden Calling DXers" gave some details recently of the broadcasting plans of the Pakistan government. This follows a similar announcement recently by All India Radio.

Khulna, East Pakistan, has been carrying out experimental broadcasts on 1340KHz at 1300-1430GMT. Transmitters of 1000KW for medium-wave are being installed at Dacca and Islamabad. The Dacca transmitter is expected to go into operation in 1973, while two 100KW short-wave units are to be installed at Islamabad. The 5KW short-wave transmitter at Lahore is to be replaced by a 10KW transmitter. A 150KW medium-wave transmitter will be installed at Quetta, and 120KW transmitters are planned for Multan and Hyderabad.

Hyderabad is to have a 100KW short-wave transmitter according to a press release from the Director General of Radio Pakistan.

BROADCASTING RECORD

Something of a record for broadcasting on international short-wave must have been made by Arthur Cushen in the first week of November 1970. During that week, his voice, on tape, was broadcast 33 times on international short-wave stations in Holland, Hungary, Sweden and New Zealand and over the Bonaire relay station.

Radio Sweden carried a tape on the introduction of the new service to Australia and New Zealand 11 times in its transmission; Radio Nederland carried Arthur Cushen's monthly "Pacific DX Report" 12 times in its DX Juke Box program that week; Radio Budapest, Hungary in its DX session carried a special talk, recorded, at their request, about Radio New Zealand and short-wave broadcasting in the South Pacific in general in seven of its transmissions; and Arthur Cushen's DX World program on Radio New Zealand was carried in three transmissions from Wellington.

BROADCAST BAND NEWS

AUSTRALIA: We list elsewhere in this issue details of the Australian stations which are to change frequency, and also details on projected stations. Station 7QT Queenstown, in Tasmania, has changed from 720 to 840KHz. At present there are 11 ABC stations and 17 commercial stations using directional aerials.

PHILIPPINES: Station DYLV in Cebu City, on 1450KHz, has confirmed our reception with a card. The station uses 1KW and is on the air 24 hours a day. Verification came from the Manager, Camilo A. Hermosa, Radio DYLV, President Hotel, Cebu City, Philippines.

NEW ZEALAND: The Broadcasting Authority has now granted its sixth private commercial licence. This was awarded to Radio Whakatane Ltd. The proposed station will serve the eastern Bay of Plenty area, which has no station at present. Frequency and call sign have not been allocated. The station plans a schedule of 1700 to 1230GMT, seven days a week.

Valley Broadcasters, in Hutt Valley, Wellington have made application for a station to serve the Wellington suburban area. The licence hearing has been held, and the result of the application is expected to be known shortly.

FLASHES FROM EVERYWHERE

ASIA

NEPAL: According to an item in "World Radio Bulletin", Radio Nepal is now dealing with a backlog of reports going back to more than two years. All are being verified by a detailed card signed by K. B. Khatry, Chief Engineer.

JAPAN: Radio Japan is using the new frequency of 11840KHz, 1200-1530GMT, to South-East Asia. This frequency replaces 11920KHz. The General Service beamed to North America is also on new channels, and is now broadcast 2200-0030 on 17785KHz, 0100-0330 on 15105KHz, 0400-1830 on 9505KHz, 1900-2130 on 15105KHz.

KUWAIT: Radio Kuwait has changed its frequency for its evening transmission in English, 1900-2100GMT. This program is now on 11845KHz and consists mainly of light music. A transmission on Sunday from 1930 to 2030GMT consists of an hour of jazz. The transmission on this frequency is for reception in Europe. Another frequency, 4967KHz, is for reception in the Kuwait area.

PHILIPPINES: Station DUH2 is now being received on a new frequency, 6165KHz. This replaces 6170KHz, but seems to suffer more interference, particularly from VTVN in Saigon. The station, operated by the Philippines Broadcasting Service, has news in English at 1000GMT.

PAPUA, NEW GUINEA: Station VL8BM at Port Moresby has been heard at fair level by James Stack, Gladesville, NSW, on 11880KHz. Broadcasts were noted from around 0445 to sign-off at 0530GMT. Another transmission is observed from 0100-0200. Most of the program material consists of news for the stations of the Australian administration in the area. The power of the transmitter is 10KW.

THE AMERICAS

BRAZIL: Station ZYC7 on 6115KHz is seldom reported because of the use of this frequency by Radio Union in Lima. Since Radio Union has discontinued its 24-hour-a-day operation we are now hearing ZYC 7 opening at 1000GMT on Sunday. The station has the slogan "Radio Tamoio" and is located in Rio de Janerio. The program included music and commercials at the commencement of the transmission and this was followed by light music.

Radio Universo de Curitiba is a new name for Radio Emissora Paranaense. The station broadcasts on 9545KHz from 0900 to 2100GMT. ■

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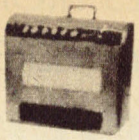
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14-watt, 4 Inputs. Base and Treble Boost. 2 Twin-cone Speakers, $63
17-Watt 4-Channel. Base and Treble Boost. Two Twin-cone Speakers $76.25

35 WATT

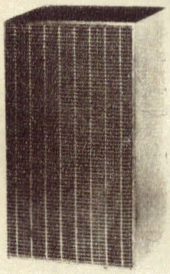
4-Channel. Bass and Treble Boost 4 Twin-cone Speakers, $109.05
Vibrato with foot control and 2 preset controls for frequency and intensity. $16.50 extra on above models.

50 WATT SOLID STATE GUITAR AMPLIFIER

E.A. July and August Issue
Kitset, including Cabinet.
$98.00
Wired and Tested.
$114. 00

3" VERNIER DIAL

8:1 Ratio
$2.95, Post 25c.

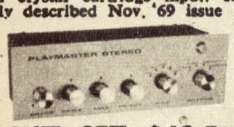


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Designed bookshelf enclosure with 6WR twin cone and 3TC tweeter $24.75 ea
Super bookshelf enclosure with 2 x 6 WR . . . . . $36.75 ea.
Hi-Fi enclosures with magnavox 8WR or Rola C8MX . . 8 watts RMS . . . . . $36.75 ea.
With 2 x 8WR or 2 x 8CMX 15 watts . . . . . $45.00 ea.
With 12WR—10 Watts $45.00 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 — Innerboard 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 $95 00
Wired and Tested $109.00

CAPACITOR DISCHARGE IGNITION SYSTEM

Kit of parts as per E.A. Aug. 1970
$27.95

LOTRING LIGHTWEIGHT SOLDERING IRON

240V AC. 30 watts $6.50
12V DC 30 watts $6.50
Weight 2½ozs.
Heating Time 1.8mins.

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

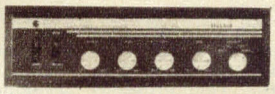
MODEL TE-65 V.T.V.M.

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.

