AUSTRALIA'S LARGEST-SELLING ELECTRONICS & HI-FI MAGAZINE

ELECTRONICS

Australia

APRIL, 1973

50c

FEATURE STORY:
25 YEARS OF THE TRANSISTOR

SOUND IN THE ROUND SPEAKER ENCLOSURE

SIMPLE SHORTWAVE INVERTER

CAMERA IC

LOW COST HUMMER FOR YOUR LIGHTS
There's more behind our pretty faces than you might think

Sony's unique new Ultra Linear Magnetic Circuit reduces undesirable distortion in the high and mid range speakers to less than one fifth compared with conventional speakers.

It is generally accepted by audio engineers that distortion results from the shape and materials used in the cone. SONY's audio group observed that this distortion results much more from nonlinearity of the iron core around the circumference of the voice coil. So the SONY group developed a new circuit that successfully eliminates this distortion through a specially shaped centre pole. This is the unique new "Ultra Linear Magnetic Circuit". This circuit utilises two revolutionary developments:

1. By slicing a part of the centre pole, the magnetic flux generated around the circumference of the pole is magnetically saturated.
2. By coating copper or covering copper cap over the sliced portion of the pole, undesirable distorted flux generated at the pole is short-circuited.

From the top these superb SONY "Ultra Linear Magnetic Circuit" speaker enclosures are:

- SS-7100, a beautifully balanced but compact bookshelf-type speaker 11 1/2 x 20 3/4 x 11 1/2 with 8" dome-type woofer and 1" dome-type tweeter.
- SS-7200, a larger bookshelf-type or free-standing system 13 3/4" x 23 3/4" x 11 1/2" with the rich natural sound of much larger enclosures. Has 10" cone-type woofer, 5" mid-range and 1" tweeter. Individual level controls.
- SS-7300, magnificent system with 100W maximum power handling capacity and individual level controls. Measures 15 1/2" x 24 3/4" x 11 1/2". Has 12" cone-type woofer, 5" mid-range and 1" tweeter.

All tasteful walnut-colour enclosures eliminate projecting baffle frame for smooth and wide sound expansion.

For further information please fill in the Reader Service coupon in this issue.

RCA's new TV camera, featuring a solid state "bucket brigade" IC sensor. Compact and very efficient, it heralds a new era in television technology. Our story starts on page 16.

Looking for an easy to build omnidirectional enclosure for smoothly distributed 2-channel or 4-channel hi-fi systems? Full details for the new Plessey Rola enclosure are given in the article commencing page 46. Its performance is quite impressive, yet the cost is low.

On the cover
Transistor inventors Shockley, Bardeen and Brattain shown at Bell Laboratories in late 1947, with the original point-contact device shown beneath. Our story commemorating the transistor's discovery starts on page 24. (Pictures courtesy Bell Laboratories.)
We'll make up a special I.C. to meet your special need.

When you need an integrated circuit to do a particular job, a standard I.C. may not be suitable.

Our local I.C. Design and Development Group may have the answer.

We are the largest, most diversified manufacturer of solid state devices in Australia. Our experience is not just restricted to a single assembly technique.

We can advise, design, bread board, process, diffuse, assemble, encapsulate, and most important, carry out in-depth static and dynamic testing. Whether your requirement is for laboratory scale samples or for a million or more devices, our service is still available.

Digital coding and allied systems, instrumentation and control, radio and television, whatever the area of your involvement, our technical team offer world-wide experience and advice on the application of I.C.s for your system.

CUSTOM I.C.s made by ELCOMA
Want to know more?
Contact your Elcoma representative.

PHILIPS
EDITORIAL VIEWPOINT

Colour TV reception and receivers

Last month's issue carrying my editorial about Colour TV reception and receivers had only just been printed when a letter arrived from the Australian Broadcasting Control Board. It was an invitation to attend a special demonstration of Colour reception at the ATN Television Centre in Epping, NSW. Happily both the Editor-in-Chief and myself were able to attend, and we found it very interesting.

The primary purpose of the demonstration was to show the effect of multiple-path "ghosting" on PAL colour reception. To allow this to be done in a valid and realistic way, ATN radiated a suitable variety program in full PAL colour from their transmitter in Artarmon — some 7 or 8 miles from the studios. Various receiving aerials and delay lines were then used to derive signals with varying degrees of ghosting; the signals being fed to monochrome and PAL colour receivers placed side-by-side.

The demonstration showed quite clearly that reception of PAL colour transmissions is certainly no more degraded by ghosting than for monochrome, under the same conditions. This applied for signals with severe ghosting, often less affected subjectively by the ghosting, presumably because of additional cues provided by the colour information.

Full marks must go both to the ABCB and to ATN for this demonstration, which should go a long way towards dispelling undue fears about Colour TV reception problems. However a second phase of the demonstration was neither as satisfying nor as convincing. It involved comparison between a normal PAL colour receiver and another which had been modified for "pseudo-NTSC" operation.

It was not entirely clear whether the comparison was intended purely to demonstrate the wisdom of the ABCB's choice of the PAL system for Australia (which few would dispute) or in addition a somewhat self-conscious attempt to lend weight to the move to ban importation of receivers such as those made by Sony and mentioned last month. But whatever the board's intentions, it became obvious that the audience included representatives of local receiver manufacturers who were very eager to interpret the results as evidence supporting an import ban.

Those of us with less reason to be partisan in our reactions found it somewhat harder to draw any definite conclusions. Certainly there were differences between the two, and taken overall for varying degrees of ghosting, the PAL picture would certainly get the vote. But quite frankly, the differences were not nearly as dramatic as we expected. At times we even found ourselves preferring the "NTSC" picture.

This rather inconclusive result must inevitably weaken the case for banning imports of "non standard" Colour receivers, particularly when it is remembered that those with slight and moderate degradation. If anything, the colour pictures were often less affected subjectively by the ghosting, presumably because of additional cues provided by the colour information.

Those of us with less reason to be partisan in our reactions found it somewhat harder to draw any definite conclusions. Certainly there were differences between the two, and taken overall for varying degrees of ghosting, the PAL picture would certainly get the vote. But quite frankly, the differences were not nearly as dramatic as we expected. At times we even found ourselves preferring the "NTSC" picture.

This rather inconclusive result must inevitably weaken the case for banning imports of "non standard" colour receivers, particularly when it is remembered that at least one prominent range of these receivers offers distinct advantages in terms of picture brightness and simplified convergence circuitry.

— Jamieson Rowe
Last month we showed you, what we claimed to be, the only twenty TO92's worth buying.
It's no longer true.
Now there are 40 worth buying.
It’s still true however that the Fairchild type TO92 is the only one worth buying.
The long term reliability of the Fairchild TO92 design makes it far superior to any competitive device in terms of moisture resistance, stability under temperature stress, and in resistance to physical damage on the users assembly line.
If you’re prepared to put up with reliability significantly less than these devices, then go to our competitors.
But otherwise go to our distributors. They’re listed on the following page.
LICLY RETRACTS MENT ON TO 92'S.

<table>
<thead>
<tr>
<th>Type No.</th>
<th>NPN or PNP</th>
<th>Similar to</th>
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<tr>
<td>General Purpose Amplifiers &amp; Switches</td>
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N.S.W.
Warburton Franki Industries (Syd) Pty. Ltd., 199 Parramatta Road, Auburn, N.S.W. 2144 Telephone: 648 1711

George Brown & Co. Pty. Ltd., 247 Sussex Street, Sydney, N.S.W. 2000 Telephone: 519 5855

South Australia
Gerard & Goodman Pty. Ltd., 192 Rundle Street, Adelaide, S.A. 5000 Telephone: 23 2222

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Western Australia
Warburton Franki Pty. Ltd., 41 Great Eastern Highway, Rivervale, W.A. 6103 Telephone: 61 8688

A.C.T.
Electronic Components Pty. Ltd., 3 Pirie Street, Fyshwick, A.C.T. 2609 Telephone: 95 6811

Victoria
Warburton Franki (Melb) Pty. Ltd., 220 Park Street, South Melbourne, Vic. 3205 Telephone: 69 0151

FAIRCHILD AUSTRALIA PTY. LTD.
Goldring’s ES-70EX4 is an ultra-high performance stereo cartridge which has been newly developed for use in discrete 4 channels of the CD-4 system in the CD-4 system, where frequency band is required to range from 20 Hz to 45 KHz. Performance of stereo cartridges has already been developed to their almost complete state. Yet ES-70EX4 is not a cartridge only for exclusive use in New Type ES-70EX4 discrete 4 channels. It also reproduces sounds from conventional monaural as well as matrix 4-channel discs even more faithfully.

**New Goldring ‘ES-70’ series of magnetic stereo cartridges**

**ES-70S**
- Frequency response: 15-25,000 Hz
- Output voltage: 5m V 1KHz/5 cm/sec.
- Channel balance: Within 1.5dB at 1KHz
- Channel separation (minimum) 20dB at 1KHz
- Compliance: 10x10 µm/dyne
- Weight 5g
- Stylus replacement Goldring D170SR

**ES-70EX**
- Frequency response: 10-35,000 Hz
- Output voltage: 3m V (50mm/sec. 1.000 Hz 45°)
- Channel balance: Within 1dB (1,000 Hz)
- Channel separation 30dB (1,000 Hz)
- Compliance: 20x10 µm/dyne vertical and horizontal
- Tracking force: 0.7-2g
- Stylus: Diamond, Elliptical, radius 0.2 mil x 0.8 mil
- Stylus replacement Goldring D174SRE

**ES-70SH**
- Frequency response: 15-22,000 Hz
- Output voltage: 10m V 1KHz/5 cm/sec.
- Channel balance: Within 1.5dB at 1KHz
- Channel separation (minimum) 20dB at 1KHz
- Compliance: 8x10 µm/dyne
- Tracking force: 1.5-3.5g
- Weight 5g
- Stylus replacement Goldring D171SR

**ES-70F**
- Frequency response: 15-27,000 Hz
- Output voltage: 5m V 1KHz/5 cm/sec.
- Channel balance: Within 1dB at KHz
- Channel separation (minimum) 25dB at 1KHz
- Compliance: 15x10 µm/dyne
- Tracking force: 0.7-2g
- Weight 5g
- Stylus replacement Goldring D172SR

**ES-70E**
- Frequency response: 10-30,000 Hz
- Output voltage: 10m V 1KHz/5 cm/sec.
- Channel balance: Within 1dB at 1KHz
- Channel separation (minimum) 25dB at 1KHz
- Compliance: 30x15 µm/dyne
- Tracking force: 0.7-2g
- Weight 5g
- Stylus replacement Goldring D173SRE

**EM-82 Specifications**
- Omni-Directional
- Frequency Response: 40-18,000 Hz
- Impedance: 600 ohms
- Sensitivity: -65dB ± 3dB
- Operating Voltage: 1.1 to 1.5 Volts
- Consumption Current: 160mA
- Continuous hours: 10,000 hours
- Cable: 16.5 ft. with phone plug
- Dimensions: 0.87x6.38 in.
- Weight: 6.7 ounces
- Accessories: Built in talk switch, Mike holder, lavalier. Wind screen and Battery (UM-3)

**EM-82H Specifications**
- Omni-Directional
- Frequency Response: 40-18,000 Hz
- Impedance: 50K ohms
- Sensitivity: -45dB ± 3dB
- Operating Voltage: 1.1 to 1.5 Volts
- Consumption Current: 180mA
- Continuous hours: 10,000 hours
- Cable: 16.5 ft. with phone plug
- Dimensions: 0.87x6.38 in.
- Weight: 6.8 ounces
- Accessories: Built in talk switch, Mike holder, lavalier. Wind screen and Battery (UM-3)

**EM-83H Specifications**
- Uni-Directional
- Frequency Response: 40-18,000 Hz
- Impedance: 50K ohms
- Sensitivity: -50dB ± 3dB
- Operating Voltage: 1.1 to 1.5 Volts
- Consumption Current: 160mA
- Continuous hours: 10,000 hours
- Cable: 16.5 ft. with phone plug
- Dimensions: 0.87x6.38 in.
- Weight: 6.9 ounces
- Accessories: Built in talk switch, Mike holder, lavalier. Wind screen and Battery (UM-3)

GOLDRING
Engineering (A'asia) Pty. Ltd.

New South Wales: 26-28 Ricketty St., Mascot, 2020. Tel. 669-6088 • Victoria: 162 Pelham St., Carlton, 3053. Tel. 347-5177 • Queensland: 35 Balacia St., Woolloongabba, 4102. Tel. 91-4972 • South Australia: 76-78 McLaren St., Adelaide 5000. Tel. 23-3488 • Western Australia: 32 Northwood St., Leederville, 6007. Tel. 84-988 • Canberra: 19 Molonglo Mall, Fyshwick. A.C.T. Tel. 95-8248

ELECTRONICS Australia, April, 1973
Professional TV Service Technicians are in short supply

YOU COULD BE
ONE OF THE CHOSEN FEW!

By the mid 1970's the new and exciting field of colour television will be with us in Australia. The demand for qualified experts in colour television technology will be great. The time to enter a profession with such a promising future is right now.

Even today the number of television sets in this country runs into millions and the figure is increasing all the time. The opportunities for you as a trained technician both now and in the long term are boundless if you choose TV servicing as your career.

THE ICS "CAREER PROGRAMME" FOR TV SERVICE TECHNICIANS

ICS now offers any career-minded person with an interest in electronics the opportunity to qualify as a professional in this fast growing career field. The ICS TV Service Technician Career Programme is a complete and integrated course designed to train you to take your place in a career field where experts are really in demand.

The advantages and the security of being a trained professional in an industry where such talents are in short supply are obvious to any ambitious person. Take up the challenge and reap the rewards. Post the coupon today for your free prospectus detailing the complete Career Programme.
Everything you've ever wanted to know about Eveready rechargeable batteries but were afraid to ask.

*Our unabashed coupon will reveal all.

Please send me all the details on Eveready nickel cadmium rechargeable power cells.

Name

Address

Postcode

You are almost certainly aware that Eveready make a prodigious range of nickel cadmium rechargeable power cells.

Each one is completely sealed, utterly reliable and exhaustively tested. They come in just about every possible shape and size and voltage.

Along with our magnificent charging units which are compact, ruggedly constructed and modestly priced.

But rather than go on and on bending your ear about them in the narrow confines of this advertisement, we've prepared a brochure bursting with details. And it's yours, absolutely free, in return for the coupon above.

We'll forward it to you promptly under plain wrapper together with the answers to any thorny problems you may have with regard to nicad cells or anything else concerning portable power that just may be keeping you awake nights.

No charge.

Union Carbide Australia Limited.
Melbourne 905 St. Kilda Rd. 261241, 262332. Adelaide 41-49 Currie St. 516099. Perth 901 Hay St. 212926

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Eveready & Union Carbide are registered Trade Marks.

ELECTRONICS Australia, April, 1973
Another of the world’s most durable heads

This rather sneaky use of an arresting picture/caption combination is really to introduce you to another bogey—that is, dust on the head of a tape recorder which leads to bad sound from your tapes. Now the good news from AKAI—they have come up with a superior tape head that is trouble free. It’s called the GX (which stands for glass and crystal) HEAD, and unlike other heads, it doesn’t allow dust to stick to it. Which means no more cleaning. Despite the fact that you don’t have to clean the GX HEAD, AKAI actually GUARANTEE IT FOR A LIFETIME! Nobody else has got a head that hard. Combine this with Dolby Noise Reduction and AKAI Automatic Distortion Reduction systems on the GXC-46 and you’ve got a cassette recorder to match the performance of quality open reel. Have a listen to the AKAI GXC-46 Cassette Tape Recorder at your nearest AKAI dealer. For further information please write to:
Bell Labs detect pollution with laser

A quick method of identifying pollutant gases in the air has been devised by a Bell Laboratories scientist. Lloyd B. Kreuzer has teamed a laser and an electronic computer in a unique system for immediately detecting and measuring concentrations of pollutant gases. Identification and analysis of pollutants is a first step toward their control.

Capable of identifying concentrations of gases as low as 1 part in 10,000 million, the laser-computer system has a far greater sensitivity than most present regulatory standards require. The US Occupational Safety and Health Act, for example, requires measurements of pollutants only in parts per million.

Essentially, Kreuzer has taken an established laboratory technique — gas spectroscopy — and clothed it in modern dress. The technique is based on the phenomenon of different gases absorbing light at different wavelengths. Thus, specific gases leave their "fingerprints" on laser light at specific wavelengths. The amount of light absorbed shows the amount of pollutant in the air.

The computer — which is about the size of a small home stereo receiver — controls the laser, tuning it through the telltale wavelengths of various pollutant gases. Samples of air being analysed are held in a chamber called an opto-acoustic absorption cell, specially designed by Kreuzer.

The laser beam is directed into the absorption cell. Light energy absorbed by a gas increases the temperature and pressure of air in the cell in direct proportion to the quantity of gas. A sensitive microphone in the cell detects the increase in pressure and converts it to an electrical signal which is fed to the computer. The computer matches the signal with "fingerprint" data stored in its memory and identifies the pollutant.

For a feasibility demonstration in the laboratory, the system has been used to identify five different gases simultaneously. However, it can be programmed to handle up to about 20.

One of the unique features of the system is its ability to identify many pollutants with no change in instrumentation. Other methods — wet chemical systems, for example — require essentially different instrumentation for different pollutants. Also, such systems need skilled operators. The laser-computer system can operate virtually unattended.

Television network orders character generators

Television stations ATN 7 in Sydney and HSV 7 in Melbourne have each ordered a Datavision D2400 character generator from Plessey Electronics to provide up to the minute program titling.

Datavision character generators provide a flexible and inexpensive method of generating supplementary character information for television display. Information can be produced from a keyboard input for immediate imposition in any video picture or, alternatively, stored with up to a four page capacity for presentation as required.

The display provides up to eight rows of 32 scan line high characters with 16 characters in each row or as a one line horizontal crawl across the screen.

Model D2400 is a self-contained portable unit with a two channel capability enabling one of the four stored pages to be displayed via the program video output channel while other material is prepared on preview.
Dunrossil lecture by F. J. Philips

The third IREE Dunrossil Memorial lecture will be presented in Sydney on April 4th by Mr Frederik J. Philips, Chairman of the Supervisory Board of the Philips Company.

Mr Philips was President of the huge Philips empire from 1961 to 1971, before that holding the position of Vice President from 1946. The grandson and nephew respectively of the original founders of the company, Frederik and Gerard Philips, he joined as works manager in 1930 after graduating as a mechanical engineer from the Delft University. Mr Philips’ father Anton Philips joined the company in 1899, eight years after founding, and retired as president in 1939.

The Dunrossil Memorial lectures were established by the IREE to honour the memory of Viscount Dunrossil, Governor-General of Australia and IREE patron who died in 1961.

Cousteau teams with NASA

Captain Jacques Cousteau is working with NASA during his current Antarctic expedition to see how space-age technology can be used to find ocean regions which are biologically productive.

So far, the results have been excellent and Cousteau says, “The space-age has opened a whole new dimension to ocean resource monitoring.”

Cousteau, aboard his research vessel, the Calypso, is in direct contact 5 days a week with Ames Research Centre, Mountain View, California, transmitting and receiving information via weather satellites and NASA’s Applications Technology Satellite (ATS-3).

The Calypso is now operating along the coast of the Antarctic Peninsula. NASA weather and communications equipment were put aboard last spring. The Calypso will sail up the west coast of South America, continuing oceanographic studies, ending the cruise at Los Angeles this winter.

The research ship is making direct measurements of chlorophyll and temperature readings of the ocean and transmits these data via ATS to scientists at Ames. John Arveson, of Ames, and Dr Ellen Weaver, a professor from California State University, San Jose, use these measurements to derive correlations with ocean colour and temperature observations from Earth Resources Technology Satellite-1 (ERTS-1), the Nimbus and NOAA weather satellites.

Siding Springs telescope shipped

The new 48-inch telescope to be used by Britain’s Science Research Council to map the southern sky has been tested and is being shipped to Australia for installation at Siding Springs, NSW.

Dr Vincent Reddish, senior project officer for the telescope, praised the builders, Grubb Parsons at Newcastle upon Tyne, for building and siting the telescope within two years — less than half the time normally taken for such a project. He said the telescope would enable astronomers to study a very wide galaxy for the first time and that results would be available to all British universities, and to European and Australian astronomers.

The SRC’s atlas will require up to 300,000 photographs to be taken. The most sensitive photographic emulsion known has been developed by Kodak for the work, allowing astronomers to photograph stars down to magnitude 22.

Many new objects are expected to be discovered in the southern sky, such as asteroids, comets and nebulae, just as the northern sky atlas did in 1950.

Pye mini survival beacon for RAF

Royal Air Force aircrew are to be equipped with a new miniature survival beacon which will indicate their location to search and rescue teams.

Pye Dynamics Limited in the UK, a member of the Pye of Cambridge Group of Companies, has received a major contract to produce these personal locator beacons for the British Ministry of Defence.

This equipment is based on a proprietary design which is being marketed worldwide. The construction of the beacon embodies thick and thin film hybrid microcircuits and it is one of the smallest of its type available.

It measures only 4.7 x 3 x 1 1/2 inches (11.94 x 7.62 x 3.38cm) and weighs under 20oz (0.567Kg).

It has been designed to meet a specification for a minimum detection range of 60 miles (100km) at 10,000 ft (3km) and for a minimum range of 10 miles (16.5km) for two-way contact with search and rescue operations.

The beacon operates on the military international distress frequency of 243MHz with a chopped carrier swept tone and incorporates a two-way speech communication facility. A secondary ‘scene of search’ speech-only channel (282.8MHz) releases the emergency frequency and enables two-way communication to be continued at the scene of the search.

In its aviation role, the beacon is auto-activated after ejection. The aerial system has been designed into the life jacket in such a way that when the jacket is inflated, the aerial is automatically erected.

ELECTRONICS Australia, April, 1973
**Service Instruments and Test Equipment**

**Insulation Testers**

All units illustrated come complete with batteries, leads and operating instructions and are backed by University sales, service and spare parts.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Range</th>
<th>Price (incl. tax)</th>
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<tbody>
<tr>
<td>UM1000</td>
<td>Hand wound high resistance insulation tester. Range 0-100 megohms: 1000 Volt.</td>
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<td>$60.00 + Sales Tax</td>
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<tr>
<td>YF300</td>
<td>New compact clip-on type Volt, Amp tester with an ohmprobe for checking resistances up to 5 Kohms. Ranges 0-150-300-600 Volts A.C. 0-15-60-300 Amps A.C. 0-5 Kohm Resistance. Housed in Leather Case.</td>
<td></td>
<td>$30.00 + Sales Tax</td>
</tr>
<tr>
<td>T.M.1.</td>
<td>Transistorised insulation tester housed in a durable hard rubber case. Range 0-50 megohms: 500 Volt.</td>
<td></td>
<td>$50.00 + Sales Tax</td>
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<tr>
<td>EA77</td>
<td>Solid State Automotive Engine Analyser. Checks R.P.M., Voltage, Resistance, Diode, Spark, Condenser.</td>
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<td>$50.00 + Sales Tax</td>
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**Tong Testers**

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<td>UA301</td>
<td>Heavy duty clip-on type tong tester for measuring currents in a cable or bus bar up to a diameter of 2½ inches (60mm). Leather carrying case incl. in price.</td>
<td>0-10-30-100-300-1000 A.C.</td>
<td>$65.00 + Sales Tax</td>
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<td>UAV302</td>
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<td>0-300-600 V. A.C.</td>
<td>$70.00 + Sales Tax</td>
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**Multi Testers**

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<th>Model</th>
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<tr>
<td>MVA-100</td>
<td>Diode protected, sensitive (10000 ohm/Volt) multirange tester and is a proven unit for all TV service and radio workshops.</td>
<td>$35.00 + Sales Tax</td>
</tr>
</tbody>
</table>

Prices quoted are recommended retail and all units are normally available ex stock from:

**University Graham Instruments Pty. Ltd.**

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ELECTRONICS Australia, April, 1973
GE use UV light to remove photoresist

A process that uses intense ultraviolet light to speed and simplify the fabrication of semiconductor wafers has been invented by scientists at the General Electric Research and Development Centre in New York.

The process uses ultraviolet irradiation to clean excess photoresist from semiconductor wafers — a long-standing problem in the semiconductor processing industry. The photoresist, a polymer film sensitive to light, is used in etching microscopic circuit patterns onto the wafer. After etching takes place, the leftover plastic film must be completely removed.

In the new GE process, the photoresist is exposed to intense ultraviolet light in the presence of air, causing the material to break down and vaporise. A typical film of photoresist plastic (depending upon its composition and thickness) can be completely removed from a semiconductor wafer in 25 to 40 minutes.

This process, developed by Dr Donald A. Bolon, is the first that lends itself to the continuous removal of excess photoresist material. All other known techniques require the processing of wafers in batches, and are thus inherently slower.

In addition, "ultraviolet polymerisation" is the first dry process that operates at atmospheric pressure and at modest temperatures (about 350°C). The most widely used methods for removing photoresists currently involve soaking the polymer film in solvents, or where the presence of carbon contaminants would interfere with subsequent fabrication steps.

New radio link for rural telephones

Two channel VHF radio links are now available to APO subscribers who live on the fringes of rural settlements, where installation of landlines is not feasible. The equipment in no way affects the operation of the telephone system, and telephone subscribers operate their telephone in the normal manner.

The new equipment, the FM770, was developed in Australia by Philips TMC for the APO. The company has been made the world design centre for this type of equipment for the Philips group of companies.

Apart from the Australian Post Office, a number of these VHF links have been supplied to the Hong Kong telephone authorities to overcome a problem of providing telephone communications to ships anchored at buoys in Hong Kong Harbour.

An FM770 system comprises a subscriber terminal for connection to a two-wire standard automatic or manual telephone and an exchange terminal providing either a two-wire connection or a four-wire connection to an exchange.

The equipment is designed to operate within the 50/60kHz or 25/30kHz channel spacing in the 148-174MHz band or the 70-85MHz or 92-94MHz bands.

When the radio subscriber lifts the telephone handset an out-of-band signalling frequency is shifted, and the transmitter switched on.

At the exchange, the received signal keys the transmitter and loops the two-wire line. When dialling to an automatic exchange, the signalling frequency change (from the subscriber to exchange terminal) causes breaking of the DC loop in sympathy with each impulse.

For an incoming call to the radio subscriber, ringing voltage from the exchange starts the exchange terminal transmitter and shifts the exchange-to-subscriber signalling frequency, causing ringing of the subscriber telephone.

India sets up duty free manufacturing zone

Thirty-two international electronic companies including giants like International Telegraphs & Telephones and AEG-Telefunken have expressed interest in participating in the new Santa Cruz Airport Electronics Project in Bombay in the form of joint ventures or marketing arrangements.

Four specific proposals aimed at generating exports worth US$13.8 million a year have been already processed by the Government of India's Trade Development Authority which is the sponsoring agency of the Airport Project.

Another 120 applications have been received from Indian companies many of which are willing to go in for export-oriented production with their own know-how, thus underscoring technical competence achieved by many local manufacturers in this field.

India's Electronics Department has estimated that within another four years India can export no less than 100 million dollars worth of electronic equipment, most of it from the Santa Cruz Project. The products identified for production in the bonded processing zone include radios, television sets, tape recorders, desk calculators, computer parts, communication equipment, and microwave components.

The airport scheme is to give employment to about 50,000 people when it becomes fully operational.

Personal contacts have been established by the Trade Development Authority with 180 foreign companies mostly in Japan, the United States, the United Kingdom, West Germany and France. A total of 78 marketing outlets both in the Far East and North Atlantic have been identified.

India's exports of electronic equipment are at present only four million dollars a year and much of this is due to the export obligation imposed on the two computer firms IBM and ICL. Hence the export-oriented production remains a largely unexplored territory, and it is therefore encouraging that so many applications have been received for putting up factories in the bonded duty free zone.

from N. Viswanath, New Delhi

Doppler radar on a chip

At the Mullard Research Laboratories in the UK, distributed thin film microwave circuit techniques have been applied to an inexpensive Doppler radar module designed to give warning of intruders. The unit replaces the individual microwave elements currently used in microwave intruder alarms.

The system comprises a Gunn oscillator source, a Schottky detector and a circulator which separates the transmitted and received signals and provides local oscillator power at the detector via the isolation path.

All these elements are incorporated in a thin film circuit on a single, 1cm square, ferrite substrate, together with appropriate filtering networks for the DC supply. The Gunn oscillator is varactor tuned and the circuit is stabilised by coupling a resonant line to the oscillator.
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NEWS HIGHLIGHTS

Australian develops electric car

After 15 years work developing electric cars, Mr Roy Emmerton of Lower Hawkesbury, NSW, claims he has produced Australia's first high performance model. His prototype, a converted VW "Super Bug", is capable of 100mph and very impressive acceleration performance.

The motor used is a British made series type with slight compounding. It currently runs from a set of modified lead-acid batteries which deliver up to 150V. The batteries have modified plate connections for greater current capability, similar to a traction battery but lower in cost. The ultimate aim is to use sulphur sodium or catalytic reforming type batteries, or perhaps fuel cells, to provide higher performance and greater range.

The motor has a continuous rating of 10kW, and uses an interpolar structure to prolong brush life. The motor has already done 30,000 miles without brush replacement.

Ferguson lab gets NATA registration

Ferguson Transformers, manufacturers of transformers, discharge lamp control gear and power supplies, have announced their registration by the National Association of Testing Authorities, Australia, as a NATA Laboratory in the field of electrical testing. The laboratories are situated in a modern building of 9,000 square feet at Chatswood, NSW. The main laboratory area contains a variety of precision equipment for the accurate measurement of voltage, current, power, resistance and temperature.

NATA testing by Fergusons is now available to customers and other interested parties within the terms of registration. NATA reports are universally accepted throughout Australia as being factual and accurate.

Siemens studies laser communication

Scientists from the Siemens Research Laboratory are investigating the atmosphere as an optical communications channel for laser beams over a trial path of 5.4km between the Munich districts of Obersendling and Giesing. The terminal stations consist of Cassegrainian telescopes having a concave primary mirror with a secondary convex mirror in front to link it with the detector or laser transmitter. The picture above shows a receiving setup.

The carbon dioxide laser used for the tests has an output power of 5W continuous, at a wavelength of 10.6um. This wavelength has been found considerably less affected by atmospheric disturbances than visible light from a helium-neon laser, although it is still affected to some degree. Despite this reliable communication is possible in heavy mist, moderate rain, fog and snow.

The modulator for the transmitter laser uses a gallium arsenide crystal. The receiver uses a gold-doped germanium detector cooled in liquid nitrogen.

Performance to date suggests excellent prospects for laser communications. With a carrier frequency of 28.3THz, the carbon dioxide laser channel offers an extremely wide potential bandwidth.

ELECTRONICS Australia, April, 1973
Solid state TV camera

Much research is currently being directed towards finding a solid state optical image sensing device capable of replacing conventional TV camera tubes. This description of an experimental camera recently made by RCA Laboratories for the US Air Force gives a good idea of the progress being made using sensors based on the "bucket-brigade" charge transfer principle.

by W. PIKE, M. KOVAK, F. SHALLCROSS & P. WEIMER
RCA Laboratories, Princeton, New Jersey

The experimental camera employs a self-scanned 32 x 44 element sensor which uses the "bucket-brigade" charge transfer principle explained in the box shown elsewhere in this article. The camera itself is quite compact, measuring approximately 3.75 x 2.75 x 2.25 inches without the lens, and weighs about 12 ounces less lens. It connects via a cable to a control box which contains the power supply, output video amplifier and sweep generators used for the monitor.

The camera chain, exclusive of the monitor, requires approximately 930mW of power, which is provided by a commercial +15-volt dual regulated supply located in the control box. Of the 653mW used by the camera, about 250mW is used in various bleeder chains that set the operating potentials of the sensor electrodes. Much of the remaining dissipation is in the driver circuits that interface the timing logic with the sensor. This could be reduced at least 50 per cent by using complementary-symmetry drive circuits, so that battery operation would be entirely feasible.

The camera operates in non-interlaced fashion at a frame rate of 60 Hz. Although the field rate used is identical to that in conventional broadcast television, the line rate is lower, as the sensor has only 32 horizontal lines of 44 elements each. The horizontal line rate is 2160 Hz and approximately three line times are allowed for vertical retrace. The non-standard line rate necessitates the use of a commercial X-Y display unit as the monitor.

The camera operates with full frame-time storage, i.e., each element of the sensor integrates the illumination incident on it for the entire frame time. This tends to produce image smear, because light continues to be integrated at each element during readout. However even with the relatively small number of lines used in the experimental sensor, where the readout time per line is a relatively large fraction (about 3 per cent) of the total frame time, smear is barely perceptible. With larger sensors having more elements, this phenomenon should be virtually negligible.

Mechanically, the camera circuits are organised on four plug-in printed wiring cards. The card nearest the lens carries the solid-state sensor in its socket. The output processing circuit is just below the sensor, and trimmer potentiometers for setting various sensor potentials are located in a line above the sensor. A second card, behind the sensor card, carries the driver circuits.

This article is adapted from a paper in "RCA Review", Vol. 33 No 3, by arrangement.
The remaining two cards comprise the timing logic circuits. These have been implemented with 13 dual in-line, COS MOS integrated circuit packages. The power savings made possible by this logic family are appreciable. The entire timing system consumes less than 10mW. By contrast, a single binary counter in the resistor-transistor logic family used in an earlier camera consumed over 80mW.

The block diagram and circuit of the 32 x 44 element bucket-brigade sensor employed in the camera are shown in the diagrams. A charge pattern formed on the photodiode array is scanned by the transfer of charges via bucket-brigade registers to an output amplifier located on the same silicon chip. Each of the 32 rows of the sensor consists of a bucket-brigade register in which the reverse-biased sources and drains of the MOS transistors act as photodiodes when illuminated. During the 1 60-second period between scans, the horizontal clock pulses are disconnected from each line so that a charge pattern corresponding to the image builds up on the photodiodes. When a given line is to be scanned, the horizontal clocks are reconnected by means of the transmission gates, causing the charge pattern to be transferred toward the continuously running output register. The output register is a similar bucket brigade that delivers the charge packets in sequence to an output amplifier on the same chip. A 32-stage bucket-brigade vertical scan generator turns on the transmission gates for each line in sequence. The two photodiodes associated with each element of the sensor registers are omitted from the circuit for lack of space.

A photomicrograph of the completely integrated sensor is shown, in which the output register is on the right and the vertical scan generator is on the left. The integrated sensor is 190 mils in the x direction and 140 mils in the y direction. The devices were fabricated using PMOS metal-gate technology. A more detailed photomicrograph of the upper right-hand corner of the sensor itself is also shown. Individual picture elements are spaced on 3-mil centres.

The electrical design of the camera is quite unlike that found in a camera using a conventional beam-scanned camera tube. Instead of supplying linear saw-tooth currents to the horizontal and vertical windings of a deflection yoke, it is necessary to provide properly timed trains of pulses (typically square waves) to appropriate electrodes of the sensor.

Assume that a scan of the sensor is about to commence, i.e., the trailing edge of the vertical synchronising pulse to the monitor has just passed. The start-pulse generator applies a pulse approximately 460 usec (one horizontal line) in length to the vertical scan generator. The vertical scan generator is a 32-stage bucket-brigade shift register. The start pulse loads a logical "1" into the first stage of the register.

At the same time, clock square waves from the master oscillator are gated onto the horizontal clock bus by a gate driven from the divide-by-48 counter in the sensor counter chain. This bus connects to a set of transmission gates on the sensor chip driven by the 32 stages of the vertical scan generator. A logical "1" in any stage of the vertical scan generator will open the associated transmission gate, applying the master oscillator signal to the corresponding horizontal line of the sensor. When the horizontal clock voltages are applied to the first line of the sensor, the stored charges produced by the optical information impinging on this line are shifted to the right and into the output shift register. This register is continuously clocked by the master oscillator, hence any information fed into it is immediately shifted upward into the output amplifier on the chip.

After 44 clock cycles, the horizontal clock gate closes, cutting off the master oscillator signal from the horizontal clock bus. The divide-by-48 counter in the sensor counter chain then changes state. This action causes any information in the vertical scanning shift register to advance one stage, hence the logical "1" in the first stage moves to the second. This opens the transmission gate between the horizontal clock bus and

BEHIND THE LENS view of the new RCA camera is shown on opposite page. View above shows the camera in use, while at right is a closeup of the picture produced on the monitor. Later models will give considerably higher resolution than this.

BLOCK DIAGRAM of the bucket-brigade sensor device used in the camera.
The lowdown on bucket-brigades

The “bucket-brigade” charge transfer technique was developed in 1969 by the semiconductor division of Philips Gloeilampenfabrieken, in Holland, although it had been proposed in 1943 by US engineer K. Schlesinger. Like the “charge-coupled” device or CCD developed in 1970 at Bell Laboratories, it is basically a technique whereby packets of charge carriers are moved around beneath the surface of a semiconductor crystal without direct connection to the crystal. The carrier packets are instead manipulated by means of localised electric fields or “potential wells” controlled by electrodes deposited on a thin insulating layer at the crystal surface.

But whereas the CCD technique uses a completely homogeneous crystal, and relies solely upon the potential wells induced into the lattice to hold the carriers together as packets (diagram A), the bucket-brigade approach uses islands of opposite impurity doping to the main crystal chip (B). The islands act as charge “buckets”, storing the carriers without significant loss when they are not actually being moved. The carriers are moved from island to adjacent island by manipulating voltages fed to the pattern of electrodes at the surface — hence the analogy with a line of people transporting water by means of a bucket brigade.

Perhaps the most obvious use for the bucket-brigade technique is in shift registers, particularly long shift registers for use as dynamic memories and delay lines. As each element in a bucket-brigade chain is very simple, it can be made very small, and a very long chain can be produced on a relatively small chip at relatively low cost.

