ELECTRONICS Australia

March, 1969

Incorporating RADIO, TELEVISION & HOBBIES

Vol. 30 No. 12



AIR CONDITIONING—KING SIZE!

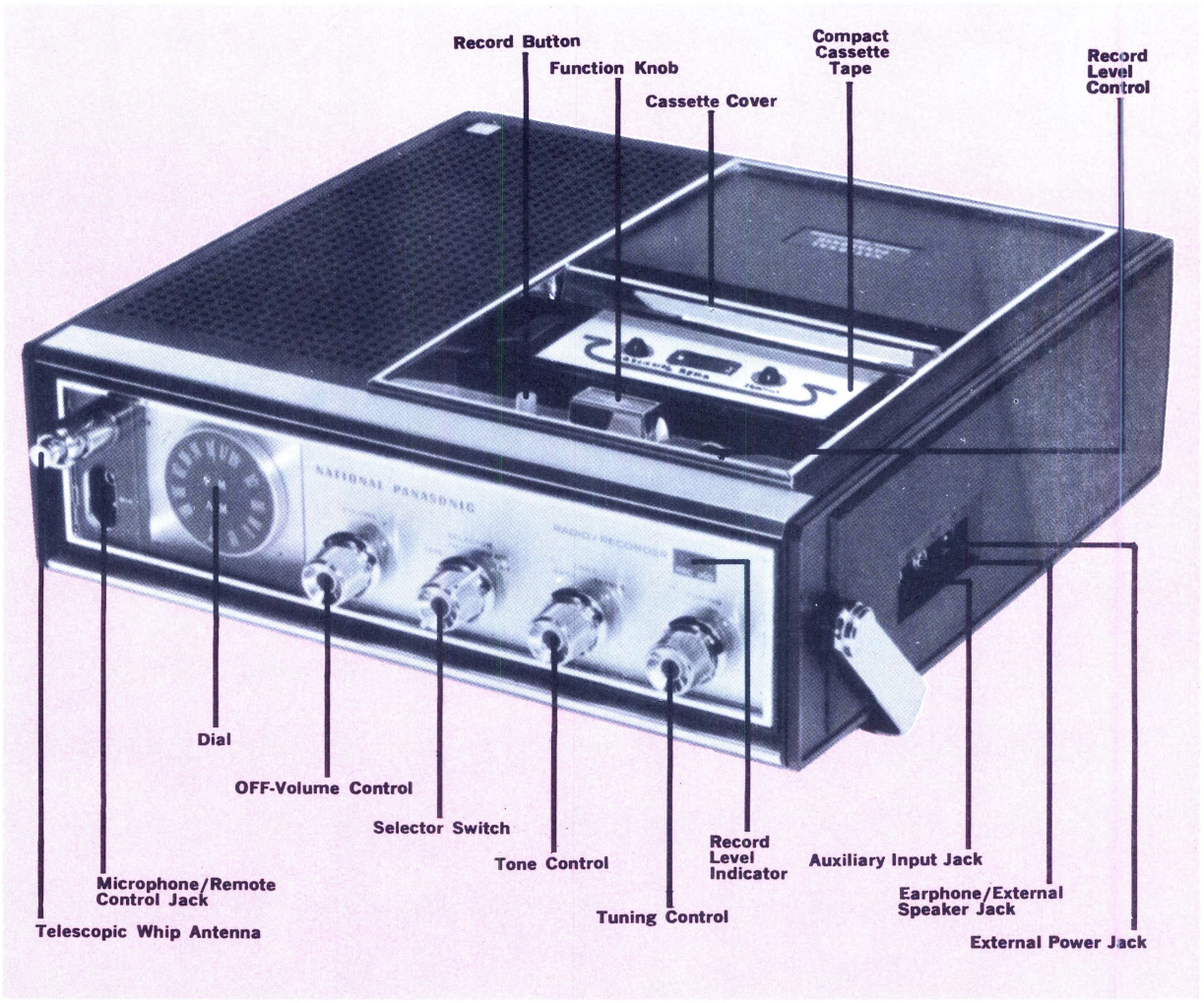
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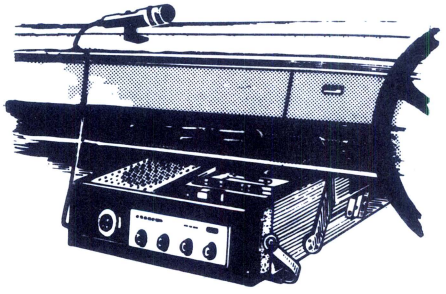
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Editor:
NEVILLE WILLIAMS, M.I.R.E.E. (Aust.) (VK2XV).

Assistant Editor:
PHILIP WATSON, A.M.I.R.E.E. (Aust.) (VK2ZPW).

Technical Editor:
JAMIESON ROWE, B.A. (Syd.), B.Sc. (Technology, N.S.W.), A.M.I.R.E.E. (Aust.).

Technical Staff:
IAN POGSON (VK2AZN).
ANTHONY LEO (VK2ZHK).
HARRY TYRER (VK2ZHH).
JOHN HORSFIELD.
ROBERT FLYNN.
LEO SIMPSON.

Editorial Office:
12th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext 2531 2525-6-7.

Postal Address:
Box 2728, G.P.O., Sydney, 2001, Australia.

Advertising:
SELWYN SAYERS, Mgr.
BILL SUMMONS, Rep., Sydney.
Offices: 8th Floor, 235-243 Jones Street, Broadway, Sydney, Australia. Phone 2-0944, Ext 2931, 2508, 2943.
CLARRIE LEVY, Rep., Melbourne, 392 Little Collins Street, 3000. Ph. 67-8131.

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Build . . . and relax

A traditional picture of contentment has been that of the old-time craftsman — a man able to select or create his own raw materials, evolve his own designs, cope with the rough work and the fine finish, sell the end product and win further orders on the merit of his own highly personal accomplishments. Perhaps the picture has been overpainted but there is no doubt that industrial and social developments through the years have, for many people, reduced the breadth of their involvement in their daily work. They are now much more a cog in some vast industrial, commercial, or tuitional machine.

The steps to this situation have been progressive, over a hundred years or more:

- Initially machines and motive power drove a wedge between man and his product, by substituting for his muscle power and manipulative skill.
- Multiplication of machines and power sources led to mass production, with skills diverted to narrower, more repetitive work.
- Automatic sensing and control techniques made machines more self-sufficient, less reliant on the skill of the operator.
- In the last decade computers have "mechanised" planning, computation and design, as surely as machines have mechanised production.
- Machines, sensing and control techniques, and computers in combination have made possible systems of automatic production with a degree of complexity, precision and speed which human craftsmen could not possibly match.

The fact that man has contrived such automatic production may be good for his collective ego, but the restriction of individual human endeavour to a particular system-oriented task—be it in a factory or a computer hall — is certainly not in the best interests of a contented, broadly based life.

If the frustration of a too-narrow work involvement has contributed to social unrest, it has also strengthened the more healthy and constructive urge for many to "do-it-yourself." It is not just to save money that people from all walks of life choose at weekends to paint their own houses, repair their own cars, build their own boats; that readers of this journal, engaged during the weeks in a variety of industrial, commercial and educational activities, gain pleasure, instruction and relaxation from building anything from a crystal set to a complete hi-fi system.

W. N. Williams

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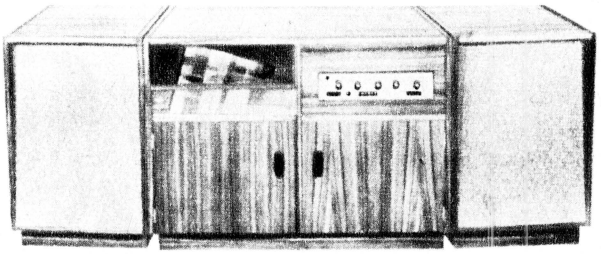
March, 1969

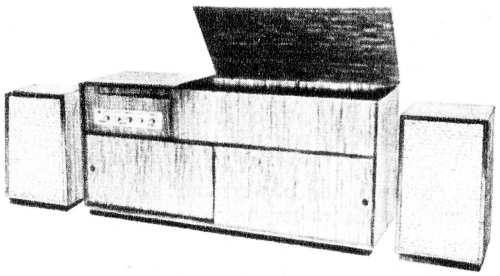
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COVER PICTURE: One of the impressive features of the Royal Festival Hall, London, is the air-conditioning system, which can cope with a full audience "load" without introducing perceptible sound. Controlled from this room in the basement, the system also services the Queen Elizabeth Hall which is adjacent to the R.F.H.

INSTROL *hi-fi systems . . .*

There's a custom built Instrol hi-fi System to suit every possible purpose. For example, this prestige system, based on the magnificent new Instrol Cabinets "Series One Thousand." We suggest the Kenwood TK250 Amplifier, and Dual 1019 Player (with Shure M75G magnetic cartridge), plus two Wharfedale Super 12 RSDD Speakers all fitted in Instrol Teak Cabinets one Model 1002 and two of enclosure 1001. Built and tested for $709.50. Many fine combinations can be produced to suit your requirements, with and without tape recorders, in any of the craftsman-made cabinets from the Instrol range. Let us quote you for your choice. You can save more money if you prefer to assemble your own from Instrol Cabinet Kits.





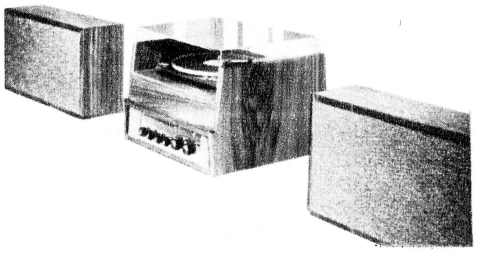
Here's another splendid selection. Take Instrol Model 375 R.S. Cabinet, with two Wharfedale Super 10 Speakers fitted into Instrol Vented Enclosures. The cabinet work may be Queensland Maple, Teak or Walnut. For your amplifier, what better than Instrol, solid state Model 20-20, or Kenwood TK150 or Instrol Model AT1 Amp-Tuner, Add Sony TC255 Tape Deck, and Dual 1015 (with Shure M44MG magnetic cartridge). Cost, within the range of $690.00 and $731.00. The same systems, but without tapedeck and fitted in Instrol Model 250 R.S. Cabinet, between $453.00 and $494.00.

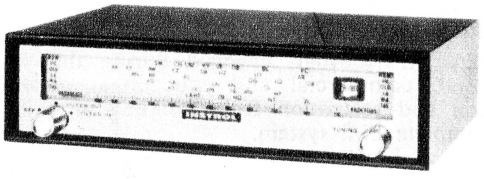
SPECIAL

Two compact, shelf or table mounting systems — quality at very low cost.

(A) Instrol 20-20 Solid State Amplifier, plus BSR UA70 Player, fitted to Instrol Model 75 Cabinet (Teak) which features hinged perspex top. Add two Instrol-Mullard mini speaker systems. $229.00

(B) Instrol 20-20 Solid State Amplifier, plus Dual 1010F or Garrard AT60/2 Player, in Model 50 Cabinet, plus two Instrol-Playmaster Bookshelf speaker Systems (all Teak). $249.00.





INSTROL WIDE BAND TUNER
Solid State Model T-101

A high quality hi-fi tuner designed to operate with all makes of valve and solid state amplifiers.

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- **Built-in AC. Power Supply.**
- **Major Stations, all States clearly marked on large illuminated scale. Housed in smart metal box. Available as Amp/Tuner in combination, with the Instrol 20-20 Amplifier, in attractive Teak cabinet (as illustrated) or less cabinet for panel mounting.**

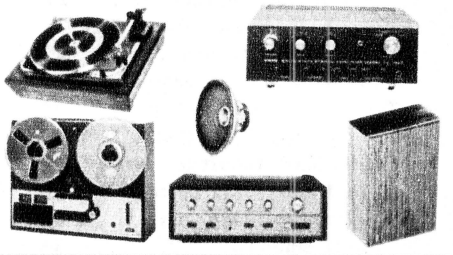


PRICE DETAILS:

T101 TUNER (in Metal Case)	$72.00
T101 TUNER (without case)	$69.80
20-20 AMP. (in Teak Case)	$99.00
Combined 20-20-T101 in Teak Case . . .	$176.00

Yes, we carry a range of imported Loudspeakers, Players, Amplifiers and Tape Recorders. Please state your requirements and we will gladly quote. All well-known brands stocked.

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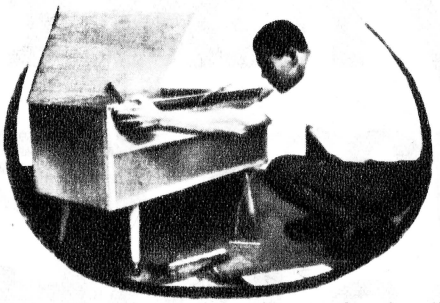


INSTROL *cabinet kits . . .*

Easy to Assemble

MAKE YOUR OWN HI-FI FURNITURE FOR LITTLE MORE THAN HALF COST . . .

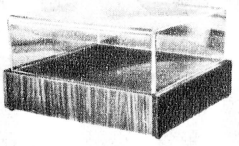
So easy, a child can manage it. The Instrol way—a new simplified method of assembly. A hammer, screwdriver, few hours of your time, and you can make for yourself a complete high quality hi-fi cabinet setting, fully professional in appearance.



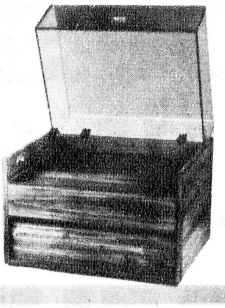
Each kit is complete with all necessary timber parts, plus nails, screws, full, easy to follow instructions. Speaker enclosure kits are complete with acoustic Inner-bond lining felt, and acoustic grille cloth. Equipment cabinet kits include hinges, knobs, catches, sliding stays, castors, slides, leg sets, etc. All timber parts precision cut, fit together smoothly . . . panels are best quality veneered in selected Teak or Queensland Maple. Instrol cabinet designs will cater for virtually any make of speaker, player, amplifier, and tapedeck. If required, all designs are available ready built and polished, but it's highly economical and much more fun to make your own.

PLAYER STANDS

The Instrol range includes a wide variety of player stands and combination amplifier-player cabinets. High quality perspex covers (clear and tinted) are also available, some hinged, others separate.

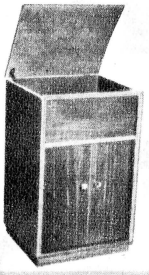


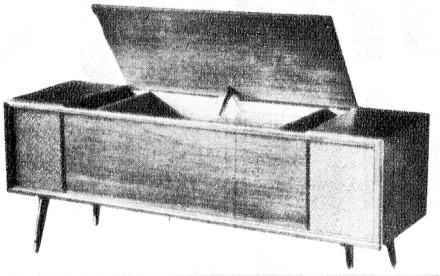




EQUIPMENT CABINETS

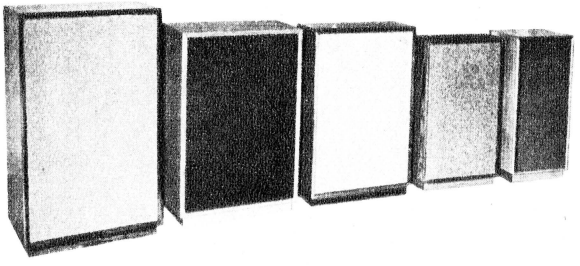
There are more than sixteen Instrol equipment cabinet designs, all available built and polished or as kits of parts to assemble yourself. They range from massive floor units to compact table models, and include cabinets for record storage and wall shelf units.





SPEAKER ENCLOSURES AND SYSTEMS

Name your speaker and Instrol can supply an enclosure to suit. If it's not in the standard range we can quickly produce enclosures to suit speaker manufacturers' specifications. Enclosures only or complete speaker systems are all available built and polished or as kits.



Post coupon, call, or phone for free fully illustrated Instrol hi-fi cabinet brochure. It includes full specifications and down to earth price details of all Instrol cabinet designs. (If writing please include postage stamp.)



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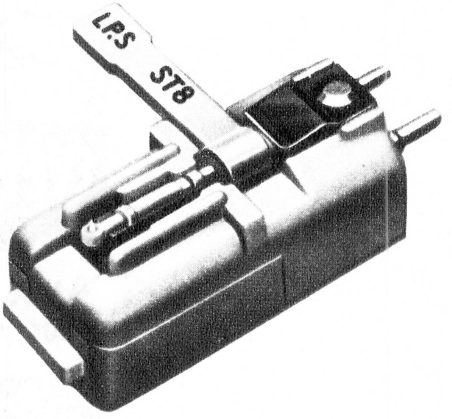
Alkaline cells have been around for ages. We're the first to admit we're not the first. But because we are the biggest name in the game we had to be sure that our alkaline cell would be significantly better than any other. We believe it is. The Eveready Alkaline Energiser will outlive carbon-zinc up to ten to one because they are more efficient in heavy-duty use. You'll also find that it will outlive comparable alkaline cells. That's because we're still the biggest name in the battery business.

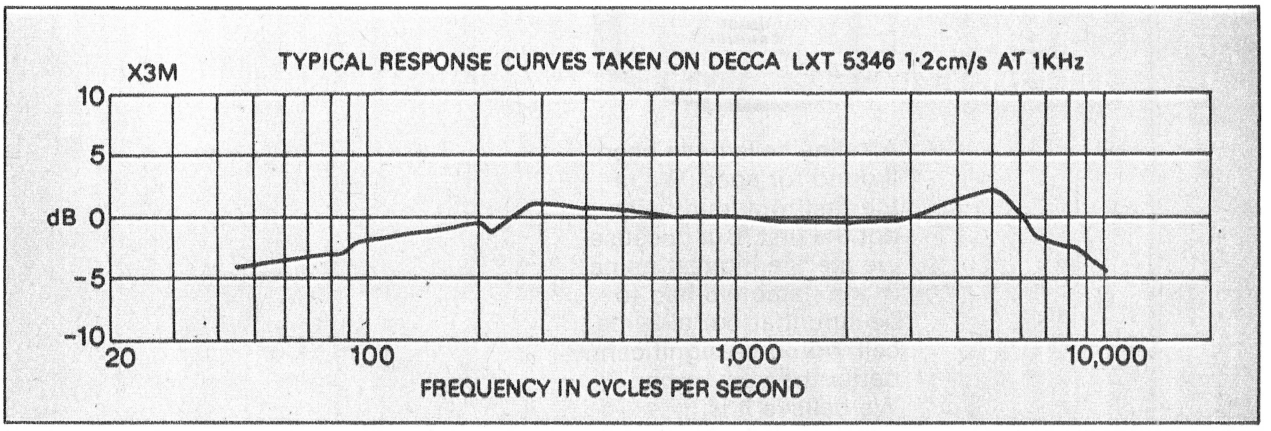
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E84

With a BSR X3M 'compatible' cartridge, almost any mono record playing equipment can take stereo records (without damaging them)





Why compatible cartridges?

An increasing number of record companies are now making stereo LP records only.

Until now these records could not be played on a mono player without distortion and damage to the records.

When playing stereo records the stylus tip moves vertically and horizontally following groove contours. Mono records have grooves which only move the stylus horizontally so old mono cartridges will not allow vertical movement of the stylus. Playing stereo records with old mono cartridges will damage the vertical component of the groove irrevocably.

The X3M 'compatible' cartridge, designed and perfected by BSR, is the answer to this problem. For a small outlay it allows you to play both stereo and mono records without harming either. Retail price, $6.00.

TECHNICAL DATA X3M

Output:	350 mV ± 2 dB
1 KHz test record Decca LXT 5346 at 1.2 cm/s	
Frequency Response:	See typical curves above
Dynamic Compliance:	
Horizontal	3.0 x 10^{-6} cm/dyne (±20%)
Vertical	1.0 x 10^{-6} cm/dyne (±20%)
Equivalent Capacity:	800 pF
Nominal Recommended Loading:	2 M. ohm 100 pF
Stylus Pressure: depending on pick-up arm	4-6 grammes
Measuring Temperature:	20° C 68° F
Colour:	Beige

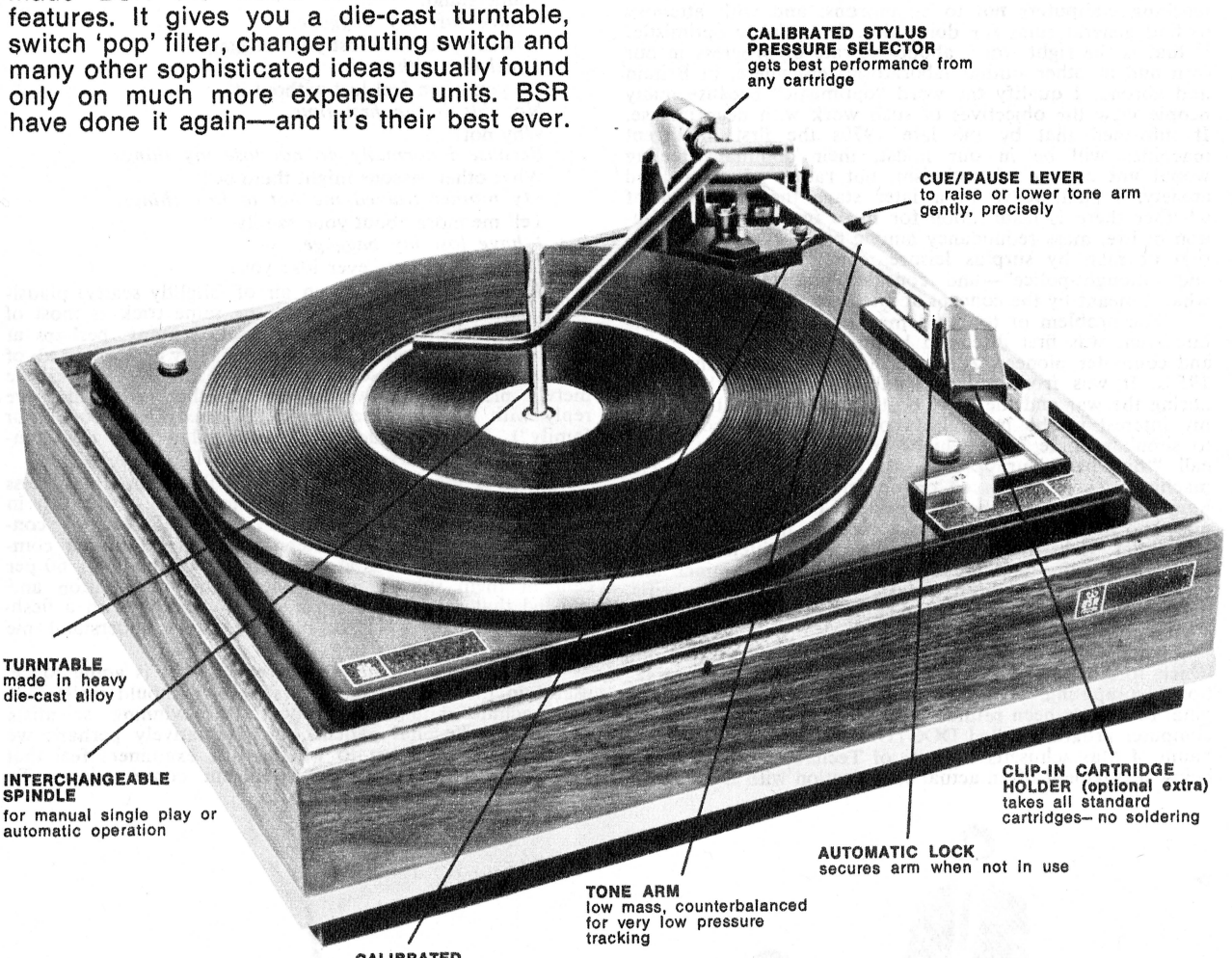
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COMPUTER — SERVANT OR

It used to be possible to sweep the social challenge of computers under the carpet with the dismissive phrase "high-speed morons." While this term might have been applicable to the early machines, it may now be time to revise our ideas, in view of what machines can now do, and do very well.

Today, computers play draughts at a good club standard; solve difficult problems in logic; compose dull but passable music; outperform librarians in the relevant retrieval of certain classes of documents; translate Russian into useful dog-English; and perform many other exacting tasks of a non-numerical nature. Clearly, if we are to bolster our self-respect as humans in the face of the new wave of machines accomplishments, we may have to find some other way of doing it than by talking about morons.

My own research as a scientist is concerned with teaching computers **not** to be morons, and with attempts to find general rules for doing this. I am fairly optimistic, if that is the right word, about the rate of progress in our own and in other similar laboratories elsewhere, in Britain and abroad. I qualify the word "optimistic" because many people view the objectives of such work with deep unease. If informed that by the late 1970s the first intelligent machines will be in our midst, their dominant feeling would **not** be one of optimism, but rather of gloom and anxiety. I shall leave to a later stage the discussion of whether there is justification for these fears—de-humanisation of life, mass redundancy among brain-workers, suffocation of man by surplus leisure, computer-aided snoopers and "thought-police"—and consider first in more detail what is meant by the concept of intelligence in a machine.

The problem of testing a machine to see whether it is intelligent was first discussed by the great British logician and computer pioneer, Alan Turing, who died in the early 1950s. It was from my personal association with Turing during the war and the early post-war years that I acquired my interest in the possibilities of using digital computers to simulate some of the higher mental functions that we call "thinking." Turing proposed the following test. The machine was to be placed on one side of a screen and a human examiner on the other side. Conversation between man and machine was permitted through the medium of a teleprinter. If after an hour or two's typewritten conversation the machine had managed to fool the examiner into thinking that he had been conversing with a human being, then according to Turing the machine's claim to intelligence should be conceded.

There was undoubtedly an excellent idea here and one which foreshadowed the modern trend towards "conversational computing." Unfortunately Turing's test, in its original form, has been refuted by an ingenious conversational computer program called DOCTOR written by Joe Weizenbaum of Massachusetts Institute of Technology. I reproduce below a fragment of an actual conversation with DOCTOR.

How do you do. I am the DOCTOR. Please sit down at the typewriter and tell me your problem.
I wish I had my baggage.
Can you elaborate on that?
I am not quite clear as to what sort of elaboration is wanted.
Do you believe it normal to be not quite clear as to what sort of elaboration is wanted?
Yes, quite normal.
I understand.
I have lost my baggage.
You say you have lost your baggage.
I feel lost without it.
Do you often feel lost without it?
No, this is the first time.
Why not?
Because I normally do not lose my things.
What other reasons might there be?
My mother trained me not to lose things.
Tell me more about your family.
I have lost my baggage.
Did your parents ever lose you?

At first sight this has an air of (slightly scatty) plausibility. In reality it is a trick — the same trick as most of us employ when keeping a conversation going, perhaps at a cocktail party, while our mind is elsewhere. Instead of attending to the sense of our companion's remarks we merely pick up key words (e.g. "mother") to which we reply with stock phrases (e.g. "Tell me more about your family"). If really stuck, we merely play back our companion's last remark with some suitable trimming.

This is essentially how DOCTOR works. Its success as measured by Turing's test is impressive. Patients in Massachusetts General Infirmary were allowed to converse with the program, after being warned that a computer, not a doctor, was at the other end of the line. 60 per cent of them subsequently rejected this information and insisted that they had been in communication with a flesh-and-blood doctor — "No machine could understand me that well."

So Turing's test has to be refined if it is going to be useful in the way intended. Perhaps we should insist that the machine should fool Nobel Prize-winning scientists rather than hospital patients, or alternatively perhaps we should direct attention to whether the examiners feel that they have been having an intelligent conversation. To



The "conversational" computing system at Edinburgh University's Department of Machine Intelligence and Perception, where the author is tutorial professor.

MASTER?

By Professor Donald Michie

Department of Machine Intelligence and Perception, Edinburgh University



The Elliott-Automation 920M microminiature computer shown here is constructed from micro-electronic circuits by new production techniques. The small computers of this type may well bring about the widespread use of computers predicted by the author.

apply these definitions, they do not need to be philosophically watertight. Machine intelligence is not an exercise in philosophy but an engineering project.

One side of this engineering project is concerned with defining and implementing the separate components of mental aptitude — such capabilities as trial-and-error learning, pattern-recognition, generalisation from individual instances, deductive and inductive reasoning, problem-solving and linguistic skill. Somehow these different capabilities, each represented in the computer by a different program, have to be integrated so that they function as an organised whole. We have some ideas about how this co-ordination of computer programs might be achieved, but these are still rather primitive and will not be discussed here. What I shall do is to take one of the constituent capabilities as the subject of a brief digression, before considering some of the social and psychological apprehensions which are voiced concerning the development of intelligence in computers.

The mental capability which I shall single out is trial-and-error learning. This is the simplest and lowest form of learning, in which the learner proceeds entirely **ad hoc.** He says to himself merely "Have I been in this situation before? If so, what did I do? What were the consequences of my action? If satisfactory, I shall choose the same action again. Otherwise I shall try something else."

Note that no **generalisation** from experience is involved. Situations are separately assessed in the light of past experience without attempting to link them together into meaningful categories according to higher-level considerations. The surprising thing about pure trial-and-error learning is how far a computer system can get using this trick alone, without venturing into the realm of generalisation. Samuel's famous computer program for playing draughts was able to train itself to a passable amateur level with a system of pure trial-and-error. Samuel called it "rote-learning" even before its standard of play was further improved by the addition of a learning-by-generalisation component. The program asked itself "Have I been in this draughts position before? If so, what move did I make? What were the consequences . . .? etc."

Some years ago I extracted much spare-time amusement from constructing a trial-and-error machine out of matchboxes, whose task was to learn to play noughts and crosses. More recently with the help of my colleague R. A. Chambers I have developed a computer version, and this has been tested on a difficult problem which on the face of it does not look in the least like a game.

The task is to learn to control an unstable physical system which I shall call "The Donaldson system," after the Cambridge physiologist who first used it in studies of machine learning. A motor-driven cart is free to run on a straight track of limited length and balanced on it is a pole pivoted at the base which is free to fall down either left or right along the line of the track (see figure 1). The motor is controlled by a single switch which determines at each instant whether the motor's force shall be applied in the left or the right direction. The task is to manipulate the switch so as to keep the cart running backwards and forwards along the track without either running off the end or dropping the pole. This task has obvious similarities to one which most of us attempted, with eventual success, during childhood, namely learning to ride a bicycle. Inevitably the child learns by sheer trial-and-error to begin with.

Our computer program does in fact learn to master the Donaldson system — without using any special knowledge about it or being "taught" by any human or machine.The program is no more and no less designed to tackle a pole and cart than to learn to guide a car round a closed track or to monitor and control some simple industrial process. In this it illustrates a property which is a "must" for any component of an intelligent computing system—**task-independent capability.** The striking feature of the human brain is not so much any outstanding performance at any particular task but rather its ability to make a useful, even if fumbling, attempt at almost **any** task.

An option in the program allows the human user to intervene and perform the control task himself and a further option permits program and user to work on problems co-operatively, each benefiting from the other's trials and errors. I believe that this type of co-operative interaction between intelligent user and intelligent machine will come more and more to the forefront, and indeed will set the pattern in the future.

When thinking recently about the subject of particular mental capabilities, of which trial-and-error learning is just one example, I amused myself by copying out the late Ludwig Wittgenstein's list of what he called "language games" and measuring each item against the present state of the art in machine intelligence. I reproduce his list below:—

Giving orders and obeying them—
Describing the appearance of an object, or giving its measurements—
Constructing an object from a description (a drawing)—
Reporting an event—
Speculating about an event—
Forming and testing a hypothesis—
Presenting the results of an experiment in tables and diagrams—
Making up a story and reading it—
Play-acting—
Singing catches—
Guessing riddles—
Making a joke—telling it—
Solving a problem in practical arithmetic—
Translating from one language into another—
Asking, thanking, cursing, greeting, praying—.
Now let us run through the list again.

Giving orders and obeying them has been a routine function of computing systems for many years.

Describing the appearance of an object, or giving its measurements, is a difficult task facing those engaged on "hand-eye" computer projects. For a machine to inspect an object with a mechanical "eye" and then manipulate it with a mechanical "hand" the first step must be to form a description from the visual image.

Constructing an object from a description (e.g. Building a tower from a photograph of a tower) is among the most difficult long-term goals of hand-eye projects.

Reporting an event is beyond our present technique. Again, synthesis of a description from primary sense-data is the first step. The second is the use of the synthesized description to generate appropriate language text.

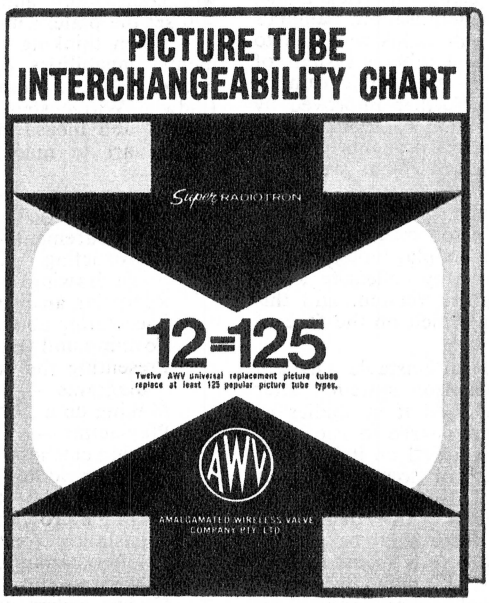
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Speculation about an event is even further from present technique.

Forming and testing a hypothesis is a process under active current study.

Presenting the results of an experiment in tables and diagrams is a routine operation of contemporary computer programs for survey analysis.

Making up a story is beyond present technique, although **reading it** from printed text is now marginally feasible.

Play acting would require a great extension to the arts of robotics.

Singing catches — humming the tune is easy to program, but singing intelligibly is not.

Guessing riddles is under active current study, but **making a joke** is very far beyond present technique.

Solving a problem in practical arithmetic presents no difficulty even to primitive computer systems.

Translating from one language into another is just attaining marginal feasibility by commercial criteria.

Asking, thanking, cursing, greeting, praying are activities which express emotions, attitudes, desires, sympathies. It is meaningless to talk of them except on the basis of consciousness and self-consciousness in the intelligent system concerned. Many workers in the field of computers believe that success on a really significant scale will hinge on the degree to which machine-representations of these phenomena can be devised — at least to the degree of permitting the machine to form some sort of internal logical model not only of the external world but also of itself in relation to that world. I share this view.

Who is to be master? I am inclined to regard the dilemma "Computer: servant or master?" as a false one. To clear the ground for what I have to say under this heading, let me first sketch a division of tasks into three categories.

1. **Tasks suitable for humans alone.** This category is concerned with value, i.e. what sort of result do we want to see? For example, what weather do we want, irrespective of problems of prediction. Or what rate of road deaths relative to motorists' convenience are we prepared to tolerate?

2. **Tasks suitable for computers alone.** These tasks are those of complicated detail and "tactical" decisions: for example prediction of weather, or control of a city's traffic light system. The case of traffic lights has a special point of interest in the present context: the citizen seems prepared quite happily to accept this form of computer interference in his life, even though he may express great alarm over other forms. The implication is, I think, that the emotions of doubt and opposition to the computer revolution do **not** in reality hinge on a matter of principle —it seems to be a matter of the appropriateness or otherwise of computer control in the given case. As applied to traffic lights, the sheer in-human equitableness of computer control has a positive appeal. I believe that something similar is involved in the popularity among schoolchildren of computer programming as opposed to Latin. With programming there is no conceivable vulnerability to possible biases or prejudices of the teacher. The entire proof of the pudding is (if I may be allowed to mix a rather sticky metaphor) in the running of it on the machine.

3. **Tasks suitable for co-operation.** These are tasks which are too difficult at present for either partner to do alone or are in some way intrinsically suitable for conversational computing. In the second category I would place the use of a console connected to a conversational computing system as a "home tutor" whereby the user can be steered through courses and subjects of study of his own choosing. It is not always easy, once one has taken the plunge into conversational computing, to distinguish between a program to **help** you do something and one to **teach** you to do it.

In this category of intrinsically conversational uses is the "question-answering" facility which will one day become available as a service. Not only schools, hospitals and commercial firms but also the ordinary householder will be able to tap information and problem-solving power from a national computing grid with the same ease and immediacy as that with which he now draws on central supplies of gas, water and electricity. Along with question-answering services, which will allow us to enquire about restaurants in our locality or politics in Paraguay, will come the games opponent, the puzzle-setter, and the quiz-master. An increasing demand upon computer systems will be for aid in coping in a stimulating way with the growing burden of leisure.

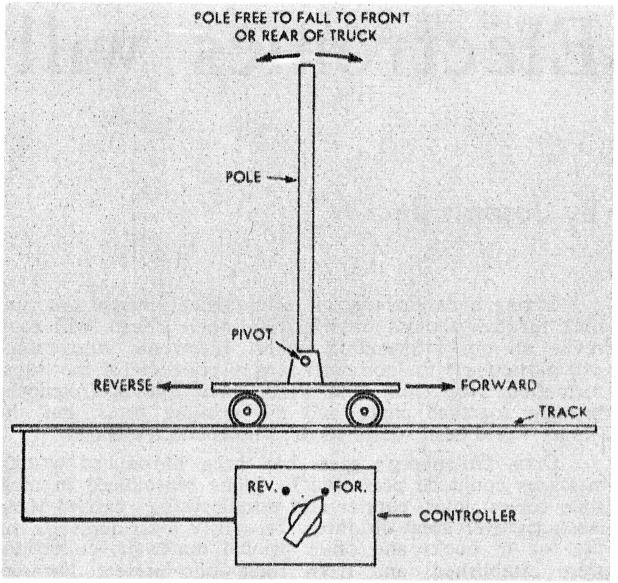


FIGURE 1. The "Donaldson System" type device described by the author. The upright pole is pivoted so that it can fall to the left or the right. The pole must be balanced by moving the trolley in the appropriate direction by means of the "Left-right" switch.

For many years only the rich will be able to install terminals in their private homes, but I have no doubt that the coming decade will see public telephone boxes up-graded to include a keyboard terminal connected to the computing grid, and it is well within the reach of foreseeable software technology to offer services which will tempt ordinary people to place a coin in the slot.

Will the computer "take over"? In the world of information-handling, of course the computer will take over. The question is will it take over as servant or master? To this one must reply: not as servant nor as master, but as tutor, as secretary, as playmate, as research assistant. None of these in their human embodiments is a servant or a master; each is better described as a helper. The lessons of experience with computers do not support the idea that brain workers will be thrown out of employment by the machine. The indications are that as soon as brain workers learn to use the new facilities their work will be enlarged and enriched by the new possibilities which become available to them. The working week will, of course, continue to shorten in advanced countries as productivity rises, but this is a question of technological progress in general, and not specifically a consequence of computers. Whether the increase of leisure time is felt as a burden or a joy will depend on the means available for developing spare-time activities which can exercise and challenge man's varied capabilities.

It is my confident prediction that computer-aided self-instruction in science, history and the arts will have become a consuming hobby of large sectors of the population by the turn of this century. As for fears sometimes expressed that by then Big Brother will be able to watch us over the computational grid, or that our superiors or our neighbours may be able secretly to tap our dossiers kept on the universal electronic file, these fears can be dismissed. It is easier to devise "unpickable locks" in a computing system than in the world of bank vaults and safes.

The present fears of computers represent nothing new. When the first passenger-carrying railway services were opened, eminent medical men warned that if the human frame were transported at these speeds, fatal haemorrhages and seizures would be caused. There is a good parallel here. Imagine framing the question "Railway train; horse or rider." The answer, of course, is "Neither horse nor rider but **travel assistant.**" As soon as people discovered this, their fears of rail travel disappeared. When computer terminals can offer a useful coin-in-the-slot service, the citizen will, I believe, cease to regard the computer as an alien monster or a ruthless competitor. Instead, the conversational terminal of the future will be welcomed for what it will do to enlarge daily life—as planning assistant, as budgeting assistant, and above all as a novel and challenging type of conversational companion. ■

Electronics will extend libraries'

By Joseph Becker*

Strong undercurrents of technological change are running through today's libraries, and their effects will soon revise all our information habits. Electronic innovations, and particularly the computer, are responsible for the transformation. Not since A.D. 1440, when Johann Gutenberg brought together paper and the printing press, has the library world been subjected to so profound a change.

Once Gutenberg's press had been introduced written messages could be preserved by being reproduced in multiple copies; later, courier and postal systems carried these messages over great distances. To satisfy local demands for the use of books and other printed materials, collections were established, and from these our present libraries grew.

Over the years, libraries have developed techniques for making recorded material widely available. These techniques have weathered the storm of operation: they work. Libraries, generally speaking, are effective information systems; they provide their customers with information, with reasonable speed and at minimal cost; they excel at storing information and providing easy and often open, unlimited access to printed material. Despite rich printed resources and effective organisation, however, library service has always been limited by the requirement that a reader must travel to the library in order to use it. Progress in electronic communications indicates that this remaining barrier can be removed by providing alternative means of transporting printed information from the library to the individual.

By no means does this freedom to communicate imply that the book is obsolete and about to vanish from the library. Its portability, compactness, and ease of use will keep it a dominant form for many years to come. However, tomorrow's library is also expected to handle other media, such as video tapes, digital computer tapes, and microfilm.

For the first time, libraries can transmit and receive all forms of messages—oral, digital, printed and graphic—virtually without constraints of space or time. Improved communications can extend the resources of a library far beyond its physical borders, and it can also marshal the resources of many libraries to meet a particular information need.

Projections of future demands for library service indicate that these expanded facilities will be needed. As the population grows, and as a greater proportion of the population acquires advanced education, pressures on the library to supply the reading public with more materials for recration, research, and education will increase. The only hope that the library has of satisfying its burgeoning clientele is through these new arteries of communication.

It is the marriage of computers to electronic communications that is destined to transform the library's traditional role as a passive receiver of information into the much expanded and infinitely more useful role of an active transmitter and distributor of information. New channels of communication will connect libraries to homes enabling individuals to be in two-way remote contact with multimedia sources of information stored elsewhere.

The developments taking place in libraries that will make future knowledge incomparably accessible can be divided into four parts: (1) application of the computer to the performance of internal library functions, (2) research in information retrieval, (3) communication with multimedia files, and (4) creation of library networks.

Until recently, the computer in the library was used mainly for housekeeping functions, such as book ordering, accounting, and the clerical processing of library records. However, another type of application has evolved, in which the computer is used not as a business data processor but as a control tool for library management. In fact, some librarians have begun to view the library as a "total system" and are employing operations research techniques to provide answers to questions about cost versus effectiveness, quality and rate of service, and so forth. Alert to this trend, schools of library science are revising their curricula in order to equip the next generation of librarians with the fundamentals of information science and thereby to accelerate progress to new systems.

Professional groups, such as the American Library Association, American Documentation Institute, and the Special Libraries Association, are also establishing continuing education programs in library automation in order to raise the level of understanding among practising librarians. As a result, computer applications are being introduced into libraries at a rapid pace. By 1970, the profession expects to reach the point where the new technology, no longer a mystery, will have become part of a new way of doing things. As with other professions, the rate of change in the library will depend on how fast the librarian can make things happen. Although some individuals are resisting the challenge of change, most librarians have accepted library automation and are encouraging it.

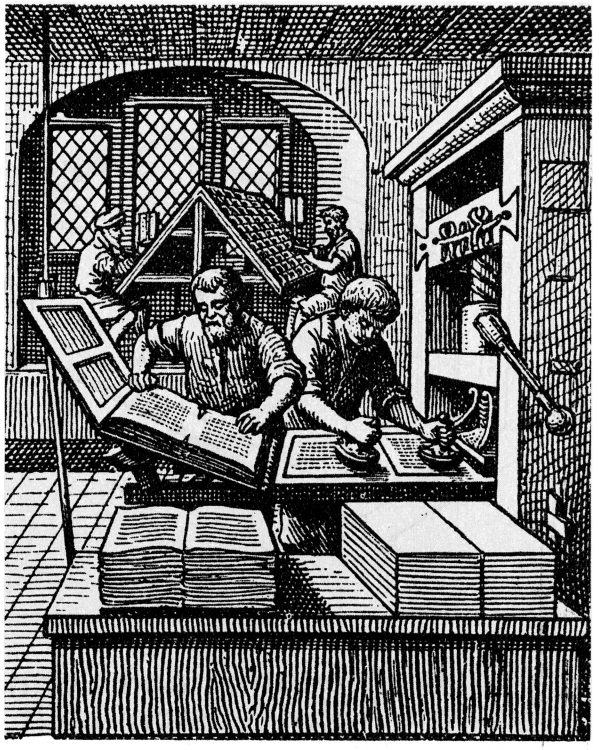
Aside from these applications, research is being pursued to find ways of using the computer to answer library reference questions and for information retrieval. Until now, language subtleties have proven too fine for computer programming — but the work continues. Libraries of the future expect to have the full text of certain materials stored in a form readable by machine. However, such digital files will be of limited value unless computer programs are devised which possess intellectual concepts for retrieval that mark a significant improvement over the traditional, manual method of hierarchical subject classification. The crux of the problem is to develop computer programs that not only organise information by subject but are capable of logically reorganising stored information to satisfy changing interests. If this can be done, it may then be possible to extract underlying patterns of meaning from a mass of digitally stored language. This is the ultimate goal.

A current trend in the library profession is to produce bibliographical data that are machine readable. Bibliographical data include the identifying elements of cataloging that describe a given book: the author's name, the title of the book, the publisher, and so forth. The retrieval process here is more manageable because the elements of catalogue data are determined. Since many different libraries are required to catalogue the same title, the Library of Congress has inaugurated a program called Project MARC (Machine Readable Catalogue), which converts catalogue data into machine-readable form. These data are then transferred to magnetic tape, which the Library of Congress plans to make available to any library.

Computer programs are also available that permit the recipient of a MARC tape to prepare automatically any number of useful library by-products. However, once bibliographical data are in machine-readable form, the next logical step is to store them in a direct-access memory of very large capacity and to communicate and display the data rapidly in a form suitable for use at the local library level. The addressing of a direct inquiry to such a file by a user has some interesting implications. Imagine, for example, that the Library of Congress' catalogue of books and periodicals was in machine-readable storage in a national network. It would then be possible for a professor, say at the University of Alabama, to use the cata-

*JOSEPH BECKER is a noted author and lecturer on library science. He is currently Director of Information Sciences of the Interuniversity Communications Council.

service facilities



logue from his office instead of having to travel to Washington. The prospect of having access to the country's most comprehensive bibliographic resource will greatly stimulate research and scholarly activity.

The idea of remote direct access to central stores of digital information is of recent origin. Computerised airline reservations systems, banking systems, and insurance systems have employed this technique for accessing files of limited size and purpose. In 1964-1965, the American Library Association featured demonstrations of remote retrieval of library information at the Library/U.S.A. exhibit in the United States Pavilion at the New York World's Fair. Any library or person with access to a teletype machine was able to interrogate a real-time computer at the Fair for selected essays, bibliographies, translations, and current periodical references by subject.

The Massachusetts Institute of Technology has an experimental system that places at a user's fingertips the terminal communications equipment needed to interrogate a large store of information under the control of a computer program while numerous other persons are simultaneously using it. This time-sharing system, called MAC (Multiple Access to Computers), led Dr. M. M. Kessler of the MIT library to develop a working model of an on-line retrieval system for selected bibliographic information in the field of physics. Interaction between man and machine is direct, and the system employs an uncomplicated inquiry language that closely resembles English and uses verbs common to bibliographic searching such as "find," "search," "print," and so forth. For example, in asking the computer to search all issues of the Physical Review for all titles of articles in which the words "ion collision" appear, the researcher addresses his request as follows: "Search Physical Review, all, find title ion collision, output print author title indentification, go."

Files of bibliographic data are not the only digital files likely to be accessible in tomorrow's libraries. Machine-readable information is beginning to be produced by some publishers and by scholars and researchers. Publishers generate full digital text as a by-product of manuscript preparation and later use it to drive automatic printing devices. In addition, certain humanistic scholars, for example those interested in comparative literary style, are painstakingly converting original material to digital form prior to computer analysis. Many of these digital sources may some day become an integral part of every library's collection and be made available through remote communications.

Although libraries have always concentrated on the collection, preservation, and organization of printed materials, there is a growing awareness that the newer media forms — digital, audio, film, and video — are also the library's responsibility. A wide variety of new communications equipment and techniques have been introduced by the communications industry for use with the newer media, and their impact on data transfer methodology is growing stronger. Dial-access systems to distant stores of information are already in use commercially, and libraries are experimenting with them as well.

For example, research programs have been devised to test the thesis that audio communications can be used effectively in libraries to supplement the printed word. A typical dial-access medical tape recording library is in operation today at the University of Wisconsin Medical School. Staff physicians record four- to six-minute commentaries on current information having to do with various medical subjects or procedures. The list of subjects is circulated by mail to physicians in the state. A practising physician may telephone Area Code 601/262-4515 at any time of day or night and request that a particular tape be played.

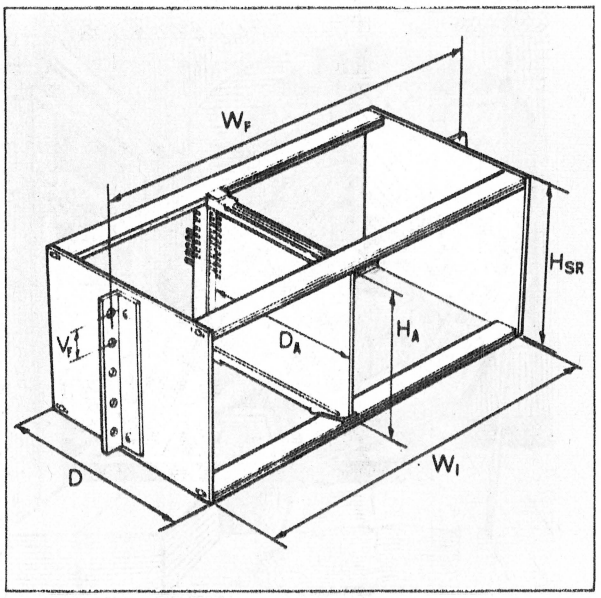
Although audio communication is a slow form of information exchange, advances have been made in the production of audio tapes that permit more information to be recorded per unit of time. The President's Committee on the Employment of the Handicapped, through the Division for the Blind at the Library of Congress, is encouraging compressed speech research because it promises to provide a method for recording two to three times as much information per linear inch of tape without distortion or loss of comprehension. Direct access to stores of audio information in libraries offers an inexpensive and practical method for up-dating information frequently and distributing it to both the sighted and the blind over established telephone networks.

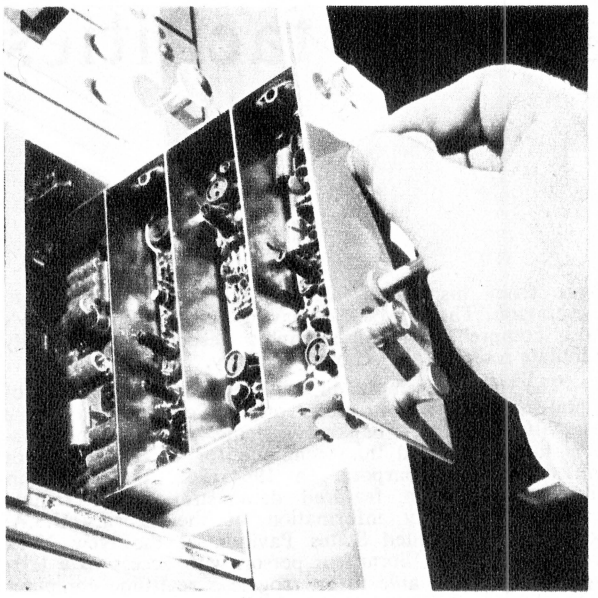
Dial-access systems to audio-visual materials can be found in many educational institutions today. An individual carrel is provided for each student from which he is able to direct-dial a language lesson or obtain audio-visual instruction on selected topics. RCA's dial-access system at Oral Roberts University in Tulsa, Oklahoma, is a good example and even goes a step further by integrating this new learning process into the library. Carrels are located physically within the library, thus making the total multimedia resources of the institution available to the student.

Since 1950, libraries have also been experimenting with facsimile systems capable of electrically transmitting printed copy from one library to another. The facsimile system is not a new idea. The electrical transmission of pictures, maps, and other printed matter dates from the work of Alexander Bain, who in 1843 outlined such principles in a British patent. Its first application to libraries, however, was demonstrated in 1952 when RCA introduced ULTRAFAX. This system scanned a film copy of Margaret Mitchell's "Gone With the Wind" on the stage of the Coolidge Auditorium at the Library of Congress in Washington, D.C., and recorded a faithful factum simile on film in San Francisco moments later.

A few years ago Xerox introduced LDX (long-distance xerography)—a high-speed facsimile system with exceptionally good resolution—and recently a number of library facsimile networks were established in Hawaii, Nevada, New York State, and California. Although the high cost and low speed of transmission over narrow-band lines are inhibiting widespread use of facsimile in libraries, the introduction of wide-band telecommunications facilities is expected to change the trend.

The next step, of course, is to develop the ability to transmit printed copy on remote command from a library file at one location to a service point at another. In this connection, RCA Laboratories in Princeton, N.J., recently announced an experimental television system that can broadcast printed pages of a book to a home TV set along with standard television programming. It works by converting the original copy into electromagnetic signals which are blended at the transmitter with those of regular tele-





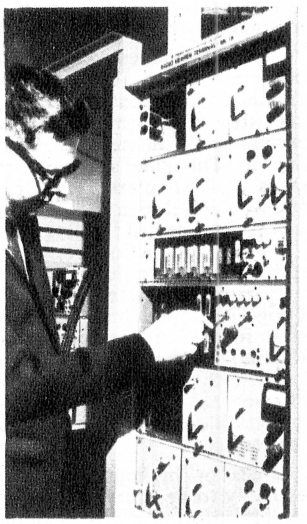
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vision programs by means of an electronic "hitch-hiking" technique. The blended signal is then broadcast for reception by standard home antennas. This is only a step away from dialing at home for one or more pages of information in the library.

Libraries are keenly interested in systems that can provide remote access to files of video information. Systems are currently available which store individual video frames on tapes or disks. Both forms of storage can be addressed digitally. Thus, using a touch-tone telephone, it is possible to dial for a particular frame and receive it automatically for viewing on a TV monitor. Ultimately, we can expect to see information systems capable of broadcasting video frames to TV sets which can be uniquely addressed by the transmitter. This form of TV time-sharing will profoundly influence the design of library information systems.

As the tempo of library communications quickens, and as the rate of computer usage in libraries increases, the tendency among libraries will be to find new ways of sharing resources, not to compete for them. In the past, the trend was toward local self-sufficiency, but this was before electronics. Communications offers libraries their first real chance to develop the concept of information distribution. Networks of this type can turn information into a national resource readily available to every corner of the country.

At the moment, the technology of networking is better understood than are the functions it is expected to perform. Experimental communications networks, such as the one for facsimile in the New York State Library and the teletype network at Duke University for interlibrary loan with four other medical libraries, are investigating the advantages to be gained through interlibrary communications. Librarians who are aware of the potentialities of networking see it as providing two-way channels for the distribution of multimedia materials, as a system capable of improving the efficiency of clerical operations, and as an opportunity for extending library services to any person desiring information.

A nationwide network of library systems connecting local, State, and national resources is bound to involve several processing centres and many stations using combinations of leased and switched communications facilities. The design of such a system or systems is highly complex, and the introduction of broad-band transmission channels between libraries will require more than simple agreement among them on common rules of practice. Success will depend on painstaking system design, the utmost technical skill and, above all, a sense of purpose and commitment on the part of network participants in the library community.

Yesterday's image of the library was that of an archive — a place to go where the books were kept. Tomorrow's image will more than likely be that of a communications centre — an active source of information exchange and redistribution. Electronic innovations in libraries may well prove to be the catalyst that will help to bring about this change. ■

Widespread use of Laser Devices in U.K.

More than 400 standard laser devices have been sold in U.K. by International Research and Development Co. Ltd., of Newcastle upon Tyne. The company is continuing research into new gas and ruby laser devices and their applications.

One such device is a laser microwelder (figure 1) which is being evaluated in practical micro-drilling and micro-welding operations. The device consists of a small pulsed ruby laser mounted on a research microscope in such a way that the laser light-pulses can be fired down the optical axis of the microscope. It is thus possible to view, focus and aim along the path taken by the laser beam. The device enables small, controlled amounts of laser energy to be applied to a small area of a workpiece so as to melt, vapourise or selectively irradiate it.

In general, pulsed ruby lasers are finding increasing uses in machining otherwise inaccessible workpieces, and in small-scale work such as the manufacture of semi-conductor devices. They are also useful for working close to certain heat-sensitive materials.

A program of research sponsored by British National Engineering Laboratory is investigating lasers as a source of radiation for interferometric measurements in engineering. It is hoped to develop suitable detectors for the observation of infra-red interference patterns. Another research program is concerned with the most powerful type of laser yet developed — the carbon dioxide laser — and its applications in cutting, welding and drilling. Figure 2 shows a high-energy solid-state laser boring a tungsten plate.

For medical research, IRD has developed a new range of high-powered lasers one of which, a multimode helium/neon gas laser with an output up to 100mW, is now available for research into the treatment of retinal disorders and for experiments in tissue transillumination. Other research is concerned with the application of lasers in the diagnosis and treatment of cancer, and with the nature of the reaction of lasers with biological materials.

The IRD laser ophthalmoscope (figure 3) which is marketed by Keeler Optical Products Ltd., is now widely accepted by the medical profession for the simple treatment of retinal detachments and other eye conditions. The Royal Victoria Infirmary, Newcastle upon Tyne, which partly sponsored this research, has now obtained a greater return in royalties than its original investment in research.

Lasers have also been applied to high-speed photography of moving particles. Investigations in this field by conventional photographic methods are limited by the effective shutter-speed and the speed and physical size of the particles. These limitations have been overcome by using a ruby-laser light-source with a switching device to reduce the pulse-width to 0.02 microsecond. This gives much clearer and more accurate results. Typical investigations concern the size and distribution of atomised particles in fuel-injection systems, and the erosion of steam-turbine blades by high-speed water droplets in the steam. IRD have been able to determine the size and distribution of the droplets leaving the back edge of one set of blades before they strike the following set.

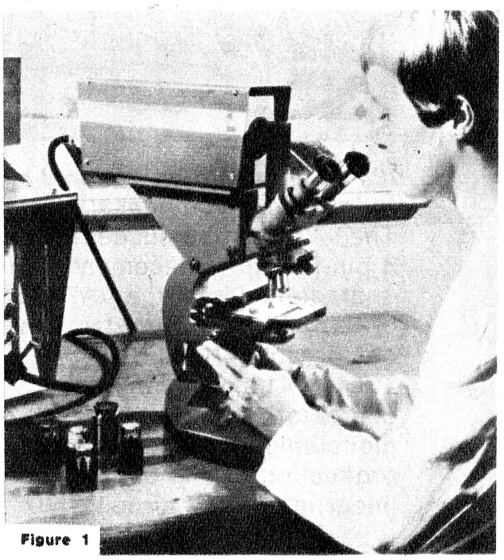


Figure 1

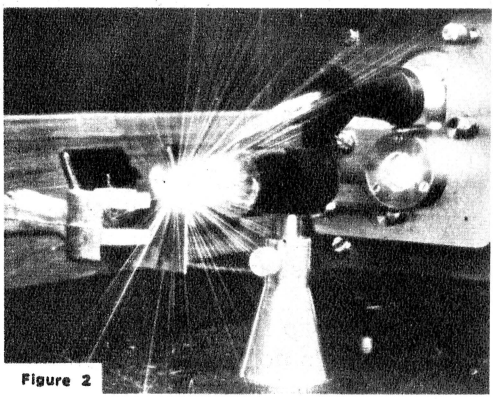


Figure 2

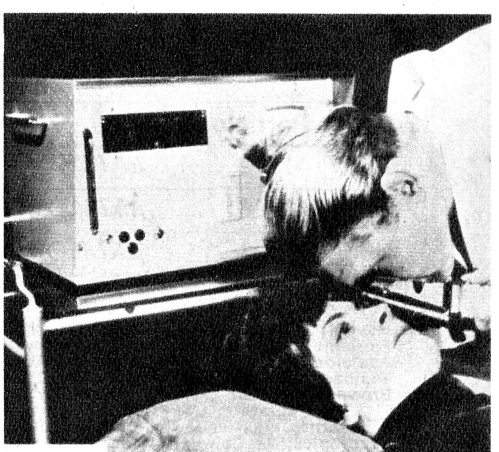


Figure 3



It's a monolithic operational amplifier with built-in frequency compensation

The μA741 is the successor to the μA709 and is a pin-for-pin replacement for it. Performance characteristics of the μA741 far exceed those of the μA709, but the two devices are comparably priced.

The μA741's excellent stability and performance characteristics are the result of proven, monolithic high-yield processes used in the production of all Fairchild Second Generation linear integrated circuits.

Internal Frequency Compensation

You don't need stabilisation components for closed loop operation because the μA741 has internal frequency compensation (using a built in 30pF MOS capacitor).

Short Circuit Protected

The amplifier can withstand indefinite short circuits to ground or supplies because the output stage is current limited.

Latch-up Proof

There's no latch-up when the common mode range is exceeded.

Performance Features

The μA741 has a wide differential input voltage range of ±30V. Offset current is 200nA and offset voltage is 5mV. Input resistance is 300k and output swing is ±12V. Minimum open loop gain is 50,000. Power dissipation is only 50mW with ±15V supplies. A 10k-ohm potentiometer is all you need to zero the input offset voltage. The adjustment range is ±25mV without degrading common mode or power supply rejection. And, there's no internal positive feedback to cause transfer function hysteresis.

Any application using the μA709 can use the μA741

You can use the μA741 any place the μA709 can be used, and, many places the μA709 can't be used. The μA741 can function as an integrator, differentiator, summing amplifier, voltage follower or comparator in such applications as process control systems, analog computers, instrumentation and power supplies. The μA741 is available in a TO-99 package and the μA741C in either TO-99 or Dual in-line.

Operating temperature ranges are:—

μA741	—55°C to +125°C
μA741C	0°C to +70°C

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FE.16

U.K.'s MORTAR LOCATING RADAR

Radar equipment developed for the British Army enables the position of enemy mortars to be determined accurately and rapidly.

by John Marriott

During World War II, half the total casualties sustained by land forces were due to mortar fire. Later in Korea, and now in Vietnam, the mortar has proved to be a deadly weapon; so it is not surprising to find that efforts in Britain have been concentrated on finding the most efficient method of counteracting this unpleasant device. It can be destroyed by gunfire, but the first, and most difficult, requirement is to locate it.

Up until 1944 the only means of locating mortars was by sound ranging, but it is a slow method and was not particularly successful, because the mortar is essentially a highly mobile weapon and can fire a number of bombs very quickly and then move its position before retaliatory fire can be brought to bear.

In 1944 the Allied Forces in Italy started experimenting in the location of mortars by the use of anti-aircraft fire control radar and some success was achieved.

As a result of the Korean war, Britain realised that a special radar was required. The Army evolved a specification requiring rapid and accurate mortar location in all weathers and in 1955 a development contract was awarded to E.M.I. Electronics Ltd. In 1962 the British Army took delivery of its first radar specially designed for mortar location and it is still giving valuable service. It is officially known as FA No. 8 Mk I, but is more commonly known as Green Archer.

The principle of mortar location is simplicity itself. The radar projects a beam slightly inclined above the horizontal. When a mortar bomb passes through the beam it is detected and its position accurately found. The beam is then elevated ready to catch the bomb at a higher point in its trajectory. A second detection of the bomb is then made and its position noted, together with the time between the first and second detections. From this information it is possible to calculate the trajectory of the bomb for this portion of its flight. If this trajectory is then projected backwards, the position where it touches the ground will be the position of the firing mortar.

Briefly, the system operates in the following manner: The radar uses a PPI (plan position indicator) type of display, and the associated scanner scans an arc in the general direction of the enemy's known location, with the beam in the lower position. When a mortar shell is fired, and passes through the scanning beam, a "blip" appears on the display. The operator immediately points to the position of the "blip" on the face of the tube with an electronic indicating device, causing a marker to appear which remains until cancelling action is taken. At the same time a timing mechanism is set into operation, and the beam elevates to the higher position. As the shell again traverses the scanning beam, the position is marked as before and the timing device stops. The beam then returns to the lower scanning position.

The operator then aligns two cross wires with both positions in turn, pressing a button as each alignment is made. This passes the position information to the computer. The only other information that has to be manually fed to the computer is the radar's own position in grid co-ordinates.

On receipt of all information the computer does its sums and finally displays the position of the enemy mortar as a 10-figure map reference. The average time taken to locate a mortar is 30 seconds.

In the British Army, two operators are used, one to set the markers and the other to read off the mortar's co-ordinates and pass them by telephone or radio to the Battery Command Post. The latter controls the artillery fire and, with such a short location time, can bring retaliatory fire to bear before the mortar has time to move.

As a result of experience in the jungle, the British Army decided that a smaller and more mobile version of the locater was required. E.M.I. Electronics were asked to study the problem and they found that with modern methods of light construction, as used in the aircraft industry, and with the use of micro-electronics, it was possible to design something very much lighter but with comparable performance.

The firm found that the greatest proportion of equipment weight was accounted for by the mechanical structures, such as aerial systems, mountings, component housings, bracket and the chassis. The actual weight of the circuit components, such as resistors, capacitors, semiconductors, transformers and so on, was surprisingly low.

The major problems were, therefore, of a mechanical rather than of an electronic nature. Weight was saved here by systematic attention to design details and by the appropriate use of new materials and techniques. Full use was made of integrated circuits and micro-electronics and the designers finally came up with an equipment which was both light and rugged, could be used by semi-skilled operators and which, above all, would be reliable. They called the radar Cymbeline.

Cymbeline consists basically of three main units—the main electronic unit, comprising the transmitter/receiver, timing and ranging circuits, and the computer; the display unit; and the primary power unit.

The display unit contains a 5in cathode ray tube in the form of a "B" scope. A dark fibre-optics face allows daylight viewing and eliminates marking errors due to parallax. The full range over which the radar can operate can be displayed, or alternatively range zones of about 4,000 metres. The full azimuth scan is displayed at all times. It is worth noting that the layout of this display is based on a thorough human engineering evaluation to ensure its effectiveness under all operating conditions.

Also attached to the display unit is an indicator containing two sets of numeral counters—one for setting in the grid reference of the radar and the other for reading out the grid reference

(Continued on page 166)



Green Archer, the first radar system designed specifically for mortar location, and still used by the British Army.

Looking at the World of the Atom

Working with a highly advanced electron microscope, two scientists at the General Electric Research and Development Centre have produced — with greater clarity than ever before — images which correspond directly to the planes of atoms in a crystal and the spaces between them.

Within a crystal, these planes of atoms are incredibly close together—only a few Angstrom units, or about ten billionths (U.S.) of an inch, apart. Spacings of this size are much too small to be seen under an optical microscope, since light waves are about a thousand times too long to resolve them. But this basic limitation can be overcome by taking advantage of the very short wavelengths of the beam of electrons in an electron microscope.

Using a Philips EM300 electron microscope, Dr. Victor A. Phillips and John A. Hugo examined specially prepared crystals of germanium and silicon. The scientists were able to magnify interplanar spacings 500,000 times with such good image quality that they could be enlarged photographically another 40 times without becoming intolerably fuzzy.

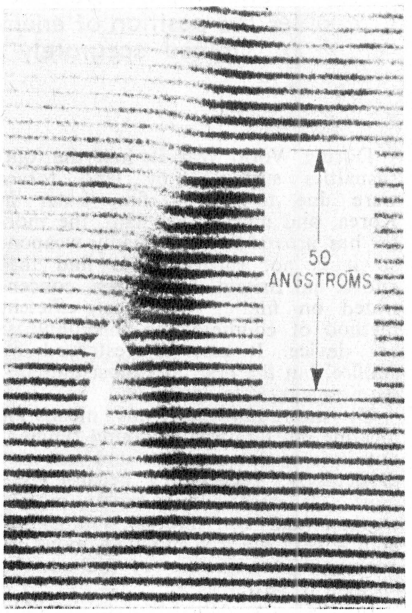
The resulting pictures are so sharp that tiny defects in the lattice of a crystal can be seen as slight variations in the regularity of the spacing between planes. In one picture, for example, the type of defect known as dislocation shows up very clearly as an extra plane which distorts several neighbouring planes where it terminates — much as an out-of-line row of cars distorts the pattern of a parking lot.

For a group of their electron micrographs, Mr Hugo and Dr Phillips recently were awarded first prize in an exhibit sponsored by the Electron Microscopy Society of America.

The ability to observe imperfections in crystals is of great practical importance. Various kinds of lattice irregularities and impurities bear directly on the usefulness of materials in all sorts of mechanical and electrical applications. They can play a dominant role in determining the strength and hardness of metals and ceramics, for example, and they are crucial to the inner workings of such solid-state devices as transistors and switches without moving parts.

In their studies, Dr Phillips and Mr Hugo have been using what has come to be called the "two-beam" technique, a procedure introduced in 1963 by W. C. T. Dowell, now with the Commonwealth Scientific and Industrial Research Organisation in Melbourne, Australia.

The term "two-beam" refers to the fact that the image is formed by combining two beams of electrons. These are two of the many beams which emerge from one face of a thin sample when the other face is irradiated by the beam of the electron microscope. One is the central, undeviated beam, and the other is one of the beams that are reflected at various angles by planes of atoms in the crystal in such a way that parallel atomic planes act as a diffraction grating. (See photograph.)