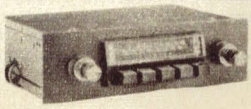
HI-FIDELITY TWIN CONE SPEAKERS

Aust. made. 8 to 16 ohms.
6in . . $9.00
8in . . $7.50
8in . . $9.50
10in . . $10.75
12in . . $12.75
Postage:
Interstate 80c.
N.S.W.. 50c.

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



8 TRANSISTOR CAR RADIOS

R.F. Stage for long range reception. 6 or 12 volt operation. On ordering please state polarity requirements complete with lock-down aerial and lead.
Speaker Selection. 5", 6", 8", 7" x 5" or 6" x 9".
De Luxe Push Button Model, $55.75.

LEADER SIGNAL GENERATOR LSG 11

240 V AC operated. 6-band 120 KC to 390 Megs. Provision for crystal.
Post N.S.W., 75c; Interstate $1.25.
$49.50

ORGAN KEYBOARDS

49-Note. Complete with Switching System.
$72.00
13-note. Pedal Claviers. Complete with Switches.
$39.95

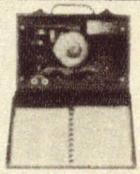
WIDE BAND OSCILLOSCOPES

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.

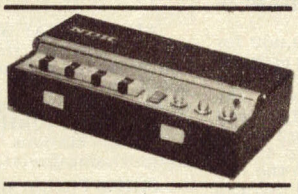
Synchronisation Devices Internal (Positive and Negative, External).
Power 240v AC 50/60 cps.
Cathode Ray Tube 3KFIF.

3-inch $102.75



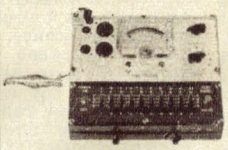
BENDIX B.C. 221

Frequency Meter, 125 KC—20 MCS. Complete Calibration book —100 KC crystal. 240 V AC supply.
BRAND NEW . . . . . $75.
USED GOOD ORDER . . $49.50



NEW GRAMMO MOTORS

240V. A.C.
3 Speeds, $2.75.
Post: 40c.



VALVE TESTER

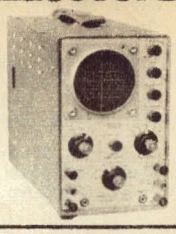
Test all valves, diodes, rectifiers, checking filaments, shorts. Merit on direct reading. Good-bad meter. Complete with tube chart.
$28.75
Pack and Post, $1.25.

STEREO RECORD CHANGER

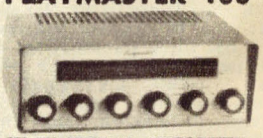
Current models, 4 speeds, automatic or manual operation.
Standard model $28.50
Ceramic cartridge, Sapphire Stylus Standard model with 12in turntable $34.00
Deluxe model with 12in turntable. Cueing device, Ceramic cartridge Diamond Stylus $40.00
Deluxe model as above with — adjustable counter balance, 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.

12V 2 AMP. TRANSFORMER

240 VAC 50CPS prim.
$3.00
Pack and Post. 50c.



PLAYMASTER 106



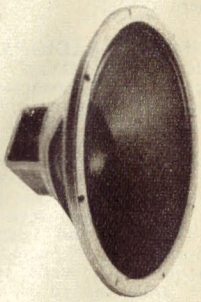
HI FI STEREO AMPLIFIER
10 watts R.M.S. per channel. Freq. Response 30-20,000 cps. Inputs—crystal or ceramic cartridge. Tape. Separate bass, treble, balance. High gain broadcast band tuner. Slide rule dial. Excellent reception in country areas.
WIRED AND TESTED $94.75

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.

AUTOMATIC RHYTHM BOX

12 RHYTHMS
9 PERCUSSIVE INSTRUMENTS
240v A.C. OPERATION.
$145.00



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

DYNAMIC LO-IMP STEREO PADDED HEADPHONES

With cord and stereo plug.
$3.50
Pack and Post., 50c.

A. AMPLIFICATION
C. COMMUNICATION
E. ELECTRONICS

★★★★★★★★★★★★★★★★★★★★

PHONE 51-3845
51-7008

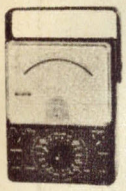
RADIO

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-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-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-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.

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.

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.

S.W.R. METER

0-100MCS.
1KW. POWER OUTPUT.
$14.75
Pack and post 75c.

HI-FI STEREO HEAD PHONES



DE LUXE MODEL WITH INDIVIDUAL TONE CONTROL
$12.95

20—12000 cps $6.75
20—18000 cps $9.00
Pack and Post 35c.

SIGNAL INJECTOR

MODEL 250-B.
TRANSISTORISED.
$7.95

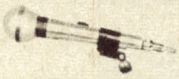
SIGNAL TRACER

Operates in conjunction with 250-B
$4.95

"ORAL" CASSETTE

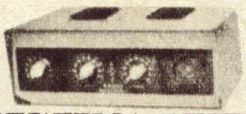
TAPE RECORDER
Transistorised. Battery operated.
$28.75
Pack and Post 75c.

DYNAMIC MICROPHONES



CARDIOID. UNI-DIRECTIONAL
On-off switch. Hand held or stand mount.
Freq. response: 80-10,000 cps.
Sensitivity—60DB/1000 cps.
Model—UDM-103.
50K-600 ohms $16.45
Model UDM-104. 50K .. $13.95
Model UDM-3. 50K .. $12.95
(Stand mount only.)
Hi Imp Dynamic DM 203 $8.75
Crystal Lapel $1.75

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 $49.50
50 Watt $69.50
50 Watt 240 A.C. plus 12v. D.C. $89.00
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.
$15.25
Line Output Transformers to suit.
$1.75 extra.

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.
$31.50

3 WAY HI-FI

Speaker System. Imp. 8 ohms
20 watt 8" woofer, 30-3000 cps $17.50
30 watt Mid Range 6", 600-10000 cps $9.50
40 watt horn tweeter. 5000-22000 cps $7.95

ELECTRIC GUITAR

PICK-UP UNITS.
Separate volume, tone control.
$9.75

SPEAKER COLUMN

VINYL COVERED—TEAK—
33in x 10in x 10in. Complete with 4 heavy duty 6in Speakers. 25 watts— 4, 8, or 16 ohms.
$32.50

TAPE CASSETTES

TENSILISED MYLAR

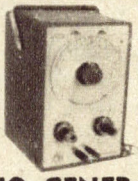
C 60 .. .. $1.25
C 90 .. .. $2.00
C120 .. .. $2.75
Head Cleaners $1.75

MECCA-SOUND MATE SOLID STATE CASSETTE TAPE RECORDER

2 track, mono. 8 transistors. Battery operated. Auxiliary input for recording records, TV, radio. Complete with microphone with remote control switch and table stand. Provision for external 7½V DC supply. Battery record level indicator.
$54.00
Pack and post 75c.