In the optical image sensor which forms the heart of the camera described in this article, the bucket-brigade technique is effectively combined with an array of photo-diodes. The diodes generate a pattern of charge packets corresponding to the optical image, while the bucket-brigade shift registers are used to perform the scanning by shuffling the packets over to one corner of the array for sensing in the appropriate order.

Note that there are three distinct bucket-brigade systems on the camera’s sensor chip: the vertical scan generator used to control the gates feeding horizontal clock pulses to the array, the array itself (consisting of 32 registers of 44 elements), and the output shift register used to shuffle the line outputs to the main chip output.

A less conventional but promising method for recovering the video signal is to make use of the signal at two successive nodes of the bucket-brigade output register, in a “correlation” type process. By summing the signals at two successive nodes, P1 and P2 of a bucket-brigade, the clock signals can be quite effectively removed. In another version of the camera, an external bucket-brigade four stages long and constructed of discrete components serves this purpose. An attractive feature of this type of processor is that it could ultimately be built into the sensor as an integral part of the output register.

The video signal at the output of the processor in the camera has a peak-to-peak amplitude approaching 0.5 volt. The control box, this signal is applied to a gain control and then to the DC level-setting and blanking-insertion circuit. It then passes through a video amplifier. The net voltage gain from input to output of this system is about 10 times. The control box also con-

CIRCUIT DIAGRAM of the 32 x 44 element bucket-brigade sensor device.
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ELECTRONICS Australia, April, 1973
In a typical picture produced by the camera, three signals are fed to the monitor: video, horizontal sweep, and vertical sweep.

A calibrated step wedge test pattern was used in the dark current measurements. Fluctuations in the dark current from element to element appear to be at least two orders of magnitude greater than the noise level of the rather low-gain amplifiers used in the camera video system. Improvement in processing of the sensor and the use of higher-quality silicon, as in the silicon target vidicon, should reduce the severity of this problem.

The overload characteristic of the silicon sensor also warrants brief comment. If a spot of light of sufficient brightness to cause overload is imaged on one of the elemental photosensors of the array, blooming occurs. However, it does not spread out uniformly in the observed picture as in a conventional television camera. Instead, it tends to spread laterally along the line associated with the overloaded element. In effect, the buckets become filled to overflowing and resolution along the line is lost. Several promising methods of overcoming this effect are being pursued. A good feature of the sensor, however, is that recovery is rapid (typically within one frame-time) and no permanent damage results.

Another interesting characteristic of the bucket-brigade sensor is that it has no perceptible lag.

Despite the limited resolution of the experimental sensor with its modest array of 32 rows each of 44 sensitive elements, the camera has been shown to produce quite good pictures at modest levels of illumination (2-20 foot candles). In view of its encouraging performance, the future seems bright for larger sensors using bucket-brigade and charge-coupled registers. It may not be very long before we see a sensor of this type capable of broadcast-quality resolution and performance.
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ADC 220X. Type: Induced Magnet; Output: 6 mV at 5.5 cms/sec, recorded velocity; Tracking Force: 1 to 2 ½ grams; Frequency Response: 10 Hz to 18 kHz ± 3dB; Channel Separation: 20dB from 50 Hz to 10 kHz; Compliance: 20 x 10^-6 cms/dyne; Spherical Stylus Tip Radius: 0.007"; Vertical Tracking Angle: 15°.

ADC 220XE . . . $22.00
ADC 220XE. Type: Induced Magnet; Output: 6 mV at 5.5 cms/sec, recorded velocity; Tracking Force: 1 to 2 ½ grams; Frequency Response: 10 Hz to 18 kHz ± 3dB; Channel Separation: 20dB from 50 Hz to 10 kHz; Compliance: 20 x 10^-6 cms/dyne; Elliptical Stylus Tip Radii: Contact radius .0003"; Lateral radius .0007"; Vertical Tracking Angle: 15°.

ADC 10E mk4 . . . $51.00
ADC 10E. Type: Induced Magnet; Output: 4 mV at 5.5 cms/sec, recorded velocity; Tracking Force: 7 gram; Frequency Response: 10 Hz to 20 kHz ± 2 dB; Channel Separation: 30dB from 50 Hz to 12kHz; Compliance: 35 x 10^-4 cms/dyne; Elliptical Stylus Tip Radii: Contact radius .0003'; Lateral radius .0007'; Vertical Tracking Angle: 15°.

ADC 220XE . . . $30.00
ADC 220XE. Type: Induced Magnet; Output: 5 mV at 5.5 cms/sec, recorded velocity; Tracking Force: ¾ to 2 grams; Frequency Response: 10 Hz to 20 kHz ± 2 dB; Channel Separation: 30dB from 50 Hz to 12 kHz; Compliance: 35 x 10^-4 cms/dyne; Elliptical Stylus Tip Radii: Contact radius .0003"; Lateral radius .0007"; Vertical Tracking Angle: 15°.

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Staran: computer extraordinary

An air traffic control computer must be able to keep track of hundreds of aircraft at the same time and perform arithmetic, search or logic operations on all aircraft simultaneously. A new type of digital computer has been developed especially for this purpose.

The computer is called Staran. Designed and built by the Goodyear Aerospace Corporation in the US, Staran is an "associative array processor", which means it is a digital computer which can perform arithmetic, search or logical functions simultaneously on either all of its words or selected words in its memory.

Essentially, this capability amounts to many simple processors operating in parallel, thus providing a dramatic improvement over the capabilities of conventional computers.

The term "parallel processing", as applied to Staran, is considerably different from its meaning in conventional computers where it refers to a parallel arithmetic operation on multiple bits of a single pair of operands.

Parallel processing in Staran means performing an operation (a multiply, for instance) on many pairs of operands at the same time. These operations are performed in a parallel-by-word, serial-by-bit manner.

The term "associative" means the same as "content addressable." This characteristic enables an associative array processor to search a data file and identify all elements it is searching for in a single instruction execution time.

The conventional digital computer operates sequentially and therefore is limited because:

1. It can perform only one arithmetic function on one data stream at any instant in time;
2. Its memory must be addressed by specific location, one address at a time;
3. It has a single, word oriented input/output.

Goodyear's Staran associative array processor overcomes these limitations with:

1. Array arithmetic;
2. Content addressability;
3. Bit-slice as well as conventional single-word input/output.

When potential collisions were detected, Staran had to single out the aircraft in conflict. Their identifications were called out on the radar screen by marking them differently from other traffic. The system then suggested evasive action to take. (In future, this information may be directly relayed to the pilot.)

As part of the project, two FAA Gulfstream aircraft flew "overtakes" and "crossovers" over the airport for transponder-beacon tracking tests with radar back-up. The aircraft overtook each other, criss-crossed flight paths and performed other manoeuvres.

Down below, air traffic controllers and FAA officials carefully followed the manoeuvres on the radar display. Each time the Gulfstreams intercepted each other on a planned "collision" course, Staran provided the display with constant identification and altitude, with those involved watching to make sure the alphanumeric tag stayed with its proper blip.

The experimental system at Knoxville provided for tracking for up to 60 aircraft at once, although larger models can track up to 4000 aircraft.

After this highly successful test, in which Staran was linked with a standard Univac 1230, a larger system was integrated into the FAA'S enroute control radar at Sutherland, Maryland, which controls aircraft movement over the Washington DC area. This was done as a demonstration for the "Transpo 72" exposition at Dulles International Airport. Hundreds of aircraft were simultaneously tracked and identified on a radar screen which was on view to the public at the exposition.

Goodyear sees many applications for the associative array system other than air traffic control. Any operational requirement for extremely rapid data processing and with highly dynamic data would benefit, such as ballistic missile defence. Also data management systems which have a requirement for immediate response to a variety of unanticipated queries could benefit from associative array processing. Weather predictions and other matrix problems are also possibilities.
The Transistor:
25 years of revolution

Only twenty-five years ago, on June 30, 1948, Bell Laboratories announced the invention of the transistor. The announcement was hardly noticed by the newspapers and even the scientific community doubted they could be made to work as a practical device. Now they have revolutionised technology and irrevocably changed the lives of nearly everyone in the world.

The basic transistor invention has led to a solid-state technology that employs nearly eight million people, creating thousands of millions of dollars in annual sales for electronics companies. The developers at Bell Labs have watched other companies tumble the price from $45 per transistor to a point where we can now buy, for a few dollars, a chip containing the equivalent of a thousand components.

Ironically, the only industry which has still to be radically changed by the transistor is the telephone industry, which started the development program in the first place.

The transistor was not a "bolt from the blue" type invention. It was discovered at Bell Labs by John Bardeen, Walter Brattain and William Shockley - who were engaged in a project to find a solid state replacement for the valve.

Ten years before, William Shockley and Alan Holden, both physicists at Bell Labs, had tried to make a solid state amplifier using carbon contacts brought together through pressure exerted by a quartz crystal. They thought a change in the resistance in the carbon as a signal was applied to the crystal would give an amplified output. It did not.

Shockley then speculated that if he were to oxidise a metal wire screen, surrounding it with a semiconducting oxide, he could limit conduction through the oxide from one side of the screen to another. But again tests were not successful.

Another staff member of Bell Labs, Russell Ohl, used silicon crystal diodes (developed during World War II for radar and microwave systems) to amplify signals. Ohl's amplifier depended on a negative resistance effect and turned out to be too unstable.

After the war, Shockley returned to Bell Labs, and after studying Ohl's device, proposed a field effect structure with silicon and germanium deposited on insulators. It was tried, but no field effect was observed.

John Bardeen suggested that the lack of field effect could be explained by charges being trapped on the semiconductor's surface. The experimental leader of the group, Walter Brattain, then began conducting experiments based on Bardeen's theory.

On November 21, 1947, they had their first success. They observed a field effect in an electrolyte in which they had immersed an n-type germanium slice with a metal point contact on its surface. It was only capable of operating up to a few hertz, but it was the beginning.

By December 4th, Brattain had successfully repeated the experiments with silicon as the semiconductor. On December 15th they showed that the point contact would reverse the flow of current and the following day they achieved power amplification.

By December 23, 1947, the team had developed what they thought would be a practical device and held a demonstration in which the transistor (then un-named) demonstrated a power gain of 18. The next day, Christmas Eve, the device was made to oscillate, and they had the device that Bell Labs had asked for.

They had discovered, however, that it was not a field effect device after all, but instead that the control electrode was injecting the extra carriers that flowed into the point contact (collector) and added to the current.

It was the experiment of December 23, 1947, for which Bardeen, Brattain and Shockley won the Nobel prize in 1956.

Shockley continued to refine his theories and by the time the point-contact transistor patent was applied for on June 17, 1948, he had a working model of the junction transistor. A patent for this device was applied for the same month.

The transistor owes its name to John Pierce, who was executive director of research communications sciences at Bell Labs in 1948. In a discussion with Brattain, he mentioned that since the point-contact device was the electrical dual of the valve and the most important function of a valve was transconductance, the dual for the new device would be transresistance. They had the idea of calling it a "transfer resistor", then finally settled on "transistor".

About this time plans were under way to start production on the point-contact device.

TRANSISTOR INVENTORS Bardeen, Shockley and Brattain (left to right) shown in 1948 with the original test setup.
While it became relatively simple to make one transistor, it was quite another problem to make them in quantity. For no viable reason, transistors made in the same way stubbornly refused to behave in the same fashion. Western Electric, the manufacturing division of the Bell System, was given the job of finding the answers.

Part of the problem was the incredibly small dimensions involved in transistor manufacture. Transistor action occurs in areas so infinitesimally small, you can fit thousands of them into the thickness of a sheet of paper. Other dimensions are equally fearsome.

But the real name of the ghost in this story was contamination. The purity of the germanium used for transistors had to be several orders of magnitude higher than anything then available. The slightest trace of any unwanted impurity would make a transistor behave erratically or kill it altogether.

At times, the transistor "death rate" due to impurities was so high, harried engineers invented a mysterious (and facetious) element called "deathnium" to explain their difficulties. This ominous, and completely fictitious element will never be found on any chemist's periodic table of elements, but the wry humor it expresses helped Western through some trying times.

To further complicate the problem, germanium used for transistors had to be cut from single crystals of the element, and nobody had ever grown any before. This meant that, along with new methods for refining raw germanium, methods for growing perfect single crystals had to be developed.

In an example of necessity being mother to invention, Bell Laboratories came up with zone refining, an ingenious means of refining germanium and other semiconductor materials to a degree of purity never before obtained by man or nature.

Simultaneously, Bell Labs chemists were hard at work turning the ancient art of crystal growing into an exact science. Following hard on their heels, Western Electric engineers quickly transmuted their experimental lab work into efficient factory production methods. How well they succeeded is vividly demonstrated by the seven-pound giant silicon crystals they routinely grow nowadays, compared to the puny three and four ounce dwarfs of two decades ago.

When silicon entered the transistor pic-
TEAC's AN-60, AN-80 and AN-180 Noise-Reduction Units.

Rossini once made this boast and could probably have delivered. But a recording of the music on the best of today's cassette or reel-to-reel machines with their inherent noise and hiss could never capture the clean, crisp sound of the Rossini laundry list.

With the introduction of TEAC's AN-180 Dolby Noise-Reduction Unit, Rossini's Laundry Largo and just about anything else you record will have the same brilliancy and luster as the original.

Our Dolby circuit removes machine and tape noise with such thoroughness that there is a signal-to-noise ratio improvement of 3 dB at 600Hz, rising to 5 dB at 1000Hz and 10 dB at 4K Hz and above.

Because we manufacture the ICs used in our Dolby circuit to extremely tight tolerances, ours operates at distortion levels of less than .3%—lower than many competitive units. So you see there is no question that you should have a TEAC Dolby Noise Reduction Unit.

We designed the deluxe AN-180 not only to Dolbyize fine decks, but to afford them features they might be missing.

It's actually a simultaneous record-playback control center with its own record and playback amps. It has built-in mike and line preamps that maintain mixing capability, or add this capability to recorders not so endowed.

It has large professional-type VU meters for Dolby level setting as well as record/playback level indicators. AN-180 also incorporates such features as an internal 400 Hz, 100 My oscillator level controls, source/tape monitoring and a multiplex interference filter.

Even without Rossini to write a setting for the AN-180 specs, they make such beautiful music.
The Transistor

ture in 1953, it seemed the whole arduous process of learning how to do the apparently impossible would have to start all over again. The advantages of silicon had long been known: it is as abundant as the sands of the earth, can operate at higher temperatures, and has better electrical characteristics than germanium. What wasn't known was how to work with this intractable element.

Silicon has a melting point of 1417 degrees centigrade (compared to only 937 for germanium) and reacts with any material used to contain it at that temperature. Impossible as it seemed, some means of melting and refining silicon without actually touching it had to be devised.

Once again, the Bell Labs-Western Electric team put their heads together and came up with a solution. The answer was a variation of zone refining called float zone growing, in which high-power radio waves are used to melt a thin section of silicon rod and move it and its impurities down the rod. The same kind of surface tension that lets you fill a water glass to just beyond its brim without sloshing, keeps the molten zone from spilling out of the rod.

For all the endless series of problems that beset Western Electric engineers in those days, there were some compensating advantages to being first. One of these was that the patents which resulted from the numerous inventions have been an asset in negotiating cross license agreements with other companies in the industry.

Realising the potential impact of this technological breakthrough, in April 1952, Western held the world's first transistor manufacturing symposium for its transistor patent licensees. For five very crowded days, representatives of 9 foreign and 25 American companies heard Western engineers reveal the details of what they had learned.

The April symposium led to the publication a few months later of a definitive two-volume work on transistor technology. Between getting out this massive work and getting the transistor into manufacture, many Western engineers became almost strangers to their families.

Today the 1952 symposium is remembered at Western not only for the impetus it gave to worldwide transistor technology, but also for a memorable bit of prophecy.

Western management knew the transistor would never really get anywhere unless it could eventually be made cheaply. The enormous potential was there and immediately recognizable, but would the mighty midget ever become economically feasible?

On the last day of the symposium, after four days of discussion that sometimes seemed to make the problems of manufacturing the transistor economically and technologically insurmountable, the question of cost finally came up. One attendee, daunted and bewildered by the technological demands of making the strange new device, asked the question that had been looming large in everyone's mind — "How much will the darned things cost?"

There was a hushed, almost embarrassed silence, and then Don Wilkes, Western's general manager, boomed out loud and clear, "Twenty-nine cents!"

Wilkes' faith has long since been vindicated. At the time he spoke, transistors were running between five and ten dollars each and a good month's production was measured in the hundreds. Today, transistors can be purchased for well under twenty-nine cents and annual production numbers in the United States alone run over 1000 million.

Where do we go from here? Bell Labs: magnetic bubbles, charge-coupled devices and miniature lasers. They have every hope that telecommunications will at last, principally in the form of solid state television cameras and displays, share in the transistor revolution.

Walter Brattain, however, is most impressed by a simpler use of the transistor. In his words: "The use of the transistor of which I am the proudest is in the small battery-operated radio. This has made it possible for even the most underprivileged peoples to listen. Nomads in Asia, Indians in the Andes, and natives in Haiti have these radios, and at night they can gather together to listen.

"When I was a boy the idealists said that "write, however, almost every human learns to speak, listen and understand. People might wish the dictatorials leaders might want them to hear, and I feel that this will eventually benefit human society."

(Courtesy Bell Telephone Laboratories)

Dramatic Reduction in Size brought about by transistors is illustrated at top, where a transistor and IC are compared with a miniature valve. Above is a wafer of IC devices, smaller than actual size.
Sweet and Low
Moodlighting with a Varilight

Do you still turn on the lights in your dining room, living room or any other room with a simple on/off switch? You can’t vary the brilliance? Now’s the time to get with it and build the Varilight Mk 2.

by LEO SIMPSON

Back in the days of gaslight, people could vary the brightness of their lights at will. Now, in more modern times, it is only recently that we have been able to do the same with electric light. After all, why should you always use the lights at the same brilliance. Bright lights are fine if you’re having a bath, cooking or reading or performing any other activity where the keenest of vision is an advantage.

But there are many times where the maximum brilliance of the lights is not required: such as at parties, dining, watching television, listening to music and other activities which the Editor will not permit me to list. There are in fact any number of domestic light dimming applications, both for wall-mounted dimmers and for dimmers incorporated into table lamps.

Varilight Mk 1 was our first wall-mounted light dimmer, published in December 1969. Since then light dimmers have become an accepted appliance in the modern home and there are now several different brands and models available from electrical retailers.

Typical brand name light dimmers often suffer from two problems. The first is a high level of interference to radio reception, which can be very severe in outer metropolitan and rural areas. The second is known as “snap-on” whereby the dimmer control has to be turned through 30 to 40° of its rotation before the lamp begins to glow.

At this initial setting the lamp will be quite bright. The light can be reduced by rotating the control in the opposite direction but at the lower setting a momentary drop in mains voltage may extinguish the lamp.

Our new Varilight Mk 2 has considerably reduced RF interference and “snap-on” effects compared with most brand-name dimmers, and it is more flexible in its application. In addition, it actually has less effects than its predecessor.

A typical light dimmer circuit uses a phase-controlled Triac fired by a symmetrical trigger device such as a neon lamp, diac or silicon bilateral switch. All of these trigger devices are characterised by a very high impedance in both directions until the voltage across them exceeds a certain value. When this happens the device “breaks over” and becomes a negative resistance.

For a neon lamp, the breakdown voltage is typically in the region of 60 to 80 volts; for a diac, 25 to 40 volts; for an SBS, 6 to 10 volts. The diac is the most commonly used Triac triggering device.

A feature of our new Varilight dimmer is a new type of breakover device, the asymmetrical AC trigger, made by General Electric and designated ST4. It is available in a two-lead TO-98 plastic encapsulation.

This device greatly reduces the snap-on mains supply. The smaller waveform shows the voltage across the capacitor in Fig. 1. Initially, consider the variable resistor set at maximum so that the diac is not firing. In this case, the capacitor voltage is a sine waveform lagging the major waveform. If the variable resistor is reduced in value we will eventually reach the point where the diac fires for the first time, at the end of an AC half-cycle.

Immediately the diac fires the capacitor voltage is reduced from +Vbo by perhaps 8 volts. This means that when the next half-cycle begins, the capacitor will charge to −Vbo sooner than if the diac had not fired. So, the second and succeeding diac trigger points will be sooner than desired.

Thus, the initial level of brilliance obtained when rotating the dimmer control up from zero tends to be relatively high instead of a very low level. Once the diac has begun firing the brilliance can be reduced by winding back the control. But if the mains voltage drops momentarily due to an additional load, the lamp will be extinguished. Inconvenient, to say the least!

This “snap-on” effect can be reduced by adding three components to give a second RC time-constant to the circuit. However, the second capacitor is usually a good deal more bulky than the first, due to its higher voltage rating.

Much the same improvement can be had, without extra components, by using the asymmetrical device, ST4. Typically, this
has a breakover voltage, Vs1, in one direction of 16 volts and Vs2, in the other direction of 8 volts. Additionally, its forward voltage (after breakdown) in the Vs1 direction is about 8 volts while that in the Vs2 direction is about 1.5 volts. These latter voltages are referred to as Vf1 and Vf2.

Now consider the circuit in Fig. 1 again but using the ST4 instead of a Diac. Now, when the variable resistor is reduced to the point where the ST4 initially fires, the "breakover" is from Vs2 (the lower breakover voltage) to Vf2, as shown at the first trigger point in Fig. 3. But now, instead of charging an equal amount in the opposite direction in the next half-cycle, the capacitor must charge to a higher voltage, Vs1. before the ST4 will fire. This means that the firing point in the first two half-cycles is roughly the same. (The ST4 will always fire initially at the lower breakover voltage.)

On the second firing of ST4, the capacitor voltage is discharged to Vf1 instead of -Vf2 so that when it is charged to Vs2 it undergoes the same voltage change as it did in the preceding half-cycle. This means that the firing point in the third half-cycle is the same as it was in the first half-cycle. This train of events is continuously repeated with the capacitor diac voltages alternately shifting to maintain the same firing point in each half-cycle. Thus, "snap-on" is greatly reduced.

The astute reader will no doubt comment: Aha! surely the fact that the ST4 has an asymmetrical breakover voltage will mean that the Triac will deliver uneven amounts of power to the lamp during each half-cycle and this will cause visible flicker! And he is right. There is noticeable flicker at low settings with low power lamps, but it is not nearly as pronounced as when half-wave rectified AC is applied to an incandescent lamp. At high power levels, the ST4 still fires unevenly but the effect is so small that it is undetectable.

Refer now to the complete circuit diagram. The 1M potentiometer connected as a variable resistor and the 0.22uF capacitor form the basic RC time-constant circuit. The 1.8M resistor in parallel with the potentiometer sets the minimum brilliance of the lamp(s) when the dimmer control is fully anticlockwise. It eliminates the "dead band" of rotation before the lamp initially lights, and ensures that when the dimmer is switched on there is always some light in the room.

The 10k resistor in series with the potentiometer protects the potentiometer track from excessive dissipation when it is set for high levels of brilliance. It also provides current limiting for the ST4 under the same conditions.

L1 and the 0.047uF capacitor remain to be discussed. These form a simple low-pass LC filter which prevents the switching transients of the Triac being radiated by the mains supply leads. As such, it considerably reduces the amount of RF interference produced. Similar RF interference suppression components should really be considered mandatory in all phase-controlled Triac circuits.

Having described the operation of the circuit let us now discuss the various components and the construction.

Two types of Triac are specified, both similar in appearance. They are the SC141D

At top is the rear view of the dimmer assembled on a Clipsal switch plate. Below is the corresponding wiring diagram. Check your wiring against the circuit.
World's most renowned amplifiers—
The ultimate musical experience!

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Beautifully finished timber cabinets. 26" x 15" x 12". Speakers 12'' high compliance woofer, 1.6'' dome type mid-range, 1.3'' ring type tweeter. Crossover frequency 700, 8000Hz, 12dB / oct. 60 watts 8 ohm.

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made by General Electric and the 40669 made by RCA. Both are encapsulated in a three-lead plastic package with a heatsink tab to which the A2 electrode is electrically connected. In other words, the tab is at mains potential.

Both are rated at 400 volts peak in either direction. RMS current rating is 6A for the SC141D and 8A for the 40669 but both current ratings are considerably higher than our application requires. Although SC141D has been on the market for some years it now has a new "POWER-GLAS" encapsulation process which is claimed to improve reliability. It also has improved immunity to transient damage and improved commutating dv/dt ability, which means that it's less likely to be switched on spuriously by a rapid increase in applied voltage.

Other electrically equivalent Triacs may certainly be used but the advantage of the two specified is that they can be soldered directly into circuit. As such, they can be used with incandescent lamp loads up to 300 watts without any external heatsink. Higher loads may be handled, up to a maximum of illumination, if the Triac is mounted on an adequate (and well insulated) heatsink.

Incidentally the circuit is quite unsuitable for use with fluorescent lights. Do not try it!

The potentiometer is a standard type with a linear resistance/rotation characteristic. Do not use logarithmic types; they do not give progressive control. We have not used a miniature potentiometer as their voltage ratings from terminals to case are not as high as standard types. Typical rating for standard types is 1000VAC (for 1 minute).

The charging capacitor is a 0.22μF/100VW polyester or metallised polyester type. Do not use other capacitance values as the circuit has been optimised for this value. The resistors may be 1/4 or 1/2 watt types.

L1, the interference suppression indicator, is not available commercially but is quite easily made. Start by winding a layer or two of plastic insulation tape on a 2in length of 8swg diameter ferrite rod. If a full length rod has been purchased it can be cut by filing a groove around the circumference and used in that form if it was glass.

Close wind a layer of 22 B & S enamelled copper wire over the insulation tape. Then wind insulation tape tightly over the rod in a couple of layers. This last step is important as it is not wound tightly it will emit a buzzing sound due to the currents being switched by the Triac. Do not forget to clean the inductor leads for enamel and tin them with solder to make connection into circuit easy.

In outlying areas where the interference produced by the Variilight is still a nuisance, it can be further reduced by enclosing the inductor L1 and the rest of the circuit in a metal box, to stop L1 from radiating.

We constructed our Variilight on a standard dual switch fitting made by Clipsal. One of the switches was removed to accommodate the dimmer potentiometer. The Clipsal switch plate has the advantage that it may be used vertically or horizontally, and the switch insert being set for either mode by removing it from the plate and reinserting as desired.

A small chassis is made from 24 gauge sheet metal and that fluorescent lamps must not be used. The circuit could also be built into the base of a table lamp, if desired.

Finally, attach the chassis to the switch plate with an epoxy resin glue, taking care to position it exactly. Leave for the required setting time and then attach the knob.

A plastic knob should be used so that the metal chassis and the potentiometer case are isolated from the user. The knob should be installed so its skirt is almost flush with the surface of the switch plate.

Having checked the wiring against the circuit and wiring diagrams, final testing and adjustment may be carried out. Ensure that the switch is assembled so that it functions as single-pole, single-toggle type with a "looping" terminal, isolated from the switch terminals. This can be verified with the aid of a multimeter switch to the ohms range. It is also shown in the assembly details supplied with the switch plate.

Testing may be carried out by wiring the Variilight to a three-pin mains plug and connecting a light socket in series with the active lead, as shown in the circuit diagram. With the unit switched both on and off check that there is no voltage between the chassis and the earth pin of the three-pin plug.

This is most important.

The test lamp may be the same as that to be used, although this is not critical. The brightness should increase smoothly with clockwise rotation of the knob. If necessary, replace the 1.8M resistor with another value to give the desired minimum level of brilliance with the lamp load to be used. If zero brilliance is required at minimum setting of the pot, delete the 1.8M resistor altogether.

There are several ways in which the unit may be installed. It can be mounted in a cavity of the right size or, if the house has brick walls, with the aid of a plastic power point surround.

Since it is a mains operated device, it may be necessary to seek the assistance of a qualified electrician to install it. In any case, the appropriate light fuse must be removed and, or the main switch turned off before any work is done on the lighting circuit. When this is done the Variilight may be installed by connecting the wires from the light switch which it is used to replace.

Remember that the maximum load is 300 watts and that fluorescent lamps must not be used. The circuit could also be built into the base of a table lamp, if desired.
Using the new
digital logic trainer

Learning logic concepts can be fun!

A short article showing how to wire up the trainer described last month to demonstrate for yourself the important concepts of digital circuit logic. The author also shows how to connect the trainer elements to examine the operation of many of the basic logic configurations.

by JAMIESON ROWE

With any trainer unit of this type, the number of logic configurations into which it may be wired is very great — in fact they are limited only by the imagination of the user. It is therefore not really possible in any short article to give more than a brief introduction to the use of the trainer. However I hope that by placing emphasis on what I believe to be the fundamental concepts and important basic configurations, readers will be able to obtain the grounding necessary for easy self-progression far beyond the examples given.

If you have built up the trainer and tried the configurations described here, you are very unlikely to be at a loss to think of further things to try. My own experience suggests that if you have any problems, they will be of the opposite kind — wishing you had either more time, or a much bigger unit to try out more elaborate ideas!

In familiarising yourself with the trainer, perhaps the first thing to do is demonstrate to your own satisfaction the operation of each of the basic logic elements. Once you have a sound understanding and “feel” for the operation of gates, inverters and flip-flops, it becomes relatively easy to follow the operation of circuits using them in combination.

The simplest element of all is the inverter, which simply reverses the logic polarity of signals applied to its input. When its input is taken “high” (H), its output goes “low” (L), and vice-versa.

To demonstrate this, first connect the input of one of the LED indicators to the NL (normally low) output of one of the two push-buttons. Verify for yourself that with the button not pressed, the output from the NL connector is indeed low, as shown by an unlit LED. Now press the button, whereupon the LED with light, showing that the NL output goes high for the “button pressed” condition.

Connect a second lead to the NL output of the button, and this time take it to the input of one of the six inverter elements 1-6. Then use another lead to connect the output of the inverter to a second LED indicator. With the button not pressed, the second LED should remain lighted, showing that with a low input, the output of the inverter goes high. Finally, press the button again: here the first LED should light, and the second extinguish, showing that with a high input, the output of the inverter goes low.

To check for yourself the operation of a gate element, which is only a little more complex than an inverter, first remove the wiring used to run through the inverter. This time connect two of the LED indicators to the outputs of two of the toggle switches, and verify for yourself that with the switches in the “up” position the LEDs shine to indicate a high, conversely the “low” position of each switch causes the appropriate LED to extinguish, indicating the low condition.

Now run a second lead from each of the switch outputs, connecting them to the inputs of one of the two-input gates G1-4 or alternatively one of the two-input buffered gates B1-3. Also connect the output of the gate to a third LED indicator, to enable you to look at the output state of the gate for each of the various possible input conditions.

With the gate thus set up for operation, try various combinations of the switches and watch the way the output of the gate changes its logic level or state. It shouldn’t take long to notice that the only condition for which the gate output is low (LED dark) is when both of the switches are feeding H levels to its inputs. If either or both of the gate inputs are taken low, then the output goes high.

It is worthwhile at this stage to consider carefully how this basic behaviour of the gate can be interpreted in terms of the various functions of combinational circuit logic, depending upon the logic polarity convention we adopt. If we adopt a positive logic convention, for example, where the H level is taken to represent truth (1) and the low level falsity (0), the gate may be seen to...
function as a NAND gate. That is, when both inputs are true, the output is false, but if either input is false or both are false, the output is true.

On the other hand, if we adopt the opposite or negative logic convention, where the L level is taken to represent truth, and the H level falsity, then the gate becomes a NOR gate. If either output is true, or both are true, the output is false, but if both inputs are false the output is true.

It would be a good idea to check for yourself that the gate may be used to perform the AND and OR functions also, by adopting each of the two mixed polarity conventions (opposite convention at inputs and output).

This practical analysis of basic gate operation should give a pretty clear idea of the flexibility which choice of logic polarity convention can give to the designer of logic circuits. By suitable choice of logic convention and manipulation of the convention adopted at various points in a logic circuit, any gate may be used to perform any of the standard logic functions.

Before going any further, it would also be worthwhile to repeat the foregoing analysis of gate operation with one of the three-input gate elements G3-10. The concepts involved are very important, and this will serve to reinforce them. It is also a good idea to verify for yourself that any of the gate elements may be used as an inverter, simply by using one input and either ignoring the others or connecting them to the H level outputs provided in the lower right-hand corner of the panel near the LED indicators.

Note that although the various gate elements provided on the trainer are capable of being used to perform any of the logic functions, they are shown symbolically as NAND gates. This is merely for convenience, and should be taken as nothing more than a reminder that the gates perform this function if the "straightforward" positive logic convention is used.

You should now be in a position to look at the operation of the remaining major type of digital element, the flip-flop. There are six flip-flops of the JK type provided on the trainer, F1-6, but before looking at these it is worthwhile to mock up an elementary R-S flip-flop using a pair of the gates. By doing this you will tend to gain a clearer insight into the basic concept of a flip-flop element.

Any two of the gates may be connected together as a flip-flop; two of the 2-input elements, two of the 3-input type, or even one of each. Simply connect the output of each to one of the inputs of the other. Then connect the NH output of one of the two pushbuttons to a second input of one gate, and the NH output of the second button to a similar spare input of the other gate. Finally, run leads from the gate outputs to a pair of LED indicators, so that you can watch their behaviour.

You should find initially that one of the two LEDs will light, while the other will remain dark. In other words, one of the gate outputs will be in the H state, and the other in the L state. Pressing the pushbutton whose NH output connects to the input of the gate with the H output will have no effect on the situation.

On the other hand, there should be quite a significant change if you momentarily press the other button. Now the gates will exchange their states, the one with the H output going low and the other going high.

Further pressing of the same button will now be found to have no effect on the new state of affairs; the gates will remain in their new states. However this time a quick press of the original button will produce an effect. The two gates will again exchange states, returning to the original situation.

By now it should have become fairly clear why this simple interconnection of two gates is said to form a "flip-flop". The combination has two stable states, and is capable of effectively remembering which pushbutton was pressed last. The two states of the flip-flop are by convention given the nominal labels "set" and "reset", with the set state taken to be the one where the "Q" output is true (1). Naturally the choice of which actual state corresponds to this situation will depend upon the logic convention adopted.

The simple flip-flop formed in this way by combining two gates is capable of a variety of functions, including storage of binary numbers, registering the arrival of random pulses, and "cleaning up" noisy pulses from sources such as mechanical contacts. In fact if you glance back at the circuit of the trainer itself, you will see that it uses two such flip-flops to remove any spurious pulses generated by "bounce" of the pushbutton contacts.

Useful though this simple "set-reset" or R-S flip-flop can be, it is not very suitable for counting or rapid manipulation of binary numbers. For such applications it is usually more convenient to use the more elaborate JK flip-flop, six of which are provided at the top of the trainer panel (F1-6).

The JK flip-flop lends itself very easily to pulse counting, as you can verify for yourself. Simply connect a pair of LED indicators to the outputs (Q and Q-bar) of one of the flip-flops, and the NL output of one of the pushbuttons to the clock (C) input of the flip-flop. Repeated pressing of the button should then cause the flip-flop to switch back and forth between its two stable states.

Now connect the Q output of the flip-flop to the C input of a second flip-flop, and again connect the output terminals of the second flip-flop to a pair of LEDs. Press the button again a few times, and you will note that the second flip-flop is now also changing its state periodically. But in this case it changes on every alternate change of the
Digital Trainer

first, or on every second input pulse.
A third flip-flop element connected in
similar fashion to the Q output of the second
element will repeat the behaviour as before.
However its changes in state will occur on
every alternate change of the second, or on
every fourth change of the first.

Similarly to the Q output of the second
first, or on every second input pulse.

Fairly obviously, a group of JK flip-flops
connected in this way are capable of
counting in binary fashion, with the first
counting the units, the second the two's, the
third the fours, and so on. If you connect up
all six flip-flops, with a single LED indicator
connected to the Q output of F1 instead of the Q output used for
the other elements.

If you find pressing the pushbutton pulser
a little tedious at this stage, disconnect the
lead from F1 to the button output and
connect it instead to the clock generator output.
With the clock rate switch in the
"slow" position, you will then be able to
adjust the rate of pulses fed to the flip-flops
from a slow one-per-two seconds to a brisk
70Hz stream, using the pot. At the fast end
of the range the first few flip-flops will be
changing state so fast that their LED indicators
will merely seem to flicker.

Of course 70Hz is by no means the highest
rate at which the flip-flops can count. In fact
if you switch the clock to the "fast" range,
they will be counting so fast that all of the
LED indicators will glow steadily and give
the impression that counting has stopped.
However if you look at the flip-flop output
terminals with an oscilloscope, you will see
that they are still operating as before. Note
that you will need a good oscilloscope for
this, as the highest clock rate is about 12MHz.

An important use of JK flip-flops is in shift
registers, where they are connected in a
"chain" so that they are able to pass along
the various binary digits or "bits" of a
binary number from one to the other. You
can wire the flip-flops of the trainer
together as a shift register by connecting the
J and K gating inputs of each to the Q
and Q-bar outputs, respectively, of the
preceding element. This is shown in Fig. 2,
which also shows the LED indicators connected to the Q outputs to allow you to
observe the behaviour.

Note that the clock inputs of the elements
are all connected together, so that they all
act in synchronism in response to a com-
mand pulse from the pushbutton pulser. The
data input to the shift register is provided
by one of the toggle switches, whose output
is taken directly to the J gating input of F1
and via an inverter to the K input. This
arrangement ensures that the J and K in-
puts always receive opposite or "com-
plementary" signals, so that F1 is forced to
follow the level set by the toggle switch.

The direct reset or K inputs of the flip-
flops are also all connected together and
connected to the Q output of the second
pushbutton pulser. This allows them all to
be reset before any information is fed in
an operation which is termed "clearing the
register".