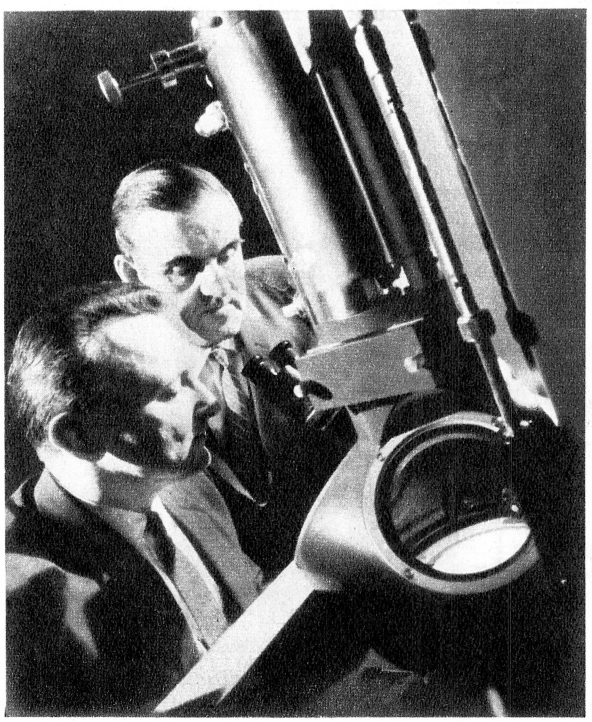


An electron micrograph produced by the "two beam" technique, showing a lattice defect only one atom wide in a crystal of germanium. The extra plane of atoms (arrowed) terminates at a type of defect known as a dislocation. The photograph is said to be the sharpest yet taken of a dislocation by the two beam method.

When used to produce an electron-diffraction pattern, the diffracted beams form an array of spots around the image of the central beam. In "two-beam" electron microscopy, on the other hand, all but one of the diffracted beams are blocked out. This single diffracted beam is then combined with the central beam by the magnetic lenses of the electron microscope to form an image of the crystal grating. In many respects, the grating image represents a view of the edges of the corresponding atomic planes.

Before a crystal can be made to reveal its interplanar spacings, it must be sliced very thin—thinner than 500 Angstroms—and it must be oriented very carefully. In their studies of selected planes in crystals of germanium and silicon, Mr Hugo and Dr Phillips obtained highly purified samples and used a diamond saw to cut slices in the appropriate directions. The scientists then erased the saw's damage by further thinning the slices chemically.

The end result makes it possible to examine such important structural details of crystalline materials as the boundaries between crystal grains and defects within the grains. ■



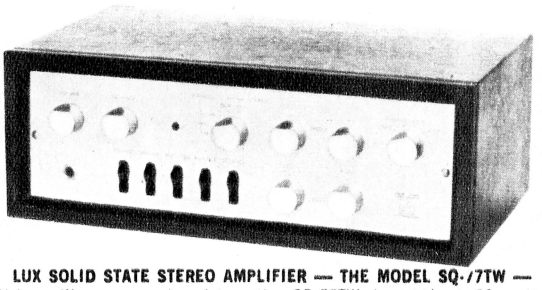
Dr. Victor A. Phillips (right) and Mr John A. Hugo with the highly advanced electron microscope with which they have resolved interatomic spacings in crystals with greater image clarity than ever before. The electron microscope is a Philips EM300 instrument.

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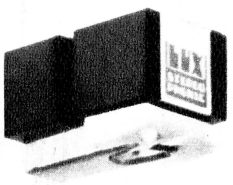
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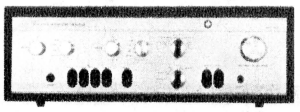
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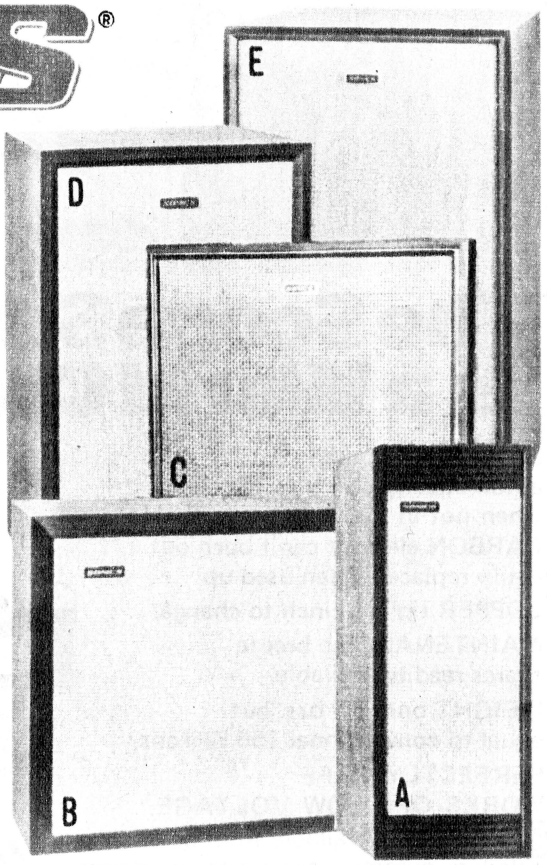


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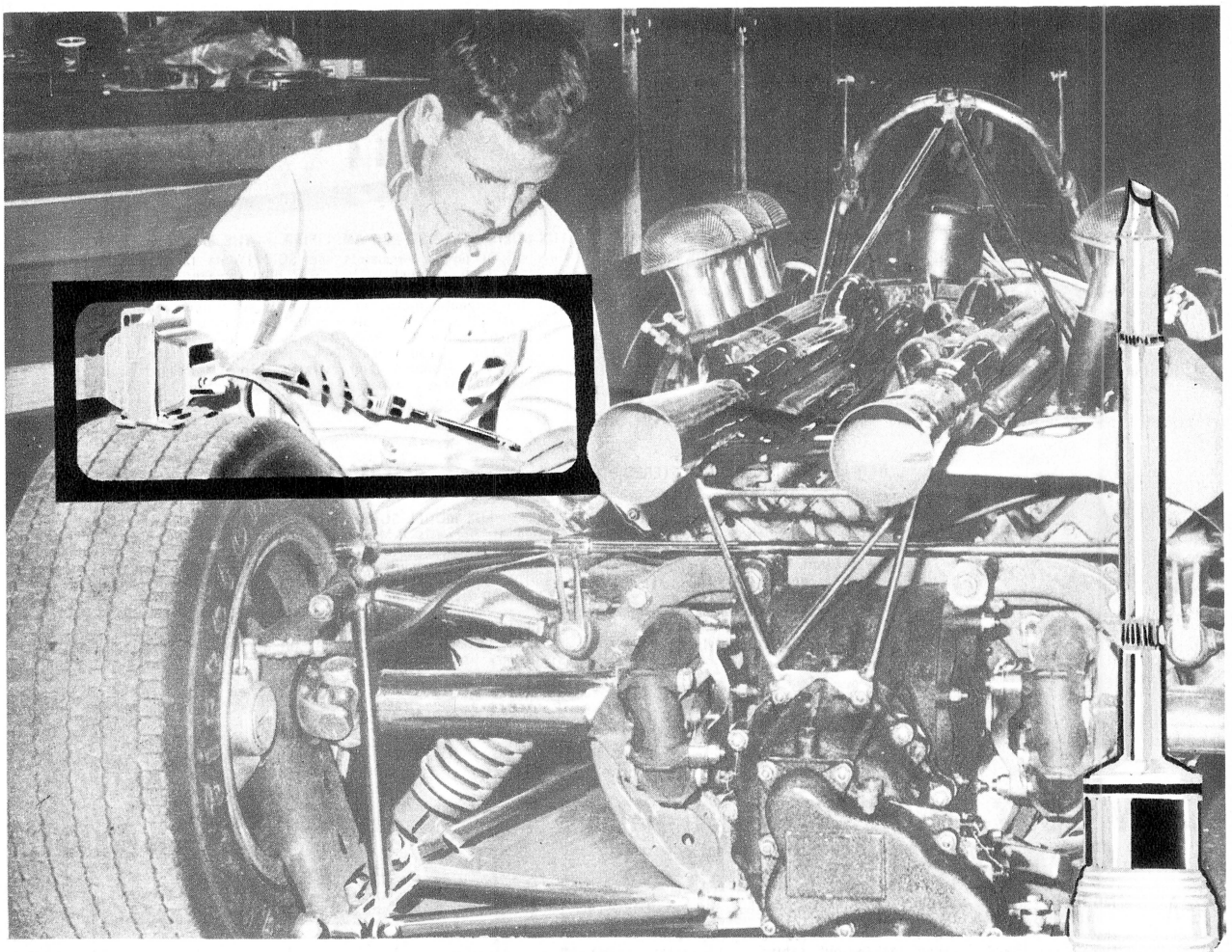
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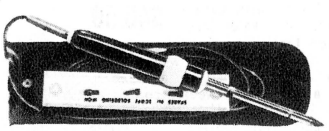


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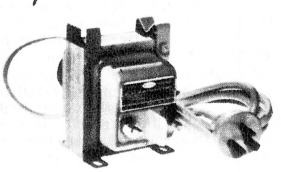
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Commonwealth Co-operation in Broadcasting

Co-operation among member countries of the British Commonwealth in the fields of broadcasting and television has provided major benefits for the developing countries.

by Ernest Chisholm Thomson

Some of the countries which now have flourishing broadcasting and television networks would not have had them as early, or as well organised, if Commonwealth partners had not given practical and material assistance. Perhaps more importantly, they could not have developed so fast and so well had they not had the benefits of such systems. Broadcasting, in either sound or vision, provides not only entertainment and news, but also practical information and mass education that leads to the prevention of disease, to improved techniques in many fields and to higher living standards.

Benefits like these have been won largely by a growing spirit of co-operation within the Commonwealth. At the hub of this intimate relationship is the Commonwealth Broadcasting Conference — a voluntary association of national broadcasting organisations whose delegates now meet in a different Commonwealth country every two or three years.

The progress of the relationship can be gauged from the growing attendance.

Whereas the first conference — in London in 1945 — represented only six countries, the seventh, in New Zealand in February, 1968, had delegates from 17 countries: Australia, Britain, Canada, Ceylon, Cyprus, Ghana, India, Jamaica, Kenya, Malawi, New Zealand, Nigeria, Pakistan, Singapore, Tanzania, Uganda and Zambia.

The broadcasting organisations in these countries are run in various ways. Some are government departments, some are public corporations, others are financed from licence or advertising revenue. But all would claim to be inheritors and guardians of the tradition of broadcasting as a public service — a tradition established by the BBC more than 40 years ago.

The ideal of mutual help has been the thread running through all the conferences — in Britain in 1945 and 1952, Australia in 1956, India in 1960, Canada in 1963, Nigeria in 1965 and New Zealand in 1968. What the delegates strive for is professional improvement, both in programs and technical expertise, by pooling experience.

It is in the training of staff that Commonwealth broadcasting co-operation takes perhaps its most influential form. Countries longest established in the radio and television arts place their knowledge at the disposal of those newest to the medium. Since 1952, for example, the Australian Broadcasting Commission has operated a scheme of training under the Colombo Plan, involving well over 100 broadcasters from 11 Commonwealth territories in Asia. In 1960 the Commission began radio and television courses for rural broadcasters from Asia and Africa, and a recent training scheme caters for broadcasters specialising in education.

The Canadian Broadcasting Corporation has concentrated on helping to start national television services in Ghana and Malaysia, sending CBC staff to those countries. Ghanaian and Malaysian broadcasters have meanwhile been on study attachment to Canadian television stations along with students from Nigeria and Uganda. New Zealand, too, has welcomed Commonwealth broadcasters on training attachment.

A major share in Commonwealth training schemes has been borne by the BBC. Since 1954 about 300 staff from Commonwealth countries have been trained by the BBC as producers and schools broadcasters. The Corporation has now established a television studio in London specially for tutoring overseas producers and directors. About 40 trainees a year learn under actual operational conditions.



Three Zambians on a training course with the BBC in London set up a taped broadcast under the guidance of Mr Geoffrey Seymour, Overseas Training Organiser. They are (left to right) Mr Jethro Hamombe, Mr Agrippa Njumgu and Mr Martin Luo.

The BBC also allows the free use of its studios by the Centre for Educational Television Overseas, an organisation established in 1962 with headquarters in London to promote the use of television for the education of adults and children in the developing countries. Financial support comes largely from the Nuffield Foundation, the British Government, and the independent television companies.

The value of radio and television as teaching mediums was stressed at the 1968 Commonwealth Broadcasting Conference. In urging its members to keep their educational broadcasting policies continually under review, the conference set about organising a regular interchange of information on teaching developments.

Such interchanges are not only mutually helpful but conducive to independence. At the sixth conference in 1965 it was noted that a principal concern of Commonwealth broadcasters should be "to reduce and eventually to eliminate their dependence on training overseas." Many of them have now established their own training schools.

To the Commonwealth peoples as a whole the immediately obvious field of co-operation lies in the vast interchange of programs, both radio and television. Scarcely a day goes by when Commonwealth broadcasters are not collaborating with their colleagues elsewhere.

In radio one of the crowning events each year is the Commonwealth Day broadcast, when one country presents a special program about itself and distributes it to the others. In 1966 Radio Malaysia were the sponsors: in 1967 — Canada's centennial year — the program was presented by the Canadian Broadcasting Corporation; in 1968 the Ceylon Broadcasting Corporation told their country's story.

Most Commonwealth television organisations subscribe to Visnews, the Commonwealth newsfilm agency which supplies a service of filmed news events throughout the world. Transcriptions of radio and television programs are widely exchanged.

Programs are sometimes produced in partnership, an outstanding instance being a 90-minute television drama, "Kain," set in the Australian outback and produced as a joint venture by the Australian Broadcasting Commission and the British Broadcasting Corporation in 1967.

Shared radio coverage of international sporting events is an everyday feature of Commonwealth co-operation. Television coverage is increasingly shared, too, as more and more use is made of videotape, films and relays by satellite.

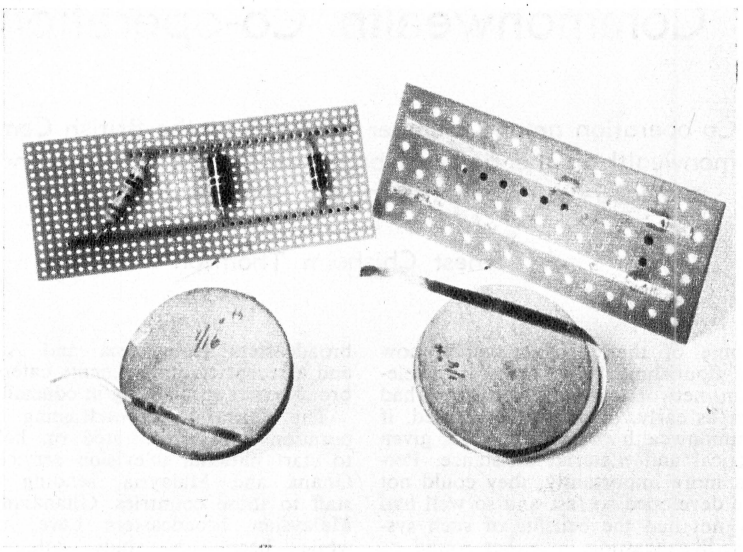
Every meeting of the Commonwealth Broadcasting Conference has been a milestone in the progress of co-operation. All the signs go to show that the tradition will be fully maintained at the eight conference in 1970, in Jamaica.

DESPITE the initial reservations felt by many people, particularly with reference to servicing, the printed circuit is now firmly established in most types of electronic equipment, ranging from the incredibly cheap pocket radios that have flooded the country in recent years, to some of the most sophisticated professional equipment available. Its origins lie in weaponry — a heritage unfortunately common to many good "electronic" ideas, but printed circuitry is, and indeed has been for some time, an attractive system for the amateur who constructs his own equipment, for it solves the mechanical problems of component mounting and eliminates the chores of wiring — as well as facilitating a neat and workmanlike job. For the amateur who has so far shied away from etching his own boards, a new system is now available, which is both economical and easy to use, yet with care, is capable of excellent results. Known as **Cir-kit**, the system utilises bakelite boards, similar to those used commercially, in conjunction with self-adhesive copper strip. This is 1/16in or 1/8in wide — easily cut with scissors or a model knife — and attaches to the boards rather like a piece of **Sellotape**. The adhesive is very efficient, although the bond is not quite as good as that on pre-laminated boards — which means that care is needed when soldering not to overheat the copper. However, anyone who is competent to solder a transistor or capacitor without causing damage should have no trouble, and the adhesive improves with aging, so that long-term stability is satisfactory. Layouts can normally be planned using the theoretical circuit diagram as a guide, and boards may be pre-punched or drilled according to requirements. With the pre-punched board, the strip can either be laid over the holes, and then punched through with a small drill or a watchmaker's screwdriver, or it can be laid alongside the holes and component leads are inserted through the board, folded over and soldered (see photo). The former method permits a more compact layout.

A few tips on planning layouts. Always be sure that the component spaces you allocate are adequate — it is preferable to purchase the bits before embarking on this task, although capacitors are available in literally dozens of shapes for board mounting and resistors are more or less of standard size, dependent on ratings. Avoid siting adjacently on to your layout components which are in different stages —as this can lead to instability. If instability does occur, of course, **Cir-kit** does permit alterations to be made, although it is as well to investigate the problem before redesigning sections of the board for it may not prove necessary.

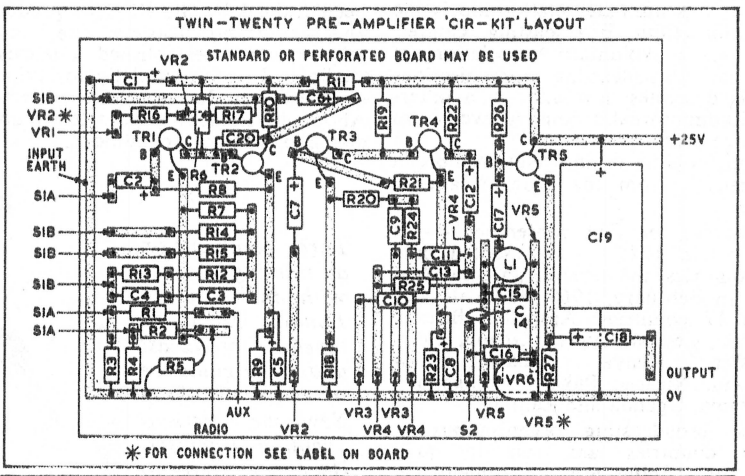
The excellence of the system, however, lies in its versatility, for it enables the home constructor to produce a wiring board on a one-off basis for most of the circuits described in this and other journals, and while it will no doubt encourage many to "try their hand," it will also enable many who already build their own equipment to achieve neater, more reliable results with a minimum of fuss.

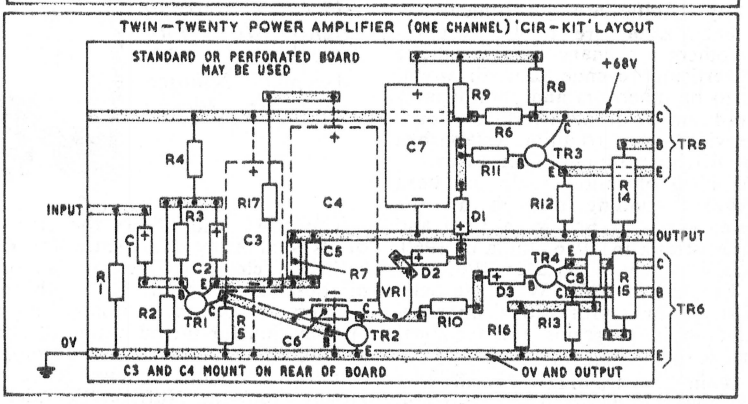
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INSTANT CIRCUITS

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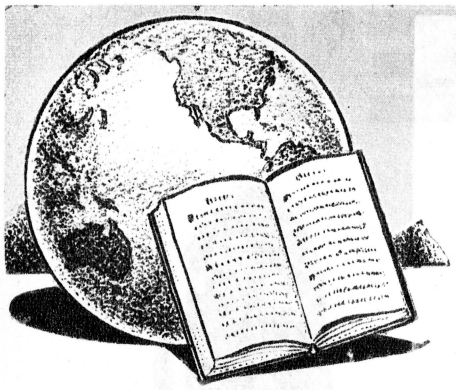


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Technical Review

Computer Plots Race Yacht's Daily Course

On Saturday, June 1, 1968, 43 entrants in a single-handed transatlantic sailing race left Plymouth, England. Less than 26 days later Geoffrey Williams sailed the Sir Thomas Lipton into Newport, U.S.A., to win.

The race was the third of a series, the proceding two being held in 1960 and 1964. Geoffrey Williams had been planning to enter for some years and had given much thought to the matter of choosing the best course to sail the Atlantic.

He first approached International Computing Services Ltd. early in 1967 and suggested that a computer could be programmed to take into account the weather forecast and compute a recommended course for each period of 24 hours. The result of the discussion was that ICSL agreed to develop the program and run it for him on each day of the race.

As the computer could not plan a course in detail the idea behind the program was that it should be used to provide a strategy for each day of the race. The strategy would be quite simple and consist of two or three straight runs, with one or two changes of heading. Williams would use the strategy as a guide and make adjustments in the light of circumstances.

In principle the computer program was simple. The computer calculated how far along each of a number of alternative courses the Sir Thomas Lipton could sail in 40 hours. It worked out about 150 courses, and then printed details of the best few which became the strategies transmitted to Williams. The calculation took some three or four minutes on a KDF9; to do it by hand would have taken between 24 and 36 hours of continuous work, if mistakes were made.

Two programmers spent some three months in planning and writing the program which would allow the KDF9 to make the calculations wanted. Sailing characteristics were measured in a number of trial runs before the race started and regarded as a series of graphs which allowed the speed of the boat to be obtained for each heading of the boat, relative to the wind and for each of a number of ranges of wind speed. A typical graph is shown in figure 1. The graphs were built into the program as a set of tables.

For each daily calculation the first action of the computer was to read a punched card which contained data giving the position, speed and heading of the Sir Thomas Lipton at 0700 hours GMT. From this it was a straightforward calculation to determine the position of the boat at the time at which the computer run was made. Then, a fan of possible courses was set up within the computer, in the pattern shown in figure 2. The starting position of the fan was the current position of the boat and the fan was orientated in a direction parallel to the initial great circle course from Plymouth to Newport, the shortest distance across.

Each course which the computer considered followed one of the rays and subsequently turned on to one of the parallels. The 150 different courses, each consisting of two legs, were generated by choosing rays of 13 degrees apart and parallels 20 nautical miles apart. However, if at some stage it appeared that the boat would be heading into the wind on the second leg a port or starboard tack was made, thus producing a course of three legs.

The program also incorporated some limits on the deviation from the initial great circle, to prevent it from attempting to route the Sir Thomas Lipton into the coast of Newfoundland or into the unfavourable Gulf Stream.

The weather forecast was obtained each day on magnetic tape from the Meterorological Office at Bracknell. It gave forecast data at each of about two thousand points spread across the North Atlantic. The tape contained fresh data for every six hours, usually covering a period of 48 hours starting at the previous midnight. For each of the two thousand points, thirteen separate items of data were provided. However, the program required only two, the wind speed and direction.

From this information, and referring to the tables containing the sailing characteristics, the program calculated the points which the Sir Thomas Lipton could reach on each of the 150 courses in a time of 40 hours. This made maximum use of the weather forecast data, which was eight hours old by the time it was used. Courses were then simply evaluated on the basis of the distance from the final points to the finish of the race at Newport. The program was usually allowed to print out the best six, although no more than three were used. ("Spectrum" No. 55, 1968.)

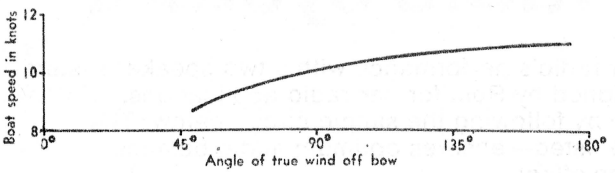


Figure 1 (above). The sailing characteristic of the Sir Thomas Lipton in a wind force of 5-6.

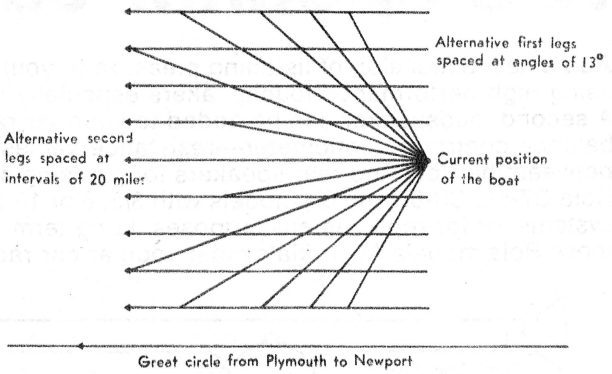
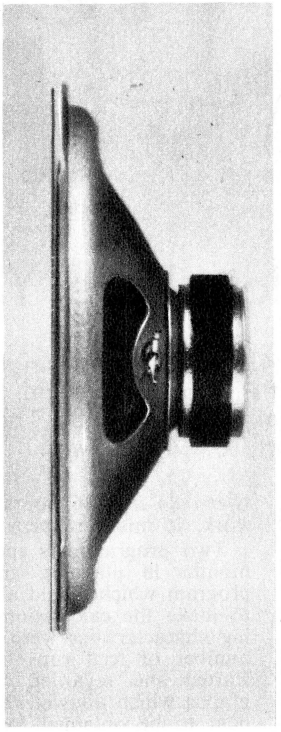
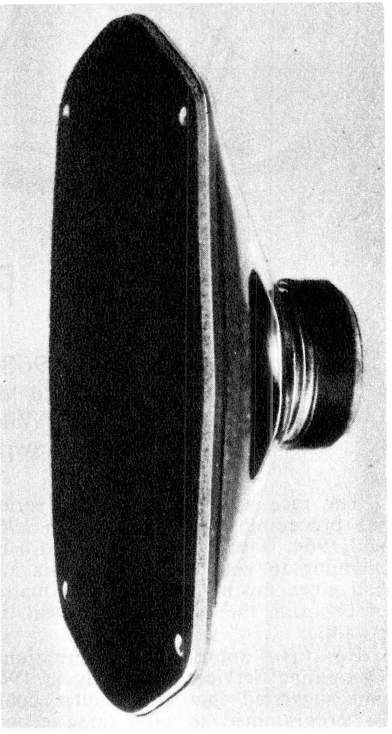


Figure 2 (right). The courses considered by the program.

PLESSEY

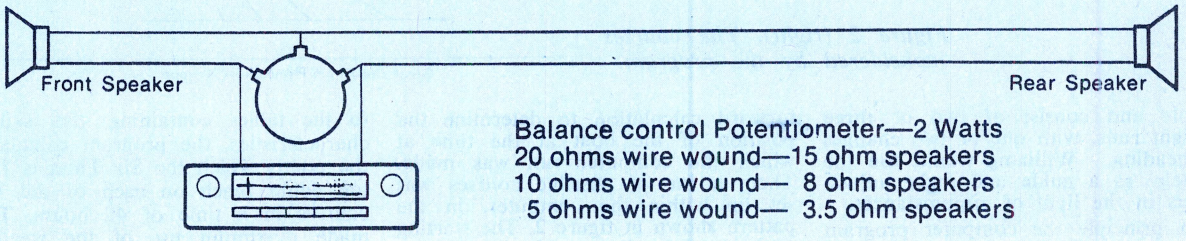






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IMAGE INTENSIFIER TUBE FOR NIGHT VIEWING

The latest developments in electronic aids to vision have resulted in instruments that can make visible objects whose illumination is only one ten-thousandth of that required for normal vision.

Unlike earlier image intensifier tubes which used a source of infrared radiation to illuminate the object or scene being observed, the Mullard XX1060 three-stage image intensifier assembly is completely passive. Starlight, or even faint sky glow, will produce sufficient light for a visible display when completely imperceptible to the naked eye.

The XX1060 series of image intensifiers improves on the best performance of the unaided eye by a factor of some 10,000 times, and does not require the observer's eye to become dark-adapted.

The tube was originally produced in close collaboration with British government research establishments for military purposes, but there are other fields of activity in which it may also offer important advantages.

Possible applications include viewing fluorescent screens excited to very low luminance levels by X-rays or electrons as in electron microscopes, navigation, aerial reconnaissance, space and underwater exploration, improving the effectiveness of astronomical telescopes, nature studies of nocturnal animals, and aiding police and security organisations in night surveillance.

The tube also makes possible the use of closed circuit television in conditions of very low ambient lighting. When it is advantageous for the observer to be remote from the viewing instrument, a television camera can be coupled optically to the intensifier. Such a system makes viewing possible in an environment which may be hazardous. It also allows a number of observers to view a scene simultaneously, or one observer to monitor displays of several scenes.

The aim of any image intensifying instrument is to provide sufficient intensification for the observer to register on his retina an event for every photon recorded at the photo-cathode of the intensifier, even though the eye may not be working in its most sensitive condition.

The simplest form of image intensifier is a vacuum tube with a photocathode on the input window and a fluorescent screen on the output window. A light image on the photocathode releases photo-electrons which, when a voltage is applied to the tube, are accelerated to the fluorescent screen. At the screen, the energy of the electrons is converted into light. If the electron image formed at the photocathode is focused on to the fluorescent screen, then the light image on the photocathode is reproduced on the screen. Because each photon falling on the photocathode gives rise to some tens of photons at the fluorescent screen, a gain in image intensity is achieved.

Image intensification is achieved in the XX1060 series of image intensifier assemblies by coupling a number of image-intensifier stages in cascade. The output of the phosphor of the first intensifier serves as the light source for the input of the second and so on.

These stages could be coupled with lenses, but these would need to have a high efficiency and would therefore be bulky. In addition, they would be incompatible with the curved screen and photocathode needed in electrostatically focused image intensifiers for the best picture quality. Both these disadvantages can be overcome by the use of fibre-optic windows. The arrangement is then as shown in figure 1.

All that is needed to operate the electrostatically focused tube is a source of EHT potential. In the XX1060 series, a Cockcroft-Walton ladder EHT voltage multiplier is built into the assembly. The connection between the second and third intensifier stages is via a high-value resistor. This is to limit the brightness of the final stage and prevent discomfort to the observer in the event of the scene illumination rising unexpectedly.

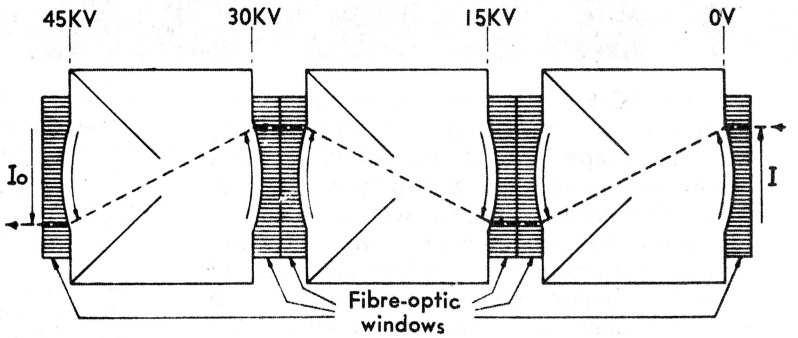


Figure 1. Schematic diagram of cascaded intensifier stages with fibre-optic windows.

The tube and power supply are encapsulated in silicon rubber and the whole mounted in a close-fitting plastic tube.

During the development of the XX1060 series of image intensifiers, the prime application under consideration was a military direct-viewing night-vision system. Consideration had also been given to the use of the image intensifiers in a remote-viewing system employing television techniques.

The direct-viewing night-vision system consists of an objective lens which forms an inverted image on the photocathode of the XX1060. This inverted image is reproduced, erect, on the output screen of the intensifier. A magnifying, non-inverting eye-piece is used to view the intensifier image. Such a system is shown schematically in figure 2.

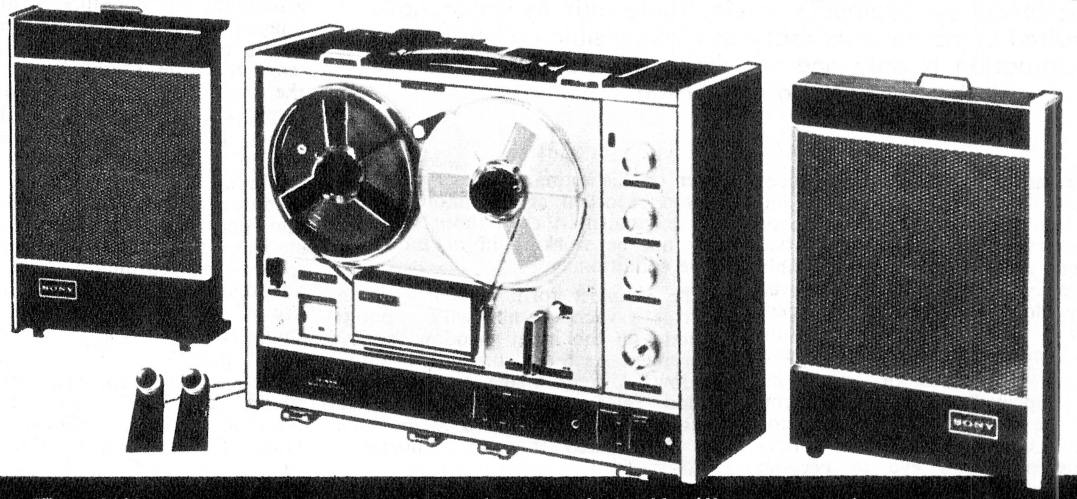
A prototype field-test equipment is shown in both photographs. This equipment employs a reflective objective optical system of the Schmidt type.



Miss Daphne Lamport, B.Sc., A.R.C.S., project leader of the group at Mullard Research Laboratories responsible for the early development work on the tube, demonstrates a prototype night viewing equipment.

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Specifications

Recording system: 4-track stereo/mono recording and playback. **Power requirements:** 100, 110, 117, 125, 220 or 240V AC 65 watts, 50/60 Hz. **Tape speeds:** 7½ ips, 3¾ ips, 1⅞ips. **Reels:** 7″ or smaller. **Frequency response:** 30-20,000 Hz at 7½ ips • 30-13,000 Hz at 3¾ ips • 30-10,000 at 1⅞ ips. **Flutter and wow:** 0.09% at 7½ ips • 0.12% at 3¾ ips • 0.16% at 1⅞ ips. **Harmonic distortion:** 2%. **Signal-to-noise ratio:** 50dB. **Power output:** 5W per channel (20W total dynamic power). **Speakers:** Two built-in speakers 4″ x 8″ and two lid-integrated speakers 4″ diam. **Recording time (1,800′ tape):** 4-track stereo 6 hrs. at 1⅞ ips • 4-track mono 12 hrs. at 1⅞ ips. **Fast forward and rewind time:** Within 2 min. 20 sec. (1,200′ tape). **Inputs:** MICROPHONE • Sensitivity —72dB (0.19mV) • Impedance 600 ohms LINE • Sensitivity —20dB (0.078V) • Impedance Approx. 100k ohms. **Outputs:** LINE • Sensitivity 0dB (0.775V) • Impedance 100k ohms EXTERNAL SPEAKER • Sensitivity 11.2dB (2.83V) • Impedance 8 ohms MONITOR • Sensitivity 11.2dB (2.83V) • Impedance 8 ohms (or 10k ohms). **Rec/PB connector:** INPUT—Sensitivity —40dB (7.8mV), Impedance 10k ohms OUTPUT—Sensitivity 0dB (0.775V), Impedance 10k ohms **Dimensions:** 19-11/16″ x 9-15/16″ x 15-7/16″. **Weight:** 41 lbs. **Accessories:** Two microphones F-96, empty reel R-7A, connection cord RK-74, two reel caps, motor pulley, power cord, head cleaning ribbon, splicing tape PS-2, demonstration tape, SONY oil OL-1K. **Optional accessories:** Telephone pick-up TP-4S, microphone mixer MX-600M, MX-6S, stereo headset DR-3A, DR-3C.

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From the results obtained with this equipment, the performance of other systems using different lenses was estimated.

The objective and eye-piece lenses must be chosen to reproduce objects with the highest possible contrast. Great care must be taken in their design and construction to ensure that stray light resulting from scatter and unwanted reflections is reduced to a minimum.

The final screen of the XX1060 is at a potential of 45KV relative to its cathode and, in order to maintain the lowest background noise, it is desirable for the photocathode to be at the same potential as the equipment. Thus the screen is at 45KV with respect to the eye-piece. Hence, a long working distance between the eye-piece and the XX1060 screen is desirable, or the eye-piece lenses must be mounted in insulating material.

Modern camera tubes have extended the performance of television systems sufficiently for them to be used satisfactorily for outside broadcasts under poor lighting conditions, but they are still not capable of producing satisfactory pictures at night. In a typical vidicon or Plumbicon chain, the lowest light level that can be used is set by the electronic noise in the video amplifier. Even with some of the fastest objective lenses, the video amplifier noise limits the system to scene light levels of 3 lux or more. This performance at low light levels can be considerably improved using an XX1060 series image intensifier assembly coupled to a conventional television system.

A typical experimental remote-viewing night-vision system comprises an objective lens focusing light from the scene on to the photocathode of the XX1060; the high brightness image on the screen of the intensifier is then coupled to the camera tube in the television system by two lenses working face to face for efficient coupling.

A standard multi - purpose camera chain would be used.

In addition to straightforward night-viewing, signal processing could produce the following improvements: Aperture correction would improve the resolution of fine detail at higher light levels; an increased integration time would improve perceptibility, but this would be offset by the reduced ability to observe moving objects; variable gamma would improve effective contrast; picture inversion would allow a negative as well as a positive picture to be produced—a possible advantage in applications such as electron microscopy. Television systems have the further advantages of permitting telemetering and video tape recording techniques to be used.

Comprehensive technical information on the XX1060 image intensifier assembly is available from the Industrial Electron Devices and Components Division of Mullard Australia Pty. Ltd., 35-43 Clarence Street, Sydney, N.S.W. 2000. ("Mullard Outlook," Vol. 11, No. 5. Mullard new product information, XX1060 Series image intensifier assemblies.)

FOUR-LAYERED PAPER DRY CELL

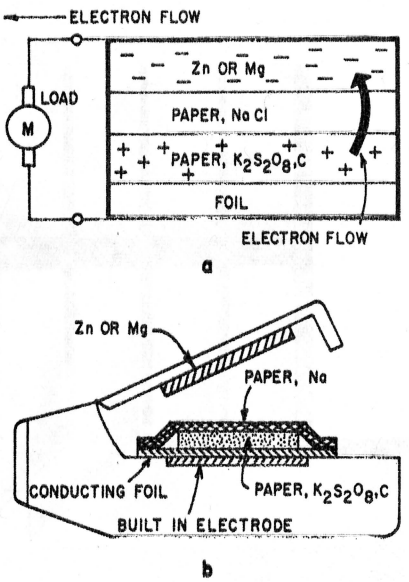
A wafer-thin "energy-paper" cell announced by Norelco of the U.S.A. offers a new source of portable power.

The unique cell, weighing less than one tenth of an ounce, has been used to power a prototype Norelco shaver. It can provide about 1 watt for 6 or 7 minutes.

Cells are moistened before use. Because of the chemicals used and the low internal resistance due to cell thickness (1mm), they have a power density five times that of a normal dry cell. This makes the cells especially useful for brief, high-output applications. For example, a number of cells were joined together to start a car with a rundown battery.

Complete cells have four sandwiched layers, although a three-layer cell is used when one sheet is built into the device to be powered. The top layer, which corresponds to the zinc can in conventional dry cells, is a zinc or magnesium sheet that acts as an electron donor. A dry paper sheet treated with common salt is beneath the donor sheet. The third layer consist of paper impregnated with potassium persulphate and powdered carbon. A conducting foil completes the "sandwich." The addition of water to the salt-treated layer forms an electrolytic solution.

Cost of the basic materials for an energy-paper cell and the capacity per cubic cm are about the same as for conventional everyday-type cells. The cells, developed at the Philips Research laboratories in Holland, were introtroduced by North American Philips Co, who says it has no current plans to mass-produce them. ("Radio-Electronics" October, 1968.)



Four-layered cell (a) has zinc or magnesium sheet covering a dry, salt treated paper sheet. Next layer is paper impregnated with potassium persulphate and powdered carbon. Bottom layer is conducting foil. Shaver (b) can use a three-layer cell; the top layer is built into the shaver.

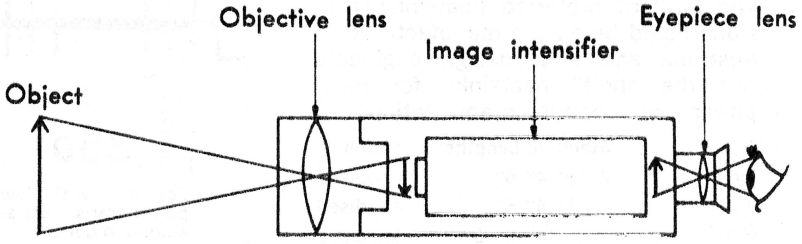
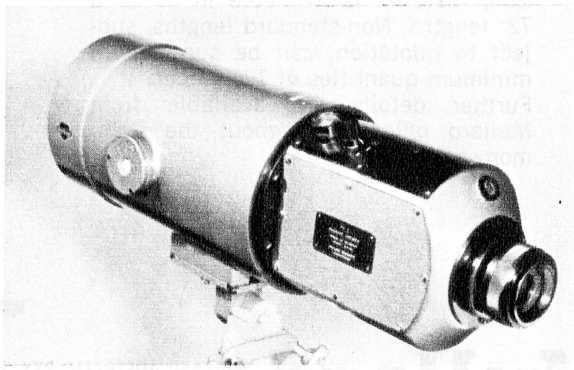
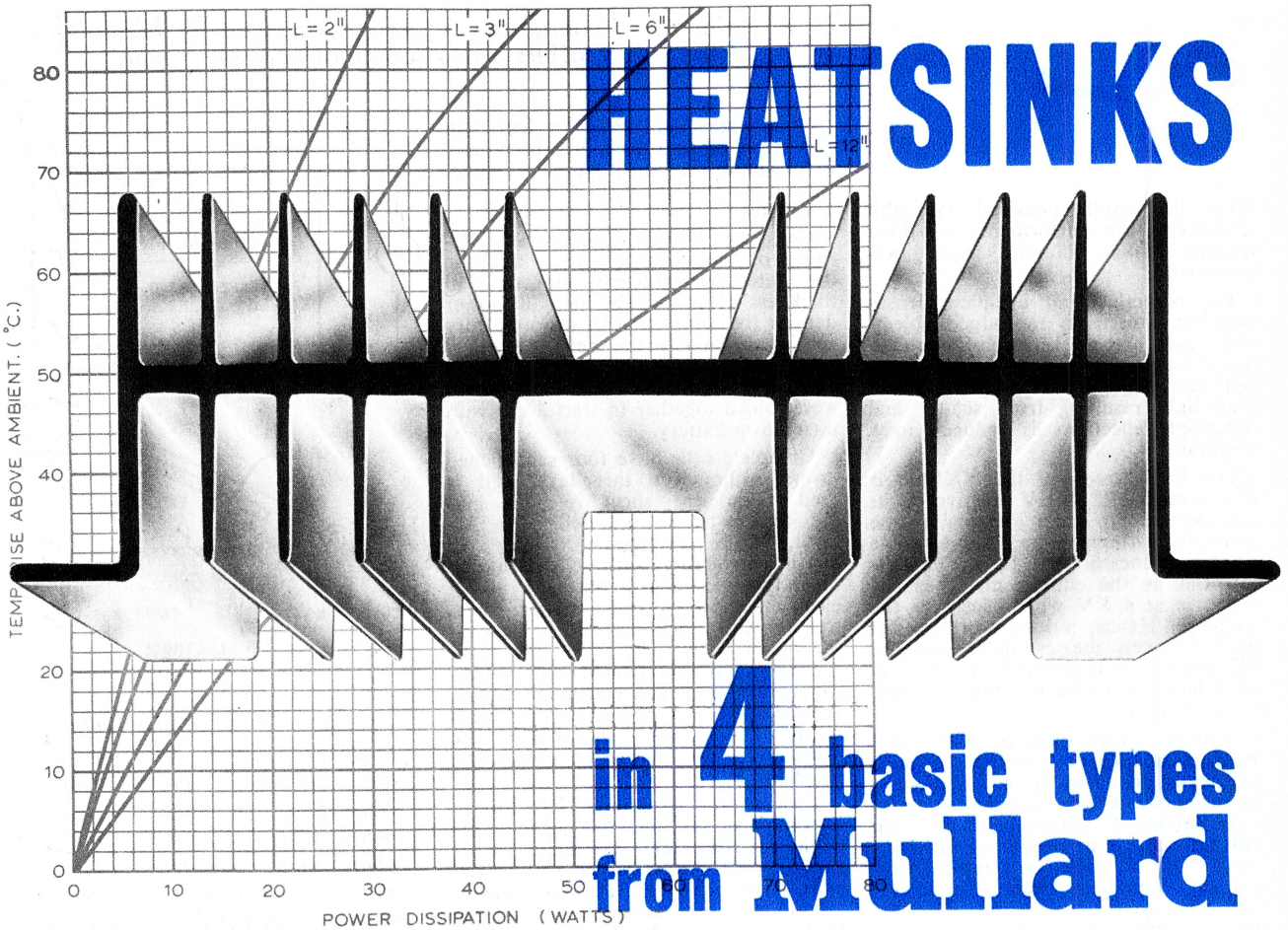


Figure 2 (above). Schematic diagram of direct - viewing night-vision system.



A prototype direct-viewing night-vision system using a Mullard XX1060 image intensifier assembly.



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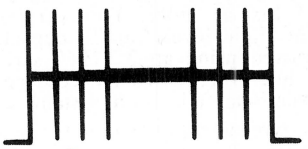
Type	Standard Lengths	Finish
35D	2" 3" 4" 6"	Anodised
45D	3" 4" 6"	Anodised
55D	4" 6" 8"	Anodised
65D	4" 6" 8"	Plain

Bulk material is available in 36" and 72" lengths. Non-standard lengths, subject to quotation, can be supplied in minimum quantities of 100 pieces. Further details are available from Mullard offices throughout the Commonwealth.



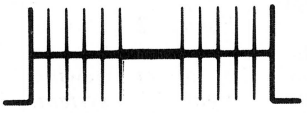
1 35D

For use with lower power transistors and silicon diodes.



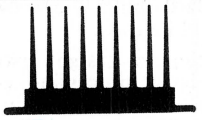
2 45D

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



3 55D

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



4 65D

For use with high power thyristors and silicon diodes under transient current conditions.

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SCIENTIFIC AND INDUSTRIAL NEWS



Advanced IC wins award

An advanced integrated circuit array, developed by Fairchild Semiconductor, was the only IC among the 100 most significant technical products of the year in the Annual National Research Week competition held in New York, U.S.A in October, 1968. Fairchild's winning entry is the 4500 Bipolar Micromatrix Array, a monolithic semiconductor device equivalent to 352 transistors and other components. It incorporates a standard semiconductor base with unique two-level wiring interconnections custom-designed to a customer's specifications. It consists of eight distinct cells on a silicon chip and, apart from its packaging, is no larger than a pinhead.

The competition is sponsored by Industrial Research Inc., of Beverly Shores, Indiana, and is held in conjunction with the National Conference on Industrial Research. The products were selected by a panel of 30 scientists and engineers. Other awards were won by 64 companies, two government agencies, a university and a hospital. Six of the winning entries came from overseas — England, Finland, Japan, the Netherlands, Switzerland, and West Germany.

International design congress

The sixth congress of the International Council of Societies of Industrial Design, to be held in London in September, 1969, will take as its theme "Design, Society and the Future." The congress will bring together members of 47 societies from 32 countries. Details are available from the 69 Congress Secretariat, The International Council of Societies of Industrial Design, 12 Carlton House Terrace, London, S.W.1, U.K.

Sweden's colour TV service

The Swedish Telecommunications Administration has ordered 46 colour correction units to be incorporated in existing black and white transmitters to assist in converting them to transmit colour pictures. The units, ordered from The Marconi Company, of the U..K, will be installed in 23 VHF transmitting stations to form part of Sweden's first colour television service, which officially opens in 1970.

Fast charging secondary cells

Researchers in the U.S.A. are investigating ways of safely recharging sealed nickel-cadmium cells, and batteries of such cells, in one hour or less. Rapid charging is made difficult only by the disastrous consequences of high level overcharging according to a paper by Hadley and Carson Jr., of the General Electric Co., U.S.A., presented at the 6th International Power Sources Symposium held in the U..K in 1968. As soon as overcharging begins, heat and gas, internally generated, destroy the cell.

Provided that the charging current stops precisely when the cell is fully charged, the whole process may be accomplished in one second, at greater than 90 per cent efficiency, by delivering a 50A pulse to 10mAH cells. After 100 cycles of full charge and complete discharge there was no electrode damage. In practice, fast charging rates are limited by the size and cost of the charging equipment required to deliver the high currents.

Water separator for spacecraft

A separator which extracts water from a spacecraft cabin's atmosphere to store it for astronauts' use is being tested for the National Aeronautics and Space Administration (NASA) by the Lockheed Missiles and Space Co., Sunnyvale, California, U.S.A. Originally developed by the company's biotechnology department and further refined under a NASA contract, the unit is part of a regenerative life support system designed to supply four astronauts with water and oxygen for up to a year in space. The separator processes cabin air, condensing moisture and, by using two filtering elements, draws water droplets into fresh water tanks and returns dry air to the cabin.

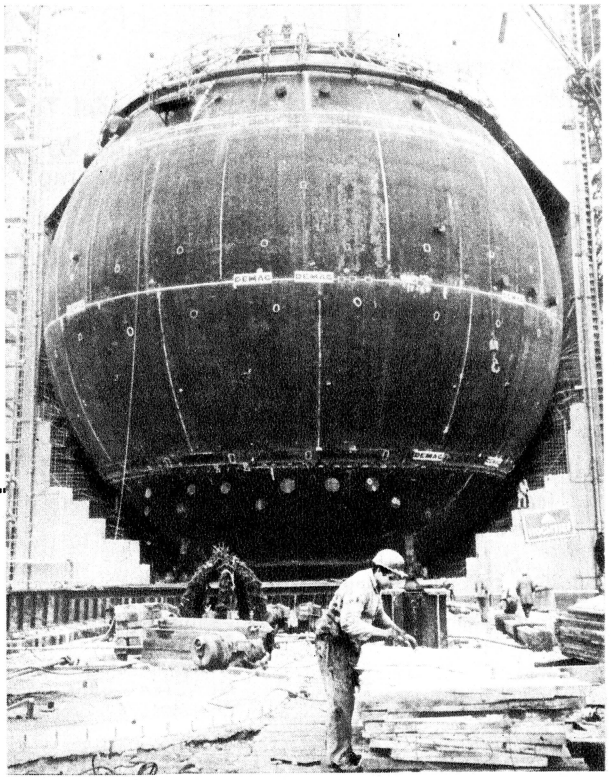
Flight planning by computer

Two new computers are being used by Qantas at Mascot Airport, Sydney, as an everyday office aid, and are already showing big savings through calculation of flight plans. Flight plans are the calculations giving routings, fuel loads, passenger and aircraft weights, operating altitudes and flight times that are worked out for every aircraft flight. The two computers have reduced the time for calculating a complex flight plan from about 45 minutes to about 4 minutes, while at the same time they provide a much wider range of alternatives in their calculations. This means that alternative flight plans can be computed for the aircraft flying at different heights, for example, thereby arriving at the most economic operation for the prevailing conditions.

Apart from producing plans for flights out of Sydney, the computers can also prepare plans for flights out of Perth, Brisbane, Darwin and Port Moresby, and from New Zealand to Australia. The completed plans are sent by teleprinter to the appropriate port. The next stage will be to extend the computer flight-planning service to B.O.A.C. flights in the Australian area.

Giant sphere moved slowly

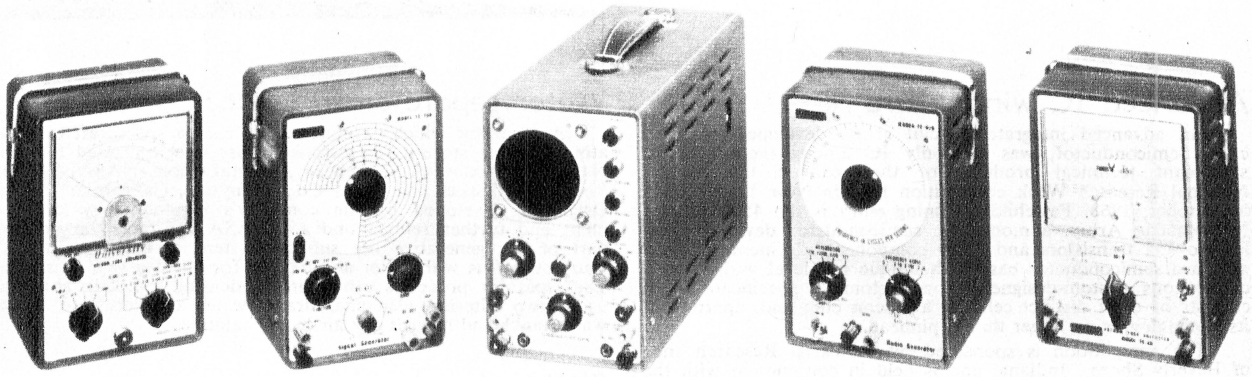
Workmen are dwarfed by a gigantic steel sphere, part of a new nuclear power plant under construction at Wuergassen, Germany. Instead of first constructing the spherical pressure container and then building around it, German engineers saved about eight months' work by doing both projects at the same time. The giant sphere was then moved into the building through a wall left open for it. It took a week to move it at a speed of 14 inches per hour.



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Trade Price $42.00

Model Te-20D Signal Generator

7 Bands 120Kc-500Mc (6 Fundamental and 1 Harmonic) Xtal Socket for: Self calibration or Marker Generator.

Trade Price $36.00

Model UC 3 3" Oscilloscope

Vertical 100mV P.P./CM (at 1Kc) Freq. Char. 1.5 cps to 1.5 Mcs Horizontal 900 mv P.P./CM (at 1Kc). Wide sweep 10 CPS — 300 Kcs Continuously variable.

Trade Price $100.00

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Sine 20 cps-200Kcs. Square 60 cps-30 Kcs. Output 7V max (1K imp) Freq. response + 1.5db 20 cps-150Kcs.

Trade Price $38.00

Model MVA-7 High sensitivity VTVM

Ac volts 1m V-300V 10 ranges. db range-40 to +50db 10 ranges Input impedance 10 meg. Accuracy 5 cps-1.2 Mcs. ± 2db.

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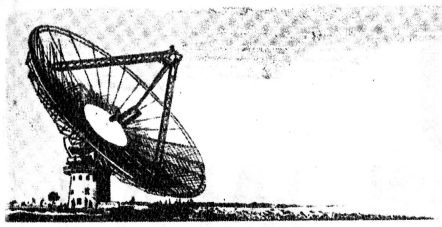
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Conference on artificial intelligence

The first International Joint Conference on Artificial Intelligence will be held at the Statler-Hilton Hotel, Washington, D.C., U.S.A., on May 7-9, 1969. It is anticipated that papers will be presented on the following topics: Theoretical foundations of artificial intelligence; Theorem proving; Heuristic problem solving; Question-answering systems and computer understanding; Man-machine symbiosis in problem solving; Psychological modelling; Linguistic research relevant to artificial intelligence; Integrated artificial intelligence systems; Self-organising systems; Pattern recognition signal processing; Pictorial pattern recognition; Linguistic and contextual methods in pattern recognition; Physiological modelling; Applications of artificial intelligence work.

Further information on the conference may be obtained from Dr Donald E. Walker, IJCAI Program Chairman, The Mitre Corporation, Bedford, Mass. 01730, U.S.A.

P.O. orders mobile phones

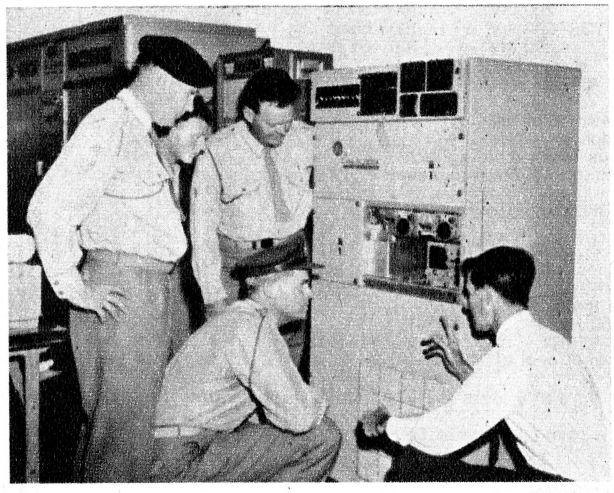
The Australian Post Office has ordered over 500 mobile radiotelephone units, worth nearly $200,000, from Pye Pty. Ltd., of Clayton, Vic. A P.O. spokesman said that the units would be fitted to vehicles used by engineering field staff in all states. Trials have shown that radiotelephones can increase efficiency in the investigation of telephone service fault reports and in routine maintenance. The Post Office has specified a hybrid, or partly solid-state, unit on the basis of easier maintenance in the field, and on proven performance in all climatic conditions.

Creative use of machinery

Large-scale systems for resolving many crucial questions were discussed recently by 300 scientists, mathematicians, engineers and administrators at the National Bureau of Standards in Washington, U.S.A., during the second Annual Symposium of the American Society for Cybernetics. Symposium participants approached cybernetics (the study of control and communication in man and machine) from many standpoints in their search for means to unravel some of the problems of contemporary government and technology.

Further information on the society and its proceedings may be obtained from the Secretary, American Society for Cybernetics, 2121 Wisconsin Avenue, N.W., Washington, D.C. 20007, U.S.A.

Army 10KW transmitter



A new 10KW transmitter being demonstrated to a party of Royal Australian Signals technical personnel by Mr A. Durie, of A.W.A.'s Engineering Products Division. In the background is a conventional 5KW transmitter to show the considerable reduction in physical size in the new equipment.

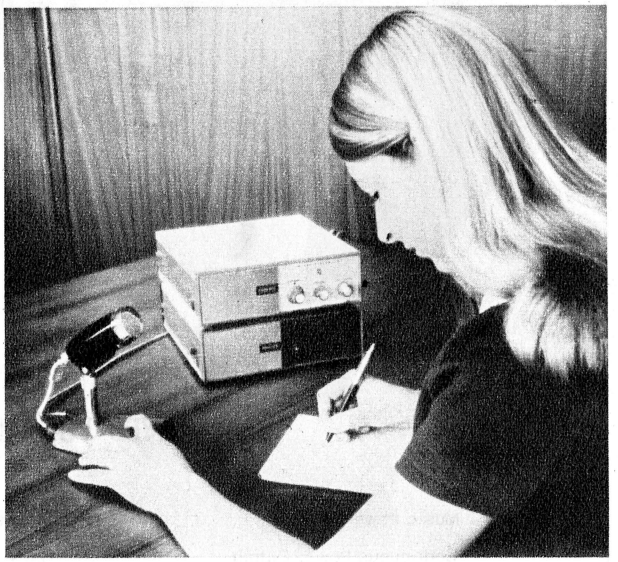
Automatic airport trains

Four automatic trains, each consisting of three eight-passenger cars, travel a 3000-foot loop to carry passengers through the Houston International Airport terminal, Texas, U.S. Each train is a driverless, trackless, battery-powered vehicle guided by electromagnetic signals from wiring embedded in the concrete floor. The trains are programmed to stop at elevators, flight gates and other passenger pickups.

Extension study courses

Commencing in March, 1969, the Division of Postgraduate Extension Studies, University of New South Wales, is presenting a number of courses consisting of a series of lectures to be presented over Radio University VL2UV, Sydney. The subjects of the courses are: Matrices and Geometry; Semiconductor Applications II; An Introduction to Statistics; Accounting for Non-Accountants. Further information of these and other courses can be obtained from the Division, postal address P.O. Box 1, Kensington, N.S.W. 2033.

Compact VHF base station



A compact VHF base station marketed by Philips Telecommunications of Australia Ltd., Alberton, S.A., comprises two units. The top one is a solid state FM radiotelephone (10 or 25 watts), while the lower unit is a regulated power supply. The station is a development of Philips' solid state FM mobile 2-way radio, and is interchangeable with mobile units to simplify system maintenance.

Broadcasting by laser

According to a report in "Wireless World", December, 1968, "A group of people intend to set up in London their own independent radio service, to be known as Radio Love. To avoid coming under the jurisdiction of the current Post Office regulations (which cover frequencies up to 3000GHz), they intend to use a laser beam as the means of carrying information. The idea is to use a gallium arsenide laser with a beam, shaped by a reflector, in the form of a horizontal disc inclined towards the horizon from a height of about 200ft. The laser will be modulated with an RF sub-carrier.

"The receivers will be conventional with the addition of a photocell, housed in a small reflector, that will feed directly into the aerial circuits of the receiver. A representative of Radio Love told us that it is their intention to house the transmitter on top of a tall building in London and to have similar repeater stations to cover shadow areas. The service is planned to start next year, Post Office permitting, covering a radius of three or four miles from Charing Cross."

(It would appear, however, that Radio Love will find it necessary to be licensed under the latest Post Office Bill introduced into the British Parliament. As the Bill stands at present, the Minister of Posts and Telecommunications—to be set up under the Bill—will control, without specifying frequency limits, the use of "electric, magnetic, electro-magnetic, electro-chemical and electro-mechanical" energy for the distribution of sound and vision programs to inform, educate or entertain. Editor E.A.)

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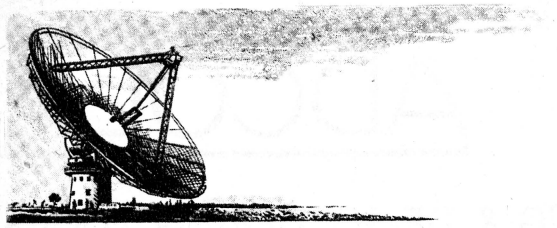
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Music Power Output	44 watts at 4 ohms (distortion below 0.5% at 1 kHz/IHF).		
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Frequency Response	20 Hz to 50 kHz ± 1 dB (AUX)		
Power Bandwidth	20 Hz to 40 kHz (distortion below 0.5% constant/IHF).		
S/N Ratio	PHONO	75 dB (volume; maximum, tone; flat,	
	AUX	90 dB at the rated output).	
Inputs and Gain, Input Impedance (at 1 kHz)	PHONO	2.5 mV	47 kohms
	TUNER	200 mV	100 kohms
	TAPE MONITOR	200 mV	100 kohms
	AUX	200 mV	100 kohms
Damping Factor	Better than 40	at 8 ohms (at 1 kHz)	
Output Terminals and Jacks	Speakers: 4 to 16 ohms Stereo headphone jack Simultaneous tape recording jack Tape recording/playback connector (DIN standards)		
Equalization Curve	PHONO	NFB type RIAA	
Tone Controls	BASS	-13.5 dB to + 13 dB (at 50 Hz)	
	TREBLE	-11 dB to + 8 dB (at 10 kHz)	
Loudness Contour	Switchable to ON - OFF +12 dB at 50 Hz +5.5 dB at 10 kHz (at the volume level of -40 dB)		
Residual Noise	Less the 0.7 mV at 8 ohms (volume: minimum, tone: flat)		
Power Consumption	65 VA, 55 W (Max) 240 volt 50 Hz		

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ITU activities in 1968

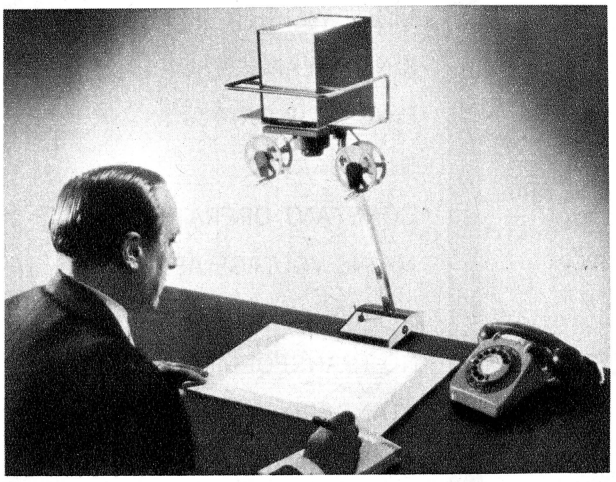
The number of countries who are members of the International Telecommunication Union (ITU) increased from 133 in 1967 to 135 in 1968 after the accession of Botswana on 2 April, 1968, and the People's Republic of Southern Yemen on 15 August, 1968. The ITU, founded in 1865, is now the specialised agency of the United Nations for telecommunications, with its headquarters in Geneva, Switzerland.

An international working party was formed to study the use of the geostationary orbit for communication satellites. A draft study program was adopted looking forward to the possible use of frequencies above 10GHz for satellite communications. A seminar on frequency management and the use of the RF spectrum was held, attended by representatives of 37 member countries. The influence on telecommunications in general of developments in terrestrial and satellite radiocommuncations was also discussed.

The program of technical assistance was continued during 1968, and three seminars were held. The first, held in the U..K, was on "Communication earth station planning and operation"; the second, in Japan, was on "Recent progress in microwave systems and techniques"; the third, held in the Federal Republic of Germany, was on "Technique and operation of multiplex telegraphy systems." A number of training courses were organised by ITU member countries.

The administrative council of the ITU at its 23rd session agreed to convene a world conference during the latter part of 1970 or early 1971. The proposed agenda includes the following items: to revise regulations for the space radio and radioastronomy services to ensure the efficient use of the RF spectrum; to consider the regulations pertaining to the aeronautical and maritime mobile services and to navigation insofar as the use of space techniques is concerned; to consider possible additional radio frequency allocations for the space radio services; to revise technical criteria for frequency sharing between space and terrestrial systems and between satellite systems.

Microfilm reader



This inexpensive microfilm reader can project images from both aperture cards and roll film in any direction with variable magnification. Called the "Monitor," the equipment is portable and occupies less desk space than a telephone. Designed for daylight viewing, the unit is mounted by a ball joint on a curved arm held in a bracket for clamping on a desk. The reader is marketed by Microgen Ltd., 119 Marylebone Road, London N.W.1, England.

Medical computer systems

Two advanced electronic systems for medical use were demonstrated recently by The Marconi Company of Chelmsford, Essex, England. One is a patient-monitoring system which receives and analyses information from sensors attached to patients in operating theatres and intensive care units. It can then display the processed information on a CRT display in the form of graphs, alphanumeric information or alarm statements. It can also receive additional data from light pen or keyboard inputs.

The other is a patient radio-telemetry system consisting of a small transmitting unit, which transmits analog signals from sensors attached to a patient, and a receiver unit, where the information may be directly displayed or recorded, or can provide inputs to a computer-based monitoring system. This system will enable data displays, recording equipment and computing systems to be used with a patient without restricting his free movement about the hospital, in an ambulance, or at home.

Dual-fuel engines

The development of natural gas in Australia will lead to much greater use of on-site power generation from engines running on both natural gas and diesel fuel, a visiting overseas expert predicted recently. Mr E. N. Evans, a director of Blackstone & Co. Ltd., England, spent four weeks in Australia on talks with industry, Federal, State and local government authorities. He said that by using the principle of total energy conservation, dual-fuel engines can increase the total thermal efficiency from 35 to 80 per cent, resulting in significant cost savings.

When the principle of total energy is applied, the heat from the jacket water of the engine and the exhaust gases is conserved to produce steam or hot water. The heat can also be used to provide cooling for air conditioning at little extra cost. The fuel supply can be changed at the flick of a switch from diesel fuel to natural gas while the engine is operating, Mr Evans said.

Image copier

The IBM 2285 display copier (left of picture) produces a photo-copy of images generated by a computer on a TV-like screen in 15 to 38 seconds, depending on the complexity of the image. The machine is designed to operate with the IBM 2250 display unit. The signals which produce the display on the large screen are transferred, when the "copy" button is pushed, from the memory core to a small cathode ray tube in the copier. Lines containing no information are scanned rapidly but lines with information are scanned slowly. The CRT's image is projected on to 8½in x 11in photo sensitive paper. The paper handling and developing mechanism is being built by the 3M Company.



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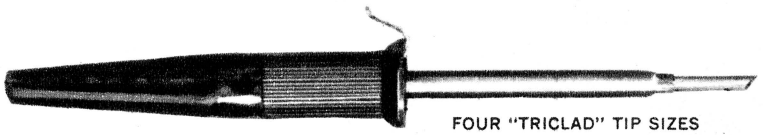
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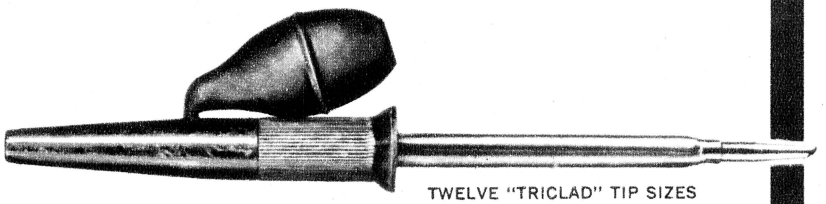
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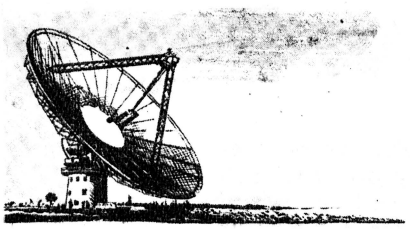
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Solar storms investigated

The first launch by the European Space Research Organisation (ESRO) of a fully stabilised sounding rocket payload, from the Salto di Quirra range in Sardinia on November 22, 1968, carried experiments by the universities of Utrecht and Leicester designed to probe solar storms and assess the amount of X-ray radiation emitted from them. Dr Kenton Evans of the University of Leicester reports that one reason why such research is important is the health hazard presented to astronauts and passengers in supersonic airliners by hard radiation. An understanding of the structure of such storms may also enable short-wave radio blackouts to be predicted.

The payload was aligned with the sun's centre to an accuracy of one three-hundredth of a degree by an attitude control unit supplied by Elliott Space and Weapon Automation Ltd. The Leicester equipment used five high resolution X-ray spectrometers to measure the emission line radiation in the 1 to 25 angstrom band. A closed-loop control system enabled a complex sequence of measurements to be made. A micro-miniature special purpose computer processed the raw data in flight and telemetered the output to the launch site.