NEW RECORDING TAPE

7in Mylar L.P. 1800ft .. $3.75
7in Mylar D.P. 2400ft .. $5.00
3" 300ft Poly 50c
5" 900ft Poly $2.50
5" 1200ft $3.00
5" 1800ft $3.65
7" 1200ft Acetate $2.50
5" 500ft Acetate $1.50



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

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

IMPORTED COMPONENTS

PO BOX 1683P MELBOURNE 3001

1N645	0.84
1N660	0.69
1N914	0.51
1N3491+R	1.12
1N3492+R	1.35
1N3493+R	1.80
2N174	5.46
2N277	3.77
2N278	4.32
2N301	2.66
2N301-A	3.84
2N384	2.88
2N404-A	1.74
2N406	1.01
2N417	1.77
2N441	3.08
2N443	3.51
2N456A	4.20
2N458A	6.12
2N489B	14.76
2N649	2.12
2N657	4.79
2N696	1.13
2N706A	1.08
2N930	1.80
2N1038	3.92
2N1046	17.94
2N1073B	11.60
2N1100	7.23
2N1302	1.01
2N1303	1.01
2N1304	1.13
2N1305	1.13
2N1306	1.32
2N1307	1.32
2N1308	1.64
2N1309	1.64
2N1563	5.45
2N1908	24.47
2N2101	2.55
2N2147	2.24
2N2148	1.68
2N2188	2.79
2N2189	3.57
2N2270	2.64
2N2646	2.19
2N2996	3.15
2N3005	5.32
2N3053	2.48
2N3055	2.63
2N3525	3.17
2N3563	0.90
2N3564	1.08
2N3565	0.86
2N3566	1.01
2N3567	1.08
2N3568	1.08
2N3569	1.23
2N3638	0.90
2N3638-A	1.13
2N3641	1.13
2N3642	1.26
2N3643	1.26
2N3644	1.13
2N3645	1.44
2N3646	0.90
2N3691	0.85
2N3692	0.90
2N3693	0.86
2N3694	0.90
2N3702	1.01
2N3703	0.96
2N3704	1.77
2N3705	1.73
2N3706	1.65
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
2SB407	3.30
2SB474	3.30
3N140	2.55
3N141	2.34
20A2	0.78
20A4	0.91
20A6	1.04
20A8	1.21
AA119	0.36
AB1101	1.20
AB1102	0.87
AB1136	0.54
AC107	2.28
AC125	0.96
AC126	0.96
AC127/128	2.21
AC127/132	2.16
AC128	1.05
AC132	1.05
AC172	1.20
AD149	2.45
AF114N	1.08
AF115N	1.08
AF116N	0.93
AF117N	0.93
AF118	2.52
AN1101	0.60
AN1102	0.68
AN1103	0.60
AN1104	0.60
AN1105	0.60
AN2001	0.45
AN7102	0.90
AN7105	0.68
AS147	0.66
AS148	0.63
AS208	1.25
AS300	0.77
AS301	0.80
AS306	0.81
AS307	0.81
AS308	0.81
AS310	0.81
AS311	0.77
AS312	0.77
AS313	0.81
ASY73	2.12
ASY76	2.10
ASY77	1.83
ASY80	1.68
ASZ16	3.03
ASZ18	2.91
ASZ20	0.98
ASZ21	2.16
AT316	0.68
AT318	0.68
AT319	0.69
AT321	0.69
AT322	0.63
AT323	0.68
AT324	0.68
AT325	0.83
AT331	1.02
AT337	0.75
AT338	1.50
AT341	0.69
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	1.70
AX1132	1.50
AX1142	1.20
AX1143	1.58
AX1144	1.44
AX1166	1.37
AX1284	1.41
AY1101	0.68
AY1102	1.04
AY1103	1.35
AY1104	1.35
AY1108	1.65
AY1110	1.50
AY1112	0.69
AY1113	0.69
AY1114	0.60
AY1115	0.60
AY1116	0.68
AY1117	0.68
AY1119	0.60
AY1120	0.98
AY1121	0.98
AY6108	1.65
AY6109	1.65
AY8108 (AY8103)	3.75
AY8109 (AY8104)	3.00
AY8112	6.75
AY8113	6.08
AY8115	2.25
AY8116	1.80
AY8117	9.15
AY8135	5.40
BA100	0.44
BA114	0.39
BC107	0.83
BC108	0.76
BC109	0.91
BC147	0.76
BC148	0.68
BC149	0.79
BC157	0.89
BC158	0.76
BC159	0.89
BC177	0.91
BC178	0.84
BC179	0.92
BC186	0.79
BCY10	2.59
BCY11	3.24
BCY12	3.14
BCY39	5.19
BCY71	2.05
BCZ10	1.95
BCZ11	2.37
BCZ12	2.16
BDY20	3.51
BF115	0.87
BF145	0.64
BF167	1.08
BF173	1.15
BF177	1.63
BF178	1.80
BF179	2.04
BF184	0.72
BF185	0.72
BF194	0.67
BF200	1.32
BFY51	5.19
BS19	2.16
BSY11	8.43
BT110A/500R	3.00
BTY79/100R	2.70
BTY79/200R	3.03
BTY79/300R	3.45
BY126/200	0.48
BY126/400	0.56
BY126/500	0.63
BY127/800	0.78
BYX21L/200+R	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
BZX70 Series	1.95
BZY88 C3V3 to C11	0.83
BZY88 C12 to C30	0.98
BZY95 Series	2.16
BZY96 Series	2.16
BZZ14 to 29	2.37
C106Y1	2.10
C122D1	3.78
D13-T1	1.95
DTG110B	6.96
DTG1010	15.16
EM402	0.45
EM404	0.63
EM406	0.78
EM410	1.39
FPT100	1.80
H35	8.07
MB05	1.88
MB1	2.03
MB3	2.65
MB6	3.39
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
OC74	0.96
2-OC74N	1.92
OC75N	1.49
OC140	1.95
OC141	2.60
OC201	3.78
OC202	3.68
OC915	2.21
OCP70	2.59
OCP71	4.32
ORP12	0.93
ORP60	1.77
PA40	4.83
PB40	7.28
SC40D	8.55
SC50D	13.05
SD55	0.63
SE1001	1.13
SE1002	1.20
SE1010	1.80
SE2001	0.98
SE2002	1.20
SE3030 (AY8112)	6.75
SE3031 (AY8112)	6.75
SE3032 (AY8113)	6.75
SE3033 (AY8114)	4.72
SE3035 (AY8114)	4.72
SE4001	1.05
SE4002	1.13
SE4040	1.20
SE5001	2.10
SE5002	2.10
SE5003	2.48
SE5020	4.05
SE5023	3.15
SE5025	1.35
SE60010.75SE6002	0.90
SE7001	4.05
SE7002	3.60
SE7070	4.05
SE7020	5.40
SE8001	4.05
SE8002	4.50
ST2	1.47
TIC44	1.68
TIC45	1.92
TIC46	2.03
TIC47	2.27
TIS37	2.36
TIS43	2.36
40360	2.48
40361	2.49
40406	1.80
40407	1.31
40410	1.65