To show how the shift register works, first
clear it by pressing the pushbutton con-
necting to the common reset line. Then set
the toggle switch to the H position, corresponding to a 1 in positive logic. If you
then activate the register by pressing the
clock line pulser pushbutton, you will see
that the first element F1 switches to the set
state, thus "accepting" the 1 from the
toggle switch. Note that once F1 has swit-
ched, the input from the toggle switch may
be changed without effect — until another
clock pulse occurs.

In fact to feed another bit into the
register, simply press the clock pulser
button with the toggle switch set to the
appropriate position — H for a 1, L for a 0.
You will see that the new bit of information
will be fed into F1, while the first bit will be
passed on to F2. If you repeat this operation
another four times, you will have effectively
fed a six-bit binary number into the register.

Having "filled" the register in this way,
you can either clear it using the reset pulser
and start all over again, or keep going.
Note that if you feed further bits of
information into the register, the bits first fed
in are "pushed out the end" from the output
of F6, and lost.

Shift registers of this type are used in a
variety of ways in digital computers, for
handling binary numbers. However it is
also possible to use such a register for pulse
counting, by connecting its output back to its
input to form a "ring counter". There
are two main types of ring counter, known
as the straight and twisted configurations.
To convert the shift register of Fig. 2 into
a straight ring counter, it is simply
necessary to connect the lead from the input
inverter to the Q output of F1 rather than
the toggle switch. However before doing
this it is necessary to first clear the register,
and then feed a 1 into F1 by setting the
toggle switch to H and pressing the clock
pulser button. The lead may then be
disconnected from the toggle switch and
connected to the Q output of F6.

Now feed a few clock pulses into the
register by pressing the pulser button,
whereupon the register will be set to
"pass around" the 1 which was initially fed
into F1. You can use the clock generator
instead of the button if you wish, and speed
up the action as fast as you like. It should be
fairly clear that the register is func-
tioning as a ring of six, and is capable of
either counting or frequency dividing by
this figure.

Why was it necessary to feed a 1 into one
of the elements before we started? Simply
to give the ring something significant to
"pass around"; if it has nothing to pass
around, it cannot effectively operate. This
can be easily demonstrated by discon-
connecting the clock and clearing the register. If you re-connect the clock pulses, the register will remain inactive, having nothing to pass around the ring.

This shows clearly that it is necessary to "initialise" a straight ring counter before it can be used. Of course in practice it is generally not convenient to break the ring and feed in a 1 whenever this initialising is required. The more usual way is to arrange that one of the flip-flops is effectively set, and the others reset, by a pulse fed to the common "reset" line.

The flip-flop elements used in the trainer do not have S terminals available. However, initialising the ring counter is still quite easily achieved. One of the elements is simply "turned upside down" in the logical sense, by swapping the connections between its J and K terminals and Q and Q-bar terminals respectively. The R terminal thus becomes an S terminal, and the F terminals respectively. The R terminal thus "initialising the ring counter is necessary 1 will be provided.

The twisted ring counter is basically a shift register with the output looped around and connected to the input, like the straight shift register. But in this case a simple logical inversion or "twist" is introduced into the loop, and this has the worthwhile effect of making the loop behave as if it were twice as long.

To wire up the trainer flip-flops as a twisted ring counter, first restore them to the basic shift register configuration of Fig. 2, i.e., with the flip-flop elements all connected identically. Then disconnect the input lead from the toggle switch, as before, but connect it this time to the Q-bar output of F6, not the Q output. This means that the feedback between F6 and F1 will have the required logical inversion — F1 will be forced to adopt the opposite state to F6, rather than the same state.

Clear the register initially by pressing the reset button, then press the clock pulse button once. You will see that F1 switches to the set state, because F6 is reset. A second pressing of the clock pulse button will cause F2 to set also, as this element effectively "takes" the first 1 from F1, while connecting the LED indicator to Q-bar instead of Q, so that the logical inversion will be complete. You should now have a straight ring counter that can be initialised simply by pressing the "clear" button.

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F1 receives another from F6 via the logical twist.

If you press the clock button another four times, this process will be repeated until all six of the flip-flops are set. But on the seventh clock pulse, note that F1 now switches back to the reset state. This is because F6 is now set, and the logical twist forces F1 to adopt the opposite state.

The counter has now entered a second phase of counting, and if five more clock pulses are fed in, you will see the elements progressively reset in the same way that they set during the first phase. On the twelfth pulse, all six flip-flops will be reset again, ready for a new counting cycle.

The twisted ring counter is thus able to count or divide in frequency by a factor of twice the number of flip-flop elements in its loop — in this case, by 12. It may therefore be regarded as being twice as "efficient" as the straight ring counter.

Like the straight ring counter, it does have to be initialised when the power is first applied. This is because it cannot operate as we have just observed unless it starts from one of the patterns in its normal sequence. An "odd" pattern will indeed cause information to be circulated around the loop, but this may not correspond to counting or division by the normal ratio. And the counter has no way of reverting to the correct sequence of patterns, once started up on an odd pattern.

You can verify this for yourself by turning off the power to the trainer, leaving it for a few moments and then turning the power on again. Very likely the flip-flops will come on again with a quite random pattern, which is unlikely to be one of those in the normal counting sequence (if this isn't so, try again!) If you press the clock pulser button a few times you will see that the register does shift this random information around and through the logical inversion, but can't ever bring itself into the correct sequence.

Fortunately the "all clear" situation is one of the patterns in the normal counting sequence, as we have already seen. Thus all that is necessary to initialise the twisted ring counter is to clear it using the reset button. If you do this and feed in more clock pulses, the counter will be seen to operate normally once more.

From the examples of the shift register and the two types of ring counter, it may be seen that the J and K gating inputs of the flip-flops allow the elements to be set to either state upon the command of a clock pulse. This characteristic enables JK flip-flops to be used for many other tasks.

An example is parallel entry of a binary number into a register — i.e., the process of entering all of the various bits of the number into the flip-flops of the register simultaneously, in contrast with the "one at a time" or serial entry possible with the shift register. Parallel entry is much faster than serial entry, and is therefore used in preference to the latter wherever speed is important.

You can demonstrate parallel entry by connecting three of the flip-flops up to three of the toggle switches as shown in Fig. 3. Here the J inputs of the flip-flops are taken directly to the switch outputs, while the K inputs are taken through inverters to ensure that they receive the opposite logic levels to

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the J inputs. The inverters effectively convert the flip-flops into “D-type” elements, it may be noted.

The clock inputs of the three elements are connected together, as they were for the shift register, to ensure that they act in synchronism. As before the R inputs are also connected together and taken to the second pulser button.

To enter a number into the register, first clear it by pressing the reset button — this is not essential, as you will see shortly, but for the first time through it will help you see the operation more clearly. Now set up a suitable 3-bit binary number on the three toggle switches, and press the clock pulser button. Instantly the three flip-flops of the register will “store” the number, showing that it has been entered in the required parallel fashion.

Now set the switches to a new 3-bit number, and without clearing the register press the clock pulser button again. The first number will be lost, and in its place the second number will have been entered. This shows that the parallel entry achieved is in fact of the “jam transfer” type, wherein the number being entered is not affected by any number previously present in the register. It was therefore not really necessary for the register to have been cleared when the first number was entered, although with other types of parallel entry this is indeed necessary.

The method of parallel entry just described is not merely one suitable for feeding information into a flip-flop register from a source such as the toggle switches. In fact one very useful application is in digital counters and similar instruments, for “display storage” — storage of the count reached during each measurement cycle, so that the readout display remains steady and easily read between cycles.

By connecting up the trainer as in Fig. 4 you can see for yourself how this works. The first three flip-flops F1-3 are connected up as a simple ripple-carry counter, operating from the clock generator (which is set to a fairly low rate). The remaining three flip-flops F4-6 are connected as the storage register, J and K inputs connected to the outputs of the three counting elements so that on command they can simultaneously store the count. The command pulse is supplied to the clock inputs of the three storage elements by one of the pushbuttons, which thus becomes a “store” or “transfer” pulse generator.

Set the clock generator to produce pulses at a fairly low rate, so that you can follow the operation of the counter. Then when you

press the pushbutton to store the count, you should be able to verify that the count is faithfully stored. Now set the clock generator to a much higher rate, and note that although the counting proceeds too rapidly to follow, the storage operation will still take place reliably whenever the pushbutton is pressed.

There are many other basic digital configurations which may be demonstrated using the trainer. For example you can set up two of the flip-flops (say F1 and F2) as a simple ripple-carry counter, and then build a simple decoder for it using the four 2-input gates with the inverters as AND gates to detect the four possible bit combinations and light four LEDs to correspond to them. This is shown in Fig. 5, and it would be worthwhile to wire this circuit up to strengthen your understanding of decoding.

A further exercise along similar lines would be to wire up a third flip-flop to form a 3-bit counter, and then use the six 3-input gates and the inverters to decode six of the eight bit combinations possible with this counter. The decoder wiring may be worked out by drawing up a truth table of the combinations, and selecting the gate connections bearing in mind the logic convention necessary to produce the AND function.

I could describe further configurations which you can easily set up on the trainer, such as those for exclusive-OR gating, the various types of synchroniser, full and half-adders, and more elaborate examples such as a pseudo-random sequence generator and a simple digital frequency meter. However at this stage it is really better for you to work out such configurations for yourself — the experience will be far more valuable than merely wiring them up according to a diagram.

With the basic practical groundwork hopefully laid by the simple configurations which have been presented, you should now be in a position to work out the others for yourself. It’s over to you!

---

The connector lead kits used for the trainer are available via trade stockists from McMurdo, at about $4 plus sales tax.
Shortwave converter uses only 2 transistors

A simple converter using two transistors which will mate with almost any normal broadcast receiver for reception of shortwave signals in the range 6-19MHz. It features a new printed wiring board which is also planned to form the basis of further converters.

by IAN POGSON

From time to time, we receive requests for a converter to listen to any one of a number of segments of the short wave and very short wave bands. Some readers have asked for such a converter to modify the Playmaster 138 Program Source, so that it will tune in overseas short wave broadcasts. Others have sought a similar converter for the Superhet Receiver which was described as part of the Home Study Course, in September, 1972. In fact there have been requests for all kinds of converters to attach to as many varied receivers.

Clearly, any one converter cannot be made to do all of the jobs which have been asked for. However, after considerable thought, we have come up with a printed wiring board which we hope to use as the basis for a wide range of converters. A kind of "universal" board has been arrived at, which may be used as a simple short wave converter covering the range 6-19MHz, or say 2-6MHz. Both of these may be arranged to feed into a first IF of 1.6MHz, which means that they may be fed into any reasonable broadcast band receiver.

By changing the output IF to say 3.5MHz or 5MHz, the converter may be fed into a suitable receiver capable of being set to one of these frequencies. More than likely such a receiver would be capable of receiving such modes as CW and SSB in addition to normal AM.

It may also be possible to extend the upper frequency limit to include say the 52-54MHz amateur band, to the various services around 80MHz and even to the 118-136MHz aviation and 144-140MHz amateur bands. Perhaps the last two bands may be stretching the friendship somewhat, but we hope to have a look at them in the not too distant future and see if they are a practical proposition.

So far, we have only considered tuning over a band of frequencies, with a variable oscillator in the converter and a fixed first IF. An alternative method is to use an oscillator on a fixed frequency, with the tuning done by the receiver at the first IF. This method has a number of advantages. One is that the oscillator may be crystal controlled, resulting in a high order of frequency stability.

A further simplification is possible if the converter is to be used for reception of one particular channel or station only. Here the RF tuning of the converter may be fixed and the first IF also fixed at some suitable frequency.

The frequency of the crystal controlled converter oscillator will depend upon the frequency of the wanted signal and the first IF. This could involve the use of an oscillator on frequencies between say 1MHz and 100MHz or so. Crystal oscillators are available to cover this wide range but the appropriate circuit varies somewhat over the range. This presents a problem when designing a "universal" board. In spite of this and other problems, we have been able to come up with a board which provides for a variable oscillator for use over the range under consideration, as well as the variations in circuitry for crystal oscillators over the same range.

In addition to the various possible oscillator alternatives, there are other variables involving details of mixer circuitry, oscillator methods of injection, etc. Many of these are also provided for and so our new board has rather a wide range of possibilities, which we hope to exploit in the not too distant future.

While this board may be used for converters for amateur use, the circuits would be of the simpler type and it is not really intended that this board should be used for more advanced amateur converters. In short, a separate approach will be needed to cover converters for amateur use, and we also hope to get around to this soon.

So much for the possibilities of our new printed board. Our first approach which we are about to describe is a very simple unit and tunes the major part of the short wave band — from 6 to 19MHz. The IF has been set at 1.6MHz, which means that the converter may be used with any reasonable broadcast band receiver.

This is the first solid state converter of this type which we have described, others have been for amateur use in the VHF bands or other specialised applications. Let us have a look at the circuit.

It may readily be seen that it is about as simple as it could be. The mixer is a junction FET, with a tuned circuit at signal frequency in the gate or input circuit. The drain or output of the FET includes another tuned circuit, this time at the first intermediate frequency, to feed into the broadcast receiver. There is a 4.7k resistor in the source of the FET, which may appear to be a rather high value; one which would bias the FET well back into the "knee" or non-linear part of the characteristic curve. This is so in fact, and is a requirement for efficient mixing of the incoming signal with that from the local oscillator.

The local oscillator itself uses a bipolar transistor, and the circuit is an adaptation of that used for our Solid State Dip

Front view of the completed converter. Note that the dial assembly shown has been superseded recently.
The circuit of the converter, which as may be seen is about as simplified as one could wish. The printed wiring board diagram is given overleaf on page 43.

FE5485 and MPF106, all having substantially the same characteristics. The oscillator transistor is a bipolar and such types as BF115, TT1002, SE1002, or similar should be satisfactory in this position.

The printed board was kindly supplied by R.C.S Radio Pty Ltd, but we imagine that other manufacturers will also be making suitable boards available. As mentioned before, we have attempted to make this a multi-purpose board and during assembly, you will notice that there are a number of unused holes. To avoid any possible errors due to the extra holes, we suggest that extra care be taken during assembly.

The output transformer is an RCS type 221 broadcast aerial coil connected in reverse. Possibly other brands could be used provided they can be made to fit the space on the printed board.

The dial assembly calls for special comment, particularly as the "Jabel" dial used on the prototype is no longer available in this form, having recently been modified. The actual mounting centres have been retained but the height has been increased by about 1/4 in. This would mean that the front panel would have to be increased in height to accommodate the new unit. This has been taken care of in the dimensions given in the parts list, and the metalwork drawing which we have prepared has also been altered to suit.

A good place to start construction would be to wind the aerial and oscillator coils. The aerial coil consists of a primary and a secondary winding, with the secondary wound first. This consists of 18 turns of 22B&S enamel wire. The start and finish of this winding may be anchored in position with a small piece of adhesive tape. This is slipped under a few turns at each end during winding. The end protruding is then folded over the top of the winding when completed. The primary winding of 2 turns of 22B&S enamel (22B&S enamel may be used) is wound over the bottom end of the secondary, after having placed a piece of tape over that part of the secondary. Again, tape is used to anchor the winding in place.

Electronic circuits and other more recent projects. This oscillator can be made to operate satisfactorily over a very wide frequency range and so has considerable potential for future converters where we hope to extend well up into the higher frequencies. The tuned circuit consists of a coil similar to that used for the signal frequencies, together with the other section of a 2-gang variable capacitor.

It may be seen that there is a capacitor connected in series with the oscillator section of the gang, the two combining with the coil to form the oscillator tuned circuit. The 0.001uF capacitor forms the "padder" for the oscillator so that its frequency will be higher than the incoming signal by an amount equal to the first intermediate frequency of 1.6MHz. As the signal frequency range from 6MHz to 19MHz, the oscillator must thus tune from 7.6MHz to 20.6MHz.

Output from the oscillator is taken inductively from the main coil, through a low impedance winding and via a 0.001uF capacitor to the source of the FET mixer. A facility is also provided in the form of a 3-pole 2-way toggle switch, which performs the functions of switching the supply to the converter as well as switching the aerial. By this means the converter may be switched off and the broadcast receiver used in the normal way, at the flick of a switch.

The components used in the converter are normally stocked items and no trouble should be experienced in obtaining a complete kit. The types of capacitors required are listed in the parts list. Generally speaking, I favour NPO ceramic types up to 100pF for normal applications. Generally speaking, I favour NPO ceramic types up to 100pF for normal applications. In the oscillator, above this value I prefer polyester types for bypasses. The time we get up to 0.1uF for bypasses, ceramic Redcaps are quite all right and polyester types may also be used.

For the mixer transistor, there are at least three different type numbers which we know to be suitable. These are 2N5485, 2N5486, and MPF106, all having substantially the same characteristics. The oscillator transistor is a bipolar and such types as BF115, TT1002, SE1002, or similar should be satisfactory in this position.

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### PARTS YOU WILL NEED

<table>
<thead>
<tr>
<th>PARTS</th>
<th>NUMBERS</th>
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<tbody>
<tr>
<td>Chassis-panel</td>
<td>1</td>
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<td>Cabinet to suit</td>
<td>1</td>
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<td>Dial assembly, Jabel 6 / 36N</td>
<td>1</td>
</tr>
<tr>
<td>Flexible coupling, 1/4in x 1/4in, Jabel</td>
<td>1</td>
</tr>
<tr>
<td>Miniature toggle switch, 3-pole, 2-position</td>
<td>1</td>
</tr>
<tr>
<td>Terminals, 1-red, 1-black</td>
<td>1</td>
</tr>
<tr>
<td>Rubber feet</td>
<td>1</td>
</tr>
<tr>
<td>Rubber grommet for coax cable</td>
<td>1</td>
</tr>
<tr>
<td>Printed board, 6in x 3in, 73 / 3C</td>
<td>1</td>
</tr>
<tr>
<td>Aerial coil, RCS type 221</td>
<td>1</td>
</tr>
<tr>
<td>Neosid coil formers, 7.6mm x 1.9mm, with grade 300M slug</td>
<td>3 / 8in</td>
</tr>
<tr>
<td>Transistor, BF115, TT1002, or similar</td>
<td>1</td>
</tr>
<tr>
<td>Resistor</td>
<td>1</td>
</tr>
<tr>
<td>Capacitor</td>
<td>1</td>
</tr>
<tr>
<td>MISCELLANEOUS</td>
<td>1</td>
</tr>
<tr>
<td>Hook up wire, 2ft coax cable, solder, screws, nuts.</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used providing they are physically compatible. Components with lower ratings may also be used in some cases, providing the ratings are not exceeded.

**CAPACITORS**
- 10pF NPO ceramic
- 12pF NPO ceramic
- 39pF NPO ceramic
- 60pF Philips trimmers
- 100pF 630V polystyrene
- 415pF Roblan 2-gang variable
- 1000uF 630V polystyrene
- 3.3uF 100V polypropylene
- 0.001uF 100V polyester (or polystyrene)
- 2.0uF 100V polyester
- 0.1uF 25V ceramic

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The oscillator coil is treated in much the same way as the aerial coil, bearing in mind that the frequency stability of the oscillator largely depends on this coil. It should therefore be wound firmly and finished in a workmanlike manner. The secondary is wound first and consists of 16 turns, centre tapped, of 22B&S enamel wire. The tap on the coil may be effected in a number of ways. One simple method is to scrape the enamel from about 3mm of the wire at the tapping point. Another short piece of the same wire is soldered on to act as a lead.

To avoid a short circuit, a small piece of adhesive tape should be placed under that turn at the tap. The primary winding of 3 turns of 22B&S enamel (or 22B&S) is wound over the bottom end of the secondary.

Now bend each of the remaining four pins normally a tap from one of the windings. The secondary construction is suggested.

About three inches of 20 gauge tinned copper wire should be used, with a loop wound firmly around each lug before soldering. This will prevent the soldered joint from coming adrift when the other end of the lead is finally soldered to the board. A trimmer must also be soldered to each section of the gang and as may be seen from the picture, we used the new solid dielectric type. If you have the old type “beehive” trimmers, then use them by all means. Care should be taken when soldering the former trimmers in place. For this task, it is advisable to approach it in a systematic manner. A good place to start is with the resistors, followed by capacitors and other small items, including the transistors. Do not forget the two links, which may be a piece of tinned copper wire or even a scrap of pigtail from a resistor. Note that the 10pF top-coupling capacitor on the output transformer is mounted underneath the board.

Due to the fact that the board was made to accommodate Neosid coil formers, and we found it more desirable to use an output transformer made by RCS Radio in this instance, some care is needed in fitting this transformer. The following fitting procedure is suggested.

Cut off the fifth pin close to the moulding so that there is no chance of it being short circuited later on. This pin is the one closest to the can mounting lugs and is normally a tap from one of the windings. Now bend each of the remaining four pins over so that they lie across the corners of the can. Then the pins are bent in dog-leg fashion such that they will enter the four holes in the printed board. The can mounting lugs must also be bent inwards and in a similar manner so that they will also pass through the respective holes in the board. This done, the can may be mounted — but care must be taken to ensure that it is orientated correctly, according to the code on the circuit and that moulded adjacent to the pins.

Having mounted the aerial and oscillator coils in their cans and bent the lugs over, each assembly may be fitted to the printed board, again taking care that it is orientated correctly. Each coil is fixed to the board with two 6BA screws. If 6BA screws are un procurable in your case, the alternative is to re-tap the holes to 4mm Whittworth.

The two-gang variable capacitor is fixed to the board with four screws and in our case, we added a half inch long brass mounting spacer under the board, to two of the screws, one nearest the front panel and adjacent to the oscillator circuitry, with the other diagonally opposite. The other four spacers may be fitted at each corner of the board.

This completes assembly of the board, except for some leads which must be provided to go to external points. Leads of sufficient length are soldered to the earth point near the earth terminal on the back skirt of the chassis, the aerial point of the coil to the switch, the +9V point to the switch, the IF output to the switch and from an earth point near the 33k resistor, to earth the IF output braid on the coax.

The two terminals, rubber grommet, switch and dial assembly may now be fixed to the chassis panel. As we mentioned earlier, the dial we used is no longer made but if you have one on hand, then it may be used, as the mounting holes remain the same. Alternatively, the new dial may be used as suggested, or you may make your own arrangements as you see fit, possibly by still making use of the dual ratio dial drive by Jackson Bros. This drive is available as a separate item from Messrs Watkin Wynne, 32 Falcon Street, Crows Nest, NSW 2065.

The complete dial assembly is supplied with a scale, having in addition to a 0-100 log scale, four blank ranges which may be calibrated according to actual needs. However, calibration of this converter may present problems to those readers who do not have any instruments for calibrating. To get around this problem, we are making available as a separate item from Messrs Watkin Wynne, 32 Falcon Street, Crows Nest, NSW 2065.

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All interconnecting leads are now terminated. The switch connections should be carefully studied to ensure correct operation. We used the centre section to switch the +9V supply and the other two were used for the aerial and IF output respectively. We arranged the wiring such that when the switch toggle arm is uppermost, the converter is switched off and
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the aerial is fed directly into the broadcast receiver. With the switch operated, the converter is switched on, with the aerial fed to the aerial coil of the converter and to the receiver. The coax cable and rubber grommet. If desired, a separate receiver may be connected to the earth copper of the board.

Having completed the mechanical work, the converter is ready to be put into operation. Quite a number of items must be considered here. We will assume that you have a suitable broadcast receiver and an aerial. We will also assume that there is a suitable aerial.

Connect the converter to the receiver, a suitable source of power and an aerial. Assuming that no signal generator is available, set the receiver to 1600 kHz on the dial or preferably, by tuning in station 3NE. Switch on the converter and tune in any station that may be audible. Adjust the slug in the oscillator coil until the station is getting a good signal. Set the converter to the IF of 1600 kHz.

Now tune to a signal towards the low frequency end of the dial and one whose frequency is accurately known. Unless you have another choice, we suggest that you tune to the standard frequency station VNG (7500 kHz). We have marked this point on the dial specially for this purpose. Having tuned the station, more than likely it will not be in the right place on the dial. In this case return to the correct frequency and adjust the slug in the oscillator coil until the station is again being received.

Now tune to a station of known frequency towards the high frequency end of the dial. Unless you have another choice, we suggest that you make use of Radio New Zealand on 17,700 kHz. Again, we have marked this point on the dial for the purpose. This station will be heard during daylight hours, the station closing around 1700 hours Eastern Australian Standard Time (EAST). Once again, having tuned in the reference station, it is not likely to be in its correct position. Set the pointer to the correct point and adjust the trimmer on the oscillator section of the gang until the station is retuned. As always, when aligning a superhet receiver, this process must be repeated several times until the stations are set at the correct points at each end of the dial respectively.

Each time the oscillator coil slug or trimmer is adjusted, the slug or trimmer on the aerial coil should also be adjusted.

If you have a signal generator or you have access to one, then the process of alignment is made that much easier, but the principles are the same. With an accurately calibrated signal generator you may also calibrate your own dial scale.

If you are located close to broadcast station 3NE on 1600 kHz, you may have trouble with breakthrough, from 3NE or another station. In this case we suggest that you move the tuning of the broadcast receiver just enough to avoid the problem. The output transformer of the converter must also be reset to the new frequency, and if necessary the converter alignment touched up.

Given a broadcast receiver of reasonable sensitivity and a good aerial system, this little converter, although about as simple as it could be, can give a very good account of itself. A point not always understood, is the fact that due to technical reasons, a converter of this type does not have as much gain at the low frequencies as it does at the higher frequency end of the band. However in spite of this it works out well in practice.

Before concluding, it may be worthwhile to give a few words on the use of this converter with receivers using ferrite rod aerials, as most modern receivers will probably be in this category. A number of points arise when it is intended to use any converter with a receiver of this type.

If your receiver has a rod but is also fitted with aerial and earth terminals for an external aerial, then all you have to do is to connect the centre conductor from the converter to the aerial terminal and the braid to the earth terminal or its equivalent. However, many receivers do not have this facility and it will be necessary to gain access to the rod to add an extra coupling winding.

I suggest that you wind on say three turns of a light hookup wire over the earthy end of the coil on the rod, tape the winding and connect the end nearest the earthy end of the main winding to some convenient earth point. The other end goes to the centre conductor of the coax from the converter.

So much for the actual connection itself. However when using converters with ferrite rod aerials, there is a potential problem caused by the fact that the rod continues to pick up broadcast stations, regardless of the fact that the converter is connected to it. This can cause interference, particularly at night. If happily you do not have a problem here, then all is well.

If trouble is experienced, then the receiver may be retuned slightly to avoid interference. Should this prove unsatisfactory, then most receivers will tune higher than 1600 kHz and we suggest that you therefore shift the first IF out of the band. All that is necessary, after finding a suitable spot, is to make sure that the output transformer is peaked to the new frequency.
Sound in the Round...

a new omnidirectional loudspeaker system from Plessey Rola

Details of an easily constructed loudspeaker enclosure which has a very smooth frequency response and an almost perfect omnidirectional characteristic. Using two new low-cost Plessey loudspeakers, it is ideal for either two-channel or four-channel stereo systems.

by PETER TWISS

Senior Engineer, Research and Development, Plessey Rola Pty Ltd, Richmond, Victoria.

Recently, Plessey Rola designed and released two new complementary loudspeakers. One is the X30 dome tweeter, which has excellent polar distribution together with a high frequency response extending well above the threshold of hearing. The other speaker is the C10-0, a 10-inch unit with low primary resonance and a curvilinear cone made using the new controlled fibre length (CFL) technology reported in the January 1973 issue of "Electronics Australia." Electrically the two speakers may be combined very simply, using a 3uF fixed capacitor in series with the tweeter for an 8-ohm voice coil impedance.

It was decided to combine these two compatible and outstanding loudspeakers to make an efficient and compact enclosure with a 360 degree radiation pattern which would handle, with reserve, the maximum output from a 20 watt amplifier.

The first question asked was why make it omni-directional? Well, from those working in the field of auditory perspective it is known that two channel stereo from two separated point sources is inadequate. With the exception of a special seating position, there is always a "hole in the middle" or inadequate breadth — an unnatural situation.

Omni-directional speakers help to eliminate this and produce in addition a wider sound field with increased realism. Also it is unnecessary to have a critical placement for the enclosures, a distinct advantage from the point of view of room arrangement.

Across both pages is the frequency response of the system, centrally located in room.

The enclosure, although it had to provide 360 degree radiation, needed to be simple to construct with a low final cost. We decided to look at the middle and high frequency dispersion first, then follow up with the bass end.

The approach we decided to adopt was the fairly logical one, where the loudspeakers are mounted on the top of the enclosure proper, facing vertically upward. The tweeter is mounted co-axially within the cone of the larger unit, and above both is positioned a diffuser to deflect the middle and high frequency radiation into the horizontal plane.

A size was chosen for the basic enclosure bearing in mind the need for a compact system and the requirements of the C10-0 for good performance at low frequencies. The dimensions we selected were 12 x 16½ x 25in (d x w x h) external, giving an internal working volume of about 2 cubic ft.

The parameters for a diffuser were readily worked out, knowing the case dimensions. A conical exponential shape was chosen as closest to ideal. Sound radiation below approximately 550Hz is omni-directional therefore we could concentrate above that frequency. A height of 6 inches was chosen as this is close to a quarter wavelength at 550Hz, the lowest frequency to be considered by the diffuser. Thus with diameter, height, and flare chosen it was simple to apply the exponential equation and work out a final shape.

A diffuser was turned out of wood and the experiments commenced, using one, two, and four tweeters. In fact we found one tweeter coaxially mounted to be adequate,
metrical and also produce a simple form to manufacture.

It was decided to experiment with a prism still having exponential faces but with a rectangular cross-section. The main requirement for the diffuser is that it be rigid and non-resonant, and we could no doubt have fashioned a solid block of wood into the desired shape. However this would not have been easy, so we elected to try a different approach: casting the diffuser using a foaming polyurethane resin.

A mould for casting the resin was made in the following way. Two large sides and two small sides were cut from cardboard in the shapes shown in the diagrams. A piece of 3/16in thick tempered hardboard 20 x 16in was then taken and a rectangular hole 16 x 11½in cut in it to form a frame. A further rectangle 16½ x 12 in was then drawn on the frame outside the hole, to mark the base of the cardboard sides.

The four cardboard sides were taken, and one at a time, taped along the pencilled line. They were then pressed into the pyramid shape and the four edges where the cardboard faces met were taped into position. The exponential rectangular pyramid thus formed was untaped from the masonite frame and a fillet of lacquer adhesive such as Tarzan’s Grip was run inside along the cardboard sides.

The pyramid was then glued and screwed to level off the top when the last addition rose above the frame level. Finally the casting and mould were left for about two hours to harden.

When the hardening appeared complete the frame was removed and the corners of the casting cut to clear the four support pillars. The pyramid was then glued and screwed to the top panel using PVA adhesive (which does not interact with the polyurethane — other adhesives do!). When dry the diffuser and underside of the top panel were lightly sandpapered (the cardboard is left on) and painted with flat black paint so that they would not be visible through the cloth ultimately added to the outside of the enclosure.

On test we found as calculated that the peak at around 550Hz had gone, and the radiation pattern was good. We had in fact produced a better diffuser than the original exponential conical design.

Since making the diffuser in the above manner, we are inclined to think that an easier approach would be to cut the sides of the mould from tinplate, folding them in the same manner and soldering the joins. The resulting tinplate mould could then be used to produce as many diffusers as required, using a moulding material such as “Spackle” or “Polyfilla.” We have not actually tried this approach, but it would be somewhat easier than the polyurethane resin and should give results just as good.

With omni-directional enclosures there is generally a loss in bass because of decreased radiation resistance resulting from the mounting position of the loudspeaker. During our work on the diffuser we used a totally enclosed box which did exhibit these properties. Experimentally we overcame the lack of bass by using a second 10in speaker at the bottom of the cabinet facing the floor with the cabinet raised 3½in on legs. A 550Hz crossover network was incorporated and the results were quite good, but it did require an additional loudspeaker and an expensive cross over network. The next experiment was to design and construct an open ended labyrinth or if you like transmission line and terminate it at the cabinet base with the cabinet still raised 3¼in on legs.

The transmission line gave a clean bass, which many people liked, but it did require bass lift from the amplifier due mainly to the relatively small cross sectional area of the transmission line, which was limited because of the required final size of the enclosure. The need for bass lift in the
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amplifier was thought to be a disadvantage, so we went "back to the drawing board" once again.

At low frequencies where the wavelength is longer than 2 feet (at 550Hz), sound radiation is omni-directional. Theory thus suggests that it is possible to use a two-speaker system with a correctly designed enclosure and obtain a simple compact system with omni-directional characteristics and a wide frequency response.

For our final experiment we designed a vented enclosure with the vent on one side close to the floor and tuned with a tunnel to 38Hz. A "V" shaped curtain of Innerbond is arranged as shown in the illustration. It gave a good bass response which matched the rest of the system and was chosen as the best practical solution. Response curves of the enclosure are illustrated. Tunnel ports will be available from Plessey Rola distributors.

The polar radiation curves were taken in the Plessey anechoic chamber, using white noise with a uniform spectrum density in the frequency range of 20Hz to 20kHz and normal gaussian amplitude distribution. A 1 in condenser microphone was fixed at a distance of 1 metre from the top opening and the enclosure rotated through 360 degrees. Any deviation in polar pattern was thus recorded as a change in level.

Two recordings were made, as a check on linearity, the outer one at 700 milliwatts and the inner one at 140 milliwatts. This was a difference in level of 7dB and is recorded as

Continued on page 125
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ELECTRONICS Australia, April, 1973
A 2-Metre portable FM transceiver - 4

This final article on the Climie transceiver describes a power supply for use with the mains or a vehicle battery, suggests a number of modifications and additions which readers may care to try, describes an improved IF amplifier, and discusses circuit changes needed to accommodate an alternative IF filter.

by FRED JOHNSON, ZL2AMJ
15 Byron St, Upper Hutt, NZ.
Inspector of Technical Institutes, NZ Department of Education.

When not used in the transportable mode, the transceiver can be powered from the mains, or a vehicle battery. This conserves the internal dry batteries. A supply circuit is shown in Fig. 19. The requirement is 12 volts at about 400mA maximum on transmit and about 50mA on receive. With this wide variation, a regulated output is desirable. A series regulator using an NPN power transistor is shown. Any power transistor capable of handling 500mA or more is suitable. The transformer is a 1 amp bell transformer.

The output is about 11.8 volts, which is very satisfactory and comparable to the dry battery voltage on the same loads. Without the regulator it rises to about 16 volts on receive, which is a triffe excessive.

A five pin DIN socket provides a number of facilities. First, the external 12 volt power supply can be fed into it. To operate from internal batteries, the supply plug is withdrawn and a jumper plug inserted. This connects the battery supply as shown in Fig. 1. This jumper plug can also act as an "ignition key" to prevent unauthorised use of the transceiver. If the relay is a plug-in type it could also be removed to disable the set. The jumper plug can be seen in the photo on page 47, January issue, at top left. The plug could be made considerably smaller if desired. The press-to-talk lead is also brought out to the external socket. This is for possible future use to operate a send receive relay in an external linear amplifier.

Although the diagrams do not show it, the remaining socket pins are available for an external speaker. Also, the speaker plug is one lead common with the positive supply line so the jumper plug (with an additional jumper) could select internal or external speakers. Leads could be taken from the external power supply to the external speaker. Changing plugs would then change power sources and speakers simultaneously.

For mobile operation the vehicle battery can be connected to the terminals at the input to the regulator. The bridge rectifier is reverse-biased and effectively disconnects the transformer when the vehicle battery is connected. The regulator holds the transceiver supply voltage to about 11.8 volts in spite of wide variations of the vehicle battery voltage. The whole supply is fitted into an electrician's box type PDL2000 and forms a neat and useful unit.

Note that the system is NEGATIVE CHASSIS. No provision is made for the opposite polarity. A motor-bike battery would be an easy solution for positive-chassis car owners! (With slight modification this supply could act as the battery charger.) The author owns two cars - one of each polarity - and proposes to change the positive-chassis one to negative-chassis!

Modular construction and the component-on-the-copper-side form of assembly enables modifications to be made with ease. Areas for experiment, some of which have already been investigated, include:

- Using the delayed AGC output from the CA3089E to control the gain of Q41. Using the AFC output to control the local oscillator frequency.
- In the interests of battery economy, a timer which, when in the scan mode, would hold the receiver off for, say, one minute, scan for 10 seconds, then switch off again.
- A crystal-locked receiver local oscillator for use when listening for long periods on a local repeater channel.
- A range of portable antennas with extension cables for use in motels, mobile, or when mountain topping.
- An aerial made from hook-up wire laced into the carrying strap.
- An external amplifier to increase the RF output.
- An audio amplifier in the audio lead between both IC's, in order to run the audio 1C nearer to its maximum ratings.

This sensitivity of the receiver can be improved by replacing Q41 with an IC stage.

---

This article is reprinted from the September 1972 issue of "Break-In," the official Journal of the New Zealand Association of Radio Transmitters Inc, by arrangement.
The following DC voltages are measured with a 20,000 ohms/volt meter, with its negative lead connected to chassis. Measurements marked with an asterisk (*) are for transmit conditions, with the transmitter operating into an RF wattmeter. None of the voltages is critical.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage (V)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1.6</td>
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<td>2</td>
<td>3.0</td>
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<tr>
<td>3</td>
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<tr>
<td>14</td>
<td>5.3</td>
</tr>
<tr>
<td>15</td>
<td>5.3</td>
</tr>
</tbody>
</table>

This problem is solved by lowering the voltage on base 2 of Q71. The LED and D71 positions are transposed, so that the LED is at the top of the series combination. A 6.2V potential now exist across the zener diode. R72 is lifted from the 8V rail and connected to the 6.2V point. This will produce a satisfactory scan. Make sure that correct polarity of the LED and zener diode is retained.

ACKNOWLEDGMENTS

Thanks are extended to all who have assisted with the development of this project, both on and off the air, and to Glen ZL2KY who took the photographs. Special thanks to members of the Wellington VHF Group for assistance with tests.