British electronics giant

The major professional electronics interests of G.E.C., A.E.I., English Electric and Elliott Automation were recently brought together with the formation of G.E.C.-Marconi Electronics Ltd., a new management company with Mr Robert Telford as managing director. Mr Telford also continues as managing director of The Marconi Company. Existing trade names and companies will continue, to secure the maximum advantage in world markets. With a turnover well in excess of £100 million sterling, G.E.C.-Marconi Electronics will be Britain's largest and most comprehensive electronics organisation. The company will cover the fields of aerospace and defence equipment, communications and navigational systems, and broadcasting and television systems.

Primary standard changes

On January 1, 1969, changes were made relating to the values of four of the primary standards of measurements maintained at the British National Physical Laboratory at Teddington, Middlesex. The previous occasion on which similar changes were made was in 1948. The quantities concerned are the unit of electrical resistance, the unit of electrical potential, the acceleration due to gravity, and the international practical scale of temperature. The changes are the consequence of resolutions passed at a meeting of the Comite International des Poids et Measures held in Paris on October 14-17, 1968. They are sufficiently small that they will affect only manufacturers and users of extremely precise instruments.

The changes are as follows: the magnitude of the unit of resistance, ohm, is increased by 3.7 parts per million; the magnitude of the unit of potential, volt, is increased by 13 parts per million; the difference between the National Physical Laboratory's value of gravity and the international reference is reduced from 0.014 to zero cm per sec. per sec; changes have been made in the thermodynamic temperatures of fixed points and the coefficients of interpolation formulae used in the international scale of temperature.

Industrial measurements

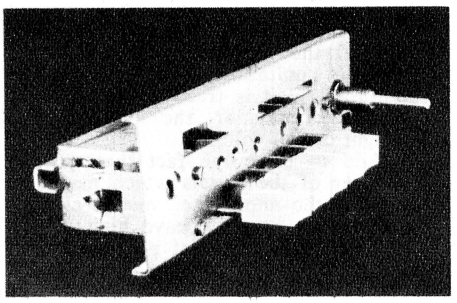


A miniature battery-operated doppler system, announced recently by James Scott (Electronic Engineering) Ltd., Carntyne Industrial Estate, Glasgow E.3, Scotland, can measure velocities up to 100 m.p.h. where a body is travelling in a straight, angled or curved path, and rotational speeds of the order of 1 million r.p.m. The device uses a Gunn-effect diode to generate 5mW unmodulated CW maximum power at 13.4GHz, and operates off a nominal 12V battery.

Microwave link for Fiji

Fiji's telephone service is to be expanded by two new microwave links to be supplied by GEC-AEI Telecommunications. The links will provide 48 speech circuits initially, and will be equipped with completely solid-state radio equipment, operating in the 7.425 to 7.725GHz band, and associated multiplex equipment. They will operate on a twin path basis with duplicated transmitters and receivers.

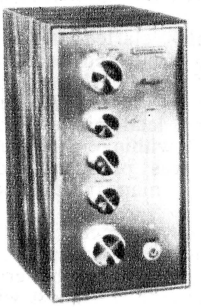
Smaller push-button tuner



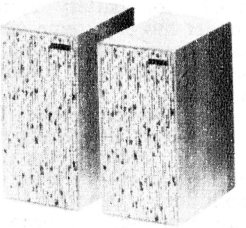
This radio tuner with permeability push-button operation, believed to be the world's smallest, has been developed by Sydney Bird and Sons Ltd., Fleets Lane, Poole, Dorset, England. The tuner's size and specifications meet the requirements of a survey to find out the future requirements of the automotive industry for car radios.

Goodmans audio suite

Comprising Maxamp 30 Amplifier, two Maxim Loudspeakers and Record Player, complete system $557.00



Goodmans Maxamp 30, fully transistorised stereophonic high fidelity amplifier 15+15 watts, solid state.



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The new Garrard Synchrolab SL95 complete in Teak case with tinted flexiglass lid.

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The Zinc-Air High Energy Density

The currrent demand for smaller and better batteries has resulted in considerable research into both battery and fuel cell design. A recent development is the zinc-air cell; a hybrid arrangement which offers many of the advantages of each. It is interesting to note that it is chemically similar to the once popular air-cell used for battery operated radios, though quite different in construction and performance.

The search for improved methods of chemically generating and storing electricity really started in 1800 when Alessandro Volta announced the development of his "pile" apparatus. By 1860 Gaston Plante had devised the world's first lead-acid electric storage battery and within eight years George Leclanche was producing "dry" cells using the manganese dioxide-zinc couple.

Steady development of these two systems has meant, in spite of the discovery of many other battery couples, that they are still the most widely used types of battery today. Rapidly advancing technology, however, has emphasised their limitations and progress in many fields is held up because the demands for battery systems to operate under more extreme conditions (producing greater power and energy in relation to weight and volume) have not been satisfied.

One such demand arises from a need to develop an electrically powered car to help reduce the menace to society of ever-increasing atmospheric pollution. Another, technically more exacting, has been created by space exploration and it is, in fact, the space research program which is providing much of the initiative (and financing) for the current intensive efforts in battery development.

A high proportion of this effort is applied to the development of fuel cell batteries, which are not true electric storage batteries. Even so, fuel cell technology has wider uses, a fact recognised by the Leesona Corporation in the United States. The scientific research division of the company, the Leesona Moos Laboratories, has been engaged for a number of years on fuel cell research and is now able to apply this technology to the development of a zinc-air battery which will offer, in many aspects of performance, quite considerable advances over conventional patterns of battery.

By a patent-licensing and know-how agreement, Crompton Parkinson Ltd. has taken up the development, manufacture and marketing of these batteries.

Batteries consist of a number of individual cells electrically connected in series or parallel to integrate voltage or capacity and all types produce electricity by the same basic electro-chemical process. Each cell contains dissimilar electrodes immersed in a conductive electrolyte in which positively and negatively charged ions are formed by dissociation. When the electrodes are externally connected by a conductor the charged ions migrate to the electrodes of opposite polarity, chemical reactions occur at their surface which release or take up electrons, and the transfer of electrons through the conductor sustains an electric current.

This current will continue to flow as long as there are reactants at the electrodes sufficient to maintain the chemical reactions. By the nature of this process one electrode (the cathode or positive plate) must use a reactant which will readily accept electrons and reduce chemically to a lower state of oxidation. Conversely, the other electrode (the anode, or negative plate) must use a reactant which will readily give up electrons and oxidise.

With some combinations of electrolyte and reactants the chemical reactions which take place at the electrode surfaces are found to be reversible, and when an electric current is passed through the cell in the reverse direction the electrode reactants are reformed ready for use again. It is this critical factor which determines whether the cell couple may be used as a true storage (secondary) battery. If the reactions are not reversible then the cell couple will not store electricity put through it and may only be used in the primary sense to generate electricity.

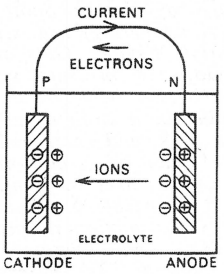


Figure 1 Conventional Cell

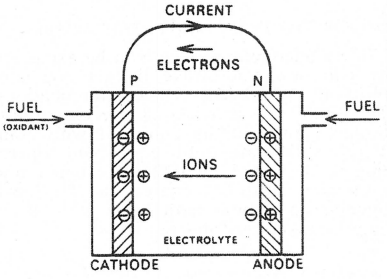


Figure 2 Fuel Cell

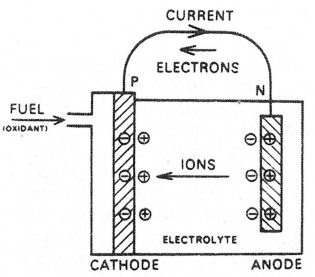


Figure 3 Metal-Air Cell

Apart from this distinction between primary and secondary use, it has been sufficient to recognise only two main classes of battery until recently. The first, which we shall refer to as conventional batteries, is typified by the fact that the electrical energy which the battery produces comes directly from the chemical energy of the reactants, which are part of the cell electrodes themselves. That is, the electrodes have a store of electro-chemical energy.

In the second class, fuel cell batteries, the electrodes have no stored reserves of electro-chemical energy and the reactants, not being part of the electrodes themselves, have to be supplied as "fuels" from external sources. These fuel cell electrodes are only electro-chemical energy conversion devices. Figures 1 and 2 illustrate the two types of cell schematically.

With fuel cells, though it is not axiomatic, the greatest success has come through the use of gaseous fuels and, of these, the highest efficiencies have been obtained using hydrogen as the reactant at the anode and oxygen at the cathode.

The availability of oxygen from the atmosphere and the development of cathodes which use it efficiently have now created the need to recognise a third class of battery:—metal-air cell batteries, in which an anode of the storage type is coupled with a cathode of the energy conversion type.

Figure 3 shows a metal-air cell diagrammatically and this combination of fuel cell and conventional cell electrode principles will be easily recognised.

Some of the advantages such a system might have to offer, as compared with conventional batteries, begin to appear: the cathode reactant is available in unlimited quantities in the atmosphere; it is free; and it does not comprise part of the original cell weight or cell volume.

Add to these the fact that quite a number of the metals which might be used at the anode (i.e., metals electronegative to oxygen), have high energy and electrode potential properties, and the possiblity of a high energy density

Reprinted from the Hawker Siddeley Technical Review, volume 4, No. 2.

Battery

by E. R. Musgrove
General Manager
Newport Battery Works
Crompton Parkinson Ltd.

battery of the metal-air type becomes obvious.

The potential to be realised by using the metals listed in the table below in combination with oxygen is enormous. Unfortunately, the problems of using many of them have yet to be overcome, though development studies continue. Cadmium and zinc are, however, metals with which there is already a considerable amount of electrode experience. Of the two, cadmium is the more expensive, the less readily available, has the lower electrode potential and the lower energy density. Zinc is considered to offer the best immediate prospect of realising some of the advantages of metal-air cell battery systems.

Metal	Energy (AH/lb)	Potential (Volts)
Lithium . . .	1755	3.05
Aluminium . . .	1350	1.67
Magnesium . . .	1000	2.34
Cadmium	216	0.40
Zinc	371	0.76

Electrode properties of some metals electro - negative to oxygen.

Zinc (though not completely problem free) exhibits very modest self discharge characteristics and good reversibility in alkaline electrolytes, is readily available and comparatively cheap. High energy zinc-air batteries have, in fact, been in use for over fifty years, using a highly porous mass of carbon as the oxygen cathode. This cathode will support only very low current drain rates, will not tolerate a reversal of the reaction for recharging and limits the battery to specialised primary applications. In turn, such batteries have never provided an incentive to develop zinc anodes to the limits of their performance. The Leesona oxygen cathode has changed this.

The key to the system is the unique cathode, made from a thin film of hydrophobic plastic having a catalytic layer applied to the reaction face. A metal screen is embedded into the catalytic layer to act as a current collector, unless the cell is being designed for very low drain rates when the catalytic layer may prove to be sufficiently conductive.

A variety of catalysts and screen metals may be used according to the electro-chemical performance desired. Platinum is one of the more obvious choices and gives high performance

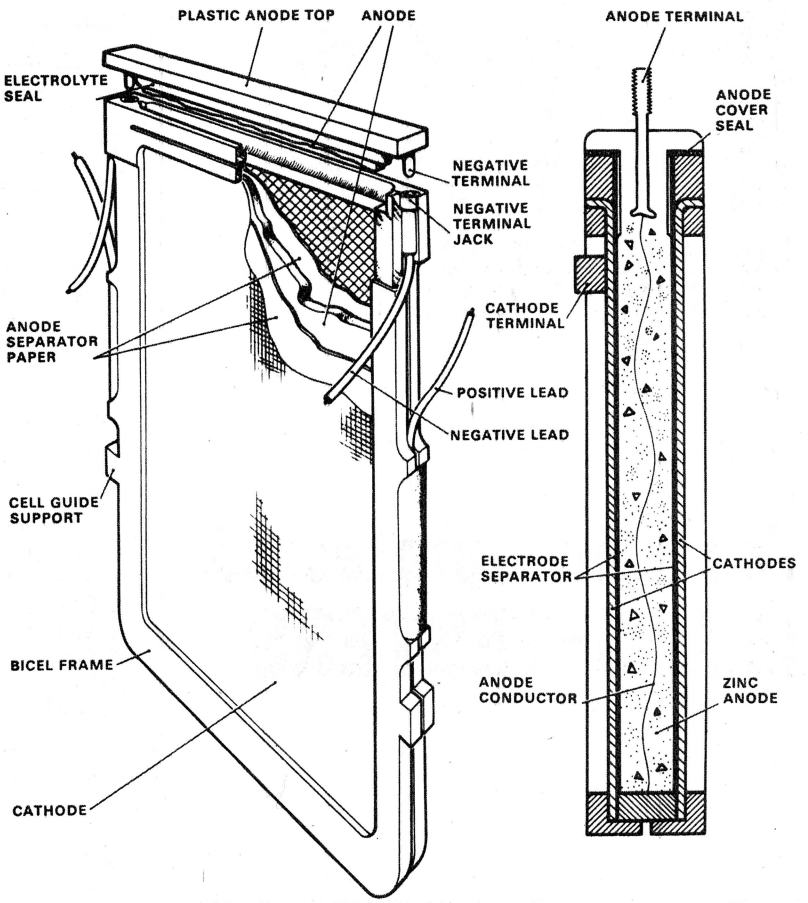


Figure 4. Cut-away drawing and diagramatic cross section of a typical Leesona zinc - air bi-cell unit, showing principle components.

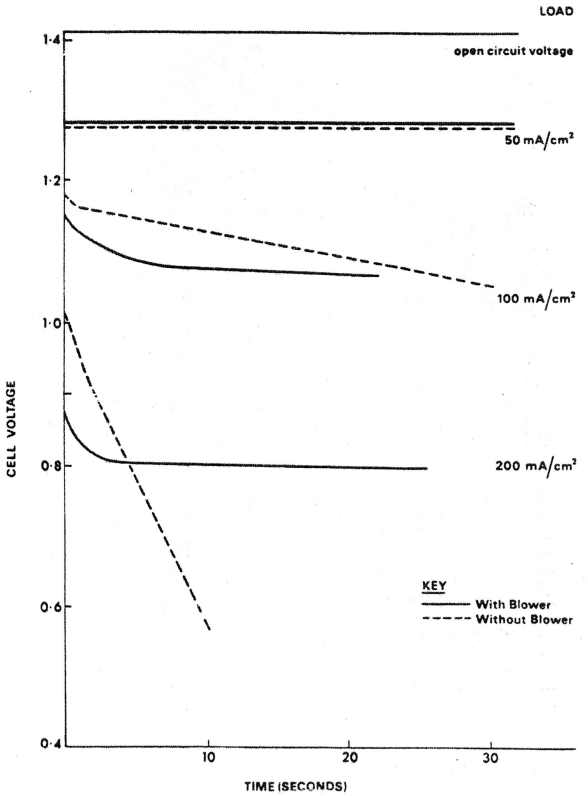


Figure 5. Zinc-air cell transient load performance on discharge. Note the improvement in performance when a blower is used to increase the quantity of air available to the cell.

but, through high cost, may not necessarily be the first choice when the economics of any one desigh are considered.

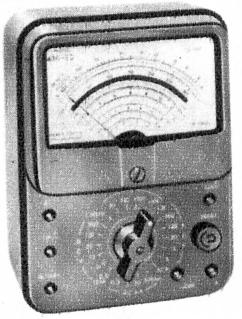
The plastic film on which the catalyst is laid, being hydrophobic, allows air to pass to the reaction face but is impervious to an aqueous electrolyte. Consequently, it may also be used as the wall of the cell container, thus contributing significantly to a reduction in the overall cell weight and volume.

In practice it is convenient to use a thin rectangular plastic frame to separate two cathode films, so forming a narrow box into which an anode may be inserted. By connecting the two cathode films the effective cathode area

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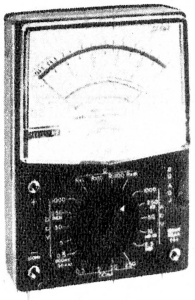


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This unit has a 10 micro-ampere movement giving sensitivity of 100k ohms/volt for all DC ranges to 300 volts. The movement is supported by spring backed jewels and is protected by a parallel diode. Frequency response is to 100 KHZ

Measurement ranges available

DC Voltage: 0.3v-3v-12v-30v-120v-300v (100kΩ/v)
1.2kv-6kv-30kv (with probe) (16.6kΩ/v)
DC Current: 12ma-0.3ma-3ma-30ma-300ma-1.2a-12a-300mv
AC Voltage: 3v-12v-30v-120v-300v-1.2kv (5kΩ/v)
AC Current: 1.2a-12a
Resistance: Up to 50 megohms (40 ohms to 400k ohms midscale)—decibel scale is provided

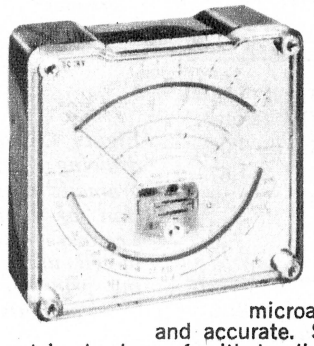


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Measurement ranges available

DC voltage: 0.1v, 0.5v, 5v, 50v, 250v, 1000v (20k Ω/v)
AC voltage: 2.5v, 10v, 50v, 250v, 1000v (8k Ω/v)
DC current: 50μa, 0.5ma, 5ma, 50ma, 250ma
Resistance: From 50 ohms to 50k ohms in four ranges
Volume level: — 20~ + 62db



MODEL
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Measurement ranges available

DC voltage: 0.25v, 2.5v, 10v, 50v, 250v, 500v, 1000v (25k Ω/v)
AC voltage: 2.5v, 10v, 50v, 250v, 500v, 1000v (5k Ω/v)
DC current: 40μa, 0.5ma, 5ma, 50ma, 500ma
Resistance: From 100 ohms to 250k ohms Midscale in four ranges. **Load current: LI** — 15ma, 1.5ma, 150μa
Load voltage: LV — 1.5v
Volume level: — 10~ + 10db, + 5~ + 36db

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of the cell is doubled and both sides of the anode will be worked (Figure 4 shows this bi-cell in cut-away and cross section).

This cathode construction demonstrates the following performance characteristics:

1. Good stability in operation.
2. Flat polarisation characteristics with only a small voltage change over a wide range of current densities.
3. Ability to provide current densities in excess of 200mA sq.cm. (see Figure 5).
4. No flooding of the membrane at atmospheric pressures, in spite of very adequate air diffusion rates.
5. Minimal temperature dependence.
6. Long life.
7. Low weight.

The anode is formed as a highly porous mass of zinc around a central copper conductor, which helps to maintain power output through to the limits of material utilisation. It is dimensioned to substantially fill the space between the cathode surfaces and is supported from a plastic moulding which plugs into, and closes, the cathode box.

Because the anode is made highly porous it will support high current discharge rates, which cannot be achieved on cast or rolled zinc plates. Moreover, the porosity is such that the pores of the anode will contain the greater part of the electrolyte needed by the cell.

The thickness of the anode has an important bearing on the energy density of the cell but it has been found that as thickness is increased to improve capacity and energy density so discharge efficiency falls off. Some compensation may be gained by increasing porosity with thickness, but increasing it too far will only result in a net loss of metal (and capacity) in the anode. Anodes up to 0.20 inches thick appear to satisfy these conflicting demands for normal battery applications.

As with any other battery system, the electrodes must not be allowed to touch one another and so the Leesona anode is wrapped in a separator material. The nature of this separator material is varied to suit the conditions under which the cell will operate. It must always have low electrical resistance characteristics but if the cell is to be rechargeable then it must also effectively prevent penetration by dendritic crystalline growths (to which zinc anodes are prone) which will short-circuit the electrodes.

The electrolyte is a solution of potassium hydroxide, which may be zincate saturated so that the product of reaction at the anode, zinc oxide, may be thrown into suspension. At concentrations around about 30 per cent by weight this electrolyte gives satisfactory electrical performance over a fairly wide range of temperatures but is not required in great quantity to satisfy the cell reactions. It is, in fact, true to say the Leesona cells have practically no free electrolyte since all is held within the porous anode and separator materials. This is again a factor which helps to reduce cell weight and volume.

Figure 6 shows a photograph of a typical Leesona bi-cell unit with the anode partly withdrawn . . . clearly seen are the built-in connector wires which allow these units to be connected together in series to form a battery of any given voltage.

When building batteries using bi-cell modules of this configuration the block of bi-cells will normally be clamped together, inter-connected and enclosed within a light metal or plastic case. This case needs to be provided with air entry points to allow an even supply of air to the cathodes. Within a properly designed casing natural convection will normally provide sufficient air at the cathodes to support discharge rates near 100 mA/sq.cm. of cathode, but lengthy discharges above this rate require the casing to be equipped with a small fan to draw air across the cathodes at a higher rate.

Provided that the battery is open to a source of air or supplied with oxygen, the Leesona system is perfectly suited for use in primary batteries. The improved energy density available from the system at greater power output makes it an attractive alternative to other existing types of battery, and its use will depend only upon the economics of engineering design and manufacture to the particular application.

However, because the Leesona cathode is not exhausted during the discharge of the battery there is obviously operational advantage to be gained by being able to replace the anodes of a discharged primary battery. Further reference to 4 and 6 will reveal how the Leesona bi-cell has been designed

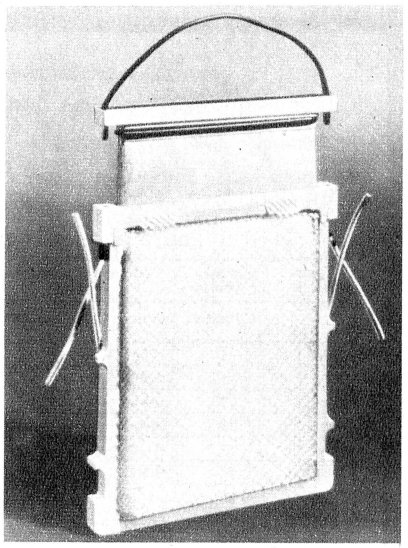


Figure 6. A typical Leesona zinc-air bi-cell unit, showing the anode partially withdrawn.

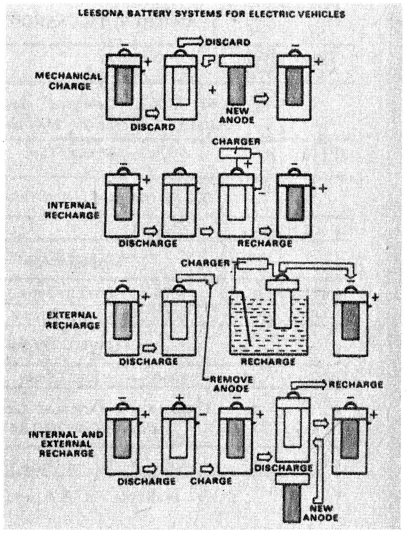


Figure 7. Diagram showing alternate charging procedures for Lessona zinc-air batteries in electric cars.

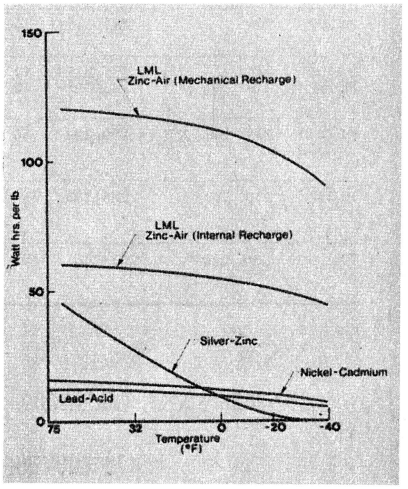


Figure 8. Energy density performance versus temperature for various battery systems. Note particularly the high "watt hours per pound" rating of the zinc-air cell.

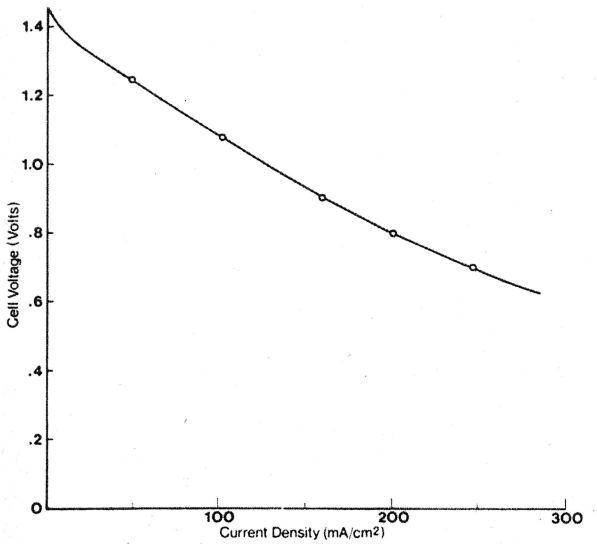


Figure 9. Discharge characteristics of zinc-air battery with blower.

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OPM 7A	15	(10000) 8000, 7000	P.P. 15, 8 3.7, 2
OPM 8A	15	(10000) 8000, 7000	P.P. 500, 250, 166 100
OPM10A	25	(8000) 6600	P.P. 15, 8 3.7, 2
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PF201 PF151	240 230, 240	225/225 285/285	50 60	6.3V—2A 6.3V—2A C.T 6.3V—tap 5V—2A
PF1460	230, 240, 250	250/250	80	6.3V—2A C.T 6.3V—2A 6.3V—tap5V—2A
PF130	230, 240	285/285	100	6.3V—2A C.T 6.3V—2A 6.3V—tap5V—2A
PF174	230, 240	285/285	150	6.3V—3A 6.3V—3A C.T. 6.3V—tap5V—3A

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PVD102*	250 240 230	120 110 100	310 285 260	100	6.3V—4A CT
PVD103	250 240 230	50 140 130	380 355 330	100	6.3V—5A CT
PVD104	250 240 230	120 110 100	310 285 260	125	6.3V—3A CT 6.3V—3A
PVD105	250 240 230	146 136 126	380 355 330	125	6.3V—3A CT 6.3V—3A
PVD108	250 240 230	173 163 153	450 425 400	150	6.3V—3A CT 6.3V—3A
PVD109	250 240 230	146 136 126	380 355 330	180	6.3V—3A CT 6.3V—4A
PVD110	250 240 230	193 183 173	500 475 450	200	6.3V—3A CT 6.3V—4A
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PF2114	24	20V, 0, 20V, —2A DC
PF2440	240	19.4V, 0, 19.4V, —1.5A DC
PF2228 PF1763	240 240	30V—0.6A 30V tapped at 25V, 20V—2A
PF2876	240	32V at 1A 32V at 1A
PF2004	240	35V, 0 35V, —750mA
PF114	240	50V—2.3A tapped at 24V—4.8A tapped 12V—9.6A
PF115	240	50V tapped at 30V, 25V, 15V—5A
PF2235	240	150V, 125V, 100V, 75V, 50V, 25V, or 75V 0 75V at 30mA 6.3—1.2A

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PF1630	240	5.3V—2.25A C.T.
PF476	240	6.3V—3A C.T.
PF162	240	6.3V—3A, 6.3V—3A C.T. or 12.6A—3A C.T. if series connected.
PF2565	240	12.6V—0.5A 12.6V—0.5A or 25V—0.5A if series connected or 12.6V—1A parallel windings.
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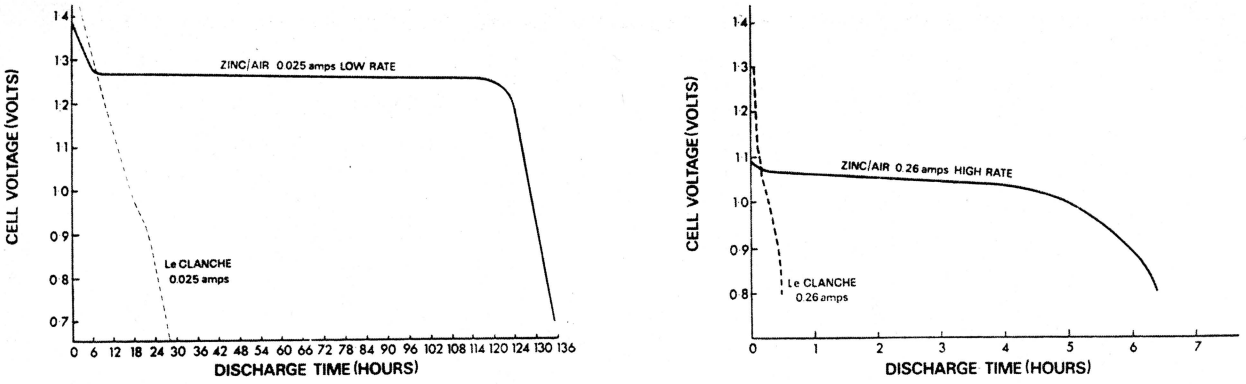


Figure 10. Comparison of potential-time curves for small primary AA ("Pelite") cells. Zinc-air performance of the high rate is particularly impressive.

with this concept in mind. Vacuum packed fully charged anodes, already impregnated with solid electrolyte, will remain in good condition for many months. Removal of the exhausted anode from a Leesona cell, insertion of the new anode and its activation with water takes only a few seconds. This feature makes it possible to supply batteries which can be mechanically recharged in a few minutes, away from sources of electric power and in complete silence.

The operating economics of the mechanically rechargeable battery are never likely to be able to compete successfully with those of an electrically rechargeable battery in the majority of industrial applications. Therefore, complete success with the Leesona zinc-air battery must depend upon its ability to perform as a secondary battery. In the strict electrochemical sense it will certainly do so but, as yet, a uniform and adequate cycle life remains to be demonstrated. The basic problems lie in the recharging of the zinc anode without causing uneven growth and penetration of the separators by dendrite crystals. Active investigation of these problems is in hand and enough success has already been achieved to warrant a good deal of optimism. Success with the development of techniques to allow repeated electrical recharging will then mean the Leesona cell may be used as a primary and also as a rechargeable battery in accordance with figure 7.

No one parameter is available to tell the whole story in battery system comparisons and in consequence discussion of the performance of the Leesona zinc-air system can only be in limited terms within this article.

Figure 8 illustrates graphically the energy density available at various temperatures from different types of battery. The upper typical curve for the zinc-air battery was obtained from a primary battery and the lower curve is projected for secondary use where material utilisation has to be lower to achieve satisfactory cycle life. The lower temperature dependence of the Leesona system and its superior energy density is obvious.

The relationship between cell terminal voltage and rate of discharge is shown in figure 9. The open circuit voltage will be seen to be slightly over 1.4 volts. With the zinc-air battery the products of reaction go into suspension in the electrolyte and the electrode surfaces are not made passive as the discharge proceeds. This minimises voltage decay with time of discharge. The value of this phenomenon can be appreciated from figure 10 which is particular to a small "penlight" primary battery.

Figure 10 actually shows the performance obtained from two slightly different designs of Leesona zinc-air "penlight" primary cells compared with Leclanche cells of the same duty. A minor change in the design, shown in exploded form in figure 11, permits high rate discharge not normally possible with such cells without great loss in performance.

The photograph, figure 12, is a 28 volt, 25 ampere-hour battery designed to fit to a military portable radio transreceiver and intended for mechanical recharging.

It successfully competes with the silver-zinc battery formerly used. Its watt-hour capacity is 600 as against 480 for the silver-zinc type, weight 10lbs (16lbs), watt-hours per pound 60 (30), charging time 10 minutes (10 hours), life cycles 100 (40).

This very brief outline of some

(Continued on page 166)

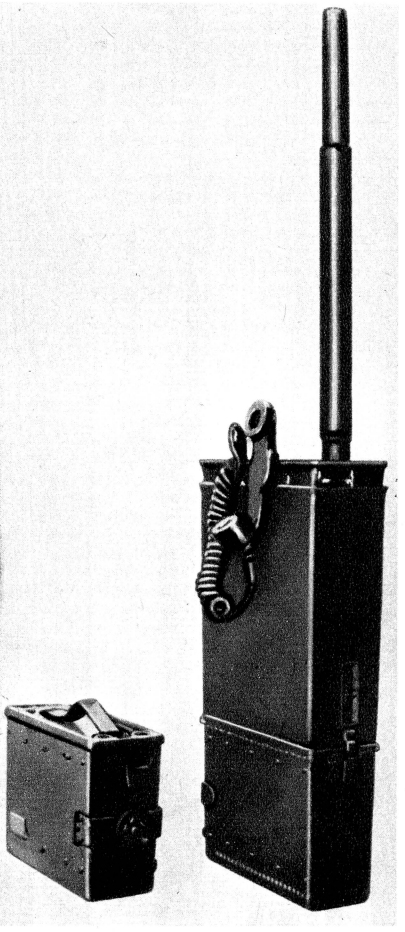


Figure 12. A 28 volt, 25 ampere-hour Leesona zinc-air battery fitted to a U.S. military portable radio.

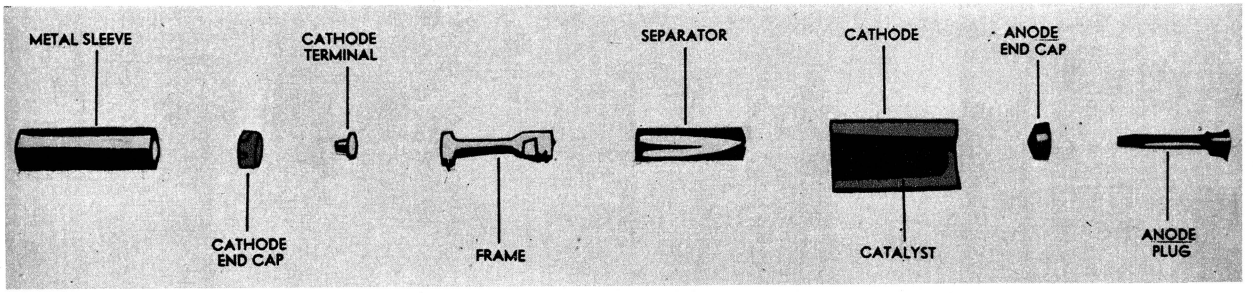
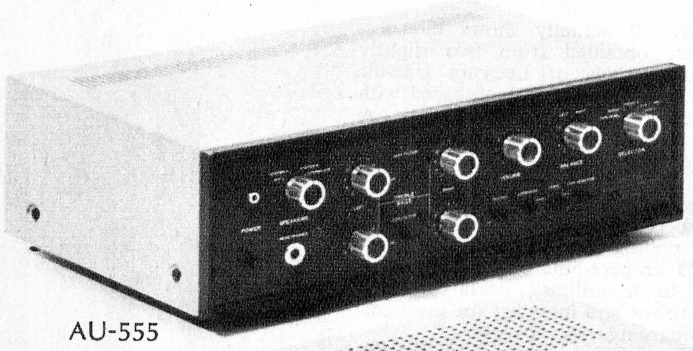


Figure 11. Exploded view of a Leesona zinc-air throwaway primary battery of the penlight ("AA") size.

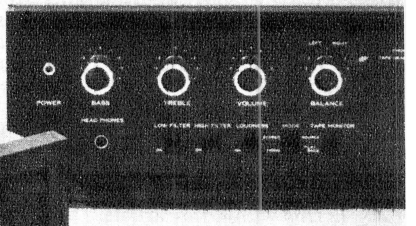
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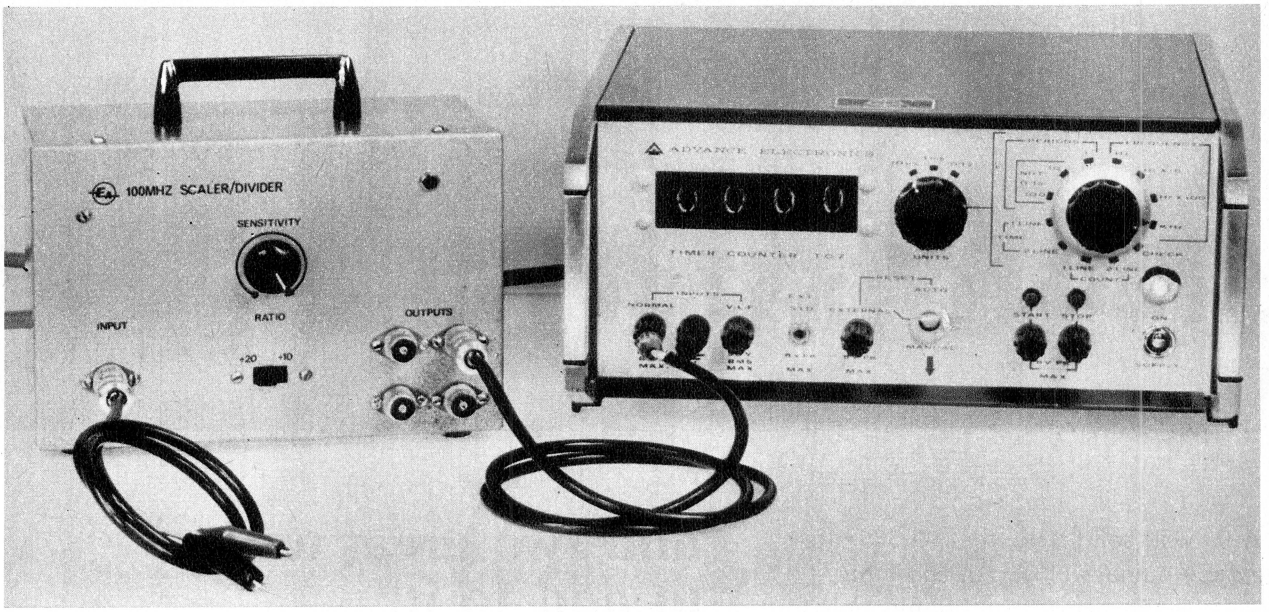
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Scaler/Divider using ICs extends counter range to 120MHz

by Jamieson Rowe

The advantages of digital techniques applied to frequency measurement, time measurement and event counting are undisputed. Digital counters and frequency meters offer an order of stability, reliability, resolution and reading convenience which is very difficult to achieve by other means. Yet, despite these advantages, digital instruments tended to remain in the realm of esoteric laboratory equipment until a few years ago, as a result of their relatively high cost.

Happily the situation has changed significantly for the better in recent years, largely as a result of developments in both component technology and circuit design techniques. The cost of low- and medium-frequency digital instruments has fallen to a quite moderate level, and as a result this class of instrument has become accessible to a wide variety of users in research, development, servicing and teaching organisations.

A typical instrument of this type is shown, the TC7 Timer-Counter by Advance Instruments. Capable of performing four-digit frequency measurement up to approximately 7MHz, together with multiple period timing and event counting, it is available at a cost of approximately $360.

The advantages of digital measurement are thus readily available nowadays at low-to-medium frequencies. However, few, if any, of the moderate-cost instruments currently available have a frequency range which extends significantly beyond about 12MHz. Instruments capable of operation at frequencies higher than this figure tend, by virtue of considerably increased cost and complexity, to be restricted to the somewhat rarefied atmosphere of the advanced research laboratory. As a result, the not-so-fortunate worker in typical development, teaching and servicing situations has generally been forced to make higher-frequency measurements using techniques which are less convenient, and often less reliable.

It is this specific problem which the unit described in this article has been designed to solve, and from our tests it would appear to solve the problem rather well. The unit consists of a scaler/frequency divider, which connects between the counter/frequency meter and the signal to be measured. By subjecting the signal to a stable scaling/frequency division, it effectively increases the range of the basic instrument by up to 20 times.

The unit is capable of handling input signals up to approximately 120MHz, so that for 20:1 division it will effectively convert any counter or frequency meter with a maximum frequency capability of 6MHz or more into a 120MHz instrument. Counters with an upper limit of less than 6MHz will be extended by a proportional amount, for example a 3MHz counter will effectively become a 60MHz instrument; however, those with a maximum capability of greater than 6MHz will only be extended to approximately 120MHz, because of the capability of the scaler/divider itself.

The unit provides a maximum scaling/division ratio of 20:1, this figure having been selected as a desirable cost/performance compromise; it would appear to be sufficient to extend the capability of a majority of moderate-cost counters and frequency meters to 120MHz. However, as a ratio of 20:1 necessarily involves slight "mental gymnastics" on the part of the operator, an alternative ratio of 10:1 has been provided to permit more convenient system readout when the full extension range is not required. Hence when making measurements on signals below 60MHz with a 6MHz counter, readout with the 10:1 ratio involves nothing more than a mental shift of the decimal point one place to the right.

Selection of the scaling/division ratio may be made conveniently at any time by means of a front-panel slider switch.

Input sensitivity of the unit is quite high, requiring less than 100mV RMS

Specification

A scaler/frequency divider unit designed for use with digital frequency meters, counters and similar instruments, and capable of very high speed operation as a result of the use of emitter-coupled integrated logic microcircuits. Scaling or division ratio is highly stable, and may be either 10:1 or 20:1 as selected by a front-panel switch.

The instrument will respond to input signals from below 100KHz to above 100MHz, with a triggering sensitivity of better than 100mV between approximately 2MHz and 100MHz. Input impedance approximately 500 ohms. Four independent outputs are provided, two positive-going and two negative-going. Output amplitudes are approximately 700mV peak, with an output impedance of approximately 120 ohms.

The circuit of our new scaler/divider, shown at right, is relatively simple — a major gain accrued from the use of microcircuits.

between approximately 2MHz and 100MHz. The input signal amplitude for reliable operation rises at both ends of the usable frequency range, as shown in figure 1. The fall in sensitivity at the high end is due to distributed circuit losses, while that at the low end is due to a maximum rise-time limitation imposed by the input circuitry. As a result of the latter, the low-frequency sensitivity is higher for "square" and similar fast-rise-and-fall waveforms than for sinewaves.

The input sensitivity of the unit may be reduced by means of a front panel control, to cope with situations where it is required to measure relatively high-amplitude signals accompanied either by an appreciable noise level or by spurious signals. The input circuitry of the unit is designed to self-limit the input signal amplitude to approximately 1.5V peak-to-peak, giving a fair measure of overload protection.

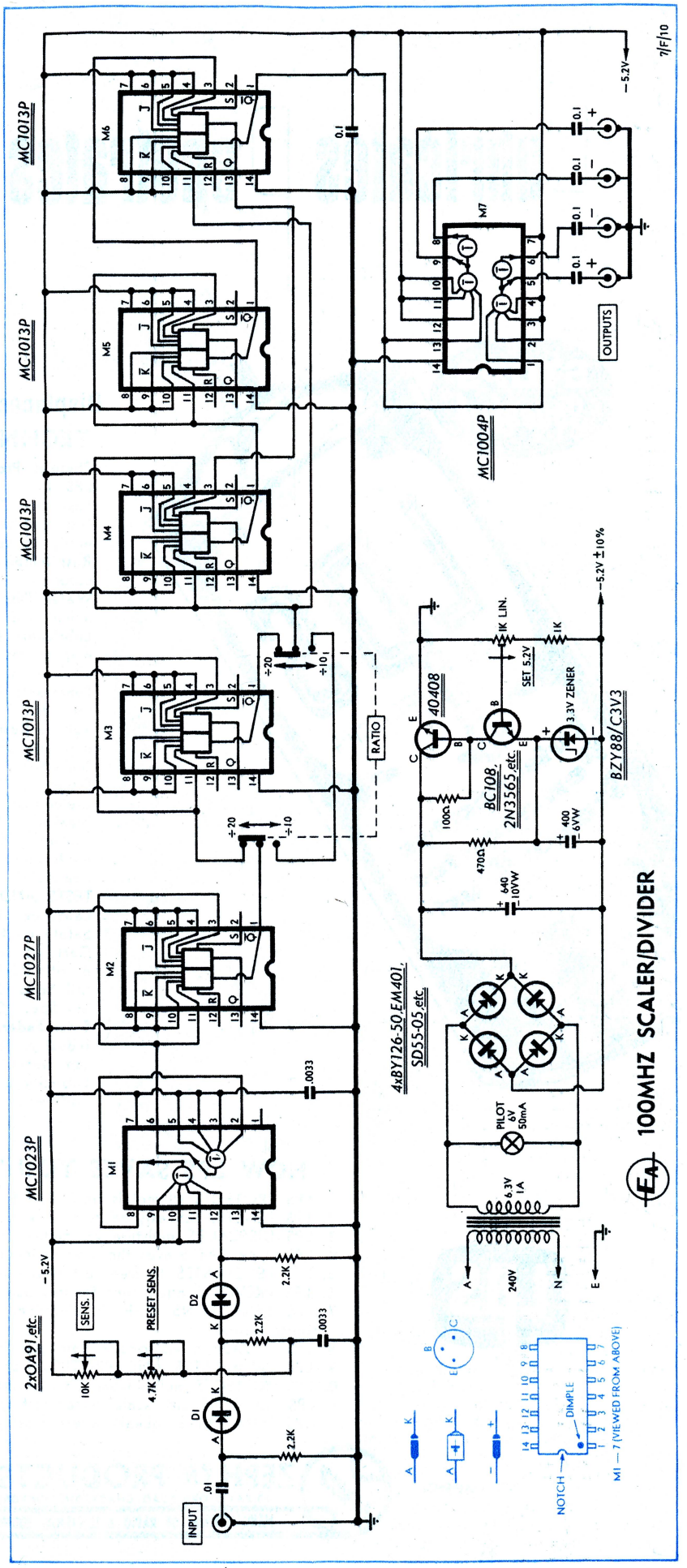
Four independent output signals are available from the unit, permitting the connection of up to four instruments to the output without interaction. Two of the output signals comprise positive-going pulses, and two negative-going, all substantially in phase with one another (within approximately 8 nanoseconds). Output amplitudes are approximately 700mV peak, unloaded, at an output impedance of approximately 120 ohms. All outputs are AC coupled.

Forming the heart of the new scaler/divider and directly responsible for its impressive performance are seven integrated logic microcircuits. All are recently released devices by Motorola Semiconductor Products Inc., forming part of their "MECL II" family of very high speed emitter-coupled logic (ECL) devices. As the performance of these devices equals and in most cases exceeds that of any other integrated logic microcircuits currently available, they can truly be described as representing the "state of the art."

Possibly the most impressive device in the MECL II range is the MC1027P, an AC coupled J-K flip-flop with a typical maximum rated toggle frequency of 120MHz. As one might expect, it is quite complex internally, containing no less than 24 transistor elements, two diodes, two capacitors and 16 resistors; its internal circuit is shown in figure 2. The MC1027P is used as the initial 2:1 scaler stage in the new scaler/divider, and it is largely due to this device that the design of the unit has been made possible.

The other devices in the MECL II range which are used in the unit are the MC1023P, a very high speed dual 4-input gate used as an input shaper/driver for the MC1027P; the MC1013P, an AC coupled J-K flip-flop similar to the MC1027P but with a slightly lower typical maximum toggle frequency of 85MHz, and used here for the remaining scaler stages; and the MC1004P, a high speed dual 4-input gate used here as an output buffer.

The MECL II devices used are



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available in Australia from the local representatives for Motorola, Messrs. Cannon Electric (Aust.) Pty. Ltd. Addresses for mail ordering are 58 Cluden Street, East Brighton, Victoria, 3187, P.O. Box 25, Mascot, N.S.W. 2020, and Commonwealth Aerodrome, Parafield, S.A. 5106. Price of the devices is very reasonable considering their impressive performance, ranging from around $1.80 plus tax for the MC1004P to approximately $8.15 plus tax for the MC1023P and MC1027P. Overall cost of the set of the microcircuits used in the project will therefore be approximately $31.50 plus tax and postage, and this will be the principal expenditure for the project.

In passing it is perhaps worthwhile to note that the number of transistor elements included in the seven microcircuits used in the scaler/divider amount to no less than 150, so that together with the two discrete transistors used in the regulated power supply the total effective transistor count for the project is 152. While of no great significance in itself, this figure demonstrates rather well the advantages of integrated microcircuits in terms of circuit wiring simplification and cost reduction.

The input triggering sensitivity of the scaler/divider as a function of input frequency, shown for both sine and square wave signals.

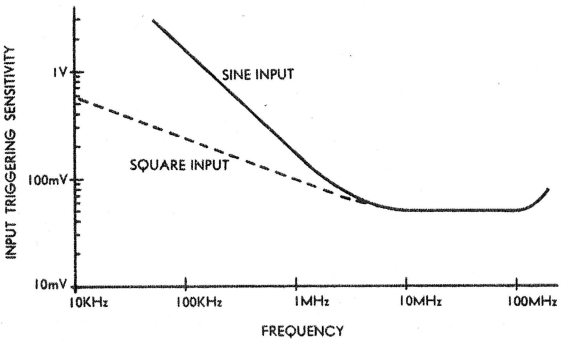


Figure 1

INPUT TRIGGERING CHARACTERISTIC

A simplified logic diagram of the scaler/divider is shown in figure 3, and reference to this diagram should assist in understanding the operation of the unit.

From the input connector the signals are first "squared up" in the input shaping stage formed by M1. With rise- and fall-time thus reduced they are then fed to M2, which is a J-K flip-flop connected for toggle-mode operation. The output of M2 is accordingly a series of pulses correspond n to every alternate cycle or pulse of the input signal.

It may be noted that the MECL II flip-flops MC1027P and MC1013P, used here as M2—M6, are provide with four each J-complement and K-complement gating inputs as well as the uusal R and S direct inputs. No separate "toggle" or "clock" input is

About circuits, logic and "ICs" . . .

Designers of circuits to perform switching, gating, encoding and decoding, counting, scaling, frequency division and similar functions have found it both convenient and profitable to interpret the operations involved in these functions from a point of view derived from symbolic logic. One important advantage of this approach is that logical analysis can often show ways of simplifying and reducing the amount of circuitry necessary to perform the required functions, when from a purely electrical or electronic viewpoint such simplification or reduction may not be obvious.

From a logical viewpoint, the two voltage or current or other circuit parameter levels normally found in such circuits may be equated with the "true" and "false" logic values, symbolised respectively by "1" and "0." Just which circuit voltage or current level is equated with logical 1 (leaving the other automatically equal to logical 0) is not important, provided that the "logic convention" which is adopted at any point in the circuit is consistent with circuit operation considered from both the electrical and logical viewpoints.

Looked at in another way, this means that from the logical viewpoint the operation of a particular circuit may be interpreted in a variety of ways simply by adopting appropriate logic conventions at the input(s) and output(s).

An example would be a gating circuit whose inputs and output switch between 0V and +6V. The adoption of a single logic convention common to both inputs and output (say 1 equals 0V, 0 equals +6V) may allow the circuit to be used as an AND gate, or one in which the output is true (1) when and only when all inputs are true together. However, reversing the convention (i.e., 1 equals +6V,0 equals 0V) at either input(s) or output(s) would alter the effective logical function of the gate, permitting it to be used as either an OR gate or a NAND gate.

AND, OR, NAND and NOR are logical "building brick" functions performed by gates, and as such they represent logical operations in which the output value of 1 or O is an instantaneous function of the input values. Another type of logical operation is that in which the output value is a "stored" function of the input values obtaining at a previous point in time; one logical element which acts in this fashion is the "flip-flop" or bistable multivibrator, used extensively in counting, storage, scaling and frequency division.

The so-called "J-K" flip-flop is a variant in which the value of the output (and hence that of its logical opposite available at the "complementary output"), following any particular input "clock" pulse, depends upon the values present at two or more "gating inputs" (symbolised usually by "J" and "K") when the pulse is applied.

If gating signals having values of logical 0 are present at both the J and K inputs when the clock pulse is applied, the element does not change in response to the pulse but simply remains "locked" in the state corresponding to the output value present prior to the pulse arrival. If, in contrast, either J or K are taken to logical 1 while the other remains at logical 0, the element will change or remain at a predictable output value of 1 or 0. If J is taken to 1, the element will have an output value of 1 following the pulse, regardless of its prior value; if K is taken to 1, it will conversely always end up with an output of 0.

Finally, if **both** J and K are held at logical 1 during the presentation of the pulse, the element will always **reverse** its output value to the opposite of that prior to the pulse. A series of input pulses applied to the element with the J and K inputs tied to logical 1 will thus cause it to switch alternately back and forth. This is accordingly known as the "toggling mode" of operation, and as such it provides a convenient means of performing counting, scaling and frequency division.

Logical operations may be performed by an extremely wide variety of circuit configurations and devices, ranging from simple mechanical switching circuits through semiconductor diode and transistor circuits to the relatively complex integrated logic microcircuits ("ICs") used in this article. Some configurations or devices offer advantages in terms of simplicity and low cost; others offer the ability to operate reliably at very high speeds and/or in the presence of electrical noise. In general the type of circuitry used to perform any particular logic operation will depend upon the requirements of the application in terms of cost, speed, power dissipation, noise immunity, and so on.

Of the many types of logic circuitry involving transistors, the emitter-coupled configuration (often symbolised as "ECL") has emerged as that which is to date capable of the highest-speed operation. This arises from its use of emitter-followers to provide a low impedance level at the switching nodes, common-base transistors to perform the actual switching with a minimum of delay and storage time, and configurations which ensure that all devices are prevented from entering the charge-storing saturation region.

The Motorola "MECL II" series of ICs used in this project are a family of ultra-high speed logic microcircuits based on ECL circuitry, and capable of operation at speeds up to approximately 120MHz. As such they are representative of the current "state of the art," not only with respect to monolithic integrated circuits but also with respect to high speed logic circuitry.

Readers interested in gaining an insight into logic circuitry and the other concepts involved in the rapidly developing sphere of digital electronics could refer to the author's book dealing with this subject, entitled "An Introduction to Digital Electronics." Published by "Electronics Australia," this book is available to mail order at a cost of $2.20 post paid.

Tandberg

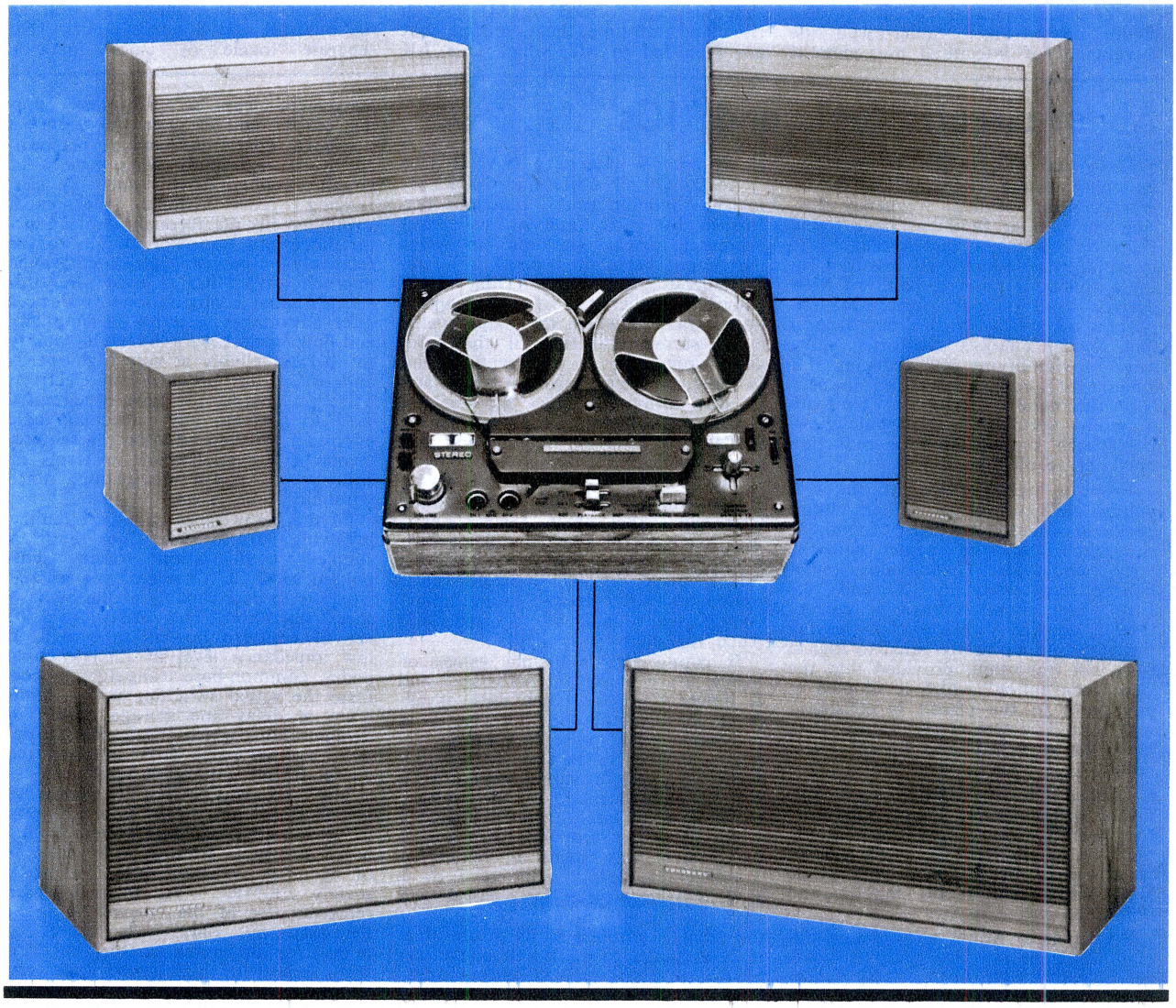
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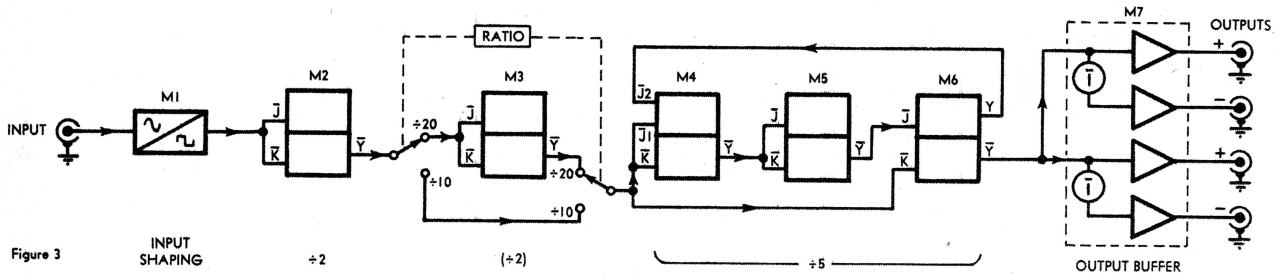


Figure 3

Above is a logic function diagram of the unit, which should assist in following its operation. At right is the interior circuitry of the MC1027P device.

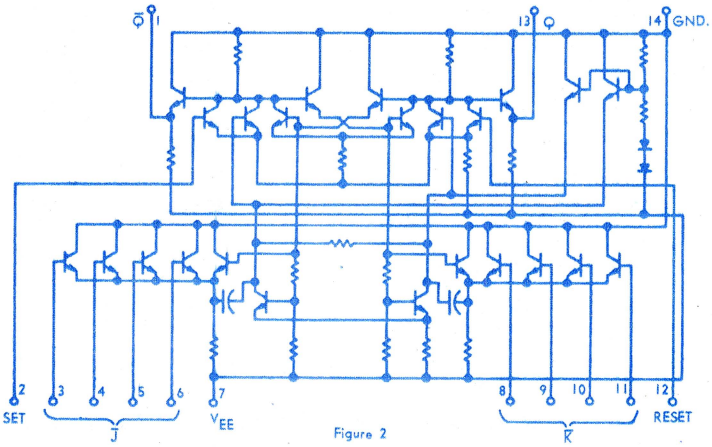


Figure 2

provided; however such an input is effectively formed by joining together one J-complement and K-complement input as shown. If the remaining J-complement and K-complement inputs of the device are connected to logical O (here —5.2V), the flip-flop operates in the toggling mode of operation, changing its state on alternate input pulses. In this design it may be seen that M2, M3 and M5 are connected in this fashion, while M4 and M6 are connected slightly differently.

Devices M4, M5 and M6 are interconnected in a fairly standard feedback-gating configuration which gives an effective scaling or division ratio of 5:1. This together with the 2:1 provided by M2 gives an overall 10:1 ratio, and this is therefore the scaling/division ratio provided by the instrument when the ratio switch is in the lower position shown in figure 3. The alternative overall ratio of 20:1 is produced in the upper switch position, in which an additional 2:1 ratio is provided by M3.

As the operation of M4, M5 and M6 as a 5:1 scaler may not be obvious, the following description of the operation of this section may be found helpful. For convenience it is assumed that the flip-flops are initially all in the "reset" or "O" state.

On the arrival of the first input pulse from the ratio switch, M4 switches to the "set" or "1" state. Although the input pulse is also directed to the K-complement input of M6, this element is prevented from switching from the O state because its J-complement input is tied to the Y-complement output of M5, and the latter element is in the O state.

The arrival of the second input pulse causes M4 to switch back to the O state, while M6 is again prevented from switching by the gating potential applied to its J-complement input from M5. However in reverting to the O state M4 provides a toggling pulse for M5, which therefore switches to the 1 state shortly after.

The third pulse to arrive is able to switch both M4 and M6 to the 1 state, M6 being permitted to switch because M5 is now set to the 1 state. Following the third pulse, therefore, all three elements are set to the 1 state.

On the arrival of the fourth pulse M4 switches to the O state, and in doing so provides a toggling pulse for M5 which thereupon follows suit. However, as M5 only switches following the switchover of M4, it is still in the 1 state when the input pulse is applied to the K-complement input of M6. Hence the latter element is prevented from switching, and remains in the 1 state.

The final step in the cycle occurs on the arrival of the fifth pulse, and it is here that the function of the feedback connection between the Y output of M6 and the second J-complement input of M4 becomes evident. On the arrival of the pulse, M4 tends to switch once again from the O to the 1 state; however it is prevented from doing so by the gating potential applied to the second J-complement input by M6. On the other hand M6 itself is this time permitted to switch, because M5 has reset to the O state on the fourth pulse; accordingly M6 switches to the O state once more, and all three elements are reset and ready to begin a new cycle.

The foregoing sequence of events is shown in concise form in the truth table of figure 4. It may be noted that as element M6 is in the O state for three consecutive pulses from the ratio switch, and in the 1 state for the remaining two pulses, the output signal available at either of its outputs will be a rectangular waveform with 2:3 mark/space ratio (40 p.c. duty cycle), and with a cyclic period five times that of the input pulses.

The final microcircuit element M7 is used here as an output buffer stage, isolating M6 from any loading circuitry which may be connected to the output of the instrument. As shown in figure 3, M7 effectively acts as four separate output buffer amplifiers,

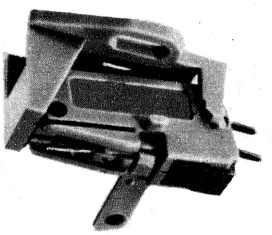
INPUT PULSE	M4	M5	M6
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	1
4	0	0	1
5(0)	0	0	0

Figure 4

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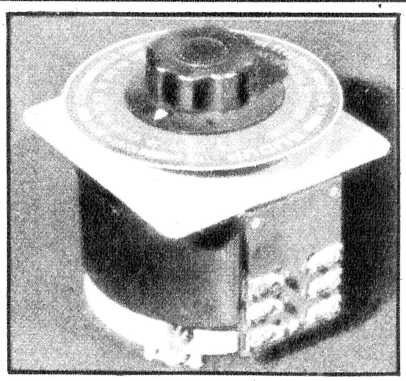
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two of which provide inverted-polarity output pulses.

Using the simplified logic diagram of figure 3 as a guide it should not be difficult to follow the operation of the complete scaler/divider as shown by the main circuit diagram. Most of the apparent complexity of the latter arises from the need to show the connections to the many microcircuit electrodes which play no significant part in the present design.

Whereas figure 3 shows a direct connection betwen the input connector and M1, it may be seen that in fact the two are linked via a small coupling network including two germanium diodes. The function of this network is twofold; first and foremost, it serves to protect the input circuitry from overload damage due to excessive input signal amplitude. A second function is to permit adjustment of the quiescent bias applied to the input of M1, either for maximum sensitivity or for reduced sensitivity if required.

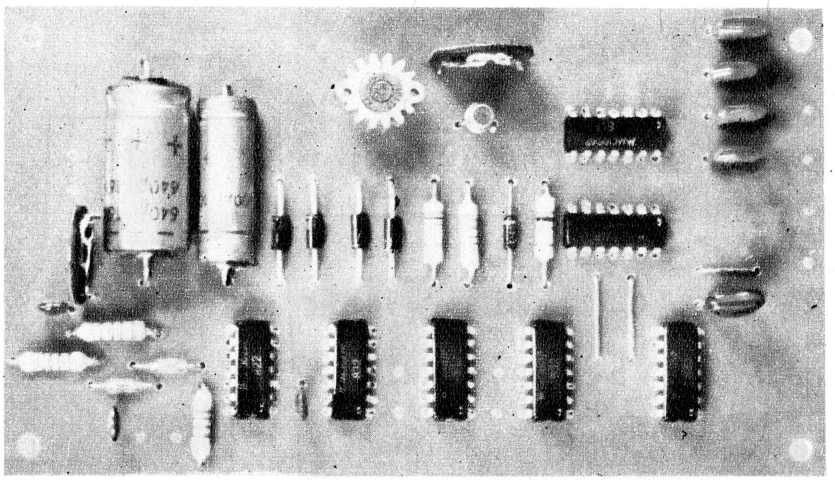
Basically the network consists of the two diodes D1 and D2, which are connected in series opposition as far as the AC-coupled input signals are concerned, but effectively in parallel with respect to an adjustable forward bias current applied to both via the three 2.2K fixed resistors, the 4.7K preset sensitivity control and the 10K front panel sensitivity control.

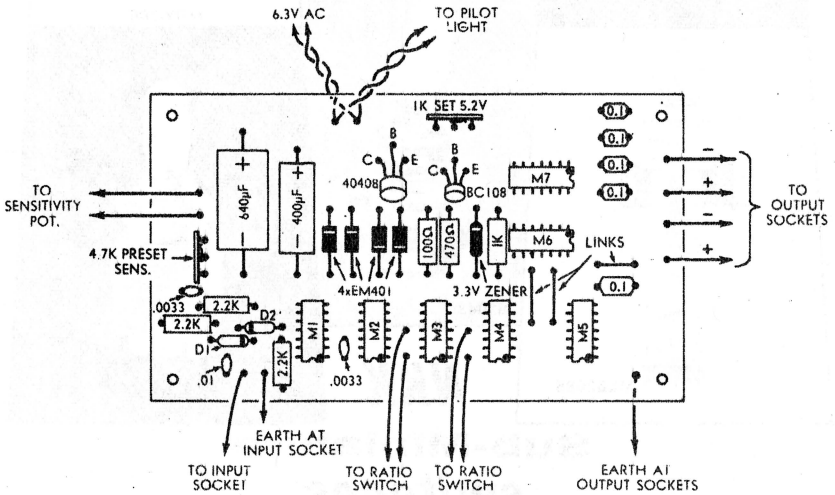
Operation of the network is as follows: With the front-panel sensitivity control set for minimum resistance (fully CW), the current through the diodes is adjusted by means of the 4.7K preset control until the potential at the anode of D2 and the input of M1 (pin 12) produces maximum input sensitivity. This occurs when the potential at this point corresponds to the switching level of the M1 input gate, since at this potential a minimum-amplitude input signal will be able to switch M1 between the two output logic levels.

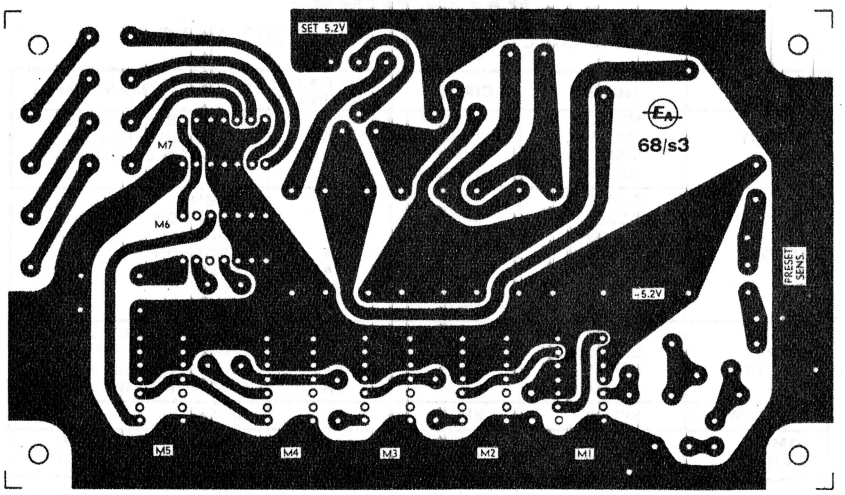
Although the diodes are in series opposition as far as the AC input signals are concerned, they are forward biased by the DC current from the sensitivity controls; hence for signals smaller in amplitude than about 1.5V peak-to-peak they appear as only a slight series impedance in the input signal path. But if the signal amplitude exceeds approximately 1.5V P-P, one or the other of the diodes will be biased out of conduction on each signal peak — D1 on negative peaks, and D2 on positive peaks. Accordingly the maximum signal amplitude applied to the input of M1 is limited to a figure well within the capability of the MC1023P device.

When required, reduction of the input sensitivity of the instrument may be performed by reducing the diode bias current using the 10K front-panel control. This lowers the potential at the input of M1 from the maximum sensitivity level, increasing the signal amplitude necessary to swing M1 between the output logic levels. The reduced diode current also tends to increase the effective series signal impedance provided by the diodes.