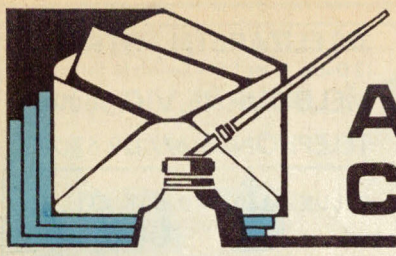
F.E.T.'S

2n4889	2.70
2N5459 (MPF105	1.60
2N5485 (MPF106)	1.77
2N5245 (TIS88)	2.62
2N5458 (MPF104)	1.77
MPF102	1.77

INTEGRATED CIRCUITS

FUL900	1.20
FUL914	1.20
FUL923	2.25
FUL719	5.25
FUL723	7.27
FUL739	5.25
PA222	3.12
PA230	4.29
PA246	13.57

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ANSWERS TO CORRESPONDENTS

FILE NUMBERS WANTED: I have been reading your magazine for only eight months but I must say that is is the best I have tried. I intend to build a good stereo amplifier system using one of your projects, but am having difficulty finding the file numbers. Could you tell me the file numbers of the Playmaster units numbers 115 and 127, the Musicolour, the Basic Stereo Amplifier, and the two 10 Plus 10 amplifiers. Please state whether the designs use valves, transistors or integrated circuits. Do you have any relatively strong output valve radios for use in the home? Could you briefly explain what DXing is? **(G.K., Kooweerup North, Vic.)**

● We are pleased you find our magazine so enjoyable G.K., we will endeavour to keep up the standarda. The information you request on the various projects is as follows: Playmaster 115 stereo amplifier, published in April 1967, File No. 1/SA/25, uses transistors including FETs; Playmaster 127 control unit, published in November 1969, File No. 1/SC/8, uses transistors and ICs; the Musicolour, sound control of coloured lights, published in October 1969, File No. 2/PC/8, uses triacs and diacs; Basic Stereo Amplifier, published in June 1966, File No. 1/SA/24, uses "junk box" valves; the 10 Plus 10 Amplifier with overload protection, published in April 1969, File No. 2/SA/30, uses transistors. The original 10 Plus 10 amplifier is no longer preferred. We are not sure what you mean by "relatively strong output" valve radios. If you require a means of picking up normal broadcast stations and obtaining from these an output loud enough for normal lounge room listening, any of our standard receivers will meet the requirement. The last valve receiver we published in this category is the ABC Five, of August 1966, File No. 5/ACR5/47. On the other hand, if you require an output of 10W or more, we would suggest the use of a tuner with your normal audio amplifier. The latest valve tuner which we published was the Playmaster 114 Program Source of September 1966, File No. 2/TU/24. Copies of each of the articles mentioned above may be obtained through the Information Service for the usual fee of 20c per article. Incidentally, it is not necessary to quote File Nos. when ordering a project through our Information Service. If you can quote a File No. it certainly helps, but it is sufficient to quote the name or the description of the project plus, if possible, month and year of publication. Briefly, DXing can be described as the hobby of receiving long distance (DX) signals for the sake of logging these long distances, rather than from necessity. It is often applied to normal broadcast signals, but could apply to amateur signals or, in some parts of the world, to television signals. If you read "Listening Around the World" each month, you will pick up some valuable tips on the hobby.

MODEL CONTROL ENTHUSIAST: I add my compliments to those of many others on the fine quality of your magazine. I am particularly pleased that you have begun to publish radio control circuits, a sphere of electronics which I feel you have previously disregarded. I am a high school student, and particularly interested in radio control for models. I am interested in a converter, all-transistor, specifically for 50-51MHz. If possible I would like it to cover from 30 to about 200MHz. Have you published such a circuit? Could the front end, up to coil L3, of the 1970 Fremodyne be used in conjunction with the 1970 All-Wave Two, and if so, what form would the coupling take? **(D.O., Brighton, Vic.)**

● Thank you for your comments, D.O. We expect to publish articles from time to time on model control but, at the moment, we have nothing on the stocks. We have described a number of 50MHz converters, the latest being in the March, 1963 issue. Reprint material for this article is available through the Information Service for the usual 20c fee (File No. 2/CV/17). We see no reason why the front end of the Fremodyne should not be used with the All-Wave Two, but our staff does not have the time to sit down and work out the method of interconnection. If you want to experiment in this direction, this could be useful experience, but if you do not feel you have the level of knowledge required, it might be better not to get involved with such modifications for the time being.

STATIONS LIST: I follow your lists that you publish each January on the medium wave radio stations, but I notice that you mention only Australia and New Zealand. Would it be possible for you to include a list of some of the medium wave stations on some of the islands, such as Fiji? Can you send me a list of the frequencies and call signs of these stations? Do you know the call sign of the new station at Streaky Bay-Ceduna on 670KHz, the frequency and call sign of the new commercial station at Alice Springs and of that at Gosford? Also can you tell me the frequency and call sign of the new station to serve Bourke-Cobar-Brewarrina? Finally, can you send me a list of American radio stations or, if not, tell me where I can obtain them? **(R.C., Marrickville, NSW.)**

● You may have noticed, R.C., that our list covers the broadcast stations of Australia's overseas territories. But whether we should extend the list any further is another matter. The problem is where to draw the line. Do we include all Pacific islands? Do we include parts of South-East Asia? We feel that it is safer to draw the line at listing stations in the areas where the majority of our readers live. And, as you may have noticed, both the Australian and New Zealand lists are expanding every year. You can obtain details of the Pacific (and American) stations from the World Radio and TV Handbook which is published each year and is available from most large booksellers or through our short-wave contributor, Mr Art Cushen. Incidentally, our section "Listening Around the World" each month regularly includes news of the broadcast band. The call sign of the Streaky Bay-Ceduna station is 5SY. The station at Alice Springs will be 8HA operating on 900KHz. The Gosford station will operate on 1310KHz, but no call sign has been allotted to date. The station for North-Western New South Wales will be located at Byrock with the call sign 2BY and operate on 660KHz.

100 WATT GUITAR AMPLIFIERS: Will "Electronics Australia" be publishing details of a guitar amplifier with a 100-watt output in the near future? A cousin of mine plays a guitar in a group and it seems that an amplifier with a power capability such as this is the fashion these days. He feels that your previous 50

"ELECTRONICS Australia" Information Service

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 G.P.O., Sydney, N.S.W. 2001: 5/69

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26,640 MHz	27,095 MHz	27,425 MHz
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26,790 MHz		27,880 MHz

PRICE $3.50 EACH.

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HC6 Holders, ½ inch spacing.