The foregoing should be sufficient to enable a constructor to build a VHF FM transceiver from scratch. If you strike trouble, then there are many useful textbooks to which you can turn for assistance. Local VHF groups include technically interested amateurs in their ranks and assistance will be gladly given.

If all else fails, the author's address is at the head of this article and all mail is answered. You learn nothing if I solve your problems, so please ensure that all reasonable tests and investigations are done by you first. From experience it has sometimes been found to be difficult to diagnose faults by letter so please ensure that a full description of the problem is enclosed.

73 de Fred, ZL2AMJ

THE VOLTAGES YOU CAN EXPECT TO FIND

Power out on wattmeter: *1 watt

<table>
<thead>
<tr>
<th>Device</th>
<th>Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q41S</td>
<td>1.0</td>
</tr>
<tr>
<td>Q41g2</td>
<td>2.7</td>
</tr>
<tr>
<td>Junction R44 and RFC41</td>
<td>11.4</td>
</tr>
<tr>
<td>Junction R47 and C48</td>
<td>11.5</td>
</tr>
</tbody>
</table>

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ELECTRONICS Australia, April, 1973
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Vague new hope for VHF FM supporters

About the end of last year, the whole matter of frequency modulation broadcasting in Australia was effectively pushed into deep freeze, there to remain for several years at least. It's still there but a new and quite surprising development could conceivably cause it to be taken out for re-examination.

This development has nothing to do with the time-honoured pleas and arguments which have been advanced through the years by the champions of high quality FM stereo broadcasting. The same group is still campaigning patiently, with varying degrees of credibility, but with no more apparent effect than heretofore.

One of their less credible efforts is a letter to hand from a reader from Castle Hill, NSW. He writes:

Sir,

As an American expatriot and FM devotee I was disgruntled by your recent editorial condroring the PMG's allocation of FM outside of the standard 88-108MHz band. I find your argument based on the potential "overcrowding" of this band to be technically false.

In the New York City area, which has the densest FM propagation in the world, I consistently logged over 25 FM stations with my portable radio. Using a high-quality FM tuner of high sensitivity, high selectivity, and low capture ratio, I consistently logged over 45 stations in FM stereo. I cannot envision any Australian metropolitan area being "overcrowded" with regards to FM until perhaps the year 20,001. Remember, an FM transmitter with a power of 100,000 watts has an effective reception radius of approximately 100 miles day or night.

Reconsider your support of the PMG's decision and save thousands of Australian audiophiles needless equipment duplication and expense. Who's pulling the wool over whose eyes?

L.B. (Castle Hill)

At the risk of being tedious, I can only repeat that this is the kind of letter which, in the past, has done nothing to advance the cause of VHF FM in Australia. In fact, it tends to have the reverse effect by making statements which can be discarded with scarcely a backward glance.

Whether or not you agree with its financial illusionism, the Board did set out its reasons with great care. The Board did not even have the vaguest idea that the suggestion would be put forward seriously by industry executives themselves.

It does not mean, of course, that anything will come of it. I doubt that too many station operators will volunteer to have their own particular licence cancelled, nor will they see it taken away without a full-scale battle.

Some kind of merger and re-distribution of shares would seem to be a much more equitable basis for any re-allocation.

Where the public interest lies is another complicated matter. It's good to have a wide choice of programs but questions have been raised about program quality and the whole viability of FM. I think that such things, and the many other implications would be sorted out in a high-level inquiry, based hopefully on facts rather than emotions.

What the new proposal does seem to indicate is that provision for the future of television, made in the last decade, was perhaps needlessly generous. The wisdom of issuing a third commercial licence in the capital cities has long been questioned and plans for cultural/educational services on channel 11 have remained in limbo.

If there should be an inquiry into the scale, and viability of television services, and if it is established that the planning can be scaled down, it could leave room to rethink the FM situation. It may become possible to re-shuffle the TV allocations, without too much additional trauma and to create space for a VHF FM service.

Such a course would undoubtedly be a convenient one, politically and technically. When he was Leader of the Opposition, the present Prime Minister expressed a view contrary to that of the then Postmaster-General. This was expected of him, of course, but now, as the nation's Chief Executive, Mr Whitlam might be happy enough at any opportunity to back his words with deeds.
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Again, while the Australian Broadcasting Control Board advised in favour of UHF FM as lesser of two evils, it has not relished the task of determining entirely new standards within the time scale imposed upon it by the former Liberal Party interminably. The Board may well have the opportunity to abandon the plans for a sophisticated UHF stereo/quadruple broadcasting system and to settle for conventional UHF stereo multiplex, limitations and all.

In short, the proposition would regress to the rather familiar formula: let’s set up what we want now and leave the next generation to sort out the expansion bit, whether it means UHF, cable or what!

All this rests on two big "ifs" and our philosophy about future planning but, for the champions of VHF FM now-at-any-price, they could present a new peg on which to hang their case.

The foot of the previous page is a letter with a rather good number of interest to enthusiasts of the popular organs.

Of rather more general interest, still on the subject of recordings, is a letter from a reader in East Ryde, NSW.

Dear Sir,

On page 89 of E.A. for February 1973, you printed an extract from H.A.T. mentions a "somewhat puzzling circumstance" in that an early Toscanini recording of the New World Symphony was in genuine stereo. The explanation of how this is done is contained in the enclosed copies of extracts from recent newsletters of the Arturo Toscanini Society.

The President of the Society, Mr Clyde J. Key noticed in an old photo that the Toscanini broadcasts were recorded in two channels as far back as 1937. The Toscanini Society obtains its recordings from "off the air" recordings by private individuals and from official recordings made when the equipment was "accidentally" turned on during rehearsals.

Already the Society has made one stereo tape from "off the air" recordings, as noted in the newsletters. As NBC have all the masters of the original broadcast, the recording reviewed by your reviewer may be the first of many stereo Toscaninis.

J.H. (East Ryde, NSW)

Our correspondent has appended a number of photostats from the Arturo Toscanini Society Newsletter originating, individually, from 912 Dumas Avenue, Dumas, Texas 79029 USA. An excerpt from one of them is in the panel above.

I wouldn’t blame you at all if you did a quiet double-take while reading it. The obvious point is that the two microphones would have been positioned so that each would hear the whole orchestra. They would not have been angled with the usual stereo cross-mic technique to favour the respective sections, left and right. While they would hear two versions of the performance, by reason of their physical displacement, any stereo effect would be entirely dependent on this and the very short time intervals involved.

Here extreme accuracy is required. Only recently, for example, has the BBC been able to overcome the problems of relaying F.T.T. stereo programs throughout Britain over distances greater than 25 miles. The problem has been that different time delays introduced into the left and right channels by pairs of ordinary program lines have been sufficient to compromise the stereo image.

If the differences between two otherwise satisfactory program lines is sufficient to cause problems, how could one possibly marry two acetate recordings into a stereo pair, having in mind the relatively random signal paths into the respective recorders, and the inevitable differences between the recorders and replay turntables in terms of speed and wow content?

It is apparent that members of the Arturo Toscanini Society have already debated this matter at some length and the answer is more or less as one would expect.

The disc recordings are transferred to high quality tapes and set up for replay on a pair of tape machines, one of which is a variable speed type.

Carefully, the tapes are synchronised to produce an appropriate stereo image and then copied on to a single stereo master tape.

It’s a job that calls for incredible dedication and patience and one would imagine that the finished stereo master will actually have been made up from many individual bits, suitably spliced together.

But dedication of this order would not be anything new for enthusiasts of Arturo Toscanini or NBC RCA engineers.

---

**Toscanini recordings in true stereo**

Recently while viewing Robert Hupka’s unpublished photographs of Maestro and the NBC Symphony Orchestra in Studio 8-H, I noticed the bar to which the microphones were clamped contained three microphones rather than one. Under the supposition that only one mike was used (due to Maestro’s dislike for the engineer to mix his sound) I asked Mr Hupka why there were three. His reply was that one was used to broadcast (and at the same time record for reference) the concert and fed to the NBC network lines. The middle one was a spare in the event one should develop mechanical trouble during the broadcast and the third was used only for recording the concert with Spanish announcements and commentary as NBC made transcriptions from the master recordings to be sent to Latin America for rebroadcast over their stations.

I asked Mr Hupka if the Spanish broadcast was engineered on a separate line from the one fed to the NBC network stations in the US and if the masters still exist. The answer was yes. I suggested that transferring the domestic copy to tape and on another tape, transfer the copy with the Spanish announcements and then fed into a stereo recorder inputs each tape corresponding to the left and right microphone we would have true Toscanini stereo. There was a silence then Mr Hupka exclaimed, “My God! why has no one ever thought of that?”

The following day we visited Mr Peter Munves, director of classical recordings at RCA and told him of the idea. He was most enthusiastic needless to say. It is just a matter of time until we shall one day have MANY stereo recordings of Maestro. The above described microphone placement was in effect from the first broadcast until the beginning of the 1947-48 season (at which time a different engineer came and changed the microphone placements to positions not allowing the separate recordings to be used to make stereo copies).

A look at the listing of Maestro’s concerts with the NBC Symphony for the years from 1937 to 1947 will give you an idea of potential recordings. With all sincerity, I feel the classical music market is about to undergo the most sensational experience since the advent of stereo records in 1957.

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Ingenuity can sometimes save money

It is not unusual for servicemen to accuse their colleagues of having no initiative; of not measuring up to the standards of the "good old days". Whether you subscribe to this theory or not, it is always gratifying to hear of an ingenious approach to a tricky situation.

This story came to me from a colleague. In truth I would like to be able to claim it as my own, since I would like to think I could be as ingenious as he was, in similar circumstances. Since I can't make any such claim, I will let him tell it in his own words.

The story concerns a similar fault in two TV sets, both of the same make but different models. The first set was an 81in portable, and the complaint was horizontal drift. More specifically, if the picture was locked when first switched on, it would remain so for only a few minutes. Then the picture would tilt, and have to be restored by means of the horizontal hold control. This procedure would have to be repeated a number of times during, say, the next half-hour, until it finally settled down. I need hardly add that the final setting of the horizontal control would be quite hopelessly out when the set was next switched on.

It was a make and model of set with which I was not very familiar. The valves, in particular, were unfamiliar, being of the so-called "compacron" type. These valves are designed to accommodate as many valve functions as possible in one envelope, and many of them use a 12 pin base to accommodate all the connections. Many are also designed for series heater operation and, in fact, this set employed this technique.

My only quarrel with these types is that, being relatively rare, and also designed for series heater operation, they sometimes require replacement when it occurred to me that it might turn out to be something quite simple, like a faulty resistor nicely charred so that it was immediately recognisable! I need hardly add that I found no such resistor, or any other component for that matter which seemed likely to cause the problem. It just had to be one of the valves. But which one; the horizontal oscillator or the horizontal output?

As before, I didn't want to invest in one of these purely "on spec." As sure as I did, by Murphy's law it would be the wrong one. Neither was I all that keen on pestering the makers again. Not that they had been anything but most co-operative, but I felt a bit sensitive about inquiring about the same kind of fault twice in a couple of weeks.

Thus I decided to indulge in a spot of unconventional thinking, and, as my colleagues might have expected, I ruled out the output stage as a likely culprit, naturally enough, was the horizontal oscillator. This was an 8B10, a twin diode, medium mu twin triode, with three separate cathodes, one for each triode and one for the two diodes. I had almost reached the stage of ordering a replacement when it occurred to me that it might be worthwhile ringing the manufacturer. After all, he should know more about the set than anyone and there might just be some point which I had overlooked.

It was just as well I did. When I related the symptoms to one of their own technicians, and asked whether it could be the 8B10, his reply was cautious.

"Well, it could be, but our experience is that it would be the 33GY7." (The 33GY7 is a combined beam power tube and diode, used as a horizontal output stage and damper respectively.)

"Don't ask me why, and I know it sounds unlikely, but before I could reach the oscillator stage, the output stage affected the oscillator stage, but for some reason it does. If I had to make a choice it would be for the 33GY7."

To cut a long story short I took his advice and it proved correct. So I made a mental note that the next time I struck that fault in that set, I would know what to do.

I am convinced that what happened next could only have been brought about by some mischievous spirit, kindly contributed by the same team that inspired Murphy's Law. It so happened that, less than two weeks after the first incident, I did encounter the same problem again, and in the same make of set.

"You beauty", I thought, "I ought to be able to knock this one over in no time."

Then I realised that it wasn't the same model. This was a 19in portable and closer inspection confirmed my worst fear; the valve line-up was nothing like that of the 81in model. This posed something of a problem. Since no one seemed to know the true reason why the horizontal output valve behaved as it did in the 81in model, there was no way of knowing whether it was basically a circuit problem — and might thus be expected to appear in more than one chassis type — or essentially a problem peculiar to the 33GY7.

On the other hand, there was no point in meeting trouble half way. It might turn out to be something quite simple, like a faulty resistor nicely charred so that it was immediately recognisable! I need hardly add that I found no such resistor, or any other component for that matter which seemed likely to cause the problem. It just had to be one of the valves. But which one; the horizontal oscillator or the horizontal output?

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It was just as well I did. When I related the symptoms to one of their own technicians, and asked whether it could be the 8B10, his reply was cautious.

"Well, it could be, but our experience is
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trick in such situations — assuming a replacement valve is not readily available — is to switch the set on, set it up quickly for correct operation, then remove the suspect valve and leave the set running for an hour or so. If the cold valve is now plugged into the hot set the set's behaviour will give a pretty good indication whether it is the valve or the rest of the set which is temperature conscious.

There was only one snag. I couldn't pull that trick on this set because of the series heater arrangement. Pulling out one valve would disable the lot. This is where my cunning came to the rescue. The first move was to load the chassis in the car and take it home, where the equipment I needed was more readily available.

Having set the chassis up on a temporary workbench I switched it on and quickly set the horizontal hold control for a stable picture. Then I switched off, let everything cool down for 10 minutes or so, switched on again and checked that the picture came up locked. It did, and I switched off again.

Then I removed the horizontal output valve / damper diode — a 38HE7 — loaded it into the domestic oven and set this for about 350 degrees F. This figure was a rough estimate of the temperature obtaining temperature of a valve. I let the valve "cook" at this temperature for about 10 minutes then, handling it very gingerly with a heavy pot holder, I replaced it in the set and switched on. The picture came up locked, exactly as for a cold set, which seemed to indicate that the trouble was not due to any heating effect in the 38HE7.

But just to make sure I pulled another trick. I switched off immediately, withdrew the valve again, and popped it in the freezer; temperature about 20 degrees F. After about 15 minutes I put it back in its socket — again using the pot holder! — and switched on. Again the picture came up locked and I considered the point proved; the 38HE7 was not to blame.

Next I considered the horizontal oscillator valve, an 8LT8. To cut a long story short, I worked through the same ritual. This time, plugging the hot valve into the cold set produced an unlocked picture and it was necessary to reset the hold control in the (say) clockwise direction. The amount was not as much as I would have anticipated, but the indication seemed quite definite.

When I put the valve through the cold cycle, the same thing happened, except that the hold control now needed to be turned anticlockwise from its normal cold setting. Again it didn't need a lot of movement, but the indication was quite definite.

On the basis of these tests I felt reasonably confident about purchasing a new 8LT8; a confidence which proved to be justified, for it completely cured the fault.

Truly has it been said that there are more ways of bringing about the demise of a domestic feline than blocking its respiratory tract with a fatty substance prepared from the milk of the domestic cow!

Well, that's my colleague's story. I can only commend him on his ingenuity, which seems to be on a par with his modesty!

And, finally, here's a letter to hand from a country serviceman whom I happen to know personally, who lives in central NSW:

Dear Sir,

I refer to your articles in the May and August issues concerning the lack of service from manufacturers of solid-state TV's. Would you give some thought to the position of the country serviceman who, in addition to having similar problems to those referred to in the letters previously published, has the additional headache of unsatisfactory service from manufacturers, distributors and suppliers.

Ordering spare parts by letter or phone can be very trying, especially when one consistently gets the wrong parts. It is frustrating to have to return incorrect parts to suppliers, and waste time writing letters to personnel who obviously don't know their jobs, to explain the exact part you want.

If you are lucky, you might get the right part the second time around. While this is happening, one has to try and appease an irate customer.

For example — about two months ago, I ordered a replacement stylus for a particular brand of pick-up cartridge. About two weeks later I received a reply that they could not supply. I then wrote to hear from other firms with the same result. I then tried another firm and, for a change, received an immediate reply that they did not stock this valve, but recommended another supplier whom they named. A letter to this firm and I had the stylus in a few days. This is not an isolated incident but happens in about seven cases out of ten.

Another thing which drives one up the wall is the non-arrival of goods ordered. This is happening all the time and, when I phone on the insistence of the customer, nobody at the firm seems to know anything about the order. The stock reply is "we will look into the matter and advise you". Nine times out of ten they don't, and it is usually necessary to make two or three trunk line calls before one gets the order. Now I ask you is this fair to the serviceman or to his customers?

Another frustrating point is where a country serviceman has a "tough dog" and wishes to contact the manufacturer's service department. With one or two exceptions, the chap at the other end of the phone does not know any more about the problem than the inquirer. He usually asks such silly questions as "have you got correct HT?" "did you try a new valve" &c. Usually you have to give up. Unfortunately one is stuck with the problem, and have to solve it the hard way. We just can't send an ap-

(Continued on page 125)

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ELECTRONICS Australia, April, 1973
Regulated Power Supply

Here is a circuit for a regulated power supply capable of 0-30V at 3A. Three 2N3055 transistors in parallel are used as a series regulator. An AY8139 senses the voltage drop across a 0.68 ohm resistor and whatever resistor is connected in series with the output and by so doing, protects the unit against overload.

A type 748 or 777 IC and an AY8171 emitter follower function as the error amplifier for the regulator circuit. Output voltage is adjusted with the 10k potentiometer at the input to the IC. A supply of -3.9V for the IC is provided by a small separate supply from a low current 6.3V winding.

In practice, a selector switch is used to determine the maximum current which can be drawn from the supply, according to requirements of the load. It may also be desirable to provide means of measuring output voltage and current. Mechanical arrangements may be adopted to suit individual needs. The 2N3055 transistors should have adequate heat sinking.

(This power supply was designed by Charles Kosina and built by Roger McGlinn of Fairchild Australia Pty Ltd.)

Diodes for Battery Isolation

"Mullard Outlook" for September October 1964 contained an article describing the use of a silicon power rectifier diode to provide isolation between two batteries being used to increase the storage capacity in an automotive electrical system.

Editorial note: This article was reprinted in "Radio. Television & Hobbies" for January, 1965).

Whilst this system has proved its reliability over two years, on changing to a new vehicle, the author decided to adopt an idea which had been in mind for some time. (The original circuit had a problem introduced by the fact that a diode was used only on one of the batteries and which resulted in an asymmetrical condition between the two batteries. Isolation was only in one direction. Ed.)

The original circuit may be modified by incorporating additional diodes as shown, thus providing complete isolation between the two battery systems during discharge. Whilst both batteries will charge simultaneously, the discharge cycle will be confined to the equipment actually connected to each individual battery.

Low cost automotive silicon diodes as used in motor vehicle alternators, such as the BYX21L-200 and the opposite polarity version, the BYX21L-200R, enable the dual system to be incorporated for approximately the same price as the single diode system developed earlier. In this case, four diodes are pressed into a single 6in length of 35D heatsink (type 35D6C or 35D6CB) and the heatsink itself used as the
PLEASE NOTE

This four page catalogue is intended as an addition to our advertisements in the August and December editions of this magazine. Copies of those four page advertisements are available on request.

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<td>29c</td>
<td>0.74&quot;</td>
<td>0.55&quot;</td>
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</table>
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Please note these units were tested by one of Australia’s largest audio equipment manufacturers with the following results.

<table>
<thead>
<tr>
<th>Model No</th>
<th>Noml Dia (inch)</th>
<th>V.C. Impedance (ohm)</th>
<th>Reson Frequency (c/s)</th>
<th>Frequency range (c/s ± 8db)</th>
<th>Max Power (W)</th>
<th>Nominal Size (Φ mm)</th>
<th>Magnet Size (Φ mm)</th>
<th>Front Size (mm)</th>
<th>Thickness (mm)</th>
<th>Weight (gr)</th>
<th>Baffle Opening (Φ mm)</th>
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<td>80x15</td>
<td>81</td>
<td>95</td>
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</table>
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Testing Unknown Zener Diodes

The diagram shows a simple method for determining the zener point of unknown zener diodes. All that is needed is a VOM or VTVM, two 1/2 watt resistors and a high voltage, low current supply near 250 volts DC. If a variable power supply is on hand, it can be used in place of the fixed supply and the 250k pot. The 250k pot is used as a voltage divider and the 270k resistor serves to limit the current through the diode.

The diode is placed in the circuit with the cathode to the positive side. The voltage is adjusted upward until the meter shows no further increase in voltage. This is the zener breakdown voltage of the device under test.

If the meter reads zero, the zener is shorted and if it reads the supply voltage, the zener is open.

By Bruce A. Rahn, WB9ANQ, in “CQ”.

Coil Tip

An idea which is new to us comes from Electronic Design. Mr J. Leeb suggests that an air core inductance can be adjusted, and its Q improved by winding one or more layers of ordinary magnetic recording tape over the coil, the exact number of turns or layers being determined by trial and error and the end of the tape then secured by a dab of cement.

An alternative idea is to wind the magnetic tape into a core to fit inside the inductor.

We do not know how far the inductance of a coil can be shifted in this way, but it might be well worth trying, for example, if one wanted to alter the tuning range of a receiver without changing coils.

(From “Amateur Radio Techniques.” Fourth Edition.)

Preamplifier for Digital Scaler

(EDITORIAL NOTE: This little preamplifier may be used to increase the sensitivity of DEM scalers, such as the one which we described in October, 1972. The availability of the type 2N5179 may be in doubt and we suggest that either the BF180 or BF200 may be used instead.)

The sensitivity of our scaler prototypes varied from approximately 130 millivolts at 100MHz to 240 millivolts at 260MHz. This is adequate for many uses. For greater sensitivity however, a single transistor preamplifier may be added. A schematic of a wideband amplifier, using a 2N5179 transistor is shown herewith. Normal VHF construction practices, such as the shortest possible leads and adequate decoupling are needed.

Component values are given on the diagram. The peaking coil L1 consists of 8 turns of 26&5, 5/32in diameter, air wound and spread to 5/8in long.

By F. Everett Emerson, W6PBC, in “Ham Radio”.

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ELECTRONICS Australia, April, 1973 67
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Magnetic Recording


One of the noteworthy advances in electronics following World War 2 has been the development of magnetic recording, and in particular the tape recorder. In its many forms, both domestic and professional, this device has found wide acceptance among radio and television stations, artists, dramatic schools and clubs, and in fact in any situation where a simple sound recording and replaying system can be used to advantage.

Most previous sound recording systems had called for quite complex equipment, requiring considerable operating skill, and further expensive and lengthy processes before the results could be heard. The acetate "home recording" disc was a step in the right direction, but was still relatively expensive and inconvenient.

The tape recorder, on the other hand, seemed to overcome all these problems in one sweep. It was relatively inexpensive to buy, simple to operate, required no processing and, above all, permitted erasure of mistakes and re-recording to correct them. This latter feature not only avoided waste of recording material, but also the precious time and effort put into what had already been recorded.

The development of the transistor and its application to the tape recorder permitted the latter to be developed to the point where it is compact enough, and priced low enough, to appeal directly to the individual. Even without any special requirement, the ability to make personal recordings appeals in much the same way as does the ability to make personal pictures with a camera. In fact, personal recorders are currently enjoying a popularity approaching that of the camera.

Where did it all start?

If we endeavour to trace the definite beginning of magnetic recording we find that, although credit for building the first magnetic recorder belongs to the Dane Valdemar Poulsen, there are indications that others had thought of the idea before Poulsen.

One of several references to magnetic sound recording may be found in "The Electrical World" of September, 1888. An article in this issue by Oberlin Smith tells of his developing "a successful machine for spinning metallic dust into a cotton cord on which sound might then be recorded." Like so many other experimenters, however, Smith did not press on with his invention and it was left to Poulsen, in 1896, to produce the first actual working model for a magnetic recording machine.

Poulsen's early recorder consisted of a drum on which was wound steel wire a few millimetres thick. As the wire rotated with the drum it passed in contact with a magnetic "head" comprising two soft iron laminations in a coil. Magnetic impulses were transferred to the wire by the head laminations pressing against opposite sides of the wire.

The head was arranged to move along a path parallel with the drum, and the wire, being wound in spiral form on the drum, was used to propel the head in the manner of a lead-screw.

There being no electronic means of amplification available at the time, the coil of the magnetic head was connected to a carbon microphone and a battery during recording and to a set of headphones for the playback. From the mechanical point of view the "Telegraphone," as Poulsen called his invention, was similar to Edison's phonograph, although it operated on much more advanced principles of recording and reproduction.

Although Poulsen's invention won the Grand Prix at the 1900 Paris Exposition, and enjoyed some popularity at the time, it never made any inroads into the domestic market because it required headphones for listening. In contrast the gramophone, although of inferior sound quality, was a "loudspeaking" device. The gramophone was also a much cheaper device to produce and this has always been an influencing factor on the domestic market.

In addition, gramophone records, at least in disc form, were ideally suited to mass duplication by pressing, thus further reducing costs. Even today, this factor remains a major one in favour of the gramophone record as a medium for mass program distribution.

Poulsen's company eventually went...
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bankrupt and magnetic recording was forgotten until 1919, when the recently inverted valve led to a revival of interest. At this time Dr Kurt Stille in Germany tried to adapt the "talking wire," as he called it, into a sound carrier for motion pictures. Experience showed, however, that photographic film recording was not only better in quality but also easier to use for the purpose; and the "talking wire" once more passed into obscurity, at least as far as a popular or domestic market was concerned.

Magnetic recording continued to be developed by some companies, and was used extensively by the BBC, using steel tape as the recording medium. At the outbreak of World War 2 it was pressed into service by the armed forces as a means of recording high speed code transmissions for later replay at a slower speed.

During this period some very compact wire recorders were developed and used by the Allies. The Germans, in their turn, had developed a recorder using a plastic based, metallic oxide coated tape, very similar to that used in present day machines. Magnetic recording really "arrived" after the war and the art continued to develop to the high standards achieved today.

In order to understand just how magnetic recording works we will need to enlarge on some of the basic fundamentals of magnetism covered in an early chapter. You may recall that certain materials, namely iron and similar alloys and compounds, have the ability to concentrate magnetism within themselves. These ferrous materials are termed "ferromagnetic" and they are said to have high "permeability," permeability being the ratio of magnetic flux density produced in a material to the magnetic flux density that would be produced in air by the same magnetising force.

If we take a sample of unmagnetised iron and subject it to a gradually increasing magnetising force, we will find that the amount of magnetism induced in the iron will rise slowly at first, then more rapidly, and then again slowly until the iron will absorb no more magnetism, this latter state being known as the saturation point of the material. This process is shown graphically in Fig 1 (unbroken curve).

Here we start at point "A," which represents zero magnetising force and zero induced magnetism, and apply a steadily increasing magnetising force along the "H" (magnetising force) axis, to the right of point A. As we do so, the induced magnetism which results is plotted along the "B" (induced magnetism) axis, giving rise to the curve ACDE.

From this graph we can see that only the middle section of our curve shows a reasonable linear relationship between magnetising force and induced magnetism, the section from A to C and D to E being distinctly non-linear.

When the magnetising force is removed from the iron the induced magnetism in the material does not disappear entirely. If following a path other than that of its original magnetisation curve, it falls to a value which is a proportion of the original value. This is shown by the dashed curve E'E' the magnetism remaining in the iron at E' is known as its "remanent" magnetism.

If we consider any value of induced magnetism along the curve A to E we will find that it will fall to a remanent value along a path which may be regarded as "parallel" to E-E'. Thus induced values C, X, D and E will produce remanent values C' X' D' and E' along the B axis. It is important to note that remanent values resulting from any induced values between C and D will be linearly spaced along the B axis, while those resulting from values A to C and D to E will be non-linearly spaced.

The curve shown as A to E might typically be that created in our piece of iron by the "north" pole of a bar magnet or by current through a coil in a specific direction. If we had used the "south" pole, or caused the current to flow in the opposite direction, we would have created the curve A-J in the bottom left of the drawing. Note that the two curves, although of opposite polarity, are mirror images and both show the same degree of non-linearity at the beginning and end of their trace.

But also that the iron would only have followed the curve A-J had it been initially in the unmagnetised state. If we had simply applied our reverse magnetising force after first taking the iron up to E and then down to A, the curve followed would have been as shown by the dashed line. The induced magnetism would have gone directly from E' to J, as shown, and on removal of the reverse magnetising force it would have dropped to zero.

If we again applied a magnetising force, this time in the initial direction, the induced magnetism would pass from J' to E, and so on. Unless we demagnetise the iron, it will not return to the zero point A but simply swing around the "loop" E'E'-J'J shown dashed. Such a loop is called a hysteresis loop and it will have a shape depending upon the type of magnetic material concerned.

In the first and simplest form of magnetic recorder produced by Poulsen, the recording head was fed with an AC signal at audio frequencies. This is shown in Fig 2, where the head signal is shown as "input waveform" and can be visualised as swinging the magnetising force alternately left and right along the H axis. From this we can plot points of induced magnetism along the B-H curve, from these plotting remanence points along the B axis resulting from here, and finally extend these points to the right and use them to create a graph of the waveform which has actually been recorded.

As can be seen, this is badly distorted. The distortion comes from two sources, the non-linearity represented by G-A-C, which is called "crossover" distortion, and that represented by D-E and F-J, which is called overload distortion, or saturation.

Overload distortion may be avoided by restricting the level of signal recorded, and this precaution must still be observed in modern recording systems; but there is no such simple solution for the crossover distortion problem and this is the real limitation of a simple recording system.

In an effort to overcome this distortion Poulsen introduced in 1907 a simple technique known as "DC biasing." He achieved this by applying a current of fixed polarity to the recording head so that, without the AC input signal, a magnetising force approximately midway between points C and D was applied to the wire (Fig 3). When the AC input waveform was applied along with the bias it would cause the magnetising force, and therefore the induced magnetism, to swing from the centre point of the curve up toward D or down to C, depending on the polarity and amplitude of
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ELECTRONICS Australia, April, 1973
the signal. Subsequently the remanent magnetism would range between \( C' \) and \( D' \).

The important thing about the introduction of "bias" was the fact that it allowed magnetism to be induced in the wire over the substantially linear portion of the curve. The distortion introduced by the previous method was therefore reduced to a minimum.

The use of DC bias in this fashion allows quite faithful recordings to be made, and many early tape and wire recorders used this system. It is still used to the present day in battery-operated recorders of the cheaper variety.

The main disadvantage of DC biasing is that recordings made in this way are noisy; they have a very poor signal-to-noise ratio. The noise level is high because the steady bias remanence recorded on the tape along with the signal tends (for complex reasons) to accentuate noise due to the unevenness and granularity of the magnetic coating of the tape.

The system of biasing which is used in all modern recorders (except the cheaper battery machines) produces recordings having a considerably better signal-to-noise ratio than DC biasing, by using as bias an AC signal of super-sonic frequency. Let us now see how this supersonic bias system works.

Let us first consider no-signal conditions — the case when we have no audio recording signal. Under these conditions the recording head of a recorder using supersonic bias has applied to it a current alternating at a supersonic frequency — usually from 40 to 100kHz.

The effect of this current is to produce in the head gap and the tape passing over it a magnetic field reversing at the same extremely rapid rate. The amplitude of the bias current is arranged so that the peak value of the magnetic flux density experienced by the tape immediately over the gap is halfway up the linear section of its \( B-H \) curve, in each direction.

This procedure results in the state of affairs suggested by Fig. 4. As the tape approaches the recording head gap, and enters the field, it is swung through a number of rapid flux alternations, passing through a series of expanding hysteresis loops (not shown) until it is swung through the loop MNOP directly over the gap. \( M \) and \( O \) are points halfway up the linear portion of the \( B-H \) curve of the tape oxide in each direction.

When the tape moves away from the head gap, it is swung through a further series of alternations, but this time they are decreasing in amplitude. Thus, as Fig. 4 shows the tape passes through a series of decreasing hysteresis loops. It ends up at a point which is virtually at the intersection of the \( B \) and \( H \) axes — ie, with zero remanence.

In other words, the net effect of the high frequency bias signal itself is virtually zero. Now let us consider what happens when we superimpose upon the bias signal our audio recording signal. Fig. 5 should help in understanding this.

At the bottom of the diagram is shown the audio signal superimposed upon the supersonic bias signal. Above this is shown the hysteresis loop corresponding to zero signal amplitude, marked \( A \) (solid line); the loop corresponding to the time \( BB' \) when the audio is at maximum amplitude in one direction, marked \( B \) (dashed line) and the loop corresponding to the time \( CC' \), when the audio is at maximum amplitude in the other direction, marked \( C \) (dotted line). Note that the loops shown correspond to the tape directly over the recording head gap. In each case there will be an expanding and contracting series of loops as the tape approaches and moves away from the gap. These have been omitted to preserve clarity.

As may be seen the effect of the audio signal is to "wobble" the hysteresis loop of the bias either side of zero, and providing the amplitude of the audio signal is kept below the level where the tips of the loops reach the saturation "knee" of the curve in each direction, this wobbling will be quite linear. The movement of the loop will follow faithfully the audio signal waveform. Because the movement of the loop is linear, the nett magnetic remanence produced by the loop will also be linear. Thus, although the AC bias alternations themselves produce no recording, the tape is left with a recording of the audio signal which is a faithful replica of the original. The recording represents the nett remanence of the linearly wobbled loop.

The effect of supersonic AC bias is thus to make the effective \( B-H \) curve of the tape oxide material quite linear around the zero-remanence point. This is suggested by the small diagram at the right of Fig 5, which shows the actual \( B-H \) curve and the effective curve produced by using supersonic bias.

Before a recording is made, of course, the tape must be wiped clean or erased of any previous recording. This can be done by either passing the tape close to a permanent magnet or electro-magnet, or by passing it over the gap of a head similar to the recording head but fed purely with a supersonic alternating current.

With the first of these methods, called "DC" or "permanent magnet" erasure, the tape oxide is taken into saturation in one direction (ie, past \( E \) or \( J \)), when it leaves the recording field it simply drops back to either \( E' \) or \( J' \). This leaves it with a steady remanence only — although on replay the tape will sound very noisy for the same reasons which make DC biasing noisy.

The second method is the one used in most modern recorders, and is the logical method of erasure where supersonic biasing is used. As we saw from Fig 4, a head fed solely with supersonic AC simply forces the magnetic oxide through a series of expanding and then contracting hysteresis loops, leaving it finally at \( A \) with zero remanence (or close to it). A supersonic erase head thus erases by taking the oxide through a series of loops until it saturates in both directions, and then back through another series of loops to zero. As with supersonic bias, this gives a very low noise level, and supersonic erase gives a very "clean" tape for new recordings.

Normally the erase head is arranged to operate on the tape just before it passes to the recording head, automatically erasing the tape ready for the new recording.

Having thus explained the manner in which a magnetic recording is induced in a wire or a metallic oxide coated plastic tape, we might now investigate some of the properties of the actual recording material.

In the earliest recorders produced by Poulsen and others, the recording material was either a thin wire or tape of approximately 1.16in thickness. In order to obtain a reasonable frequency response with the fairly wide head gaps then used, this wire was transported past the head at
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the relatively high speed of about two metres per second.

It takes little imagination to see that this thick wire posed difficulties in mechanical handling and, even when large spools were used, yielded very short playing times. Recording wire was eventually refined, however, to a thread of 0.003in diameter, made from stainless steel and able to withstand a pull of approximately three pounds.

In the later stages of development recording wire was considered, in many respects, to be superior to oxide coated tapes of the type used today. The wire then developed would stretch less than tape, was relatively immune to the effects of extreme temperatures and humidity and was much more compact, for a given playing time, than any of the plastic tapes then produced.

It has been said, in fact, that wire would be an almost perfect recording medium were it not for three inherent faults. First, since it is round, it tends to twist and therefore the parts in contact with the recording head may be twisted around when the wire is played back. The result is a deterioration, often quite severe, in the quality of the reproduced sound.

Secondly, one recorded layer in intimate contact with another causes magnetic "print through" and this leads to echoes and a much higher background noise level than that of tape. The third fault is that wire cannot be as easily edited as tape, since good knot-tying in thin wire requires more dexterity than many people possess.

The development of metallic oxide coated paper and plastic tapes occurred at around the same period in the history of magnetic recording, but the paper tapes soon fell from favour because of various inherent faults which they possessed.

The unwanted sound, or noise, that any coated tape produces is caused mainly by two factors: (a) the lack of uniformity in the size and distribution of the tiny needle-shaped particles of ferric oxide in the coating, and (b) the roughness of the surface of the base material.

Since even the finest grade of paper has a noticeable "grain," it would, when coated with a magnetic oxide, have "hills" and "valleys" in its thickness and these irregularities would cause noise in spite of the fact that the outer surface of the oxide coating may, to all intents and purposes, appear to be perfectly smooth.

Paper-backed tape was, to be sure, quite a deal cheaper than the plastic tapes and it did have good dimensional stability but the disadvantage already mentioned plus the fact that it tore easily and deteriorated rapidly under adverse (very humid) storage conditions soon precipitated its downfall in favour of the plastic tapes used almost exclusively for magnetic recording today.

When plastic tapes were first developed, they came in two basic types — homogeneous and coated. The homogeneous tape, as the name implied, consisted of a plastic material with ferric oxide particles dispersed evenly throughout the body of the material.

This tape never really achieved any popularity because not enough oxide to permit good quality recording could be mixed with the plastic without excessively weakening the material.