From M1 the signals progress through M2 and the remainder of the microcircuits—including M3 when 20-1 scaling is required, finally reaching the output connectors through M7. It will be noted that DC blocking capacitors are connected in series with the four outputs, mainly to protect M7 in the





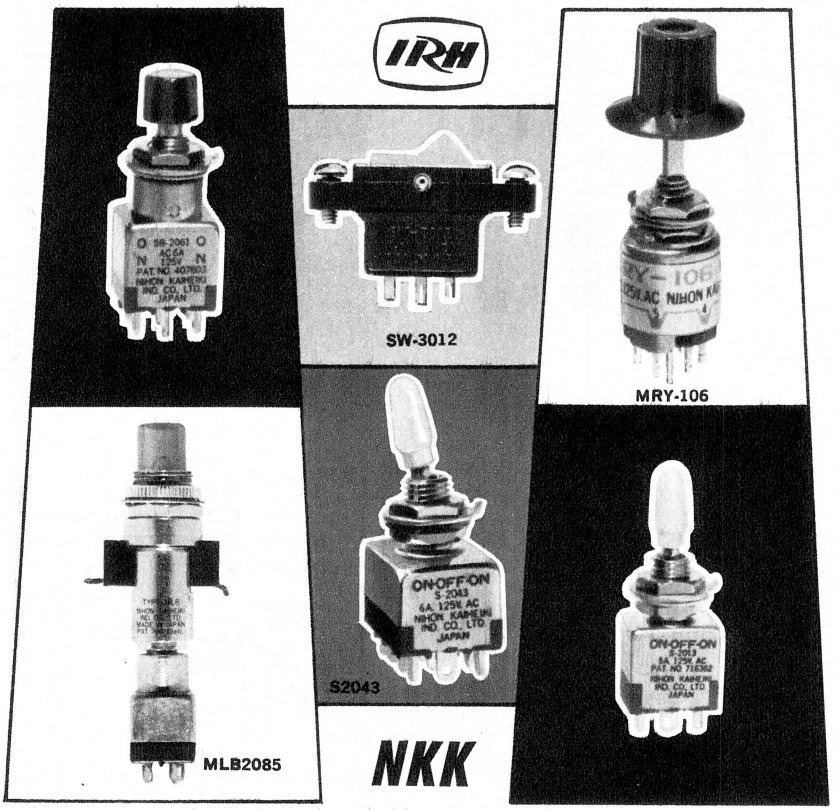


At top is a view of the top of the printed wiring board, with components mounted. Centre is a diagram to aid in component placement, while lowest is a reduced copy of the wiring board etching pattern (actual size 6in x 3½in). Full size prints of the pattern are available.

event of accidental shorting of the output connectors.

The MECL II series of microcircuits are intended to operate from a supply of 5.2V, regulated to within 10 per cent and with the positive polarity grounded, To provide this supply voltage at the current drain of approximately 260mA required by M1-7 the instrument includes a small regulated power supply.

The supply employs a small 6.3V/1A stepdown transformer and a full-wave bridge rectifier using four silicon diodes type BY126-50 or similar. Following the rectifier is a simple series regulator circuit employing a nominal 3.3V zener diode, an error voltage amplifier using a silicon NPN transistor type BC108, 2N3565 or similar, and a series element using a 1-watt silicon NPN transistor type 40408 or similar. A small tab potentiometer in the base circuit of the error amplifier permits compensation for variations between zener diodes and transistors.



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	MRX-204	2 POLE	1A	1-4 USABLE POSITIONS
	MRX-402	4 POLE	1A	2 POSITION
TOGGLE	S-2012	SPDT	5A	ON-ON
	S-2013	SPDT	2A	ON-OFF-ON
	S-2022	DPDT	5A	ON-ON
	S-2023	DPDT	3A	ON-OFF-ON
	S-2025	DPDT	3A	ON-MOM ON
	S-2042	4PDT	5A	ON-ON
	S-2043	4PDT	3A	ON-OFF-ON
PUSH BUTTON	SB-2011	SPDT	2A	ON-ON (MOMENTARY)
	SB-2061	DPDT	3A	ON-ON (MOMENTARY)
	SB-2065	SPDT	2A	ON-ON (DOUBLE ACTION)
	SB-2085	DPDT	3A	ON-ON (DOUBLE ACTION)
SEE SAW	SW-3012	SPDT	3A	ON-ON
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and allows the microcircuit supply rail to be set to the required 5.2V.

To ensure stable and reliable operation of the instrument at high frequencies the negative supply rail is bypassed at both "input" and "output" ends of the microcircuit chain. The input network bias supply is similarly decoupled to ensure input stage stability.

As may be seen from the photographs, almost all components of the scaler/divider are mounted on a printed wiring board. The board measures only 6in x 3¼in, but incorporates all the components of the unit with the exception of the power transformer, the front-panel sensitivity control and ratio switch, the pilot lamp and the input/output connectors. The board includes three small wire links which perform conductor crossovers.

The board pattern is reproduced on these pages, together with a photograph showing the position of all components. Using these as a guide it should be possible to construct the unit with a minimum of difficulty, even for those with little previous wiring experience.

It should be noted that the copper side of the board includes coding which identifies not only the respective positions of the microcircuits M1-M7, but also their orientation: the "notched" end of each device should be nearest to the appropriate code symbols. Note also that the 40408 transistor in the power supply is fitted with a small clip-on finned radiator, to reduce case-ambient thermal resistance.

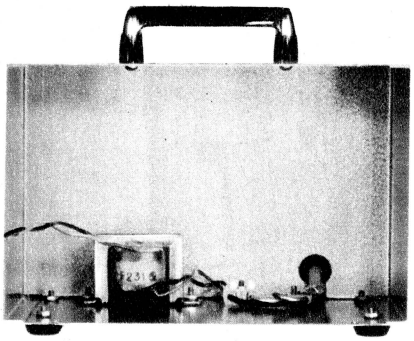
When soldering the various components to the board, the usual precautions should be taken. The board copper should be clean, and preferably prefluxed; the component pigtails should be bent carefully after emerging on the copper side of the board, and if necessary cut to approximately 1/8in prior to soldering to the copper. The soldering operation itself should be performed quickly but with care using a small, well-tinned iron, the idea being to produce a true bond without causing component damage due to overheating.

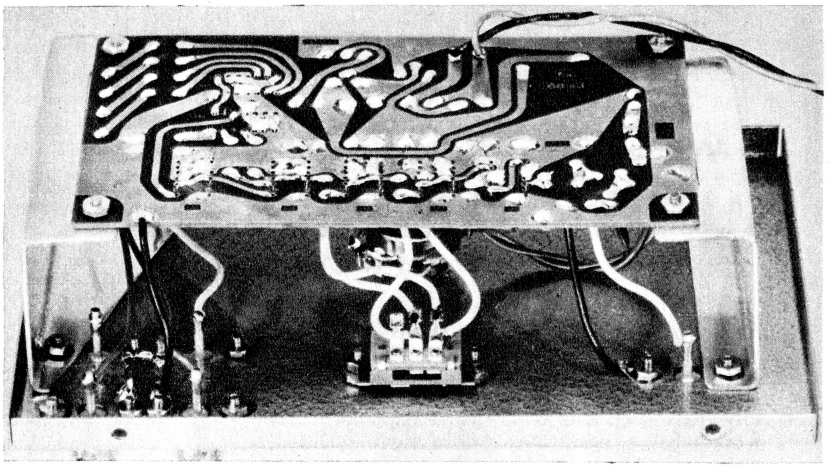
It will be found that the input coupling capacitor (.01uF) and the two diodes D1 and D2 are mounted on the board with minimal lead length, to reduce input circuit losses; this also applies to the associated 2.2K resistors, and the various bypass capacitors. When soldering these components into position it will therefore be necessary to use particular care to avoid overheating.

Special care will also be required when soldering the microcircuit pins, to ensure that inter-pin shorts are not produced by solder blobs bridging the rather narrow inter-pin gaps. It is particularly for this reason that a small-tipped iron is recommended, as the job will be made doubly difficult if a large iron is employed.

Note that the board makes no provision for solder connections to some of the microcircuit pins. The pins concerned should be cut off with sharp sidecutters as close as possible to the board — preferably AFTER the other pins have been soldered down, to avoid errors. Care should be taken to ensure that none of the severed pin remnants adheres to the board, as this could cause shorts.

The instrument is housed in a stan-





At right is a view of the wiring board attached to the rear of the case front panel. Above is the case interior.

dard small instrument case measuring 7½in x 5in x 4in. The input connector, ratio slider switch and output connectors are mounted from left to right in the lower area of the front panel, with the sensitivity control mounted centrally above the slider and the pilot bezel at upper right.

The wiring board is attached to the rear of the front panel via two brackets fashioned from scrap sheet metal, with the panel-board spacing approximately 1¼in. Short lengths of hookup wire are used to make the connections between the front-panel controls and connectors and the board; these leads should be kept as short and as direct as possible, in order to keep circuit losses to a minimum. A small hole drilled in the left-hand board mounting bracket (viewed from the front of the panel) permits convenient adjustment of the "preset sensitivity" pot when the board is mounted in position.

The power transformer is mounted in the lower rear of the case proper, with the mains cord active and neutral conductors connecting to the primary leads via a 2-way section of miniature "B-B" connector strip, alongside. The mains cord enters the case rear via a grommetted hole, and is clamped to the floor of the case upon entry to prevent strain on the connections. The earth conductor is connected to a solder lug mounted under the cable clamp, and this thereby connected to the case. The transformer secondary leads are left at the length supplied, and connect direct to the appropriate pads on the printed wiring board.

When the unit is completed and deemed ready for operation, the first part of the adjustment procedure is to set the microcircuit supply voltage to the required 5.2V.

Prior to switch-on, turn the power supply tab pot fully anticlockwise as viewed from the top of the board when mounted. This will ensure that upon switch-on the supply voltage will be a little lower than the correct setting, rather than excessive. The unit may then be connected to the AC mains, and with a reliable voltmeter connected between the negative supply line and earth, the supply tab pot may be advanced until the voltmeter reads as close as possible to 5.2V.

Adjustment of the preset sensitivity control forms the second part of the setting-up, and this is done with the unit connected either to the counter/frequency meter with which it is to be used, or to a similar instrument. The input of the scaler/divider is connected via a short co-axial cable to a signal generator capable of delivering approximately 100mV, the latter being set to produce any convenient output frequency between 2-60 MHz.

The front-panel sensitivity control should first be turned fully clockwise (minimum resistance) and the preset tab pot control to the fully anti-clockwise extreme viewed from the adjacent side of the board. The preset control may then be slowly advanced, and it should be found that for a small range in settings, correct and stable operation of the unit will occur and be manifest as an appropriate indication on the counter/frequency meter. Outside the small range in which a stable reading is produced, there should be a zero reading.

The optimum setting for the preset control is in the very centre of the critical range, as this will produce the maximum input sensitivity. With the tab pot so adjusted the input sensitivity of the unit should be such that for signals between about 2MHz and 100MHz, a signal of 100 mV or less is capable of producing stable readings on the counter/frequency meter. ■

Scaler Parts List

1 Case, 7½in x 5in x 4in, with wrap-over front panel.
1 Printed wiring board, 68/s3.
1 Stepdown transformer, 240V to 6.3V at 1A.
1 DPDT slide switch.
1 Miniature pilot bezel with 6V-50mA lamp.
5 Co-axial connectors, plugs as required.
1 Clip-on finned radiator for TO-5 transistor.

SEMICONDUCTORS

1 MC1023P microcircuit.
1 MC1027P microcircuit.
4 MC1013P microcircuits.
1 MC1004P microcircuit.
1 BC108, 2N3565, TT3565 or similar transistor.
1 40408 or similar transistor.
1 BZY88/C3V3 or similar 3.3V zener diode.
2 OA91 or similar germanium diodes.
4 BY126-50, EM401, SD55-05 or similar silicon diodes.

RESISTORS

Half-watt 5 per cent type: 100 ohms, 470 ohms, 1K, 3 x 2.2K.
1 IK linear tab pot, p.w. board type.
1 4.7K linear tab pot, as above.
1 10K linear pot.

CAPACITORS

2 .0033uF LV plastic.
1 .01uF LV plastic.
5 0.1uF LV plastic.
1 400uF 6VW electro.
1 640uF 10VW electro.

MISCELLANEOUS

Mains cord and plug; scrap sheet metal for board mounting brackets; handle and rubber feet for case; 2-way section of miniature B-B connector strip; tinned copper wire for board links; connecting wire, solder, screws, nuts, solder lugs, etc.

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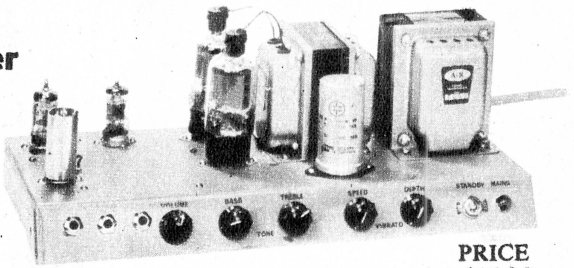
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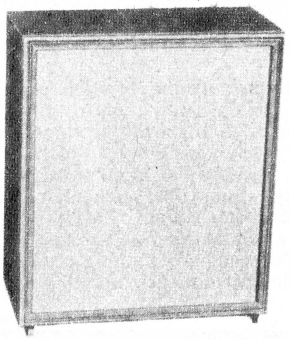
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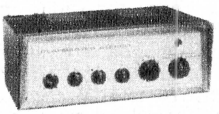


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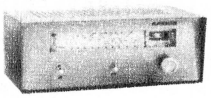
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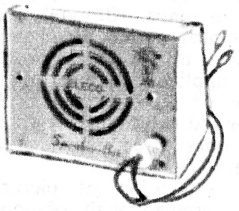
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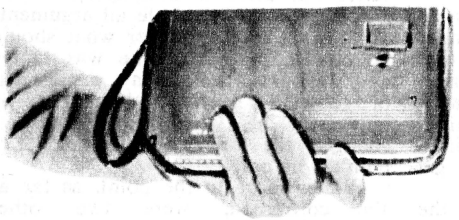
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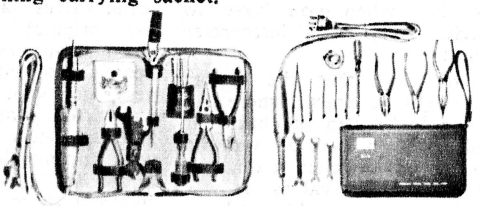
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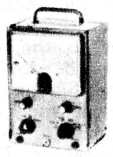
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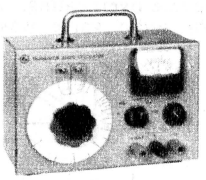
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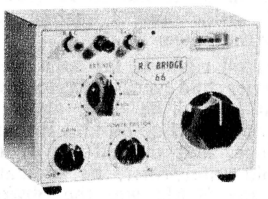




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The Serviceman

FAULTS THAT SHOULDN'T HAPPEN

Why do electronic devices fail? Mostly it is because an individual component fails and, much as we might deplore such failures, they are at least understandable. Occasionally however, failures are due simply to poor design or poor workmanship. A couple of recent experiences reminded me of this.

The first story started out as a fairly routine complaint; "no sound, no picture." I imagined it would be a simple and obvious trouble, such as a faulty fuse, defunct rectifier, or something else common to the whole system.

My first problem turned out to be the language barrier. The set belonged to a migrant family, relative newcomers to the country, and able to speak only limited and halting English. As so often happens in these cases, the one with the best command of English was the son of the family, but even he had his limitations. Trying to get a technical explanation from or to a lay person is difficult enough in any circumstances, but when you have to work through a six year old interpreter —Oh brother!

The trouble was that the owner knew, or thought he knew, where the fault was. He had taken the back off the set and, as soon as I arrived, he lead me to the set, switched it on, and pointed to one of the valves. It was the 6CM5 line output valve and, as the set warmed up, I realised why he had picked on it. It started to glow a bright red inside and I instinctively reached for the power switch.

That was all right as far as it went, but the owner had very definite ideas about what should be done about it. With a combination of halting English, sign language, and the efforts of the six year old interpreter, he indicated that, since the 6CM5 was the obvious cause of the trouble, that was what should be changed, and that was what he wanted changed.

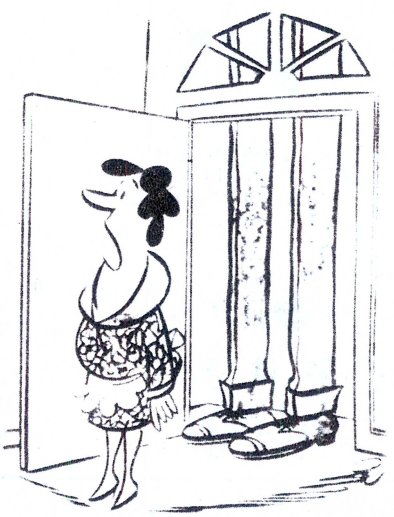
How could I explain to him that the valve itself was the least likely cause of the trouble; that it was likely to be almost anywhere, particularly as the sound section was somehow involved in the trouble?

In the end I simply went ahead with the job, doing my best to ignore the excited three-way conversation between Mamma, Poppa, and Bambino, and hoping that I wasn't supposed to be a part of it. Or, if I was, that my absence wasn't too noticeable.

Most of the set was constructed around two printed wiring boards. One board carried the complete audio stage, a 6GW8 triode-pentode, the vertical oscillator-output stage (6GV8), and the line oscillator (pentode section of a 6BL8). The other board carried most of the remainder of the set with the exception of the tuner and line output stage.

The first thing I noticed, as soon as I could allow my attention to wander from the overheated 6CM5, was that the valve heaters on the first named board did not seem to be alight. I switched the set off and allowed things to cool down a little while I shifted the cabinet a little so that I could get a better view of the valve heaters.

When I switched on again the valves came on with a sudden burst of brightness, in the manner which some valves have, and I imagined that my original observation had been wrong. But no. As I watched, the heaters dropped to their normal brightness, then kept on dropping until there was virtually no light to be seen. Well, at least I now had some idea of what was responsible for the main symptoms. With no horizontal oscillator function there would be no drive for the 6CM5, no bias, since this is normally derived from the grid drive, and hence the severe overheating. And since the 6GW8 audio valve was on the same board, it was easy to see why there was no sound.



"The man's here to fix the television aerial" (Radio Times)

The next thing to discover was what was going on in the heater circuit to make it behave as it did. After some checking I established that there were four heater runs from the power transformer winding; one to the tuner, one to the EHT cage, one to the other printed board, and one to the board in which I was interested. In the case of the first three sections the "earthy" side of each sub-assembly was strapped to the main metal chassis by a substantial lead, thus ensuring that the return side of the heater circuit was provided with a reliable path.

Not so in the case of the board I was interested in. The earthy copper pattern was connected to the main chassis by nothing more than a small rivet, whose main job was simply to hold the board in place. Although the rivet did not appear to be noticeably loose, the heater circuit "came good" immediately I applied pressure to it with the blade of a screwdriver. A hastily improvised bridging strap, similar to the other three, provided a more permanent cure.

The sudden restoration of picture and sound was greeted with obvious delight by the owner and his family. After all, there is nothing quite like a complete cure to settle all arguments as to what was wrong or what should be changed. So everyone was happy and we parted with many expressions of goodwill. Even so, I imagine he may still be wondering whether I changed the valve or not; and if I didn't, why not.

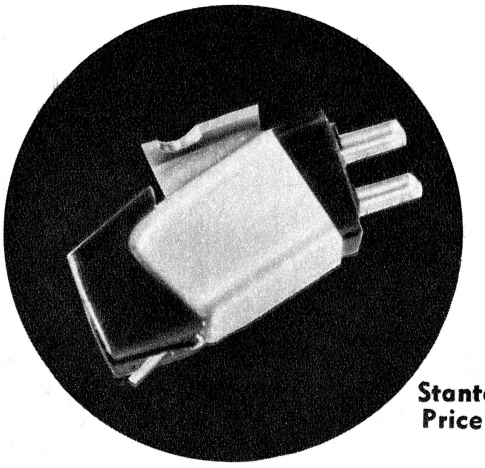
Rather more to the point, as far as I'm concerned, were two other questions; Why there was no strap in this part of the circuit in the first place, and why did the valves behave as they did at the moment of switch on?

In regard to the first question, I am inclined to the theory that the design of the set called for a strap in that position, but that it had simply been forgotten in this individual chassis. The riveted connection was presumably good enough when it was new to let the set get through the factory tests and into the field. It was only with the passage of time and formation of oxides on the metal surfaces that trouble developed.

An answer to the second question is not so easy to provide. Valve heaters, like lamp filaments, exhibit minimum resistance when cold, increasing to several times this value at normal running temperature. Thus they would draw most current at the moment of switch on, assuming negligible impedance in the supply. However, in this case it would appear that there was considerable resistance in the circuit which would effectively limit the current. How was it possible, then, for the heaters to produce the preliminary bright glow?

Frankly, I'm not sure. I can only assume that the faulty connection was heat sensitive so that, at the moment of switch on, the circuit was continuous.

Almost immediately, however, the heavy preliminary current surge would create some heat at the point of imperfect contact, expanding the metals involved until only a relatively imperfect connection remained. This may have continued to generate enough heat to retain the imperfect condition,



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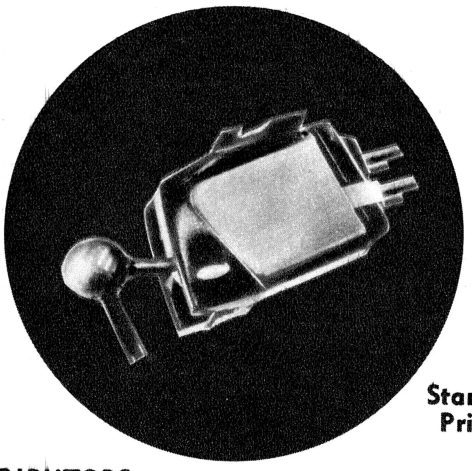
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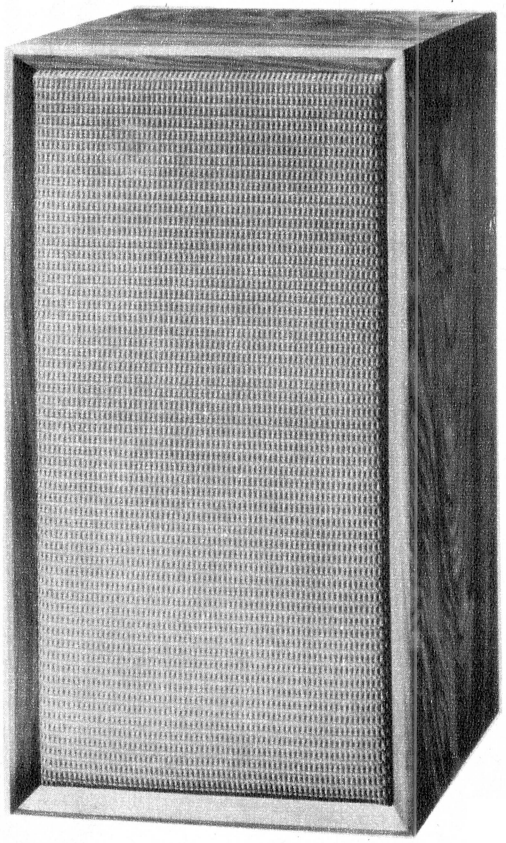
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or it may, in some circumstances, have opened the circuit completely, cooled until the circuit was restored, then repeated the cycle. I don't know, I didn't have time to check all the possibilities.

Hard on the heels of this incident came another, broadly similar. In this case the owner was one of my regular customers who had taken himself, his family, and a 12in portable set up the coast for a few weeks holiday over the Christmas break. Almost immediately the set had packed up, to the disgust of the rest of the family in particular. Since a business situation had then arisen which necessitated a one-day trip back to town, the owner had taken the opportunity to bring the set in to me and ask if it were possible for me to fix before he left for the holiday resort that night.

I said I would do my best.

In fact, it was easy. One glance inside the cabinet showed that all the valves on the printed board were not alight — and that was most of them. In this case the printed board had been made to swing out for easier access and, to ensure a reliable connection to the main chassis, had been equipped with a stout flexible strap.

Which was all very well as far as it went. The trouble was that the flexible strap had been connected to the chassis proper by means of a self-tapping screw and this had not been tightened as well as it might have been. Once this fault was corrected the set came good and a grateful owner took delivery of it later in the day.

The thing that surprised me about this fault was that it should ever have been allowed to happen. The set was a well known make and it came as something of a shock to realise that it had been designed to depend on a screw connection of this type, rather than a reliable soldered joint. Granted, it may be argued that soldered joints can fail also, and I would agree with this. Nevertheless, I imagine that the chances of failure would be much less with a soldered joint than with a screw type.

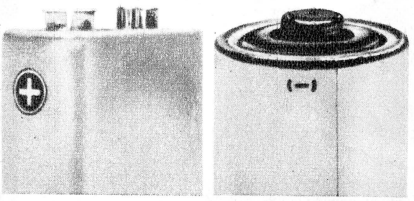
Here is a short story related to me by a colleague and which is sufficiently interesting to bear repeating. He had been working on a TV set in his own workshop and, while the original fault for which it had been brought in had been found and fixed, it now appeared to be suffering from an intermittent fault. At odd intervals the picture would be broken up by heavy black lines, occasionally losing sync. into the bargain. As my colleague described it, it was very much as if there was a loose connection somewhere in the signal line, particularly the feeder. He also noticed that it was most pronounced on channel 2.

However, all tests along these lines proved negative, and my colleague had almost reached the end of his tether. Then he suddenly realised that the interference on the screen seemed to synchronise with a faint mechanical clunking sound coming from somewhere outside the workshop. He hurried to investigate, and suddenly all was clear.

My friend's workshop is adjacent to his own residence, in the backyard of which is the usual rotary clothesline. Also in the yard was a children's play structure; a combination of slippery dip, swings, and gymnasium bars constructed from metal tubing. On the

ONE CAN'T BE TOO POSITIVE ABOUT PLUS!

From a reader at Orange, N.S.W., we have received two examples of batteries with incorrect polarity markings. We are reproducing photographs of these to indicate the nature of the error, but we have deliberately erased the brand names. With only one sample of each discovered so far, there



is nothing to indicate that they are anything more than isolated cases and, while we feel that we should warn readers that this can happen, it would not be fair to condemn the makers on the basis of one faulty unit. However, we would be interested to hear from any other readers who may have experienced a similar fault.

One battery is the popular miniature 9V type used for the smaller size portable radios, and which uses a pair of snap fastener terminals. The other unit (by a different manufacturer) is a small cylindrical cell normally used in torches, flash guns, and similar devices.

In the case of the 9V battery the cell assembly and terminals appear to have been fitted to the outer case (with label) the wrong way round, so that the female snap fastener, which is normally negative, is shown nearest the "+" sign on the label. However, the terminal really is negative.

In the case of the single cell, the label has been fitted upside down so that "—" sign is shown closest to the metal cap on the end of the carbon rod; the positive terminal.

While neither error would matter particularly where the true polarity can be recognised by the physical shape of the terminals, it would be possible for people unfamiliar with terminal conventions to be confused. In the case of the single cell, fitting it in strict accordance with the label could cause the equipment not to work, or to work poorly. In the case of the 9V cell, it could only be fitted to existing equipment the correct way, by reason of the polarised terminals. However, an experimenter, wiring equipment to suit such battery, and taking the markings at their face value, could finish up applying wrong polarity voltage to polarity conscious components, such as transistors, possibly damaging them in the process.

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previous day this had been moved from its normal site to a temporary position near the clothes hoist—a little too near in fact, because a light wind was now causing the hoist to bash against the play structure with every gust.

And that, believe it or not, was sufficient to cause the intolerable interference on the TV screen. I can only guess at the exact mechanism by which this happens; it could be that some part of the hoist or play structure was resonant at the frequency of channel 2, or the two of them together could have produced a resonant length which was working as a trap in regard to the nearby aerial.

The alternative suggestion was that there was sufficient electrical field around the hoist, from nearby house and street wiring, to create an interference pulse whenever the two pieces of metal touched. That this effect does happen is well known, and is easily demonstrated. In fact a common cause of radio and TV interference is the electrical conduit found in old houses, particularly where two runs of conduit cross one another or run parallel and are lightly touching. Fortunately, conduit has not been used for many years and the trouble is becoming more rare as old houses disappear.

But the story served to remind me of a similar incident which I experienced many years ago. I was a lad in the country at the time, and interference from power lines and other causes was the bane of radio reception, a situation which was aggravated by the relatively low powered transmitters.

On this occasion I was listening to a radio program one morning when the peaceful mood of the program was shattered by a series of regular blurts from the loudspeaker. These followed a definite pattern; there would be a series of five or six blurts, at about half-second intervals, followed by a period of silence for several seconds, then another series, and so on.

The trouble continued for some time and I was about to switch the set off when it ceased and I was able to enjoy the remainder of the program in relative peace and quiet.

The same afternoon, there was another program I wished to hear. It was a hot day and I decided to seek the cooler atmosphere of a side verandah, taking the radio program with me in the form of an extension speaker.

I had just settled down to enjoy the program when the rhythmic series of blurts commenced again. However, such annoyance as I might have felt, was tempered by a realisation that the cause was now fairly obvious. Each blurt in the speaker was followed, a fraction of a second later, by a thumping sound originating several hundred yards down the road. Further investigation revealed a team of workmen engaged in replacing the roofing iron of a house. The thumping sound was the rammer driving in the roofing nails and every time the hammer hit a nail, the vibration apparently found a weakness of some kind in the electrical conduit or wiring, which generated an interference pulse.

As in my colleague's case, the interference pattern had been quite meaningless until it was related to mechanical sound produced along with it; then the relationship between the two was so obvious as to make one wonder why it had ever been a mystery.

Some thoughts on

ORGAN TREMULANT, VIBRATO

By Neville Williams and Anthony Leo

This article discusses tremulant and vibrato effects, as applied to electronic organs and goes on to explain the potential advantages of the less well-known phase modulation. A fully developed phase modulation unit is presented.

To add variety and interest to sound, music makers commonly adopt the trick of modulating — or varying in periodic fashion—either the frequency or loudness of the sound, generally at the rate of a few cycles per second.

Singers achieve a modulating or pulsating effect by suitable muscular control over breath, vocal chords and mouth configuration. Tone, amplitude and frequency are all likely to be modulated and, depending on the vocal expertise of the singer, the result can be variously pleasing or displeasing, interesting or painfully monotonous. It has been suggested that, in extreme cases, singers may modulate frequency or pitch by about 6 per cent, which is equivalent to plus and minus one complete semitone.

Violinists commonly vary or modulate the frequency of notes by rocking the fingers of the left hand, which are being used to "stop" the strings. "Pop" guitarists achieve a similar result by means of a lever, which allows the tension of the strings to be varied in a periodic manner. As a general rule, the frequency variation applied to instruments is less than the extreme figure quoted for the human voice, and 3 per cent or a half-semitone is accepted as a realistic limit figure.

The technique of periodically varying the frequency of a musical note is commonly described as "vibrato."

Vibrato rates usually lie within the range 5 to 8 cycles per second (i.e. 5 to 8 Hertz), with 7Hz probably the most commonly used figure. Rates outside this range are sometimes used but only for rather special effects.

In acoustic organs, it is not easy to modulate the frequency produced by the pipes and an alternative approach has long been used of varying the pressure of air to the pipes in a periodic fashion, usually by means of small, mechanically driven supplementary bellows. Varying the air pressure has a minor effect on frequency but its main effect is to vary the loudness of the sound produced.

The technique of modulating the loudness of notes is commonly referred to as "tremulant." As with vibrato rate, tremulant rate usually falls in the range 5-8Hz, with 7Hz again the most usual figure.

Vibrato or tremulant effects are exploited heavily in modern electronic (or electric) organs, partly from necessity, partly by reason of opportunity. Let's explain this:

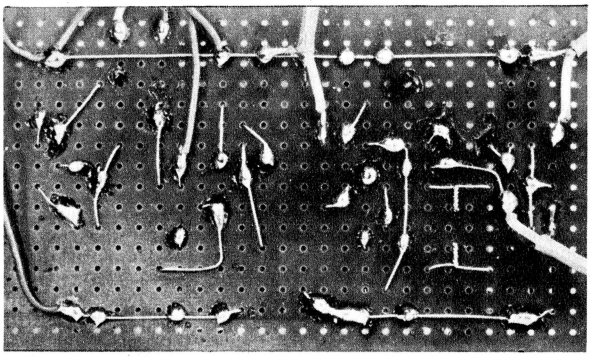
When a complex chord is played on an acoustic organ, the sound as heard is the resultant of many independent pipes, speaking simultaneously. For practical reasons, organ pipes are never perfectly in tune and the constantly changing phase relationships, along with the spatial separation of the pipes, emphasis the complexity of the chord and adds to its aural interest.

Electronic organs, for the most part, are designed within limits of cost and complexity which dictate the use of a much smaller number of sound source generators. In many cases the generators are highly interdependent, which makes for ease and accuracy of tuning, but the phase relationships are fixed and locked rather than random and variable. And, of course, the sounds are usually propagated through common loudspeaker channels.

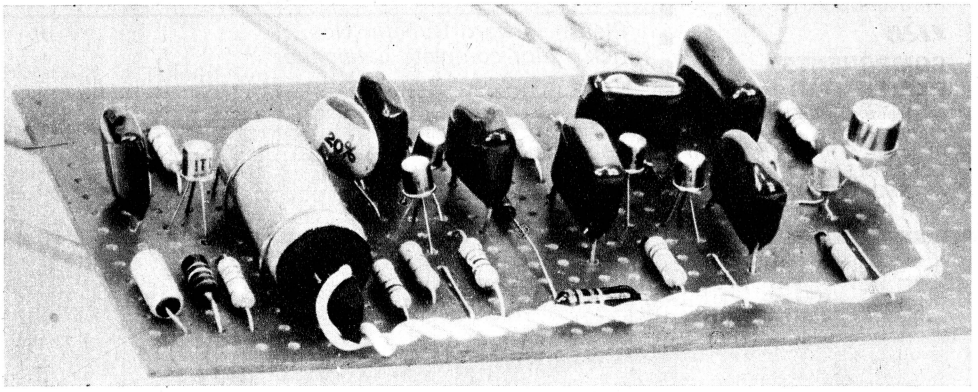
Compared with a pipe instrument, the chord structures from an electronic organ tend to lack complexity and aural interest; or, to borrow a phrase, the unembellished sound tends to be "bland."

This being so, the designers of electronic organs have been forced to adopt all kinds of measures to render the sound less bland—or more complex. They — and the players — have come to rely on vibrato and/or tremulant effects to a much greater extent then is traditional or necessary in pipe instruments. So much for necessity!

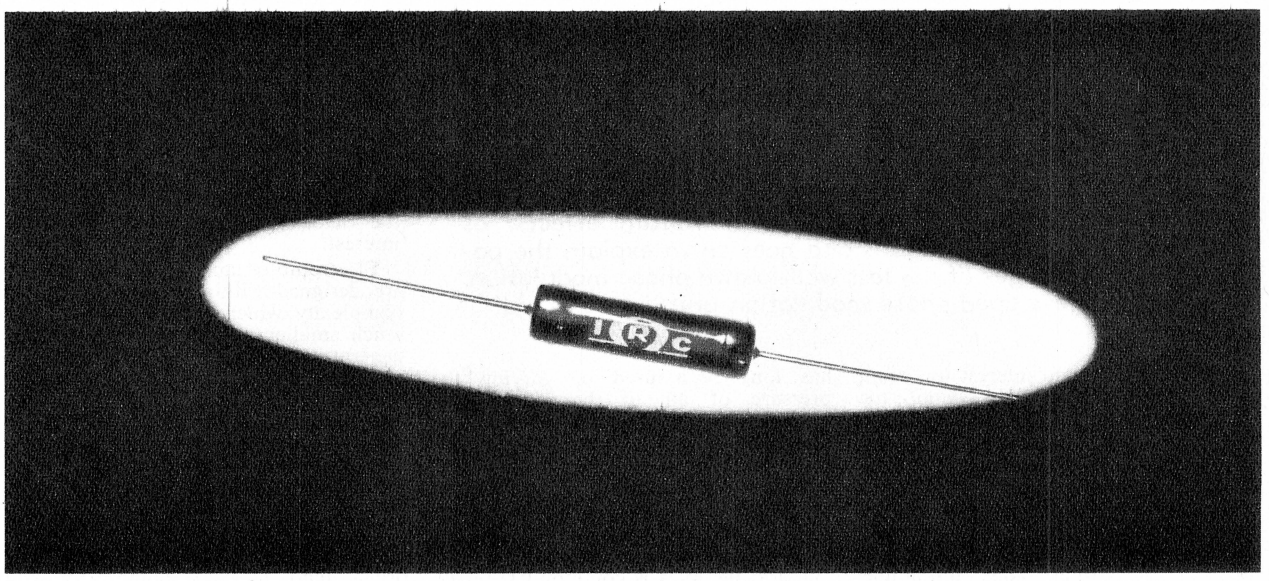
As far as opportunity is concerned, designers of electronic organs can draw upon a very wide range of techniques, either to simulate traditional organ effects or to achieve others which have



An underneath shot of the wiring board is shown at left. The actual wiring uses no tags or eyelets, the component leads being simply bent over and soldered point to point.



A relatively simple phase vibrato unit, comprising one stage only, is shown at right. The LDR and lamp complement are housed in a small aluminium tube and wired to the board at one end.



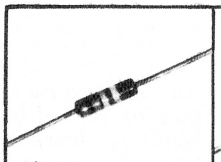
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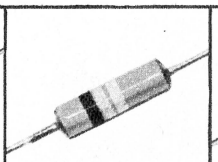
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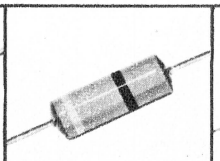
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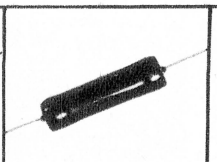
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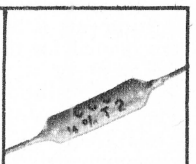
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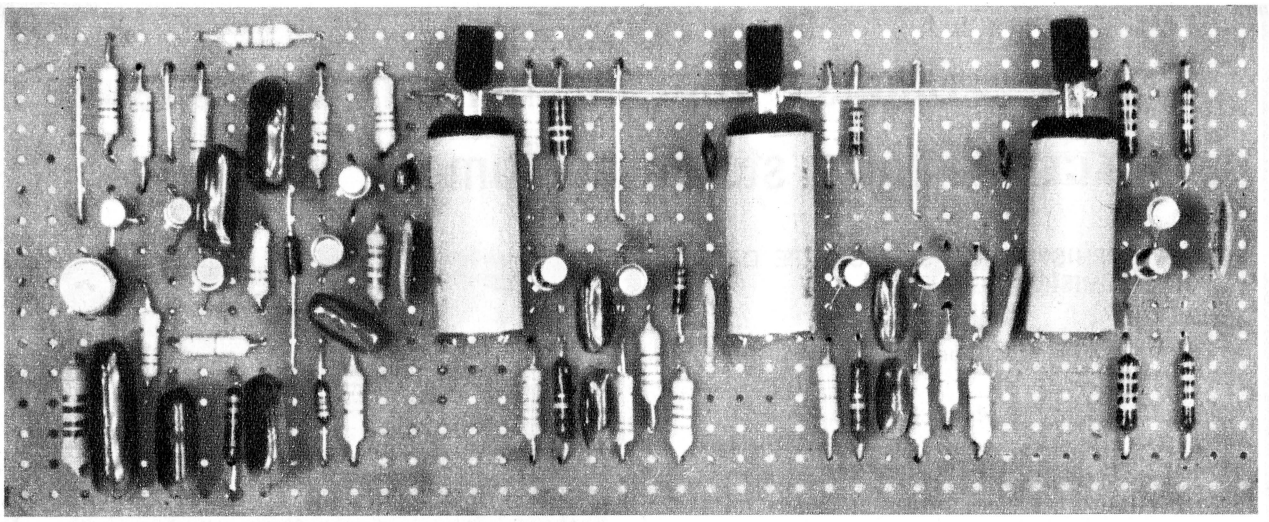
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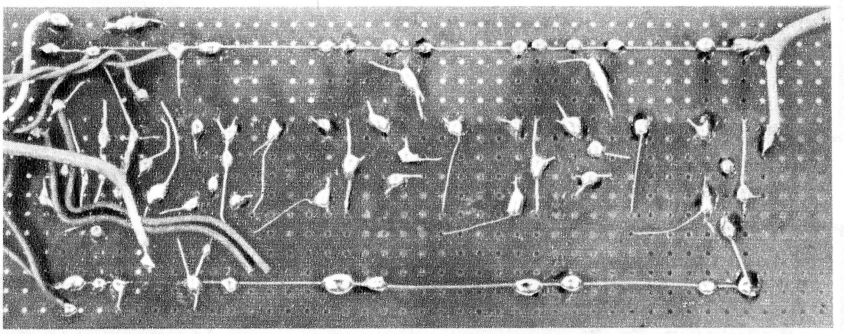
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The fully developed three-stage vibrato system is shown above, clearly showing the sectional placement of various components. Again the same wiring technique is used for this unit, as shown at right.

no obvious counterpart in acoustic instruments.

A tremulant effect can be achieved by causing the gain or amplification of a stage in the amplifier to vary at the desired tremulant rate. Or, again, by introducing into the signal path a resistive element whose value varies in a cyclic manner. In current practice, this commonly takes the form of an LDR (Light-Dependent Resistor) illuminated by a small, rapidly flashing lamp.

More significant, however, is the fact that an electronic organ designer can outdo his acoustic counterpart by providing full vibrato. This can be achieved by suitably varying the operating conditions of valve (or to a lesser extent transistor) oscillators or by varying the reactive quantities in the frequency determining circuits.

Should it be considered desirable, there is no special problem about providing part tremulant, part vibrato, making either peculiar to individual organ voices, varying modulation depth and speed, or even providing different rates simultaneously for special effects.

It has been stated fairly frequently that there is not a great deal of difference aurally between tremulant and vibrato and this is, in fact, a conclusion one might easily reach, based on observation of single tones or even simple chords. In both cases, the main aural impression is a rapid fluctuation in the loudness of the sound.

With tremulant this is exactly what one would expect to hear, because the signal is, in fact, being modulated, in terms of loudness or amplitude.

With vibrato, or frequency modulation, the effect has to be explained on a completely different basis.

Imagine that a pure, unvarying tone is being propagated into a listening area. What the listener hears is a mixture of direct sound from the loudspeaker, with that reflected from walls, ceiling, structures, etc. The subjective loudness at the listening position is a random resultant of how the multi reflections add or cancel in terms of amplitude and phase but, provided everything remains fixed, so will the level of sound as heard.

But now change the frequency of the tone by a small amount. Immediately the pattern of reflections and standing waves in the listening area changes, as also will the amplitude and phase resultants at the listener's ears. An inevitable effect will be a change in the apparent loudness of the signal, in addition to the change in frequency.

In fact, there is good reason to believe that the average listener may react more to the loudness change than to the frequency change!

Evidence of this is provided by the fairly common complaint that the vibrato (not tremulant) in certain electronic organs can scarcely be heard when the player is listening to his own music only through earphones. On the loudspeaker, the vibrato may be quite heavy; on phones it is scarcely discernible.

Almost certainly, the explanation is that there is no pattern of reflections and standing waves between the transducer and the listener's ears and no cyclic variation in this pattern as the frequency is modulated. The listener is left only with pure frequency modulation, to which — surprisingly — he is less sensitive than he might otherwise have believed.

At first glance, this seems to confirm the idea that, in a typical listening environment, there is little to choose between tremulant and vibrato; that vibrato only has a clear impact on the listener when it is transformed by the acoustic environment into a loudness modulation.

For single or simple tones this is not far from the truth but the contention breaks down completely when the reasoning is applied to complete chord structures and harmonically rich sounds, as commonly produced by electronic organs.

Assume a given chord structure, complete with harmonics, being played at fixed level in a fixed listening situation. The listener hears each component of the total sound, not just as a direct radiation from the loudspeaker but as a resultant of the direct sound and its multiple reflections. And, obviously enough, the pattern of reflections will be different for every single component of the total sound.

Now imagine that the frequency of all the oscillators responsible for the particular chord structure is shifted slightly. Immediately the standing wave patterns in the listening area will be affected — but not uniformly. At the listening position some components of the sound will increase in level by various amounts, some will decrease by various amounts and others will **not** be affected much at all.

A simple shift may not produce a very obvious aural effect but a constantly changing pattern certainly does and here the vital difference emerges, between pure tremulant and pure vibrato, as applied to an electronic organ.

With pure tremulant, simple tones or complex tones alike appear merely to be modulated in loudness.

With pure vibrato, all tones exhibit the expected tremulant effect, but the complex structures tend also to separate out as each individual frequency component behaves in its own individual fashion.

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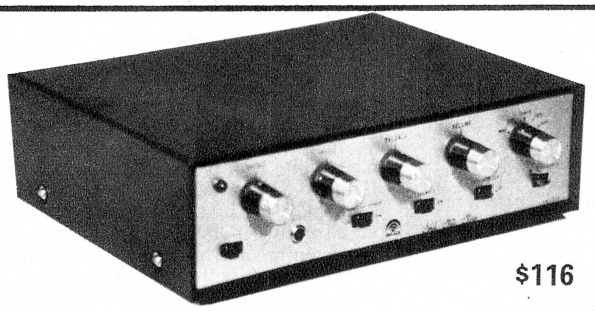
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the echo of what has preceded them in time.

In short, frequency modulation tends to impart an individual characteristic to tones and overtones which, aesthetically, have been locked more than they should have been. Thus, vibrato adds an order of complexity and a potential aural interest to chord structures, which is not provided by tremulant.

Is vibrato or frequency modulation, then, the obvious and best choice for electronic organs?

Not necessarily, and for a number of reasons.

The first is the very practical reason that it cannot easily be achieved when the tone generators are toothed wheels (as in most Hammond organs), reeds (as in early electronic Wurlitzers) or some forms of transistor oscillator, which are more inclined to "stay put" than be swung in frequency.

A second reason is that, if the oscillators which supply the manuals also supply the pedal clavier by frequency division, vibrato intended for the melody and accompaniment is imposed on the pedal notes. This is usually reckoned to be musically undesirable because the vibrato frequency becomes too great a percentage of the music tone frequency.

A third reason is voiced by some but not admitted by others. This is that the percentage of frequency swing which might be regarded as musically desirable or appropriate for 8ft tones in the melody region, may be excessive for notes in both the lower and upper region.

In the lower register, heavy vibrato is judged by some to be unnecessary and unpleasant, for reasons which differ only in degree from those which apply to the pedal notes.

In the case of high notes and overtones, the interplay of numerous rather wildly deviating frequency components can produce resultants which impart an unpleasant quality to the final sound. Nasal, unnatural, off-key are some of the adjectives used to describe this situation.

Out of these circumstances, of both choice and necessity, has emerged another technique — that of modulating the **phase** of the organ tones at some convenient point within the amplifier chain. Advancing and retarding the phase of the signals in a periodic fashion has a rather similar effect to varying the frequency.

The method has the advantage that it can be applied to individual preamplifier chains so that in more complex instruments, it can operate on the manuals but not the pedals, on individual manuals or even on particular voices. Such flexibility involves additional circuitry but this is not such a problem in these days of transistors and ICs.

An additional and interesting characteristic of most practical phase modulation circuits is that they tend to produce maximum phase shift in a frequency region, which can be selected, with a diminishing amount of phase shift towards the lower and higher frequencies.

This means that the aural effects expected of a vibrato system can be achieved for frequencies in the melody region of the keyboard, with a diminishing amount of modulation in the lower register (particularly the pedals) and for the higher order overtones.

Phase modulation therefore has a strong appeal to the designer who finds tremulant inadequate but who is unable or disinclined to apply vibrato to the basic tone generators. Or again, to the designer who wishes to provide vibrato selectively for individual manuals and voices, which are derived from a common oscillator/divider system.

A basic phase modulating circuit, which is essentially a split load type phase splitter, is shown at right. A detailed explanation is given in the text.

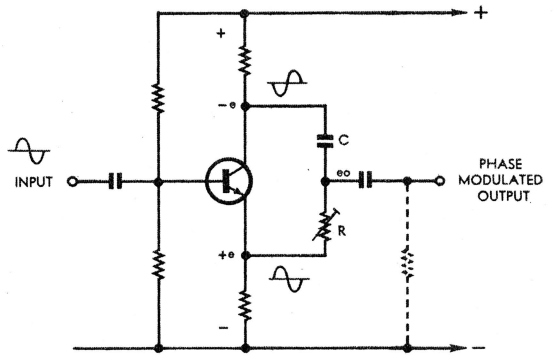


Figure 1

In general terms, the amount of pure vibrato effect which can be obtained by not-unduly-complex phase shifting systems is less than can be obtained by direct frequency modulation of those basic generators which are amenable to the treatment.

It is therefore substantially true to say that frequency modulation of the basic generators can produce a more dramatic vibrato more easily, than can phase modulation within the amplifier chain. For the reasons already explained, however, frequency modulation can produce a greater array of undersirable effects and phase modulation may therefore be described as more modest but "safer" in its application to a wide variety of voices.

Phase modulation can be achieved in a number of ways, some of them mechanical, as by rotating capacitors or capacitive switches, rotating transformer elements or rotating loudspeakers. Electrical systems include sequential sampling of the 180-degree displaced signals across a push-pull signal source and/or deriving signal from an R/C phase-shifting network of which one or more elements are varying in a cyclic fashion.

In applying these systems a major problem is to achieve phase modulation without simultaneously modulating the amplitude. It is all too easy to end up with a system which is more akin to tremulant than vibrato.

Two practical phase modulating vibrato circuits follow. The first is a relatively simple approach, providing only a limited frequency shift effect. The second circuit, while more complex, is capable of providing a substantial phase shift, resulting in an entirely acceptable vibrato characteristic.

The basic phase modulating circuitry is shown, in simplified form, in figure 1. In essence, it consists of a single stage phase splitter providing two signal sources, one at the collector and the other at the emitter, out of phase by 180 degrees. The modulated output is taken from the junction of a capacitor and resistor which are connected in series from collector to emitter.

The circuit differs from some earlier configurations in that the output from a network is strung between two active signal sources, not between one such source and earth.

Looking back from the output terminal there are two impedances, one the frequency conscious reactance of C and the other a variable resistance R, connected to the independent out-of-phase signal sources. Operation of the circuit may be understood by considering the limiting values of R, infinity and zero.

If R has an infinitely large value, signal output will come from the collector, with a phase angle of —180 degrees with respect to the input, via the reactance of C. On the other hand, if R is zero, the output will come from the emitter with a phase angle of zero. The relatively high reactance of C compared with the zero resistance will have negligible shunting effect.

For intermediate values of R, the output phase will swing between the limits of —180 and zero degrees. There will be no reaction on signal amplitude—provided the junction point is not significantly loaded by the external following circuitry.

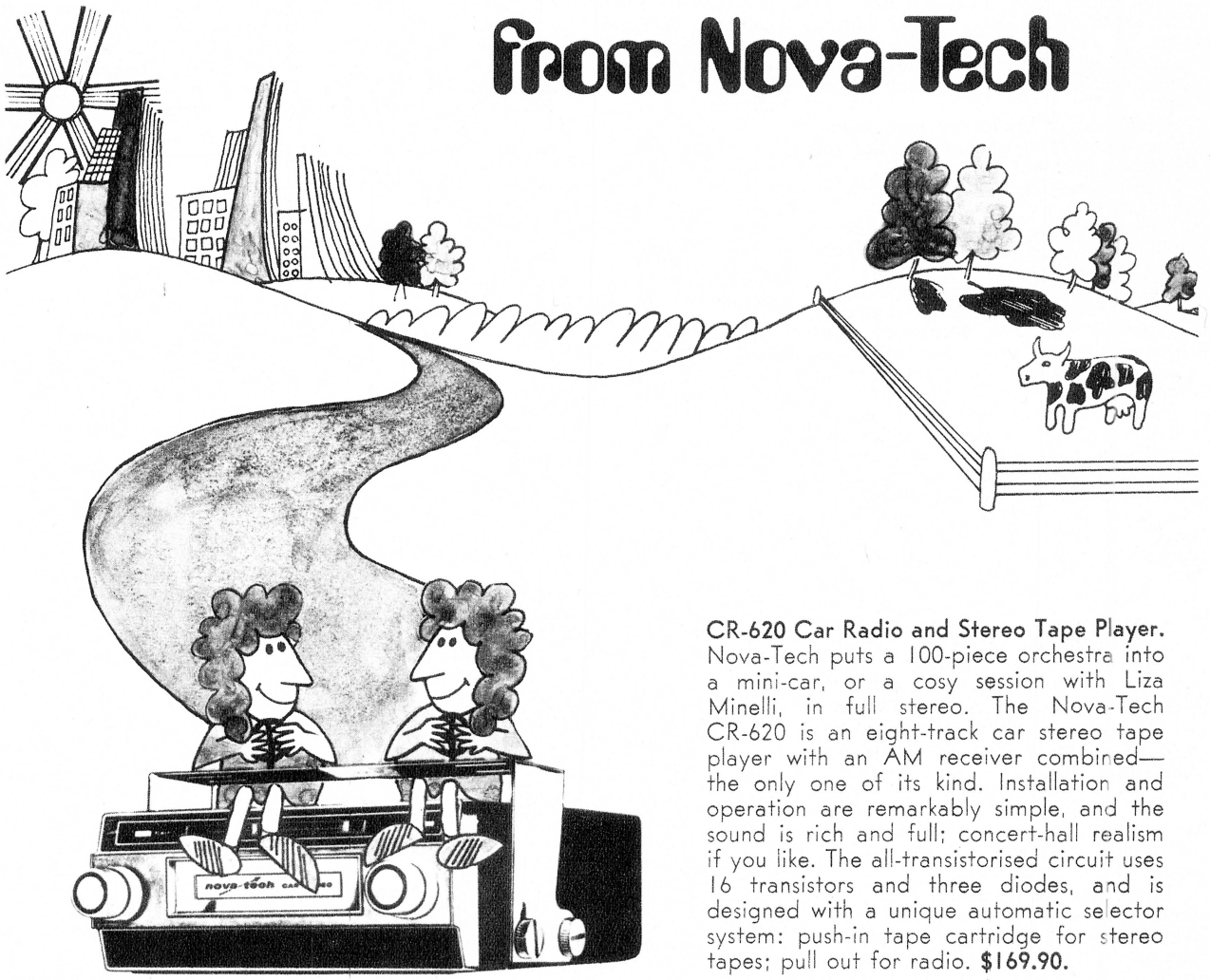
To explain in detail this variable-phase constant-amplitude characteristic would require resort to a vector, or more correctly, a phasor diagram. Those who understand such diagrams should have no special difficulty in working out what goes on. For those without as much background it may be sufficient to suggest a vector resultant of constant length, rotating from zero phase angle to —180 degrees and back again, with its tip describing a half-circle.

Ideally, the value of R should vary between zero and infinity for maximum modulation but, in practice, we must be content with a swing between two finite limits. This practical limitation modifies the modulator's basic characteristics, fortunately to advantage in certain respects.

A resistance variation between zero and infinity would theoretically provide a full 180 degrees modulation over the whole frequency range but, in practice, the finite resistance variation compared with the reactance of C results in modulation of less than 180 degrees peaking at one particular frequency. At frequencies above and below this point the phase deviation tapers off gradually.

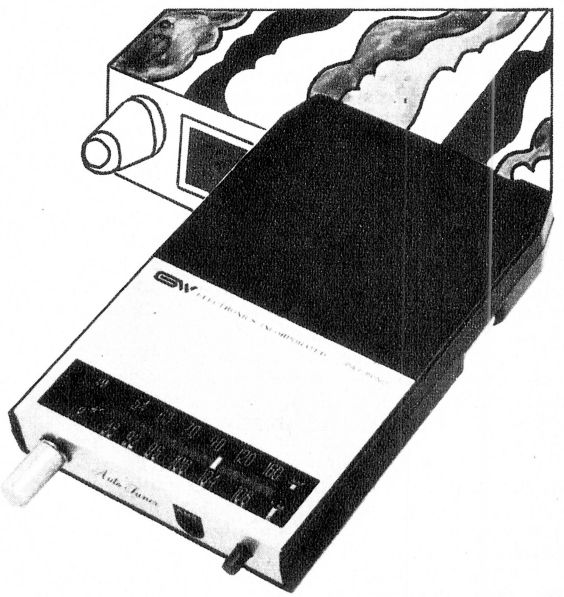
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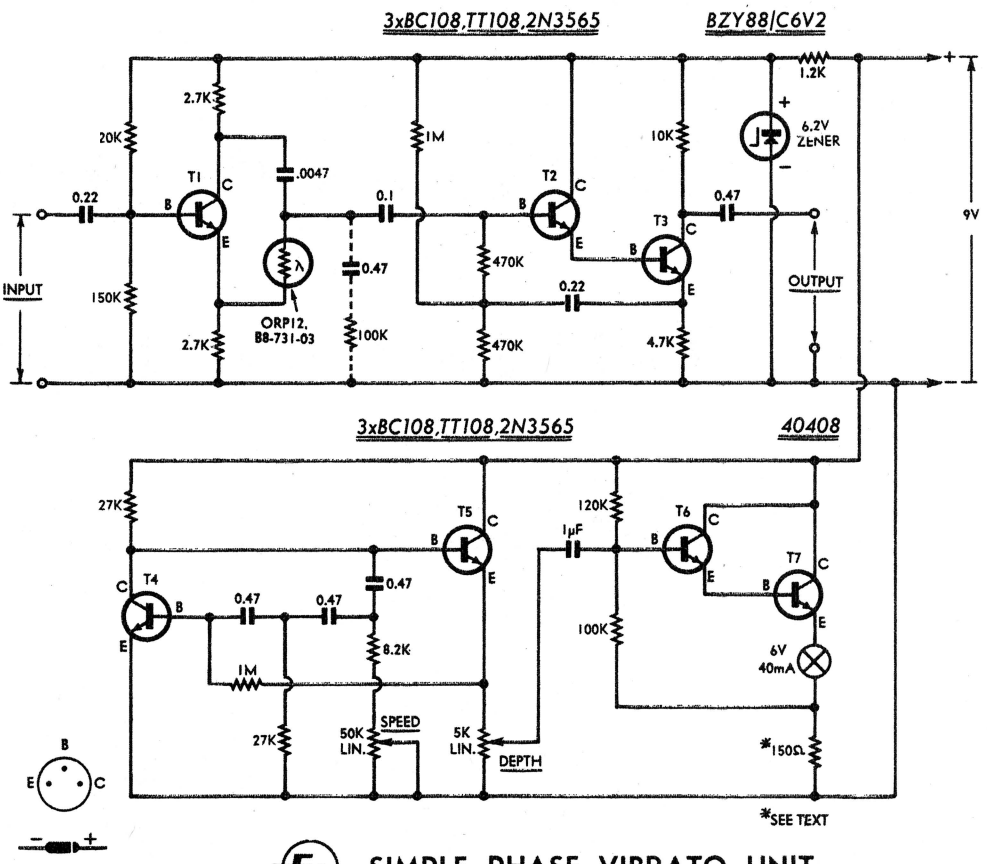
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A circuit diagram for the simple phase vibrato unit is shown at right. Main sections of the circuit are the lamp oscillator/amplifier section and signal modulating section containing the LDR.

Figure 2

SIMPLE PHASE VIBRATO UNIT

1/EM/21

a definite disadvantage, the progressive reduction of modulation for frequencies towards either end of the musical range may be regarded as a desirable effect, for reasons explained earlier in the article.

It is also interesting to note that while constant amplitude is a natural characteristic of the circuit, an amplitude or tremulant effect can be obtained by deliberately introducing some loading between the signal output point and earth, as shown dotted. This extra loading forms a voltage divider with resistor R and variations in the latter then affect the amplitude of signal reaching the following stage.

For application as an organ vibrato system the value of R must be made to vary electronically at a rate of between 5 and 8 Hertz. To accomplish this, a light dependent resistor or LDR is used and its resistance is varied by a source of modulated light.

Ideally, the variation of resistance should be equal in both directions about a centre value, resulting in symmetrical modulation of phase angle about a reference point. Unfortunately, the resistance characteristic of the LDR-lamp combination is by no means linear; it is, in fact, rather exponential in shape.

While in theory it would be possible to obtain a linear resistance characteristic by driving the LDR's light source from an asymmetrical waveform, the generation of such a complementary waveform would be a rather difficult task. Added to this is the variation in resistance characteristic between LDRs of the same type, requiring individual compensation.

Accepting that the LDR's associated incandescent lamp must be driven with a symmetrical waveform, we are consequently restricted to a relatively small resistance swing to obtain reasonable modulation linearity. In the circuits presented here the modulating waveform is sinoidal with the lamp(s) driven from a class A amplifier consisting of two transistor stages.

Essentially, the amplifier is a compounded emitter follower, comprising transistors T6 and T7, as shown in the circuit of figure 2. Sufficient current amplification to drive up to three 6V 40mA lamps is available, with the addition of negative current feedback to stabilise their operating points and raise the input impedance of the driving stage.

The quiescent operating point of the lamp should be such as to produce an LDR resistance of about 18K. This can be adjusted by means of the 150 ohm resistor in series with the lamp. Depending upon the exact mechanical set-up and proximity of LDR and lamp, the above condition will be met with approximately 1.2 volts across the lamp.

It is important that the LDR resistance be set between 15 and 20K in the quiescent condition, otherwise there will be a displacement in the frequency of maximum phase deviation, which should be approximately around centre keyboard.

Modulating signal for the unity-voltage-gain lamp amplifier is generated by a phase-shift oscillator, T4. As readers will no doubt recall, this oscillator depends upon the inherent phase shift in a resistance/capacitance network. By adjusting one of the resistance arms, in this case the 8.2K resistor and 50K potentiometer, the oscillator frequency can be varied.

An emitter follower (T5) functioning as an impedance buffer then delivers the signal to the lamp amplifier via a luF plastic capacitor. Note that this capacitor must be a plastic or other **non-polarised** type; electrolytics are not suitable. With the 5K potentiometer in the emitter of T5 the signal level can be adjusted, thus providing a modulation depth, or deviation control.

For simplicity we used potentiometers for both the speed and depth control in the prototype oscillator/amplifier combination. However, some may wish to provide pre-set speed and depth controls, usually in the form of rocker switches, on an organ console and these may be arranged in the present circuit if desired.

Turning now to the actual modulating stage (T1) in the circuit of figure 2, it will be seen that there is very little difference between it and the basic stage of figure 1. The collector and emitter load resistors are relatively small in value, providing sources of constant voltage. Either an ORP12 or B8-731-03 LDR, in conjunction with a .0047uF capacitor, may be used in the series network between collector and emitter.

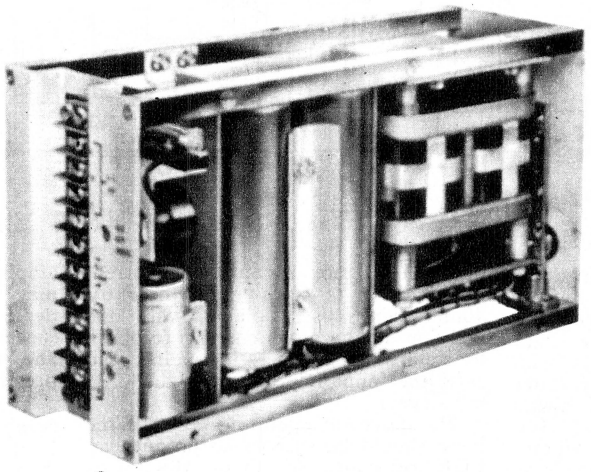
Output from the modulator is coupled via a 0.1µF capacitor to a compounded stage having an input impedance of several megohms. As already mentioned, high impedance is vital, as any loading of the modulator will introduce amplitude modulation, i.e. tremulant.

This following stage, comprising transistors T2 and T3, employs "bootstrapping" of bias resistors to obtain the very high input impedance. At the same time it provides a voltage gain of two, off-setting a small loss in the modulator.

A maximum phase swing of about 120 degrees is available from the single modulating stage, as presented. This may be considered quite sufficient for a classical organ situation, particularly as it is possible to augment the phase modulation with a judicious level of amplitude modulation.

This may be introduced by loading the output of the modulator stage with a capacitively coupled resistor. A suggested value of 100K in series with a 0.47uF capacitor is shown in dotted form. For increased amplitude modu-

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lation the resistor may be reduced, but not to less than 47K. Incidentally, the circuit can be made to provide amplitude modulation only by simply removing the .0047uF capacitor.

The power required for the circuit of figure 2 is an approximate 9 volts at about 18mA. The most convenient source would probably be a small mains supply or rectifier and filter powered from a heater line. Alternatively a small commercial "Battery Saver" supply may be considered.

With the signal frequency circuits operating from an effective 6 volts, the signal level which the unit can cope with is strictly limited. It should be inserted at an early point in the organ amplifier system, where the maximum signal level is not likely to exceed 0.5V RMS.

For those requiring a more dramatic vibrato effect, as for popular organ music, the more elaborate circuit of figure 3 is a natural and consequent progression from the simpler phase modulating system just described. In essence, the enlarged vibrato system is simply three cascaded modulating stages with the phase shift in each being additive, and giving a maximum of 360 degrees at a centre frequency.

We did look at the effect which could be had with two stages, giving about 240 degrees, but ultimately decided in favour of the three-stage system as being more appropriate to the requirement.

The comments relating to the basic modulation circuitry apply equally to this circuit but there is one additional point which must be mentioned. It is important to have the quiescent resistance of each LDR about the same, otherwise the frequencies of maximum phase shift will not coincide. In practice, it will be satisfactory if they are within the limits of 15 and 20K.

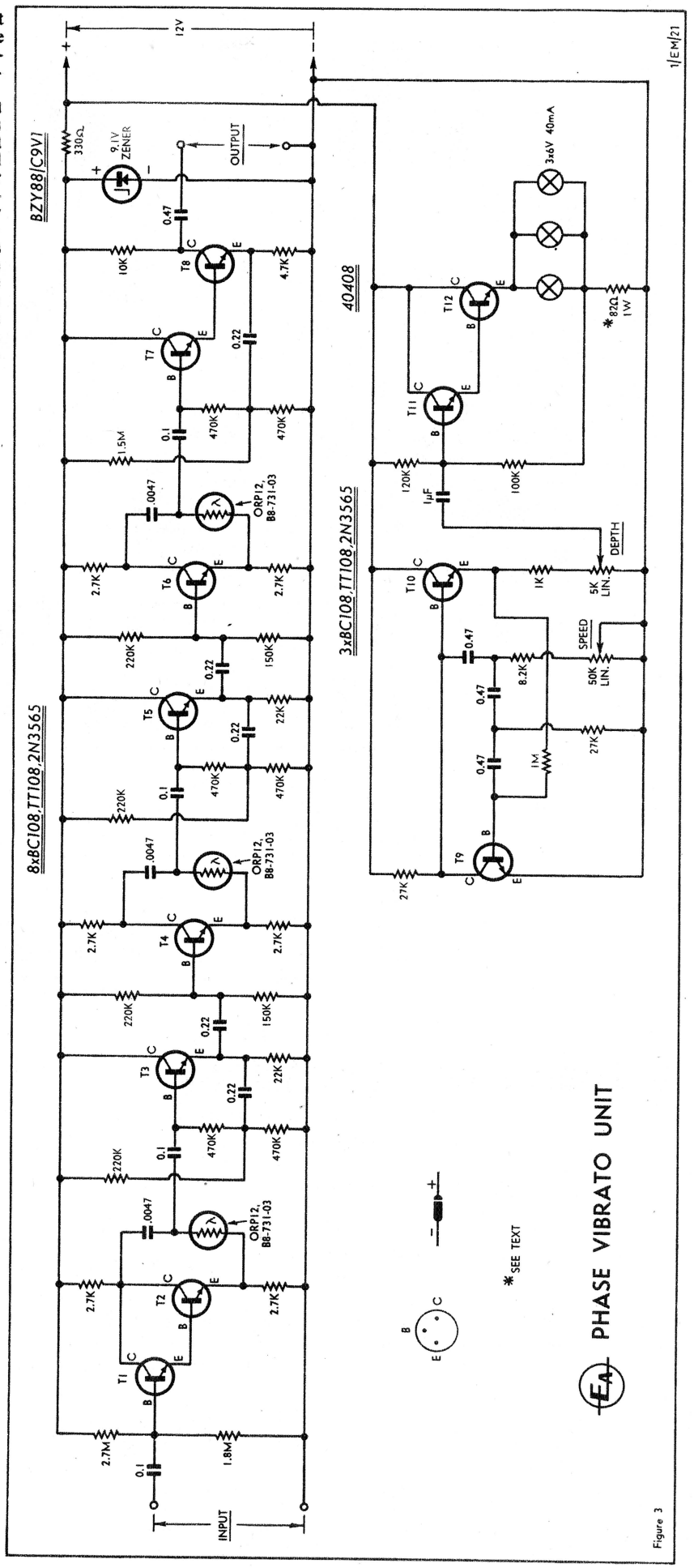
In this more developed vibrato system, the input impedance to the unit has been increased to over 1 megohm to accommodate all likely applications, including its possible use with valve circuitry. This requires the use of an extra transistor in the first modulator, connected Darlington fashion. If an input impedance of 70K is considered sufficient, however, the simpler input circuit may be retained.

The first modulator, be it high or medium input impedance, is followed by a bootstrapped emitter follower (T3) again to avoid loading the modulator output. These three transistors, T1, T2 and T3, thus form the first modulating unit. This is followed by a second unit comprising transistors T4 and T5.

A signal which has been modulated by up to 240 degrees is available at the output of T4. Constructors desiring to use only two stages of modulation, could follow T4 with the compounded output buffer used in the

(Continued on page 173)

The fully developed vibrato circuit is shown at right. An important point to note is the sectionalised configuration of the circuitry. The lower section comprises the lamp oscillator/amplifier while, above the signal circuitry may be divided into three main sections.





3 OF A KIND WITH A DIFFERENCE

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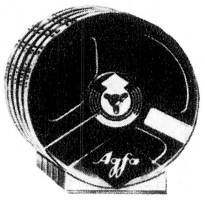
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PE31PE31RPE31KPE41PE41RPE41KPE65PE65RPE65K?