Channel A	Transmit	4,051.55 KHz
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Channel B	Receive	10,285.71 KHz
Channel C	Transmit	4,059.61 KHz
Channel C	Receive	10,296.14 KHz
Channel Z	Transmit	4,048.88 KHz
Channel Z	Receive	10,411.55 KHz
Channel 4	Transmit	4,066.66 KHz
Channel 4	Receive	10,278.57 KHz
Channel 1	Transmit	4,058.33 KHz
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100 KHz Marker	$12.00
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2,524 KHz	2,739 KHz	6,280 KHz
2,603 KHz	2,979 KHz	6,735 KHz
	4,095 KHz	

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Specifications:

Circuit: 13 Transistors, 1 Diode, 1 Thermistor. Range: Up to 10 miles (depending on terrain, etc). Frequency: 27.240 MHz (PMG approved). Freq. Stability: Plus or minus 0.005 per cent. Transmitter: Crystal controlled, 1 watt. Receiver: Superheterodyne, Crystal controlled. Antenna: 13 Section Telescopic. Power Source: 8 UM3 1.5 volt pen batts. Size: 8¼in x 3¼in x 1¼in. Weight: 25oz. Other features: Leather carrying case, battery level meter, squelch control, earphone jack, AC adapter jack, etc.

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3DX	15 ohms	" " $3.95	Post 20c
6A7	8 ohms	" " $5.50	Post 40c
6A7	15 ohms	" " $5.50	Post 40c
8A7	8 ohms	" " $7.20	Post 40c
8A7	15 ohms	" " $7.20	Post 40c
12CMX	8 ohms.	$10.75	Post 80c
12CMX	15 ohms.	$10.75	Post 80c

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Type 2N441	.. Price $2.40.	Post 10c
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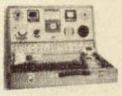
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and 60 watt designs will not meet his requirements. My congratulations on an interesting and informative magazine. (J.G., Glenunga, SA.)

● At this stage, we have no plans for publishing a guitar amplifier with such a power capability. We did publish a 100-watt PA amplifier in the July 1960 issue (File No.1/PA/19). This unit uses valves. Thank you for the comments about the magazine.

THEREMIN: I am intrigued by the connections around the 2N5459 FET in the Theremin circuit published in the June 1969 issue of "Electronics Australia". This seems to defy all the conventional set-ups uin which FETs are used. Also, the 33K resistor is marked with an asterisk on the circuit, but I have been unable to find the section of the text which this is supposed to note. (r.A., Mayill, SA.)

● As we noted in the text on page 101 of the article, this particular FET circuit makes use of the fact that the drain-source resistance can be modulated by a DC control voltage applied between gate and source electrodes. No DC current flows through the FET so the fact that the source is connected to the positive supply rail is immaterial. The asterisk on the 33K was supposed to draw attention to the fact that it may have to be adjusted to suit FETs which have a low "pinch-off" voltage.

YOUTH CLUB, MAGAZINE: I am 13 years old and an ardent electronics enthusiast. I formed an electronics club in March 1969. We named the club "E.C." and had weekly meetings. We are printing a monthly magazine, the first issue (enclosed) being called "E.C.M.". We intend to appoint a better name; "Radiotronics". Our first issue (two pages) was printed by the Science Department at East Hills Boys High School. Could you possibly mention it in your magazine? I am also writing to obtain information about transceivers with a range of 2 to 3 miles (circuit, cost, parts list, etc). (J.S., Panania, NSW.)

● Good luck with your club and your publication. You'd better think again about the name, however, because "Radiotronics" is the name of a publication put out by the Amalgamated Wireless Valve Co Pty Ltd. Readers tend to grumble because we keep saying this in these columns, but it is illegal to build and operate simple transceivers or transmitters of the type you have in mind. Transmitters other than those used by licensed amateurs in the amateur bands must be type-approved by the Radio Branch of the Postmaster General's Department and, even then, may only be operated in accordance with a licence granted by the same department.

NOISE GENERATOR: I am a young reader of your fine magazine. I enjoy making audio sound effects and would like to see more projects of this nature. I know that you have published many circuits but I have not seen a white generator or any similar devices. Also, I am thinking of building the CRO described in your August, 1968 issue. Have you made any modifications or extended its uses? (S.G., Dee Why, NSW.)

● We have published several audio white noise generators, the latest appearing in February 1965 (File No. 7/N5). We have no immediate plans for the development of any further sound effect circuits. The 1968 oscilloscope is our latest design and is unchanged in its design or use. Copies of this article (File No. 7/C/25) and of the noise generator article are available through the Information Service for 20c each.

RECEIVERS, MF to SHF: Can you supply me with plans for a "set" of receivers capable of being tuned to all frequencies from MF to SHF. I should like them to be of good sensitivity and transistorised, one set to receive the MF and HF bands, and three to pick up the VHF, UHF and SHF bands respectively. Can you tell me what the space frequencies are, as used for scientific satellites, etc, and where I may obtain plans for a small "all bands" dish antenna? (G.S., Claremont, Tas.)

● We assume from the general tone of your letter that you have had very little experience in electronics as yet, and to think about UHF and SHF receivers and dish antennas is, frankly, somewhat unrealistic. We have never published designs for receivers operating in these frequencies, mainly because there is little demand for them, but even the most experienced constructors are likely to encounter serious difficulties at these frequencies. Our Deltahet receiver, originally published as a valve design in 1963 and 1964, is currently being redesigned with solid state circuitry, and this will provide reception on the MF and HF bands, with single-sideband facilities, but this is a project for the advanced constructor. We do not have on file a listing of space communications frequencies, but we did publish in our August, 1969 issue a listing of the frequencies used for the USA's Apollo missions.

STUDENT READER: I am a 14-year-old student. I have read only two of your magazines, but have become very interested in electronics. Could you please advise me of a simple project which I could purchase with little expense. Also, could you advise me of a manual which explains the terms of electrronics. (J. N., Taree, NSW.)

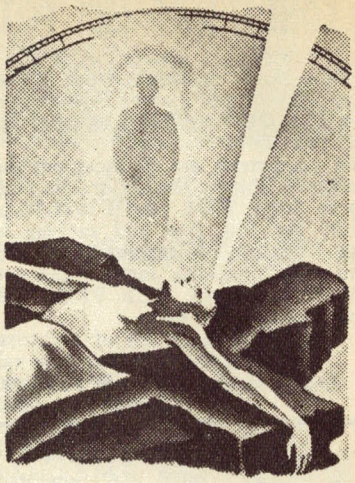
● We regularly publish projects intended specifically for beginners in electronics. If you could write to the Information Service indicating the type of project in which you are interested, we will probably be able to help you. Our publication, "Basic Electronics", explains the principal terms in electronics as well as teaching the fundamentals of the subject. You should find this of considerable help at this stage of your studies. Copies are available through the Information Service for $2.20 including postage.

THE NUMBER IS UP!