The first really successful tape was the "coated" variety, originally developed in Germany by Fritz Pfleumer. This tape consisted of a cellulose acetate base to which a thin coating of ferrous oxide was glued. At a later stage, but still in the years prior to World War 2, polyvinyl chloride (PVC) was used as a tape base. This material was extremely pliant but had the disadvantage of stretching rather badly in use.

When first developed the coated tapes were inferior in performance to the steel tapes then in use, though much cheaper. Even at the outset of World War II very little had been heard about them, and Britain and the USA continued to develop and use fine steel wire.

It was only after the war that it was discovered that German scientists had developed tape and tape recording to a very high standard; a standard which put it far ahead of wire techniques of the day.

Today the wire recorder has virtually passed into history, tape having proved superior in all important respects. Extended playing time in particular, once a feature in favour of wire, has been markedly improved in recent years.

Thus, whereas some early tape machines ran at tape speeds as high as 30 inches per second, many modern machines run as low as 15/16ips and still offer a quality of reproduction perfectly adequate for many applications.

At the same time, the development of thinner tapes, such as "double play" and "triple play," and the technique of putting two ("half") tracks or four ("quarter") tracks on the one tape have also contributed.

As a result many hours of recording can now be packed onto quite small reels of tape. For example, a five-inch reel will hold 1,200 feet of double play tape which, if used with a half track head at 15/16ips, will provide four hours playing time in each direction, or a total of eight hours. And this is without considering quarter track recording and "triple play" tape.

Today, tape is the recording medium in a wide range of applications. It is used as the "master" for gramophone records, for motion picture recording, for recording sound in broadcast studios, and sound and video in TV studios.

Tape recording is also used in a wide range of other applications, from computers to office dictaphones. Portable tape recorders are used extensively as "talking note books" by students, by reporters, by storemen for taking stock, by engineers checking large works, etc.

In the home, the tape recorder remained something of a novelty until about the mid 1960s. Apart from use at parties for casual entertainment, it was used mainly by hifi enthusiasts as a way of recording broadcast programs for future enjoyment. However with the development by Philips of the now well known "compact cassette" tape system, tape recorders have very rapidly found a valued place in most homes.

Compact cassettes are small and easily handled. Using tape about 3mm wide, they provide up to four tracks of recording at a speed of 1-7/8ips. With a C90 cassette, fitted with long play tape, this gives a total playing time of 1-1/2 hours for stereo recording in both directions.
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Simple Power Supply—Regulated and Variable

Last month we promised a variable regulated power supply. Here it is — capable of supplying up to 12 volts at 500mA. Cost has been kept to a minimum by keeping the design very simple, and at least some of the parts may be obtained from oddment sources.

Basically the circuit involves a centretapped transformer, followed by a bridge rectifier and a 2-transistor regulator using a zener diode as a reference.

Voltage adjustment is made by a potentiometer on the front panel but, because of component tolerances, we have not provided for a graduated voltage scale. We suggest you calibrate it, after completion, with the aid of a multimeter.

We plan to make available a front panel card on bromide photographic paper for one dollar, which will have all markings except the voltages. The nearest way to mark these is to use "Leteraset" rub-on lettering, but ordinary ink letters may have to suffice.

As well as variable DC, AC is also brought out to the front panel. Since it involves mainly the price of three extra terminals, we thought it worthwhile.

We must make a point, however, about simultaneous use of the AC and DC outlets. While this is possible, there are limits to the amount of current which can be taken from the transformer. If you find the regulation of the DC supply is poor, too much current is probably being taken from the AC terminal. Note also that there must be no common paths between the devices connected to the AC and DC outlets, because such a path could short out the internal circuitry.

We mentioned that the supply is both regulated and variable. Let us see what this entails.

There are a number of ways by which a power supply can be made variable. Perhaps the simplest is to use a high power rheostat or potentiometer in series with the load circuit, so that the voltage is divided between the load and the rheostat element.

In cases where cost or simplicity are important (such as mass-produced model train controls) this system is used extensively. However, the voltage at the end of the resistor, being proportional to current, changes with changing load, and regulation is therefore poor. Obviously, a better approach is required for our present purpose.

We have already discussed the use of a zener diode plus emitter follower as a regulator (see Fig 4 last month). If we now place a voltage divider across the zener diode, and transfer the base of the power transistor to the variable arm, the emitter of the power transistor will tend to follow the voltage at its base. In other words, we have made the supply variable. (See Fig 1.)

The behaviour of the circuit will, however, depend heavily on the base current of the transistor. If it varies in proportion to the emitter load current and becomes large enough to affect significantly the voltage at the potentiometer tapping, then the regulation of the supply will be poor.

We tried out the idea using a single 2N3055 power transistor but it became obvious that the current drawn by the base circuit would, indeed, be too high with a heavy output current being drawn from the emitter.

We had set an arbitrary figure of 500mA on the maximum current to be drawn from the supply, and to obtain this current under worst-case transistor parameters (the lowest gain of a 2N3055 is 20) we would need about 500/20 or 25mA base current. We could not expect to draw anything like this into the output voltage!

To the base circuit we have added a silicon diode — we used an EM401 — which prevents damage to the transistor base-emitter junctions by breakdown.

We talked about this breakdown effect last month. Here it would lead to damage of the transistor from a variety of circumstances. For example, breakdown could occur if a charged capacitor was placed across the output with the supply imperoperative. The diode affords protection because its breakdown voltage is very much higher than that of the transistors.

Because there are now three P-N junctions involved, (two transistors and a diode) the difference in voltage between that at the potentiometer wiper and the emitter of the 2N3055 will be 0.6V, but about 1.8V. For this reason we have specified two 6.8V zener diodes in series — we want to be as close as possible to 1.8V above 12V, in order to obtain an effective 12V supply. If we used a 12V zener, the maximum output voltage would be limited to about 10.2V.

You may recall our discussion on the disadvantage of the series regulator: its liability to damage with a short circuit. However here the 1.5 ohm resistor and fuse should provide the necessary protection. The resistor will limit the short circuit current to less than 9 amps, whereas the transistor is capable of passing 15A without damage. If the short is maintained for more than an instant the fuse will blow, thus preventing damage to the rectifier diodes or transformer.

In other words, a momentary short — such as often happens on the workbench — will not worry the supply at all. A sustained short will simply blow the fuse.

Two other components are worthy of comment: a 1000µF capacitor and a 1k resistor across the output circuit. The capacitor contributes to filtering and also helps meet peak current demands by (for example) a class B audio amplifier.
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The 1k resistor across the output is to provide a small load on the supply. This assists the emitter follower section by providing a return path at all times — not just when a load is connected.

Let us now look at the construction of the circuit from the power point to the transformer.

We start with a standard 3-pin plug and a 3-wire mains flex, which is brought into the case at the bottom of the rear panel. The hole through which it comes must be grommeted and, immediately after entry the cord must be clamped. It must then be separated into its 3 leads: active, neutral and earth. The active and neutral leads must screw into a terminal block while the earth lead must be clamped. It must then be grommeted and, immediately after entry the lead comes must be clamped. It must then be grommeted and immediately after entry the lead comes must be clamped.

Where exposed mains wiring occurs, cover with suitable insulation.

The transformers should be available from your usual parts supplier by the time you read this. Ask your supplier to make enquiries to Ferguson Transformers Pty Ltd if he does not have information on them.

Coming now to the actual assembly of the supply, most of the components are mounted on an 18 lug section of tagboard.

Follow our board wiring diagram and you should have no trouble. Some of the components, notably the two large electrolytics and the 10W resistor are soldered between the outside pairs of holes, as they are too large to fit between the inner holes.

The two zener diodes can be soldered together before they are placed in position on the board. Be careful, when soldering the semiconductors, not to apply too much heat for too long. Use just enough heat from a suitably hot iron to flow the solder, then take the iron away. Note that other wires share the same holes as the collector and emitter leads of the 7T801. These should be inserted and soldered same time as the leads from the 7T801.

It may appear from the drawing that some of the tags on the tagboard are wasted. This is not really the case, because some of the components are too big to accommodate another component immediately alongside. Also, if a component is likely to dissipate significant heat (such as the 10W resistor) it is unwise to place other components in contact with it.

Note that some of the components are underneath the tagboard: the 470-ohm resistor and two of the rectifier diodes. Treat these in exactly the same manner as the components on top. All of the links must screw into a terminal block while the earth lead must make reliable mechanical contact with the case of the supply, usually per medium of a solder lug fastened by a brass nut and bolt.

You will note that we have used the word "must" several times. This is because the paragraph interprets the Supply Authority safety rules regarding mains lead connections for appliances — especially ones such as this, where voltages are brought out from the case.

Other rules deal with transformers and have to do with the nature of the insulation, physical construction, isolation between windings and lead terminations, etc. Some transformers have good insulation between windings but are open to question because their leads are all terminated on a board on top of the transformer, with no physical barrier between the mains and low voltage lugs.

Fortunately, about the time of writing, Ferguson Transformers Pty Ltd announced that they were releasing a new range of transformers, which did meet all official requirements. The transformers are fitted with round pin terminations and are supplied with a set of six leads with shrouded connectors. The mains input and the low voltage outputs are therefore completely isolated from each other.

There are two added bonuses: the transformers are cheaper than most (mainly because they do not have a large number of taps) and they are smaller, being physically similar to small fluorescent lamp ballasts.

The particular transformer we used in the prototype, a PF 3597, has two 7.5V windings, which we connect in series to give us 15V AC for the rectifier, and 15V centre tapped for the AC output terminals. The transformers should be available from your usual parts supplier by the time you read this. Ask your supplier to make enquiries to Ferguson Transformers Pty Ltd if he does not have information on them.

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between the tags are also soldered underneath. Where links cross the board, and there is a danger that they might short onto something else, cover them with a length of spaghetti or nylax sleeving (or the plastic covering from some insulated hookup wire).

Trailing hookup wires should be left until last, as they get in the way while soldering other components. Where two or more wires go to the same place, twist them together for the sake of neatness. This can be done most easily using a drill (see Ideas Worth Trying, July 1972, p 81).

Once the tagboard is wired, we can concentrate on the case and panels. We used a small "ATC" instrument case, measuring 7in x 5in x 4in and covered in black vinyl. It is available through most parts suppliers, and distributed by Watkin Wyne Pty Ltd. Other cases of similar dimensions would be suitable.

If you do use another case, or change our layout, make sure that the mains and low tension wiring is well separated. This is important for your safety.

The "ATC" case comes complete with front and rear panels but the existing rear panel is not ideally suited to our purpose.

Because we are using the rear panel as a heatsink for the 2N3055, it must have good heat conduction properties. We discarded the original vinyl clad steel panel and replaced it with a piece of 16 gauge aluminium.

Aluminium in this size and gauge may not be too easy to obtain but, if you know of a local engineering shop, they may be able to supply a small offcut at minimal price. Alternatively, school students may be able to obtain a piece through their metalwork teachers. Lastly, aluminium supply companies (such as Alarco, 6 Cosgrove Rd, Enfield 2136) often sell small offcuts by the pound.

The aluminium should be cut to the same size as the panel it is to replace, and drilled as necessary. The front panel can also be drilled at this time.

When drilling holes, always punch an indent first. Then drill a small (1/16in) pilot hole, working up to a hole of the wanted size. This will ensure the final hole is where you want it — not 1/32nd or more away!
When you buy your 2N3055, you should get with it a mounting kit. If you don't, ask for it. It consists of a mica washer the shape of (but slightly larger than) the transistor, and two plastic bushes. There may also be two nuts and bolts, a number of washers, and a solder lug, depending on where you buy your transistor.

This transistor should be screwed to the panel as shown in Fig. 5. This prevents the case of the transistor (which is internally connected to the collector) from shorting to the panel. Note there will only be one solder lug. Its place at the other end should be taken by a washer.

It is wise to put a small dab of silicone grease (or heat conductive compound) between the transistor and mica washer and between the mica washer and case. Small tubes of silicone grease are available from most parts suppliers. Only a small dab is necessary — as the transistor is tightened down it spreads the grease.

Connection of the fuseholder is straightforward, but it must be tightened well to prevent it from turning when a fuse is replaced. The mains cord entry hole must be grommeted as mentioned earlier. If you have difficulty in passing the mains cord through the grommet when it is in place, try dipping the cord in baby powder.

Once these points are taken care of, the transformer can be installed. Washers should be used between the transformer legs and the nuts. Next, screw the tagboard into place on the other side wall of the case. It is mounted on 2½in brass spacers. If you countersink the holes on the side of the case, and use countersunk head screws, the heads will hardly be noticeable.

Once the tagboard is in position, the leads can be placed in their correct positions and trimmed as required. The transistor and fuse leads can be soldered to their correct points at this stage. The mains input can be treated next.

Push the mains cord through the grommet until approximately six inches is protruding. Trim back two inches of plastic covering, leaving the red, green and black wires. Cut the red and black wires down to approximately one and a half inches, and strip the insulation from ¼ of each of these wires. These can be twisted, tinned and locked into the terminal block before it is screwed into the case.

The lead to the mains switch goes from the same terminal as the active "in," while the lead from the switch goes to the terminal adjoining it. One lead to the transformer goes from this terminal, and one from the terminal to which the mains neutral is connected. These leads may now be attached to the transformer, and the back of the case screwed on.

The terminal block can be screwed into position in the case. Next, the mains cord can be pulled back through the grommet, until the end of the plastic insulation is just past the terminal block. The mains cord clamp is fitted at this point, being locked down hard onto the outer insulation of the mains cord.

The earth lead must make mechanical contact with the chassis — not a soldered connection. It should be stripped for approximately one inch, then wound around a screw located near the terminal block. A washer, then a nut is placed on this screw and tightened.

The only wires which should now need connecting are those to the front panel, including the potentiometer, mains switch and AC output leads. Connect the AC output leads first. Note that there are six leads supplied with the transformer — each with its own connector. Two of these are for the mains input; the other four are for the secondary output. We presume the transformer will have connection data, but if this is mislaid, the secondaries must be connected together so that 15 volts (approx) appears across the windings. If 7.5V or 0V is measured, the connection is wrong.

The pairs of secondary output leads can be cut to the correct length, then soldered to the AC output terminals, with two leads being soldered to the 0V terminal. The twisted pair of wires which go to the rectifier on the tagboard can also be soldered to the terminals, one going to each of the 7.5V outputs.

Each of the terminals is equipped with a fibre washer. In the case of the DC earth terminal (NOT the AC 0V terminal) the fibre washer can be discarded and replaced by a brass type to ensure a good connection to the front panel (and therefore earth). A solder lug should be placed between each fibre washer and nut. On these are connected the various leads.

Each of the pot leads can be attached, as can the mains switch. Be sure that when the panel is placed in position, the mains switch does not foul any other parts.

That should complete the interior wiring of the supply. After checking your wiring, you can close the front panel. All that remains is to connect a power plug.
AMPLICER TA-1055
This exciting new amplifier, TA-1055, from Sony teams brilliantly with the hi-fidelity turnable PS-5520 to create a magnificent stereo sound system. The TA-1055 features direct-coupled differential amplifier circuit — wider power bandwidth, low distortion, high stability and excellent transient response. Input and output facilities for two tape recorders — inter-recorder dubbing possible. Versatile controls with all push buttons and slide volume controls.

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SHOSTAKOVITCH — Interpretation at its best

SHOSTAKOVITCH — Symphony No. 8
Moscow Philharmonic Orchestra conducted by Kirill Kondrashin. World Record Club Stereo S 5242.

Shostakovitch's Eighth Symphony was one of the three — and in my opinion easily the best — he composed during World War 2. The first of the trilogy was the Leningrad, a work that has never had such a strong appeal for me though at the time of its production it had an enormous topical success. The Eighth was gratuitously awarded the title of the Stalingrad, which gives very little indication of its character. For instance, the first movement expresses the agony rather than the destructiveness of war — its sheer wantonness. Yet all is not without hope — though the work was composed during the dark days of 1942 — but it is hope that begins very wanaly indeed. It is really only the spirit of hope ready to grow. Then comes the anger with which almost every living thing, even the most docile, is likely to respond to a call to arms. Unretarded, all the rarities that exist on this planet, the turning of the other cheek is perhaps the rarest.

Then — we're still in the great first movement — the jugernaut bestirs itself, flexes muscles and readies for combat. Calls for sanity are drowned in a great climax which shrieks with pain while stupid brass brays its 'non-sense' message and a cor anglais wails like a woman over a dead child followed by the just passes and a cor anglais wails like a woman brays its idiot war message. This is graphic enough to permit of little other than the destructiveness of war — its sheer wantonness. Yet all is not without hope — though the work was composed during the dark days of 1942 — but it is hope that begins very wanly indeed. It is really only the spirit of hope ready to grow. Then comes the anger with which almost every living thing, even the most docile, is likely to respond to a call to arms. Unretarded, all the rarities that exist on this planet, the turning of the other cheek is perhaps the rarest.

In the second movement, a scherzo, the juggernaut bestirs itself, flexes muscles and readies for combat. Calls for sanity are drowned in a great climax which shrieks with pain while stupid brass brays its 'non-sense' message and a cor anglais wails like a woman over a dead child followed by the just passes and a cor anglais wails like a woman brays its idiot war message. This is graphic enough to permit of little other than the destructiveness of war — its sheer wantonness. Yet all is not without hope — though the work was composed during the dark days of 1942 — but it is hope that begins very wanly indeed. It is really only the spirit of hope ready to grow. Then comes the anger with which almost every living thing, even the most docile, is likely to respond to a call to arms. Unretarded, all the rarities that exist on this planet, the turning of the other cheek is perhaps the rarest.

However Frank Howes, who wrote the sleeve notes for Howells' Hymnus Paradisi, has much more to say, even if some of it takes quite a tug at one's interpretative powers. Here's just a little bit: "But if eternal rest is one thread that runs through the choice of texts even more prominent is lux perpetua', Shelley's 'white radiance of eternity', not to be apprehended by mortals save in glimpses, which the composer catches and transmutes into sound from his varied texts, from the dark-glowing refugence with spurs of flame in the first section, through the blaze of glory in 'Sanctus', to the light of dawn in high summer at the end." Mr Howes then goes on to explain how this "trans-imagination" of light into sound" is technically accomplished, which I also found about as easy to read as Schopenhauer's Philosophic Treatise on the Fourth Root of Sufficient Reason.

And 15 words to his music. I quote them: "He often shows originality in the resources of stuff — and meaningless

Hymnus Paradisi might best be briefly described as a short form of Requiem for Howells' son who had died in childhood some years earlier. It was first performed at Worcester in 1950 and its style is traditional enough to have won approval a good century earlier. It also has about it the unmistakable air of English oratorio which, and not a financial sense!

Nowadays those record buyers who spend time and money applauding the thumping of avant garde tubs will sneer at Howells' undisguised melodiousness, be unaffected by its almost constant plangency. To make the point as clearly as I can — if 'Gerontius' is your meat you may well and enjoy Howells' eloquent testimony of devotion. As to the performance I can only describe it by one word — faultless. So, too, is the balance between soloists, choir and orchestra. Most of the first part moves as slowly and purposefully as a priest at an altar. There is a setting of the 23rd Psalm in, to me, an unfamiliar translation, that I found myself responding to on the verge of tears. Indeed if one is prepared to accept Howells' traditional formula the Hymnus will be found to provide a most affecting experience. Its opponents though will, of course, describe it as a typical bit of English hypocrisy. Mock piety. Technically Howells' uses much highly skilled polyphony without any thickening of texture, vocally or orchestrally. The sound is excellent and the Hymnus has — I can't say anything otherwise — moments of exciting luminosity.

I could write much more about its many splendid features, Instead I urge you to listen to it. If your tastes resemble mine in the least, you'll be sure to want it.

NIELSEN — Symphony No. 5. The Orchestra of the Swiss Romande conducted by Paul Kletzki. World Record Club Stereo S 5187.

As a rule, a composer who gains fame, justifiably or not, during his lifetime, is almost forgotten for a while after his death. There is, of course, by extension to this rule. But in the case of the Danish Carl Nielsen things were different. He was practically unplayed in English-speaking countries during his lifetime (1865-1931) but, after the end of World War II, there were some things that he had written to be appreciated. But whilst he was alive, there was to such an extent that he was awarded prize of the utmost extravagance. Yet just before the war, in his 1938 edition of the Oxford Companion to Music that important critic
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I think this recording has been issued at a budget price at just the right time. The music can be judged on its merits, with all earlier fulsome praise forgotten. To me, as a comparative newcomer to Nielsen, the music made its greatest impact on me through its unquestionable sanity and nobility. Expect for a rowdy run of performance. The engineering is good and the orchestral playing of the Swiss Romande under Kletzki far in advance of their usual run of performance.


The Mendelssohn E Minor Violin Concerto must be imperishable. Since its composition — it was finished in 1844 — till the present day it has figured in every violinist’s repertoire. Menuhin is a name that need not necessarily soloists. I doubt there is a fiddle player in the back row of seconds in any orchestra in the world who could not scrape his way through it and has done so at some point of his career, and then on to concert platforms. I think it would be safe to bet that it is the most often played of all the great violin concertos. It is a fine concerto, inspiring to play and enjoyable to listen to, especially as it is treated here by Menuhin. For Menuhin is in top form, his unique tone as passionate as ever, his finger technique faltering only once in the super-fast final movement.

Those who know the work in recordings by other great violinists might notice the extra amount of spiccato bowing Menuhin uses. This bowing, of course, is always effective, sometimes even a little showy, in very fast passages though Menuhin’s good taste prevents him from doing anything too much. But spiccato is also a demanding style that tends to focus attention on the slight faltering in the rhythm. Despite my enthusiasm for this performance it would not be fair for me not to point out that there are moments when Menuhin’s spiccato does just this. But with the perfection of the rest of the performance in mind, together with the support supplied by the London Symphony under Fruhbeck de Burgos, it would be churlish to pursue the matter further. And still another word of praise, this time for the recording engineer who has done everything concerned proud.

I remember the fust that blew up when the “other” Mendelssohn Violin Concerto turned up. Even before it was heard it was being hailed as a lost masterpiece. The period was either just before or during the first part of the last war, when Hitler was in power, at any rate, and most of the world’s greatest violinists were Jewish. So was Mendelssohn for that matter, at any rate by birth. As a matter of fact while touring Germany in 1962 I visited the cellar of the Hamburg Town Hall where Hamburg-born musicians’ names had been cut into the stone supporting columns by the Town Senate. Mendelssohn’s was just being restored. The work was not much too about. It is an obvious student work, brightly enough written but severely limited in acquired skills. I suppose it would be only fair to say that, all round, it is ef-

efficiently played by both soloist and the string section of the orchestra but you won’t detect in this performance the same con amore approach that you have in the E Minor.

GRIEG — Lyric Suite; Homage March; Norwegian Dances; Peer Gynt excerpts. Hallé Orchestra conducted by Sir John Barbirolli. EMI Stereo OASD 2773.

Ever since Debussy’s disparaging remark about Grieg’s music which I quote from memory — “Snow wrapped up in pink paper” — the better elements of his music have constantly been underestimated by the musical fashionable. And I mean by these better elements the merely tuneful as well as the bigger forms. As an example, I tender this disc of short pieces played with loving care by Barbirolli and the Hallé. Except for the three pieces from Peer Gynt you have probably heard much of this music before, often played by a Wintergarden Trio or else in a later form as musak. But listen to this disc and hear the new life Barbirolli breathes into it. For instance, the first of the Norwegian Dances gets along with the bounciest rhythm imaginable. The sudden changes in dynamics could not be played more cleanly. The second, a slowish one even better known, is always tender but never sentimentalised. It is all kept very innocent, no easy job. And again, in the middle section, you have irresistible rhythmic appeal.

No. 3 is deliciously rustic, its bumpkin qualities most amusingly observed and as an unexpected touch of sophistication, a counter-theme is suddenly introduced at the end of the first part. No. 4 starts with a mock solemn introduction, then goes into a jolly sort of barn dance with the inevitable slow section again in the middle. The Homage March is no great favourite of mine. It is quite effective but Meyerbeer better than either. And Elgar better still. In the Lyric Suite Barbirolli again exercises in these trifles the greatest care and shows the same elegant taste as he might well devote to works of much greater stature. If he is a trifle self-indulgent in Shepherd Boy and if the Norwegian Rustic March doesn’t sound quite rustic enough, the simple, beautiful melody of the Nocturne is a lovely few minutes of sound, in whatever you might think of its serious value.

The March of the Dwarfs is as good as you might well have expected, perhaps even better. In the unacknowledged items from Peer Gynt the overture includes bits of Solveig’s Song and other bars you know put together in old-fashioned overture style, including a bit with a drone like bagpipes for solo viola. The Dance of the Mountain King’s — wait for it. Don’t be a little daughter that you in the Lyric Suite Barbirolli again, for it — Daughter has a pentatonic sounding theme that reminds one that Norwegians settled in the Orkneys during the first millennium AD.

The Bridal Procession was not, of course, included in the original Peer Gynt incidental music but adapted from a piano piece and added at a later date. Altogether, unless you are a musical snob, this is a delightful disc to relax to, though even I am prepared to admit that repeated too often you’ll soon wear out your response. Beautifully played and recorded.
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THE LIVING SOUND. Maranatha. Stereo. Light LS-5601-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

Formed in 1969 by sixteen talented young people, "The Living Sound" is a group which has devoted itself to itinerant evangelism, with special emphasis on Gospel music. Their travels have taken in USA, Canada, South Africa and the Caribbean Islands.


The instrumental and the vocal work of the group is smooth and polished without being ostentatious. In fact, my feeling is, that this album will go down very well with all members of the family, irrespective of age. I certainly enjoyed it. Recommended. (W.N.W.)

ELLER IT LIKE IT IS. Organ solos, played by Clare Fischer. Stereo. Light LS-5596-LP. (From Sacred Productions Aust, 181 Clarence St, Sydney and other capitals).

"Tell It Like It Is" is a musical composition by the two well known Gospel musicians Ralph Carmichael and Kurt Kaiser. Having gained quite wide acceptance on stage and record, it has now been transcribed for organ and is presented here as an organ recording by Clare Fischer.

The organ used is an electronic one of untried type and the performance lays heavy emphasis on the melody and harmony, with heavy registrations totally avoided. As such it will have an immediate appeal to those who are familiar with the lyrics.

However, there is more to it than that. While the songs are modern, Clare Fischer at times produces a sound that has quite classical overtones, particularly on side 2.


It could have been Gospel pop, or a heavy-handed exercise but Clare Fischer's restrained but talented approach came as a complete surprise. It tends to grow on one, as evidenced by the fact that, having played it once, I played it straight through again. (W.N.W.)

SONGS FOR SUNDAYS. Harry Secombe with orchestra and chorus directed by Peter Knight. Stereo. Philips 5306-119.

The true and powerful voice of Harry Secombe is heard to advantage in this collection of Gospel songs, many of which have emerged again as favourites on the British TV show "The Stars on Sunday". Song Of Joy — Do You Hear What I Hear? — Amazing Grace — The Old Rugged Cross — One Little Candle — Battle Hymn Of The Republic — Let There Be Peace On Earth — Wonderful Words Of Life — Take My Hand Precious Lord — Walk With Me — May Each Day Of The Year — Goin' Home.

The jacket notes by Harry Secombe's brother, Rev F. Secombe, reveal that Gospel songs are not a new experience to the artist, having been heard frequently in the home environment where they spent their boyhood.

If you enjoyed Gospel albums in the robust style of Tennessee Ernie Ford, or Bev Shein in his prime, then you're pretty sure to enjoy this one. Recommended. (W.N.W.)

Instrumental, Vocal and Humour

GLAZUNOV — THE SEASONS and other orchestral works. The Moscow Radio Symphony Orchestra conducted by Boris Khaikin. Stereo, World Record Club S 5155.

While it has not achieved the remarkable popularity of Vivaldi's "Four Seasons", this ballet suite by the Russian Glazunov has maintained its place both in the concert hall and in the record catalogues. The last scene (No. 4, Autumn), however, is undoubtedly the most often heard, and every listener to classical programs on radio will be familiar with its rumbustious theme, which in the ballet accompanies a wild Bacchanale.

If you have a liking for this work, this performance from Russia, originally released on the Melodiya label, can be highly recommended. Plainly Russian orchestras can hold their own with the best of those in the Western world, and may also perhaps have a legitimate claim to be better interpreters of music composed by their compatriots. Equally, their recording engineers and equipment have nothing to apologise for.

This disc offers a bonus in the form of two short Glazunov works as fills. They are "Finnish Fantasy", based on Finnish folk songs; and "Wandering Procession" which sounds just as you would expect. All highly colourful music in the typically florid style of the Russian romantics and very well played. (H.A.T.)


The sleeve note explains how Mozart's ballet music for "Les Petits Riens" came to be lost for nearly a century and pretty sorry reading it makes, too. For too often Mozart was imposed upon to write music as a favour, and not only did he receive no payment for this score, but the French ballet master Noverre for whom Mozart performed this service did not even do him the courtesy of according him a credit in the program. Toujours la Politesse! Not that the music can be included among Mozart's best scores but it has a lighthearted charm which makes for pleasant listening, particularly when played with the characteristic polish and precision of the St. Martin's orchestra.

Reviews in this section are by Neville Williams (W.N.W.), Harry Tyrer (H.A.T.), Leo Simpson (L.D.S.), Gil Wahlgquist (G.W.), and Norman Marks (N.J.M.).

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**VARIETY FARE**

Of the four overtures which complete the disc. "The Impressario", dating from 1786, is easily the best, and certainly deserves to be heard more often. This is perhaps to be expected, as Mozart was then 30, whereas the other three — "Il Re Pastore", "Lucio Silla" and "La Finta Semplice" — were written when Mozart was 19, 15 and 12 years old respectively. However virtuosic these may be for youthful works, they lack the mature brilliance of the older Mozart. Interesting trifles, perhaps, but hardly absorbing music, even with the advocacy of the St. Martin's players. The recording is first class in every respect. (H.A.T.)

**18 WALTZES — Chopin. Aldo Ciccolini. Pianio. Stereo, Columbia (EMI) SOEX 9593.**

Aldo Ciccolini is a very accomplished pianist with a fine technique and very clear fingerwork. However, you need more than this to be a successful Chopin performer, and Ciccolini seems to me to lack the instinctive feel for phrasing, balance and tempo variation possessed by such notable performers as Rubinstein and Horowitz in the older generation, Ashkenasy and Harasiewicz among the younger performers. He seems more concerned to demonstrate his ability to play very cleanly and very fast and he seems to be determined to prevent any trace of sentiment from creeping in. You may like your Chopin this way — I do not. Also, I did not like the brittle tone Ciccolini produces from his instrument.

Although this is a budget-price recording, and presumably a re-issue, the sound quality is very clean, with no noticeable defects. (H.A.T.)

**C'EST MAGNIFIQUE. Various artists. Stereo, Columbia series 299. SOEX 9529.**

Tired of listening to English lyrics? Want to practice your French? Well here's an album containing 14 tracks by nine different artists:


It's not the kind of record that one would rave about, but, on the other hand, it's quite a pleasant album and well worth the budget price if you're at all partial to the atmosphere across the channel. (W.N.W.)

**THE MAGNIFICENT WALTZ. 101 Strings.**

Ashley stereo S-5263.

If you have ever wondered just which orchestra the "101 strings" is, I really can't help you. My tip is that there is more than one orchestra recorded under this title. However, if you thought the title was a little dubious in the past, you need not worry with
this album. It is a very pleasant collection of waltzes, four from Strauss and one from Jean Sibelius. Tape noise is noticeable on some tracks but it is not objectionable.

"Which waltzes?" you ask. Blue Danube - Waves Of The Danube - Gold And Silver - Emperor Waltz - Valse Triste. (L.D.S.)

**DANCES FOR THE WORLD BALLROOM CHAMPIONSHIP.** Joe Lons and his orchestra. Columbia stereo 6502.

Ballroom and Latin-American dance fans will not miss this collection of dance tunes. Each track is clearly identified as Cha-cha, Waltz, Tango or whatever. Arrangements are by Alan Moorhouse which makes them pretty lively and listenable even though the timing is strict. Recording quality is good.

Fourteen tracks are featured which means that just about every dance likely to be performed in a championship is there. Some of the tracks are: Something Tells Me — For All We Know — Can Someone Tell Me How — Is This The Way To Amarillo — Beg, Steal Or Borrow. (L.D.S.)

**Nobilmente.** Extracts from the works of Sir Edward Elgar. Various artists and orchestras. Stereo, His Master's Voice SHELP 9925.

The title of this disc is derived from the first movment of Elgar's first symphony, headed “Nobilmente e semplice”. The strange thing is, there is no extract from the symphony included, nor from most of the other works referred to in the sleeve note, such as “Enigma” Variations — Violin Concerto — Cello Concerto. One would perhaps have expected a “Pomp and Circumstance” March to fit in well under the theme of nobility. Instead, we are offered the following: Triumphal March (“Caractacus”) — Larghetto (“Serenade for Strings”) — Prelude (The Kingdom) — Romance (Violin Sonata in E Minor) — Ave Verum — Sabbath Morning at Sea (Sea Pictures) — Go Forth — O Christian Soul (Dream of Gerontius) — The Sun Goeth Down (The Kingdom). Not, in my opinion, a particularly suitable selection to demonstrate nobility in Elgar’s music, and too heavily slanted towards vocal and choral works. However, at its budget price of £2.99, many people will find this attractive as an introduction to Elgar. Presumably, this is what the producer had in mind.

The recordings from which these tracks were selected date from 1965 to 1971, and, for the most part, have the desired merits of modern recordings — notably minimum distortion, wide dynamic range, and good stereo spread. (H.A.T.)


Most record buyers will be familiar with the unique vocal arrangements of classics developed by Ward Swingle for performances by his group of singers, with the voices taking the parts of the various instruments. If you do not know the group you should be aware that the group does not swing, as their title might imply. They present a vocal version which retains the strict tempo and harmony of the original. If you think you would find this interesting, I do recommend at least sampling a track or two before buying.

The titles in this selection are: Fugue in D minor — Aria (Air on the G string) — Fugue No. 5 in D (Well Tempered Clavier) — Sinfonia (Partita No. 2) — Canon — Prelude and Fugue in E minor (Well Tempered Clavier) — Chorale (Herz und Mund und Tat und Leben) — Fugue in D — Adagio (Sonata No. 3 for violin and piano) — Prelude (Nun Komm der Herren Heiland) — Fugue No. 21 in B flat (Well Tempered Clavier) — Bourree (English Suite No. 2). Good sound and well spread stereo. (H.A.T.)

**ROMANTIC CONTEMPORARIES. I MUSICI.** Stereo, Philips “Universe” series. 6580 045.

The “romantic contemporaries” are Respighi (Ancient Airs and Dances. Suite 3) — Samuel Barber (Adagio for Strings) — Bela Bartok (Romanian Folk Dances) — Benjamin Britten (Simple Symphony). Since Respighi died over 36 years ago and Bartok 25 years ago, “contemporary” seems to me to be stretching the meaning of the word somewhat, but let us not quibble — the program is eminently enjoyable and the playing of the Italian chamber orchestra I MUSICI is right up to the high standard which has established their international reputation.

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VARIETY FARE... cont.

and complex structures of their works, do not be put off this pleasant disc. It is much more "romantic" than "contemporary". The lilting melodies and entrancing rhythms of the Bartok suite will be a particular surprise if you know this composer only by reputation.

Although these recordings are presumably all re-issues dating from a few years ago, I could find nothing to complain about on the technical side. (H.A.T.)

NANA MOUSKOURI — BRITISH CONCERT. Stereo, Fontana 6652 002. Two disc set in folding sleeve.

This two-disc set of the Greek entertainer is made up of tracks recorded during a tour of the UK. Although it has been released on the budget-priced Fontana label (two discs for $3.90) it is not a re-issue. The Philips company apparently did not judge it worthy of release on their full-price label and the reasons are obvious. The recording suffers from the usual defects of recordings taken during on-stage performances — mediocre sound quality, limited (perhaps artificial) stereo spread, and the inevitable (to me) irritating audience noises.

Recording companies usually claim that these defects are offset by the sense of occasion and the tendency of artists to perform better before an audience. Perhaps these advantages are present here — if so, I was not able to discern them.

There are 25 titles listed on the sleeve, including: Outward Bound — A Place in My Heart — Odos Orinon — Turn on the Sun — Nickel Song — Try to Remember — Enas Mithos — White Rose of Athens — Scarborough Fair / Canticle — Plaisir d'Amour — Bridge Over Troubled Water — Amazing Grace. Mainly for Mouskouri fans who are not hi-fi conscious. (H.A.T.)

RAVEL — BOLERO and other orchestral works. Various orchestras and conductors. Stereo, Philips "Universo" series 6560 031.

The "other orchestral works" referred to above are Rapsodie Espagnole — La Valse — Tzigane. In other words this is "popular" Ravel. The best performance here is Bernard Haitink's rendering of "Rapsodie Espagnole", in which he conducts the Concertgebouw Orchestra. This is hard to fault at any point. Pierre Monteux conducts the London Symphony in "La Valse", presenting a lilting and rhythmic performance.

Arthur Grumiaux is the solo violinist in "Tzigane", which is a "concert rhapsody for violin and orchestra". I have always admired Grumiaux's playing, in particular the warm yet clear and sweet tone he produces. I do not feel this particular work is very suited to his style. I found this performance unsatisfying, without being able to pinpoint exactly why. Perhaps further listening will disclose the reason.

The lowest marks go to Igor Markevitch's conducting of the Spanish Radio and TV Symphony Orchestra in the Bolero. In the famous crescendo it is a case of "too much
too soon”. Some performances of this work hold the attention throughout — this one doesn’t.
The sound and stereo are of good standard throughout. (H. A. T.)

* * *

LA GUITARE ET L’ESPAGNE — Oscar Ghiglia. EMI Stereo SXLP 7566.