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Forum

Power line interference problems

This month's "Forum" is of the kind that an editor can't help but like: It calls for a certain amount of arrangement, but not much original writing. In it, readers comment on various matters which have been discussed in recent issues.

Conducted by the Editor

There is, for example, the matter of interference radiated from high voltage power lines — a problem which continues to build while the authorities continue to shrug off their responsibilities. A Victorian reader has this to say:

"Your editorial on the subject of power line interference reminded me of what I saw (and heard) when at Coolangatta some time ago. In this coastal town on the Queensland/N.S.W. border, interference to radio reception can be very severe at times. Underground cables would appear to be the only satisfactory answer.

"Again, when walking along dark roads at night south of Geelong, in the neighbourhood of Leopold (Vic.) I have seen continuous discharges across the insulators of the high tension lines, apparently due to the salt-laden air.

"I have an interest in radio historical research and my mind goes back to the Interstate Electric Conference in 1903. Apparently the P.M.G. Department were afraid of something of the kind eventuating and sought to control transmission lines, etc., in a way which the States regarded as over-stepping the Post and Telegraph Act and the Wireless Telegraphy Act; also exceeding the powers conferred by the Commonwealth Constitution and infringing on the powers of the States.

"The incumbent minister was Sir Philip Fysh, a Tasmanian businessman of substance, who promptly settled the dispute by ruling that the P.M.G. Department must not try to take on too much responsibility!

"Yet, if someone causes radio interference, the P.M.G. Dept. is supposed to be able to act. This should surely apply to power lines.

"When one tries to get something done which is on the borderline of authority between the Commonwealth and the States, things are complicated by inter-governmental jealousy. The Federal Attorney General's Dept. might be the body to look into it.

"Incidentally, therapy plants, X-ray plants, etc., are other possible sources of interference, with specific problems occurring everywhere from the very high to the very low frequencies. There was the instance of a medical installation at Footscray which produced enough radiation for the signal to be heard in America!"

(E.C., Heidelburg, Vic.)

To which one must surely remark: "That's quite a signal."

Just imagine walking into the surgery or consulting rooms and finding the walls plastered with QSL cards.

Or lying there being irradiated by a device that keeps buzzing away: "CQ DX . . .CQ DX GPs . . ."

Funny? In print, maybe.

But not when radiating devices (which are not transmitters within the meaning of the Act) add their quota to the radio frequency noise ambient, untouched and untouchable in this enlightened (?) land.

A reader from Western Australia also voices his dismay at the rising interference problem and comes up with a specific suggestion.

Dear Sir,

"Your recent editorial entitled 'Anybody seen Jack?' was right to the point. Is it not time that the Radio Branch of the P.M.G. was dropped out of existence, with the Federal Government introducing a similar department to the F.C.C. in U.S.A.?

"As a DX'er for many years in both New Zealand and Australia, I can say that the QRM problem is one that concerns every reader of your journal. 'Electronics Australia' is in the best position to coax the wheels into motion to have radio and television transmission and reception of all types — and the interferences with it — controlled by one specific body rather than by a Government Department which has a variety of involvements over and above radio and TV."

(D.McK, South Perth, W.A.)

Mention of the F.C.C. may, of course, bring sneers from some quarters for its present involvement in tobacco advertising, its fumbling of radio and TV station licensing and its inability to cope with larrikinism on the Citizens' Band.

The matter of tobacco we'll leave for others to argue. As for the organisational problems, the lesson may well be the reverse of what appears on the surface. If a specialist body is experiencing so much difficulty in administering the problems of the radio frequency spectrum, how much longer do we think we're going to get away with departmental sub-groups, divided responsibilities and a sheer lack of legal authority to do what should be done?

27MHz transmissions

Mention of the Citizen Band situation in U.S.A. leads naturally to a letter from a reader in New Zealand. He writes:

Dear Sir,

"Your editorial in the November, 1968, issue was right to the point. The Citizens' Band Radio Club in New Zealand has gone altogether too far. They have QSLs, call CQ, and chase DX.

"In general, they use ground plane antennas and — the greatest insult in my eyes — call themselves radio amateurs!

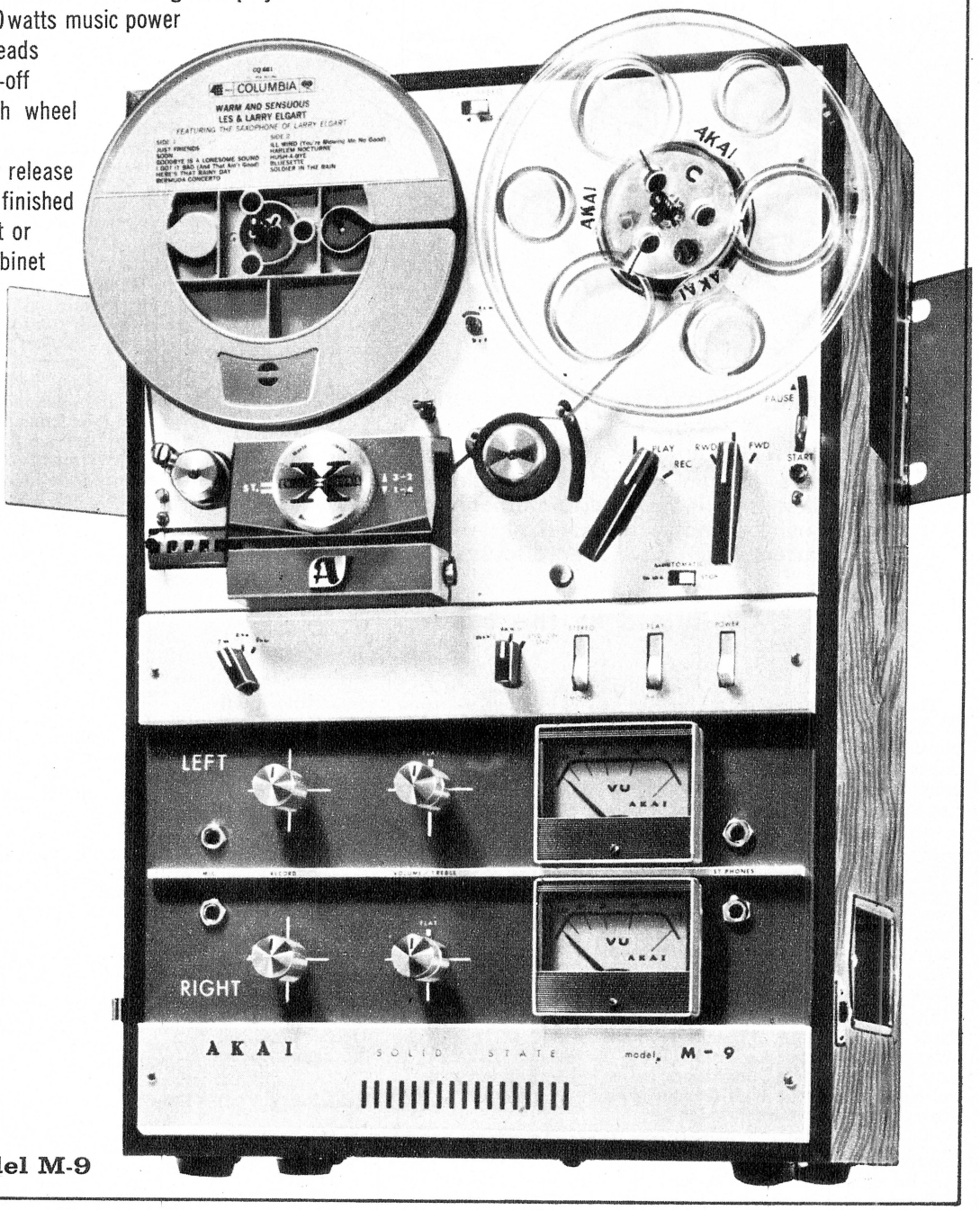
"The Post Office should solidly restrict the power to 125 milliwatts except for approved stations which, by the nature of their use, need higher power — say 1 watt. Two stations I have heard recently had vibrator hum . . . for one watt!

Some 27MHz operators will even QRM anybody that interferes with them. A concrete example of careless

Play It By Ear With CROSS FIELD HEAD

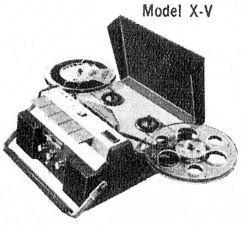
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*The wide frequency CROSS-FIELD HEAD
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*Magnificent oil finished wooden cabinet or vinyl leather cabinet

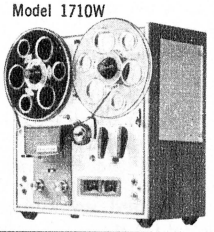


Model M-9

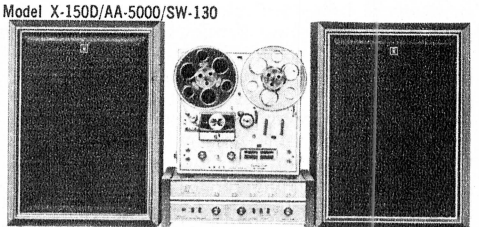
Model X-V



Model 1710W



Model X-150D/AA-5000/SW-130



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Homecrafts, Petrie St., Canberra, A.C.T. **J.B. Young**, Giles St., Kingston, A.C.T.

interference occurred recently when I was trying to use a 27MHz unit as part of my job. The channel was jammed completely by a solid carrier, with a background of vibrator hum. Apparently he was loading up an aerial or carrying out other air tests.

(A.L., Stratford, N.Z.).

Signals on the mains

The same reader comments elsewhere in his letter on the subject of signal tones on the power mains. Superimposed on the lines by the power authorities and used to control switching functions on the system — substations, lights, hot water services, etc. — the tones can penetrate P.A. amplifiers, electronic organs, domestic amplifier systems, causing annoying whistles. We quote:

"Recently, you commented on ripple injection for load control on power mains. In New Zealand the Boards are charged on their KVA peak demand and, by closely controlling the peak load, a big saving can be effected. I believe that the saving is about NZ $150 per year per controlled KVA.

"Ripple is either about 1000Hz or 500Hz. The lower frequencies cause less trouble but it can still happen. In my area the system operates on 530Hz and causes no trouble. The injection level is only about 1 volt but I understand that levels approaching 5 volts are used by other bodies.

"I understand that, if a choke filter is used, very little ripple gets into a set but, if trouble persists, a capacitor of about 0.1uF across the rectifier output helps."

Our correspondent's observations about the 5:1 difference in injection level confirms my own conviction: namely that the rising incidence of readers' complaints, plus personal observations, has to do with a tendency for supply authorities to sneak up the level of injected signals to save having to set the responder equipment too finely, and therefore more prone to accidental triggering.

The higher the control voltage that can be used, the better — until the customers start to complain! And in some areas that level has plainly been exceeded.

However, I find the suggestion quite unconvincing that the tones can be blocked by the addition of a simple inductor or capacitor. In some of the instances which we have observed or heard about, the equipment has been fitted as a matter of course with a regular line filter, with virtually no effect.

In fact, this is not surprising because the usual kind of line filter, containing a couple of inductors and up to four capacitors is intended to discriminate against interference in the radio frequency region, usually over the bands of interest from 500KHz upwards. A line filter intended to discriminate against energy in the 1KHz region would need such large values of inductance and capacitance that it would seem to be quite impractical. Some kind of resonant filter would be the only answer.

Again, I cannot see how a 0.1uF capacitor across the output of the rectifier would help. Such a capacitor might conceivably bypass RF type interference but I fail to see how it could influence the response to 1KHz energy when it would simply be in parallel with a large number of microfarads, represented by the normal and existing filter.

In fact, before one can get very far in discussing how to keep 1KHz energy out, it is essential to have some idea as to how it gets in. Perhaps stray paths — resistive, capacitive, inductive, per chassis currents etc.—which cause negligible trouble at 50Hz, are penetrated much more readily by 1000Hz, even at low voltage.

But then again, should the consumer really have to try to figure all this out and become responsible for preventive measures? Should he really have to take precautions against something that should not be there in the first place?

★ ★ ★

The second letter on this page draws attention to abbreviations and words used in the journal.

While we accept the criticism in the spirit in which it is offered, the style to be adopted in abbreviations is one that bugs any company concerned with producing a wide range of publications.

One of our basic "house" rules is that full points should be used in abbreviations which cannot be pronounced as a single word. We've had to buck this rule with abbreviations of technical quantities; firms and organisations provide more scope for fun and games because many omit the full points just as diligently as others put them in. A few seem not quite to have made up their own minds.

But if K.F. really wants to pick a fight, he should get a copy of the Sydney phone directory. There, at the start of each letter listing is a great collection of initials, all replete with full points, company style notwithstanding!

As for the word Hertz, we have not sought to coerce advertisers into using it. We have stated clearly our editorial policy and have tried to stick to it. We hope that advertisers gradually fall into line for the sake of consistency but, if any of them insist on using the older terminology, they have a reasonable right to do so.

As far as odd-ball words and phrases are concerned, we simply don't have time to read advertisers' copy for literary merit and enter into debate as to why we think it should be changed.

If the copy is obscene, slanderous, patently dishonest or in contravention of accepted advertising industry practices, we would step in for our own protection as publishers. But we certainly couldn't sustain the position where we tried to alter or debate any phrase that we didn't happen to like.

As for the term "alright," it has all the signs of a word in the state of being born. Webster's describes it as being commonly used but not recognised by authorities. ■

TECHNICIANS' SALARY LEVEL

Dear Sir,

I would like to comment on a letter in your January issue from a Mr George A. Wiffen, of Melbourne. He comments on the fact that he is unable to get suitably trained men for service in Papua-New Guinea.

Sir, I can tell him in one word: Pay.

To quote him, a "good" technician can earn up to $3,696 per annum, including allowances, but with an additional allowance of $360 for married men.

Well, Mr Wiffen, a good technician with similar qualifications and taking on similar responsibility can get a basic salary of $3,500 as a first year B-grade technician at any of Australia's tracking stations. With shift penalties, location penalties, etc., the same technician can double this amount and still work a 40-hour week.

Even the R.A.A.F. pay their married technicians a minimum of $3,900 per annum (approx.) and, in the majority of cases, subsidise their housing expenses to a certain extent also.

The answer is obvious. If Mr Wiffen (or anyone else for that matter) wants good technicians, especially in remote areas, he must be able to offer them as much as they are able to get at home — or better.

R.B. (Dee Why, N.S.W.).

Abbreviations, poor words

Some 12 or 13 years ago, when I was employed by the British Broadcasting Corporation in England, I remember a memo coming round saying that in future B.B.C. would be printed or written without full stops after the individual letters. In other words, B.B.C. was out. As I notice that you still put B.B.C. in your articles I thought you might be interested, as to my mind BBC looks much neater. Perhaps you would like to confirm this detail.

The other point I wish to bring to your attention is the use of the ghastly word 'alright' in a recent advertisement. 'Alright' is not a word, not a real word, and if it were it would probably mean something quite different from 'all aright,' in the same way that 'already' and 'altogether' mean something different from 'all ready and 'all together. You sometimes tell correspondents that you are not responsible for what advertisers put in the space they buy, but as I believe you have also said that you would change 'c/s' to 'Hertz' you must have some system of control. I hope that in the future it prevents the marring of a fine magazine in this way.

K.F. (Darwin, N.T.)

FROM TOYS... TO SPACE SHIPS...

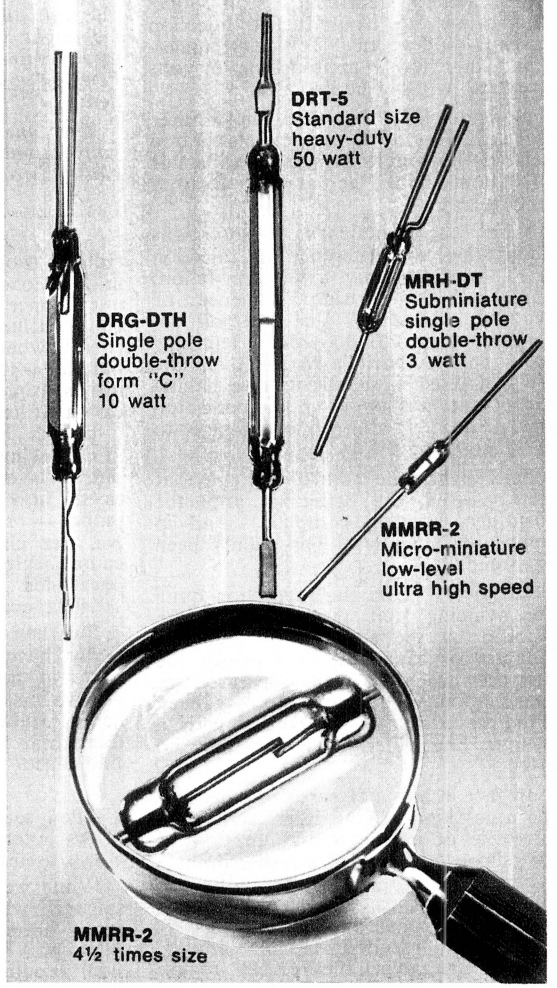
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Hamlin Reed switches have met every conceivable test in a broad range of environmental and electrical applications. As the pioneer in the development of dry-reed switches, Hamlin offers the widest selection and is the industry's largest producer of magnetic reed switches.

They are available with contacts of gold, silver, tungsten, or rhodium for switching various load types. Mercury wetted contacts are used to eliminate contact bounce. Nitrogen or hydrogen, at various pressures, offer inert atmosphere for clean operation, while evacuated switches are used for high voltages.

There are dozens of reed switches designed for specific load requirements, such as low-level dry circuit loads, or high voltage loads. Various switch configurations in different sizes, ranging from the standard through to micro miniature (Grain of Wheat), are available in single pole throw or single pole double throw. Also with contacts mercury wetted, biased, polarized, or spring loaded. All Hamlin switches are further classified in close tolerances according to magnetic sensitivity. Depending on switch design, these ranges are from 20 AT to 150 AT for pull-in and 10 AT to 100 AT for drop-out.



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Versatile circuits for LV Lamp Flashers

This brief article describes two circuits for flashing warning lamps which can be used on parked motor vehicles, trailers, boats and stationary obstructions. In addition, a suitable modification is shown which allows the flasher circuits to be automatically switched on at nightfall and off again at daybreak.

by Anthony Leo

The lamp flasher circuits described here are intended to fulfil a need which, although not universal, is very real to those who may require such a device. However, they will no doubt appeal to a number of experimenting readers who will find a diversity of uses for a flashing lamp.

Primarily though, the lamp flashers are intended as warning devices for use on parked or broken-down vehicles, caravans, trailers or other stationary obstructions. Possibly the most useful application would be as a warning for approaching traffic when changing a wheel or carrying out other repairs on the roadside at night. Further applications might include mooring buoy indicators or other navigational requirements.

The main requirement for a portable warning flasher is that it should have low average current drain to ensure prolonged battery life. This condition is satisfied, without reducing lamp brightness, by having a very short duty cycle in which the lamp is switched on for short bursts only. For the circuits presented here, the ratio of on time to off time is about 1 to 5.

Two circuits are presented, the first of which is a low current unit for portable or continuous operation (figure 1). Using a 12V 250mA pilot lamp with duty cycle of about 18 per cent, the average current drain is reduced to approximately 44mA. For portable operation the supply could be made up from two 6V lantern batteries connected in series, providing an operating life of several hundred hours.

As an alternative arrangement, a 6.3V 300mA pilot lamp could be used in the same circuit without any alteration, except for the power supply which could be a single 6V lantern battery. With this configuration the average current drain will be increased to about 50mA, slightly reducing the battery life.

It will be noticed that the supply voltage is shown connected to the circuit via a diode bridge network. The purpose of the network, which is the same as a bridge rectifier used in AC to DC power supplies, is to make the circuits insensitive to supply polarity. Thus the transistors are protected against the inadvertent application of wrong supply polarity which could have disastrous effects. Incidentally, any available 500mA diodes, or a suitable bridge rectifier could be used.

The polarity protection provided by the diodes will be of particular value when the flasher is to be constantly connected to supplies of unknown polarity; or where darkness prevents the identification of battery polarity. However if the flasher is to be permanently connected to an external or self contained supply the diodes will not be necessary, and may be omitted.

The second flasher circuit, of which there are also two versions (figure 2), is designed to operate from a 12V auto accumulator with intermittent current levels of up to 1 amp. We used auto tail-lamps, in the mock-up circuit, having ratings of 6 and 12 watts or 0.5A and 1A respectively. However, with short duration flashes the average current consumptions are quite modest.

With a 6-watt lamp and a duty cycle of about 15 per cent, average current drawn by the lower power version is around 225mA. However, if a 12-watt lamp is used the duty cycle is increased slightly to about 19 per cent with an average current consumption of about 350mA. Nevertheless, the current drain imposed on an auto accumulator by even the 12-watt unit is still quite modest.

Again, the supply voltage is connected via a diode bridge network for transistor protection. As the high current circuit is intended for exclusive use with an automobile accumulator as an emergency warning light, the protection network should be considered as essential. In this case the diodes or bridge rectifier should have at least a 1-amp rating.

The fundamental circuit configuration and operation of both flasher circuits is quite conventional, being that

(Continued on page 174)

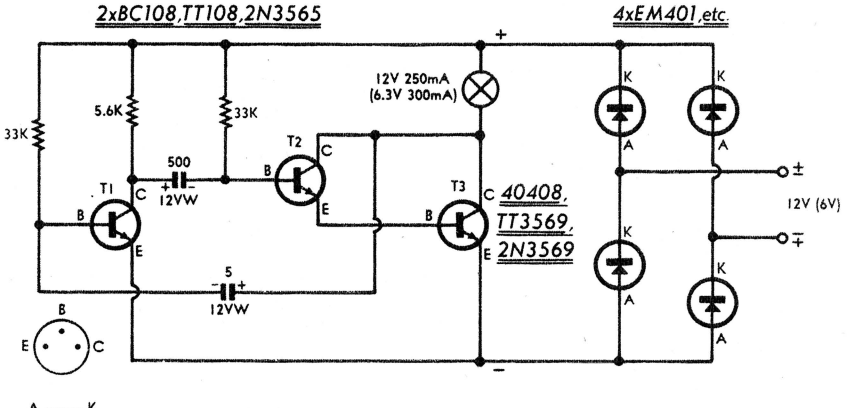


Figure 1

EA 250mA AUTO WARNING FLASHER

3/MS/16

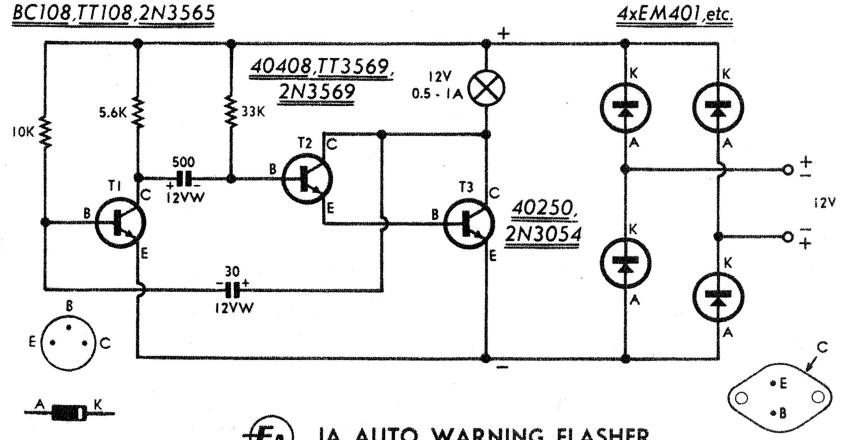


Figure 2

EA 1A AUTO WARNING FLASHER

Circuits for two lamp flashers, a low current unit and a high current version, are shown above. The flasher circuit with a current capacity of up to 1/4 amp and operated from 6 or 12 volts is shown in the top block, while a 1-amp 12-volt version is shown below.

A LOW-FREQUENCY CONVERTER

From time to time, we have been asked for a converter or other means of receiving some of those signals which are somewhat of a mystery to many, in the frequency domain below the broadcast band. This little converter has some interesting features and covers from 160KHz to 400KHz.

by Ian Pogson

We have been looking recently at the possibility of designing and developing some solid-state receiver front ends for the high frequencies and, while doing so, the idea of adapting such a design for the lower frequencies was also raised. The differences between a converter for low frequencies and those for the high frequencies are not very great and accordingly, we decided to have a closer look. The converter here presented, is the outcome.

Before dealing with the converter, it would be perhaps a good idea to outline what can be expected by listeners wishing to explore these lower frequencies. For the average listener there is, in fact, very little which would be of lasting interest. At the same time, however, there are certain services which may be of particular interest and value to other readers.

A report of the Australian Radio Frequency Review Committee gives details of all radio frequency allocations. From 10KHz, yes 10KHz, up to 160KHz, frequencies are allocated to such services as Radionavigation, Radiolocation, Fixed Maritime Mobile and Standard Frequency transmissions. From 160KHz to about 400KHz, Maritime and Aeronautical services may be found.

As we mentioned earlier, our converter only tunes down to 160KHz, leaving all below this frequency untouched. One of the main reasons for this is the fact that as one goes lower in frequency, it becomes necessary to provide coils of very high inductance and these become increasingly expensive and difficult to make. The problems are by no means insurmountable but the inductance required for the main tuned circuit would require many turns, even on a large ferrite rod. Also, the ferrite toroid used for the detector transformer would need a very large number of turns, to retain its efficiency. With these difficulties in mind, we accepted a deliberate limit on the lower frequency tuning point.

The type of transmissions which are tuned by our converter, between about 200KHz and 400KHz, are mainly set up as aircraft navigational aids and these are dotted strategically all over the continent. In the Sydney area, we have tuned in the signals from such places as Wollongong on 242KHz, Burragorang on 281KHz, Sydney on 317KHz, Richmond on 347KHz, Katoomba on 353KHz and Williamtown on 365KHz.

From our observations, all of the above stations except Sydney simply keep repeating their call sign in Morse Code. For example, the Katoomba station keeps sending "KAT" in code. On the other hand, the Sydney station transmits "SY" in Morse Code and then goes on to give such details as wind direction and velocity, barometer and temperature readings and other details which are helpful to pilots of commercial aircraft approaching the Sydney Airport.

From this, it would be reasonable to assume that the same pattern would exist around other capital cities of the Commonwealth. If you are interested in a continuous and up-to-the-minute weather report in the vicinity of your capital city, then such a converter would be worthwhile.

In addition, by using a ferrite rod for the aerial tuning coil, it is possible to use it for direction finding. Provided you know where the various stations are located, the system could be used for navigation, whether over land or along the coastal waters.

In short, it would be wise to consider the foregoing and decide whether you really want or need a converter to cover this range, before going to the trouble and expense of building one.

Let us turn to the circuit and examine its various functions. We begin with a radio frequency amplifier. This uses a junction field effect transistor. At least two reasons are offered for this choice. Firstly, the type 2N5459 junction FET is not expensive and it is readily available. This gives us an opportunity to explore these relatively new devices and so become familiar with them. The second main reason for its use is that, unlike bipolar transistors with their low input resistance, the FETs have a high input resistance. As a result, we are able to avoid the need to tap down on the tuned circuit, as would be necessary to match into a normal base circuit.

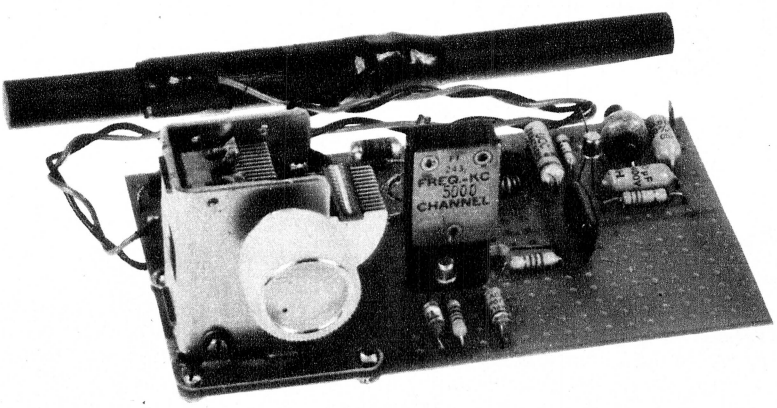
The signal input circuit involves a coil wound on a ferrite rod tuned by an independant single-gang capacitor. The rod is one which is normally used for broadcast receiver use and is readily available. In addition to the tuned winding, we have provided a primary winding which may be used if you wish to use an additional aerial and earth system. The coil unit is quite easy to wind. To restrict the upper frequency tuning limit, a 22pF capacitor is shunted across the tuned circuit. Also, it was found necessary to damp the tuned circuit slightly with a 220K resistor. This was found necessary, in spite of the fact that the effective drain load of the FET is low enough to have a stabilising influence on the stage.

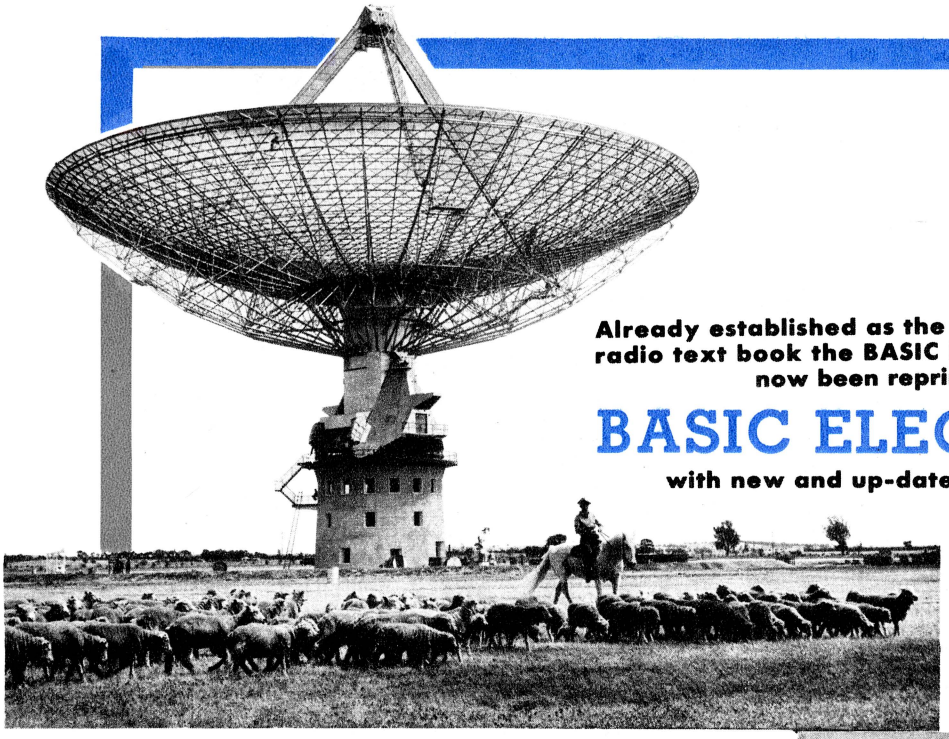
Although the spread in characteristics of the lower-priced FETs has been considerable reduced it is nevertheless still fairly wide; the value of 100ohms for the source resistor is about optimum to deal with the expected spread of characteristics.

Since we are using a ferrite toroidal transformer in the drain circuit, we decided to keep DC out of the primary winding by shunt feeding it via a 2.5mH RF choke, the DC voltage being blocked off by the .01uF capacitor.

Another unusual feature of this converter, is the use of the double balanced or ring modulator for the mixer. This circuit is commonplace in some telephone equipment but it is not often used in radio applications. However, it is emerging as a desirable type of mixer when associated with other solid state devices.

Features of the ring modulator, when used as a mixer, include its signal handling ability with a minimum of cross modulation and blocking. Also, when properly balanced, there is no break-through of any signal which





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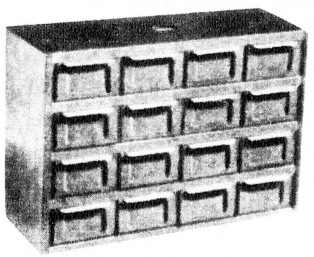
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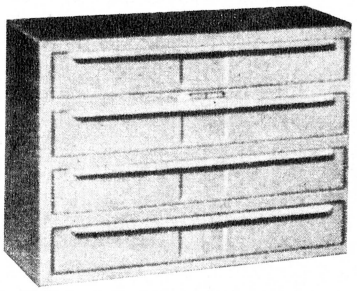
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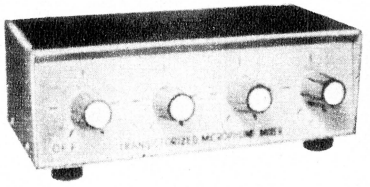
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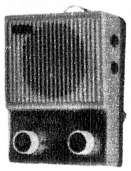
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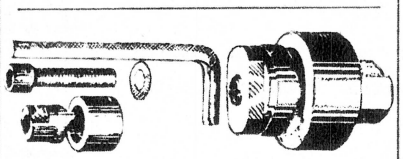
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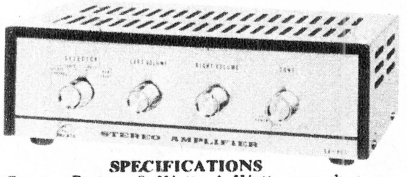
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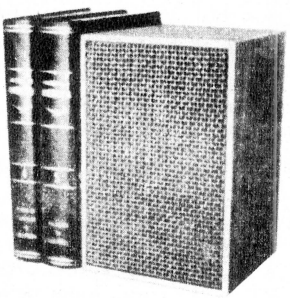
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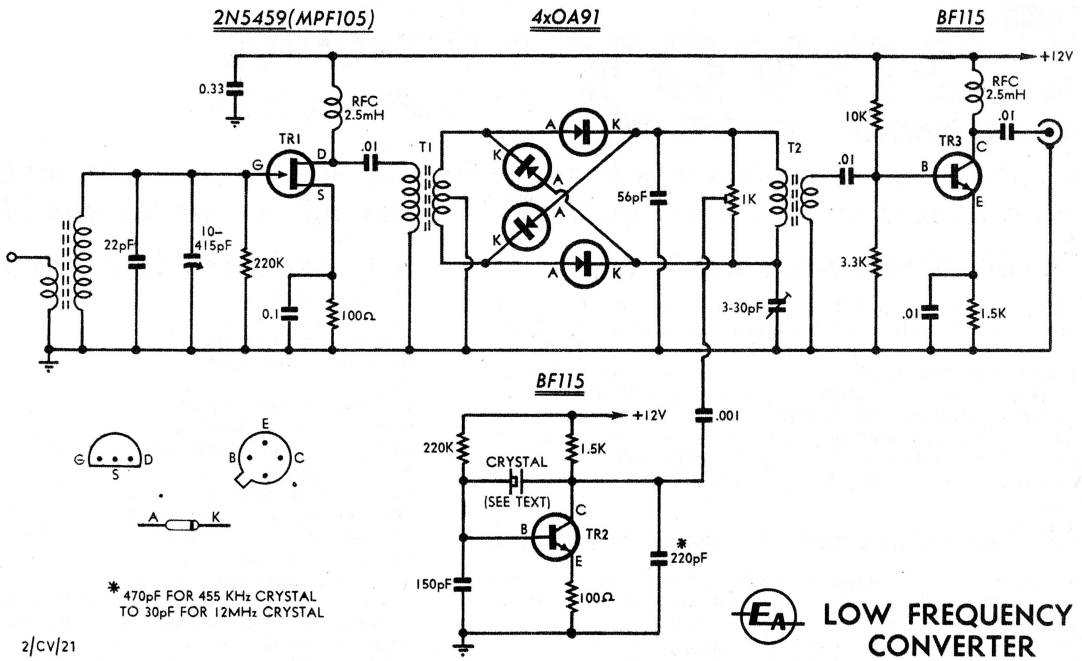
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The circuit is unusual in that it uses a FET RF amplifier and a ring modulator for a mixer. Both of these features make for desirable performance, particularly regarding signal handling ability and freedom from blocking and cross-modulation.

This circuit for the alternative self-excited oscillator, to replace the crystal oscillator, can be used either as a fixed or variable oscillator, as discussed in the text.

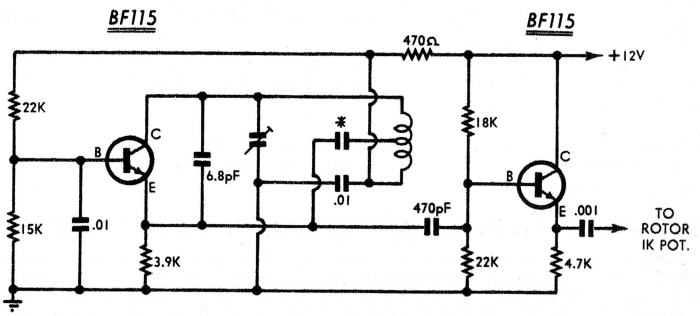


Figure 1

*SEE TEXT

is fed into it; only the sum and difference frequencies should appear at the output. Although the mixer has no gain of its own, this can be made up easily with a following amplifier.

As the output from the mixer turned out to be a little lower than may be convenient for some receivers, we decided to add an extra low gain stage. This consists simply of a BF115 transistor, arranged as a broad-band amplifier. Although the collector output will normally feed into the low impedance aerial terminal of a receiver, the gain will still be found to be adequate. In fact, we did try an emitter follower between the additional amplifier and the output but the available gain turned out to be little short of embarrassing!

Injection for the mixer is from a simple Pierce crystal oscillator. This oscillator, with the circuit constants given will accommodate almost any crystal from 1MHz to about 8MHz. By raising the value of the 220pF capacitor to 470pF, crystals down to 455KHz will oscillate satisfactorily. On the other hand, by reducing the value of the 220pF capacitor to about 30pF, crystals up to at least 12.5MHz will oscillate.

By using a fixed crystal frequency from the oscillator, a high order of stability is obtained but it is, of course, necessary to tune the receiver into which the converter is fed; in effect, this becomes "tuneable IF." If a suitable crystal is not available, a self-excited oscillator may be used. It will degrade frequency stability somewhat but not enough to prejudice use of the converter. More will be said about this self-excited oscillator later in the article.

At this stage, a word or two about the oscillator frequency would be appropriate. The choice open to the user is very wide indeed and is largely limited by the crystals which you may have available, and/or the range over which the receiver may be operated as the tuneable IF. Briefly, we wish to cover signal frequencies from 160KHz. to 400 KHz. We can conveniently add the oscillator frequency to this range. Let us have a look at some examples to make the point quite clear.

Suppose we happen to have a crystal on 5000KHz. If we add this to the incoming signal range, we have at the output of the mixer, 5000KHz + 160KHz, which equals 5160KHz, up to 5000KHz + 400KHz, which equals 5400KHz. So we tune our receiver over the range, 5160KHz to 5400KHz. The same arithmetic is used regardless whether the crystal is say, 2000KHz or 8000KHz. It remains true for ex-disposals crystals at all kinds of odd frequencies, except that dial readings cannot be interpreted with the same facility.

Particular comment is called for where a reader may have a crystal on 1000KHz, causing the low frequency signals to appear across portion of the broadcast band, from 1160KHz to 1400KHz. Because of the strength and concentration of stations on the broadcast band, use of the receiver as a tuneable IF in this frequency range would only be practicable if the receiver was reasonably well shielded and connected to the converter by a length of coaxial cable. A car radio would be well suited to the role but a standard transistor portable, with its rod aerial permanently in circuit, would be virtually hopeless.

The same would be true with a 455KHz crystal, which would result in a tuning range of 615KHz (455 + 160) to 855KHz (455 + 400). As mentioned earlier, the 220pF capacitor would most likely have to be increased to 470pF for the oscillator to operate at this frequency.

As you may have guessed already, there is a serious trap in the last example. More than likely, your receiver will have an IF of 455KHz and there may be so much direct radiation from the crystal oscillator, that it will be almost impossible to keep it out of the IF channel. This would show up as a steady strong signal, which would render normal operation of the receiver out of the question.

As mentioned earlier, it is possible to use a self-excited oscillator, in place of the crystal oscillator. The suggested circuit is shown in figure 1 and the oscillator section is substantially the same as the solid state dip oscillator which was described in February. To avoid undue loading of the oscillator, an emitter-follower is added. The out-

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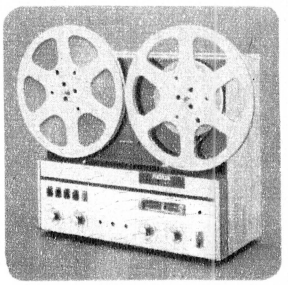
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The coil and tuning circuit details generally for the oscillator, will depend upon the frequency which you decide to use. In our prototype, the tuning capacitor across the coil had a maximum capacitance of 100pF and the following coil details are given to cover from 1.3MHz to 16MHz. If you wish to get down to 1MHz, it will be necessary to add some turns to the coil, or increase the size of the tuning capacitor. For 1.3 - 3MHz, wind 136 turns, centre tapped, 30 B&S en. wire on a ¼in dia. former, winding, 1-11/16in long. A 68pF capacitor connects from the centre tap to the oscillator emitter. For 2.9 - 7MHz, 60 turns, centre tapped, 24 SWG en., 1½in long, with a 39pF capacitor to the emitter. For 6.5 - 16MHz, 23 turns, centre tapped, 18 B&S en., 1in long, with a 10pF capacitor to the emitter.

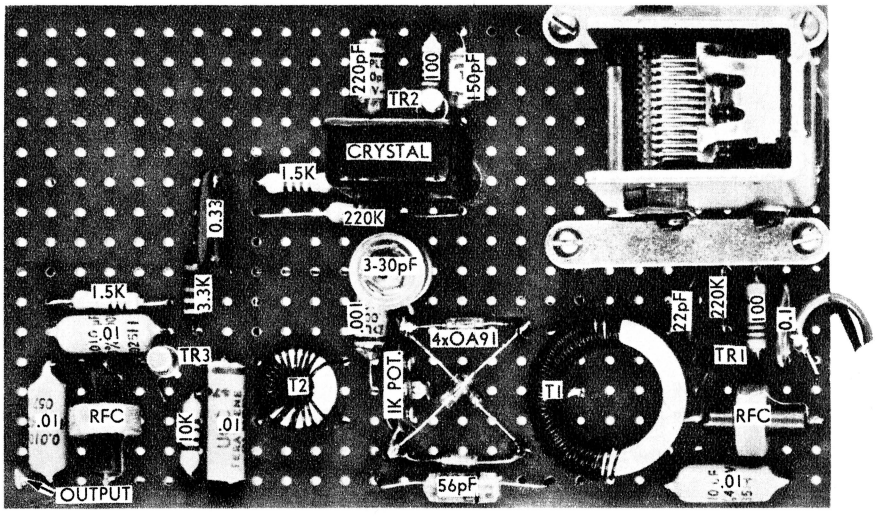
From this information, it will be possible to wind up a coil to suit the particular frequency to which you intend to set the oscillator. An interesting point now arises from this approach to the oscillator. Up to now, we have assumed that the local oscillator will be set to a fixed frequency and the "tuneable IF" will be used to tune in the wanted signals. There is no reason why we should not make the oscillator variable, by providing a suitable capacitor, and setting the receiver which would otherwise be the tuneable IF, to some specific frequency.

Suppose that we wish to use an ordinary broadcast receiver, into which we will feed the output of the converter. A convenient frequency, depending upon the possibility of interfering local stations, would be say, 1600KHz. So that we can tune from 160KHz to 400KHz, then we would need to tune the variable oscillator over the range, 1760KHz to 2000KHz. As was already the case with the fixed frequency first oscillator, it would still be necessary to peak the input tuning circuit, as well as the main tuning.

Some readers might ask why we do not gang the oscillator and signal tuning circuits. This could be done but, for a unit of this type, it is hardly worth the extra trouble. It is not too much of the burden to have to tune the signal circuit separately.

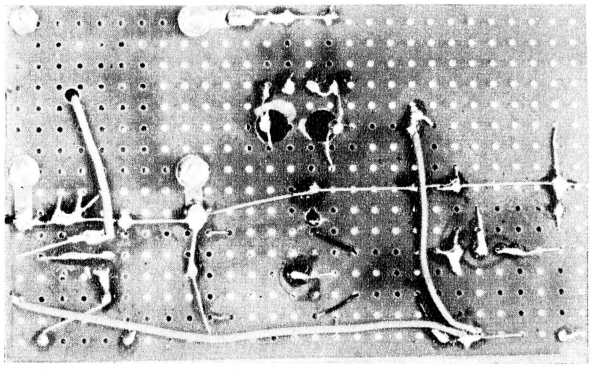
From the constructional point of view, we made up the prototype on a piece of "Veroboard," which measures 5½ x 3½in. This includes everything except a power supply and the ferrite rod assembly. We made it up this way, simply as a convenient way of presenting the working unit. Some readers may see fit to make up the board more or less as we have done and possibly mount it in some convenient case. If the rod is to be used for direction finding, it could be mounted atop the case, in such a manner as to allow free rotation through at least 180 degrees. It is also important to keep the rod at least an inch or two from any metal parts. On this occasion, we are leaving the exact physical details to the builder.

Starting with the signal tuned circuit, the coil consists of 150 turns of 30 B&S enamelled copper wire, on a 9/16in O/D cardboard former. This is made to slip easily over the ¼in diameter ferrite aerial rod. A primary winding is also provided by adding 15 turns over the top and at the earthy end of the tuned winding. The bottom leads of both windings are connected to earth and the other end of the 15 turn winding may be used if a separate aerial wire is used. When the winding is finished, it may be held in place with plastic adhesive tape. The windings are located at about the centre of the rod.



This photograph from the top of the board, shows the layout and disposition of the components.

Wiring under the board gives some idea how this may be done, although it is not necessary to follow it in detail.



The variable capacitor is a standard 10-415pF single gang, made by Roblan. Any broadcast type of capacitor would be satisfactory in this position.

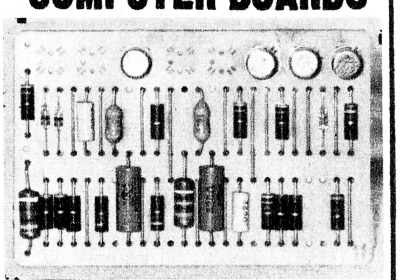
The two transformers for the ring mixer also have to be wound. The input transformer consists of a primary winding of 40 turns of about 24 gauge enamelled wire and when wound on a Mullard type FX3019 ferrite toroidal former, should occupy about half of the available space. The secondary winding is centre tapped and should be wound each way from the centre and so that it is equally distributed about the primary winding. The output transformer is wound on a Mullard type FX3012 ferrite toroidal former. The primary winding consists of 20 turns of the same gauge wire and this occupies about three-quarters of the available space. The secondary winding is wound equally about the centre portion of the primary. (Your supplier should be able to obtain the toroids without difficulty from Mullard Australia Pty. Ltd., 35-43 Clarence Street, Sydney, 2001.)

The OA91 diodes for the ring mixer, strictly speaking, should be a matched quad and if you wish to obtain a matched set, Mullard will make them available for a small extra charge for matching. However, we feel that for this particular application matching is not really necessary; more will be said about this under adjustment.

Many readers will have a suitable crystal on hand. As mentioned earlier, we tried a number of different crystals in this oscillator with success. The crystal in the socket when the unit was photographed, was one on 5000KHz, in the familiar FT243 holder. This brought the tuning into the 5-6MHz range which we provided on the April, 1968 version of the 1967 All-Wave Seven receiver.

The coded photograph shows the position of most of the components and no trouble should be had in copying the layout. The layout does not appear to be critical but if you intend to depart from this one, then

COMPUTER BOARDS

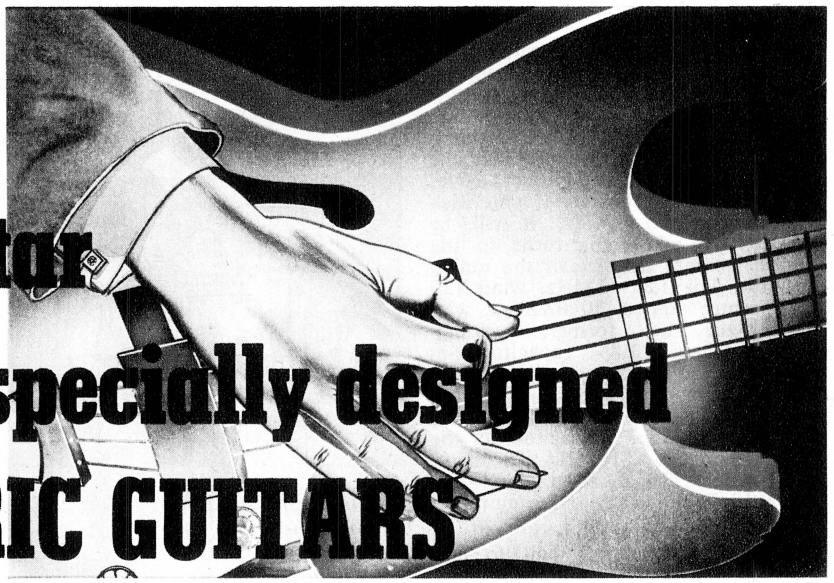


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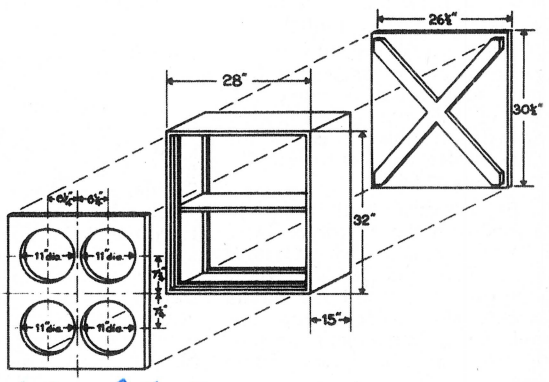
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SPECIFICATION

TYPE NUMBER	50226/12PQ/15 PRESTIGE FINISH	21622/12PQ/15 MANUFACTURERS TYPE	53416/12PQ/8 MANUFACTURERS TYPE
Impedance	15 ohms	15 ohms	8 ohms
Frequency Range	35-6000 Hzs	35-6000 Hzs	35-6000 Hzs
Resonance	40 Hz	40 Hz	40 Hz
Maximum Power Handling	15 W	15 W	15 W
Magnet Material	Alnico V	Alnico V	Alnico V
Flux Density	10500 gauss	10500 gauss	10500 gauss
Total Flux	82000 lines	82000 lines	82000 lines
V.C. Diameter	1¾″	1¾″	1¾″
Mounting Hole Centres	11¾″ P.C.D.	11¾″ P.C.D.	11¾″ P.C.D.
Maximum Depth	6¾″	6¼″	6¼″



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it would be wise to at least follow a logical sequence.

In the process of wiring, the usual precautions should be observed. These include attention to properly soldered joints. At the same time, care should also be taken not to overheat any components in the process. The junction FET appears to be reasonably rugged as such items go. With reasonable care in handling and soldering it into place, no trouble should be experienced. Make sure that you refer to the diagram to get the correct connections.

Having assembled and wired the unit, it is always wise to make a thorough check to be sure that no errors have been made. Assuming that all is well, a power supply of 12 volts will be required. Our unit, when fed with 12 volts, takes 13½ milliamps. This current value will vary from one unit to another, due to normal component variations but more particularly due to the spread which occurs with the junction FET. Although we have specified 12 volts, satisfactory operation can be had down as low as 6 volts, although the output is somewhat reduced.

The power supply can be a battery, or any other unit which will deliver the required voltage and current. A suggested supply, if no other is available, is that as used for the Playmaster 123 Program Source and described in October, 1968.

Connect up the unit to the power supply and feed the converter output into the aerial terminal of the receiver to be used as the turntable or fixed first IF. Switch on and search for signals. The variable capacitor across the ferrite rod should be adjusted for maximum noise pickup during the tuning process. When a signal is found, it should be peaked by the tuning capacitor just mentioned, as well as at the tuneable IF. If a fixed IF is used, then the variable oscillator must be peaked.

As a direction finder, the ferrite rod may be rotated, for a "null," or weakest signal. The rod will then be pointing in line with the transmitter location. Maximum signal will be obtained by rotating the rod through 90 degrees from the null.

At this point, the converter is virtually complete. However, there is one adjustment procedure which may be done, although it may not have much effect on the signals received. The adjustment involves balancing the ring mixer.

To do this, you must be able to tune the receiver to the frequency of the crystal or self-excited oscillator. Suppose that the oscillator is on 5000-KHz. Tune the receiver to this frequency and you will find the "carrier" of the oscillator and it will possibly be very strong. In order to make the adjustment, the receiver should have an "S" meter. If this is not the case, then a VTVM should be put across the AGC line of the receiver. If this is not available either, it is scarcely worthwhile attempting to make the adjustment and, as a compromise, the 1K potentiometer should be set with its rotor in its mid position. You may even omit the 56pF capacitor and the 3-30pF trimmer shown as part of the mixer circuit.

But, assuming that a meter is available, the method of adjustment is to vary both the 1K potentiometer and the 30pF trimmer, in conjunction with each other, with the object of reducing the signal from the oscillator, to an irreducible minimum. This takes some patience and a steady hand, particularly when you are approaching maximum attenuation.

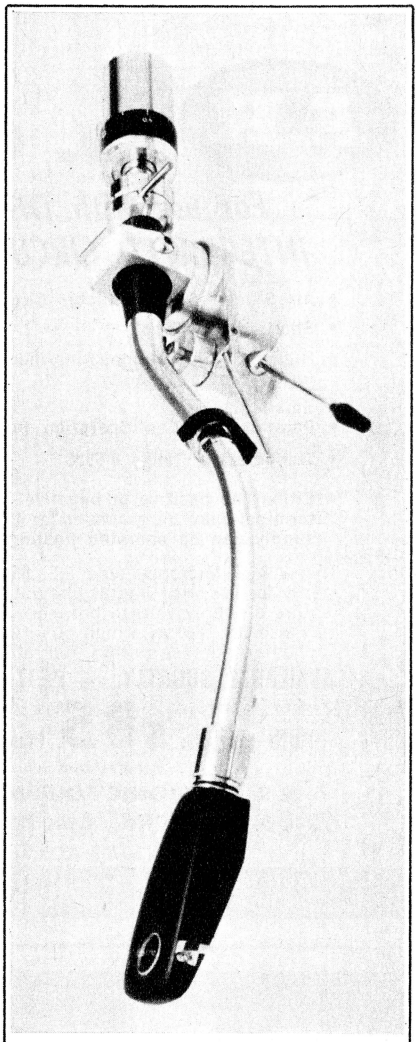
We have shown a 56pF capacitor on one side of the mixer. It is possible that your mixer will not balance with this value. You will be able to tell by the behaviour of the 30pF trimmer. If the trimmer has to be screwed right in and the null is not reached, a larger capacitance will be needed. If the trimmer has to be screwed right out, the opposite is the case. Even if you are unable to bring the signal well down, it does not really matter in this particular unit. If you have gone to the trouble to get a matched quad of diodes, then better balance will be attainable.

Once you have succeeded in getting this little converter going, we hope that you get the fun and satisfaction from it that you are seeking. Just one more thing; although this unit is not designed for the higher frequencies, it will perform quite well, simply by changing the ferrite rod over to a coil which will cover the frequencies desired, together with suitable choice of local oscillator frequency and tuneable IF. ■

PARTS LIST

1 Base board, 5½in x 3½in.
1 Variable capacitor, 10-415pF.
1 Crystal.
1 Crystal socket.
2 2.5mH RF chokes.
1 Ferrite rod, ½in dia., with tubing.
1 FX3019 toroid.
1 FX3012 toroid.
1 1K tab potentiometer.
1 3-30pF trimmer.
4 OA91 diodes.
1 2N5459 FET (Motorola).
1 BF115 transistor.
2 100 ohms ¼W.
2 1.5K ¼W.
1 3.3K ¼W.
1 10K ¼W.
2 220K ¼W.
1 22pF NPO ceramic.
1 56pF polystyrene or NPO ceramic.
1 150pF polystyrene.
1 220pF polystyrene.
1 .001uF polystyrene or ceramic.
4 .01uF low voltage plastic.
1 0.1uF low voltage plastic or ceramic.
1 0.33uF low voltage plastic.

NOTE: The above list is a guide only and reference should be made to the text for possible other details and possible substitutions.



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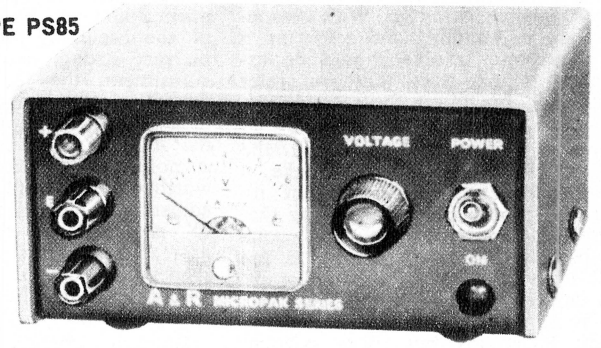
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A SIMPLE TWO-STATION TELEGRAPH SYSTEM

by Philip Watson

Here is a simple project which will appeal to our younger readers, particularly those who wish to gain practice in Morse code for their A.O.C.P. At the same time, building the project will provide useful experience for those just beginning on the practical side of things.

The basic idea is a simple telegraph line between two "stations," over which code messages may be passed. The important thing is that these two stations should be physically separated by a reasonable distance; at least sufficient to prevent the students having any other convenient means of communication. In short, their only means of communication should be over the telegraph line.

Such a situation provides a much greater incentive to concentrate than one where verbal communication can override the system one is trying to perfect. There can be no idle chatter, mistakes are seen at their true value, (they must be corrected by the same communication system) and one must, of necessity, concentrate entirely on the job in hand.

Such a system also provides practice in procedure; calling and identification (using fictitious call signs) message handling, break-in, correction, etc.

An ideal situation is where two enthusiasts live in adjacent flats or home units, allowing the cable to be run temporarily, without going outside the boundaries of the one property. A more typical situation is between adjacent houses with the cable hung on a trellis or otherwise kept out of the way.

In fact, the latter idea is possibly against the strict letter of the law.

When, in the November, 1967 issue, we described how to make a simple telephone which the reader could use to "talk to his mate next door" we received a prompt, polite, but firm message from a Mr D. M. Coleman, on behalf of the Director General of Posts and Telegraphs. In it he drew our attention to Telephone Regulation 154A, which he quoted in detail. We reprinted this in "Forum" for February, 1968 (page 75) but, in its essentials, it makes it an offence for a person to set up ". . . any private line which passes beyond the boundary of land of which he is the owner or occupier . . . ."

And, while the above appears to apply specifically to telephone (as distinct from telegraph) lines, it would be a pretty good bet that the P.M.G. has a similar regulation tucked away somewhere in which all references to "telephone" becomes "telegraph" etc.

On the other hand, the department is apparently not entirely without a heart. Mr Coleman commented, "There is, of course, no intention on the part of the Post Office to discourage the building and use of instruments like the one described; in fact, this could be an encouragement to young people to interest themselves in the question of becoming Post Office technicians. However, I have to draw your attention . . . etc."

From which one might surmise that the Department is not likely to concern itself with the efforts of a couple of lads practising Morse Code through the intervening fence. At the same time, it would be most unwise to invite trouble by going beyond this or, above all, by stringing wires along or across a footpath or any other public property.

From which one might surmise that, provided the Department's attention was not specifically drawn to a situation such as we have suggested, they would not go looking for it. So, whatever you do, be discreet.

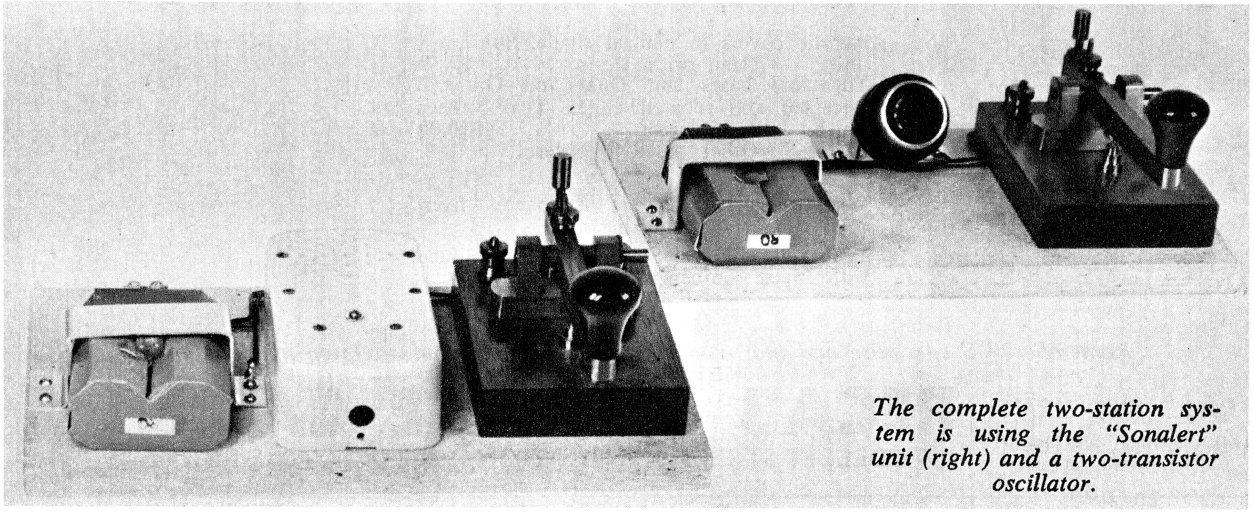
Another situation would involve clubs and Youth Radio Schemes where, ideally, there may be a building large enough to allow two rooms to be used as stations, or there may even be two buildings available on the one site.

At this point we should perhaps emphasise that the scheme is not intended as a way of learning code, so much as a way of pracising it; and these are really two different things. Learning involves memorising the code, in an approved fashion, learning how to hold and operate a key, and the first stages of recognising a character by its complete sound, without the need to analyse the individual elements of which it is composed. But at this point, when a speed of a few words per minute has been achieved, the student needs practice—and lots of it. It is then that our telegraph system could be most valuable.

In considering the requirements of such a system we decided that it should, (1) allow either party to call the other party by simply operating his key. (2) allow a listening party to interrupt a sending party in the event that a character or word was incorrectly sent or received, and (3) ideally should not involve any switching requirements at either end.

Such requirements are not difficult to satisfy, and the set-up shown in the accompanying diagram is also simple and economical. In fact, a number of stations could be connected to such a line, if desired, permitting practice in "net" operation. In this case anyone wishing to initiate a practice session might reasonably call "CQ."

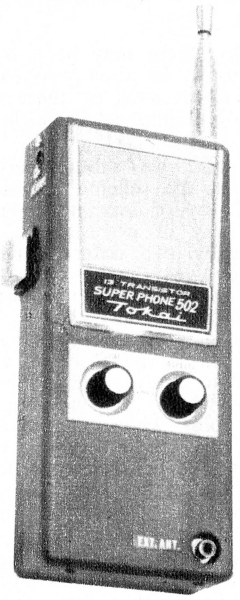
In simple terms the arrangement is one where all sounders are permanently connected across the line, thus satisfying requirement (1). Each key and battery combination, in series, is also connected across the line, so that any key which is depressed will cause all sounders to operate. This satisfies requirements (2) and (3). In practice, a listening party who wishes to interrupt a sending party for any reason simply holds his own key down. This



The complete two-station system is using the "Sonalert" unit (right) and a two-transistor oscillator.

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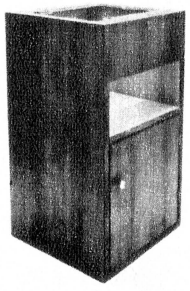
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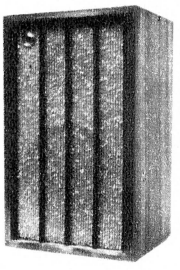
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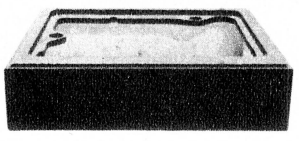


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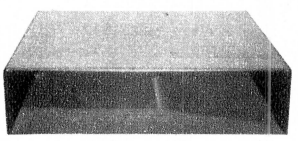


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will cause the sounder at the sending end to operate continuously, rather than in accordance with the keying impulses. The sending party can then cease transmission and wait for the receiving party to indicate what is to be repeated.

The equipment required is quite straightforward, and is the same for each station; a key, a battery, and some form of sounder such as a buzzer or oscillator. The line may be almost any kind of wire strong enough to withstand normal handling: Twin bell wire, or 1/.028 twin figure-8 extra low tension PVC insulated bell wire, to give it its official title, is one suggestion. Alternatively, it may be possible to use a single wire and an "earth" return, assuming the availability of a reasonably good earth connection, such as a water pipe. This is well worth investigating if wire has to be bought.

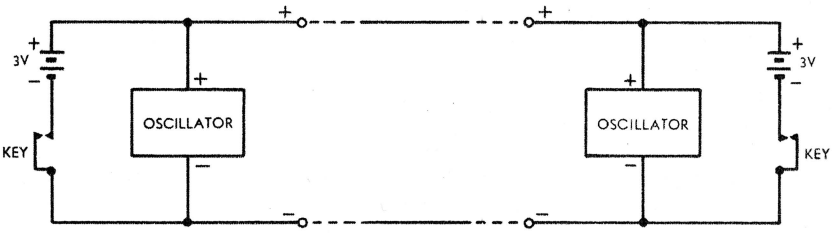
The key selected will be largely a matter of personal choice and what is available. If you intend to continue with the code when you get your licence, then the key you buy now might just as well be the one you will ultimately use. If, on the other hand, you plan to join the "Dusty Keys Club," then it may be possible to borrow a key for the duration of the course. Unfortunately, there does not seem to be a plentiful supply of keys on the market at present, but it is worth trying disposals sources, particularly those specialising in ex-P.M.G. equipment.

For the sounder there is a fairly wide choice. One ready-made device is the Sonalert, described in detail in the November, 1968 issue (page 68). Alternatively, a simple transistor oscillator driving a small loudspeaker can be made up quite easily and, if some of the parts can be found in the junk box, quite economically. Such an oscillator was described in the May, 1962 issue and again in the November, 1968 issue (page 71). Even if it does not take the same physical form, it will still do the job required.

Another suggestion is a small high-pitched buzzer. These are quite good when they are working properly, but some types are inclined to be cranky and critical of adjustment, particularly older ex-disposals models. However, if you can find a good one at a reasonable price, by all means try it. Even the more conventional type of buzzer might be tried, but the harsh note from most of them can become very trying after a while.

The battery will be dictated by the voltage requirements of the sounders selected. And, while the sounders used at each station need not be the same, they should at least have similar voltage requirements, since it is essential to use the same voltage battery at each station. This is to avoid complications if two or more keys happen to be pressed at the same time, as in break-in operation, since this effectively connects the batteries in parallel. For the same reason it is desirable that the batteries be of a similar type and in a similar condition of discharge. Otherwise there will be a tendency for the battery with the higher voltage to discharge into the one with a lower voltage.

Our own transistor oscillator will work quite well from a 3V battery and the Sonalert, although specified as requiring 6 to 28V, also appears to work quite satisfactorily from 3V. In fact, the lower voltage is something of an advantage in this case, since both devices tend to generate more volume than necessary on higher voltages. On this basis the popular 3V cycle lamp battery (Eveready type 701 or similar) would seem to be a logical choice. Alternatively, a pair of 950 cells connected in series would serve nearly as well, and have the advantage of being readily available.



Block diagram showing how the two stations are interconnected.

The layout of a station can take almost any form, but it is worthwhile to provide some orderly method of combining the separate parts into one unit. We provided a small baseboard cut from particle board and secured each item by the most appropriate means.

A key with a wooden base is most easily secured by driving a pair of countersunk screws upwards from underneath the baseboard. This avoids marring the visible surface of a polished wood base. Make sure that the screws do not foul any part of the key mechanism which is recessed in its own base. Other types of keys may be already provided with mounting holes.

The battery can be held by means of a "U" shaped strap, cut from a scrap of aluminium. The oscillator, if built as originally described in a plastic box, is probably most easily secured by drilling a single hole through the face—opposite an area inside which is free of components—and passing a long (about 2in) wood screw through the box into the base.