I wonder if you could help me with a problem regarding the number of values there are in resistors. I recently ordered a full complement of resistors from a firm, three of every value in 1W that they had. Now I have put them into trays, I realise that there are many values in between the ones I have. Can you possibly supply me with a list of all the resistors there are from about ½-ohm upwards? I have a similar problem with capacitors. (C. T., Charters Towers, Qld.)

● No, we don't have such a list, but you can work a few figures out for yourself. Based on a coarse, 20% tolerance, the values from 1 to 10 ohms would run: 1, 1.5, 2.2, 3.3, 4.7, 6.8 and 10 ohms. Following the same sequence, they would then run 10, 15, 22, 33, 47, 68 and 100 ohms. You could work the sequence back down to 0.1 ohm and up to 10 megohms. That would add up to quite a lot of resistors, using the widest tolerance as a basis. If you divide each decade on the basis of 10% tolerance, you involve roughly twice as many values. The sequence then is: 1, 1.2, 1.5, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, 10. That is probably as far as you need go, but it is not the end. For the purpose of closer tolerances, the sequence can be modified again and again. Capacitor values are allotted on a similar basis but, in practice, they seldom go beyond the 10% sequence.

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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.

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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.

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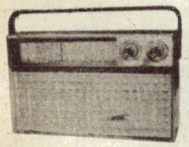
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Post N.S.W., 75c; Interstate, $1.25.

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- Dial calibrated for all States.
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Stereo Kit **$8.50.**

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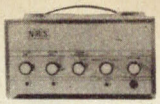
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NEW IMPORTED SLOT CAR KITS AT LESS THAN HALF PRICE



Complete kit of parts, including 12V motor and full instructions.

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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

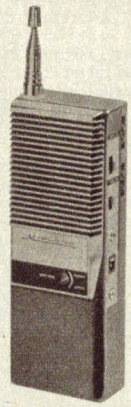
SPECIFICATIONS

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.**

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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.

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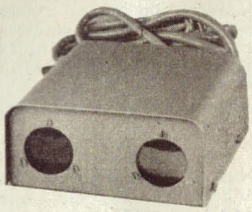
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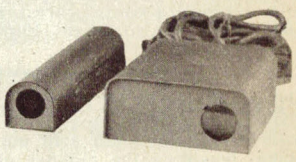
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ANSWERS—continued

MODEL ROCKETRY: In your magazine recently, a reference was made by R.D., of Townsville to model rocketry. If R.D. would like to contact me on requirements, restrictions, etc, associated with such a hobby, and whether there are magazines or books available on the subject, I would appreciate it. My name and address are as follows: **Mr G. McKechnie, 11 Olga Ave, Horsham, Vic 3400.**

● There you are, R.D. Countdown for blast off!

MUSICAL PROBLEM: Many groups are currently using amplified wind instruments. The quality of reproduction from a trumpet, sax, clarinet or trombone is tremendously improved when an integral pickup (inserted into a hole drilled into the instrument) is used instead of playing into a microphone. I am currently using the American R & B pickup, which has an impedance of 1000 ohms, and I am delighted with the results. Recently I heard a trumpeter employing the same pickup produce a tremendous variety of sounds, using a special unit between the pickup and the amplifier. At the depression of a foot switch, he was able to produce the sound of a flute, trombone, etc. Unfortunately, he knew nothing about the workings of the unit, which had been brought in from America for him by a friend. I imagine that the circuitry is similar to that used in an electronic organ. I have sent a letter similar to this to eight of your advertisers, without turning up what I want. Can you help? **(A. W., Waverley, NSW.)**

● It is not difficult to visualise the general nature of the unit you refer to. It would almost certainly consist of a preamplifier to raise the signal from the microphone to a level at which it could be conveniently "processed". Then would come one or more stages incorporating the kind of format filters found in electronic organs, followed by an output network allowing the unit to feed into a standard amplifier through a length of cable. It is easy enough to visualise but a good deal of work would be involved to translate it into a finished and reproduceable prototype. It would be necessary to bear in mind that the waveform arriving from the microphone would be quite different from that derived from the normal organ tone generator and it might be necessary to modify the input waveform or the formats, or both, to produce a musically satisfying result. In other words, it would turn into a musical exercise involving access to typical instruments and people to play them – not just an exercise in marrying electronic circuits from other areas. We are not in a position to assist at the moment and we very much doubt whether any one of our advertisers will be better placed.

TESLA "TRANSMITTER": I saw reference in "Answers to Correspondents" recently to licences for transmitters. Can you tell me if it is necessary to obtain a licence or permit from the PMG's Department to build a Tesla coil. I read in a book that "Dr Tesla proposed a 7500KW *transmitting* plant producing RF currents at 100 million volts." We call it the Tesla coil, but the fact is that it is a transmitter. I always wanted to build one, but so far my pocket has not been full enough. **(A. B., Broadmeadows, Vic.)**

● A licence should not be necessary for a Tesla coil, since licences are normally required only for equipment with which it is intended to transmit messages, or "intelligence". In fact, there are many thousands of items of equipment which radiate RF which are not classified as transmitters within the meaning of the relevant Act of Parliament, and although they may cause a serious nuisance, the PMG's Department can do virtually nothing about them. However, it is always a good idea, where even the slightest doubt exists in these matters, to consult the Radio Branch of the PMG's Department and ask their ruling.

YOUNG READER: I am nearly 15 years of age and like your magazine very much. Although I have studied radio for some time, there are several points which I do not understand. Could you describe briefly the operation of the newly developed Deltahet receiver and the principles of SSB reception. Although I have heard single sideband being mentioned many times, I have never had it explained. Also, I would like a pen-friend interested in radio so would you publish my name and address. **(Simon Rodeghiero, Cullrora, Sandy Creek, SA 5350.)**

● We described a valve version of the Deltahet receiver in 1963 and 1964. As a preliminary to the construction articles, we published two explanatory articles, the first of which described the principles of the Deltahet, (File No 2/SW/30). We discussed the principles of SSB reception in an article "Getting Started on Single Sideband" published in February, 1963 as a preliminary to a series of articles on the construction of an SSB transmitter, (File No 2/TR/24). Copies of the articles are available through the Information Service for 20c each. As requested, we have published your name and address; it is now up to interested readers to respond.

TECHNICAL TERMS: I am 15, and enjoy reading your magazine very much. I like making your novelty circuits such as flashing lights, and the Hot Canary. Can you tell me the meaning of the following: Fremodyne, superheterodyne, heterodyne? Are there any others in this category? Can you tell me what IF stands for? **(P. S., Albury, NSW.)**

● The Fremodyne is a receiver which was first described in our magazine some years ago, and in an updated version in May, 1970. The Deltahet is a communications receiver designed by one of our staff and described in 1963-4. A solid state version is currently under development. IF stands for intermediate frequency. The implication of "heterodyne" and "superheterodyne" cannot adequately be described in these columns. We suggest you obtain our book "Basic Electronics" in which these, and many of the other matters which you inquire about, are covered. The book is available from this office for $2.20, posted.