Oscar Ghiglia is. I believe, Italian, and I seem to remember a disc of his was issued here about two years ago to coincide with an Australian tour. His program here presents Spanish composers from the 16th century (Luis de Narvaez) to the present day (Federico Moreno Torroba).
The complete listings are: Cinq Airs a Danser (Gaspar Sanz) — Fantasias, Nos. 9 and 10 (Alonso Mudarra) — Variations on ‘Gardame las Vacas’ (Luis de Narvaez) — Canarios (Francisco Guerau) — Six Pavanes (Luis Milan) — Albada, Arada and Fandanguillo (Torroba) — Zambra Granadina and Mallorca (Isaac Albeniz) — La Majas de Goya (Grandos).

Those familiar with Spanish music will realise that none of the modern works which make up side 2 were written for guitar. All except the Granados piece were transcribed for guitar by the master himself, Andres Segovia. All the older pieces on side one were written either for guitar or its predecessor, the vihuela. (H. A. T.)

* * *

MASTER CONCERTOS FROM THE ITALIAN BAROQUE. I Musici. Philips Stereo 65300 028.

Three concertos are featured: Concerto in D for Violone and Orchestra by Guiseppe Antonio Capzzi; Concerto in G for two mandolins, strings and Continuo (organ) by Antonio Vivaldi and Concerto in D for Cello, Strings and Continuo by Leonardo Leo. These are all very pleasant pieces guaranteed to cheer you up at any time.
The sleeve notes make no mention of the “I Musici” or relate any of their history but they rank, as one of the finest chamber music groups in Europe today. Every piece is played very precisely but not to the point where feeling and emotion is erased. If you see one of their records on the rack and you like baroque music, buy it. It will be good.

As befits a fine performance, the record quality is outstanding and surface noise is nil. (L. D. S.)

* * *


Here is a fun record for the hi-fi fanatics. How about a hopped-up version of Bach’s Toccata and Fugue in D Minor with electric organ, drums and cymbals? You can even jive to parts of it. Or what about a whirring sounding “Jesu, Joy of Man’s Desiring” with same instrument line-up? A rousing wedding march from Wagner’s Lohengrin? You can jive to that too. Take it from me, I did.

Recording quality is A-1 but tape hiss is noticeable on some tracks with wide-range equipment. A variety of bands is represented here: James Last, Cy Coleman, Max Gregor, Kai Warner (not Kai Winding), Ingrid Hoffman and Heinz Schachtnner, to name most. A good buy, unless you regard the classics as sacred. (L. D. S.)

* * *

SHOWTIME. Strings Unlimited. Astor, Golden Grove Series, GGS-1397.

Apart from the fact that the original came from the Alshire label (USA) the jacket will tell you nothing about the orchestra or conductor. But does it matter? The sound is virtually indistinguishable from several other string orchestras, or the same orchestra by different names. It is lush, gently rhythmic and easy on the ear.

Add to that the ten popular show hits and you have a record: Fiddler On The Roof — Hair-Rad — I Talk To The Trees — Tonight — The Impossible Dream — People — As Long As He Needs Me — Hey There — Till There Was You — Man Of La Mancha.

The quality is generally good, just a trifle edgy on the massed strings but it spreads around well on 4-channel gear. (W. N. W.)

* * *

EVERGREEN MEMORIES. Werner Muller and his Orchestra. Stereo Karussell 24066 (Phonogram).

Ten stock standard dance tunes make up this bargain priced release from Karussell. The stereo sound and stereo are of good quality and the sound is normal with good sound throughout. (L. D. S.)

* * *

THE WORLD OF GOLDEN MELODIES. Mantovani, Ronnie Aldrich, Stanley Black, Frank Chacksfield, Roberto Mann. Les Reed. Decca Stereo SPA 207.

If you like a full lush treatment of your light music then give this disc a hearing. With the collection of well-known talent on this disc it almost sounds like a sampler, and in a way it is. Soft light and a pleasant meal with old friends would be the right setting for playing it.

There are two tracks from each big name including: This is my song — Love theme from Romeo and Juliet — The music played — Theme from “Love Story” — Sea Mist — A Man and a Woman — Fascination.
The sound is excellent and the stereo is used to good effect. (N. J. M.)

* * *

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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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VARIETY FARE

sound" is produced by a very competent band that sounds like a cross between Bert Kaempfert and Ted Heath — it might be a Common Market effort! Recording quality is okay and the price is right at $2.99.

Some of the tracks are as follows: April In Portugal — Love Letters — Those Were The Days — One Note Samba — The Last Waits — A Man and A Woman. (L.D.S.)


Stanley Black needs no introduction as a conductor who uses modern recording techniques to the best advantage to give a "wide screen" impression to his style of orchestration — and this record is no exception.

We hear the themes from some of the best-known hits of the 20's, 30's, 40's and 50's. The recording quality leaves nothing to be desired. (N.J.M.)

HAPPY ROSAMUNDE. Frank Valdor and his Orchestra. Somerset Stereo 715. Astor release.

This record is in the best tradition of the big sounding German dance bands with a medley of 28 familiar sounding tunes played with great verve and enthusiasm. The sound quality leaves nothing to be desired. (N.J.M.)

INVITATION TO DANCE. Ronnie Aldrich with the London Festival Orchestra and Chorus. Decca PFS 4242.

Here is a fairly routine but eminently listenable performance by Ronnie Aldrich on his two pianos (he whizzes from one side to the other and back) with the London Festival Orchestra and Chorus. It's fine for dining or just listening but it's not the quiet mood music that the title might suggest.

Recording standard is up to the usual high standard of Decca Phase Four and surface noise was negligible.

Eleven tracks are featured: Cherish — Gypsies. Tramps & Thieves — Summer Of '42 — I Want To Teach The World To Sing — Baby, I'm A Want You — The Oneind Line (the bell tolls — the Doctor Zivago — Ben Hur — 2001 — Sea Hawk — The Alamo — Patton. The sound quality leaves nothing to be desired. (N.J.M.)

SALUTE TO GLENN MILLER. Hal Vincent at the Baldwin Organ. Stereo Calendar R66 9954 Festival release.

This record suffered by comparison with the television show the night before of a big band reconstruction of the original Miller arrangements. I feel Miller's music was meant for big band playing and any other performance tends to be disappointing. Apart from this comment, brought on by the television programme, the performance was acceptable. (L.D.S.)

HADMOND DANCE PARTY. played by Tony Back. Stereo. AR/Interfuson (Festival) 2 record set ($7.95). ITFL-2341.

The nature of this 2-record set is summed up pretty well by the title and by the jacket and by the pictures on all four faces of kids doing their thing! If you want party music, Hammond and percussion style, here it is. Or, if you like party-style music without the party, the same remark applies.

All told, there are 41 tunes on the 4 sides including: My Sweet Lord — Close To You — Mrs Robinson — Can't Buy Me Love — Alfie — Love Story — Moon River — Maria — Michelle — Georgy Girl — Goldfinger — Soul Organ, and many others.

For party mood it's okay but four sides of the one sound, varying only in tempo, would be a bit much in other circumstances. (W.N.W.)

THE SANDPIPERS. A&M stereo AML 193/4. 2 record set $1.95.

On this album, the music could be classified as "music for lovers" or alternatively, music for those who wish to spoon but aren't. As such, the muted vocal style of the Sandpipers is well suited. On some tracks though, their approach is too ponderous almost as if they were trying to inject religious overtones.

Recording quality is generally good throughout the two discs but tape hiss is noticeable on some tracks. We suggest you listen before buying.

Some of the twenty four tracks are listed: Love Is Blue — Guantanamera — All My Loving — The Windmills Of Your Mind — Temptation — La Mer — Today — Jennifer Juniper — Yesterday. (L.D.S.)

MILLION SELLING SONGS OF TODAY. Vol. 12 by the Fish Chips. Alshire stereo 8-7249.

Usually, this type of album is a dud. The recording quality is generally poor and the performers leave much to be desired. But this album, I'm happy to report, is okay. The recording quality generally very good and the surface noise on my pressing was negligible. Each tune is performed in the same style as the original recording. For those who want a collection of pops, it is a good buy.


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corners of the studio, but the sound quality
and lack of surface noise were good.
If you are a dyed-in-the-wool Glenn Miller
fan, listen to this record; you could like it.
(N.J.M.)

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NETH McKELLAR. Decca Stereo SPA
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Kenneth McKellar’s pleasant voice
should be familiar to anyone viewing some
of the English variety shows on television.
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As such, this is a record which should
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With a cone area more than 1½ times that of an 8" speaker and the high performance characteristics of the new CFL technology, the new Plessey 10" speakers provide rich bass response and excellent overall performance.

The CFL technology
CFL—“Controlled Fibre Length”—is a new advanced technique developed by Plessey for manufacturing speaker cones. The length of the fibre used in the cones is a critical factor in the final performance of the speaker. Both frequency response and speaker efficiency can be changed considerably by varying fibre lengths. With CFL, Plessey can now assert rigid control over the basic paper pulp used to felt the cones. Fibre lengths and pulp densities can be varied to meet specific requirements, resulting in cones with optimum resonance/efficiency combinations.

Plessey CFL cones provide better transient response, minimum distortion, smoother, richer bass, brighter top frequency performance and improved overall efficiency in the new Plessey C100 and C100X speakers.

Write to us for the technical résumé “CFL" — A New Loudspeaker Technology”

Plessey C100 woofer
This new 10" high fidelity bass speaker provides significant performance benefits in multi speaker applications. The curvilinear CFL cone with rigid apex produces a most satisfying rich bass, extended high frequency response and a valuable increase in efficiency. Full application details are available.

Plessey C100X wide range
An excellent high efficiency 10" speaker providing superb sound reproduction over the full frequency range. The CFL cone adds richness to the bass, improves transient response and provides a brilliant top performance to satisfy the most discerning enthusiast.

Enclosures
Full construction details for one, two or three way enclosures with suitable crossover networks are available from Plessey Rola distributors, wholesalers or Plessey Rola direct.

Specifications

<table>
<thead>
<tr>
<th></th>
<th>C100X</th>
<th>C100</th>
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<tbody>
<tr>
<td>Power handling</td>
<td>20 watts</td>
<td>20 watts</td>
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<tr>
<td>RMS*</td>
<td>45 Hz</td>
<td>45 Hz</td>
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<tr>
<td>Fundamental resonance</td>
<td>1&quot;</td>
<td>1&quot;</td>
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<tr>
<td>Voice coil diameter</td>
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<tr>
<td>Impedance</td>
<td>8 or 15 8 or 15 ohms</td>
<td></td>
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<tr>
<td>Frequency response</td>
<td>33 Hz — 13 kHz</td>
<td></td>
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</tbody>
</table>

*In Recommended enclosure

Look for the Plessey CFL stickers. The CFL mark is your guarantee of a speaker with exceptional performance characteristics.

Plessey Rola Pty. Limited
The Boulevard Richmond Victoria 3121
Telephone 42 3921 Telex 30383
NSW: PO Box 2 Villawood 2163 Telephone 72 0133


96 ELECTRONICS Australia, April, 1973
**Jazz and Rock . . .**

**SEVENTH SOJOURN.** The Moody Blues. Threshold stereo TIS 1.

The Moodies continue their experiments with tonal colour on this album. Rock is the starting place of their music. The five members, playing a number of instruments, multi-track until they get something that suits them.

"Nights in White Satin", recorded several years ago, continues to be the standard Moodies piece.

"Isn't life Strange", on this LP, may replace it. "Strange" is a six-minute ballad, a lament for a life which is slipping away. Perhaps the Moodies are feeling their age.

"I'm Just a Singer in a Rock and Roll Band" is another piece of philosophy. If there's an English sound in rock music, the Moodies have it. This disc, recorded at Tollington Park Studios in London, could never have been made by an American group.

Sound quality is excellent. Perhaps I should warn readers that I am now feeding all discs through a choice of four circuits on a quadraphonic sound system (no free ads allowed).

**SONGS OF THE ISLANDS.** The Hawaiian Surfers Orchestra. Calendar stereo R66 9966.

The Hawaiian Surfers Orchestra is something like a Hawaiian version of the Gunter Kaltmann Choir but not quite as polished. As such, the music is not the lilting Hawaiian Wedding Song - Honolulu - On Treasure Island - Sing Me A Song Of The Islands - Pagan Love Song - Paradise - Drifting And Dreaming - Goodbye Hawaii - Aloha Oe (L.D.S.)

**LET SLEEPING DOGS DIE.** Ticket. Atlantic stereo SD-1010.

The members of Ticket are Eddie Hansen (lead guitar), Rick Ball (drums); Paul Woolwright (bass and vocals) and Trevor Tombleson (vocals and percussion). They are a New Zealand group which made this record at T.C.S. in Melbourne last year.

**STAR SPANGLED BANNER.** Havoc stereo HST 4905.

This Melbourne group makes its comments on a variety of current musical styles. The members are John Brownrigg, Paul Doo and Ron Walters. They take off on John and Yoko on "Pull Together". The protest singers get theirs on "Protester Man". "Country Son" is a Tiny Tim outdoors epic.

**RASPBERRIES.** Capital Stereo ST-11036.

Taking up where the Beatles left off when they made Sgt. Pepper, the Raspberries are playing in the style of the mid-sixties — and getting hits out of it.

Their song "I Saw the Light" sounds as though it could have been written by Lennon and McCartney. It is by Raspberry members Eric Carman and Wally Bryson.

The group uses two-part and three-part harmonies like the Beatles of those bygone days, not forgetting the Beach Boys. "Go All the Way" is quite good and so is "Drivin' Around" but if I want to listen to Beatles music, I'll listen to the Beatles, not the Raspberries.

Another problem with the Raspberries is that they smell. At least their record cover does. It has been printed with an ink which will not fracture or break down due to vibration. "INNER BOND" is odourless, highly resistant to attack by bacteria or fungus and a vermin repellant. "INNER BOND" of 160z sq. yd. has a normal thickness of 1/16 and at this density is recommended as a packing in speaker enclosures for sound absorption.

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(4 / 25A)
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- lightweight • dual trace

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High sensitivity and fast timebase speeds make OS3000 ideal for the display of fast transient. **Comprehensive dual timebases allow detailed study of complex waveforms and pulse trains.** Mixed sweep facility allows continuous pinpointing of the location of the section of waveform being examined.

Triggering facilities are independent for each channel—a essential feature for TV and pulse operation to eliminate waveform jitter.

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Plus Sales Tax

BRIEF SPECIFICATIONS:  
- **Display** – 8 x 10 cm CRT. EHT 10 kV
- **Bandwidth** – DC 40 MHz
- **Rise Time** – 9 nS
- **Sensitivity** – 5 mV/cm to 20 V/cm in 1-2-5 sequence, A x 5 facility on each channel giving 1 mV/cm, bandwidth DC to 10 MHz
- **Accuracy** – ±3% (±5% on x 5)
- **Input Impedance** – 1 MΩ/28 pF
- **Signal Delay** – at least 1 cm
- **Operating Modes** – Y1 only, Y2 only, channel Y1 and Y2 chopped (500 kHz approx.), Y1 & Y2 alt., Y1 & Y2 (algebraic addition)
- **Horizontal Deflection** – Dual timebase: sweep speeds from 200 nS to 1 S/cm and x 10 extension giving fastest timebase speed of 20 nS/cm • **XY Operation** – Y2 output coupled to external X input with x 10 x expand. Bandwidth DC to 1 MHz
- **Operating Temperature Range** – 0-50°C

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JM/119-73
Teac AS-100 — a quiet power-house

The name Teac is familiar to most people in the Hi-Fi industry as a manufacturer of quality amplifiers and recorders. Their recent amplifier release, the AS-100, upholds that reputation.

The AS-100 has a tasteful front panel design that would fit in with almost any home decor. The outer cover and front panel frame are finished in matt black and the panel in brushed silver and black. The black knobs are fitted with spun silver inserts. Dimensions are 141mm high, 410mm wide and 328mm deep, the weight being 10kg.

Front panel controls include source and mode switches, which give not only reverse, stereo and mono, but also allow both channels to be driven from either left or right signals. There are separate switched bass and treble controls and concentric balance and volume knobs.

The lower panel carries the tape monitor switch and tape deck record-play jacks, high and low filter and loudness switches, headphone jack, power switch and switches for local and remote speakers.

The interior finish and layout is in keeping with the external quality appearance, with most small components mounted on six printed wiring boards. The output transistors share two large finned heatsinks, the driver stage board being mounted directly onto the sinks. Overload protection is provided by means of a 'crow-bar' circuit backed-up by fuses.

On test, the AS-100 matched most of its specifications, at least within normal measurement tolerances. The claimed output with both channels driven is 40 watts per channel, we measured 38.25 watts per channel before clipping at 0.16% THD. Signal-to-noise ratios were given as 70dB and 80dB for phono and aux respectively; we found levels of 68 and 73. Residual noise with the volume control turned to zero was a tiny 1.2mV.

Following what seems to be something of a trend, the designers have opted for rather limited tone control action, with 10dB cut or boost rather than the more usual 15dB. Also, the high and low filters provide only a nominal 6dB per octave. To be really effective against noise and rumble, &c., the filters should have a slope of at least 12dB per octave.

New LED’s with in-built resistor

Circuit board designers will welcome two new light-emitting diodes released by Hewlett Packard. With a built in current limiting resistor, they obviate the need for a separate component on the board, and with a forward current of 16mA at 5V they are fully TTL compatible.

The 5082-4860 is a standard T1⅓ size lamp with a diffused red encapsulation and long leads suitable for wire wrapping. It may be panel mounted in a 0.257 in dia hole by means of a plastic mounting clip available in clear or black. Panel thickness is limited to 0.125in.

The 5082-4860 is a smaller lamp, in a T1 package 0.125 in dia with a clear diffused encapsulation. The typical luminous intensity of both lamps is 0.8 millicandelas with an emission wavelength of 655 nanometers.

Both the lamps, 5082-4860 and 5082-4468 are economically priced at 54c in 1000 quantities.

Further information is readily obtainable from Hewlett Packard Australia Pty Ltd, 22-26 Weir St, Glen Iris 3146, or their offices in other states.
NEW PRODUCTS

Akai GX-1900: two recorders in one

Those of us with an interest in tape recording must sooner or later face up to the dilemma: do we standardise on the reel-to-reel format, or on cassettes? This new machine from Akai provides what is probably the perfect answer — retain both.

The Akai GX-1900 recorder combines a two speed, four track reel to reel mechanism with a cassette deck and also provides the means of transfer from reel to cassette and vice-versa.

Designed for vertical use, the GX-1900 weighs in at 20.5kg including the cover, and measures 375 x 435 x 248mm (HxWxD). The timber case is finished in a satin walnut laminate and the absence of a carrying handle would suggest fixed installation rather than portable use. Matt black with white lettering is the finish for the lower half of the front panel, which carries the program controls in a clean, logical layout. The cassette unit covers most of the left hand half of this panel, with the reel tape heads directly above. Transport controls, speed change and reel spindles are on the brushed aluminium upper panel.

Removal of the unit from its case, involving eleven screws, reveals an interior comparable to the outside finish. With the exception of the cassette deck, the mechanical components are mounted on a substantial steel sub panel. The IC output stages and power supply occupy a subframe at the rear of the chassis, with the preamplifier in a shielded compartment at the bottom. Moderate baffling for the four inch high compliance internal speakers is provided by the side frames.

Removal of any electronic modules is expedited by the use of multi-pin connectors. A single hefty synchronous motor provides all transport functions, including that of the cassette deck.

One possible hazard to cassette users is the absence of the usual safety lock to prevent erasure of pre-recorded cassettes. Although this point is covered in the operator manual, it is an all too common human failing to read the manual as a last resort. For personal listening or monitoring, a jack is provided for low impedance headphones.

Electrically, the GX-1900 performed substantially in accordance with the test slip provided, the one exception being a slightly poorer bass response at 3¼ ins/sec than that claimed. At 7¼ ins/sec the response claimed is 40-20kHz±3dB, and at 3¼ ins/sec, 40-14kHz on both tape and cassette although the sample under review was down a further 2½dB at 40 Hz. Distortion at 1kHz was better than that claimed by the suppliers, being 0.8pc at 7½ins/sec and 1.25pc at 3¼ins/sec.

Output into 8 ohm loads was 5 watts before clipping. The internal speakers gave a good account of themselves, although the use of larger speaker systems of high sensitivity would no doubt improve the acoustic output.

Input sensitivities are 0.5mV for microphones, 50mV line via RCA type sockets and a choice of 50V or 3mV via a 5-pin Din plug. Line output is also available at the Din plug, and also via a pair of RCA type sockets, at a level of 400mV.

For dubbing from records a ceramic or crystal pickup is recommended, using the line input. A magnetic cartridge should be used in conjunction with an external preamp to provide the necessary compensation.

One useful feature, particularly where the recorder is providing background music is an automatic shutoff device, which when switched in cuts the power to the machine at the end of each side. In the cassette unit, the transport is stopped at the end of each side, although the power is still on. A pause lever with a release button adds to the general ease of use.

The basic recorder as it stands only allows inter-format dubbing with a reel to reel speed of 3⅔ips, and the owner’s handbook makes no mention of any alternative. However an accessory capstan kit permits doubling of reel speed, so that tapes recorded at 7⅔ips may be dubbed onto cassette and vice-versa. This also allows the playback and recording of tapes only at 15ips.

The Akai GX-1900 should find ready acceptance among those requiring both reel and cassette facilities. It is in effect two high quality tape machines combined into a single unit for convenience.

Distributed by Akai Australia Pty Ltd of 276 Castlereagh St, Sydney, the GX-1900 carries a recommended retail price of $687.

(N.J.M.)

New range of adhesives

Tradesmen and technicians engaged in the construction and maintenance aspects of industry will find interest in a new range of adhesive and sealant compounds under the name Permaloc. Whilst exposed to air they remain liquid but when air is excluded, polymerisation takes place to form a strong and chemically resistant sealant.

Some of the applications are locking of screws and other threaded fasteners, retaining bearings and fittings on shafts, sealing flanges and pipe joints under pressure, and eliminating porosity in castings.

High viscosity grades are used where large parts and coarse threads are involved, conversely the thinner grades apply to small parts and fine threads. To reduce setting time an additive known as PermaQuick is used, with the added advantage of increasing the gap-filling properties.

Full information on Permaloc may be obtained from Industrial and Medical Electronic Company, 6th floor, 288 Little Collins St, Melbourne 3000.
NEW PRODUCTS

SANSUI SF2: The music goes round and round...

According to Sansui stylists and engineers, a four-channel system looks better and sounds better if the loudspeaker systems do not have an obvious "front" and do not have to be angled towards the listening position. Latest end product of this thinking is the Sansui SF2 system pictured here.

The SF2 system is 627mm (approx 25in) high and 400mm (approx 16in) wide and deep in plan. As such, it can stand unobtrusively in the corners of the room, or it can be elevated on a stand or a broad shelf, if so desired.

The SF2 literally has no front or back. It has a solid, finely finished base and top and a wooden grille for all other surfaces backed by sound diffusing foam. The intention is that, while a proportion of the sound will reach the listener directly, the rest will be reflected from adjacent wall surfaces and help create a true "surround sound" effect.

This is in line with a fair amount of current thinking, although the same end result can be achieved in a number of ways.

From the illustrations it is apparent that the SF2 system is really an enclosure inside an enclosure. The internal structure of stout chipboard houses two 20cm woofers, one facing upwards and one downwards. Each of these woofers directs its output against the surface of a conical reflector, which deflects the sound radially in all directions and from two distinct planes — from the bottom and top of the system.

Suspended above the top woofer is a 5.8cm diameter sealed tweeter which also uses the top deflector to achieve 360-degree sound dispersion.

The outer shell is functional as well as decorative. It constitutes "an inexpensive piece of fine furniture": it also provides structural unity and carries, behind the grille, an internal foam layer which modifies and further disperses the radiated sound.

It is apparent that a main system resonance is indicated at about 120Hz, sufficiently well damped not to produce any obvious output peak. Below this resonance, the output tends to fall away at the expected rate of 12dB per octave, so that it is well down at the lower claimed response limit of 50Hz. This would indicate the desirability for some bass boost from the amplifier but the power rating of 50W is well down at the lower claimed figure of 9, rising to 18 at the system bass resonance. Sensitivity is quoted at 90dB (new JIS at 1m/W).

Quantity supplies of the SF2 loudspeaker system had not arrived in Australia at the time this issue went to press but, in the meantime, inquiries will be welcomed by the distributors: Bleakley Gray Corporation Pty Ltd, 28 Elizabeth St, Melbourne, or at their interstate offices. Anticipated retail price will be $185 per unit. (W.N.W.)

HI-FI STEREO ANNUAL

An authoritative yet highly readable guide to hi-fi, stereo, tape recording and quadraphonics — printed on ultra gloss paper. Priced at $2.30 including postage, from "Electronics Australia" at Box 157, PO Beaconsfield, 2015.

LANTHUR ELECTRONICS

69 Buchanan Ave, Nth. Balwyn Vic 3104 PO Box 162
Tel: 85 4081

BASIC BATTERY CHARGER KIT
Will charge 6 & 13 volt car batteries at 4amps. Consists of transformer, rectifier, ballast resistor, pair clips & circuit. Prices include postage.

- $14.80
- $14.80
- $0.85

Sel plate rectifier as used in above. $4.95
- $4.95

BASIC LAMP DIMMER KIT
Will control incan. lamps up to 1000 watts. Consists of: Triac, diode, switch pot, knob, inductor, caps. & res. Circuit supplied. $5.95
- $5.95

6 amp: Triac & Diac as used above. $3.25
- $3.25

Prices include postage.

BATTERY SAVER BASIC KITS
Use instead of batteries in radios, record players, tape recorders etc. DC voltages from 6 to 15 available. Tap, transformer, rectifier, filter, cap. & circuit supplied.

- 1 amp: size $6.50
- 2 amp: size $8.50
- Plus postage Vic $0.40
- Other $0.70

RADIO TUNER FOR BROADCAST BAND
Suitable for use with Hi-Fi amplifiers, tape recorders etc. Bandwidth 50kHz. 15 volt output. DC input 9 volts at 5 ma. Features straight line dial 6kHz, 1kHz, 100Hz, 50Hz. $12.30
- $12.30

SILICON DIODES - 25 AMP STUD MOUNTING TYPE
4 x 25A stud type diodes. Type 1N4007, 1N4004, 1N4001, 1N4007. $0.50
- $0.50

HAND TOOL SPEED CONTROLLER
Controls speed from full to stop without loss of torque. Suitable only for ac, dc or brush type motors. Complete with cord & plug. S.E.C. approved. 2 amp size 500 watt $14.90
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Fwd & rev types avail. Suit batt. chargers, alternators etc. 56 plv $1.20 100 plv $1.35 Heat sink adaptors $0.35
- $0.35

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electronic kits for beginners

POPULAR IMPORTED ELECTRONIC KITS, NO SOLDERING, EASY TO ASSEMBLE, BATTERY OPERATED, SAFE, SUIT ALL AGES - CHILDREN & ADULTS, BOARD TYPE CONSTRUCTION WITH EASY TO FOLLOW INSTRUCTIONS THAT MAKE THEM IDEAL GIFTS.

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1C-20 20 Project Electronic Kit, learn about intergraded circuits with this educational kit, 20 working projects including intergraded circuit. $11.90 p.p. .95c

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Delux Electronic Project Kit using intergraded circuits. Contains all parts for 150 different working projects including I.C. diode & transistor radio, electronic switches, relays, alarms, test equipment, etc. Very good value, Prices $30.95, p.p. 95c

NEW PRODUCTS

Portable 2-metre FM Transceiver

The Ken KP-202 is a very compact hand-held FM transceiver expressly designed for use by radio amateurs on the 144MHz or 2-metre band. Fully solid state, it has provision for operating on six switched channels.

Made in Japan by Ken Products, the KP-202 is imported and distributed in this country by Sideband Electronics Engineering. It is about the same size and weight as typical 27MHz transceivers, and at first glance it could easily be mistaken for one of the better quality units of this type. The case is moulded in dark blue ABS plastic, with the main panel at the top and a metal casting finished in black and chrome.

The KP-202 is really a transmitter and a receiver combined, as there is virtually no common circuitry. The transmitter uses 12 transistors, three in the audio section and nine in the RF chain. The audio section includes a series diode amplitude limiter and actually phase modulates a buffer stage following the crystal oscillator.

RF output of the transmitter is a nominal 2 watts. On the sample unit tested the actual output varied somewhat with the crystal in use, but was well over 1 watt in all cases. The output circuit is provided with quite extensive harmonic filtering, so that TVI should not be a problem.

The receiver uses 19 bipolar transistors together with a FET in the RF stage. Double conversion is used, with switched crystals for the first injection oscillator and a fixed 11.155MHz crystal oscillator for second injection. Demodulation is via a diode ratio detector, while the last limiter current is used to operate a very effective audio squelch circuit using three transistors. A separate transistor and diode doubler detector is used to drive a small edgewise 5-meter, which is switched to read battery voltage on transmit.

On test the sample KP-202 proved to be an impressive performer. With only 2W of RF output its transmitter range with the telescopic rod aerial is not enormous, but quite adequate for most local working. With a more efficient aerial it would even be usable in suburban areas. With the rod alone the receiver sensitivity was quite dramatic. In the mid-western suburbs of Sydney we had no trouble listening to the Gosford repeater at 5 and 9-plus.

In short, very good value at $150 (includes crystals for 4 channels). Sideband Electronics Engineering, PO Box 23, Springwood, NSW 2777.

Ferrograph "Studio 8" Recorder

The name Ferrograph is synonymous with high quality and advanced engineering in the field of tape recording and their recently released "Studio 8" model recorder should enhance that reputation.

The "Studio 8" recorder is designed for continuous professional usage without any deterioration in performance. The signal electronics are constructed in modular form, with separate plug-in boards for each function to allow ease of service or major change of functional requirements. The signal electronics are constructed in modular form, with separate plug-in boards for each function to allow ease of service or major change of functional requirements.

The "Studio 8" recorder is designed for continuous professional usage without any deterioration in performance. The signal electronics are constructed in modular form, with separate plug-in boards for each function to allow ease of service or major change of functional requirements.

The electronic elapsed time indicator can be used to stop the tape transport after a pre-determined interval, either for recording or editing and play-back purposes. The time indicator derives a tachometer type signal from a wheel driven by the tape and displays the count on a numerical LED readout. This display can be duplicated at a remote location, being controlled by TTL signals from the internal counter.

The use of digital control in the "Studio 8" permits easy remote control of all operating functions, either by push-button or computer.

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Plug-in equalisers facilitate rapid change of recording and play-back characteristics and the bias and erase circuits have ample reserve available for future requirements.

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Two main types of electronic sub-assemblies are available initially, the simpler version depending on external signal processing with 600 ohm input impedance balanced to ground.

A second model has microphone input and line inputs together with metering facilities for input and output level and bias current. The use of digital control in the "Studio 8" permits easy remote control of all operating functions, either by push-button or computer.

The use of digital control in the "Studio 8" permits easy remote control of all operating functions, either by push-button or computer.
Automatic 18GHz Digital Counter

A new type automatic digital readout frequency counter covering an extended frequency range has been developed by EIP. It is marketed by Jacoby, Mitchell Ltd.

The counter offers completely automatic readout, high speed and high accuracy over the very wide range of 20Hz to 18GHz. It is the latest in a line of achievements by EIP Inc. of California, USA.

The instrument's outstanding performance results from a specially developed Autohet circuit, which uses two digitally programmed YIG-tuned converters to translate any CW signal into the range of the basic 210MHz counter. This technique is basically the same as that used in conventional manually tuned heterodyne converters. Consequently it measures frequency, even of signals with a considerable amount of PM component, 30 to 1000 times faster than any other available automatic frequency counter.

The model 351 counter continuously covers the range 20Hz to 18GHz. Available also is the model 350B, with a range coverage of 20Hz to 12.4GHz.

This broadband coverage is achieved without loss of performance. Accuracy of both models is 1 count + the stability of the crystal time base (less than 5 parts in $10^9$ in 24 hours). For particularly critical applications, where the highest degree of accuracy is necessary, this figure can be further improved by using an external reference, or one of a range of optional higher stability time bases available from the makers (typically better than 5 parts in $10^{10}$ in 24 hours).

The designers have taken particular care to simplify accurate frequency measurements, and models of the 350 series incorporate a number of innovations to this end. The 11 digit readout has been conveniently sectionised in GHz, MHz, kHz, and Hz. The confusing gate time and measurement units necessary with conventional counters are unnecessary with the 350 series. Because of its high resolution and fast reading time, resolutions of 10Hz and 1Hz are obtainable at maximum rates of 10 and 1 readings per sec respectively.

For applications where less resolution is required, push button display blanking is provided to simplify the readout by turning off the unwanted digits.

Enquiries should be directed to Jacoby Mitchell Ltd, 215 North Rocks Rd, North Rocks, NSW 2151.

New Sydney studio for AVE

Australian Video Engineering have set up a new demonstration and training studio within their premises at Electronic City in Sydney. The studio is provided with broadcast colour equipment, monochrome camera and telecine chains, and VTR equipment.

The facilities of the studio include an International Video Corp VC-500A studio colour camera, shown at left above with AVE engineering representative Syd Griffith at the controls. The VC-500A incorporates a silicon matrix target tube in the red channel, and is capable of giving good colour balance down to very low light levels.

Also included in the studio facilities is an ITC monochrome telecine chain, with a 16mm projector and a rotary magazine slide projector. This is shown at right above, with engineering representative David Jeans. Various other IVC and ITC cameras, monitors and video recorders are also available. The studio is fitted with quartz-halogen lighting, and features resolution, gray-scale and colour balancing test charts.

The studio and its facilities will be made available by AVE to customers and those considering purchase of CCTV systems, both for staff training and for feasibility and cost evaluation.

Enquiries and bookings for the studio may be directed to Australian Video Engineering at 443 Concord Road, Rhodes, NSW.

SOLID STATE, WIDEBAND RF SIGNAL GENERATOR

MODEL SG-402

This is an all solid state, wideband RF Signal Generator which produces low impedance, low distortion RF signals. It is highly dependable and easy to operate, and is a handy working instrument for service benches and electronic equipment production centres.

SPECIAL FEATURES
1. Generates wide range signals from 100kHz to 30MHz in six frequency ranges.
2. All solid state construction for instant waveforms, compact and lightweight portability.
3. Includes 400 Hz signal source for modulation of output signal, which can also be modulated by external sources.

PARAMETERS

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The world class performers!

The world of Micro is a talented team of Engineers, skilled sound technicians, and expert designers specialising in the production of turntables that challenge the ultimate in the faithful reproduction of original sound. In the Micro range, you'll find a turntable that gives good performance at a reasonable price, or ultimate performance regardless of price.

For your consideration Micro offers the MR 611 (right) turntable with tonearm; also MB 300, MB 600, MB 800 S turntables only for those to use their own tonearm. Micro also offers a superb range of cartridges: VF 3200 E, with the special design that reduces the moving mass to half that of other cartridges, also VF 3100 / 7, 3100 / 5, Conical diamond stylus, 3100E, M 2100 / 6, M 2100E, and the "rave notice" MC 4100 moving coil, with 6321 S matching transformers.

MR611 turntable is a professional quality, belt-drive turntable with 8 pole hysteresis synchronous motor assuring smooth, constant and stable rotation, with minimal wow-flutter and superb signal-to-noise ratio. The 611 incorporates the MA 101, MK 11 static balance type tonearm, with adjustable, perfect antiskating device, direct reading, stylus, pressure gauge and oil damped arm lifter.

NEW! MICRO MS1 Electrostatic Headphones

"A magnificent musical experience.
Here's top quality personal listening from famous Micro! For pure sound, for lightweight long term comfort, for an outstanding dynamic range and remarkable flat response from 20 to 20,000 Hz, hear the new Micro headphones at your Interdyn stockist — a magnificent musical experience!"

N.S.W. M & G Hoskins Pty. Ltd., 37 Castle St., Blakehurst, 2221. Telephone 54 1464.
Q’L.D. Stereo Supplies, 100 Turbot St., Brisbane, 4000. Telephone 21 3623.
TAS. Audio Services, 72 Wilson St, Burnie, 7320. Telephone 31 2390.
VIC. Encel Electronics Pty. Ltd., 431 Bridge Rd., Richmond, 3121. Telephone 42 3762.
W.A. Albert TV & Hi-Fi, 282 Hay St., Perth, 6000. Telephone 21 5004.

Sole Australian distributor

INTERNATIONAL DYNAMICS (AGENCIES) PTY. LTD.
P.O. Box 205, Cheltenham, Vic. 3192.
NEW PRODUCTS

IC tone generator-responder

Of particular interest to the telephone and communications industry will be the release by AWA Microelectronics of a three section monolithic tone generator-responder IC with principal applications in tone signalling systems.

Known as the AWM 1427, the module consists of three sections: an RC gated tone oscillator, a bandpass filter and a peak detector. These have the following features:

Oscillator — Frequencies up to 100kHz at 0.5 per cent stability, 700mV output, gated by TTL input.
Bandpass Filter — Centre frequencies to 100kHz with 0.5 per cent stability, Q values up to 100.
Peak Detector — Adjustable attack and release times, TTL compatible output.

Applications for the new IC include voice band signalling in telephony, paging systems, data communications, selective calling, remote control systems, radio controlled models and many more which will come to mind once engineers become familiar with the unit and its possibilities.

The package is a 16 pin DIL ceramic block. Storage temperatures can vary over the range -55 to +125 degrees Centigrade while operating temperatures are within the range 0 to +75 degrees Centigrade. The supply voltage is between +10 and 15 volts, and the power dissipation is 90mW.

With the advance data supplied comes some suggested arrangements and design notes for a modified Wien bridge, a bandpass filter with an active RC filter section, a peak detector, and a typical tone generator oscillator-responder circuit and curve.

Also shown in the picture above are two AWM 1437 devices (10-lead TO-5 packages). The AWM 1437 is a trigger device for phase control of Triacs and other thyristors. Deriving its power directly from the AC power line, it is suitable for line voltages in the range 20-600V RMS. Maximum trigger current is 200mA. A feature is an inhibit facility which is TTL compatible.