If using the Sonalert, it is best to mount this device at an angle of about 45 degrees so as to approximately face the user, since the beam from the device is quite narrow. The Sonalert sits more of less naturally in this position with its terminals resting on the board. A couple of small "L" brackets, drilled to accommodate mounting screws in the baseboard and the terminals of the Sonalert, will solve this problem very neatly. ■

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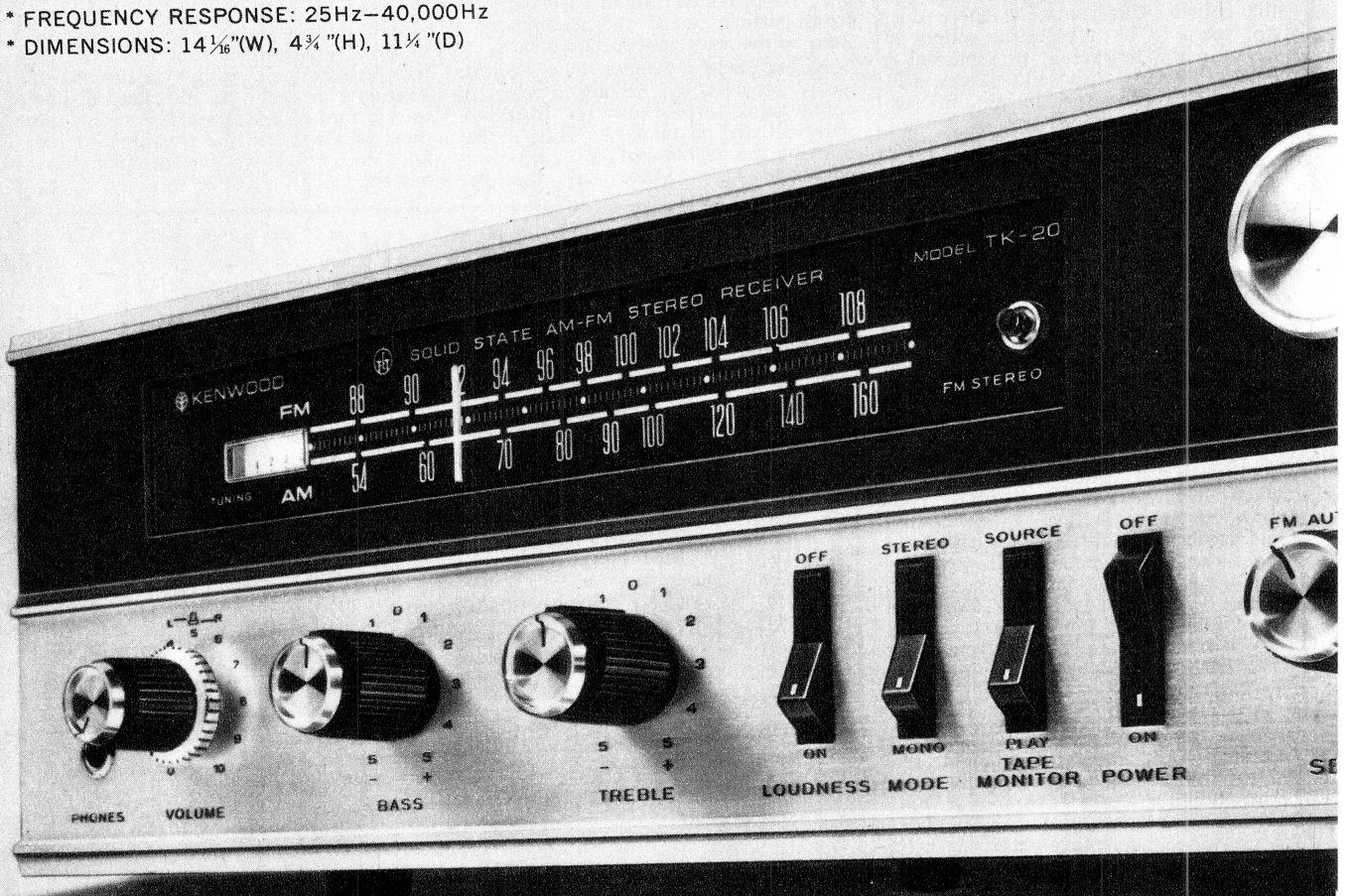
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5 IF stages with a top-tone bass and clean treble sound.
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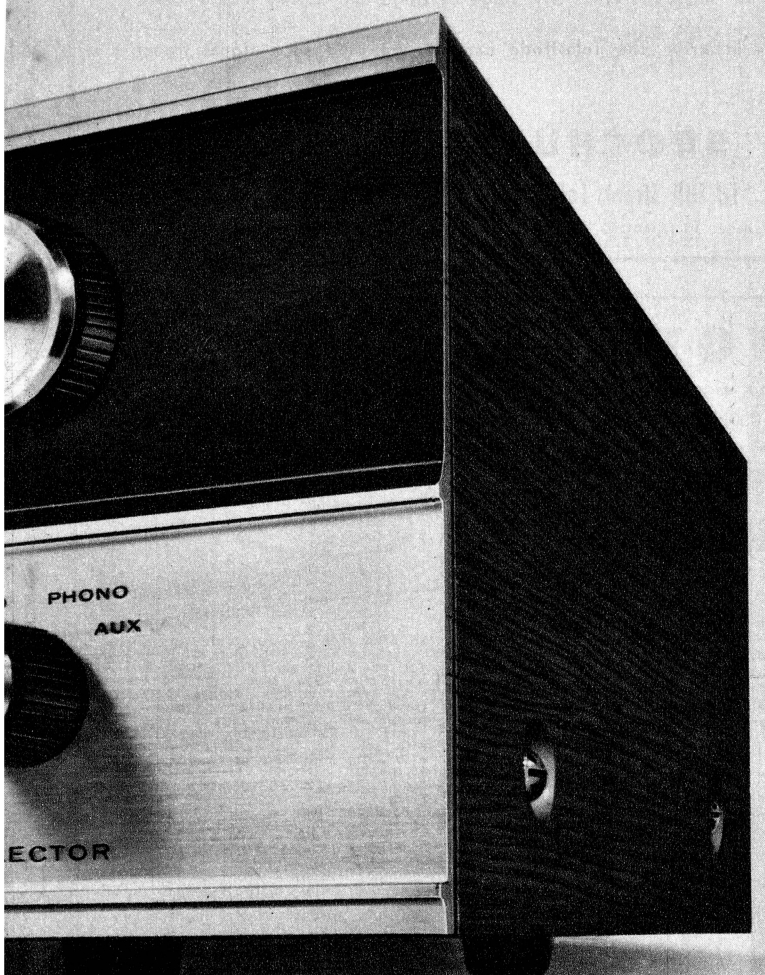
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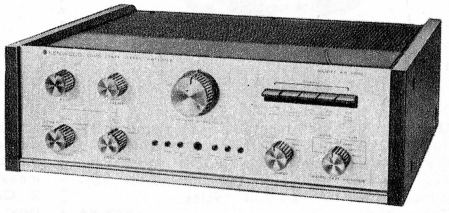
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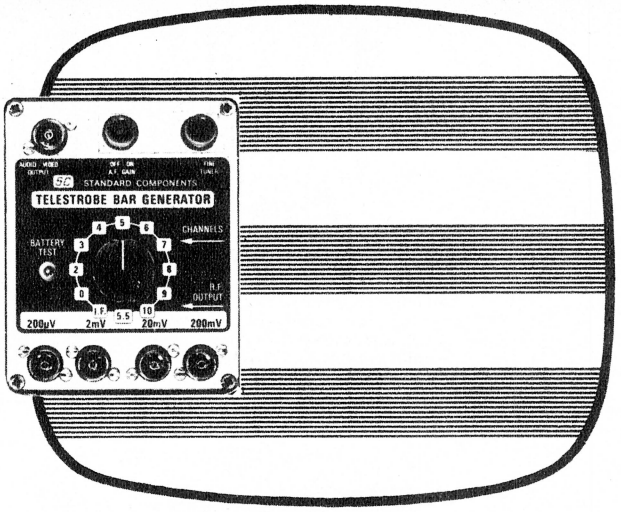
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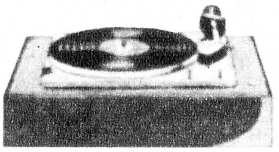
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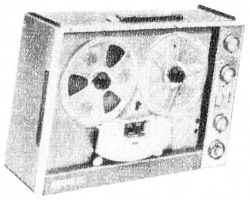
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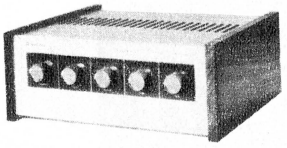
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Unit 2: P.E. 34 turntable (as illustrated), Sansui 222 fully transistorised amplifier, 2 Wharfedale Golden 10in RSDD loudspeakers, Empire 808 cartridge, frequency response from 10—20,000 cycles.
Total Price **$365.20**
Special Package Deal **$277.00**



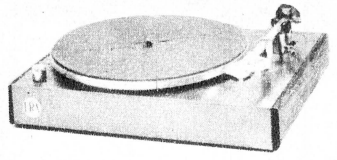
Unit 5: Ampex Model 753 tape deck (as illustrated), 4-track stereo, sound on sound tape monitor, sound with sound, echo chamber, with Armstrong Model 226 tuner/amplifier, 2 Jordan Watts loudspeakers.
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Unit 6: Armstrong 222 integrated stereo amplifier 10-watt RMS per channel, frequency response from 30—20,000 cycles plus over minus 1dB, less ½% distortion measured at 8-watt RMS (as illustrated) 2 Goodmans 8in Twinaxlette loudspeakers, Dual 1010F turntable, complete with cartridge.
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Unit 3: Kenwood TK-250U amplifier, Dual 1015 turntable, Empire 888 cartridge, frequency response from 12—25,000 cycles, 2 Goodmans 10in Twinaxion loudspeakers.
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Total Price **$564.00**
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Unit 7: Pioneer SA-400 amplifier, 2 Wharfedale 8in RSDD loudspeakers, Dual 1010 turntable complete with cartridge.
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Mr A. G. Murrell, P.O. Box 18, Penola, S.A., has developed a communication system using modulated incandescent light, claimed to give satisfactory signals up to 300 yards by night and 70 yards in daylight.

The principle of light modulation is very simple, and I first tried out the idea in 1941 using a photo-electric cell recovered from a faulty gramophone pick-up. The exciter for the pick-up was an ordinary pea lamp, and the possibility of modulating it was investigated. All the necessary equipment was available—photo-electric cell, supply and amplifier—and it only needed the lamp to be connected across the 8-ohm speaker terminals of the transformer.

The results were very distorted. Further investigation suggested that the lamp would have to be biased so as to operate at some suitable "mid point" on the luminance characteristic curve, so that positive and negative halves of the audio AC would cause equal changes in luminance above and below this reference point. Unbiased, the lamp caused frequency doubling and gross intermodulation distortion.

A battery was therefore connected into circuit to provide a DC bias, see figure 1. The best results in this early experiment were obtained with a 2.5V lamp energised by a 3V battery, with the modulation kept below the point where the lamp could be seen to flicker. These conditions still apply. The voltage at the lamp was the battery voltage less the voltage drop across the transformer secondary winding, and was somewhat less than 3V.

This rather crude set-up gave really surprising results, and a plotted response showed the —3dB points at 45-Hz and 5KHz. The limited high frequency response is due, in the main, to the thermal inertia of the lamp filament, it being obviously impossible for the filament to heat and cool rapidly enough as the frequency increases. It was also considered that some loss may have been due to core magnetisation caused by the rather heavy DC current (300mA) through the transformer secondary.

No further experiments were carried out until 1961, when a germanium junction photo-electric cell — an STC type P50A — was substituted for the original "Lumatron" cell. The same supply and amplifier were used. A condenser lens was used to focus the light on to the small area of the cell, and a 7in parabolic mirror was placed behind the lamp. Both lens and mirror were from theatre picture projectors. With this equipment, it was possible to send quite good quality music over a distance of up to 70 or 80 yards and intelligible speech up to 300 yards.

More recently, attention has been given to solid state circuitry using phototransistors, but results were marred by the everpresent hiss from the light-sensitive cells. The greater sensitivity, however, allowed the use of much simpler and cheaper optics still with a useful range of up to 250 yards.

Some experimenting was done to see if amplifier output matching was critical. For this purpose a transformer was made up with design characteristics which allowed for the 300mA DC in the secondary and which matched the 3-ohm output of the amplifier to the approximate 8 ohms of a 2.5V pea lamp drawing 300mA, see figure 2.

It was found that, for the frequency range required and the level of distortion acceptable (voice only), the parallel feed system of figure 3 was quite satisfactory. The mismatch of the amplifier load had little or no effect due to the small amount of audio power being involved. It is possible to reduce the voltage across the lamp to a point where the filament is a mere red spot with the modulation causing the very slightest flicker, and still receive a good signal over a distance of more than 60 yards.

The diagrams below illustrate the development of the transmitter. The receiver circuit is shown at right.

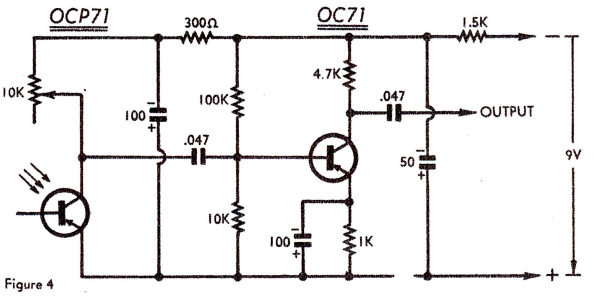


Figure 4

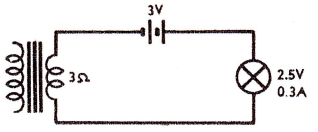


Figure 1

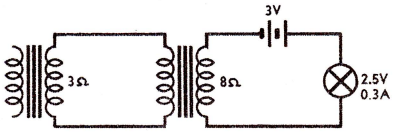


Figure 2

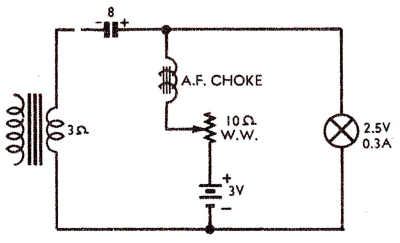


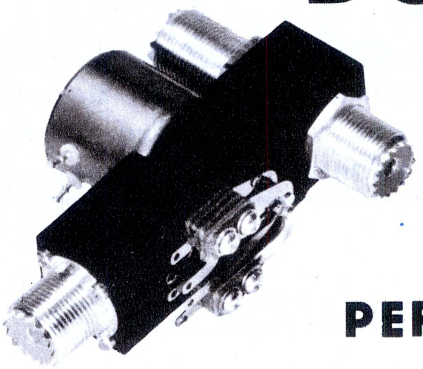
Figure 3

Although the main circuit shows the lamp biased from a separate battery, it may derive its power from the main amplifier battery or power supply, by adding sufficient resistance in series with the 10W variable resistor shown in the lamp circuit.

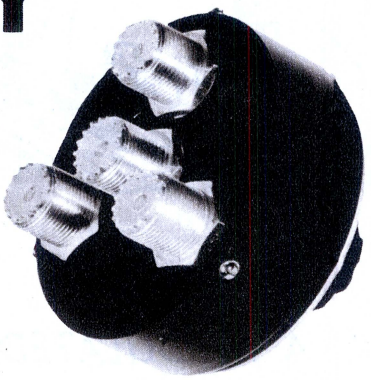
The receiver, figure 4, starts with an OCP71 phototransistor which has an ordinary 3in reading glass to focus the incoming light on to the tiny sensitive area. These are arranged in a tube made by soldering three jam tins together to provide a mounting for the lens and keep extraneous light away from the cell.

The OCP71 is quite sensitive to variations in the light intensity of what could be termed the carrier. It is possible to vary the sensitivity over a wide range by adjusting the collector load resistor to give maximum signal. Too high a light intensity can easily drive

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MODEL RP242

TRANSISTORS:	20 Transistors. 2 Power Diodes.
OUTPUT POWER:	24 Watts (4 ohm), each channel 12 Watts. 16 Watts (4 ohm) continuous sine wave.
AUDIO SENSITIVITY:	8 Watts per channel. AUX . . . . . 140mV. TUNER . . . . . 140mV. MAG . . . . . 5mV. TAPE HEAD . . . . . 5mV.
FREQUENCY RESPONSE:	30c/s, 25 Kc/s plus over minus 1 db.
HUM and NOISE:	AUX. or TUNER: 60 db at 8 ohm SPKR Max Vo. Flat Tone. TAPE or MAG: 50 db at 8 ohm SPKR Max. Vol. Flat Tone
AUDIO DISTORTION:	(AUX) Max.Output 1/10 Output 100 c/s . . . . 0.7% 0.52% 1 Kc/s . . . . 0.55% 0.55% 10 Kc/s 1.70% 0.6%
CONTROLS and SWITCHES:	Selectors: Phono: Tape Head, Aux. Tuner. Made: Stereo. Mono. Bass: Treble, Volume, Balance, Power.
TERMINALS:	Input: Mag. Tape Head, Tuner Aux. Output: 4 16 ohm SPKR.
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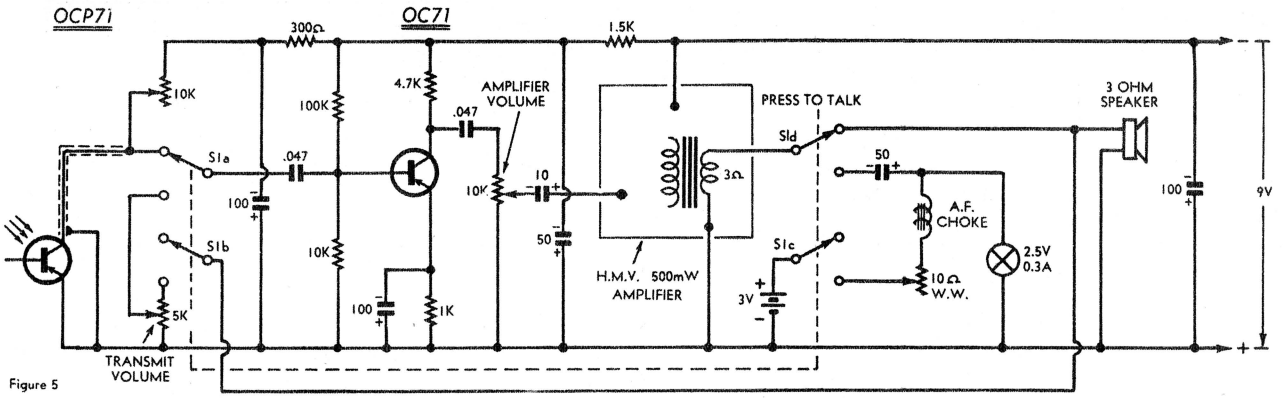


Figure 5

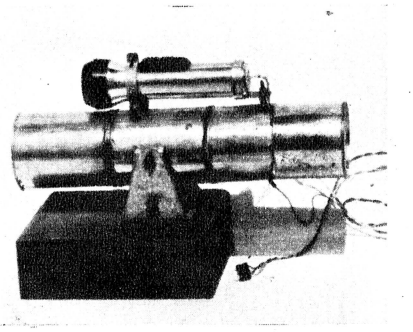
the OCP71 to cut-off, and the adjustment caters for this. With the receiver set to maximum sensitivity and with careful focusing of the lens, it is possible to pick up the pea lamp, without reflectors, across a 12ft room or up to 20ft with a fairly high hiss level.

If a reflector of any kind is used behind the pea lamp and the distance is less than about 40 yards, a lack of signal strength from the cell is more likely to be due to too much light than to too little! Reducing the light intensity by shading and/or adjustment of the cell sensitivity control should create optimum conditions. Reducing the lamp intensity by means of the pot in the lamp circuit will also have the desired result provided that modulation depth is also adjusted to prevent distortion.

The amplifier which follows the phototransistor is a pre-amplifier stage using an OC71 transistor with comparatively small coupling capacitors to cut low frequencies. The main amplifier can be any type, valve or transistor, with a sensitivity of approximately 100mV. This is used for transmitting as well as receiving as it is only necessary to connect the output to the lamp circuit instead of the loudspeaker.

This is the method used in the complete circuit, figure 5, which shows one of two units used as a communication system. Using ordinary good quality torches as light sources and lenses which cost me $1.75 each, they provide telephone quality communications usable to more than 250 yards. Distances obtainable depend on the quality of lenses and reflectors and the care with which they are set up.

Using the original equipment (one unit of which is seen in the photograph, below) first class communication was



set up over a distance of 70 to 80 yards in broad daylight. Alignment of the beams is a little more difficult than in darkness, and there is an increase in hiss level due to the ambient light. However, the signal level indicated that a much greater distance should be possible before the signal disappears in the noise. Test distances greater than 70 to 80 yards were prevented by practical limitations such as buildings, trees, traffic, etc. The hiss due to ambient light can be reduced by painting the inside of the lens mounting tube with a flat black paint, such as chartboard black.

By using an old car headlight instead of a torch head, i.e. only increasing the reflector size, a readable signal was received at a distance of considerably more than one mile along a main road at night. Above this distance distortion became a pertinent factor due to heat haze and air movement above the road surface. The total power required to transmit and receive a readable signal over this distance was only 1.1W!

Larger lenses, larger mirrors and more powerful lamps will all extend the range, but there is a limiting factor to the type of lamp which can be used. The type of filament dictates the thermal inertia and upper frequency limit, and a current rating of more than 300mA irrespective of voltage, brings roll-off below 5KHz. Experiments are currently being carried out with a 15W 240V light source, but unfortunately, the filament will not focus.

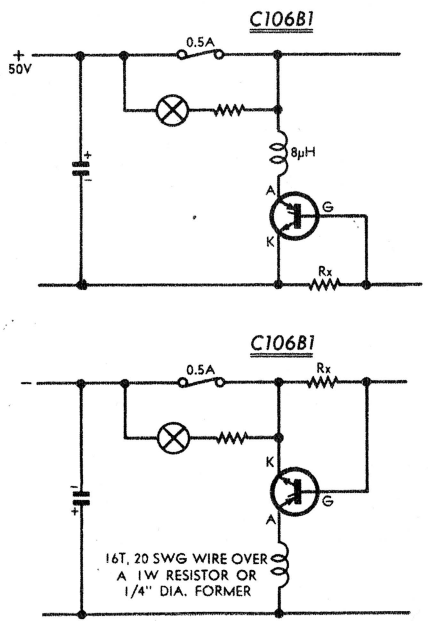
(Continued on page 174)

PROTECTING OUTPUT TRANSISTORS

Mr L. Paal, Technical Officer, Department of Psychology, The Australian National University, Box 4, Post Office Canberra, A.C.T., has submitted a method of protecting output transistors from overload.

Following your article "One Stray Wire — Two Dead Transistors," published in Audio Topics in December, 1968, I would like to add this circuit I built to protect power transistors from overload.

The circuit is placed between the power supply and the power transistors. The principle is quite straightforward. The voltage developed across a properly chosen resistor will turn on the SCR when the current reaches an unsafe amplitude. This in turn presents a short across the power supply, removing 60 per cent of the voltage from the transistors in about 4 microseconds.



The inductance of 8uH keeps the current rise within the maximum allowable value. (The 0.5A fuse has about 1.5 to 2 ohms resistance.) The short circuit current, up to 35A, is under the maximum surge current limit (75A) of the C106B1. After a few milliseconds, the fuse wire will blow and the small lamp will show the overload.

The apparatus has to be switched off to restore the circuit to the unactivated condition, also to replace the fuse. If larger currents are to be drawn from the power supply, an additional resistor (of about 2 ohms) is needed between the SCR and the electrolytic capacitor.

Editor's Note: We have revised the design of our 10-plus-10 amplifier to include protection, using an alternative approach to the one shown. An overload triggers an SCR but the result is used to disable a transistor in a simple regulator circuit. The amplifier has to be switched off to restore operation, but the problem of having also to replace a fuse is avoided. The circuit will be published, probably next month.)



THE SHOW-OFF

There is a great reserved pride in the higher priced cartridges, such as the top-rated ADC.10E/Mk II. In quality and sound reproduction it is in a class by itself, and accordingly, you pay well for this prize.

However, take the case of the perky ADC.220 . . . BOOM. Although it sells for about one-fifth the price of the 10E, it has many of its excellent qualities . . . It has the same unique "induced magnet" principle, almost the same construction, flat frequency response, REMARKABLE SMOOTHNESS, and freedom from resonance in the audible range. In fact, most audio critics have taken the position that it sounds very much the same.

Although it has astounding separation at the higher frequencies (up to 20 dbs), it does not compare to the10E separation of over 25 dbs. Yet, its higher tracking force is ideal for all playing conditions, even for inexpensive record changers. To wit, as was stated by Hi-Fi/Stereo Review Magazine, " . . . we know of no other cartridge of comparable sonic quality."

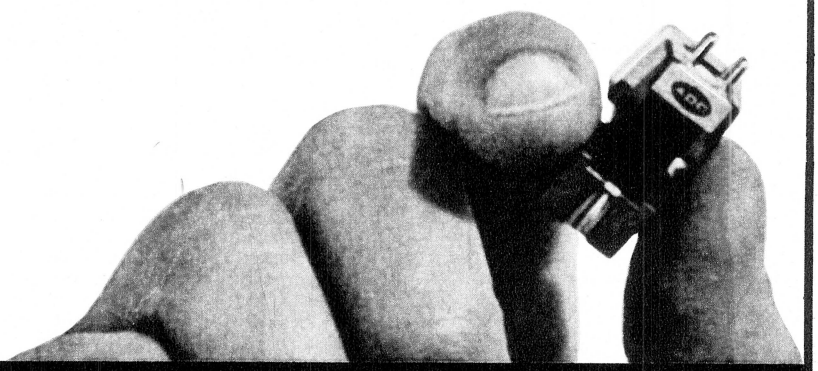
With rave reviews like these, it's no wonder why the 220 is as proud as a peacock and thrice as show-offy.

Given the opportunity, the ADC.220 can reproduce the entire musical range from piccolo to bassoon **DRAMATICALLY BETTER THAN ANY OTHER CARTRIDGE IN ITS PRICE CATEGORY;** track better ("I'm the grooviest"); and out-perform consistently.

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And, in closing, the final word from the magazine review board, " . . .

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LAYMAN'S GUIDE TO RECORD MANUFACTURE

Between the recorded performance and the gramophone record which spins on your turntable, there is a chain of events which require the utmost skill and care to give you a high quality product. This article describes, in largely non-technical terms, what goes on in the record factory.

By E. B. PINNIGER

The shining black plastic disc that is the gramophone record is such a familiar object in most homes that it is taken very much for granted. Few of us pause to wonder how the minute grooves, often less than one thousandth of an inch deep, manage to contain all the information necessary to re-create in our living-room the complex sound of a full orchestra. The spread of sound and separation of instrumental detail from a modern stereo record almost rivals the experience of listening to a live performance. Most of us accept the near perfection of the modern record and we think about quality of the product only if some minute blemish in the 700 yards of groove produces the odd snap or pop which disturbs our listening. Some of us are then quick enough off the mark to complain about the shortcomings of record manufacture.

There is so little written about the complex processes used to produce a record that I suppose one cannot blame the record-buying public if they know little or nothing of the details. The wonderful BBC film of the recording of Gotterdammerung in Vienna must have given viewers some idea of the complexity of modern recording techniques. But few people can have seen Decca's own excellent film "Handle With Care" which illustrates the subsequent technical processes through which the complex recorded signal gets on to the finished record.

The pioneering work on sound recording was carried out by Thomas Edison and his team of co-workers, using cylinders; and Emil Berliner, who invented the disc recording. The early recordings were made by acoustic methods, which relied on the vibration set up by sound pressures in a diaphragm to operate the cutting stylus. In the subsequent development of recording methods, certain events stand out as major landmarks, notably the introduction of electric recording systems; the invention of the single groove stereo recording, first successfully demonstrated in 1930 by the brilliant British scientist Alan Blumlein, of the E.M.I. company, whose death during the war was a major blow to science; and the development of the lightweight pickup which made possible the long-playing microgroove disc.

On a somewhat lower plane, but still contributing to the present-day excellence of recordings, are the steady improvements in pressing materials and studio equipment; and, of course, the development of the tape recorder which is used exclusively now for the initial recording.

Few readers of this magazine will not be familiar with the method of operation of tape recorders. As the professional recorders used by the recording industry operate on the same basic principles, despite their more elaborate construction, there is no need to go into details of the master tape, which nowadays forms the starting point of gramophone record production. Of course, the original tape must be as near perfect as possible, if the finished record is to have the desired standard of quality.

The tape is its final edited and approved form is known as the Master Recording. The disc that we know really begins to take recognisable shape with the transfer of the recorded signal on the tape to the blank lacquer disc. This Recording Blank, as it is termed, consists of a disc of aluminium coated

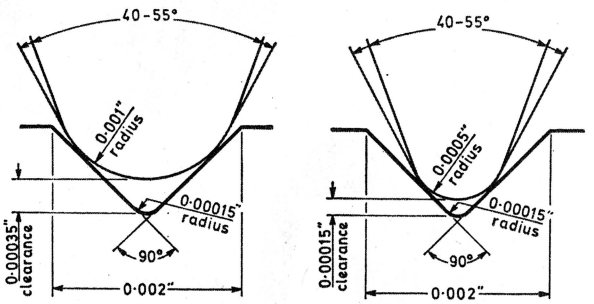


Figure 1. Profile of the standard LP groove, showing the reduced bottom clearance on a 0.0005in radius stylus (right) compared with an 0.0001in stylus.

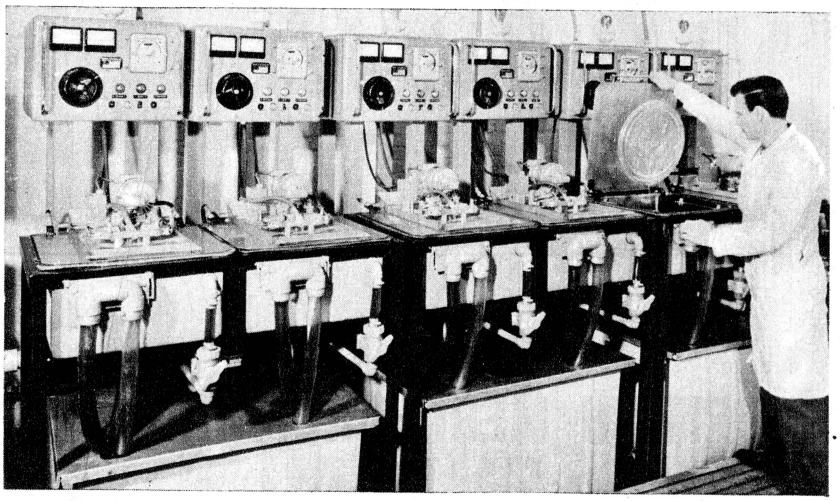


Figure 2. A bank of rotary nickel plating tanks as used in record production. (Courtesy Metals and Methods Ltd.)

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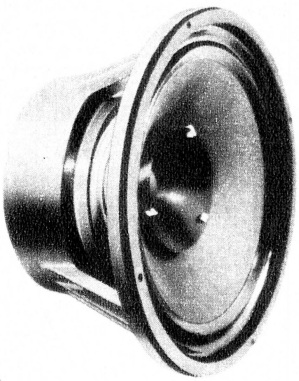
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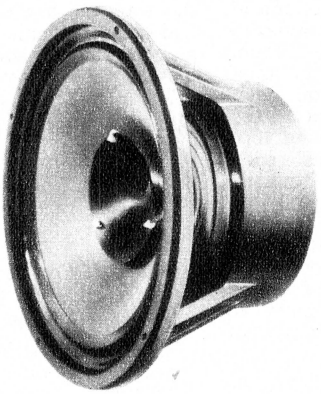
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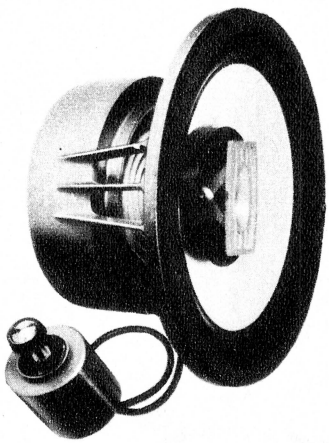
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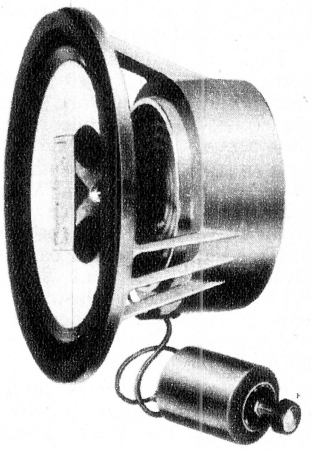


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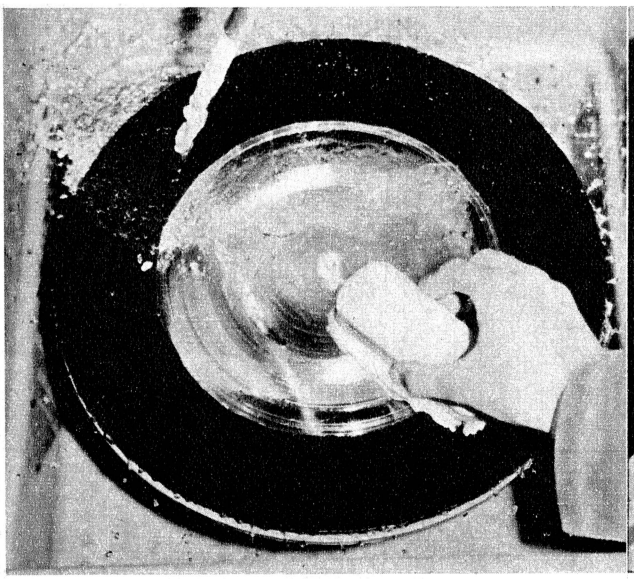
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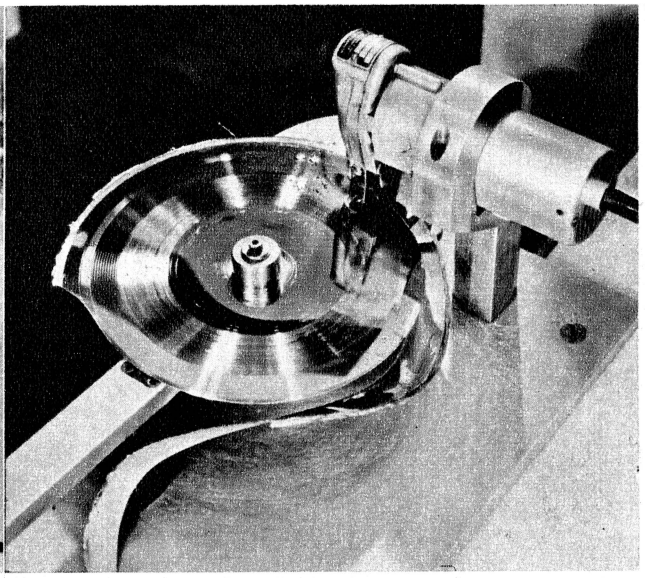
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LEFT: Figure 4. Cleaning a metal master to remove contaminants before a mother is made by electro-deposition. RIGHT: Figure 5. Trimming excess metal from an unfinished stamper.

with a cellulose lacquer. The formulation of the lacquer is very carefully controlled to produce a compound suitable for cutting by the recording stylus. This cutting stylus consists of a minute sapphire chisel which cuts a groove in the lacquer of the recording blank by removing material in the form of a continuous, thread-like swarf. Cutting the disc to produce the master takes place on a special precision lathe. The recording blank rotates on the face plate (turntable), usually being held in position by suction, and the cutting head is carried on a lead screw which traverses it across a radius of the disc.

In basic principles, the cutting head is the converse of a gramophone pick-up. The signal is fed to a coil, producing movements of the armature to which the cutting stylus is attached. Pitch and depth of groove can be automatically varied to accommodate changes in the degree of modulation of the groove. It is also usual for the cutting stylus to carry a minute heating coil in order to soften the lacquer as it is cut. The resulting swarf is removed by suction. Naturally, clean air conditions are vital both at the cutting and the later pressing stages.

The sound track on a record takes the form of an archimedian spiral which, on a long playing record, consists of a groove of 90 deg. included angle, 0.022in top width and 0.00015in bottom radius. On a monophonic disc the modulation is lateral: on a stereophnic record the groove carries two signals recorded at 90 deg. to each other and at 45 deg. to the plane of the record surface. Differences in phasing and content between the two signals cause the groove to vary in both depth and width. Normally the outer wall of the groove carries the channel which actuates the right hand loudspeaker.

Having now obtained the original recording in a form substantially similar to the finished record, the disc now goes through a sequence known as electroforming. Although the sound track is now in exactly the same form as it will appear on the finished record, and is capable of being played, it is not usually considered advisable to do so as the risk of deforming the soft lacquer groove is so great.

Electroforming is basically a form of heavy electroplating. Ordinary plated articles have metal deposited on the surface less than one thousandth of an inch thick, whereas an electroformed record master may have 25 times this amount. Recording blanks are of an insulating material, therefore the first step in processing is to render the surface electrically conducting.

All the earlier recordings were made "live," the signals obtained going directly on to massive wax blanks (in fact the term wax still persists in the trade). Waxes were usually "metallised" by coating the delicate surface with finely divided graphite or bronze powder to produce the necessary conducting film. The fact that this mass of individual particles gave rise to noise was masked by the fact that the shellac pressings of that time contained a mineral filler which was responsible for the typical record surface noise. In the later years of 78rpm records, attempts were made to process waxes by chemical methods employing the immersion deposition of silver, or vacuum coating with gold or silver. However the introduction of direct recording on to lacquer discs, just before the last war, produced a revolution in the industry. Lacquer blanks are thin and light. They do not need the exacting conditions necessary for cutting waxes and the surface is not so easily damaged. From the processing angle a lacquer disc is much more easily "wetted" than a wax and, as all processing solutions are aqueous, a wet silvering process can be used.

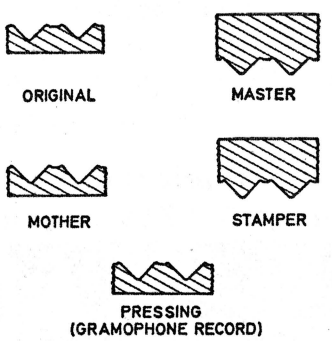


Figure 3. Stages of production leading up to the stamper used for record production and the actual pressing.

The first stage consists of careful cleaning of the disc with detergent to produce a chemically clean surface, with a water film showing no breaks. After sensitising in a special solution, the disc is rinsed with pure water and a silver film applied by a special spray gun with two barrels. The two jets of mist blend on the surface of the disc to produce a mirror bright film of silver by chemical reduction. One jet applies a silver-bearing solution and the second a reducing agent which causes rapid deposition of the silver in the metallic state.

The next stage is the deposition of the metal master (or negative). Until recent years, electroforming of the master and subsequent positive usually used copper. However, with improvement in nickel plating processes, almost all record electroforms are now made in nickel. Basically, the process consists of connecting the silvered disc as the cathode in a nickel electrolyte with pure nickel anodes. A DC current of up to 200 amps per square foot is passed at 12V to 16V. Under these conditions, nickel is deposited from the nickel sulphamate electrolyte at a rate of about 0.01 inch/hour, to produce a master of suitable thickness in 1½ to 2 hours. Conditions under which the deposit is made vary widely in different factories but it is usual to rock or spin the cathodes while the nickel solution is constantly agitated and filtered. Under the right conditions the nickel is fine grained, hard yet ductile, free from stress and is almost ideal for the production of masters.

When the metal has reached the required thickness, that is after a specified number of ampere-hours, the disc is removed from the plating tank and stripped from the metal master. This operation often damages the delicate lacquer surface, which is then of no further use. The newly stripped master

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is carefully rinsed, dried and any roughness removed from the edge. It is then "filmed" by immersion in a potassium dichromate or organic colloid solution which produces a separating film about one molecule thick on the surface. This enables a further positive electroform to be made on the master and subsequently parted from it. This second electroform is known as the positive (or mother) and is in effect a record in solid nickel, which can be played for quality control purposes.

For the production of the stampers, which are the negatives used in pressing the record, the positive is "filmed" and a third stage nickel electroform

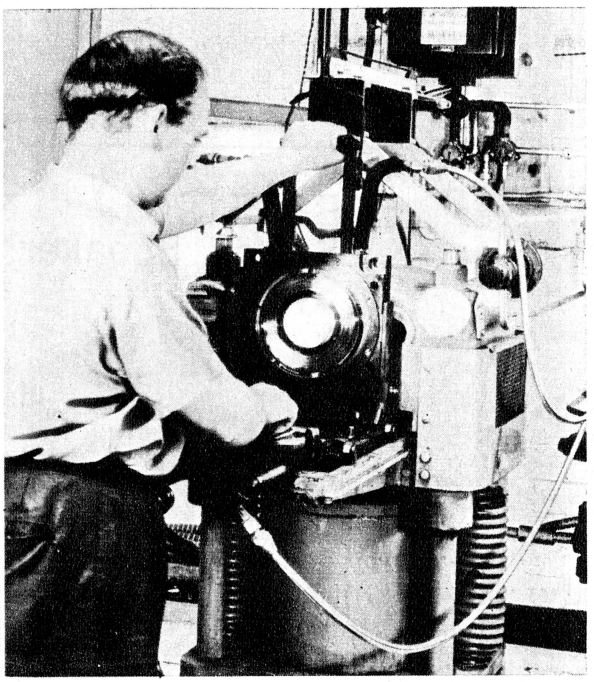


Figure 6. A four column press for 7in disc production. (Courtesy Hunt and Mitchen and British Homophone Co. Ltd.)

produced. These stampers are usually thinner than the previous stages, being only about 0.01 to 0.015 inch in thickness. All the matrices, which is the generic term by which processing electroforms are known, have a mirror surface and are objects of quite considerable beauty. It is fortunate that they are capable of reproducing the minutest details through all the stages of processing, otherwise the mass production of records would be impossible.

Even when the disc has reached the master stage and is in solid nickel, careful handling is vital. At the negative stage, the minute bottom radius of the groove is very easily damaged. The plates are carefully examined for blemishes at each stage. Finally, the stampers are trimmed to size and provided with an exactly central pilot hole. To do this, the spiral is centred by viewing it through a microscope while it rotates on a face plate. This is adjusted until the spiral feeds steadily towards the centre without any "kick back." The thin nickel plate is then "coined" in a forming tool to provide the contours of the modern LP record with raised edge and centre. In the case of a 7-inch stamper, the anti-slip serrations are also embossed at this stage. In some factories the stamper is given a light flash of chromium plate to improve abrasion resistance. Opinions vary on the need for this added layer of metal nowadays, though it was essential with the abrasive materials used for 78rpm records.

As all the operations needed to produce a stamper have now been completed, the final stage is reached with the production of a test pressing. Before we consider the production of pressings it will be as well to examine the raw materials from which records are manufactured. The old-standard 78-rpm disc consisted of a compound made in the following proportions: shellac 25-30 per cent, other resins up to 5 per cent, mineral filler 50-60 per cent, pigments, lubricants, etc., about 5 per cent. It will be seen that over 50 per cent of the mix consisted of a cheap mineral filler so that, despite the fact that shellac was itself quite expensive, the compound could be produced comparatively cheaply. The hard mineral was needed, as acoustic soundboxes, and early "groove straightener" pick-ups, often had needle pressures of 150-200 grams, which amounted to tons per square inch on the record face. Under these playing conditions it was essential that the needle sustained more wear than the record.

The principles employed in pressing LP records are similar to those used for shellac discs but the techniques have become much more refined and the raw materials are synthetic rather than natural products. Natural raw materials (particularly shellac, which is an insect product) are very prone to variation between batches and quality control becomes very difficult. Synthetic materials can be much more uniform in quality. In contrast to the heavily filled shellac material, modern records contain up to 95 per cent of basic plastic and only the odd 5 per cent of pigments, stabilisers and lubricants. The plastic employed is usually a copolymer of vinyl acetate and vinyl chloride. Polystyrene, cellulose acetate and polyvinyl acetal have all been tried in the past but the best combination of wear resistance, dimensional stability and satisfactory signal-to-noise

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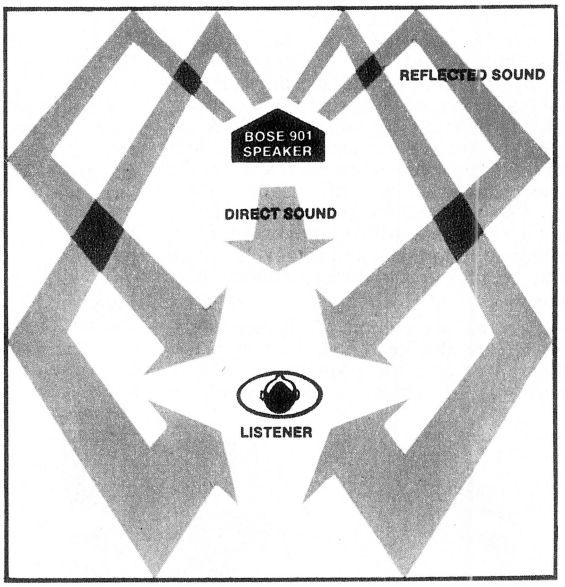
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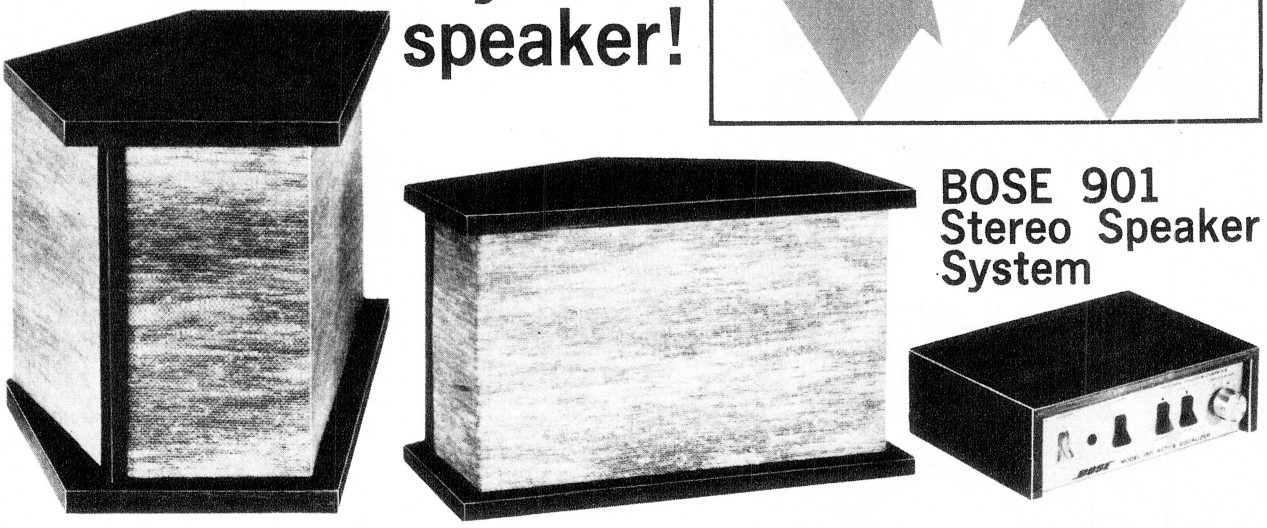
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ratio seems to be found in pressings made from vinyl copolymer.

In the pressing of 78rpm discs, the shellac material was normally made up in rectangular slabs or biscuits. These were softened on a steam-heated hot plate immediately before the pressing operation.

With suitable adjustment of operating temperatures, the same system has been adapted for the pressing of the LP disc. The vinyl compound is used in the same biscuit form, and is preheated on the hot plate to 290 deg. F before being placed in the press. Other methods which are currently practised is to use the vinyl compound in granular form and to pre-heat it by hot air blast so that it starts to cohere before it is fed to the press.

More recently, a method has been finding favour in which the basic dry ingredients of the vinyl compound are mixed in a special blender to become as homogeneous as possible, then forced out through a turn by a worm type drive similar to that used in the domestic mincing machine, passing through a heating zone in the process so that it emerges in plastic form. The material extruded in this way is placed directly onto the press.

When the material is in position, the two halves of the stamper are brought together by hydraulic pressure which is carefully controlled to ensure that the material is evenly pressed over the entire surfaces of the stampers. The stampers are then automatically cooled by cold water flushed through the dies, so that the vinyl sets immediately, and the finished disc can be removed from the press.

A gramophone record, then, is simply a moulding of thermoplastic material, produced from two stampers by the application of heat, pressure and subsequent cooling. A record press consists of top and bottom plattens carrying the record dies which in turn hold the stampers. Provision is made for closing the daylight between the plattens by applying hydraulic pressure to one of them. The dies must be capable of being heated and cooled at the correct points in the pressing cycle.

In its simplest form, the press consists of a four-column structure with a fixed head and portable dies mounted on slides; the base consists of the main hydraulic cylinder and piston. In the open position the dies are supplied with steam for heating, and insertion of the dies completes an electrical circuit bringing into operation a process timer. This applies the hydraulic pressure and, after a pre-determined period of heat, shuts the steam valve and opens a further valve causing cold water to circulate through the dies. When the record is cooled sufficiently, the hydraulic pressure is released causing the press to open. The moulded record is then extracted and steam heating is restored to the die faces in readiness for the next cycle.

The usual type of top platten or press head is pivoted and counterbalanced to form a tilting head press. In this case the dies are fixed to the plattens and, after loading, the pressing cycle commences with the lowering and locking of the head. The actual time cycle is very critical and the stampers must be at the correct temperature at the start of each moulding sequence. A typical example of such a manufacturing sequence is as follows: open press time for loading labels and material 10sec, automatic closing and locking or press 5sec, heat and pressure 10sec, cooling 20sec, opening press 5sec. This is a total press time of 50 seconds for the production of a 12-inch record. As, during this brief period, the temperature of the die may range from 80 deg to 320 deg F, it is obvious that efficient steam and water circulation and rapid heat transfer are essential. In compression moulding the weight of material used always slightly exceeds the weight of the finished record. The waste material forms a ring or "flash" round the record and the removal of this flash is the only operation needed to complete the manufacture.

Records may also be made by injection moulding. In this the pre-plasticiser is an integral part of the press and closing the press results in injection of the soft plastic into the mould cavity. This method is speedy and can be used with double impression dies to produce two records per press cycle. The application of this technique to the production of 12-inch long playing records presents problems but at least one factory is making 7-inch records in large numbers by this method. It is a development of which more may be heard in the future.

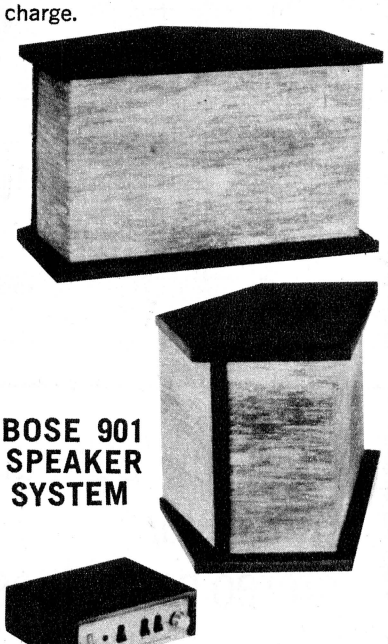
A very obvious feature of the finished record is the label. This should be of attractive design, and well printed, but the paper and print must be capable of withstanding the high temperatures and pressures encountered in the pressing cycle. No adhesive is necessary or desirable as the labels are moulded into the surface of the plastic and will not be removed even by prolonged immersion in water. The stampers are held in the dies by means of clamp rings at the edge and steel bushes at the centre. There is a fixed pin in the bottom bush and a retractable pin in the top. These pins must be of the correct diameter to form the centre hole of the record and the hole in the centre of the labels must be dimensioned to grip the inverted top pin and locate correctly in the centre of the record. Setting up the stampers and bushes calls for great care as the centre of the recorded spiral must coincide exactly with the centre of the pin which forms the central hole; otherwise the record will be a "swinger."

As they come off the press, the records are stacked in special containers or on a spike. Periodically they are collected from the press and passed to the examination and bagging department. There they are inspected and placed in the inner bags and, finally, printed sleeves before being packed in boxes ready for dispatch.

The first pressing from each set of stampers goes for critical evaluation by quality control, where it is checked for concentricity of the centre hole and played to check for sound quality. At regular intervals during the production run, samples are taken and similarly checked. Thus everything possible is done to ensure that the gramophone record reaching the customer is technically perfect and free from blemishes. That a few accidents occur is the penalty we pay for the economic benefits of mass production. In fact, faulty records represent an extremely small percentage of the millions of records manufactured each year. ◘

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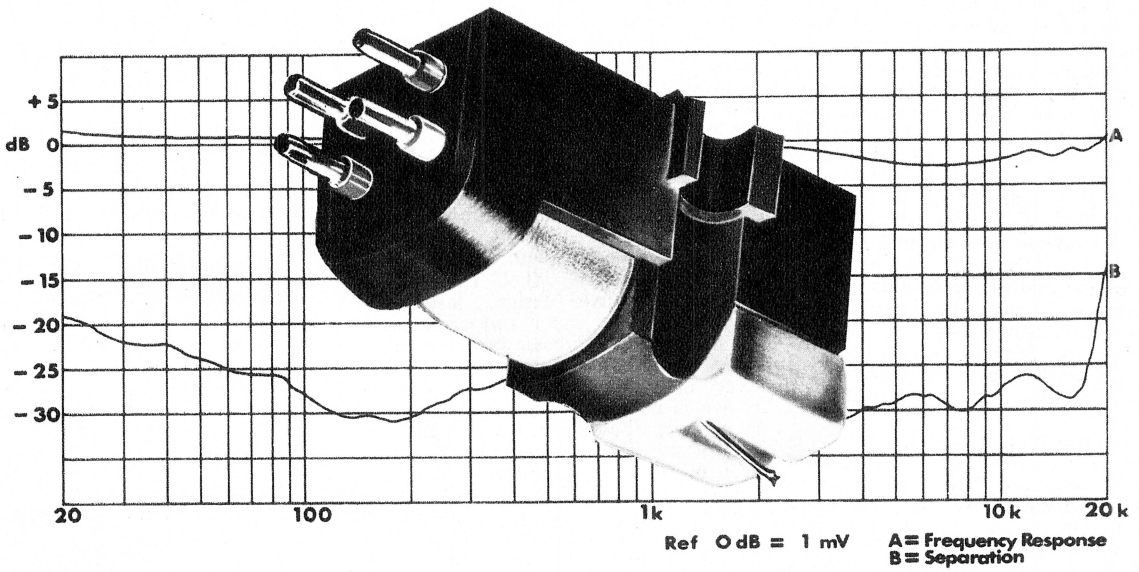
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Compliance Static	20×10^{-6} cm/dyne	30×10^{-6} cm/dyne
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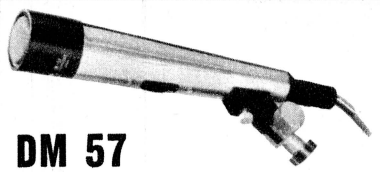
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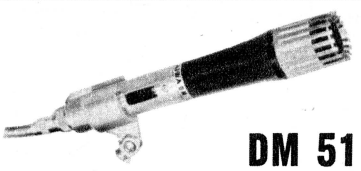
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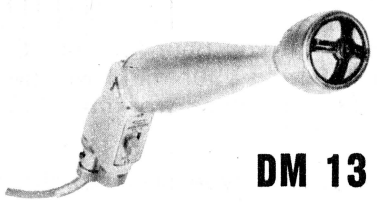
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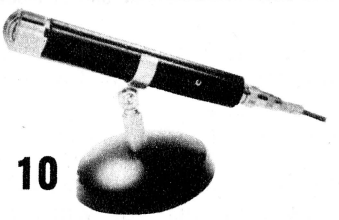
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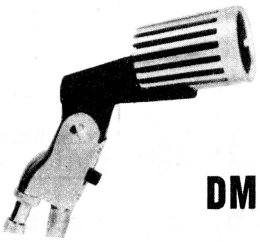




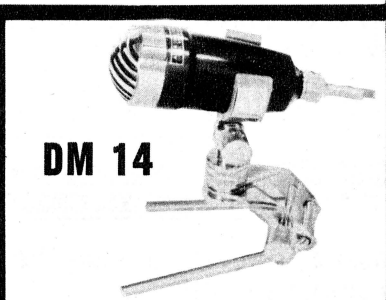












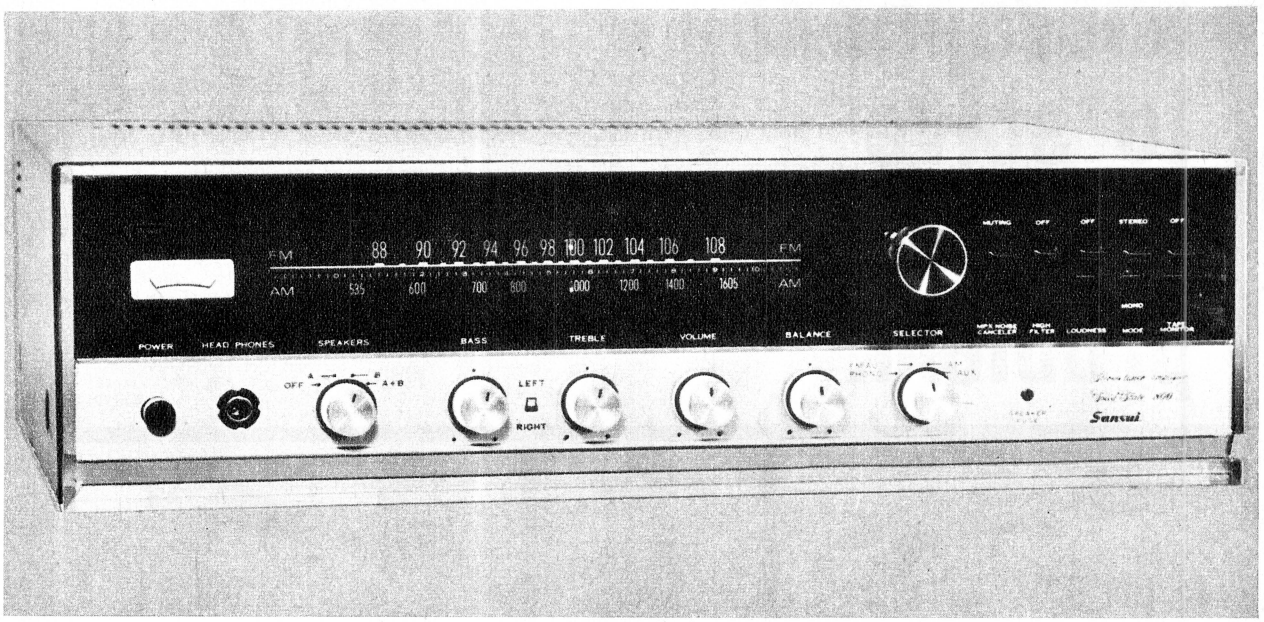
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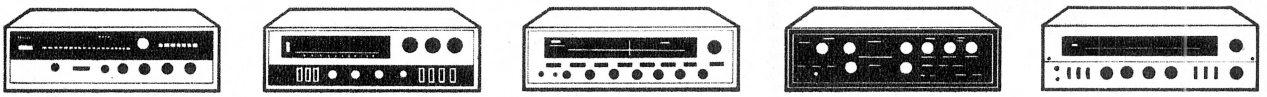


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Classical reviews

By JULIAN RUSSELL

Karajan "lyrical" in new Rheingold

WAGNER — Das Rheingold. Complete Music Drama. Dietrich Fischer-Dieskau (Wotan); Robert Kerns (Donner); Donald Grobe (Froh); Gerhard Stolze (Loge); Erwin Wohfahrt (Mime); Zoltan Kelemen (Alberich); Karl Ridderbusch (Fafner); Martti Talvela (Fasolt); Josephine Veasey (Fricka); Simone Mangelsdorff (Freia); Oralia Dominguez (Erda). Berlin Philharmonic Orchestra conducted by Herbert von Karajan. DGG Stereo 104966/7/8.

Back in 1959 Decca issued the first complete recording of "The Rhinegold," in the now famous Solti performance. In those days even the most sophisticated of critics was awed by the sound of producer John Culshaw's anvils and the shrieks of the Nibelungs when they fled from Alberich's whip. The set won instant universal success, both artistically, and, surprisingly so far as Decca's upper echelons were concerned, financially. It was this later factor that encouraged the always venturesome company to record the whole of "The Ring," a project which took six years to complete. Decca recorded the works in the order Wagner wrote them, with their recording techniques improving all the time until, when they reached "Gotterdammerung," they produced a set which many today still regard as the finest example of the recording engineer's—and recording producer's—art.

It was inevitable that another complete recording would appear one of these days, the only impediment being the vast cost of such an enterprise plus the fact that there was always the danger that anyone who wanted a complete set of "The Ring" would already have the Decca and would be naturally reluctant to go to the expense of buying another. DGG took the plunge and with conductor Herbert von Karajan started their set with the "Ring's" most popular component, "The Valkyrie." Now we have "The Rhinegold" in a version that can stand up fearlessly to its earlier rival. Both the Solti and Karajan sets have enormous virtues and a few shortcomings. The approach of each conductor to Wagner's great scores is slightly, but nonetheless importantly different.

Very briefly the difference between the two readings might be summed up as Solti's being the more vivid, more overtly dramatic, Karajan's the more lyrical. Indeed there are long passages in Karajan's "Rhinegold" in which the orchestra is treated with almost chamber music-like sensitivity. Yet let there be no mistake, Solti's fine performance never lacks lyricism, while Karajan, if perhaps more sparing in his use of overwhelming climaxes, never plays down a dramatic thrust when it occurs.

When, however, comparison is made of the singers in the two sets potential buyers will find their choice still more difficult to make. For one singer excels in his Decca role, another is better in the DGG version. The most important character in "The Rhinegold" is Wotan, the king of the gods, his character a mixture of grandeur, irresolution, and disreputable shiftiness. For Decca, George London offered a Wotan given godlike stature by his powerful, dark-coloured voice and dignity of bearing. DGG's Fischer-Dieskau has a lighter voice but scores on the grounds of his perfect diction, used with such high musical intelligence that every word receives its full value. And, in my opinion, Fischer-Dieskau's already great performance is helped to a great extent by Karajan's use of his orchestra in a slightly more custom-built account of the accompanying music.

The same problems of preference are presented by the other characters. I found nothing to separate the two Alberichs, both Niendlinger for Decca and Keleman for DGG allotting their part a full measure of malice and hatred. With Donner I found the choice easier, preferring Waechter's (Decca) to Kern's solely on the former's bigger voice that is more suitable to the god of thunder. On the other hand Wohfahrt's Mime (DGG) is, to me, preferable to Kuen's (Decca) because his vocal characterisation is both deeper and broader. DGG's and Decca's Fafner are about equal and both fine, but the former's Fasolt, Talvela, has a walkover win over his Decca rival, Kreppel.

After Wotan's, the most important contribution to "The Rhinegold" must come from Loge, the tricky god of fire who encourages his master in his double dealing, and here again I choose Stolze as the finest Loge singing — and acting — the role today. He was the Loge in the Bayreuth performances of "The Ring" I attended in 1962, and I left the Festspielhaus after "The Rhinegold" feeling that his had been the performance of the evening. I thought at the time that a good deal of his success was due to the highly imaginative production by Wolfgang Wagner, but even without the benefit of this visual aid, his recorded performance is just as vivid and his understanding of the complex character just as surely projected.

I find little to choose between the excellent performances by the women in both sets, though I have a slight preference for Decca's Rhinemaidens. But the most formidable problem of choice is offered by the different orchestral readings of Solti and Karajan. Both present incontrovertibly valid interpretations with Solti's perhaps the most vehement and immediately impressive, and Karajan's better calculated, with the whole work, and not only a scene to scene, presentation in mind.

Some readers may think Solti's brilliant use of his brass more dramatic than Karajan's restrained handling of this section of the orchestra. But it must be remembered that Wagner, who himself designed the Bayreuth Festspielhaus especially for performances of his works only, was careful to make provision for the brass under the apron of the stage, the better to balance the orchestra against the singers. That Karajan's brass is less assertive shows—to me at any rate—that this was in his mind when he made the DGG recording. Temperamentally the two conductors are very different and which you will prefer must always remain a personal choice. The engineering of both sets is fine and I can only express my regret at not being able to make a more clearcut decision on which to buy.

The old Decca set has been recut and is nowadays obtainable only on special indent. The DGG should be available in most good record or music stores. There is a difference of only 50 cents in the price, the Decca $17.50, the DGG $18.

★ ★ ★

BRAHMS—Piano Concerto No. 1 in D Minor. Daniel Barenboim with the New Philharmonia Orchestra conducted by Sir John Barbirolli. HMV Stereo OASD 2353.

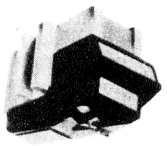
There have been many fine recordings of the two Brahms Piano Concertos but I like this new one of the first as well as any, and better than most from all those I heard. In the first place, here is an interpretation that has many novel features, none of them wilfully eccentric. Thus Barbirolli's majestic introduction makes one immediately expectant of something different. It is immensely massive but quite without stodginess. The whole structure is enlarged to heroic proportions but without disfiguring inflation. Moreover despite this weight, Barbirolli brings to the notice small details of the scoring which might have otherwise passed unheeded. And I repeat that he does all this without hint of freakishness. It all sounds immensely grand.

As soon as Barenboim enters you know that you can look forward to a completely satisfying collaboration between soloist and conductor, for Barenboim's playing has the same grandeur as Barbirolli's. For a pianist in his middle 20s his is an astonishingly mature performance, forceful when that merit is necessary but beguilingly tender in Brahms' moods of poetic reverie. You won't have to be much of an expert to spot an unusual detail in his performance. A cadenza plainly marked forte by the composer is delivered very quietly indeed. Why I shall probably never know. From the wilful Glenn Gould such an adven-

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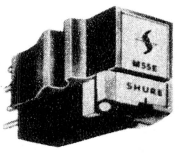
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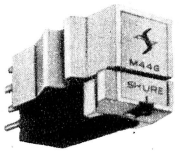




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ture might well be expected, but from anyone with the respect Barenboim has always shown for strict observance of the composer's intentions it is a little puzzling. I hurry to add, however, that this is the only fault I could find in an otherwise quite wonderful performance of the concerto, the only rival to which, in my opinion, is Curzon's. Moreover the whole superb exercise has been recorded with great fidelity by HMV.

★ ★ ★

BEETHOVEN—Symphony No. 5 in C Minor transcribed for piano by Franz Liszt and played by Glenn Gould. CBS Stereo SBR235296.

I mentioned the unpredictability of Glenn Gould in the previous review, and here is a prime example of his irrepressibility. Who but he would have ventured to record the Liszt arrangement of this, perhaps the most famous orchestral work ever written? That he expected astonished comments is shown by his witty sleeve notes in which imaginary critics writing for non-existent journals have at him in typically English, American, German and Communist fashion. Each attacks him for a different reason and each made me rock with laughter. I only wish there was enough space here to reprint them, for I doubt if any but those seeking a musical curio will find any other reason to buy this disc.

Not that it isn't beautifully played. On the contrary. Gould is sometimes content to make the music sound just pianistic, at others seeks, with often surprising success, to suggest orchestral timbre. Though I must add that some of his tempos would sound very odd if played at a similar speed by an orchestra. The sleeve notes suggest that Gould undertook the whole enterprise as a great joke. But his playing sometimes makes one uneasily uncertain about this. Why not go and listen to it just for the hell of it?

★ ★ ★

LISZT—A Faust Symphony. Two Episodes from Lenau's "Faust." Orchestra of the Swiss Romande conducted by Ernest Ansermet with, in the Faust Symphony, Werner Krenn (tenor). Decca Stereo SET 370/1.

Except for his two piano concertos and an odd tone poem Liszt is an unjustly neglected composer nowadays. Indeed it is fashionable to sneer at the music of a man whose influence on the whole of the German romantic movement was as great as the sums of money he so generously donated to its cause. Those however who accept Liszt in the context of the mainstream of 19th century Central European music should find this new recording of one of his finest works of much more than ordinary interest.

Even Liszt's greatest admirers find bars throughout his oeuvre that can only be described as vulgar, though much the same charge might be laid against many other composers, too. But Ansermet is, for these days, in an unusually virile yet sensitive mood and refines even these into acceptability. I think it is the best performance to come from him and his Swiss Romande

Orchestra for many a long year. And this fact is made even more obvious by the generally spacious and fine-toned recording Decca has awarded him. In the epilogue, the Pro Arte Choir of Lausanne and the clear, high tenor singing of Werner Krenn should thrill all but the most resolutely unresponsive.

The symphony takes up three sides, and on the fourth are two interesting episodes, also by Liszt, from Lenau's "Faust" which differs considerably from the Goethe version to which Liszt went for his inspiration in the symphony. The first is a sombre funeral-like procession to which Wagner was considerably indebted for his Pilgrims' Chorus in Tannhauser. The second is the better known Mephisto Waltz. Both are admirably played and recorded.

★ ★ ★

TCHAIKOVSKY — Suite No. 3 in G for Orchestra, Op. 55. Orchestra of the Swiss Romande (with Ruggiero Ricci, violin) conducted by Ernest Ansermet. Decca Stereo SXL6311.

The Swiss Romande plays much less attractively in this suite. Tchaikovsky's notes present no difficulty to modern orchestral players, but what he does demand is tonal richness and quality, both completely absent in this exercise. In addition the orchestra lacks verve to a degree that makes much of the playing sound downright listless. This suite has long been famous for its Finale, the Theme and Variations. It used to be a popular piece to end a Henry Wood Promenade Concert before World War II. And here it is the mostly satisfactory movement chiefly due to the brilliant contribution of Ruggiero Ricci in the extended solo violin part. He seems to encourage the orchestra to capture some of his own tasteful vitality. Otherwise I can find nothing else to recommend.

★ ★ ★

BORODIN. Symphony No. 2 in B Minor.

TCHAIKOVSKY. Francesca da Rimini, Op. 32. (Fantasia after Dante). Orchestra of the Swiss Romande conducted by Silvio Varviso. Decca Stereo SXL 6352.

I found the Swiss Romande's playing much more enjoyable in the Borodin Symphony. Much of it goes with a brio that makes one forget the often stringy woodwind tone, expecially in the oboes. Here the phrasing sounds much more purposeful, at times even elegant. It was a favourite work of the fine conductor Albert Coates, a musician who spent much of his adult life in Russia before and during the early part of the revolution. Quite without authority he used to take the first subject of the opening movement at a slowish four in a bar instead of alla breve, as the composer intended. I got so used to it played like that that even today I find it difficult to accept the correct tempo which Varviso uses here. The work iself wears very well, and the quite wonderful modulation that leads from the first to the second movement can still give me a thrill. But while I can recommend the orchestra in this piece, I am much less happy with "Francesca da Rimini." Here again the luscious Tchaikovsky tone is diluted to almost pastel hues. And the vehemence one expects to find in the tense climaxes is replaced by disappointing laxity. True, it has its moments, but they are much too rare to move one.

★ ★ ★

ORFF. Carmina Burana. Chorus and orchestra of the German Opera, Berlin, conducted by Eugen Jochum. DGG Stereo 139362.