RADIO: Unofficial history

The advertisement in the paper called for assembly line workers and radio technicians to join the staff of "an ever-increasing company with attractive advantages". Amongst others, the advertisement found Bill, who was duly allocated to the TV section as a technician and tester.

To the consternation of his fellow workers, Bill proved himself able to maintain an above average "output" in the number of TV receivers fault-found, tested, aligned and ready for the cabinet section. Concern deepened when it became evident that Bill was being accepted by the Production Manager as a standard by which others should be measured.

Clearly, something had to be done and the clan were not lacking in suggestions.

In due course, a 6BL8 valve, used as a mixer/oscillator valve in the turret tuner, was specially "modified" for Bill's benefit. The extreme of its exhaust tip was carefully nipped off – under water. This unusual operation filled the envelope to the brim with clear water, avoiding the white oxidised appearance which readily betrays a valve with an air leak.

The "modified" 6BL8 was then placed in a receiver on the testing rack and the receiver identified by removing its record and serial number tag and tying this to another corner of the chassis so that none of the others would trap themselves.

Completely unaware of the set-up, Bill finally grabbed the bugged receiver, placed it on his bench, plugged it in and proceeded to fill in a few details on the tag while he waited for the set to warm up.

After a few moments, the screen lit up, but with a blank raster devoid of "snow". With an adept flick of the wrist, Bill turned the receiver around and went to work tracing the IF strip from the video amplifier back towards the tuner.

Meanwhile, the heater was beginning to raise the temperature of the water in the modified 6BL8 and a few drops of water dribbled on to the bench. We all thought Bill would spot this unusual characteristic of the tuner (a grid leak?) and spoil the fun.

But Bill was much too methodical a person to be looking anywhere but at the wiring and the situation continued to boil up. However, not even Bill could overlook the jet of steam which finally and unaccountably spouted from the 6BL8. No one ever grabbed for a switch faster than Bill did and no one ever looked more puzzled as he contemplated the strange sight.

Naturally, we all gathered round, showing great interest in the phenomenon and the explanations as to how it might have happened were ingenious in their variety. But Bill wasn't that dumb and very quickly realised that he had been "got at".

More importantly for the rest of us, he also got the message! (G. H., Ryde).

● Readers are invited to submit contributions to "RADIO: Unofficial History" and a publication fee will be paid for those used. Stories must be humourous 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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High Fidelity Experiment . . . continued from page 81

popular music to their votes for narrow-range sound.

Olson also disproved another belief held by the broadcasting industry: that the product of the upper and lower limits of the reproduced frequency range should always equal about 500,000 in order to ensure proper balance between highs and lows. He found that his listeners did not approve when he cut off the bass at 100Hz to balance the high-frequency cut-off at 5000Hz.

Tests on speech produced comments that the restricted frequency range produced "muffed" speech that was not as intelligible as the full-range speech.

Olson's experiment showed that previous workers who had attempted to find the "ideal" frequency range for music reproduction had been working in the dark. Evidently his third suggestion, that distortion was less objectionable with a narrow frequency range, was correct.

"Distortion was inherent in the phonographs and radio receivers of that day", Dr Olson said recently. "The engineers cut back the frequency range until the performance was satisfactory".

But the fact that listeners preferred full-range sound, if undistorted, had now been proved. It gave a solid foundation for hi-fi development work that had once been conducted on faith alone. The hi-fi or stereo fan of today owes much to Dr Olson and to the men who kept building better amplifiers and speaker systems when no one else seemed to care enough to listen.

If you ever find that your ears and your test equipment disagree, trust your ears until they are proven to be wrong. The listeners who chose the narrow range for reproduced music were reacting to the high-order distortion in the wide-range equipment of the 1940s. In that respect their low-fi choice was the correct one and explains why the professional musicians objected more than the average listener to the distortion. And it was the ears of Dr Olson's listeners that proved the desirability of a full-frequency range.

Perhaps there should be a minority report from the people who chose the narrow band with live music. Even today there are people who apparently prefer narrow band sound. One such reaction came from a lady in Texas when the local radio-TV shop returned a repaired console radio to her. "Oh good", she said. "I'll be glad to listen to a radio with a good tone again. And the records you get today just don't sound like the old ones".

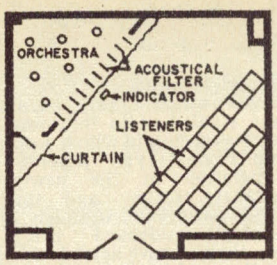
1 CHINN, H. A., and EISENBERG, P. "Tonal Range and Sound Intensity Preferences of Broadcast Listeners", *Proceedings of the IRE*, Vol 33, September, 1945, p. 571,

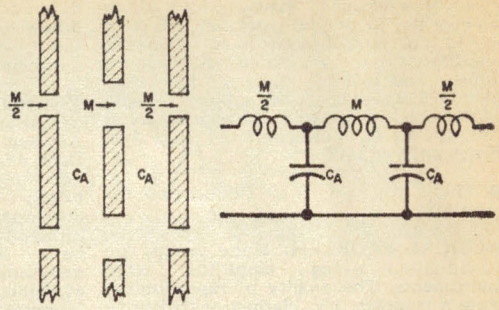
2 HANSON, O. J., "Comments on High Fidelity", *Electronics*, Vol 17, August, 1944, p. 130.

3 EAGLESON, H. V., and EAGLESON, O. R. "Identification of Musical Instruments when Heard Directly Over a Public Address System", *Journal of the Acoustical Society of America*, March, 1947.

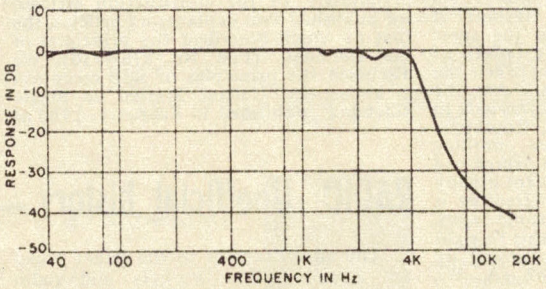
4 OLSON, H. F., "Frequency Range Preference for Speech and Music", *Journal of the Acoustical Society of America*, July 1947, p. 41.

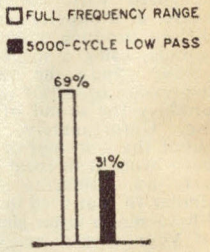
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LEFT: The floor plan for the experiment. RIGHT: Sectional view of high pass acoustic filter, with its electrical network equivalent.





LEFT: Frequency response characteristic for the acoustic filter. RIGHT: The bars indicate the frequency range preferences of the listeners.

FUEL INJECTION

(continued from page 25)

also reduces harmful exhaust emissions, such as hydrocarbons, carbon monoxide, and oxides of nitrogen, substantially.