Further information is available from AWA Microelectronics, 348 Victoria Road, Rydalmere NSW.

Static AC inverters from DC Electronics

DC Electronics Pty Ltd has announced the availability of new options for their range of static AC power inverters, increasing the possible applications. The series "100" DC / AC Sinewave Power Inverters, with output power capability ranging from 125VA to 1500VA can now be reconfigured to provide synchronisation of two or more units for higher power. They can also be synchronised with 120 degree phase shifts for three phase operation, or locked to external 50Hz supplies, such as a frequency standard.

Either 50Hz or 60Hz output options are currently available, with 400Hz available shortly. All units offer line and load regulation of better than 1pc, sinewave non-purity content of typically 3pc, and power conversion efficiency of 75pc. All units offer RFI-free performance, previously difficult to obtain with either static or rotary inverters.

A brochure describing the range of inverters and their applications is available from the manufacturers, DC Electronics Pty Ltd, 32 Smith Street, Collingwood, Victoria 3066.
NEW RANGE OF RESISTORS, CONDENSERS AND POTENTIOMETERS

CARBON RESISTORS
Current type resistors by Philips, IRC, Ducon & Morganite in a wide range of values from 100 ohms to 10 meg. ½ and 1 watt.
$1.50 per 100
Post 30c Extra

MIXED CONDENSERS
The condensers are in most popular brands and include polyester, paper, mica ceramic and electrolytic on values to 8mfd.
$1.50 per 100
Post 50c Extra

CERAMIC CONDENSERS & THERMISTORS
A large range of current disc & tube ceramic condensers & thermistors.
$1.50 per 100
Post 30c extra

POTENTIOMETERS
The pots are all current types and include switch pots, standard pots, pre-set etc.
$1.50 per doz.
Post 50c extra

POLYESTER CAPACITORS
Pack of 100 new polyester capacitors .001 to 0.1 in 160, 250 and 400 volts working. $3.50 Plus 50c Post and Packing

REGRET SPECIAL VALUES IN RESISTORS, POTS, & CONDENSERS CANNOT BE SUPPLIED.

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 Transceiver.

MIDLAND 1 WATT TRANSCIEVER
for 27.240 KHz operation with switch provision for two additional channels, tone call signal, background noise squelch 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 $39.95 PER UNIT, FULLY GUARANTEED.
Post & Packing $1.50 extra (Reg. Post)

MAGNAVOX WIDE RANGE TWIN CONE SPEAKERS
8 on 16 ohms VC. Post and packing 65c
6WR MK V 12 Watts RMS $9.90
6WR MK V 16 Watts RMS $10.75
10WR MK V 16 Watts RMS $11.50
12WR MK V 16 Watts RMS $12.50
8-30. 30 Watts RMS $17.00
3TC Tweeters $3.75
Philips Dome Tweeter $10.50

NEW IMPORTED STEREO TURNTABLE AND PICK-UP
240 VOLT AC OPERATION
3 speed turntable with ceramic stereo pickup counter-balanced tubular arm, $7.90. Base in teak or walnut, $6.50 extra. De luxe base $8.50 Post 50c or $1.00 with base.
Turntable and motor separate $4.50

PLAYMASTER 136 STEREO AMPLIFIER
As featured in Dec '72 issue of Electronics Australia

High fidelity amplifier with an output of 13 watts R.M.S. per channel, frequency response 20Hz to 120kHz, distortion 0.2 % mag. input equalised to RIAA, bass & treble controls, provision for simulated 4 channel.
Complete kit of parts including All Transistors. $62.00 as above but less Fairchild special transistor offer $55.00. Reg postage $2.00 extra.
As an added feature to the 136 amp. We have added provision for headphones with phone jack & switch mounted on front panel which is silver anodised with black lettering & matching knobs. We have also had a special transformer wound for this unit with separate 6v winding for indicator bezel & with electrostatic shield.

PARTS FOR ABOVE AMPLIFIER
Metalwork inc. heat sinks $7.50 post 70c.
Circuit boards set 3 $5.50 post 25c.
Anodised front panel $3.70 post 25c.
Power transformer $8.50 post 70c.

PHILIPS VALVE & PICTURE TUBE DATA BOOKS
hard covered book of over 500 pages covering all modern valves & picture tubes. List price $4.75 — Special $1.75

A TRANSISTOR PREAMP FOR MAGNETIC PICKUP OR TAPE HEAD (Stereo)
Using 2 transistors per channel, as featured in "Electronics Australia" (Sept. 1971). Complete kit includes transistors, PC board, resistors, capacitors. Circuit and full details supplied.
Kit (not incl. box) $7.90
240V Power Supply $4.50
Metal box $2.75 extra
State if required for pick or tape head.

NEW LOW COST STEREO SYSTEM
AS FEATURED IN JAN. ELECTRONICS AUSTRALIA
Complete kit of parts including "Garrard" record player with auto, stop and crystal pick-up. Magnavox 8WR or 6WR wide range twin cased speakers (Cabinets not supplied). Amplifier only, less speakers and player. $52.90
$69.50 Post and packing $2.50 extra.

BROADCAST TUNER KIT
$22.50
Post 75c
Complete kit of parts including dial mechanism and zener diode for this I.C. tuner as featured in Feb. 71 E.A.

NATIONAL RADIO SUPPLIES
332 Parramatta Road, Stanmore, NSW 2048 Phone 56 7398

106 ELECTRONICS Australia, April, 1973
New low profile transformers from Ferguson

A new range of low profile 20VA low voltage transformers has been released by Ferguson Transformers. Complying with Australian Standard C126, they should be of great interest to manufacturers and home constructors alike.

The transformers are very similar in construction to fluorescent lamp ballasts. Each transformer has two identical secondary windings with a total nominal rating of 20VA with the following voltage combinations: 6V+6V, 7.5V+7.5V, 9V+9V, 12V+12V, 15V+15V, 20V+20V and 25V+25V.

The secondaries may be series or parallel connected and the manufacturers give typical regulation figures under various load conditions. For example the PF3599 with two 12V windings, when series connected supplies an output voltage ranging from 26.4V at 5VA to 22.4V at a loading of 25VA.

The overall dimensions are a compact 1 1/2" high, 4 1/4" wide and 4 1/4" long, with round pin terminals for connections. Each unit is supplied with a set of leads having insulated receptacles. The shrouded design should prevent accidental damage to the windings during installation or transport.

The transformers will be a welcome addition to the already comprehensive range from this manufacturer, particularly in view of their very attractive cost structure. Enquiries should be directed to Ferguson Transformers, 331 High St, Chatswood 2067, or to trade stockists.

BWD improve scope

In keeping with their policy of continuing development and product improvement, BWD Electronics have incorporated significant improvements in their Model 539A Dual Trace Oscilloscope to increase its usefulness, particularly in the colour television field.

The improvements include extension of the amplifier bandwidth from DC to 12MHz at -3db, thus making the response flat within 5pc over the entire colour video bandwidth. Precision triggering and active synch separation allow very stable video waveforms to be displayed.

Vertical risetime has been reduced to 30ns over the whole sensitivity range from 10mV to 50mV/cm. These improvements, plus the unaltered price of $375 plus tax, make the 539A worthy of very serious consideration by anyone equipping a laboratory or service shop for any special instrumentation project being undertaken by the company.

Information on the 539A and other BWD products may be obtained from BWD Electronics at 328-332 Bourke Rd, Gardiner, Vic 3146 or 127 Blues Point Rd, North Sydney, NSW 2060.

A book written as a text for the undergraduate student in communications engineering and as a handbook for the systems design engineer. It is aimed at providing insight into the mathematical techniques required for the analysis and solution of many of the practical problems encountered in modern communications engineering.

The chapter headings give a good idea of the scope and presentation: 1 - Introduction and Basic Mathematics; 2 - Thermal Noise; 3 - Analog Modulation Methods and Interference; 4 - Echo and AM to PM Distortion in FM Systems; 5 - Nonlinear Distortion; 6 - Digital Modulation Systems. Each of the chapters ends with tutorial problems and a reference list, while the book itself ends with mathematical appendices and a topic index.

A rather specialised book, but one which gives every evidence of being well planned and executed with the stated aim in mind. As such it should be of considerable value to those either studying or working in the field.

The review copy came from the local office of the publisher. (J.R.)

Thyristors, diodes


RECTIFIER DIODES Edited by H. Koppe. Published by the Electronic Components Division, N.V. Philips' Gloeilampenfabrieken, Eindhoven, The Netherlands. Soft covers 147 x 210mm, 316pp, well illustrated with line drawings and photos. Price in Australia $3.70.

Although both these books are written around the products of one manufacturer they are so thorough in their treatment of the subject matter that this fact can be disregarded.

Both books cover both theory and practical applications in considerable detail, with the major emphasis on the heavier end of the power spectrum. The chapter headings in the book on Thyristors are as follows - Thyristors and their characteristic properties - Turn on methods - Turn off methods - Protective measures - Control techniques - Series and parallel operation.

"Rectifier Diodes" covers diode theory and physics - characteristics and thermal considerations - pulse loading considerations - cooling - transient protection - overcurrent protection - series and parallel operation - survey of rectifier circuits - battery chargers - miscellaneous applications - quality and reliability. The book closes with a list of symbols and definitions and a bibliography. (N.J.M.)

E-M compatibility


A rather specialised book, intended for senior undergraduate and graduate students in communications engineering as well as practising engineers. Although it may not be clear from the title, it is basically a handbook covering a broad spectrum of topics which could perhaps be summarised as concerned with "electromagnetic pollution". This includes the analysis and solution of noise, harmonics and other spurious emissions from communications, navigation and other systems, not only from the point of view of preventing or alleviating inter-system interference, but also with the idea of increasing the efficiency and effectiveness of the individual systems themselves.

The book is divided into seven main parts, each with multiple chapters. The parts are headed 1 - Introduction; 2 - Systems; 3 - Signal Generation and Amplification; 4 - Filters and Nonreciprocal Elements; 5 - Signal Processing and Detection; 6 - Antennas; and 7 - Intrasytem Electromagnetic Compatibility. The book ends with a list of references and a bibliography (298 entries), together with a topic index.

A book dealing with an important field, and one which appears to be well planned and presented. But it will be of prime value to those with a sound engineering background.

The review copy came from the local office of the publisher, who advises that copies should be in stock at most major bookstores. (J.R.)

Antenna manual


A practical little manual for the radio amateur wanting to build up some simple and low cost aerials and not make too much of a fuss. The book is written for those operating on both HF and VHF, and gives information on such things as aerial matching units, coaxial cable, connector fitting and SWR measurement as well as aerials.

The chapter headings give a good idea of the material covered and its order of presentation: 1 - Sugar-Coated Antenna Fundamentals; 2 - Radio Waves and the Nature of Things; 3 - Your Antenna and Signal Reception; 4 - Dipole and Ground Plane Antennas; 5 - The Co-axial Cable; 6 - The SWR Meter; 7 - DX Dipole Antennas You Can Build; 8 - The End-fed Multi-band Antenna; 9 - Vertical Antennas You Can Build; 10 - Work DX with an Invisible Antenna; 11 - Wire Beam Antennas for DX; 12 - A Universal HF Antenna System; 13 - Antenna Roundup. The book ends with a biographical note about the author and a topic index.

The text is a little rough in places, and the author's deliberately "conversational" style get a bit irritating after a while. There are also one or two technical bloopers, like the recommendation that an SWR bridge should be connected at the transmitter end of the feeding line for best results. However, the down-to-earth manual on simple and practical aerials and their construction, it
would be well worth having on the bookshelf in the shack.

The review copy came from Technical Book and Magazine Company, of 299-299 Swanston St, Melbourne 3000, from whom copies may be obtained by mail (postage 50c within Vic, 60c interstate) or direct.

**Phase-locked loops**


A handbook for those working with phase locked loops already, or anticipating doing so. It has been written mainly as an application guide for Signetics’ own PLL integrated circuits, but is sufficiently general in its treatment to make it of value to anyone working with PLL systems, whether using discrete components or ICs.

The material is divided into four sections, the first of which introduces the basic concepts of PLL operation and explains the relevant terminology. Section 2 then gives a basic but satisfying analysis of PLL behaviour, discusses in detail the various elements of the loop, and introduces the primary functional applications of PLLs.

Section 3 deals with practical design considerations, trade-offs, and measurements. It gives a description of each of the PLL devices in the Signetics range, and discusses ways of extending device performance in various directions. Finally section 4 gives practical descriptions of a number of specific PLL applications. Many of the designs given are the outstanding entries in a “PLL Design Contest” which Signetics and EDN magazine ran recently. They include a voice scrambling circuit, a metal detector, a simple system to use an ordinary tape recorder as a digital data recorder, and a flutter meter.

For those interested in PLLs, it would make a very worthwhile addition to the reference bookshelf.

**Literature available**

Two new publications released by Hewlett Packard should be of great interest to those engaged in solving design problems at very high frequencies. Application Note 922 covers the use of PIN diodes as attenuators, switches and phase shifters. One illustration compares device performance in various directions. It gives a description of the basic concept of PLL operation and explains the relevant terminology. Section 2 then gives a basic but satisfying analysis of PLL behaviour, discusses in detail the various elements of the loop, and introduces the primary functional applications of PLLs.

Section 3 deals with practical design considerations, trade-offs, and measurements. It gives a description of each of the PLL devices in the Signetics range, and discusses ways of extending device performance in various directions. Finally section 4 gives practical descriptions of a number of specific PLL applications. Many of the designs given are the outstanding entries in a “PLL Design Contest” which Signetics and EDN magazine ran recently. They include a voice scrambling circuit, a metal detector, a simple system to use an ordinary tape recorder as a digital data recorder, and a flutter meter.

For those interested in PLLs, it would make a very worthwhile addition to the reference bookshelf.
AMATEUR BAND NEWS & NOTES
by Pierce Healy, VK2APQ

NSW Central Coast Club field day

Field Days are a fundamental part of amateur radio activities throughout the world. As well as providing an opportunity to discuss the latest trends in radio communication, many have developed into a yearly family event.

The 16th Annual Field Day of the Central Coast Amateur Radio Club was held at the Gosford Showground on Sunday, 18th February, 1973. The day was overcast and showery.

Due to the possibility of further rain, six inches having been recorded during the previous day, use was made of the ideal conditions the Dwyer Pavilion offered to set up the registration booth, trade displays, disposal stall, handicraft exhibits and demonstrations, refreshment bar and communication control centre. The total of 407 persons registered, including amateurs, their families and friends. The total was slightly less than the 1972 attendance, due no doubt to the weather. Nine radio events were conducted during the day, all keenly contested, and valuable prizes were awarded to the winners. The results were as follows:

- 25MHz Scramble: Dave Andrews, VK2AWZ
- 144MHz Scramble: Dave Andrews, VK2AWZ
- 7MHz Hidden transmitter hunt: Chris Minahan, VK2ZUZ
- 144MHz Hidden transmitter hunt for pedestrians: Bill Collins, VK2ZYG
- 144MHz Hidden transmitter hunt for mobiles: Dave Andrews, VK2AWZ
- 144MHz Hidden transmitter hunt for pedestrians: Tony Mullens, VK2ZL
- 144MHz Hidden transmitter hunt for mobiles: Carl Palmer, VK2GZX
- 1.8MHz Hidden transmitter hunt for pedestrians: Chris Minahan, VK2ZUZ
- 144MHz Hidden transmitter hunt for mobiles: Tony Andrews, VK2AWZ

The overall winner on points was Chris Minahan, VK2ZUZ, who was awarded a kit of three VHF power transmitters, donated by Dick Smith Electronics. Second place on points was Carl Palmer, VK2GZX, who received a combined VSWR/Power meter donated by Bail Electronic Services. Third prize, an alphanumeric display unit, donated by Cema Distributors Ltd went to Tony Mullens, VK2ZL.

Several non-radio and quiz contests were held. An interesting point in regard to the 7MHz hidden transmitter hunt was that the transmitter was hidden in the same location where it had not been found during the previous two field days. This time the transmitter was found two minutes inside the 30 minute time limit.

It has been stated that the secret of success this year was travelling on foot using a transistor radio during the latter portion of the search. The prizes were donated by a number of trade organisations and individuals, to whom the club expresses appreciation: Ampex Australia Pty Ltd; Amalgamated Wireless Valve Co.; Adcola Products; Bail Electronic Services; Cema Distributors; Dick Smith Electronics; General Electric Services; Manufacturers Special Products; O. T. Lempiere & Co; Union Carbide; and Major Collett, VK9RU.

The club station call sign is VK3AWS and is operated by the ATV group members of the club. The transmitter used to provide the ATV link had a power output of 100 milliwatts fed into a small horn type antenna. The frequency used was 5.8GHz and power was obtained from a portable petrol driven AC generator.

The camera was a small commercial type as used in closed circuit television. Both transmitter and camera had been much modified from their original form to suit ATV requirements.

Initially the link was established with the transmitter, antenna and power supply sitting on the ground, to eliminate possible clues to the actual location of the 144MHz transmitter hidden nearby. However, it was realised that an unintentional obstruction could be placed in the path of the link by a vehicle stopping on the bush track in front of the equipment. To forestall this possibility the unit was placed on the roof of a car.

It did not take long for some of the participants in the hunt to find their way to the area. Four cars arrived simultaneously to negotiate the last 366 metres of steep rough track. At the end of the track the searchers had to continue on foot into the scrub and, in doing so, had to pass in front of the television camera.

Back at the Dwyer Pavilion, in the Gosford Showground, all the action at the finish of the hunt was viewed by a large number of those present. Portion of the telecast was recorded and replayed many times during the afternoon.

The equipment was set up, without any prior tests from the location, and the link established in a period of minutes prior to the start of the event.

Those who provided the ATV equipment and organised this novel demonstration are to be congratulated on their success. It is believed to be the first such amateur TV "spectacular" in this country.

During the afternoon, those wishing to do so, were taken to the Australian Reptile Park or a bus tour of the scenic spots of the Central Coast area.

The ladies and club members who staffed the kitchen and refreshment stalls did an exceptionally good job. In addition to morning and afternoon teas, 400 fish luncheons were served and, in amateur radio parlance, six hundred 807's were degassed.

The 16th Annual Field Day of the Central Coast Amateur Radio Club was indeed successful. The Field Day manager, Ross Mudie, VK2ZQR, has expressed his thanks to all contributors to this success. Ross issues an invitation to all to attend the event next year.

WIA ACTIVITIES

ICTORIA: Geelong Club

The Geelong Amateur Radio-TV Club meetings are held at the club rooms 189-205 Moorabool Street, North Geelong, every Friday night. Business meetings are on the First Friday of each month. Visitors are welcome.

The 1973 committee includes:

- President: Mike Trickett
- Vice- President: Alan Bradley
- Secretary: Bob Woonkey
- Public Relations: Terry Leitch
- Treasurer: Colin Lowe
- Property: Jim Goucher

Full details may be obtained from the secretary at the club room address.

Western Suburbs Radio

On Friday evening 2nd February, 1973 the Western Suburbs Radio Club held its annual general meeting. Officers elected for the next twelve months were:

- President: Dave Hunt
- Vice-President: Tom Page
- Secretary: Raphael Szczepan
- Treasurer: Ian Yule
- Publicity: Bob Johnson
- Newsletter: Keith Campbell
- Disposals: John Bear
- Committee: Mark Maischall, Tony Atkins

Activities nights are held at the clubrooms, 260 Elizabeth Street, Coburg, on the 3rd Thursday of each month. Visitors are welcome. Further details are available from: the President, VK3ZPB, 115 Mitchell Street, Maldon, Vic 3402 or telephone 317 8254.

The club station call sign is VK3AWS.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent direct to Pierce Healy at 69 Taylor Street, Bankstown, NSW 2200.
CIRCUIT BOARDS — pre-tinned

The "Rolls Royce" of circuit boards are now available from Dick Smith — all boards are heavy duty and most are fully pre-tinned to prevent oxidation marks and to make soldering easier.

72 G7 Guitar Amp 1.50
72 SA9 Amplifier 1.50
72 510 Scale 1.60
72 119 IC Probe 95
72 511 1.50
72 SA30 1.70
ET025 Super Stereo 1.90
ET025 Tape Slide Sync 1.50
ET029 Tuner 1.45
IC Power Supply 1.50
ET033 Int. audio supply 2.60
ET034 Int. audio system 2.60
ET111 Power Supply 1.50
ET142 100W AMP 2.20

TANGENT KITSETS

2 Transistor Radio Kit. A most popular price — requires no aircraft, complete with "how to build" Instructions — all you require is a soldering iron. Our kit only 30 min to build. Pre-wound aerial coil and crystal earpiece supplied or can be used with any small amplifier (such as below) to operate a speaker — $5.70 plus battery 50c.

4.5 watt RMS (4 watts peak) amplifier, features excellent fidelity and extremely low distortion (less than 0.5% at 1 watt), easy to build. Supplied complete with comprehensive instructions. Suggested uses are—

1) Stereo amp
2) Baby alarm
3) Amp for 2 tran. radio
4) Intercom
5) Thing a mob.

Requires approx. 18 to 12 volts DC. AMP KIT — $8.70 incl. P&P.

VHF POWER TRANSISTORS 30 watts at 12.6 volts — FANTASTIC OFFER FOR AMATEURS — $9.65.

These transistors manufactured by "Solid State Scientific" are exactly as supplied by Australia's largest VHF mobile radio manufacturers. They are virtually indestructible (they withstand severe V.S.W.R.) and are guaranteed to give in excess of 30 watts at 12.6 mcs on 12 volts (more at 15.6 volts) Supplied complete with data sheet, test, circuit and layout diagram.

FEATURES:

4) Withstand severe V.S.W.R.
5) Low inductance stripline package
6) All leads electrically isolated from shod
7) Greater than 4 db power gain

DRIVER TRANSISTORS AVAILABLE. Complete with data sheet and suggested circuit and layout diagram.

2N 5990 (15 watts) $7.35
2N 5589 (7 watts) $6.50 p.p. 50c

The complete set of three transistors are available as a special package offer for $22.50 plus p.p. 50c.

Data sheets available separately 10c plus 20c p.p.

BASE & COVER

Uncut plinth finished in equal quality hand rubbed teak will take almost any turntable. Supplied complete with clear perspex cover.

TREMENDOUS value at $16.50 P/P $1.00

I.C. SOCKETS

Protect your valuable I.C.'s by not soldering them into circuit — plug them in quality McMurdo
14 Pin D.I.L. Sockets 80c
14 Pin D.I.L. Sockets with wires 90c
8 pin gold plated round socket $1.20 Inc. I.P. P/P

PARTS FOR RECENT PROJECTS

Signetics 555 TIMER 1 C. $2.35
Signetics NE 561B Phase lock loop 1 C. $9.50

DICK SMITH & STAFF

SUPER VALUES

GO SOLID STATE

Dick Smith "Super Kits" are very special as they have been selected by himself for "P.P." treatment. At least one of each kit has been built by Dick Smith himself and is on display at the electronics centre. Other features are:

1. Expensive pre-tinned "silver" boards.
2. Full copies of constructional articles included.
3. Extras in circuits in addendum etc. are included — saves checking and eliminates parallel circuits and addendums.
4. Most kits contain "extras" at no cost. These extras have been added where Dick Smith thinks they may be more reliable or where he feels the construction may have difficulty in pur chasing them.

DIGITAL LOGIC TRAINER E.A. MARCH '73

The complete kit including metalwork, patch leads, front panel and construction details to build this logic trainer.

137.65 P/P 50c.

All separate parts are available — write for our quote.

PLESSEY 3 & 3 AMPLIFIER KIT

Thoroughly recommended, this high quality stereo amplifier utilises the well known Plessey SL.401D I.C.'s. It is supplied complete in an attractive display pack and includes all components other than the power transformer. The instructions supplied are very explicit. In fact, a person who can solder but has had no previous electronic experience could easily build this amp. Our staff member, Ian Smith (age 16) built this himself in less than two hours. The complete unit is now operating in our Sound Room for all to see and listen to. Also included are full details of a suitable speaker enclosure, a silk screened board, and all controls. The cost of the separate parts is a lot more than the total kit price.

Plessey AT102 amp $13.50 50c P/P Transformer to suit 60 8.44 .75 P/P

ATTENTION CUSTOMERS WE ONLY STOCK AND SELL NEW COMPONENTS. WE DO NOT STOCK OR SELL SECOND HAND PARTS, COMPUTER BOARDS, DISPOSALS, EQUIPMENT, ETC. THEREFORE BE ASSURED THAT THERE IS NO CHANCE OF OLD AND NEW COMPONENTS BEING MIXED.

SUPER KITS

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Many thousands of our 1973 catalogues have been sold — get yours now before the better salesman's items — "The one in our catalogue is fully covered by our construction guarantee" — if for any reason you are not satisfied with it, return it and your money including p.p. will be refunded in full. Note: Any purchase to the value of $10.00 will entitle you to a free catalogue — please mention if required in your order.

Electronics Australia, April, 1973

Dear Dick

Please send me your catalogue. I enclose $50 towards the cost plus 25c to cover p&p knowing that it contains special $50 discount vouchers.

NAME

ADDRESS

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CATALOGUE AVAILABLE AT NO CHARGE TO ORGANISATIONS, RADIO CLUBS, SCHOOLS ETC. APPLYING ON OFFICIAL LETTERHEAD.
SCIENCE MEANS A LIFETIME OF SATISFACTION

VERSATILE
Copies with all soldering jobs—from miniature components to large solder lugs. Temperature control at your finger tips. Heat only when, where and as much as needed.

SAFE
Low voltage operation. Scope irons operate from 2.5V to 8V.

For your complete protection and the satisfactory operation of your Scope iron, demand and use THE APPROVED SCOPE CROMO TRANSFORMER which incorporates a specially designed ELECTRONIC STATIC SHIELD.

CONVENIENT
Ideal for those almost inaccessible spots. No burning of adjacent insulation.

LIGHT WEIGHT
Scope De Luxe weighs only 3½ ozs. Miniscope 1¼ ozs.

All irons are supplied complete with a spare tip and two elements and suitably packed for presentation as a gift.

SPARE PARTS
No expensive resistance wire heating elements to replace. Maintenance without special tools. Spare tips, carbon elements and other parts readily available from your Scope Distributor. Scope products are available from all major electrical wholesalers and Hardware Stores throughout Australia and from H. W. Clarke, Wellington and Auckland, New Zealand.

*Approved by electricity authorities APP. No. N/360/884-5

IRH Components Pty. Limited
THE CRESCENT, KINGSGROVE, N.S.W. 2208. PHONE: 50-0111
74 RAGLAN ST., PRESTON, VIC. 3072. PHONE: 44-5021

Please Post free SCOPE literature

NAME

ADDRESS

CITY

POSTCODE

ECONOMICAL
Consumes current only whilst in use, Scope performs all the functions of other irons from 40 to 150 Watts. (Miniscope—up to 75 Watts).

FAST
Fast heating due to the unique replaceable carbon element. Only 5 to 6 seconds' initial heating up time from cold, then practically instantaneous.

SCOPE DE LUXE

MINISCOPÉ

NEW SOUTH WALES: 52MHz BEACON

An addition to the 52MHz beacon list is VK2WI in operation on 52.1111 MHz at Dural, about 15 miles (24.09 km) north-west of Sydney. The beacon is unattended and operates continuously on 52.450MHz. The call sign VK2WI is transmitted in CW at 7 words per minute followed by 20 seconds of carrier. Power is 10 watts input, shortly to be increased to 50 watts output, feeding stackedturnstile antenna through a coaxial filter. The antenna is 50 feet above ground.

Reports have been received from ZL4, VK6, VK8 and VK9 call areas.

Maintenance of the installation is carried out by Roger Hord, VK2ZRH, who, together with Roger Harrison, VK2ZTB and Mike Farrell, VK2AM constructed and installed the unit.

St George Amateur Radio Society

The St George Amateur Radio Society held its second monthly meeting for 1973 on Wednesday, 7th February. A good attendance with a minimum of formalities allowed those attending to get straight on with the main attraction for the evening— the auction.

The auctioneer, John Lambert, VK2AKQ, kept things moving. Most of the gear was supplied by club members, several of them donating the larger portion of the proceeds to the society for its own use.

The magazine 'Dragnet', which is wholly produced by the society, by listening to the WIA broadcasts on 50 MHz is available to new members who write to the Secretary, WIA, I WA Division, Box N. 1002, GPO Perth, W.A 6001.

The Zone 29 Award is issued by the West Australian Division of the WIA to licensed amateurs and short-wave listeners throughout the world. Eligibility for the award, the following conditions must be satisfied.

1. Establishment of two-way communication with an estimated five different amateur stations situated in Zone 29, Communication to be made after 0001 WAST, January 1957. The total of 25 different stations may be obtained by operation on or more of the amateur bands.

2. Any type of emission which is permitted by local licensing authorities may be used.

The certificate will be endorsed when the confirmation of fulfilment of the following special conditions is received:

(a) All 25 stations obtained from operation on one band only (open). (b) All 25 stations obtained from operation of phone transmission. (SSB—AM—FM—etc.)

All 25 stations obtained from operation of CW transmission.

(i) All 25 stations obtained by one band operation and phone only.

(ii) All 25 stations obtained by one band operation and CW only.

(iii) All stations heard by a shortwave listener, in (i) or (ii). Confirmation in writing of all contacts must be submitted to the Secretary, WIA, WA Division. For your complete protection and the satisfactory operation of your Scope iron, demand and use THE APPROVED SCOPE CROMO TRANSFORMER which incorporates a specially designed ELECTRONIC STATIC SHIELD.

SCOPE DE LUXE

MINISCOPÉ

ECONOMICAL
Consumes current only whilst in use. Scope performs all the functions of other irons from 40 to 150 Watts. (Miniscope—up to 75 Watts).

FAST
Fast heating due to the unique replaceable carbon element. Only 5 to 6 seconds' initial heating up time from cold, then practically instantaneous.

VERSATILE
Copies with all soldering jobs—from miniature components to large solder lugs. Temperature control at your finger tips. Heat only when, where and as much as needed.

SAFE
Low voltage operation. Scope irons operate from 2.5V to 8V.

For your complete protection and the satisfactory operation of your Scope iron, demand and use THE APPROVED SCOPE CROMO TRANSFORMER which incorporates a specially designed ELECTRONIC STATIC SHIELD.

CONVENIENT
Ideal for those almost inaccessible spots. No burning of adjacent insulation.

LIGHT WEIGHT
Scope De Luxe weighs only 3½ ozs. Miniscope 1¼ ozs.

All irons are supplied complete with a spare tip and two elements and suitably packed for presentation as a gift.

SPARE PARTS
No expensive resistance wire heating elements to replace. Maintenance without special tools. Spare tips, carbon elements and other parts readily available from your Scope Distributor. Scope products are available from all major electrical wholesalers and Hardware Stores throughout Australia and from H. W. Clarke, Wellington and Auckland, New Zealand.

*Approved by electricity authorities APP. No. N/360/884-5
Effective 1 Jan. 1973, special "Worked all Zones Awards" will be honored to licensed amateurs presenting proof of contact with 40 zones of the world in 2 years, the highest frequency bands, 3.5MHz, 7MHz, 14MHz, 21MHz 28MHz. Contacts for a single band "WAZ" award must be made after 0000 hours 22 Dec. 1972. Proof of contact shall consist of proper QSL cards checked by the DX editor or a member of the "CQ Magazine" DX Awards Advisory Committee. QSL cards must be acknowledged by the DX editor or the "CQ Magazine" DX Awards Advisory Committee. The first band WAZ award shall be presented in the DX editor or the "CQ Magazine" DX Awards Advisory Committee.

The following overall rules apply to the single band WAZ program:

1. The official CQ WAZ Zone Map will be used in determining Zone boundaries.

2. Confirmations must be accompanied by a list of completed contacts, giving the call letters of the station QSO'd, the date, time, and band. The list must also show the applicant's name, call letters, and address. The list must be signed.

3. All contacts must be made with licensed, land-based, amateur stations working authorized amateur radio frequencies.

4. All contacts submitted by the applicant must be made within a 50 mile (80.6Km) radius of the official CQ WAZ Zone Map.

5. Any altered or forged confirmations will result in permanent disqualification of the applicant.

6. Continued use of poor operating ethics will result in disqualification of the applicant.

7. Include with the application $1.00 (US) or $1.50 International Reply Coupons to defray the cost of the award.

8. Decisions of the CQ DX Awards Advisory Committee on any matter pertaining to the administration of this award shall be final.

9. All applications should be sent to the DX Editor, P.O. Box 205, Winter Haven, Florida 33880.

10. Zone maps and/or WAZ applications are available from the DX Editor or from "CQ Magazine" for a self-addressed stamped envelope or one international Reply Coupon.

The following list of zones is presented as a guide to the DX Awards Committee on any matter pertaining to the administration of this award.

Zone 1. Northwestern Zone of North America: KJ7, VE7-VE9, the VE8 Northwest Territories District of Makensee and Franklin and the islands west of 102 degrees including Victoria, Banks, Melville and Prince Patrick.

Zone 2. District of Mackenzie North America: VE2-VE7-Labrador, that portion of VE3-Quebec north of 50th parallel and a portion of the Northwest Territories checked by VE2 of longitude 101 degrees. The latter includes part of the District of Franklin and the islands of King William, Prince of Wales, Somerset, Gasthur, Devon, Ellesmere, Baffin and the Melville and Boothia Peninnsula.


Zone 4. Central Zone of North America: VE3, VE4, VE5, VE6, VE7, VE8, VE9 and the WT states of Montana and Wyoming W0, W1, W8 (except W0A), W3 and the WS states of Alabama Tennessee and Kentucky.

Zone 5. Southeastern Zone of North America: F8, VE7, VE11, that portion of VE2-Quebec south of the 50th parallel, VP9, W1, W2, W3 and the WS states of Florida Georgia South Carolina North Carolina and Virginia and the W8 state of West Virginia.

Zone 6. Southwestern Zone of North America: XE and XF.

Zone 7. Central American Zone: FX9-CQ9, HH, K4S, K5Z, TI, T9P, VP9, YK, YN and YS.

Zone 8. Western Zone of South America: FO, FG, FM7, HH, KG4, VP3, VP3, 7N-K4CA, NU7M, PJM-JST, PJ3E, PJ3ES and YV0Ave.

Zone 9. Southeastern Zone of South America: FY7, HH, PJ2, PZ, 8R, YY and YV.

Zone 10. Western Zone of South America: CP and CZ.

Zone 11. Central Zone of South America: PY and ZP.

Zone 12. Southwest Zone of South America: CE.

Zone 13. Southeast Zone of South America: CX, LU.

VP8 and Antarctic prefixes.

Zone 14. Northern European Zone: CT1, CT2.

Zone 15. Eastern European Zone: FC, HA, HV, IT, IS, OE, OH, OK, SP, UA, UP, UQ, UR, ZA, ZU and ZA1.

Zone 16. Southern European Zone: UA1, UA3, UA4, UA6, UA8-Baashir and Chakal. UBS, UC2, UN1 and UO5.

Zone 17. Western Zone of Siberia: UA5-Udovlevsk, Komi, Jurgan, Molotov, Omsk, Tyumen, plus UHK, ULI 7 and UM8.


Zone 21. Southeastern Zone of Asia: EP, HZ, MP4, W9, (except Madilives and Socorita), YA, VI, WI, UD6, UFP, UG6, and AP-Western Pakistan.

Zone 22. Southern European Zone: AC3, AC5, CR8, CV7, VU (except Andaman and Nicobar Islands), N1 and S. Bangladesh.

Zone 23. Eastern Zone of Asia: AC4, and BY provinces of Sinkiang, Korea and Hind and UAA-Tanna Vaiva.

Zone 24. Eastern Zone of Asia: BY (except the provinces in Zone 23), BV, CR9 and V58.


Zone 26. Southeastern Zone of Asia: HS, XV, WX, XZ, SW and WW.

Zone 27. Philippine Zone: DU, KO4 and KG8.

Zone 28. Indonesian Zone: CR6, V4E, VK9 (except Nauru, Norfolk Is and Christmas Is.), V3S, EF and 9M.

Zone 29. Western Zone of Australia: VK6, VK8 and VK9-Christmas Island.

Zone 30. Eastern Zone of Australia: VK1, VK2, VK3.

Zone 31. Central Pacific Zone: KB8, KH6, KJ8, KM6, KP6, KX6, VK3A, VK1, VK4 and ZU1.

Zone 32. New Zealand Zone: FK8, F08 (except Clipperton), F08-YJ, KS8, VK8 Norfolk Island, VE8, VR2, VR3, ZK1, ZK2, SL and 5W.

Zone 33. Northwestern Zone of Africa: CN2, CN8, CT3, EA9, EA9, SV8 and 7X.

Zone 34. Northeastern Zone of Africa: ST, SU, and SA.


Zone 36. Equatorial Zone of Africa: CR5-Sao Thome, CR6, EA9, TI, TT, TN, TR, 9Q6, 9U5, 9J, ZD7 and ZD9.

Zone 37. Eastern Zone of Africa: CR7, ET2, ET3, FL8, 4Q1, 4Q3, 5X5, 5X6 and 7Q7.

Zone 38. South Central African Zone: ZG2, ZG2 and ZS.


WIA Youth Radio Scheme

MALTIDAY RADIO CLUB

The objects and aims of the Maltiday Radio Club are to encourage and assist all persons interested in amateur radio in the City of Maitland and surrounding districts to gain their Radio amateur's licence.

Age limit is 1st Form at High School upwards but membership of the club is open to any person interested in amateur radio or shortwave listening. Members below I Form at High School level may gain membership with special permission of the committee.

Application for membership must be made on the prescribed form and receive approval of the committee. The membership year is from 1st February to 31st January. Fees are - Adults $3.00 per year, Juniors $2.00 per year.