I know of no work which won such universal acclaim as "Carmina Burana" when it first reached the public early in the 1950s. To most audiences Orff's style, strongly rhythmic and made to sound almost elemental by its constantly reiterated ostinatos, was new at the time, and did much to disguise the lack of melodic stamina of most of the themes. However, after a few repetitions it went out of favour and has since appeared only sporadically on concert programs though it has been recorded, not too brilliantly, several times.

But I found my interest re-awakened by this admirable performance and recording. It is unquestionably the best ever offered. Except for Fisher-Dieskau's tendency to strain after top notes in the high tessitura of his part, the singing, by both soloists and chorus, is splendid. The rhythms are as springy as anyone could desire and Jochum, though dominating the ensemble with unrelenting discipline, is completely successful in avoiding monotony. The engineering is absolutely first rate and the whole production, if critics can forget its present lack of fashionable acceptance, should bring it up among the best to be issued in 1968.

★ ★ ★

HAYDN. Symphony No. 93 in D Major. Symphony No. 94 in G. Major (Surprise). Cleveland Orchestra conducted by George Szell. CBS Stereo SBR 235284.

By now readers of this column should have become accustomed to my enthusiasm for almost everything Szell records with his Cleveland Orchestra. Moreover most other critics share my enthusiasm, though the public, generally speaking, is much less inclined to accept him. I am forced to conclude that he must be a musician's rather than a public's conductor. I can only put this down to his unremitting purity of style that eschews facile effects in favour of classical Apollonian readings. But even the most lukewarm listeners to this record must be impressed by the unfaltering precision of the instrument he has fashioned over the last 20 years. And in these two Haydn Symphonies, with their beautifully limpid, yet always resourceful and ingenious scoring, this merit can be enjoyed without any qualifications whatever. The fast movements though always solid in th Central European tradition, lack nothing in geniality. The slow movements are warm but utterly devoid of sentimentalisation, and the Minuets graceful without ever mincing. I found the whole disc a continuing delight and the sound completely faithful. I refuse to be discouraged and can only reiterate my enthusiasm for this great conductor and his incomparable orchestra.

★ ★ ★

PONCHIELLI — La Gioconda. Complete Opera. Renata Tebaldi (La Gioconda); Oralia Dominguez (La Ciesca); Robert Merrill (Barnaba); Nicolai Ghiuselev (Badoero); Marilyn Horne (Laura); Carlo Bergonzi (Enzo). Orchestra and Chorus of the St. Cecilia Academy, Rome, conducted by Lamberto Gardelli. Decca Stereo SET 364/5/6.

This opera, though it dates back to 1876 — which makes it nearly 100 years old — is unlikely to be known to many readers, except for the famous excerpt "The Dance of the Hours" and the aria "Cielo e Mar." Its composer wrote many operas but "La Gioconda" is the only one to survive in the repertoire of famous opera houses. It is an opera on the grand scale and needs all the resources of a great opera house to do it justice. Moreover the title role is one of the most taxing in the Italian repertoire, demanding as it does, vocal and dramatic powers seldom encountered nowadays. Its libretto, by the famous Arigo Boito, based on a Victor Hugo melodrama, "Angelo, Tyrant of Padua," is no more extravagantly improbable than many another of the period.

Ponchielli was prodigal in his use of attractive melodies, so prodigal in fact that an occasional banal one crops up from time to time. But presented as well as it is here even those can be overlooked and one can relax and enjoy a score at once intensely dramatic —in the operatic manner — and an orchestra used with much more than the usual amount of sensitivity in a work of this kind.

Tebaldi in the title role still retains enough of her admirable technique to disguise the slight deterioration in quality and the need to pay more than usual care to her resources. Carlo Bergonzi, my favourite bel canto tenor nowadays, is right up to his customary form as Enzo with Robert Merrill eminently acceptable as Barnaba. Marilyn Horne is a thought too heavy

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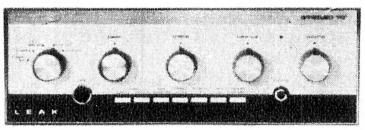
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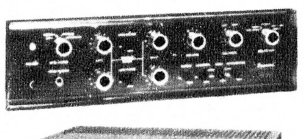
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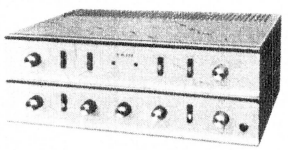
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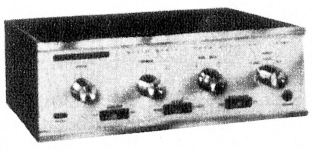
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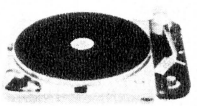
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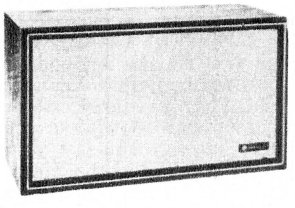
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as Laura and Nicolai Ghiuselev unimpressive as Alvise. The other, smaller roles are all more than satisfactorily filled. The conductor Lamberto Gardelli wins colourful sounds from the St. Cecilia Orchestra and Chorus, always sympathetic to the singers and firmly in control of the many fine ensembles.

Altogether a most attractive work which all lovers of the middle-period Verdi-style should enjoy.

★ ★ ★

POULENC — Piano Concerto. Aubade (Concerto Choreographique). Valse in C Major. Gabriel Tacchino and the Paris Conservatoire Orchestra conducted by Georges Pretre. Record Society Stereo. No. S/6291.

One's first impression of this pleasing disc is the superb playing of the solo pianist, Gabriel Tacchino. He has a brilliant though always relaxed technique, and can change his tone from pearly softness to firm but never metallic percussiveness when necessary. He is completely in sympathy with Poulenc's bitter-sweet style and plays with all the elegance one expects from an accomplished exponent of the French school. Poulenc's music in all three pieces shows no signs of dating, indeed they all remain deliciously fresh in form and content.

In all but a few cases, ballet music does not stand up well to separation from its stage action. But such is not the case with the Aubade which retains its charm on its purely musical merits. Indeed I enjoyed the whole disc so very much that I hope Tacchino will record more of the composer's piano music — of which there is plenty — and that Pretre will revive some of the orchestral pieces that have remained neglected for far too long. His direction of the orchestra in this recital is always sensitive, and in terms of present-day French orchestral playing, way above average.

★ ★ ★

BEETHOVEN Trio In C Minor, Op. 1, No. 3.

MENDELSSOHN—Trio in D Minor, Op. 49. The Istomin/Stern/Rose Trio. CBS Stereo SBR235265.

The playing in these two trios is never less than brilliant. The rapport between the players is faultless, as is the balance, never easy to bring off satisfactorily when a piano is added to two stringed instruments. Indeed the playing itself is of such a high standard that it seems churlish to mention that the acoustic is a little on the hard side for the romantic Mendelssohn piece, though, on the other hand, this is an asset in the Beethoven. In both trios the players find plenty to dramatise — always with discretion — and much beauty in the musings of the slow movements.

Importantly they change their style drastically to suit two such different composers. There is none of the deliberate brusqueness you sometimes find in the Beethoven used in the more mellow Mendelssohn. I can recall no comparable coupling of these two eminently pleasing works, and doubt very much if a successful rival will appear in the near future. ■

DOCUMENTARY RECORDS

Reviewed by Glen Menzies

THE IMPORTANCE OF BEING HOFFNUNG: Gerard Hoffnung with Charles Richardson. B.B.C. Radio Enterprises. Mono BBC-33,077. Released by Festival Records.

Gerard Hoffnung, who died at the very early age of 34 in 1959, is still very much with us through his books of cartoons, TV cartoons and the recordings of the Hoffnung Music Festivals in the Royal Festival Hall. He was a genuinely funny man with an eccentric humour which endeared him to millions.

Now from B.B.C. Radio Enterprises we have a selection of Hoffnung's radio soliloquies originally broadcast in 1957 and sent to many parts of the world, including Australia, by the B.B.C. Transcription Service. Charles Richardson, a Canadian broadcaster, was the sounding board, more or less, in all of the soliloquies. Mr Richardson says, "Gerard Hoffnung confronted a microphone with characteristic disrespect. He dared it to reflect anger, boredom, mockery and adulation. On some 50 occasions or more I had the pleasure of substituting for the microphone."

Mr Richardson is really a very subtle interviewer in what are, paradoxically, "non-interviews" cast in the form of the interview. He knows when to listen, when to goad and the right moment to guide the unwilling Hoffnung back on to the subject. The material once on tape was featured as a regular part of the B.B.C. weekly program called "Saturday Night on the Light," and that was the only regular thing about these interviews with the unpredictable Hoffnung.

Twelve of the best have been brought together here, and Hoffnung soliloquises on such diverse subjects as Childhood, The Moon, Sport, Dieting, The Cinema, etc. I can well believe that they were completely spontaneous and unprepared, in fact most of the time in the studio, we are told, was taken up with Hoffnung rearranging lights, tables, chairs, and as a last ditch protest, saying, "Can't we do this another day."

If you know the Hoffnung Music Festival disc or "Hoffnung at the Oxford Union," I have no doubt you will relish "The Importance of being Hoffnung."

★ ★ ★

W. C. FIELDS: The Original Voice Tracks From His Greatest Movies. Narration by Gary Owens. Music Composed and Conducted by Charles Dant. Produced by Gil Rodin and Johnny Wayne. Stereo SDL-933,106 Festival.

The cover note suggests that there is a W. C. Fields cult which has spread like wildfire across the world. That, presumably, is the reason for this very long recital of somewhat fuzzy voice tracks from the star's old films. I must say that I approached this album with a more than passing interest, with fond memories of a screen classic of some years ago in which Fields co-starred with Mae West, called "My Little Chickadee." W. C. Fields was a comedian who was not only funny to look at, but with a sharp ear for repartee. Few could deliver a clever line to greater effect.

What the producers of this album have tried to do is give us the essential W. C. Fields by selecting hundreds of snippets—some just a few seconds long—from no fewer than 14 feature films in which he appeared. They then decided on a series of headings, i.e., "The Philosophy of," "The Rascality of," "The Spirit of," etc., and proceeded to fit the snippets into whichever slot was relevant. In other words, choose your slot and hear something different every time. Would that it were so! After listening to a couple of tracks one becomes painfully aware of a growing sameness, an aural screen snapshot that lasts forever.

Not that Mr Fields is tossed at us in a jumble of bits and pieces. Mr Gary Owens, in one of those Hollywood cartoon narrator's voices of the ingratiatingly arch kind, is there to explain each insert. I suppose a narrator is essential because unfortunately these "greatest comedy moments" lose a lot of their impact when torn from the visual context of the film itself. Even today movie sound tracks are risky things to play about with, let alone the time-encrusted reels of films such as "Big Broadcast of 1938" and "Million Dollar Legs."

Is it really necessary, one wonders, to go to all the trouble of compiling this kind of thing when local TV stations fill out their days by screening so many old movies.

★ ★ ★

POETRY AND SONG 2.: Edited by James Gibson. Recorded in association with Macmillan and Co. Ltd. Read by Michael Hordern, Barbara Jefford, Prunella Scales, William Squire, Gary Watson, Patrick Wymark and others. Folk music arranged by Ewan McColl, Peggy Seeger and directed by Charles Parker. Directed by Harley Usill. Argo Stereo ZDA 51.

This album is one of a set of 14 under the general title of Poetry and Song and it is aimed at the age group from 12 to 16, just as the previous set called Rhyme and Rhythm was prepared with the 7 to 11 year olds in mind. The age groups are not meant to be arbitrary as levels of appreciation naturally vary. The anthology follows very closely the four books also called "Poetry and Song" published by Macmillan.

The poems are arranged in groups sharing common themes, i.e., Birds, The Elements, Snow and Highwaymen. The records are banded into approximately ten-minute segments, an advantage in classroom teaching where the teacher can choose any sequence at will. The main aim of the series is to present poetry and song as an adjunct to everyday language. None of the poems has been treated like elocutionary set pieces. They are, in fact, read in the same style as on the other Argo records; indeed the same panel of excellent readers is used.

With the songs an attempt has been made to link the aural tradition of song with poetry. The Highwayman sequence is a good illustration of this. First there is a simple hillbilly style version of a traditional song about Jesse James, followed by Alfred Noyes' poem called "The Highwayman," with its broad sweeping narrative and high drama, and then a further contrast is provided with "Brennan of the Moor" sung by a regional folk singer, Paul Lenihan. I can well imagine this sequence stimulating much discussion in the classroom.

Apart from the obvious educational value of the series, this style of presensation will delight many grown-ups as well. The album under review was more or less chosen at random and would, I am quite sure, be typical of any of the other albums in the set.

Towards the end of last year Argo issued their own booklet to go with the series called, "Poetry and Song in the Classroom," which gives a complete list of all the poems recorded. It also explains about the choice of material and sequences and gives suggestions for the use of recorded poetry as a stimulus for creative writing.

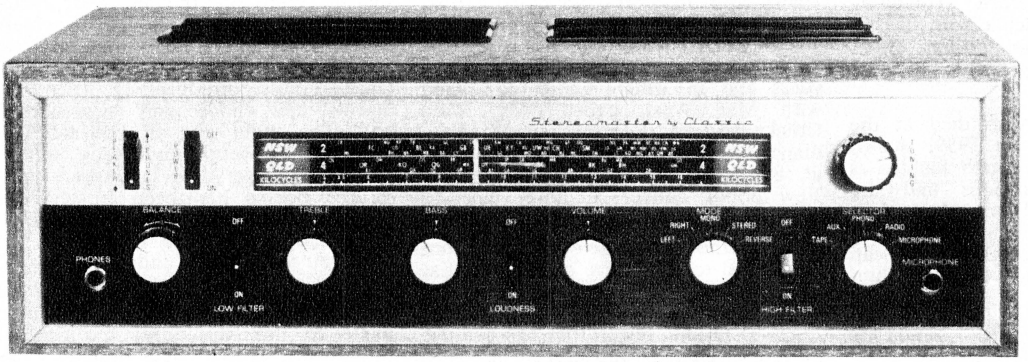
This set of recordings is a considerable achievement, and certainly fulfils the main aims of the producers as stated by Harvey Usill. "The best we, as producers of this anthology, may hope for is to have provided a library of exciting performances to enrich the teaching of English, and thus lead to a lasting appreciation of the beauty and variety of the language." ■

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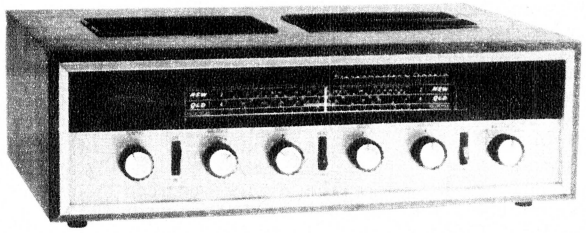
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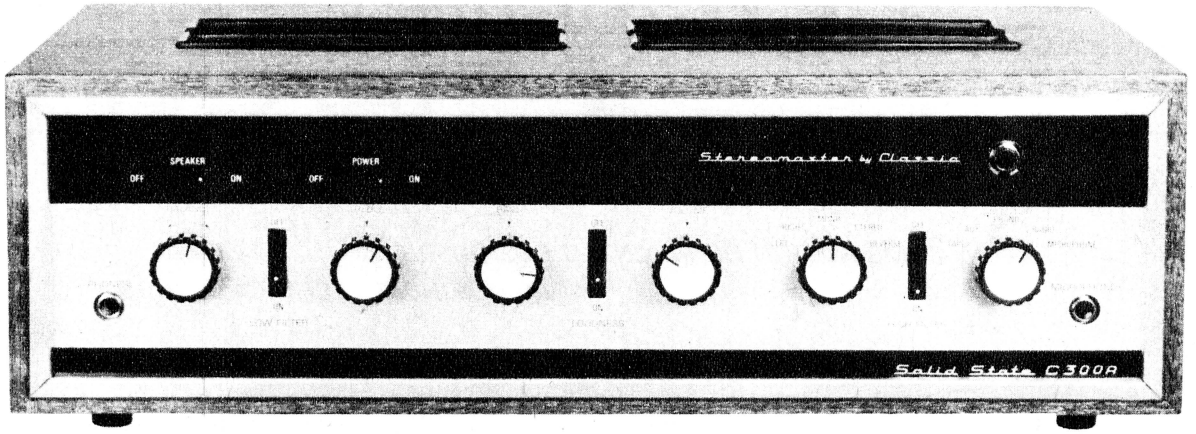
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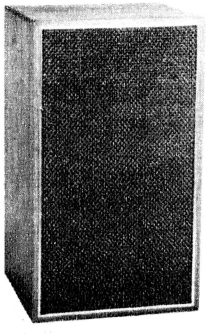
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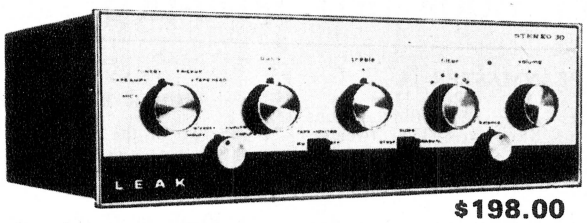
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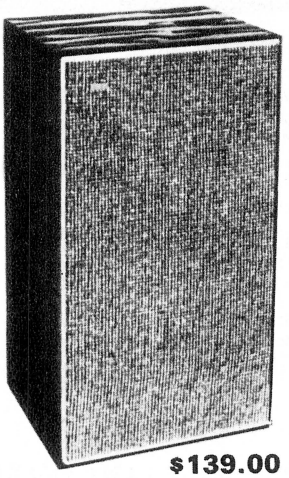
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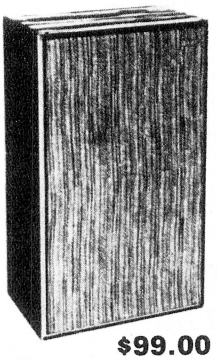
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VARIETY FARE

Reviews by: Neville Williams Harry Tyrer
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Devotional

SING PRAISES VOL. 1 Choir of Kings College, Cambridge, conducted by David Willcocks. Andrew Davis, organ; Christopher Van Kampen, cello; Douglas Whittaker, flute; Robert Spencer, lute. Stereo, World Record Club WRCS-4445.

Interest: 15-16th. century praise.
Performance: With conviction, skill.
Quality: Excellent.
Stereo: Modest but appropriate.

Drawn mainly from the Cambridge Hymnal, the music in this volume 1 dates, for the most part, from the 15th and 16th centuries. Each item is the subject of an individual and informative jacket note.

The music on side 1 is the music of Christmas but it is so completely unrelated to the rather threadbare popular carols and tinsel tunes that it could be played and enjoyed at any time of the year.

The 20-minute selection includes: Nowell; Nowell; Nowell — The Holly And The Ivy — Angelus Ad Virginem — I Sing Of A Maiden — Watt's Cradle Song — My Dancing Day — The Lord That Lay In Asses Stall — Where Riches Is Everlastingly.

A second 20-minute selection on side 2 includes: Alleluia On A Plainsong Melody — Sing A Song Of Joy — Jesus Christ The Apple Tree — Most Glorious Lord Of Life — A Hymn To God The Father — Morning Hymn — Evening Hymn.

The lead is retained, for the most part by the Boys' Choir, with occasional delicate accompaniment from flute, cello or lute. Mature voices and the organ add their support, where appropriate. The recording itself is first rate and only at the end of each track does one realise how much it has been enriched by something like 5 seconds of smooth reverberation in the Kings College church, a building no less beautiful than the cover picture suggests. (W.N.W.).

★ ★ ★

SACRED VOCAL WORKS: W. A. Mozart. Rohtraud Hansmann, soprano: Ingrid Mayr, contralto; Andre Mallabrena, tenor: Roger Soyer, bass: Olivier Alain, organ; The Philippe Caillard Chorale; The Wiener Barockenensemble. Conducted by Theodor Guschlbauer. World Record Club Stereo S/4441.

Interest: Baroque church music.
Performance: Very enjoyable.
Quality: Very good.
Stereo: Well spread.

Much of Mozart's music ostensibly written for church performances is completely secular in style, and the extremely popular "Exsultate Jubilate" which begins this disc is one of the outstanding examples of this. The work is beautifully sung by Rohtraud Hansmann. Madame Hansmann has a voice of generous proportions allied with purity of tone and precision of pitch, and her vibrato is beautifully controlled. She is also a musician of no mean ability, and handles even the difficult coloratura passages in the "Alleluja" section of this work without noticeable difficulty.

The "Misericordia Domini" which follows is completely different in style. It is severely contrapuntal, being designed to please the conservative tastes of the clergy of Munich Cathedral where it was first performed. Despite the restriction of the form, it has several flashes of originality as well as some attractive tunes. It is scored for choir, small orchestra and organ, and provides no opportunities for solo virtuosity. The performance of the Philippe Caillard Chorale and the Vienna Baroque Ensemble is entirely satisfactory. Side 2 is taken up by the "Missa Brevis in D major," a conventional liturgical work intended for Sunday performance in cathedrals. It makes no great demands on the performers or on the listener but is simply fine music, bringing pleasure to both. A very pleasing disc, well recorded and with good stereo spread. It was originally an Erato recording, released exclusively in Australia by the World Record Club. (H.A.T.)

★ ★ ★

GOD'S HAND IN MINE. Slim Whitman. Mono, Imperial (Festival) IRL-32-691.

Interest: Gospel, country style.
Performance: O.K. for C and W fans.
Quality: Good.

Never a keen country and western fan, I was personally rather relieved to find that Slim Whitman didn't seem to be overdoing the C & W idiom. In fact, the title track, "With God's Hand In Mine" could only be described as downright pleasant! But side 2 opened with a re-worked version of "My Father Watches Over Me," followed by "How Great Thou Art" — complete with yodels and "umble adoration." Let's just say that I've heard these numbers sung rather more convincingly.

The other titles: He Bought My Soul At Calvary — What A Friend We Have In Jesus — He Reached Down His Hand — A Miracle Of Love — Carried On The Shouders Of The Shepherd — He Set My Tears To Music — Who At My Door Is Standing? — He'll Understand And Say Well Done — The Love Of God.

If you like the C & W style, you'll enjoy this record but, if not, your money might be spent to better advantage on something a little more "square." (W.N.W.).

Instrumental, Vocal & Humour

FRENCH "LOLLIPOPS": THE BEECHAM LEGACY, Vol. 4. His Master's Voice Stereo HQS 1136.

Interest: See title.
Performance: Peerless.
Quality: Very good.
Stereo: Normal (and genuine).

Sir Thomas' "lollipops" were, to use his own words, "generally of an essentially syrupy, soapy, soothing or even soporific character," the aim being to play them as encores to quieten down enthusiastic audiences at the end of his concerts. I hardly feel that all the pieces included in this disc quite qualify under this description, but they all are charming works of an essentially French character which even when played non-stop as in this L.P. make for absorbing listening. The titles are: Ballet Music from "Le Roi S'amuse" (Delibes) — Minuet des Folles (Berlioz) — Danse de Pretresses de Dagon; Bacchanale; both from "Samson et Dalila" (Saint Saens) — Overture "Le Corsaire" (Berlioz) — Dolly Suite (Faure) — Pavane (Faure).

As one who has regarded Beecham as the paragon of conductors for a quarter of a century, I find it hard to be entirely objective about this disc. I can only say that I enjoyed it tremendously. The playing of the Royal Philharmonic Orchestra and the French National Radio Orchestra seems impossible to fault and the tempos used seems to me to be exactly right. If you have a musical sweet tooth, you should sample these French confections at the earliest opportunity. Even though some of the performances must now be close to ten years old, the sound throughout is of excellent standard, and all the pieces are in genuine stereo. (H.A.T.)

SERVICE

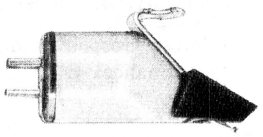
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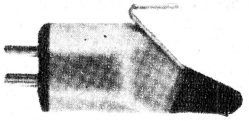
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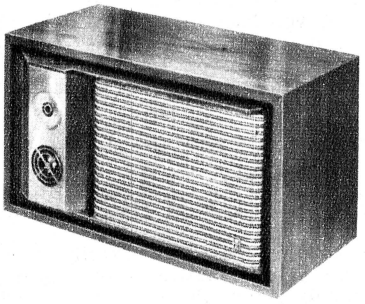
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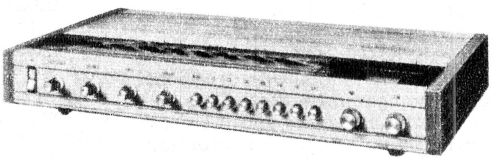


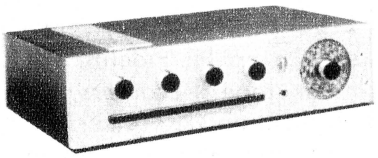
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Interest: Tchaikovsky themes.
Performance: Generous.
Quality: Very good.
Stereo: Good.

How could Tchaikovsky, a man given to moods of depression, write music that is so glowing with life? And how could his music emerge triumphant through the barrage of criticism and insult that was levelled at it when first performed? Because when Tchaikovsky did compose, it was from the heart! Such is the theme of the music, the arrangements and the jacket notes for this album.

Some of Tchaikovsky's best known themes are presented, not as distinct excerpts but as snippets, strung together, fantasia style: Romeo and Juliet (Overture) — Trepak (From Nutcracker Ballet) — Waltz (Sleeping Beauty Ballet) — Symphony No. 6 (excerpt, 1st movement) — Marche Slave (finale) — Piano Concerto No. 1 (excerpt, 1st movement) — Symphony No. 4 (excerpt 3rd movement) — Symphony No. 5 (excerpt 2nd movement) — Song Without Words— Pique Dame — 1812 Overture (finale).

Snippets they might be but they receive generous sonic treatment by the orchestra and by Decca's Phase 4 stereo. I doubt that the stylus has ever been busier than for the final track.

As Robert Sherman says in his notes, this is a record which may outrage the purist, but it will delight the layman! (W.N.W.)

★ ★ ★

CHAMPION BRASS. Black Dyke Mills Band, conducted by Geoffrey Brand and Roy Newsome. Stereo, EMI OCSD-3652.

Interest: Fine brass band.
Performance: Hard to fault.
Quality: Extremely good.
Stereo: Very good also.

Followers of good band music have certainly been well provided for in recent months. Winning its first contest in 1860, at the Crystal Palace. the Black Dyke Mills Band has won many since and is in contest-winning form on this latest album in which they play: The "Beautiful Galathea" Overture — Berceuse De Jocelyn — Honest Toil — Waltz For a Princess —Carnival Dance — Quid Pro Quo —Alpine Echoes — Betty Dear — "Pineapple Poll" suite.

The sound is full and dynamic, precise and cohesive, yet always round and smooth. Fine recording and a virtually noise-free surface adds up to an album that should find ready acceptance (W.N.W.)

★ ★ ★

CROWN IMPERIAL. The Band of Her Majesty's Life Guards, conducted by Major W. Jackson. Liberty (Festival) Stereo SLYL-933,048 Available in Mono.

Interest: Famous Military band.
Performance: Conservative.
Quality: Good.
Stereo: Rather homogeneous.

The Band of Her Majesty's Life Guards occupies a special place among British military bands, as it is called upon to play at all great State occasions. It is therefore entitled to a great deal of respect. Their playing here is undoubtedly of a very high standard, and those who appreciate traditional military band music should certainly make a point of asking their dealer to play them a track or two. However, for my part, I found the music rather too conventional for a whole L.P. A little of the variety which is found in many discs by brass bands would have been welcome. One certainly has no cause to complain about the playing time, and the band provides a very generous selection, with two fairly lengthy pieces on each side in addition to a selection of marches, gallops and post horn solos.

The selection comprises: Dettingen (fanfare for cavalry trumpets) — Overture from "Royal Fireworks Music" (Handel) — Coburg (slow march) — Medley of Trot Tunes — Down the Mall (quick march) — The Huntsman (post horn solo) — Coronation March from "La Prophete" (Meyerbeer) — Fanfare Royale — Coronation March "Crown Imperial" (Walton) — Light Cavalry Overture (Suppe) — Standard of St. George (quick march) — Post Horn Gallop (post horn solo)—Trojan March (Berlioz). The recording is of good quality but the stereo is not used as effectively as it might be. (H.A.T.).

★ ★ ★

FAMOUS MARCHES FROM THE CLASSICS. The Band of the Grenadier Guards, conducted by Capt. R. B. Bashford. Stereo, World Record Club WRCS/4442.

Interest: Fine band music.
Performance: Outstanding.
Quality: Good.
Stereo: Excellent spread.

The famous Band of the Grenadier Guards excels in this performance. recorded originally for Decca but released in Australia exclusively by the World Record Club. A band program it certainly is, but the quality of the conducting and the playing, along with the items selected, will give it an automatic appeal to the same listener group which responds so readily to classical orchestral excerpts: Entry of the Boyards (Halvorsen) — Turkish March, "The Ruins of Athens" (Beethoven) — Hungarian March, "Damnation of Faust" (Berlioz) — Procession Of The Sirdar, "Caucasian Sketches" (Ivanov) — Radetsky March (J. Strauss) — Aida Grand March (Verdi) — Tannhauser Grand March (Wagner) — March From The Karelia Suite (Sibelius) — Coronation March, "Le Prophete" (Meyerbeer) — Marche Militaire (Schubert)—Pomp and Circumstance (Elgar).

Well recorded, with effective use of stereo, good dynamic range and no surface noise, this album should have a strong sectional appeal. (W.N.W.)

★ ★ ★

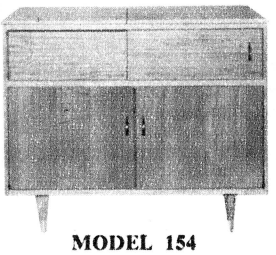
THE DANCING YEARS. Anne Rogers, with Anne Howard, Andy Cole, Cheryl Kennedy, Orchestra and chorus under the direction of Cyril Ornadel and Geoff Love. Music by Ivor Novello; words by Christopher Hassall. Stereo, EMI Studio 2, SCXO-7866.

Interest: Music from the show.
Performance: Happy.
Quality: Reservations about chorus.
Stereo: Extreme separation.

First produced in 1939, with the long shadows of war reaching over Europe, "The Dancing Years" is considered by many as the best of Ivor Novello's seven major stage musicals. On this album is a selection of some of the notable music in the show: Overture — Uniform — Waltz Of My Heart — The Wings Of Sleep — My Life Belongs To You — Chorale and Tyrolese Dance — Leap Year Waltz — When It's Spring In Vienna — I Can Give You The Starlight — Primrose — My Dearest Dear.

The orchestra is well balanced and well spread but the chorus comes

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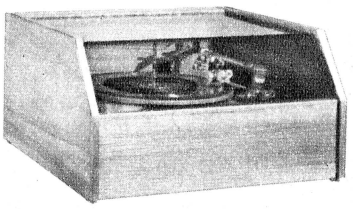


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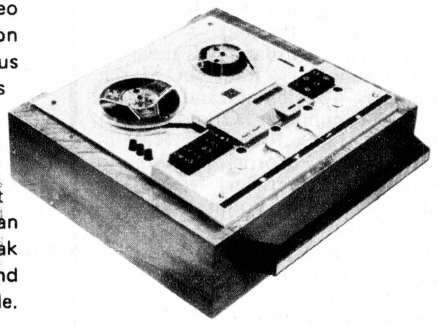
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CH319

through as two rather remote, rather thin and completely separated groups — an effect most noticeable in the track "Chorale and Tyrolese Dance." The featured solo voices are much closer up on mic. but are completely separated, so that either one can be heard alone by simply turning off the opposite channel.

Those who know the show will find plenty to enjoy on the album but to me, it didn't live up to the high promise of the jacket, the notes and EMI's "Studio-2" recording process. (W.N.W.).

★ ★ ★

GOLDEN CONTINENTAL TANGO. The Royal Grand Orchestra. Stereo, Regal Channel 20, SREG-2037.

Interest: Listening and dancing.
Performance: Happy.
Quality: Very clean.
Stereo: Normal.

Dance to these tangoes if you want to, but my guess that this record will find its most frequent use played at low volume as a background to dining. From a smallish orchestra, it has just the right kind of atmosphere. Mind you, the sound is very clean and you can run it at any level you like with pleasure.

The titles, to lend its continental flavour: Perlenfisher Tango — Jalousie —Inch Kusse Ihre Hand, Madame— La Cumparsita — Tango Notturno— Il Pleut Sur La Route—Blauer Himmel — Hor Mein Lied, Violetta — In Einer Kleinen Konditorei — Isle of Capri — Tango Delle Rose — Ole Guapa. Pleasant. (W.N.W.)

★ ★ ★

MOONLIGHT SONATA. Philippe Entremont, piano. CBS (Australian Record Company) Stereo SBR 235293..

Interest: Piano lollipops.
Performance: Lyrical style.
Quality: Excellent.
Stereo: Not significant.

One might be inclined to think that a pianist of Philippe Entremont's ability was wasting his talents on the succession of discs of this type he has been making lately. The fact remains that this type of disc finds a ready sale, while the more substantial works have to struggle against severe competition and undergo the ordeal of comparison with other versions by the record critics. The result is that those who enjoy the lighter type of fare get it played at a very high standard, as is evident here.

The program is typical of this type, comprising very familiar works with a sprinkling of the less familiar; Moonlight Sonata, first movement (Beethoven) — Hungarian Dance No. 5 (Brahms) — Traumerei (Schumann) —Spanish Dance No. 5 (Granados)— Melody in F (Rubinstein) — Gavotte from Symphony No 1 (Prokofiev) — Revolutionary Study (Chopin) — Jesu, Joy of Man's Desiring (Bach)—Spinning Song (Mendelssohn)—Humoresque (Dvorak)—Minuet in G (Paderewski)—Polonaise in A Flat (Chopin) —Entremont does not sound at all extended, even in the more difficult passages of the Chopin works, and elsewhere brings the lyricism to these works without which they sound very trite. In summary, pleasant fare, well played, and excellently recorded in the CBS "360 Sound" system. (H.A.T.)

THE CHOPIN WALTZES, 1-14. Witold Malcuzynski, piano. World Record Club Stereo.

Interest: Classic miniatures.
Performance: See review.
Quality: Excellent.
Stereo: Insignificant.

The playing of the No. 1 waltz (the Grande Valse Brilliante) made me sit up and take notice — not because of any excellence of the playing, however, but because of the ham-handed treatment meted out to it by Malcuzynski The following three waltzes are better, but still not of the standard one expects from an artist of Malcuzynski's reputation. However, from then on the playing improves by leaps and bounds, so that by the end of side one I was again prepared to regard Malcuzynski as one of the great Chopin interpreters of this decade.

Allowing for subjective preferences, side 2 provided no grounds for complaint, and the last six waltzes are exquisitely played. Despite the poor rendering of the first four waltzes, this disc is worth having, as Chopin lovers will go a long way to find a better performance of the remaining waltzes. The sound quality is of excellent standard, and I particularly liked the mellow tone of the piano which has been captured very well by the recording engineer. Too often, recorded piano works have a thin and brittle tone. (H.A.T.)

★ ★ ★

ORGAN — AS YOU LIKE IT. Stereo, RCA Camden (CAMS-137). Also in Mono CAM-137.

Interest: Electronic organ.
Performance: Competent.
Quality: Normal.
Stereo: Normal.

I can't recall having heard Barry Hall's first album "Organ . . . As Requested" but, according to the notes, its popularity was the reason for this, its successor.

Barry Hall is well known in South Australia — to listeners of radio station 5DN and television NWS Channel 9. With rhythm backing and an occasional spot of piano accompaniment, he plays a selection of tunes that will have a sure-fire current appeal: Seekers' Medley — Summertime In Venice — Underneath The Arches — Never On Sunday — Somewhere My Love — Mexican Hat Dance — Sadie, The Cleaning Lady — Moon River — To Love Again — The Wedding — More — Zorba's Dance. Playing time is about 14 minutes per side.

The brand of the organ is not specified but it is quite typical, with the usual range of voices, Leslie speaker system — and a pervading but a not-uncommon lack of anything high up in the tone range to add sparkle to its "mellow" sound. A good, average electronic organ record, made the more attractive by its modest price. (W.N.W.).

★ ★ ★

LOVE IS BLUE. Peter Nero, piano, with orchestra. RCA Dynagroove Stereo LSP-3936. Available in Mono.

Interest: Current hits.
Performance: Good, if you like it!
Quality: Excellent.
Stereo: Good spread.

There is no more skilful exponent of the piano in the field of popular music than Peter Nero, but his precise and rippling keyboard work has an explosive nervous quality which I personally find anything but relaxing. This does of course avoid the Muzak-like quality which is found in the playing of Ferrante and Teicher, and for some occasions his style of music making makes fine entertainment. However, I do not recommend it for background music or for a quiet time at home. I think you should try to hear a track or two on this disc before buying. If you like what you hear, you need not worry about the rest. The technical side of the disc is of the usual high standard of Dynagroove, and the arrangements and orchestral backing are consistently good.

Love is Blue—I Say a Little Prayer — Free Again — Windy — Sunny — The Happy Time — Theme from "The Fox"—The Glory of Love—My Ship — Try to Remember — Who Will Answer. (H.A.T.)

★ ★ ★

EACH OF US ALONE. Glen Yarborough sings the words and music of Rod McKuen. Warner Bros. (Australian Record Company) Stereo WS 1736. Available in Mono.

Interest: Modern folk.
Performance: Sensitive.
Quality: First class.
Stereo: Effective spread.

Those who enjoy the modern type of folk ballad will find much to enjoy in this interesting disc. Rod McKuen's lyrics have an intellectual quality which tends to restrict their appeal, but those able to digest the allegory and imagery used throughout will find them a rewarding experience. The melodies are always appealing and Glen Yarborough is a sensitive interpreter of McKuen's work. The arrangements in this album are by that imaginative musician Eddie Karem and the light scoring he uses exactly matches the mood of the songs. The titles are: Each of Us Alone—I'm Strong But I Like Roses—It's Raining — Hotel Room — The Beautiful Strangers — The Single Man — I'll Catch the Sun— Above the Wave — Listen to the Warm—Where are We Now—Each of Us Alone (reprise). Sound quality is of excellent standard. (H.A.T.)

★ ★ ★

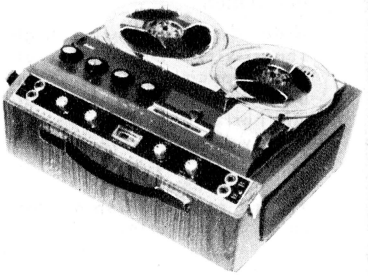
LATE AGAIN. Peter, Paul and Mary. Warner Bros. (Australian Record Company) Stereo WS 1751. Available in Mono.

Interest: Need I say?
Performance: Easy on the ear.
Quality: Very good.
Stereo: Good.

Peter, Paul and Mary are as pleasant to listen to as ever in this latest release, but they do seem to be in rather serious mood, putting considerable emphasis on social injustice, war protest and religion in this selection. No doubt their message will strike a chord with thinking people, but is this penchant for moralising perhaps a little overdone—after all, they are principally entertainers, not an expression of public conscience. Presumably their recording company will draw their own conclusion from the sales figures.

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Sweep Circuit	Frequency	IHz to 200kHz in six steps: H-TV at 15.75kHz/2.
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There is no doubt that the sugar around the pill is very expertly applied. Their finely schooled technique makes for delightful listening, and they have been provided with a large group of very accomplished musicians for the orchestral backing — 27 people are listed in the credits, among whom are some very well known names. The titles were all new to me, but even on first listening it was obvious that the quality of the material is as good as they have ever recorded: Apologise — Moments of Soft Persuasion — Yesterday's Tomorrow — Too Much of Nothing — There's Anger in the Land — Love City (Postcards to Duluth) — She Dreams — Hymn — Tramp on the Street — I Shall Be Released — Reason to Believe — Rich Man, Poor Man. The technical quality is of high standard (I presume the rather gimmicky balance of prominent guitars and suppressed voices at the beginning of track one is deliberate) and the stereo spread is good. (H.A.T.)

★ ★ ★

THE ORIGINAL COMEDY HARMONISTS. Encore (E.M.I.) Mono only OEX 9430.

Interest: Vocal instrumentalists group.

Performance: Superb musicianship.

Quality: Very well remastered.

In the 1930s, when the Mills Brothers were making a fortune out of imitating musical instruments, Germany had its own group of "instrumental vocalists," known as Die Comedien Harmonisten. Although they usually sang recognisable words, their vocal style and harmonies had an instrumental quality, and occasionally they did a wordless novelty number, such as the "Barber of Seville" overture of Rossini, or Brahms' "Hungarian Dances." Although I cannot recall hearing them personally, I understand they also had quite a following in other countries, including Australia. Here, they are heard in a selection of numbers they recorded in prewar days. If you have not heard this group before, I can assure you they are well worth listening to, as their musicianship is superb, and the arrangements they sing are very effective.

I do not propose to give the German titles of the songs, as they will mean nothing to most people. However, those of my generation will have no difficulty in recognising the first tune, presented here as "Wochenend und Sonnenschein." This was a very popular tune of the 1930s, known as "Happy Days are Here Again." Despite the age of the recordings, the sound quality is surprisingly good, due to the excellent remastering. A disc well worth the modest price ($2.50) even for its novelty value. (H.A.T.)

★ ★ ★

THE BEST OF SLIM WHITMAN, Vol. 1. Imperial (Festival). Mono only. IRL-32651.

Interest: C. and W. favourites.

Performance: Good stuff.

Quality: Dated, but good.

Here is a fine bargain for Slim Whitman fans. Included here are no less than 17 of Slim's best tracks from previous discs, including his famous performances of "Rosemarie," "Indian Love Call," "Danny Boy" and "I'll Take You Home Again Kathleen," all

of which are outside the normal C. and W. repertoire, yet which sold by the million. Also included are: Mexicali Rose — Tumbling Tumbleweeds — China Doll — A Letter Edged in Black —The Whiffenpoof Song — A Petal from a Faded Rose — An Amateur in Love. Slim makes full use of his effective falsetto throughout and, as usual, only guitar backing is used in most tracks. Sound, in Mono only, is of good standard, but owing to the length of the program the inside tracks run close to the label, and a certain amount of distortion is noticeable on the inner grooves. (H.A.T.)

★ ★ ★

HOMECOMING. The Highwaymen. Recorded live at Wesley University, U.S.A. Universal Record Club (originally released by United Artists) Stereo SU-940. Available in Mono.

Interest: Folk group.
Performance: Lighthearted.
Quality: Very good.
Stereo: Normal.

I have not previously encountered The Highwaymen, and it could be that this disc is the group's first. They sound something like the Kingston Trio augmented in number (five instead of three). They sing the same kind of material, use the same kind of gentle harmonies and use only guitars for accompaniment. Here, they are performing live at a concert given for students of Wesleyan University, Connecticut, U.S.A., from which they had graduated two years previously. Consequently, one has all the usual trimmings of a live performance — applause, laughter, sing-along, introductions and humorous asides. In between, you can hear the following songs: Standing by the Gate — Gypsy Rover — There Comes Alabama — Shotgun Talking Blues — Rhody — Careless Love — The Sinking of the Reuben James — Brandy is My True Love's Name — Riddles — Jenny's Gone and I Don't Care — Did You Ever See a Wild Goose — Morning

Organ Recital

FERNANDO GERMANI. Organ Recital at Selby Abbey, Yorkshire. (Recital No. 2). Chorales Nos. 1, 2 and 3 — Pastorale, Cesar Franck. Stereo, World Record Club S/4385.

Interest: Fine organ music.
Performance: With authority.
Quality: Excellent.
Stereo: Conservative.

Recital number 1, a companion album to this one, was reviewed in the December, 1968, issue and earned the comment: "Altogether an album to be commended to followers of the classical organ." The same comment is appropriate for this one and, unless special considerations intervene, I imagine that followers of the classical organ will want both for their collection.

In segments of these Cesar Franck Chorales, Germani releases the tremendous power of the Selby Abbey organ—a three-section Hill, Norman and Beard instrument originally installed in 1909 and completely rebuilt in 1948-50. But, despite the tremendous complexity and amplitude of the recorded sound, it came through without a trace of overload and distortion—at least on the Empire 999VE cartridge which I was using.

At the other end of the scale, the Chorales involve the delicate "Voix humaine et tremblant" and gentle passages which are unspoiled by surface or background noise.

Side one carries "Chorale No. 1 in E Major" and "Chorale No. 2 in B Minor." On side two is "Chorale No. 3 in A Minor" (Franck's last work) and "Pastorale, Op. 19, No. 4."

The jacket notes comment helpfully on the organist, the music and the instrument. Recommended. (W.N.W.)

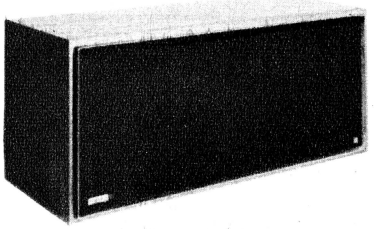
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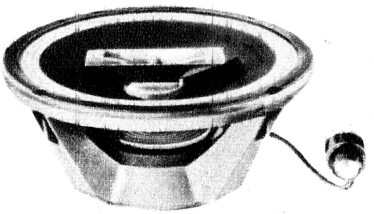


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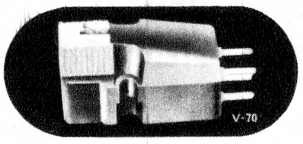
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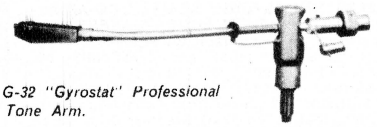
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* Review from Hi Fi News available.
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V15 "Dynamagnet" Cartridge.
Specifications — Output voltage: 5 mV. Freq. range: 20-21,000 cps. Cross talk: 30db at 1,000 cps. Stylus: 0.7 mil. diamond. 0.2 x 0.8 mil. for Model V-15E.

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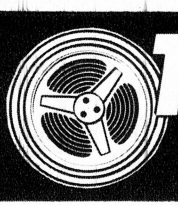
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★ ★ ★

THE GLORIOUS GREEKS. Yacoubian and Company. Crescendo (Festival) Stereo SGNPL-933,055. Available in Mono.

Interest: Greek variety.
Performance: Heady stuff.
Quality: Excellent.
Stereo: Good spread.

This is fine fare for those with a taste for the slightly exotic music of Greece. Originally issued in the U.S.A. while Yacoubian and his company were touring there, the music is sometimes lively and exciting, sometimes melodic and yearning; laced with a robust humour in parts, elsewhere expressing more tender emotions. The main instruments featured are the traditional bouzoukee, the violin and the accordion, while some exuberant vocals are contributed by the talented lead singer, Nitsa. Track titles are: Holiday in Greece — Ko-Ko-Ko — Misirlou — Rambe-Rambe — Hasapiko — Nina Nai — Speak not a Word — Sultan's Circus — Aspres Corthellis — Shish Kebab — Two Jewish Folk Songs — Katifeh. If you want to sample before buying, try "Misirlou" which has a most appealing melody for solo violin, or "Nina Nai" for a taste of Nitsa's art. Sound quality throughout is excellent, but I found it necessary in some tracks to turn the balance control to favour the right channel to counter the too prominent percussion in the left channel. (H.A.T.)

★ ★ ★

THE BEST OF JOE AND EDDIE. Crescendo (Festival) Stereo SGNPL-933,054. Available in Mono.

Interest: Close harmony vocalists.
Performance: Superb.
Quality: Very good.
Stereo: Normal.

The pleasure one obtains from the superb singing of these young Negros in this disc is tempered by the recent news of the tragic death of Eddie in a motor cycle accident. Many readers will already have heard them perform from their television appearances and will thus be aware that the termination of their career is a great loss to show business in the U.S.A. Basically, I suppose, they were folk singers, but their repertoire was very wide, taking in Negro spirituals, shows tunes and blues material. The program here includes all these forms: There's a Meetin' Here Tonight — The First Time Ever — Mariah — Children Go! — I Laid Around — Michael, Row the Boat — New Frankie and Johnnie Blues — The Drinking Gourd — Lonely and Lonesome Traveller — Summertime — The Old Man — Didn't It Rain.

With wonderful timing and understanding, the two voices intertwine and complement each other in a way which is unique. It is to be hoped that there is a store of material still to be released to commemorate their art. (H.A.T.)

JIM REEVES ON STAGE. RCA Stereo LSP-4062. Available in Mono.

Interest: Country and Western songs.
Performance: There are better.
Quality: Some distortion.
Stereo: Restricted.

Recorded live during rainy conditions in a small country town in Pennsylvania, this disc has the popular country and western singer struggling hard to coax laughter and applause from a small and not very enthusiastic audience. The sleeve note does not say whether the material has been presented on disc before, but I suspect not. The sound quality is poor, with noticeable distortion. I doubt whether Jim Reeves would have approved its release while he was alive.

Every track is preceded by patter which eats into the already short playing time of only 34 minutes. The disc is labelled "Stereo" and there is no indication that the material has been electronically rechannelled. In fact, the distribution between the channels is so restricted that there is virtually no difference when the mode switch is set to mono or stereo. Jim Reeves fans who want everything put out by him may want this disc, but for the casual purchaser I suggest there are better performances available. The tunes represented (some of them short extracts in a section devoted to impersonations) are: Mexican Joe — Yonder Comes a Sucker — Four Walls — I Missed Me — Tennessee Waltz — I Really Don't Want to Know — He'll Have to Go — Walking the Floor Over You — There Stands the Glass — One by One — Guess Things Happen that Way — I Want to be With You Always — Wildwood Flowers (H.A.T.)

★ ★ ★

SWEET, SAD AND SALTY. Burl Ives with orchestra and chorus directed by Owen Bradley. U.S.A. Decca (Festival) Stereo SDL-933010. Available in Mono.

Interest: C & W standards.
Performance: Typically warm.
Quality: Very good.
Stereo: Well spread.

During the 20 years over which I have listened to him, Burl Ives has changed not at all, but nowadays he has an orchestra to accompany him instead of his own guitar playing. In addition, here he has a chorus, to help him put over the program of country and western standards. Burl can handle this type of material as well as any and better than most, and his performance here is as pleasurable as any of his discs I have heard.

As the title implies, the pieces are in mixed mood; Bury the Bottle with Me—Lonesome 7-7203—Yesterday — The Atlantic Coastline—Evil Off My Mind—Wishin' She Was Here—Scarlet Ribbons—Green Green Grass of Home

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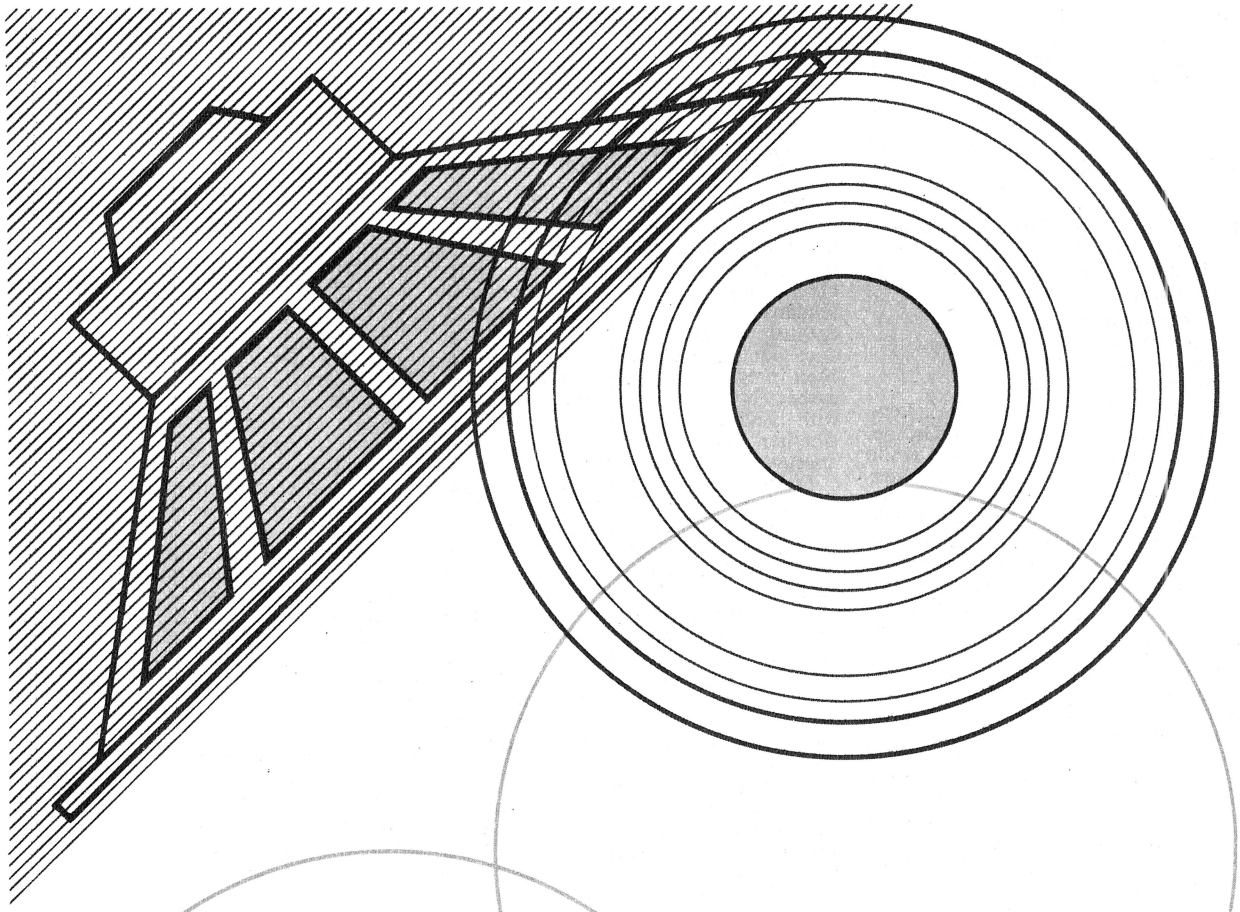


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—Billy Bayou — Hollow Words — That's Where My Baby Used to Be. Incidentally, "Evil Off My Mind" is not an error, it is described in the sleeve note as "a sequel to the successful 'Evil On My Mind.'" Burl Ives fans will find plenty to enjoy in this selection. (H.A.T.)

★ ★ ★

IT MUST BE HIM. Vicki Carr. Universal Record Club Stereo U-935.

Interest: Popular vocalist.
Performance: Emotional.
Quality: Excellent.
Stereo: Normal.

This reissue at a club price of this very good disc, first released in Australia a year ago by Festival, will be warmly welcomed by Vicki Carr fans. This fine singer who puts her heart and soul into her work and carries her audiences along on a tide of shared emotion does not require any visual impact to help her put a song over. Her rendering of the title song for this disc, "It Must Be Him," is possibly the finest I have heard of this often recorded number. The other titles here are: None but the Lonely Heart—Her Little Heart Went to Loveland—Laia Ladaia (Reza)—Look Again— Theme from "Irma la Douce"—Forget You—Cuando Caliente el Sol—How Does the Wine Taste — Should I Follow — May I Come In—Toys—San Francisco. Good orchestral backing is provided by the anonymous band, and the sound is of excellent standard. (H.A.T.)

★ ★ ★

BILL COSBY IS A VERY FUNNY FELLOW. RIGHT! Billy Cosby, comedian. Warner Bros (Australian Record Company) Stereo WX 1518. Available in Mono.

Interest: U.S. style humour.
Performance: Skillfully done.
Quality: Good live recording.
Stereo: Adds atmosphere.

Most readers of these columns will already be aware that Bill Cosby is a funny fellow, this being the third of his discs to be reviewed within a short space of time. His humour is essentially American so that, whatever the theme, it is treated in the light of the modern American scene. Thus, Noah in the last three tracks on side one is a loudtalking city type, and all the other characters are of the same ilk. Track 1 on the first side deals with the characters to be found on the New York subway, under the title "A Nut in every Car"; "Toss of the Coin" treats some famous historical occasions as they would have been if played out like the American football game, where so much depends on the right call of the coin; "Little Tiny Hairs" is a satire on a TV commercial. The side ends with the three-track Noah sketch.

Side two has "Superman" (no explanation needed); "Hoof and Mouth" where two cows discuss their symptoms on the way to slaughter; "Greasy Kid Stuff" is another knock at the TV commercial; "The Difference Between Men and Women" is concerned mainly with the way the fair sex takes itself off in groups to the Ladies Room; "The Pep Talk" has a football coach giving his losing team the traditional half-time going over; and finally "Karate" deals with the art of self defence. All these themes are treated in the fast talking exaggerated, wisecracking style which Americans find amusing. If you are a Cosby fan, and buy this record, you will probably find that the reaction from your friends will vary from helpless laughter to a lifted eyebrow. It depends so much on the individual. (H.A.T.)

★ ★ ★

SCOUT MARCHING SONGS. The Choir of St. Augustine's College, under the direction of Father Patrick Fahey, O.S.A., with Errol Scarlett (piano), George Golla (Guitar) and Reg Robinson (bass). Festival Stereo SFL-933,090. Available in Mono.

Interest: School choir.
Performance: Outstanding.
Quality: Reasonable.
Stereo: Three distinct channels.

If you have never heard the choir of St. Augustine's College, Brookvale, Sydney, you are in for a very pleasant surprise if you buy this disc. They have already made a fine recording, released in 1967. This new recording is even better, showing a very high standard of musicianship for such young performers. Outstanding are the boy soprano Scott Baldwind, and baritone Peter Bohrsmann, one of the choir's assistant directors. The material sung is very familiar, and although some of it is devotional none of it is liturgical: He's Got The Whole World In His Hands—Go Tell It On The Mountain —Vive la Compagnie—Muss-i-Denn—Kumbaya—When the Saints Go Marching In—Skip To My Lou—Alouette — Michael, Row The Boat Ashore — She'll Be Comin' 'Round The Mountain — Fires Burning — Now Is The Hour. A very pleasant program, reasonably well recorded (such defects as there are will only show up on high quality equipment), and a tribute to the work of the training staff of the college. (H.A.T.)

Popular Jazz

PERSONAL PORTRAIT — Joe Harriott. Columbia Lansdowne Series (E.M.I.) Stereo SCXO 6249.

Interest: Modern jazz altoist.
Performance: Unreservedly recommended.
Quality: Superbly recorded.
Stereo: Well balanced.

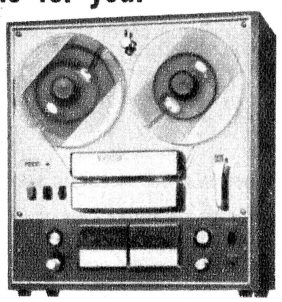
Joe Harriott is an excellent West Indian alto saxophonist who has lived in Britain since 1951. On this album, which provides an admirable showcase for him, Harriott had the considerable advantages of Denis Preston's skilful and experienced production and David Mack's fresh and original arrangements. On three tracks, "Saga," "Now's The Time" and "Darn That Dream," Harriott's alto is spotlighted against a group which featured Bob Efford (flute and clarinet), three brass — including the great Kenny Baker — and a very accomplished rhythm section of Stan Tracey on piano, Lennie Bush on bass and Bobby Orr on drums.

The accompaniment on four of the other tracks is provided by the Lansdowne String Quartet together with harpsichord, flute, bass and drums. Three of these tracks are ballads ("Portrait of Jenny," "Indian Summer" and "September Song") but Mack's writing for the strings is

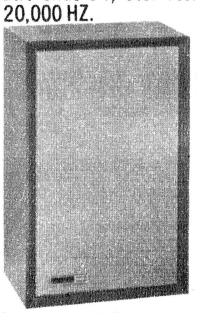
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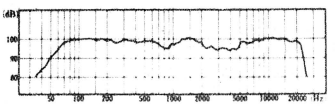
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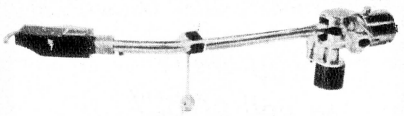
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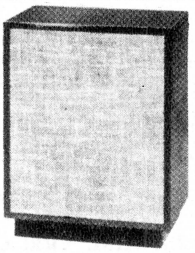
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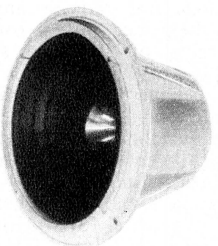
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never sentimentally lush and syrupy, but full of colour, warmth and jazz feeling. The album is completed by a fascinating free-form duet with Pat Smythe on piano and the latter's imaginative and intelligent playing stimulates Harriott to some really remarkable improvisations.

Overall, then, this album can be unreservedly recommended for the welcome variety in the music, the impressive arrangements by David Mack, the quality of the tunes and, above all, the superb musicianship of Joe Harriott. (T.F.C.)

★ ★ ★

BREAKIN' IT UP ON BROADWAY —Dukes of Dixieland, Harmony (C.B.S.). Stereo HAS108 (also in mono).

Interest: Synthetic Dixieland.

Performance: Uninteresting.

Quality: Fair.

Stereo: Adds little.

I was rather surprised to learn that John Hammond had produced this reissue album by the Dukes of Dixieland. I realise that the Dukes have a substantial popular following, particularly in America, but as a jazzband they are monumentally boring. The main problems include a lack of really good soloists, a tendency towards musical vulgarity and a complete absence of dynamics. To be sure, the Dukes are competent enough musicians but the surface excitement which they regularly generate is basically the result of louder and more erratic playing.

The material comes from a variety of Broadway shows and includes well-known standards like "Lady Be Good," "Ain't Misbehavin,'" "If I Were a Bell" and "I Can't Give you Anything But Love." It should be added that several of the tunes are totally unsuitable for a Dixieland Band.

In the absence of discographical details and recording dates, I can only suggest that the album was recorded about 1961. Even with a playing-time of 35¼ minutes and a price of $2.50, it would be difficult to recommend this album. (T.F.C.)

★ ★ ★

THE HISTORY OF JAZZ—Ray Price Quartet. Mono, Harmony (CBS) HA092.

Interest: Budget-priced Australian jazz re-issue.

Performance: Versatile but unconvincing.

Quality: Poorly recorded.

In recent months CBS has been reissuing, on their $2.50 Harmony label, a number of Australian jazz recordings by leading musicians like Judy Bailey, Bryce Rohde and Ray Price.

This album was first released on three E.P.s, each one broadly covering traditional, mainstream and modern jazz. The Ray Price Quartet of the day — about 1963 — was one of his best and featured Pat Rose on clarinet and baritone, Col Nolan on piano and John Sangster, one of Australia's greatest musicians, on trumpet and vibes.

Nevertheless, the overall sound of the quartet was inevitably a little thin with a rhythm section of piano and banjo. Somewhat surprisingly, this is not particularly noticeable on the mainstream numbers which include "Perdido" and "Stompin' At The Savoy."

The four traditional jazz tunes are standards like "St. James Infirmary" and "Jazz Me Blues" and they are memorable only for John Sangster's very hot and imaginative trumpet playing.

Without wishing to press the point too far, Ray Price should not have tackled modern jazz numbers like "Moanin" and "Night in Tunisia" with his extremely limited instrumentation.

Nevertheless this album does illustrate the versatility of the quartet, a quality which has served Ray Price well, particularly in his pioneering attempts to promote jazz in, for example, schools and country areas.

I very much welcome the policy of re-issuing Australian albums at a reasonable price, but, quite frankly, if collectors do want a Ray Price Quartet album they would be well advised to purchase the superior "One Day I Met an African" on the same Harmony label. (T.F.C.)

★ ★ ★

COMPADRES — Dave Brubeck and Gerry Mulligan. Stereo. CBS SBP-233585. Also in mono.

Interest: The new Brubeck Quartet

Performance: Interesting, with some qualifications.

Quality: Excellent "live" recording.

Stereo: Well balanced.

The break-up of the Dave Brubeck Quartet more than a year ago represented the end of a chapter in jazz history. Any attempt to re-create the substance or spirit of the group must, I think, be hazardous.

Recent overseas reports suggest that Dave Brubeck is now working on a semi-regular basis with the baritone saxophonist, Gerry Mulligan, and their first CBS album together has been awaited with some considerable interest. It was recorded "live" in Mexico and the quartet was completed by Jack Six on bass and the superb Boston drummer, Alan Dawson.

Presumably as a courtesy to their audience, the group chose to play two traditional Mexican songs, "Adios, Mariquita Linda" and the well-known "Amapola" together with three compositions each by Brubeck and Mulligan, all of which have strong Mexican and Spanish flavours. In moderation, this material may have been effective but I found that it palled after a time. Furthermore it clearly dampened Mulligan's usually free-swinging and frothy improvisations.

Understandably, too, the group lacked the well-oiled cohesion which characterised most of Brubeck's previous recordings and Mulligan and Brubeck seemed to be at odds rhythmically throughout the album.

Despite this, Mulligan turned in very good solos on his own "Jumping Bean" and on Dave Brubeck's haunting composition "Tender Woman." Brubeck's piano was relatively unaffected by the new rhythm section but his solo work tended to be somewhat heavy-handed and unswinging.

This is an interesting album and well worth hearing but it would be wise to defer judgment on the new quartet until they make an album of more testing jazz material (T.F.C.) ■

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13. A.C. Solid State Millivoltmeter.
14. Solid State A.F. Millivoltmeter.
15. Noise Distortion Millivoltmeter.
16. Standard V.T.V.M.
17. 1966—V.T.V.M.
18. 1968—V.T.V.M.

BRIDGES

19. Standard R/C.
20. 1966. R/C.
21. 1968 R/C and Signal Injector.

TV INST.'s.

22. Sweep and marker Generator.
23. Dual sweep Gen.
24. Silicon diode sweep Gen.
25. Silicon diode noise Gen.
26. Pattern Gen.
27. Trans. pattern Gen.
28. Wide range pulse gen.

AUDIO INST.'S

29. 1960 Audio Osc.
30. 1962 High perf. audio Gen.
31. Crystal locked std.
32. Electronic tuning standard.
33. 1965. Solid State audio osc.
34. Direct reading A.F. meter.
35. Sq. wave Gen.
36. 1967 transistor audio Gen.
37. Additive frequency meter.
38. A.F. tone burst gen.
38A. 1968. Solid state A.F. Generator.

R.F. INST.'s.

39. 6-band service oscillator.
40. Trans. wave meter.
41. G.D.O. wide range.
42. G.D.O. adaptor.
43. Trans. service osc.
44. Simple signal injector.
45. Transistorised signal tracer.
46. Transistorised osc.
47. Basic test osc.
48. Transistor test oscillator.

MISCELLANEOUS INST., ETC., KITS

49. 1960 Trans. Tester.
50. 1968 Transistor test set.
51. Valve and Transistor tester.
52. Electronic Stethoscope.
53. Moisture alarm.
54. Electronic Pistol range.
55. Transistor Geiger Counter.
56. Light beam alarm.
57. Burglar alarm.
58. Flasher unit.
59. Transistor alarm.
60. Electronic switch.
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62. Direct reading impedance meter.
63. Electronic anemometer.
64. S.W.R. Indicator.
65. Simple proximity alarm unit.
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68. Monophonic organ.

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69. Universal unit.
70. 1 amp unit.

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71. Transistor, 9v.
72. Transistor, fully protected supply.
73. 1966 H.T. unit.
74. 1968 lab. type, D-30v. supply

VOLTAGE/CURRENT CONTROL UNITS

75. Vari-watt unit.
76. Vari-tach. motor speed control.
77. 2KW auto-light dimmer.
78. 4KW auto. light dimmer.
79. Model train control unit.
80. Model train control unit with simulated inertia.
81. Above-hi-power.
82. No. 81 with simulated inertia.

TACHOMETER UNITS

83. 6 or 12v Std.
84. 6 or 12v Mullard.
85. 6 or 12v with dwell angle.
86. Tachometer and dwell angle unit for service stations.

TRANSISTOR IGNITION

87. Ro-Fo. 6 or 12v.
88. Hi-Fire 6 or 12v. (transformer).

POWER CONVERTERS

89. D.C.-D.C. 60w.
90. D.C.-D.C. 40w.
91. D.C.-D.C. 40w. 12v—Input.
92. D.C.-D.C. 70w 12v—Input.
93. D.C.-D.C. 100w 12v—Input.
94. D.C.-D.C. 140w. 24v—Input.
95. D.C-D.C. 225w. 24v—Input.

HIGH FIDELITY AMPLIFIERS MONO UNITS

96. Hi-Fi 3.
97. Mullard 3.3.
98. Mullard 5-10.
99. Mullard 5-10 transistor.
100. Transistor 20w.
101. Transistor 60w.

STEREO UNITS

102. Mullard 2-2.
103. Mullard (v) 3-3.
104. Mullard (t) 5-5.
105. Mullard (t) 5-5.
106. Mullard (v) 10-10.
107. Mullard (t) 10-10.
108. Philips Twin 10.
109. S.T.C. 10-10.
110. Wireless world transistor 20-20.
111. Hi-Fi 60-60.
112. Playmaster 2-2.
113. Playmaster 3 plus 3.
114. Playmaster unit 3.
115. Playmaster unit 4.
116. Playmaster 10 plus 10
117. Playmaster 101.
118. Playmaster (t) 105.
119. Playmaster (t) 113.
120. Playmaster (t) 115.
121. Playmaster (v) 118.

P.A. UNITS

122. 10 watt std.
123. 25 watt std.
124. 35 watt std.
125. 30 watt (t).
126. 100 watt std.
127. stereo P.A.

GUITAR UNITS

128. 10 watt std.
129. 25 watt std.
130. 35 watt std.
131. 50 watt std.
132. 70 watt (t).
133. Playmaster 102.
134. Playmaster 103.
135. Playmaster 40w. 116.
136. Playmaster 60w 117.
137. Guitar fuzz box.
138. Guitar Waa-Waa.
139. Reverb unit.
140. Guitar preamp.

STEREOGRAMS

141. Playmaster 105.
142. Playmaster 106.
143. Playmaster 107.

CONTROL UNITS

144. Playmaster No. 9.
145. Playmaster No. 10.
146. Playmaster No. 104.
147. Playmaster No. 112.
148. Playmaster No. 120.
149. Mullard 2v.
150. Mullard 3v.
151. Philips Miniwatt.
152. Wireless world stereo system unit.