Other attractions that the company claims for its electronic fuel-injection system are: the elimination of "dieseling" after shutdown, a simple starting procedure that is the same for all temperatures and conditions, and a throttle body that can be less than 1½ inches high so that designers can lower the engine profile and hoodline to conform to customers' styling preferences.

The Bendix electronic fuel-injection system has no adjustments other than the idle air flow. This reduces maintenance requirements and helps ensure that low levels of harmful emissions will be more easily maintained throughout the life of the vehicle. If a component should become faulty, it is replaced rather than repaired.

In summary, the owner of an electronic fuel-injection-equipped car will benefit from significant improvements in power and fuel economy, greatly reduced exhaust emissions, and easier starting under all weather conditions. ("Electronics World", September 1970.)

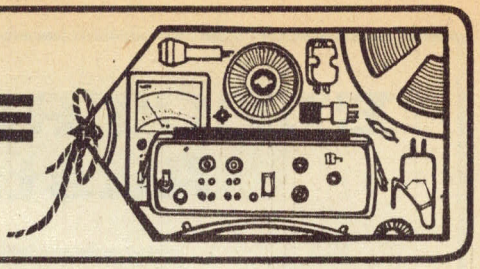
ANSWERS—continued

DOLBY "B" SYSTEM. Are you considering developing a noise reduction circuit along the lines of the now famous device developed by Ray Dolby? I realise that there are many problems associated with this project, not the least of which is the sophistication of the circuit and also the fact that the original design is patented. However, the Advent Corporation in the USA is marketing a home version (called the "B" type) selling at around $130, which puts the price range in line with most of your audio projects. I am sure the interest in this device would be tremendous. We have been hearing a lot lately in your magazine and others about demonstrations where as Dolby-raised 15ips production master of Decca's "Der Rosenkavalier" recording was compared with a tape reprocessed at 1-7/8ips, and nobody could spot the difference. I am sure there must be thousands of home constructors like myself heating up their soldering irons in ancitipation of this one. **(M. R., Bellevue Hill, NSW.)**

O The original Dolby system is a very complex multichannel compression and expansion arrangement used in the production of master tapes by the recording industry. This has no relevance to the domestic scene. The very much simpler Dolby "B" system has been in the news a fair amount recently, but whether this will prove to be any more acceptable and successful than numerous other compression and expansion devices for amateur recordists which have been played around with over the years has yet to be demonstrated. On the other hand, if you are referring to the expansion device only, for use with tapes which have already been subjected to a compression treatment, it would have to provide the exact expansion complement of the compression provided by the manufacturer. If and when tapes incorporating compression appear in quantity on the market in Australia, we might be prepared to look at the matter again, but at present we can see no point in getting steamed up. ■

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BACK issues Electronics Australia stocked, 50c each, prompt service, post free. T. Weir, 56 O'Connor St, Haberfield, N.S.W. 2045. Phone 798 7569. Wanted to buy copies also.

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CIRCUIT or manual RAAF test unit type A1053 part of test set REI identificaton no. Y105B/500133. J & K Radio, 60a Webb Street, East Gosford, 2250. Phone 23312.

TWO Raytheon IAG4 valves or equivalents. Bruce Rechardt, 177 Byrne Street, Mareeba, Qld. 4880.

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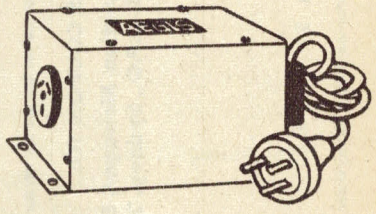
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SPEED SENTRY . . .

continued from page 43

limit, and then lower the setting of the control until the alarm sounds. Any speed below this will not trip the alarm.

An alternative to the continuously variable potentiometer and toggle switch arrangement is a multi-position rotary switch with each position equivalent to 5 mph increments above the 35 mph one. Thus, three positions above 35 mph would be the 50 mph setting, and so on.

This arrangement will necessitate a series string of resistors with a total value equal to the variable potentiometer, and each of them of such a value as to allow a 5 mph increment.

Initially, a 5K potentiometer should be installed in the Speed Sentry with a temporary scale. With an assistant, first set the 35 mph preset spot, and then accurately mark off each 5 mph on the scale above this speed.

Disconnect each wire from the variable control and measure the resistance values between the common rail (chassis) end and the highest speed setting marked. Along with each successive setting of the knob towards the 35 mph setting, tabulate each resistance value. The 35 mph position should be the total value of the pot.

The first value measured will be that of the resistor required from the highest speed position of the switch and chassis.

The difference between the first and the second will be the value of the resistor for the next 5 mph increment, and so on to the lowest speed setting.

A single pole rotary switch with the same number of positions as speed settings will be all that is required, but a switch with more contacts than necessary may be pressed into service to avoid the expense of a new rotary switch. Any unused contacts should be joined together and connected to chassis. ■

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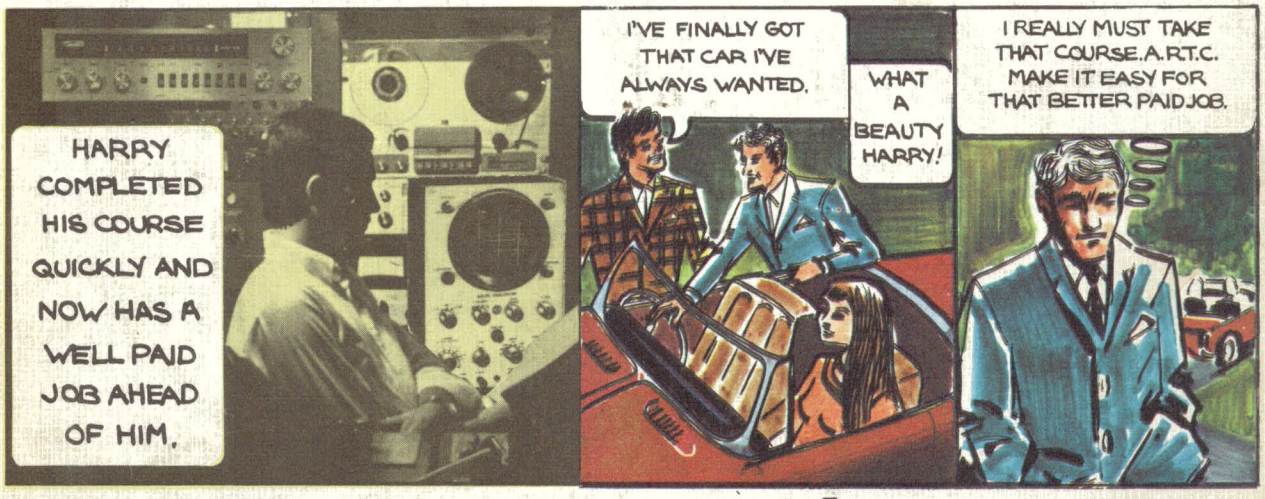
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