Committee meetings are held in the club rooms on the third Wednesday of the month commencing at 7.30 pm.
136 VICTORIA ROAD, MARRICKVILLE — 51-3845

Kaise

MODEL SK-100

VOLT-OMH-MILLIAMMETER

HIGH SENSITIVITY
100,000 Ohms per Volt DC
10,000 Ohms per Volt AC

SPECIFICATIONS
- DC volts: 0.3, 1.2, 30, 120, 300, 600, 1200.
- AC volts: 6, 30, 120, 300, 1200.
- DC Current: 12uA, 300uA, 6mA, 60mA, 600mA, 1.2A.
- AC Current: 1.2A.
- Resistance: 20k Ohms, 200k Ohms, 2M Ohms, 20M Ohms.
- Decibels: Minus 20 to plus 17, 31, 43, 51, 63.
- Accuracy: DC plus minus 0.5%, AC plus minus 4%

Overload Protected by dual silicon diodes.
- Double jewelled plus minus 2pc.
- Plus minus 1pc temperature-stabilised film resistors.
- Polarity changeover switch.
- Scale with mirror.

Complete with Calibration Frequency Meter.

Price $34.75

Post 75c. Interstate $1.00.

Sonata

GUITAR AMPLIFIERS

2 channels, 4 hi-imp inputs, 3 separate volume controls — separate bass and treble controls, speed and intensity controls for vibrato. Remote foot switch with plug & lead. Attractive black vynex covered cabinet, cabinet.

Compact Complete with Calibration Book and Circuit.

8" heavy duty speakers
30 watts RMS $93.00
35 watts RMS $129.00

Bendix

BC-221

Frequency Meter. 125kHz — 30 MHz Complete with Calibration Book and 1000Hz Crystal. Good order.

Model A/D 0140 - 78" 11" Dome Speaker, $10.00. P. & P. 50c.

Magnavox

WIDE RANGE TWIN-CONE SPEAKERS

8 — 16 OHMS

Model AD 0140 - 78" 11" Dome Speaker, $10.00. P. & P. 50c.

Model AD 0140 - 78" 11" Dome Speaker, $10.00. P. & P. 50c.

M.S.P.

8-15 OHMS

Latest Model Speakers

L.F. — 6WAC 6" $10.50
L.F. — 6WAC 6" twin $11.50
6WAC TWEETER $4.50
120G TO 30 watts $33.95

Goodmans

18" LOUDSPEAKERS

are now available. Phone or send S.A.E. for our low quote.

Ex-Disposals

Radio Equipment to CLEAR AT BARGAIN PRICES.

FIS

3275 TXRX 100-150 mcs $17.50
TR1534 TXRX 100-152 mcs $15.00
TR1533 TXRX 105-155 mcs $17.50
Command Talkers $11.00
S2 and 70 OHM COAX T/P per yd.
Ary 3 valves $2.00
No. 63 TXRX $35.00
AMATEUR BAND NEWS

The Annual General meeting is held each year in March. A special feature is the March Sale, where books and periodicals are sold at reduced prices. The club produces a monthly magazine containing news and notes on club activities. It is the only newsletter for amateurs in the area. The club is open to all licensed amateurs.

Maritime Mobile Service will commence in June 1975. The licence fee is $25 per annum, and the equipment required includes a VHF transceiver, an antenna, and a power supply. The service is intended for use in the maritime industry and will be available to any amateur who can obtain a licence.

SO YOU WANT TO BE A RADIO AMATEUR?

To achieve this aim, why not undertake one of the courses conducted by the Wireless Institute of Australia? Established in 1910 to further the interests of Amateur Radio, the Institute is well qualified to assist you to your goal. Correspondence Courses are available at any time. Personal classes commence in February each year.

For further information write to:
THE COURSE SUPERVISOR, W.I.A.
14 ATCHISON STREET, CROWS NEST, N.S.W. 2065
SPEAKER CABINETS
Solid Oiled Teak. Size 23 x 13 x 10".
For 8 and 3 inch speakers $25.

WE STOCK
THE COMPLETE RANGE OF
MSP SPEAKERS

SPEAKERS
MSP 8-inch dual-cone $7.50
MSP 12-inch dual-cone $9.50
MSP 7½ $5.00
MSP dual-cone 6-inch $7.50
Rola 6 x 4, 15 or 27-ohm $2.50
MSP 8 x 9, 15 or 15-ohm $6.00
National hi-fi built in tweeter 8-ohm $14.00
Peak dual-cone $7.50
MSP 12-inch radial beam 12POB $25.00
Mid range 8 inch woofer 4-ohm $6.00
MSP 5½ inch large magnet 15-ohm $3.00
MSP 4½ inch large magnet 15-ohm $3.00
Magnavox 6 x 9, 27-ohm $5.00
MSP 6 x 4.5 ohm $3.50
MSP 4½ 2½ 8 ohm $2.50
MSP 6 x 5-15 ohm $2.00
Magnavox Tweeter 5-inch $1.50
HF/SSC
Rola custom speaker Kit C3 GX tweeter and C60 woofer and all components $19.05
MSP 15-inch $45.00
MSP dual-cone 12 aux 2015-watt RMS $17.50
Pioneer 15-inch 30-watt RMS $40.00
Magnavox Electromagnetic 3½-inch tweeter Mid 3.5 $2.50
Tesla 8-inch 4-ohm $5.00
Rola 8-inch 15-ohm $5.00
Binch 3-ohm $4.50
Magnavox 3TC tweeters $4.00
Magnavox WKR tweeters $5.00
Magnavox 8WR tweeters $6.00
Magnavox 8-30-8-ohm $6.50
MSP 6-inch 15 ohm $4.00
MSP 5-inch tweeters $2.50
MSP 3½-inch $2.50
MSP 2½-inch $2.50
Speaker Plugs 4 pin 15 cents
Speaker Sockets 15 cents

SPEAKERS
3½-inch 45-ohm $3.50
Hitachi 2SB337 Power Diodes $1.50
WALKIE-TALKIE
Electra 1 Mile Range $18 the Pair

PHILIPS GRAMOPHONE MOTOR.
6 volts, 4-speed, and pick-up $7.75.

B.S.R. CERAMIC CARTRIDGE STEREO $4

B.S.R. RECORD CHANGERS
latest models, G11301 balanced arm, shielded motor, heavy turntable, magnetic cartridge $55
C117 magnetic cartridge $45
UA15 with 12 inch turntable $30

B.S.R. MINI CHANGER
UA50 $19.50.

SPEAKER CABINET
size 16 x 8 x 10½ inches complete with 8 tacx MSP dual cone speaker, 5 inch tweeter and crossover capacitor, $21.50
Cabinet without speakers $10.00

Speaker Cabinet
10 x 7 x 4 with 5 inch speaker $5.50

AMPLIFIERS, 3½ watts, size 7½ x 5 x 4½ $10

TUNER COMPLETE
HOROSCOLES
50c Each
Special perspex tops for record changers $4.75

BATTERY SAVER,
6 or 9 volt DC JOMA, $11.00

PHILIPS PLUG-IN PICK-UP CARTRIDGE, mono $3.50
B.S.R. 4 speed Gramo Motor and Pickup. 240 volt with built in 9 volt power supply $7.95
250 mixed screws. BA, Whit., self-tapper bolts, nuts, etc. $1 bag plus 25c post.

6.5 mm jack plug & 7ft shielded cable 95c
6.5 mm to 3.5 mm plug adaptor & 7ft shielded cable 95c

POTS
1 meg. 2 pole switch $1.25
100K switch 2 pole log $1.25
10K carbon or wire wound $1.25
1.5 linear $1.25
½ meg log $1.25
250 Dual Ganged Log Pots $1.25
20K switch $1.25
10K switch $1.25
1.5 dual ganged log $1.25
2 meg Dual Ganged Lin. $1.25
Dual 3 meg ganged log $1.25
500 ohm WW $50c
50K lin $50c
15K 5TK $50c
10K Dual ganged concentric $50c
2 meg log 2 pot $1.25
7.5K log $50c
200K lin $50c
250K log $50c
2K lin slotted $25c
500hcm $50c
250K lin $50c
16K lin $50c
½ meg lin $50c
50 log switch $7.5c
1 meg dual ganged log $1.25
2 meg log $50c
10K dual-concentric double-pole switch pots $1.25
Mixed pots, 25 different values $5.00

50-ohm POTS ideal for Ext. Speakers. 50c each

POTS
1 meg. Dual Ganged Log $1.25
1 meg. Dual Ganged Lin $1.25
½ meg. Switch Pot double pole log $7.5c
Dual concentric double pole switch pot 50K, 25k $1 each

CAR RADIO
PUSH BUTTON TUNER COMPLETE $4.50

FERRITE TUNERS
$1.50

SPEAKER ENCLOSURE
size 19 x 15 x 9 inches. Complete with two 8 x 4 speakers and 3-inch tweeter, including cross-over network, in 8 or 15-ohm $25
Morganite and IRC resistors. At least 33 values. Sui transistors, radios, TV etc., $2.00 per 100. Pack and post 25c.
100 mixed condensers, micas, ceramics, tubular. Fresh stock. $2.00. Pack and post 25c.
50 + 24, 350w + 100UF 25w, $75 each
30 + 30 300VW 250VP $75 each
Many others. Invaluable for service.
<table>
<thead>
<tr>
<th><strong>GARRARD PLUG IN STEREO CARTRIDGE, $6.00</strong></th>
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<tr>
<td>English push-button on/off switches, 75c each. Pack and post 10c.</td>
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<tr>
<td><strong>MIXED RESISTORS, 3.5 and 10W</strong></td>
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<tr>
<td>I.R.C., 25 for $2.</td>
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<tr>
<td><strong>MSP 12Aux, 20-watt RMS 45-12000Hz $17.50.</strong></td>
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<tr>
<td><strong>MSP MODEL 2MBC TWEETER RANGE 5KHZ TO 20KHZ. NEW RELEASE $5.00.</strong></td>
</tr>
<tr>
<td><strong>6 VOLT PILOT LIGHT, screw in ea. 15c.</strong></td>
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<tr>
<td><strong>RESIN CORE SOLDER 5 yards 75c</strong></td>
</tr>
<tr>
<td><strong>INDOOR TV AERIALS $1.50.</strong></td>
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<tr>
<td>Pack and Post 25c</td>
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<tr>
<td>Electro 20 400-450 75c each</td>
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<tr>
<td>Electro 10 400-450 75c each</td>
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<tr>
<td>Electro 15 50-65 75c each</td>
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<tr>
<td><strong>ALLIGATOR CLIPS on 16 inch lead 20 cents a pair</strong></td>
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<tr>
<td><strong>SATO BRACKET LAMP 25 cents</strong></td>
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<tr>
<td><strong>STEREO SPEAKER LEAD, 10 cents yd.</strong></td>
</tr>
<tr>
<td><strong>DIAL DRUMS, 5 inch, 3½, 3½ 50c ea.</strong></td>
</tr>
<tr>
<td><strong>PHONE MICROPHONES complete with 3 ft 8 inch shielded lead and 3.5MM jack plug</strong></td>
</tr>
<tr>
<td><strong>POWER TRANSFORMER 300 mA voltage doubler 220 – 260V primary 100v secondary 6.3V and 5V heater windings $8.</strong></td>
</tr>
<tr>
<td><strong>SPECIAL POTS 30 Different Values $5</strong></td>
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<tr>
<td>Including Ganged and Concentric</td>
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<tr>
<td>Speaker Plugs, 4 pin 15 cents</td>
</tr>
<tr>
<td>Speaker Sockets 15 cents</td>
</tr>
<tr>
<td><strong>ELECTROS 20 MFD 200P.V. 20c.</strong></td>
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</table>

| **TEST PRODS 50 cents pair** |
| **STEREO JACK PLUGS Mono** |
| 75 cents |
| **STEREO AMPLIFIER KIT SETS** |
| **TU 10, 3.5 watt per channel** |
| $19 |
| **TU 11, 3.5 watt per channel, has facilities for tape and microphone channels** |
| $23 |
| **TU 12, 5 watt per channel** |
| $22 |
| **TU 13, 5 watt per channel, with TU 11 facilities** |
| $27 |
| Each kit includes valves and all components. Front face plate, if required, $1 extra. Single stage amplifier kit set: 5 watt per channel $22 |
| **STEREOGRAM CHASSIS AND TUNER, 8 valve push pull output well known make** |
| $45.00 |
| **PICTURE TUBES, 12 inch for Jap sets** |
| $25 |
| **CRYSTAL MICROPHONES.** |
| $2.25 |
| **DUAL GANGED LOGPOTS, 25K** |
| $50 each |
| **ELECTROS, 20 MFD 400WK-450VP, 75 50 65 75cents** |
| **SPEAKERS, 3½ inch 45OHM $3.50** |
LISTENING AROUND THE WORLD

by Arthur Cushen MBE

Three new countries have been heard on medium-wave frequencies in the past month, primarily because they have begun to use the medium for education and information purposes. Sharjah, St. Kitts and Canton Island have all been heard, while a new and improved transmitter at Niue makes reception of this station possible also.

The station at St. Kitts in the Caribbean on 1295kHz has been heard opening at 0000GMT with gospel reception. The music is generally African in style and according to the announcement, local time is twelve hours behind GMT. Canton Island is located in the Phoenix group in the Central Pacific.

NEW CALEDONIA

Signals have been heard and received at various places in New Zealand from a French speaking station on 1450kHz. The programs are all in French and received directly relay of the ORTF broadcast from Paris beamed to the Pacific and closing at 0700GMT. This station has been observed for the last year and, from indications of the transmission pattern, it is most likely to be in Noumea.

A new transmitter, studio buildings and a new aerial tower have been installed in Naiue, and the station is now operating on 620kHz with 200W. The station first operated from 14th August, 1967, when it used the frequency of 500kHz and a transmitter of 200W. This was on loan from the marine department, enabling a broadcasting service to commence.

According to a letter from the Resident Commissioner, the new ZKZN Niaue Island on 620kHz.

The service to Australia and New Zealand broadcast from 0900-1300GMT remains on 11875 and 15235kHz. There are no changes in the service to South East Asia and North America.

The present schedule of the General Service of Radio Japan is as follows:

<table>
<thead>
<tr>
<th>GMT</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100-0530</td>
<td>9760 9760</td>
</tr>
<tr>
<td>1200-2330</td>
<td>9560</td>
</tr>
<tr>
<td>1900-2300</td>
<td>9560</td>
</tr>
<tr>
<td>0700-1330</td>
<td>Asia</td>
</tr>
<tr>
<td>1200-2130</td>
<td>Asia</td>
</tr>
<tr>
<td>2200-0300</td>
<td>Asia</td>
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</tbody>
</table>

SWEDEN'S 500kW TRANSMITTER

After a period of testing on several frequencies, Radio Sweden's new transmitter SCB2 of 500kW, went into regular operation at Karlberg in late January. The present short-wave broadcasting of Swedish transmitters of Radio Sweden, together with a number of directional and omnidirectional aerial were brought into service at Horby, in the southern part of Sweden early in 1952. It was recognised some years ago that it was necessary to replace these old transmitters by modern equipment. The Central Administration of Swedish Telecommunications, in agreement with Sveriges Radio, decided that new transmitters should be installed in order to meet the need for higher power and longer program schedules. The investigations indicated that, from a technical as well as economic point of view, it would be desirable to obtain higher power and use the existing tower.

Furthermore, a certain geographic separation of the new transmitters was considered to be advisable, and two of the new transmitters are therefore to be installed at Horby and one at Karlberg, north of Horby.

The transmitters have a frequency range of 5950 to 2600kHz.

In order to make possible additional directions of radiation, each transmitter would be fitted with a lidomeric aerial. The existing curtain and omnidirectional aerials at Horby will be kept in service in all countries. The New Zealand Post Office recently issued a list of countries which will not accept Commonwealth coupons for postal services. These include Australia, Canada, Jamaica, Lesotho, Norfolk Island, Pakistan, Papua and New Guinea, Singapore, Sri Lanka (for medium wave), South Africa, South Georgia, South Sandwich Islands, Trinidad and Tobago, Zambia.

In the case of these countries it is necessary to send postcards or an international reply coupon to pay for postal services.

FLASHES FROM EVERYWHERE

PORTUGAL: According to Sweden Calling DXers, the IBRA is carrying on test transmissions towards India using the transmitters of Trans Europa. The tests are on the air on Sunday from 0300-1300GMT on 7260 and 9950kHz. Reports on reception are welcome to IBRA Radio, Box 821, S-10131, Stockholm 1, Sweden.

FINLAND: According to the latest schedule of the Finnish Broadcasting Company, Helsinki, they have a 30 minute service in English. This is broadcast from 2000-2030GMT and is beamed to North America and, on 11755 and 9550kHz for reception in Europe.

AFRICA

BUTSWANA: Radio Botswana, Gaborone, according to Sweden Calling DXers, is testing a new 50kW transmitter on 9715kHz. The present short-wave service is to countries of the southern part of Africa.

SWEDEN: 500kW TRANSMITTER

The total cost for the new 500kW short-wave transmitter and long-periodic aerials will be about 12 million Swedish crowns.

RECENT VERIFICATIONS

PERU: According to IBRA radio, the first verification report has been received by Chris Davis (NC2N) from Radio Continental Del Sur which broadcasts from Loja, Ecuador. The address, according to the letter from the station, is in Cuenca, and the station on 1150kHz. The call is HCVC2, and, according to the World Radio Handbook, the assigned frequency is 5097kHz. The station is the first in the country to be officially licensed.

VALUE OF COUPONS DECREASES

The use of the reply coupons to pay for return postage when writing to an overseas radio station is common practice with the operators of these countries, but they have decided not to accept Commonwealth coupons for return postage. The International reply coupons, which have been used by all countries, are no longer valid.

The New Zealand Post Office recently issued a list of countries which will not accept the Commonwealth coupons. These include Australia, Canada, Jamaica, Lesotho, Norfolk Island, Pakistan, Papua and New Guinea, Singapore, Sri Lanka (for medium wave), South Africa, South Georgia, South Sandwich Islands, Trinidad and Tobago, Zambia.

In the case of these countries it is necessary to send postcards or an international reply coupon to pay for postal services.
NEW RH (Radio House) RANGE OF MULTIMETERS

MODEL RH-60 $29.00 Packing & Postage $1.00

50,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 25uA, 5mA, 50mA, 500mA.
Resistance: 10K, 100K, 1M, 10M.
Decibels: -10 to +62dB.
Accuracy: DC ±3 p.c., AC ±4 p.c. (of full scale).
Batteries: Two 1.5V dry cells. Overload protected.

MODEL RH-100 $39.75. Postage $1.00

100,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

* Overload protected by dual silicon diodes.
* Double-jewelled ± 2 per cent meter ± 1 per cent temperature-stabilised film resistors.
* Polarity changeover switch.
* Mirror scale.
* Instructions for operation with circuit diagram.

Specifications:
DC Volts: 0.6, 3, 12, 60, 300, 600, 1200 (100,000 / V).
AC Volts: 6, 30, 120, 300, 1200 (10,000 / V).
DC Current: 12A, 300A, 6mA, 60mA, 600mA, 12 amps. AC Current 12 amps.
Resistance: 20K, 200K, 2M, 20M.
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.

"HANDYMAN" RH150 $11.50

Pocket-size 3 1/8" x 4 3/4" x 1 1/4".
Instruction sheet and circuit.

Specifications:
DC Volts: 2.5, 10, 50, 250, 1000.
10,000 ohms per volt.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 1, 25, 250mA.
Resistance: 20K and 2M.
Decibels: -20dB, +62dB, 0.7KHz.
Capacitance: 0.001, 0.025, 25uF.

MODEL RH-20 $15.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 25mA, 250mA.
Resistance: 20K, 200K, 2M, 20M.
Decibels: 0 to +22 (at AC / 10V) ± 36 (at AC / 50V).
Upper frequency limit 7KHz.
Batteries: Two 1.5V dry cells.
Complete with test leads.

MODEL RH-80 $20.00 Packing & Postage 75c

20,000 Ohms per Volt DC.
10,000 Ohms per Volt AC.

Specifications:
DC Volts: 0.5, 2.5, 10, 50, 250, 500, 1000.
AC Volts: 10, 50, 250, 500, 1000.
DC Current: 50uA, 5mA, 50mA, 500mA.
Resistance: 5K, 50K, 500K, 5M.
Decibels: -10dB ± 62dB.
Accuracy: DC ±3 per cent. AC ±4 per cent (of full scale).
Batteries: Two 1.5V dry cells, size AA, "Eveready" 915.

TAPE RECORDERS AT DISCOUNT PRICES

Book type Solid State tape recorder, operated by 2 torch batteries. Mike Records, plays back, erases automatically. Size 10 1/2" x 6 3/4" x 1 1/4". Complete with mike and tape $19.75. Post and packing 75c. Looks just like a book.

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Standard desk type 3 in one unit built-in. Distribution. $25.00.(2 TELEPHONE SETS)
30c. cartage to rail. Freight payable at nearest attended railway station. Please note we are now able to include 1 mile of twin telephone cable FREE with each set of phones.

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Cuts sheet metal like a punch and die. Trimns, notches and cuts to any size or shape over 7 1/4” 5.00
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### NIFE CELLS
1.2 Volt, fully charged. 4 in 3 in 1 in 4 Ah. $1.00 each. Post N.S.W. 25c. Interstate 35c

### TELESCOPES ZOOM FOCUSING
25 x 50. $19.95 — 40 x 40 $29.95. POST NSW 95c. INTERSTATE 1.45

### TELESCOPES
60 magnification with a 60mm coated objective lens. With tripod $3.95.

### SMALL COMPUTER PANELS
3” x 2” containing 2 valves, oyl of resistors, etc. ONLY 75c. Post 24c.

### ELECTRONIC FREQUENCY COUNTER
Austronic type DFC-4 200V 50 cycle 100KHz $150

### 5” IMPELLER PUMPS
New gemmetal body stainless steel shaft neoprene impeller up to 151/2 lift suitable for almost any type of liquid subject to minor dimensions 8” x 4” x 5” 3.50.

### CONDENSER LENS
2 in. DIA. 2 in FL 3/16” each or $2.50 pair. Post 24c.

### CONDENSER LENS
1 1/8” DIA. 1 1/4” FL 50c each. Postage 24c. $1.50

### RADAR TRANSCEIVER
X BAND WITH KLYSTRON ETC. $45.00

### RADAR TRANSCEIVER
X BAND WITH KLYSTRON ETC. $45.00

### BATTERY CHARGERS
BRAKE NEW WITH METER. $21.40.

### SCOTCH BRAND RECORDING TAPES USA.
EX ABC 1/4” Polyester. 300ft. on 10 1/2” reels $3.95. Post NSW 45c. Interstate 75c.

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### FIELD STRENGTH METERS
STANDARD DESK TYPE. $95.00.

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Magnetic new cond. 12 volt DC. $1.25. Post 24c.

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### 240V COILS
AUSTRIAN TYPE DFC 4 200V 50 cycle 100KHz $150

### 5.93 HZ IMPPELLER PUMPS
New gemmetal body stainless steel shaft neoprene impeller up to 151/2 lift suitable for almost any type of liquid subject to minor dimensions 8” x 4” x 5” 3.50.

### CONDENSER LENS
2 in. DIA. 2 in FL 3/16” each or $2.50 pair. Post 24c.

### CONDENSER LENS
1 1/8” DIA. 1 1/4” FL 50c each. Postage 24c. $1.50

### RECORDER APX6
With Liquid Crystal Tube. Can be converted to 120V $17.
MULTIVIBRATOR LIGHTS: In a number of my recent articles in this magazine I have used "5V 30mA" globes. I have been searching for this type of globe for some time without success. Could you please tell me where I can find them? Also, would a short across the base and emitter or the base and collector of the 2N2222 cause it to oscillate within a second or two? If not what would G.M. Wollaston, NSW.

2 We don't know where you have been searching, G.M. because the 6V 30mA globe is a very common type available from almost any parts suppliers. Try such suppliers as Radios Despatch, Kriess, Edge Electrics, Dick Smith, George Brown, etc. A base collector short may or may not damage the transistor, depending on the amount of resistance in the particular collector circuit; a base emitter short would usually not affect it at all.

A more likely cause of a transistor damage in the multivibrator would be substitution of a larger lamp than the one specified which, by requiring a higher base current, would call for a higher base current to fully switch the transistor. If the circuit cannot supply this higher base current, and the transistor is not fully switched, it could overheat and be damaged.

DECODER & HISS FILTERS: I must first thank and congratulate you for a very fine magazine for the wealth of information you publish, and also for the clear and concise way in which you convey these facts. Although I have only recently connected with electronics I have a healthy interest in information and high fidelity reproduction so that I am brought via the back dows.

I was somewhat puzzled when you published in the November issue details of a matrix decoder. "Stereo 24" when in the December issue you announced the "Playmaster 136". I knew these two projects would have to be combined. My limited sphere of knowledge cannot perceive any serious problems in making these two units.

Whilst the Dolby noise reduction system is a marvellous piece of equipment, I would very much like to avoid using it purely on the grounds of its non-compatibility, so that I would like to ask about the possibility of including a "scratch", or hiss filter into the circuit.

Filters are devices seldom mentioned in your magazine, let alone included in a project, which, whilst they may not improve the sound of any great value to die reproduction, it is possible they could be of better utility to the replay of tape, and in particular, cassette. With this in mind I have volunteered to be a beta tester for a Dolby unit, but I do think it will do you well to publish some details of this useful ancillary. A.C.G., Ringgrove, NSW.

2 We agree there should be no problem in combining the Playmaster 136 and the Stereo 24. Regarding audio filters, we have not felt there has been a need for them. One of the reasons is that the cost of the Dolby is small compared with the effort is hardly worth the cost of the Dolby.

3 What you have probably not allowed for is the fact that your VTVM is only calibrated for sine waveforms. It will be grossly inaccurate for other waveforms such as that when playing a 2-hand chord. There is little to be gained by modifying your existing amplifier. If you want a noticeable increase in loudness over your present amplifier you will need a unit with several hundred watts capability. Unfortunately, we cannot supply details of such an unit.

PLAYMASTER 129: I have built your Playmaster 129 stereo amplifier published in October 1970 and have several problems with it. Turning the treble control to full boost results in motorboating. In one channel, boosting the bass results in very low frequency motorboating. When I adjust the output voltage up to 17 volts the problem progressively dies out. I have also found a loss of 15dB in the tone control stage. Can you help me? (G.W., Canley Vale, NSW)

2 The motorboating caused by the treble boost control is usually "squeegging" and can be eliminated by connecting a 5k ohm resistor across the base of the treble potentiometer. (See errata column, April 1972 issue.)

The instability aggravated by the bass boost control is usually caused by a faulty 25uF supply decoupling capacitor.

The gain loss is normal for a passive tone control stage. Increasing the DC voltage at the output with the 10k preset potentiometer actually decreases the open loop gain of the IC. This will tend to make any amplifier that is on the verge of instability so; but it is not really getting to the source of the trouble.

REVERSE CURRENT CHARGING: Could you please give me your opinion of reverse current battery charging? I have been told this can recharge carbon-zinc dry (flashlight) cells. Have you a circuit for such a charger? (P.A.B., Wellington, N.Z.)

2 Considerable thought was given some years ago to this question of recharging primary cells of the type I have. I do not think this subject is usually "squeegging" and can be eliminated by connecting a 5k ohm resistor across the base of the treble potentiometer. (See errata column, April 1972 issue.)

It is possible someone else has already solved the problem and may be able to help you by means of the "Circuit and Design Ideas" column. Thank you for your interest.

10 WATT AMPLIFIER: I am using your Playmaster 116 Guitar amplifier with my portable Yamaha organ. However, while the amplifier delivers a measured 43 watts R.M.S. output, due to the high quality of the speakers and turntable, I have been having problems with the bass. It would necessarily need to be reasonably cheap, robust, reliable, and obtainable, have low power requirements and, furthermore, be tamperproof. (R.C.J., Norman Park, Qld.

2 No, we have not considered this subject R.C.J., but it is possible that someone else has already solved the problem and may be able to help by means of the "Circuit and Design Ideas" column. Thank you for your interest.

PROJECT REPRINTS: These cost 50c per project. Reprints are available for all projects, but no material can be supplied additional to that already published. Reprints can be supplied more quickly if they are accompanied by technical queries. Material not on file can normally be supplied in electronic form at 30c per page.

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REPLIES BY POST: These are provided to assist readers encountering problems in the construction of our projects published within the last two years. Note particularly, that we cannot provide lengthy answers, or undertake special research or modifications to basic designs. Charge: 50c. Inclusion of an additional fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee and may be answered in the magazine at the discretion of the Editor. Technical queries will not be answered by interview or telephone.

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up or parallel, depending on the voltage available from the rectifier. The thing is to keep the charging current down to a few milliamperes. A variable series resistor would help to control this. You would also need to experiment with time and charging current for optimum results.

QUADROPHONIC DECODER: I have just completed the quadrophonic decoder featured in your magazine and I am very impressed by its performance. It has given my record collection a tremendous lift. I am also using it to decode reel-to-reel Ampex tapes and, in this role, its performance is superb. (C.S., Christchurch, NZ)

We have had a reason to revise the opinions expressed in the original article and your observations are completely in line with our own. Thank you for your report.

SPRAYED PANELS: Congratulations on such a fine magazine. I have just completed the Playmaster 136 amplifier and I am very pleased with the results, the speakers used being long Rola COF 100mcm long 2.5 cu ft. enclosures, which I recommend.

One word of warning, perhaps, to younger readers considering following constructions carefully, especially those regarding a second coat. I finished up with a mess on the front panel which cannot be removed. (S.H., Highgate, Vic.)

Thanks for the information and comments. You will be pleased to know your problem may be solved by removing the panel and soaking it in industrial thinner. This will remove the lacquer and you can then respray with regard to the instructions.

52-54MHz CONVERTER: Is it possible to use the 52-54 MHz converter as described in August, 1972, with receivers other than the 130 Receiver? Also, what frequency crystal and what type crystal would be needed for 14MHz operation? Congratulations on a fine magazine. I have been reading it for the past four years and I find it very interesting and educational magazine (R.T.M., Enston, Christchurch, NZ)

It is possible to use the 52-54MHz Converter with receivers other than the 130 Receiver, provided the receiver is tunable over the necessary range as described on page 26, and provided the receiver has the necessary input-fiber facilities which may be required. This converter was not designed for 144MHz operation and so we cannot give crystal details for use on this band. Thank you for your remarks on the magazine.

PORTABLE SUPERHET: I am intending to make the superhet receiver in the September 1972 issue (Chapter 17, Home Study Course). If possible I would like to operate it as a portable, without external aerial and earth. Could you advise me on how to make it portable? (K.M., Lyndock, S.A.)

Unless you intend to use the set very close to a transmittting station, we doubt if you would be happy with that particular design used as a portable. It is a simple design without the sensitivity required for all-round portable use. If you wish to try it anyhow, simply connect it to a ferrite loopstick aerial, available from any radio supplier, and for the best, Ferrite rods are available separately if you wish to wind your own loopstick aerial. Disregard the earth connections.

DIACS, TRIACS, ETC: Congratulations on a fine magazine. I wish to know what diacs, triacs, and unijunction transistors are, and how they work. Also, what is the abbreviation HV for? (D.E., Sunbury, Qld.)

Your question is a little too involved to go into here. L.D. Transistor devices are explained in full in our handbook "Fundamentals of Solid State", which is available from this office for $2.30. The abbreviation HV stands for high voltage.

TRANSFLECTER CHANNEL ALLOCATION: May we correct an entry in the "Electronics Australia" for February 1973 under "The World's Transflecter Stations." Our company installed the Gladstone Transflector in November 1971 and has been operating since then. The channel allocation is 10-Hz not 5 as printed. We are given to believe that the PMG Department will also be installing a Transflector in the near future at the same site, to re-broadcast the Buckingham ABC program. (C.T.A., RTQ, Rockhampton, Qld.)

Thank you for the correction C.T.A., the details have been noted for inclusion in any further lists.

PENN-FRIEND WANTED: I have been reading EA for two years and find it both useful and interesting. I am 14 years old and very interested in electronics. Could you publish my name and address as I am interested in finding a penfriend (Ian Langtree, Ensay, Victoria 3890)?

As you can see, Ian, we have done as requested. Best of luck.

CDI & TACHOS: In the September issue a question was asked about tachos and CDI ignition (page 125). I built the CDI published by STC in its "Components Review" (similar to your recent vol CDI from STC). I installed it to my 1969 Falcon GT, which was fitted with a tacho. I found no problems with CDI operation, and readings by a CDI showed no variations. (L.D., Dundas, NSW)

You probably have a type of tacho which will sense the very short pulse of the CDI system - at least in your vehicle. As a general rule, however, most tachos will not work reliably with CDI. A basic problem is that if they were made responsive to very brief pulses, they would be more easily upset by secondary effects as, for example, point bounce.

JOHN BOUTLER: I trust that you will review John Boulter's latest LP called "Sincerely John Boulter". It is on EMI, not RCA as were the last three and the serial number is OCSD 7698. You missed out on his "World's Great Love Songs" and that gorgeous "Songs of Praise". Please don't miss this one. (G.L., New Farm, Qld.)

John Boulter is a fine singer but we can't help feel that even his talents are outdone by your dedication to publicity and letter writing. We seem to remember expressing in the original article and your observations on the quadraphonic encoder featured in your magazine for optimism results also need to experiment with a number of factors, which there is no point in listing here. If we get a copy, we'll doubtless review it.

PLAYMASTER CONTROL UNIT: I built your Playmaster 127 stereo control unit as published in November 1969 and I have found that it overloads well below the specified maximum input voltages. I have adjusted the voltages at pins 1 and 13 and there are no coupling capacitors are not open circuit or that the 470 volt swing is too high. I would like to know whether the output voltage swing would be about 15 volts P-P. If you cannot obtain this, then the IC is probably faulty. If the gain is too high, check that the 500 and 100 feedback coupling capacitors are not open circuit or that the 470 ohm resistor is not low in value.

LEVEL CONTROL: I am inquiring whether or not you plan to describe a high quality level control. I think a need is very real for this type of equipment - for instance, I am in a group and a constant level output regardless of input level would be a great help. This type of circuit would also be useful in amateur radio and other applications. I have attempted some of your projects and have had great success. I hope to turn to some of your digital circuits. (D.K., Wittenoom, W.A.)

We do not index reviews. Whether we get a copy of what you want, please don't ask us to check back through past issues. We don't index reviews. Whether we get a copy of what you want, please don't ask us to check back through past issues.

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<th>Price each</th>
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<tr>
<td>TA20</td>
<td>55V</td>
<td>$6.50</td>
</tr>
<tr>
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OMNI SPEAKER from p49

such. The change in level through 360 degrees of rotation is shown as 3dB which may be interpreted as +11/2 dB from 0 to 360 degrees.

The frequency response was taken by supplying pink noise to the speaker system situated in a furnished listening room 20 x 14 x 9ft. The system was placed centrally 9ft from the rear wall. The 4¼ condenser microphone was at a distance of 1 metre from the top opening. Pink noise was used because it has a 3dB per octave attenuation with increase in frequency, which makes it compatible with the B & K spectrum analyser that has a constant percentage band width. It can be seen that both the frequency response and polar curves are very impressive.

On listened tests it is always best for the individual to make up his own mind, but a lot of people have heard this unit and we think it is the best we have heard for a unit of this size. With the omni-directional facility the system makes tremendous value using two low cost speakers and a simple flake-board enclosure.

In concluding the author would like to thank all of the members of the engineering team at the Plessey Central Engineering laboratory, for their help in developing this project.

SERVICE MAN from p61

prentice out to the manufacturer’s service division (like your city chap) and leave it to them to sort out.

Take the situation I have mentioned and compound this with your remarks in the May and August E.A. add the problems with the initial stages of colour TV and: Oh Boy! How would you like to be a TV serviceman out at Woop Woop?

I do feel however that this situation could be improved if the parts suppliers and manufacturers’ service divisions employed more competent personnel to attend to country orders. Also if the set manufacturers would send more technical representatives into country areas on a regular basis to assist country servicemen with their problems.

Another annoying point I have struck in some modern TV’s: in one particular instance the ratio detector alignment drifts slightly it affects the sound. When an attempt is made to adjust the discriminator slug, the whole coil turns and the next thing you know there are several broken wires and quite a job in front of you sorting them out. I would dread the thought of this happening if one had to realign the IF circuits of a colour receiver. So let’s hope these small hitches are sorted out before then.

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NOTES AND ERRATA

ELECTRONIC STEAM WHISTLE (OCTOBER 1972, File No. 3 / MS / 36) Delete 150K 1/2W resistor from parts list.

CAPACITANCE METER (March 1971, File No. 7 / CM / 5) On page 43, the circuit diagram shows the cathode of D1 connected to the junction of 39pF and 100pF capacitors. This is wrong. It should be connected to the junction of the 100k resistor and 100pF capacitor, as shown in the probe wiring diagram.

TA20C AMPLIFIER: In November 1972, a single-supply amplifier circuit using the TA20C hybrid amplifier integrated circuit was published to substitute for the TA20B used in the Playmaster 134 Guitar amplifier (File No. 1 / GA / 19, October '72) and 20W PA amplifier (File No. 1 / PA / 25, June '72). This circuit tends to have a hum problem which can be eliminated by removing the 220uF 50V capacitor connected between the positive supply and pin 9 of the IC.

NOTE ON SELF-OscILLATING MIXERS: Self-oscillating mixers were used in the Simple Superhet Receiver — September, 1972; Playmaster 138 Program Source — December, 1972; Tuner Receiver — February, 1973 and in some instances, instability has been encountered over the high frequency half of the tuning range. A cure may be effected by replacing the 0.1uF bypass across the 470 ohm emitter resistor, with a 0.01uF to 0.022uF polyester capacitor. In some cases, the 0.1uF bypass at the feed point of the first IF transformer should be reduced to 0.01uF as well.

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