PREAMP UNITS

153. Transistor—Mono.
154. Transistor—Stereo.
155. Transistor—Silicon, mono.
156. Transistor F.E.T. mono.
157. Transistor dyn. mic. mono.
158. Above-Stereo.
159. Playmaster 115 F.E.T. Stereo.
160. Playmaster 118 mag.
161. Sound projector.

MIXER UNITS

162. Trans. 4 ch. (1966).
163. Trans—4 ch. (1967).
164. Valve—4 ch.

TUNER UNITS

165. Playmaster u/style.
166. Playmaster No. 11.
167. Playmaster No. 114.
168. Playmaster No. 122.
169. Playmaster No. 123.
170. Philips Miniwatt.
180. Trans.—Long range.

TAPE UNITS

181. Trans. Preamp.
182. Playmaster 110 (M).
182. Playmaster 110 (S).
183. Power Unit 110.
184. Adaptor 110.
185. Playmaster 119 Adaptor.
186. Transistor V.O.X.
187. Tape Actuated relay.
188. Mullard Trans Tape Amp.

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RECEIVERS

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190. Fremodyne 4 R.F. Soct only.
191. Synchrodyne.
192. Communications RX.
193. Deltahet RX.
194. 3 Band Double Change S/het RX.
195. Explorer VHF Transistor RX.
196. Interceptor 5 Semi-Comm. RX.
197. 1967 All-Wave 2
198. 1967 All-Wave 3
199. 1967 All-Wave 5
200. 1967 All-Wave 6
201. 1967 All-Wave 7
202. Transporta 7
203. Transistor 3 Band. 8
204. 3 Band 2V RX.
205. 3 Band 3V RX.
206. Interstate 5
207. Versatile Mantel Set.
208. All-Wave Transistor 3
209. A.B.C. 3
210. 1968 F.E.T. 3

TRANSMITTERS

211. 144 MHZ 50W. Linear Final.
212. 144 MHz 20W.
213. 144 MHz 75W.
214. 144 MHz 18W.
215. 144 MHz S.S.B.
216. 3 Band A.M.
217. Basic 3 Band.
218. 5 Band. S.S.B.
219. 1967 S.S.B.

CONVERTERS

220. 50 MHz.
221. 144. MHz.
222. 50 and 144 MHz Crystal Locked.
223. 1965 S/W.
224. 1965 S/W 2 Band.
225. 1966 3 Band.
226. Basic S/W.

V.F.O. UNITS

227. Remote Unit.
228. 7, 8 and 9 H.F. and V.H.F.
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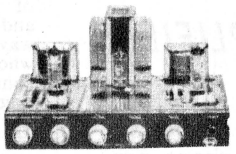
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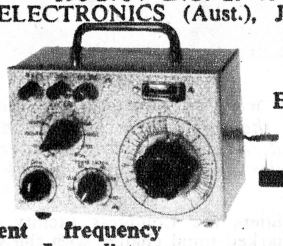


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190-270V D.C. at 40 mA.
ELECTRONICS (Aust.), June, 1966.

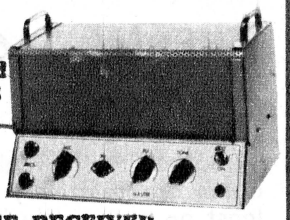


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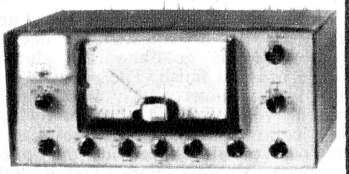


3-BAND DOUBLE-CHANGE RECEIVER
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5 BAND DSB TX

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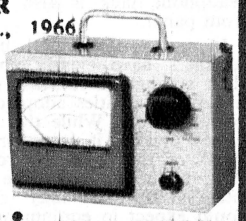


FOUR-CHANNEL AUDIO MIXER
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R. TV and H., Jan., 1965.





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TRADE REVIEWS AND RELEASES

THE JBL SA600 STEREO AMPLIFIER

James B. Lansing Sound Incorporated is an American manufacturer of high quality sound equipment whose products are relatively new to the Australian market — at least on a quantity basis. Reviewed here is their SA600, a high-powered amplifier with exceptional specifications.

The overall dimensions of the amplifier are 16¾in x 5-1/16in x 13¾in deep. The front panel is gold-anodised aluminium with a brushed finish. The panel is divided into two sections which have the grain running vertically and horizontally so that they contrast. The knobs are inset into the front panel and provide the following functions: Volume, Bass, Treble, Balance and Selector. Toggle switches are provided for Loudness, Power, Tape Monitor, Mode and a Test function described later. A headphone jack is also provided on the front panel.

In terms of general presentation, the designers have clearly opted for a very plain styling, in contrast with the "busy" display of facilities adopted by some other manufacturers. While this will have its inherent appeal, it is unfortunate that the "feel" of the panel controls leaves something to be desired. The knobs do not rotate with the silky smoothness one would expect in equipment of this quality — a characteristic partly but not entirely explained by earthing springs on the shafts. The toggle switches "flop" rather than "snap" and small pieces of red luminescent material intended to emphasise the "on" setting look decidedly makeshift and insecure. Electrically, the controls function smoothly; it is just a pity that they don't feel this way mechanically.

The rear panel is bare except for the spring-loaded loudspeaker terminals, mains fuse and mains cord socket. All the input sockets are accommodated on a recessed panel underneath the amplifier. This also accommodates three AC outlets, two switched and one unswitched. There are two sets of inputs for magnetic cartridge, along with a three-position slide switch to adjust sensitivity. Other inputs are provided for Tuner, Auxiliary and Tape record and replay.

The amplifier can be used free-standing on a shelf or installed in a cabinet, but in each case, adequate ventilation should be provided.

Removing the top of the case reveals high quality workmanship inside. All the circuitry is accommodated on fibreglass printed boards. The input connectors are soldered directly into the boards which obviates the use of shielded cable runs. In fact, there is very little point-to-point wiring at all. All the heavy components, such as the massive power transformer and power amplifier circuitry are accommodated on a cast sub-chassis which forms the rear panel and heatsink of the amplifier.

Motorola silicon transistors are used throughout and the amplifier is protected from overload, both from being overdriven or from short-circuited outputs. The input stages also have a very high order of overload capability, 250mV at IKHz being needed to overload the magnetic cartridge input when used on the highest sensitivity—4mV at IKHz for full output.



The JBL SA600 amplifier, shown fitted with optional walnut side panels. The uncomplicated appearance belies the very high performance it is capable of. All the input sockets and AC outlets are arranged on a recessed panel on the underside of the amplifier—an unusual feature.

On actual listening test the amplifier performed extremely well, as was to be expected. At all normal settings of the controls the amplifier was noise-free and, even at maximum setting of the volume control, there was only a slight hiss from the speakers. Bass and treble controls had more than adequate range and the controls were smooth in their control effect except for the volume control, which was noisy in one channel. At switch-on there were no audible "plops" from the loudspeaker; this is to be expected, as balanced positive and negative supply rails are used, which obviate the large output coupling capacitor.

It was in the performance tests that the amplifier really excelled itself. It is rated to deliver 40 watts RMS per channel and is suitable for use with loudspeakers having an impedance from 4 to 16 ohms. Space does not permit a full quotation of the specifications but in all cases they were met or exceeded.

Power output was measured as 58 watts RMS per channel into 8-ohm loads with both channels driven singly or together; 36 watts RMS into 16-ohm loads, both channels driven singly or together. Attempts to measure full power into 4-ohm loads "blew" the protective fuse but we did measure well in excess of 60 watts RMS per channel before this happened.

Frequency response referred to a level of 1-watt into 8-ohms at 1KHz was within plus or minus 0.5dB from 18Hz to 43KHz using the auxiliary input — well in excess of the specification. Power response at 40 watts RMS (—3dB points) extended from 10Hz to 150KHz.

Total harmonic distortion at 1 watt at 1KHz was less than 0.15 per cent. At a level of 40 watts RMS we measured 0.06 per cent. Where readings become this low, the accuracy is in doubt as the residual distortion in the generator used was 0.03 per cent at 1KHz. One could certainly accept that total harmonic distortion for almost all measuring conditions was less than 0.1 per cent, or better than specified.

The tone controls, which are of the negative-feedback type, yielded a range of plus 11 and minus 10dB at 10KHz and plus or minus 20dB at 50Hz. Square-wave response was good throughout the whole range. Large values of capacitance connected across the load did cause some ringing, as expected, but this was well damped.

The Loudness facility provided a maximum of 8dB boost at bass frequencies at almost zero setting of the volume control — as the control is advanced to a setting of 12 o'clock the amount of boost decreases to zero, as it should. In many amplifiers the Loudness facility will give a marked tonal change with the volume control advanced well beyond 12 o'clock. The Loudness facility should only provide boost at low listening level.

Separation between channels was very good at 60dB below 40 watts at 1KHz and 38dB at 10KHz. This was measured with one channel driven to 40 watts into 8-ohms while the other channel had an open circuit input.

Short-circuit protection was completely effective. A built-in circuit breaker opens if the speaker output is shorted and cycles on and off until the short is removed. Occasionally, the mains fuse will also blow in these circumstances.

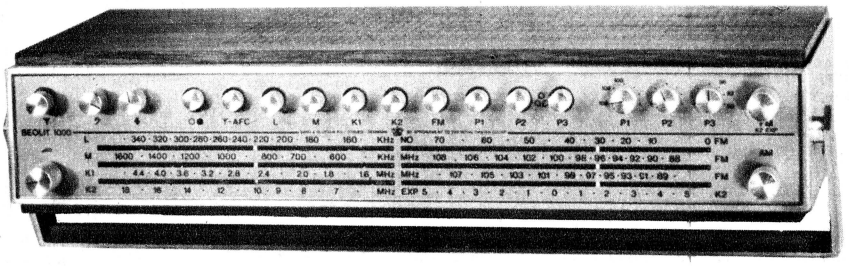
A special feature of the amplifier is the Test function, mentioned earlier. The Test switch on the front panel connects the two speakers in series across the output so that they only receive the difference of the signals applied to the two channels. This enables the gain of the two channels to be matched for magnetic cartridge inputs with a control on the underside of the amplifier. The test is carried out using a mono record and, once the gain of the cartridge/amplifier/loudspeaker chain is matched for both channels, the full range of the balance control is available for normal program correction.

To sum up, the JBL SA600 is a very high performance amplifier. It has more power than most users are ever likely to require, even if they have very large rooms and insensitive speakers. The retail price is $544 plus $22 for the oiled walnut side panels. The unit is guaranteed unconditionally for two years.

For information regarding availability, catalogues or specification sheets contact the Australian distributors, Auriema (A'asia) Pty. Ltd., 443 Kent Street, Sydney, N.S.W. (L.D.S.).

MULTI-PURPOSE, MULTI-BAND RECEIVER

The Beolit 1000 portable radio receiver is a highly flexible unit which can be used in just about any location. It gives good reception on the AM and FM bands (where applicable), can be used as a portable amplifier for tape or record reproduction, and as a car radio in conjunction with a special cradle available as an accessory.



The unit measures 13½ inches wide, 2¾ inches high and 7¾ inches deep, excluding the handle. The sides are finished in teak while other surfaces are grey or satin aluminium. It weighs 6.6 pounds when complete with five standard 1.5volt size D cells.

The dial scale covers the whole of the front of the unit and spread out across it are nine knobs or push buttons. The effect is rather eye-catching to say the least.

There are four push buttons to select the AM bands which cover the ranges: 147 to 350KHz, 520 to 1610KHz, 1.5 to 4.6MHz, 5.95 to 18MHz. Sensitivity is high on all bands and the AGC is quite efficient. Selectivity is also good, while still giving excellent quality reception on broadcast programs.

The FM coverage is from 87.5 to 108MHz. Three push buttons and three small knobs provide the facility of three pre-set stations on the FM band. Unfortunately, the FM facility is of minor interest only in this country, the band being occupied by television stations; in Sydney Channel 2 and 4 came in strongly. The FM tuning knob serves an unusual double role, functioning as a bandspread facility on the highest frequency AM band.

Depressing two of the pre-set FM station buttons allows the unit to be used for tape or record reproduction via a DIN socket in the side. Radio signals are available from the same socket to feed a tape recorder or hi-fi system, so that the receiver can serve as a comprehensive tuner for a high-quality audio system.

Another DIN socket provides a connection for an external loudspeaker which may be plugged in either to disconnect the internal speaker or leave it in parallel. The external loudspeaker needs to be of 4-ohms impedance or higher.

Three screws retain one of the wooden sides which swings out to reveal the inside. The components, which appear to be of high quality, are crowded but not as much as in some competitive Japanese makes. A special feature is the chassis, which is an injection moulding, combining high impact strength and rigidity with lightness. This is responsible for the low weight of just over six pounds.

Mullard silicon transistors are used throughout, apart from the class-B audio output stage. This uses germanium PNP types (AD162) in a conventional transformer-coupled, push-pull stage to obtain excellent power output from the relatively low supply voltage. In fact, the output is 2 watts RMS at less than 2 per cent THD with the internal batteries and rises to 7.5 watts with an external supply.

A cradle is provided for use in cars which connects aerial, car battery, etc. We presume that this would provide suppression circuitry. Apparently the cradle is meant to be installed under the dash which could be a problem in some cars with limited knee room.

All told, the unit gives high performance from a compact chassis. Inquiries regarding price, availability and accessories should be directed to the sole Australian agents, G.R.D. Instruments Pty. Ltd., 6 Railway Walk, Camberwell, Victoria. (L.D.S.)

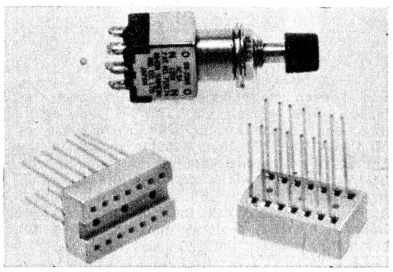
MINIATURE SWITCHES, IC SOCKETS from IRH

A wide range of miniature toggle, rocker, rotary and pushbutton type switches are manufactured by the N.K.K. Company in Japan, and available in Australia from IRH Components Pty. Ltd. Also available are attractively priced sockets for 14-pin dual-in-line (DIL) microcircuits from the Elco Corporation.

The sample N.K.K. Switch pictured is type SB-2085, a DPDT alternate-acting pushbutton type rated at 250V-3A, and measuring only 1-9/16 x ½in x 15/32in overall with a 31/64in mounting hole. All N.K.K. miniature switches are fully encased in metal/phenolic cases and employ fine silver contacts and phosphor bronze springs for long life and dependability. Solder connections are normally provided, but screw type terminals can be provided.

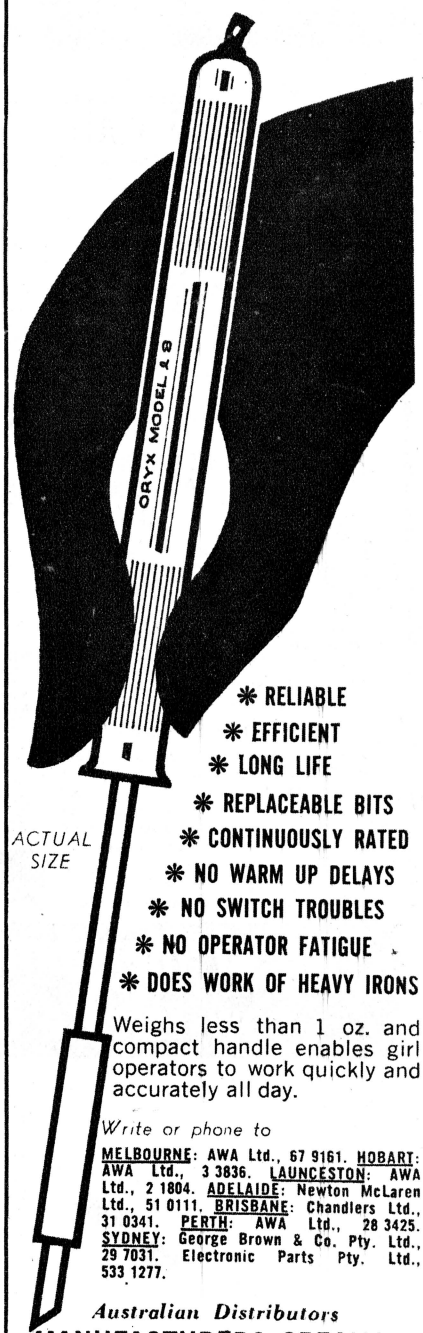
Type SB-2061, a DPDT momentary-action switch, is that used for the "battery test" switch in the recently described "Solid State Volt-Ohm Meter" (Electronics Australia, December, 1968).

The Elco 14-pin DIL sockets shown are



type 8358, and consist of a high-quality moulded body with gold-plated wiper-action pin clips. The clips extend about 5/8in from the moulding, maintaining the 0.1in spacing of the DIL package pins for printed wiring board mounting.

Enquiries should be directed to IRH Components Pty. Ltd., The Crescent, Kingsgrove, N.S.W. 2208.



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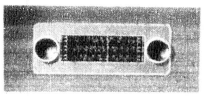
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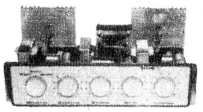
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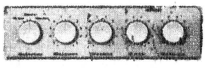


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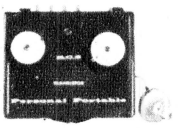


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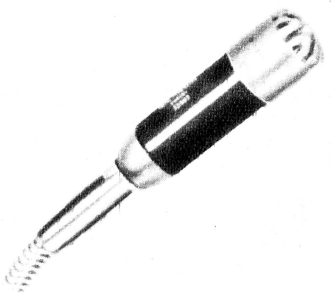
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LONDON MICROPHONES

Two London microphones have also been released. The Model LM 100 is an omni-directional dynamic unit with a response of 50-15,000° Hz. Another popular model is the LM 200, a dynamic cardioid microphone with balanced output and a response of 50-15,000 Hz. Discrimination at 180° eliminates unwanted background noise. Ask for copies of reviews from authorative overseas magazines and for complete technical data.

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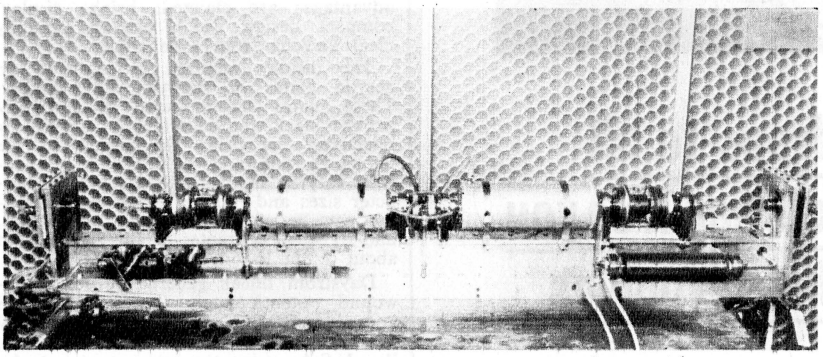
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LATEST INSTRUMENTS FROM HITACHI

A high-power three-colour ion laser system and a fluorescence spectrophotometer have been developed by Hitachi Ltd. of Tokyo, Japan.

The Hitachi gas laser system emits beams of three primary colours. Coherence and power of the beams are said to be of such quality that the system can be used to produce full-colour holograms or to project coloured images on to a screen. The system consists of a krypton laser which emits red light, and an argon laser which emits blue and green light. The two lasers employ ceramic tubes made of beryllium, a highly heat resistant material which can withstand the discharge power of 30KW.

The krypton laser has a continuous output of 5 watts in single-colour multi-mode operation. The argon laser has an output of 15 watts during simultaneous emission of blue and green light, believed to be the largest output achieved by any commercial laser of this type. The argon laser can be made to emit alternatively a single blue or green line by selecting an appropriate reflection mirror of the optical resonator. Output in single-colour multi-mode operation is 6 watts.



The Hitachi ion laser emits beams of three primary colours with an energy flux of each beam up to about one thousand times as intense as that of direct sunlight.

The Hitachi Perkin-Elmer model 203 fluorescence spectrophotometer was introduced recently at the 13th annual general meeting of the College of Pathologists of Australia in Melbourne. The instrument, which has taken two years for Hitachi to develop, is said to have the following advantages compared with earlier instruments: compact size; elimination of expensive components to reduce costs; use of grating monographs; simplification of slit adjustments to optimise the unit for most applications; use of a lower-priced mercury lamp in place of a xenon lamp; and simplified electronic circuitry.

The model 203 uses a vertical Ebert-Fastie mounting to incorporate two monochromators in one instrument, the first for excitation and the second for fluorescent radiation. In this way, the instrument gives an operator the following facilities: to select optimum excitation and emission wavelengths; to resolve close-lying bands; manual scanning to confirm simple identity and to locate and identify unexpected fluorescent contaminants; to obtain better intensity/concentration linearity than with filter units; to have wider sensitivity than filter units even with narrow bandpass and to use the entire spectral range from 220 to 780mm.

Because fluorescence is approximately one thousand times more sensitive than colorimetric analysis, the fluorescence spectrophotometer has a wide field of application, including medical science, clinical inspection, food science, drug assays, petroleum and petrochemical research, mining and mineralogical investigation, etc.

Inquiries concerning the Hitachi laser system should be addressed to Hitachi Ltd., Nippon Bldg., Ohte-machi, Chiyoda-ku, Tokyo, Japan. Further information about the fluorescence spectrophotometer can be obtained from Perkin-Elmer Pty. Ltd., 269 Prince's Highway, Dandenong, Vic. 3175.



Dr Kanji Akamatsu, senior technical engineer, Hitachi Ltd. (right) discusses the features of the Hitachi Perkin-Elmer model 203 with Mr Bill Hargrave, general sales manager, Perkin-Elmer.

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NEW INSTRUMENTS FROM OVERSEAS

Warburton Franki Industries (Melbourne) Pty. Ltd. has provided the following details of new equipment manufactured by overseas companies for which they are the Australian distributors.

Seven Erecon multi-range meters, produced by Kobayashi Meter Works Ltd. of Tokyo, Japan, have accuracies claimed to be within 1.5pc on DC ranges and 2.5pc on AC ranges. The ranges covered by the various models are:

SM301 DC current 50, 100, 250, 500, 1000uA.
SM311 DC current 1, 5, 10, 25, 100, 250, 500, 1000mA.
SM321 DC current 1, 2.5, 5, 10, 25A.
SM331 DC voltage 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1000V.
SM351 AC current 5, 25, 100, 250, 1000mA.
SM361 AC current 1, 2.5, 5, 10, 25A.
SM371 AC voltage 5, 10, 25, 50, 100, 250, 500, 1000V.

From K.G.M. Electronics Ltd., of Richmond, Surrey, England, comes a range of in-line indicators for which the following advantages are claimed: bright display; compact design which provides equally clear viewing from wide angles.

The display required is engraved on acrylic plates of non-yellowing quality. These plates are mounted in a tightly packed stack and individually edge-lit by selectively energising the circuit to the lamps. A wide range of indicators is available varying in overall dimensions, character sizes and number of plates. Mounting can be either horizontal or vertical, and standard character heights range from about 1/8in to 6in high.

Daystrom linear general purpose wirewound potentiometers (series 534-OOHS and 535--OOHS) are manufactured by Weston Components Division, Archbald, Pa., U.S.A., using the same resistance element as for the company's range of military pots. The units have 24 screw turns for full scale adjustment, and mechanical protection is provided by stops and a slip clutch. Resistance values from 10 ohms to 50K are standard with 5pc tolerance and resolution as low as 0.11 pc. The power rating is 1W in still air at 70deg C., the temperature range —55 to 150deg C., and the temperature coefficient 50ppm per °C maximum. The eqivalent noise resistance is 0.1pc or 100 ahms.

International Rectifier Corp., El Segundo, California, U.S.A., manufacturers SCRs (thyristors) which can handle 800 amperes per mircosecond inrush current. The units, manufactured by the epitaxial process, are available to 1200 volts in a TO-83 or TO-94 package. ACE-SCR series 81RLA are rated for 80A average current at frequencies to 400Hz, while ACE-SCR series 81RLB are rated to 80A average current for inverter applications to 1KHz. Contour groove and shorter emitter construction with "accelerated cathode excitation" (ACE) are said to provide fast firing parameters.

Series 1050 DC-AC choppers, from Stevens-Arnold Inc., South Boston, Mass., U.S.A., are intended for modulating or demodulating where space is limited or where shock and vibration are expected. Their non-resonant design allows operation up to 120Hz. Power requirements are very low, and DC drive units are available. Contacts are rated at 10V 1mA DC for continuous duty, with 1pF capacitance between contacts and insulation resistance of 1000M minimum. Noise is 1uV RMS measured across 100K.

Further information about these products may be obtained from Warburton Franki Ltd., 220 Park Street, South Melbourne, Vic., 3205.

JEMCO MULTIMETER IS ATTRACTIVE

Indeva Pty. Ltd. recently submitted for review a JEMCO US-100 multimeter, which is well suited to needs of the technician and hobbyist. It is compact but has a large easily read scale, a sensitivity of 20,000 ohms/volt on DC, a 10-amp AC range and meter overload protection as its main features.

The DC voltage ranges, with a sensitivity of 20,000 ohms/volt are 250mV, 1.0, 2.5, 10, 50, 250 and 1,000 volts. AC voltage ranges have a sensitivity of 5,000 ohms/volt and are as follows: 2.5, 10, 50, 250 and 1,000. The accuracy of the voltage ranges was not quoted but was found to be within 3 per cent of FSD on all ranges, which is adequate for most use. The reference which we checked against is a digital voltmeter with an accuracy of the order of 0.1 per cent.

The frequency response of the AC voltage ranges we found to be very good for an instrument of this type. It was flat within 1dB up to 40KHz. This feature, combined with the low voltage ranges would make the instrument quite useful for general audio applications.

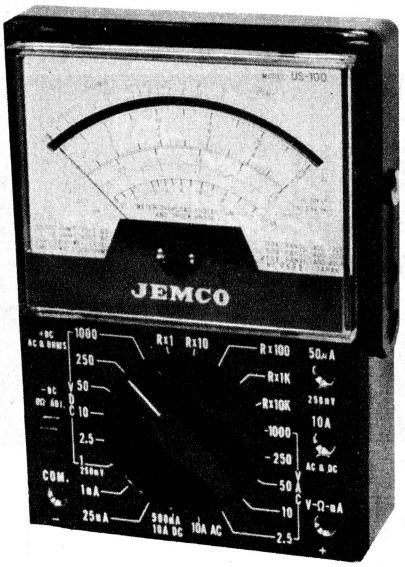
DC current ranges are as follows: 50uA, 1mA, 25mA, 500mA and 10A. The last range is not usually featured on meters in this price range. Also featured is a 10 amp AC range.

Ohms ranges are $\times 1$, $\times 10$, $\times 100$, $\times 1K$, $\times 10K$ which is quite comprehensive, enabling all common resistor values to be easily checked.

All ranges are selected by a large, easily manipulated rotary switch. Extra sockets are used for the 50uA, 250mV and 10-amp ranges. A polarity reversal switch is provided to facilitate DC measurements. Meter overload protection is provided and we tested this with a variety of overload conditions but in no case did the accuracy of the instrument appear to be affected. This feature protects the meter movement only and really severe overloads may still cause damage to the internal circuitry.

The unit is housed in a moulded plastic case measuring 5¾ x 4⅛ x 1¾ inches, not including the handle. The dial carries six ranges but all lettering and calibrations are clear and easy to read. A mirror is also provided on the dial, to minimise parallax error. The meter zero position can be easily reset, using a small knob instead of the usual screwdriver adjustment.

The test leads terminate in shrouded "alligator" clips which are particularly well finished.



The circuitry for the unit is accommodated on a printed board. The selector switch contacts are also on the board. We would normally have reservations about contact resistance, but in this case, the manufacturer states that precautions have been taken to reduce contact resistance problems to a minimum. The board is plated to reduce oxidation to a minimum.

To sum up, the unit has quite a wide range of applications and, as we have observed above, is straightforward to use. Trade price is $25 plus tax. It is available from all trade houses and the distributors, Indeva Pty. Ltd., have spare parts and repair service available.

Further information regarding this instrument and other test equipment can be obtained from Indeva Industries Developments Pty. Ltd., 24 Bellevue Road, Bellevue Hill, N.S.W. (L.D.S.).

TRADE RELEASES—IN BRIEF

HEWLETT-PACKARD COMPANY has developed a low-cost AC calibrator which can be used with instruments such as large AC moving-vane meters as it has a 25W output. The Model 6921A AC Calibrator supplies either a calibrated voltage or a calibrated current to its load, and can also operate into a fully reactive load. The RMS amplitude of its output is within plus or minus 0.25pc of the selected value. The instrument has four voltage ranges with maxima of 1.4, 14, 140 and 280 volts RMS. It has five current ranges—1.4, 14 and 140mA, 1.4 and 5A RMS.

The calibrator delivers output frequencies of 60Hz, 400Hz and 1KHz with less than 0.5pc second harmonic distortion and less than 0.1pc third harmonic distortion. This distortion is included in the 0.25pc accuracy specification. External oscillators can be connected for other frequencies between 50Hz and 2KHz. Other important specifications are: ripple and noise less than 0.1pc of range RMS; Line regulation less than .01pc of any setting; load regulation less than 0.1pc of setting; settling and transient recovery time less than five seconds. Further information may be obtained from Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

NATIONAL SEMICONDUCTOR CORP., Santa Clara, California, U.S.A., has introduced a monolithic IC operational amplifier, the LM101A, with guaranteed bias currents of 100nA and offset currents of 20nA over a —55 to 125°C temperature range. Offset voltages of 3mV, offset voltage drifts of 15uV per °C, and offset current drifts of 0.2nA per °C are also guaranteed. The device features overload protection on the input and output, no latch-up mode, frequency compensation with a single 30pF capacitor, and insensitivity to oscillation with capacitive loads or poor supply bypassing. The LM101A is available at the OEM price of $45 each for small quantities. A commercial version, the LM301A, is available at $5.25 each for small quantities. For further information contact the Australian agents, Rutherford Electronics Pty. Ltd., 833 Doncaster Road, Doncaster, Vic. 3108.

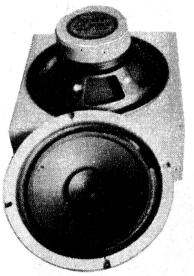
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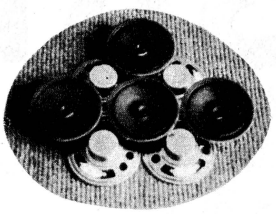
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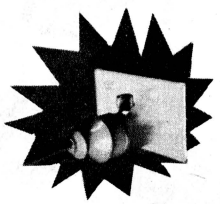
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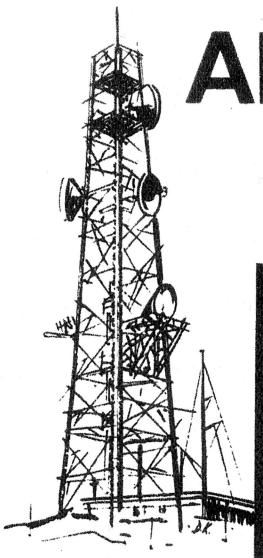


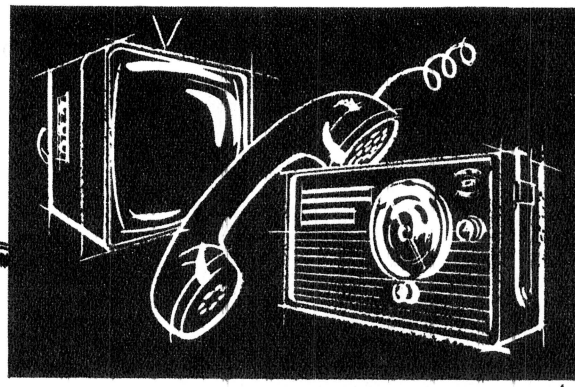
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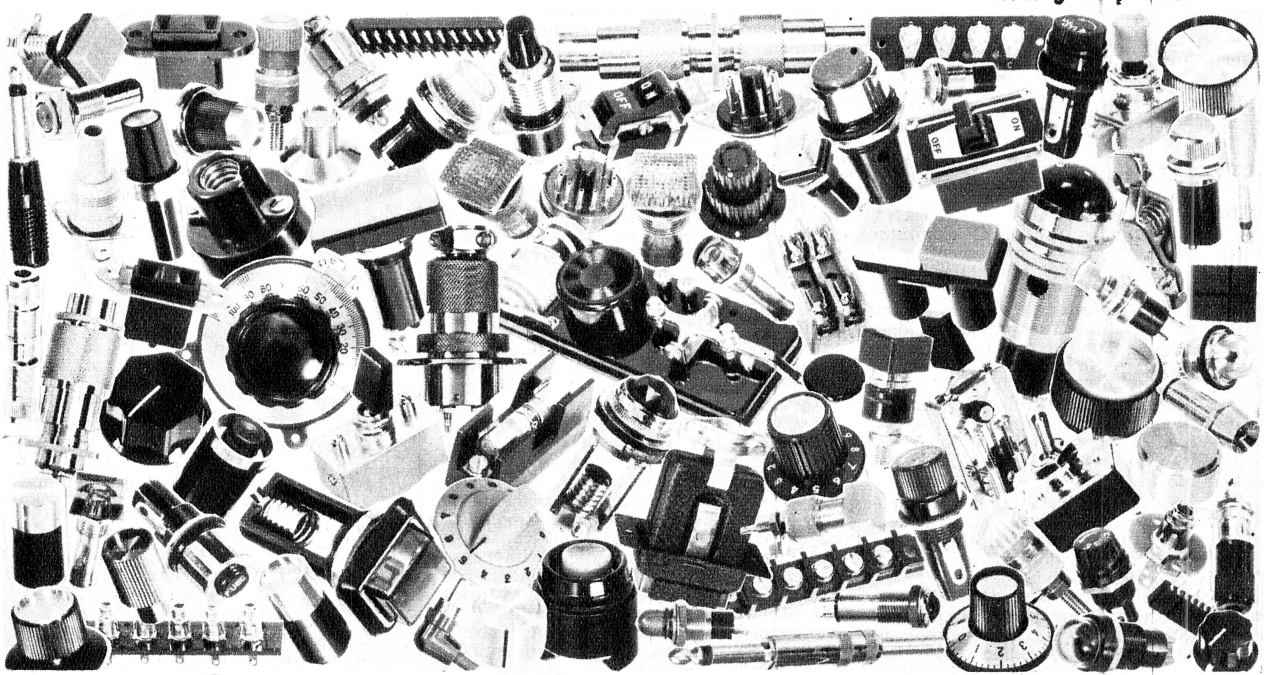
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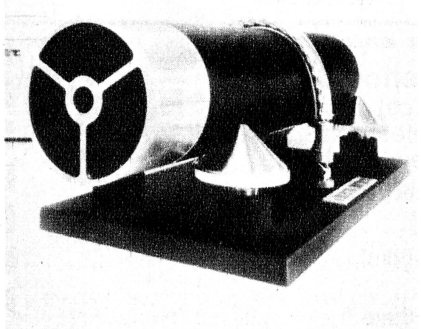
VARIAN has extended its range of parametric amplifier diodes with a new line of 400GHz gallium arsenide devices. The diodes are claimed to provide extraordinary gain-bandwidth performance with exceptionally low noise figures. A broad selection of ranges of package style, series inductance and case capacitance are provided. The diodes are designed to meet the most stringent mechanical and environmental requirements; all contacts are bonded or brazed, and the final package is hermetically sealed. The general characteristics include a minimum reverse breakdown voltage of 6V and a maximum power dissipation of 250mW. For further information contact Varian Pty Ltd, 38 Oxley Street, Crows Nest, N.S.W. 2065.

CONTROL DATA CORPORATION has announced a new computer system, the CDC 7600, with a capacity of 36 million arithmetic instructions per second. The computer, in service at the company's development laboratory at Chippewa, U.S.A., is about four times as fast as the CDC 6600. The CDC 7600 includes a maintenance processor which monitors the status of the machine during operation. This permits maintenance to be performed without interrupting the productive use of the machine. Systems currently in use have to be shut down for routine maintenance. Inquiries to Control Data Australia Pty. Ltd., 598 St Kilda Road, Melbourne, 3004.

RADIOMETER A/S, Copenhagen, Denmark, has developed a Wide-Range Oscillator, type RCO11—a transistorised, AC-operated RC oscillator. It delivers a sine wave or square wave (with a 50nS fall and rise time) with low distortion and high stability from 10Hz to 1MHz in 5 ranges. It is provided with three outputs: a direct output with an impedance of 10 ohms in series with 1000uF, and two outputs with impedances of 50 ohms and 400 ohms. The meter circuit is a peak-sensing type: the meter indicates the RMS of the sine wave, and the peak-to-peak value of the square wave. Inquiries to the Australian agents: Andrew Thom Ltd., 261 Broadway, Sydney, N.S.W. 2007.

TECNICO ELECTRONICS PTY. LTD. has moved its printed circuit department to new premises to expand its manufacturing facilities. The new location is at 53 Carrington Street, Marrickville, N.S.W 2204, only two blocks from the previous address. The new plant is equipped with the latest photographic equipment and expanded facilities for multiple drilling, semi-automatic screen printing and all types of precious metal plating.

UNIVERSITY LABORATORIES has introduced a new helium-neon gas laser, model 261. This produces over 4mW of plane polarised output in the uniphase mode at a wavelength of 6328A. The instrument uses a Lasertron plasma tube with permanently aligned internal mirrors. The advantages of this construction technique over conventional gas lasers, according to the manufacturers, are total freedom from adjustment mechanisms, more rugged design and less costly to manufacture. The tube is also available separately. Further information is available from University Laboratories, 733 Allston Way, Berkeley, California 94710, U.S.A.



University Laboratories model 261 He-Ne gas laser.

EMERSON & CUMING INC., Canton, Massachusetts, U.S.A., has available a flexible, high temperature plastic solder, Eccobond Solder 59C. This is a one component, silicone rubber based, electrically conductive bonding agent. As with all plastic solders, bonds to aluminium wire or plate are easily accomplished. Furthermore, Eccobond Solder 59C is flexible and can be reopened and resealed again and again without the use of a soldering gun. Application is simple: stir, apply with brush or spatula, wait until slightly tacky (10-20 mins.) and join surfaces using hand pressure. Further information may be obtained from the Australian agents, IRH Components Pty. Ltd., The Crescent, Kingsgrove, N.S.W. 2208.

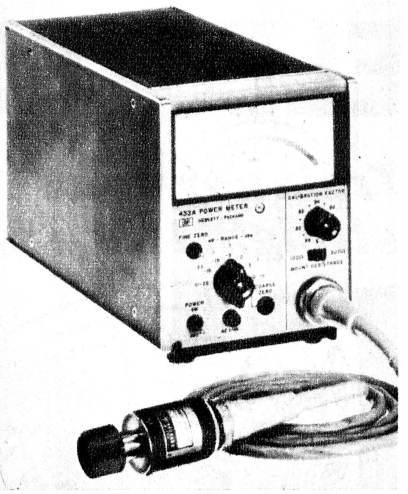
GENERAL RESISTANCE has announced the expansion of its line of low-cost precision resistors, Econistors, including new .0025pc tolerance units. Econistors provide typical temperature coefficients of plus or minus 3ppm per degree C and three-year stability of better than 50ppm. The resistors are tested on a 100pc basis three times during manufacture, with the last test following an accelerated aging thermal-shock process. Inquiries to General Resistance, 430 Southern Boulevard, Bronx, New York 10455, U.S.A.

SOLARTRON AUSTRALIA has introduced two new instruments for dynamic analysis.

The JM 1861 is a pseudo random binary sequence generator which produces chain codes of variable length and frequency. Clock frequencies from .01Hz to 1MHz and sequence lengths from 5 to 20 are provided as well as a variable probability distribution (binomial or rectangular) and six precisely defined crest factor settings. Delayed sequences are also provided with digital delay setting up to 999 clock periods.

The JM1860 time domain analyser, claimed to be the only instrument of its kind in the world, measures the RMS, mean modular or mean value of a random signal and will integrate over periods up to four hours. When used with the JM1861, it will compute the cross correlation of any value of delay set in the JM1861, allowing process identification in the time domain and derivation of impulses response. The combination permits the testing and identification of systems energised with a random signal input as simply as frequency response testing. Inquiries to Solartron Australia, 112 High Street, Kew, Vic. 3101.

Microwave Power Meter



The Hewlett-Packard Microwave Power Meter model 432A features automatic zero which is set in a fraction of a second by depressing a toggle switch. When it is zeroed on the most sensitive range, zero carryover from range to range stays within 0.25 per cent. With its associated thermistor mounts, the meter can measure power over the frequency range 10MHz to 40GHz with an accuracy of 1 per cent of full scale on all ranges from 0 to 55 degrees C. Full-scale measurement ranges for the meter are from 10uW to 10mW, allowing signals as low as 1uW to be measured. Further information may be obtained from Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146.

MUIRHEAD & CO. LTD., Beckenham, Kent, England, has changed its name to Muirhead Ltd., in accordance with a special resolution passed at the recent annual general meeting. Mr E. J. Tucker, Chairman, explained at the meeting that it was proposed to shorten the name so that it would be appropriate to use the word "Muirhead" alone on the company's products. ■

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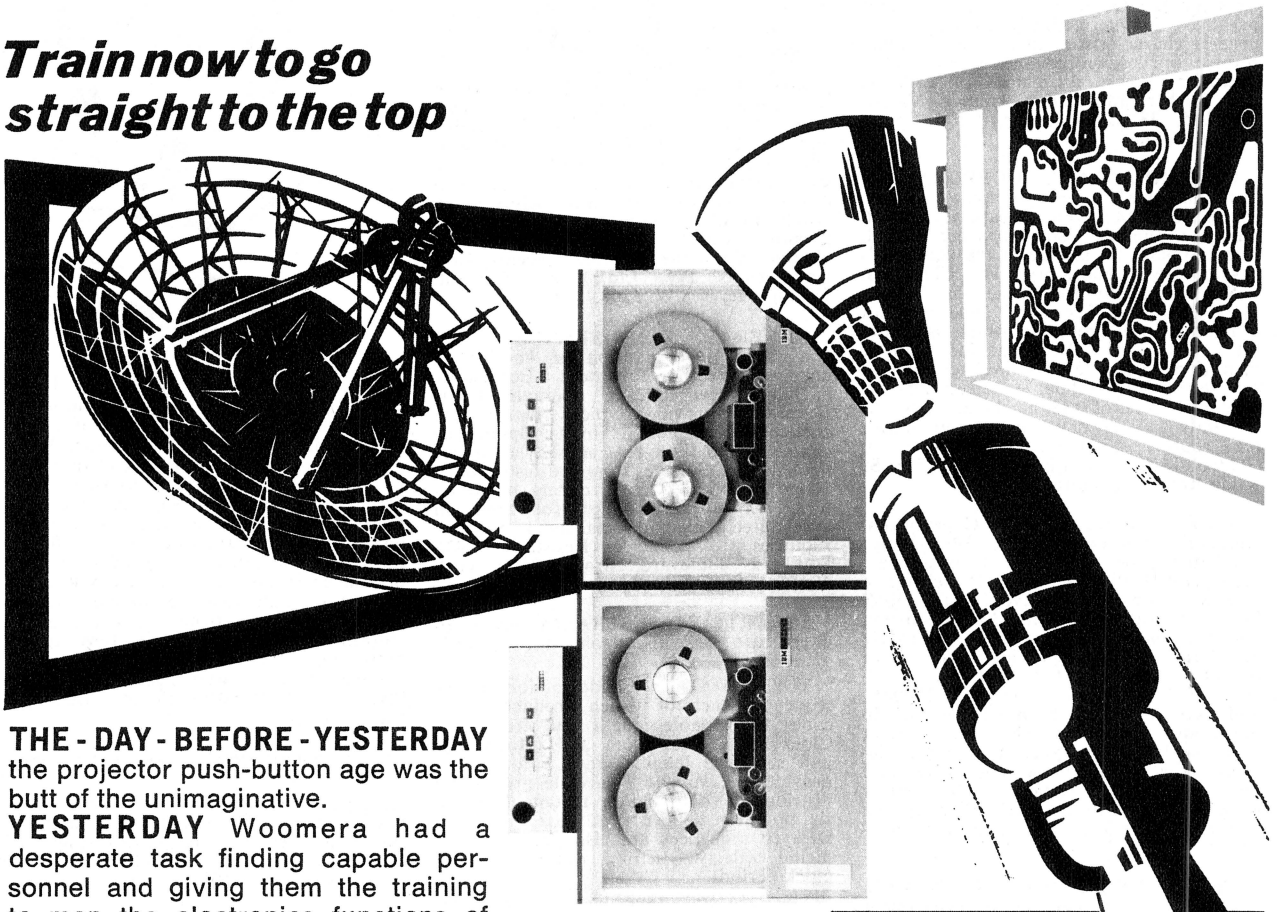
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TECHNICAL BOOKS AND PUBLICATIONS

Electromagnetics, Plasmas

ELECTROMAGNETICS AND PLASMAS, by James R. Wait. Published by Holt, Rinehart and Winston, Inc., New York, 1968. Hard covers, 6in x 9¼in, 144pp., diagrams. Price in Australia $8.40.

Not for the general technical reader, this one, but rather for the scientist specialising in plasmas and ionised gas physics. Based mainly on a series of graduate lectures given by Professor Wait at Harvard University, the book is essentially a monograph on linear electro-magnetic wave phenomena in bounded plasmas. One possible function envisaged by the author is to bridge the conceptual gap between the plasma physicist and the ionospheric worker.

For those to whom the book will be of interest, the chapter headings should give a good idea of the scope covered: 1—General Magnetoionic Theory; 2—Some Applications of Magnetoionic Theory; 3—Elementary Boltzmann Theory for the Dielectric Constant; 4—Radiation from a Dipole in a Warm Plasma; 5—Radiation from an Antenna in a Warm Plasma; 6—Boundary Effects for Waves in a Warm Plasma; 7 — Hydrodynamic Theory for Probes in Warm Plasma; 8—Waves in Inhomogeneous Warm Plasma; 9—Waves in a Warm Anisotropic Plasma.

While necessarily assuming a considerable background in both mathematics and physical theory, the book would appear to be clearly and concisely written. Each section includes a bibliography and exercise problems which are conceptually integrated with the exposition itself. The book ends with both subject and author indices.

For the specialist in the field concerned, and for the interested graduate student, a book worthy of your attention.

Our copy came from the local office of the publisher, Holt, Rinehard and Winston (Australia) Pty. Ltd., who advise that copies are available from local bookstores. (J.R.)

Lumped systems

LUMPED SYSTEMS, by Benjamin J. Leon. Published by Holt, Rinehart and Winston, Inc., New York, 1968. Hard covers, 6in x 9¼in, 223pp., many circuits and diagrams. Price in Australia $10.

A book for the graduate engineer, circuit analyst and postgraduate student. Author Dr Leon is Professor of Electrical Engineering at Purdue University, and wrote the book to provide an advanced text on the circuit theory and analysis of lumped-parameter systems.

The first of the three sections into which the book is divided consists of an analysis of lumped systems using the state-variables technique, and is intended both as a review for those with basic knowledge of the latter technique and as an introduction to the technique for those with the more traditional operational-calculus background.

The second section examines some important properties of lumped, linear, time-invariant systems, and also some important but not-often-examined properties of transforms. Finally the third section of the book extends the concepts previously given to a discussion of non-linear systems. The final chapter of this section deals with advanced non-linear system research topics of particular interest to the author, and it is suggested that if the book is used as a postgraduate course text, the lecturer could substitute for these topics of his own.

The background assumed by the book is reasonably advanced, as one might expect: virtually that of a recent graduate. However the text, while somewhat terse, would appear to be quite readable by those with this background. For those in this category seeking further knowledge of lumped systems theory and analysis, the book should therefore be worthy of serious attention.

Our copy came from the local office of the publisher, Holt, Rinehart and Winston (Aust.) Pty. Ltd., who advise that copies are available from local bookstores. (J.R.)

Integrated circuits

FUNDAMENALS OF INTEGRATED CIRCUITS, by Lothar Stern. Published by Hayden Book Company, New York, 1968. Hard covers, 7in x 10-3/8in, 198pp., many photographs and diagrams. Price in Australia $11.20.

This is the latest in the "Motorola Series in Solid-State Electronics" published by Hayden, and author Stern is Manager of the Technical Information Centre of Motorola Semiconductor Products Division. With experience both in engineering and in technical writing, he is apparently well qualified for writing a book of this type.

It seems to this reviewer that with "Fundamentals of Integrated Circuits," he has provided the first really well-written introduction to this subject at undergraduate-technician-advanced hobbyist level; it would certainly seem to be the best of such books seen to date. The text is clear and concise, the material presented is up-to-date, the many new terms and techniques involved in IC production are carefully defined and explained, and the illustrations are numerous and well-chosen. Not only this but the author has been able to strike a most pleasing balance between mathematical analysis and qualitative description, so that the book would appear to be equally suitable, and potentially as rewarding and satisfying for the inquiring undergraduate or technician as for the possibly more casual hobbyist.

In short, this book gives every evidence that it has been carefully planned and written expressly to enlighten and "communicate"; an achievement (perhaps an aim also) not often found.

There are twelve chapters, leading the reader logically from first principles to techniques and applications. The headings read: 1 — A New Era in Electronics; 2 — Basic Semiconductor Theory; 3 — Characteristics of P-N Junctions; 4 — Transistor Fundamentals; 5 — Monolithic Integrated Circuits; 6 — Thin-Film Circuits and Their Characteristics; 7 — Hybrid and Other Integrated Circuit Struc-

Basic electronics

BASIC ELECTRONICS (formerly "Basic Radio Course") third edition. Produced by "Electronics Australia" and published by Sungravure Pty. Ltd., Sydney. Paper covers, 11¼ x 7¼in, 128 pages, numerous diagrams and photographs. Price $2 or $2.20 posted.

In December, 1967, "Electronics Australia" introduced the first edition of "Basic Radio Course," to present in book form a series of articles published between August, 1963 and November, 1965. This has proved to be probably the most successful elementary radio text ever published in Australia. The initial printing sold out within a matter of weeks, necessitating the early printing of the second edition. When a third edition was planned towards the end of 1968, it was decided to up-date the contents by re-wording paragraphs and sections which were no longer appropriate. This edition has now been published under the new name of "Basic Electronics."

The purpose of the book is to give a basic insight into electronics in general, but more specifically to the aspects of it concerned with sound radio, television and sound reproduction. Those who work through this book will have a basic knowledge from which to progress to more specialised branches of the science of electronics.

The first seven chapters are concerned with basic theory, from such primary concepts as the nature of electric current and batteries through magnetism, inductance and capacitance (essential knowledge for an understanding of radio theory) to electronics, radio valves and semiconductors. Chapters 8 to 13 deal with the more practical aspects of radio transmission and reception, with examples of receiver design and power supplies. The remaining 10 chapters are entitled: Receiver Alignment — Measuring Instruments — Audio and Hi-Fi—Electronics Servicing—Radio Amateurs —Industrial Electronics — New Sets from Old Parts— A Transistor Receiver — Magnetic Recording (two chapters).

These chapters bear a close resemblance to those of the "Basic Radio Course" and it should be understood that large sections of the present book are identical with the earlier editions. Thus, those who already have one of the editions of the "Basic Radio Course" may not find it worth their while to buy "Basic Electronics." On the other hand, those seeking a first text as an introduction to electronics will find this book a very useful investment at the modest price of $2. The material is presented in clear and concise language, and although the explanations are presented in the simplest possible manner for the benefit of beginners, a high standard of technical accuracy has been maintained throughout.

Copies of "Basic Electronics" are available from the offices of "Electronics Australia" in Sydney and at the "Representation" addresses shown each month in the panel on page 1 of the magazine; also from some radio stores and technical booksellers. An advertisement for the book appears elsewhere in this issue.

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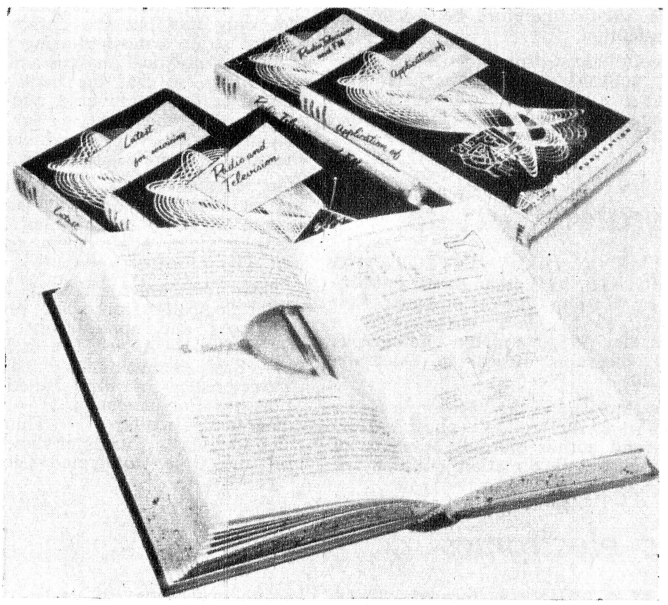
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E.A. March '69

tures; 8 — Integrated Circuit Packaging; 9 — Analysis of Standard Integrated Circuits; 10 —Practical Integrated Circuit Design; 11 — Monolithic Layout Principles; 12 —Large Scale Integration.

Most of the later chapters include many data tables and graphs, while the book itself ends with a useful glossary of terms and a topic and term index.

A book which can be commended unreservedly to anyone seeking a well-written introduction to integrated circuits. It should also be of considerable interest to university and technical college lecturers as a course text or reference.

Our copy came from Grenville Book Company, local agents for Hayden Books, who advise that copies are obtainable from all local bookstores. (J. R.).

Hi-Fi Loudspeakers

HI-FI LOUDSPEAKERS AND ENCLOSURES. Revised Second Edition. By Abraham B. Cohen. A Rider Series book, published by Hayden Book Company, Inc., New York. Stiff paper covers, 5¼ x 8¼ inches, 438 pages freely illustrated by line drawings, diagrams and photographs. Price in Australia $7.40. Hard cover edition $9.95.

The author of this book, Abraham B. Cohen, would appear to have had a long association with subjects acoustic, and with loudspeakers in particular. It would equally appear that he has industriously set out a great deal of the background information so acquired, giving no hint of any problem in filling 438 pages.

The material is largely descriptive in character and, as such, could be read and followed easily by technicians and hobbyists. If it presented any problem at all to the reader, it would not be from any technical complexity or a lack of lucidity in style, but simply by reason of the amount of material between the two covers.

After a short introductory chapter, the author devotes the seven following chapters and 140-odd pages to loudspeaker types, operation and construction. Naturally enough, the dynamic loudspeaker receives the most detailed treatment and just about every physical aspect is discussed — size, cone material, cone support, magnet structures, voice coil construtcion, cone design as related to frequency response, special purpose and multiple loudspeakers, and so on.

Cohen says most of the things that any veteran in the business would say, if they had had the time and opportunity to do so!

Part 2 of the book, involving a further seven chapters and over 100 pages, deals with enclosures. Again the materail is mainly descriptive and people who have been reading audio literature for as long as this reviewer will recognise most of the designs, diagrams, pictures, and opinions. Again, they are all there—baffles, boxes, horns, folded horns, labyrinths and, featured with almost old-world prominence, the vented enclosure and ducted port systems, with the familiar diagrams explaining how they should work.

Reference is made to the now popular sealed enclosure but necessarily cursory reading of the text left the impression that the author is a bit diffident about small enclosures, low-resonance, highly damped systems and the sacrifice that is entailed in acoustic efficiency—if that matters in these days of high-powered amplifiers!

Remaining sections of the book deal with the listening room, with stereo practice and with practical enclosure construction.

This is not a book for designers with an appetite for fundamental physics, but the

technician, hobbyist or sales representative who manages to assimilate a significant proportion of the material will have acquired a lot of useful and interesting background.

Our review copy came from Grenville Publishing Co. Pty. Ltd., 401 Pitt Street, Sydney, N.S.W., 2000. (W.N.W.)

Tape recording & Hi-Fi

TAPE RECORDING AND HI-FI by Douglas Brown. Published by Arco Publications, 1961 and 1968. Hard covers, 160pp 7¼ x 4¼ inches, mainly text. Price in Australia $2.60. Paperback edition $1.10.

To write a book which seeks to convey technical fact to non-technical hi-fi enthusiasts is quite a task. It has to make broad statements, without too many qualifications, if it is to convey an unambiguous message to the intended reader. But this very characteristic is likely to affront the more technical reader who knows very well that there are many notable and important exceptions to the broad rule.

As a professional audio man and writer, R. D. Brown has negotiated these hazards as well as most and better than many and his book could be read with interest and profit by those who are concerned with reproduced sound but whose knowledge of equipment is largely superficial. Not a book about circuits and design, it is written for the consumer whose interest is essentially confined to equipment units, connecting wires, control knobs and what to do with it all, when it is working.

After an introductory chapter on hi-fi, the following four chapters talk about record and tape equipment, its cost and its place in the home. Then follow three chapters which take a peek at "how it works," the rest of the book dealing mainly with the use of tape recorders — how, when, where and why. There are observations about tape clubs, copyright, taped commentaries and so on.

Scanning the book, one gains the impression that the author is more concerned and familiar with tape than disc and some of the observations about the latter subject are dated. He talks about "getting best reproduction from 78 rpm discs," the need to have a variety of recording compensation curves and the popularity of separate power amplifiers and control units; he advises readers to settle for good mono rather than mediocre stereo; he discusses flat baffles as if they were part of the hi-fi scene. Observations like these might have been appropriate enough ten years ago, when the text was probably prepared, but they scarcely reflect 1969 thinking in the world of stereo discs.

However, the book should not be panned too much on this account and, considering the modest purchase price, it must be rated as useful, readable and good value for those who are seeking some background in tape recording and hifi equipment. Our review copy came from Hicks Smith and Sons Pty. Ltd., 301 Kent Street, Sydney, 2000. (W.N.W.)

Successful D. J.

HOW TO BE A SUCCESSFUL D. J., by Kevin O'Gorman, M.A.I.A. Paper covers, size 10 x 8in, 57 pages. Price $2.00 plus 25c postage.

It must be obvious to anybody who listens to radio programs that there is a crying need for a book of this type. The shortage of good studio staff has led to the stereotyped announcer who begins every announcement with "Hi, this is . . ." and feels that the sure road to success is to adopt a quasi-American accent. These and other false ideas are dealt with by Mr O'Gorman in his short treatise on the work of an announcer. A good deal of more positive advice is given to guide the prospective announcer (or disc jockey, if you prefer).

Mr O'Gorman does not neglect to point out why radio stations are apparently content to put up with this state of affairs. The plain fact is, he explains, that there is a chronic shortage of good announcers. It follows that a good announcer will soon rise above the bad ones.

Mr O'Gorman's advice is concise and straight to the point. Within the 57 quarto size typewritten sheets he has at his disposal, he covers a considerable amount of ground, the chapters being: What is a D.J.? —Reading a Commercial —Developing your Personality —Using Personality on the Air —Voice Production — Outside Broadcasts — Gaining Experience — D.J. or Newsreader — Interviewing on Radio—Radio Stations, the Various Staff and Their Duties—Conclusion.

My knowledge of such matters is very limited, but I know what I like to hear, and it is perhaps significant that just about every one of my dislikes is roundly condemned by Mr O'Gorman, including that futile question that always makes me writhe in my seat — "What does it feel like . . . (to have won a fortune, to be father of quads, to win a world title, etcetera)." If every announcer took the words of wisdom to be found in this book to heart, individuality could again become the property of announcers. The book is available only by post, by writing to D. J. Book, Box 118, P.O., Clayton, Victoria 3168. (H.A.T.)

LITERATURE—in brief

TECHNICAL NEWS BULLETIN, Vol. 52, No. 11, November, 1968. Published by the National Bureau of Standards, U.S.A. Inquiries to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, U.S.A. Contents: Isotope Separator Laboratory; Peak Pulse Power Switch; Laser Applied to Molecule Kinetics Studies; NBS Studies Loss of Prestress in Concrete; NSRDS News; Cryogenic Flow Research Facility Established at NBS: Large Negative Ion Offers Key to Ionosphere; Standards and Calibration; Critical Two-Phase Flow Investigated; Standard Reference Materials; Conference Briefs; Publications of the National Bureau of Standards.

COMPONENTS REVIEW, Vol. 5, December, 1968. Published by Standard Telephones and Cables Pty. Ltd., Moorebank Avenue, Liverpool, N.S.W. 2170. Contents: Cold Cathode Numerical Indicator Tubes; Vacuum Capacitor; The ITT Engineers Kit; Morse Code Tutor; Application Note — 175MHz FM Transmitter Cascade Amplifier; Epoxy Fibre-Glass Laminate; Microwave Devices; Transmitting and Industrial Heating Valves; ISEP Modular Equipment; Silicon Photo Transistor PD32.

W. FOULSHAM & CO. LTD. published the following titles during the latter months of 1968. Copies should be available from technical booksellers or from the Australian agents, Grenville Publish-

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160	Coil Design & Constn. Manual	.85
161	Radio, TV, & Electronics Data Bk.	.60
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170	Transistor Circuits for Radio-Controlled Models	1.30
171	Super-Sensitive Transistor Pocket Radio	.60
172	International Radio Stations List	.45
173	Practical Transistor Audio Amplifiers	.60
174	Practical Subminiature Receivers	.85
175	Transistor Test Equipment and Servicing Manual	.80
176	Manual of Transistor Audio Amplifiers	1.00
177	Modern Transistor Circuits for Beginners	1.30
178	Comp.Radio Valve Guide Book No. 5	1.00
179	Transistor Circuits Manual 5	.85
180	British Semiconductor Survey	2.50
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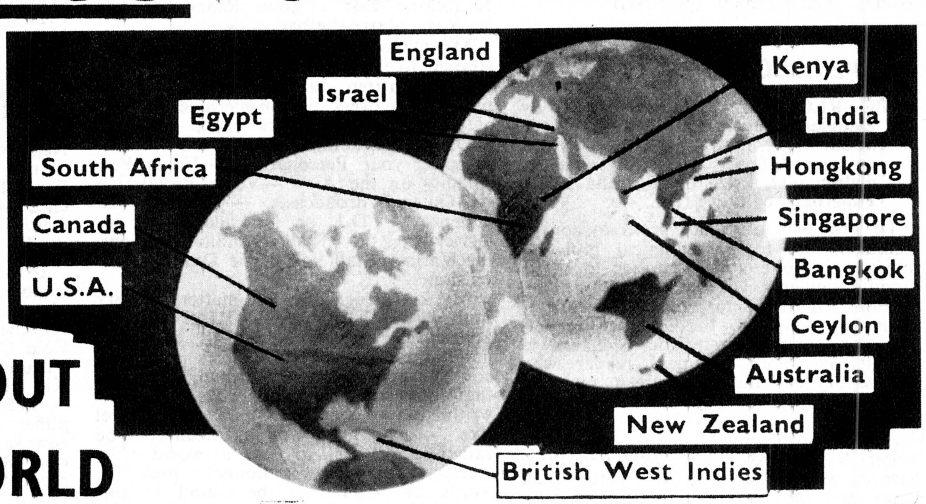
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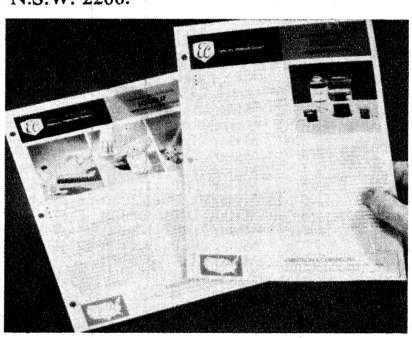
ing Co. Pty. Ltd., 401 Pitt Street, Sydney, 2000. Titles: AM-FM-TV Alignment; Handbook of Electronic Circuits; Practical Power-Supply Circuits; Symfact Guide to TV Servicing; Television Tape Fundamentals; ABCs of Electrical Soldering; Bench Servicing Made Easy, 2nd edition; Electrical and Electronic Signs and Symbols; Eliminating Engine Interference; Transistor Substitution Handbook, 8th edition; Transistor Fundamentals, No. 1 Basic Semiconductor and Circuit Principles, No. 2 Basic Transistor Circuits, No. 3 Electronic Equipment Circuits, No 4 Digital and Special Circuits.

MEASUREMENT NEWS, November/December, 1968. Published by Hewlett-Packard Australia Pty. Ltd., 22-26 Weir Street, Glen Iris, Vic. 3146. Contents: Pushbutton Network Measurements, 0.1-2GHz; The Probe That Lights When a Pulse Goes By; 2116B, Small Computer for Large Systems; Compact, Lab-Quality Square-Wave Generator; Computer-Controlled System for DC/AC/Ohms/Freq Measurements; Sweeping Wave Analyzer with Auto Ranging; Measuring Group Delay; Easier DC-40GHz Counts with New Digital Frequency Measuring System; Fast Digitally-Controlled Power System; New Note on SRDs; 10MHz Selective Voltmeter; HP Spectrum Analyzer.

VARIAN, Industrial Microwave Operation, San Carlos, California U.S.A., has published a new bibliography on works dealing with industrial applications of microwave energy. The 36-page brochure describes books, articles and papers on a wide range of subjects covering many aspects of theory and applications. Included are microwave heating theory; effects of microwave radiation; loss factors and dielectric constants; and processing plastics, sheet materials, foods, and chemicals. Inquiries to Varian Pty., 38 Oxley Street, Crows Nest, N.S.W. 2065.

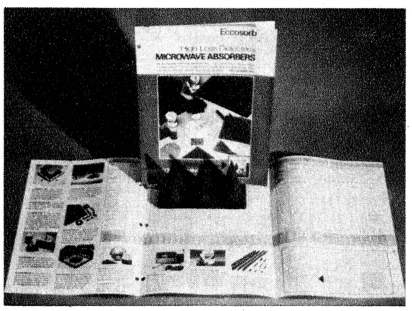
NEW ELECTRONICS FOR MEASUREMENT, ANALYSIS, COMPUTATION, Autumn, 1968. Published by Hewlett-Packard Co., Palo Alto, California, U.S.A. Inquiries to Hewlett-Packard Australia Pty. Ltd. 22-26 Weir Street, Glen Iris, Vic. 3146. Contents: summary descriptions of the company's products introduced during the later months of 1968. Products described include: computers and auxiliary equipment; test instruments, including meters, oscilloscopes, generators and recorders; components, including transistors, hybrid integrated packages, photocells, step recovery diodes and indicators; modular instrumentation; special purpose equipment.

EMERSON & CUMING INC. Canton, Massachusetts, U.S.A., has published two technical bulletins. Bulletin 7-2-17 describes three Eccostrip products useful for disintegration of organic polymers, including epoxies, urethanes, silicones, polyesters, etc. The bulletin gives instructions for use and selection of best product for typical stripping problems. Bulletin 20-12 describes four Eccoslip products useful in preventing the bonding of epoxies to various surfaces. The bulletin gives application information and helps in selection of the correct type for typical uses. Inquiries to the Australian agents: IRH Components Pty. Ltd., The Crescent, Kingsgrove, N.S.W. 2208.



INDUSTRIAL RESEARCH NEWS, No. 73, January, 1969. Published by the Commonwealth Scientific and Industrial Research Organisation, 314 Albert Street, East Melbourne, Vic. 3002. Contents: New upgrading process for ilmenite; $100,000 freeze drying plant; Cheese-making machine in production; Model demonstrates technique; Additive for bitumen.

HIGH-LOSS DIELECTICS AND MICROWAVE ABSORBERS. Published by Emerson & Cuming Inc., Canton, Massachusetts, U.S.A. Available from IRH Components Pty. Ltd., The Crescent, Kingsgrove, N.S.W. 2208. Contents: application and performance data for 16 material product lines, useful for trans-



mission line components, reduction of surface waves, reduction of mutual coupling between adjacent elements of antenna arrays, and reduction of reflections. The dielectric data presented is complete enough for a designer to design and build his own free space or transmission line absorber for special applications.

NEW TECHNOLOGY, No. 24, January, 1969. Published by the British Ministry of Technology and the Central Office of Information. Inquiries to the Central Office of Information, Hercules Road, Westminster Bridge Road, London SE1, U.K. Contents: ACTP—Britain's Computer Club; Torres Aids Supermarket Wet Fish Sales Drive; Warren Spring Know-How Keeps "Loose" Materials Moving; International Harmony of Primary Standards; News; Sharp Rise in Shipbuilding Orders.

TELECOMMUNICATION JOURNAL, Vol. 36, No. 1, January, 1969. Published by the International Telecommunication Union, Place des Nations, 1211 Geneve 20, Switzerland. Contents include : Essential characteristics of the metal sheaths of trunk cables for protection against external electro-magnetic fields, by M. I. Mikhailov and L. D. Razumov; A simplified method for calculating the supplementary attenuation due to auroral absorption for distances less than 4000KM, by P. Bronzini; There is always a substitute for spectrum, by H. J. Levin — this studies the economics of radio spectrum allocation amongst competing claimants and of alternative systems which do not use the radio spectrum.

The "Union activities" section includes the sixth of the series "The story of ITU technical co-operation" the subject being telecommunication training in Iraq. Under the heading of "Ideas and achievements" are described the Nigerian microwave and VHF networks, a survey of medium wave propagation in tropical Asia, and a new marine radar.

RAYTHEON COMPANY, Lexington, Massachusetts, U.S.A. has published a four-page booklet describing its microwave multiplier diodes. Inquiries on company letterhead to Auriema (A'asia) Pty. Ltd., 443 Kent Street, Sydney, 2000. Five units in the MS-5000 series are described in operation in x10 and x2 multiplier circuits with typical and maximum electrical specifications. The extensive testing of the units during manufacture is also explained.

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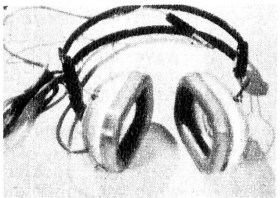
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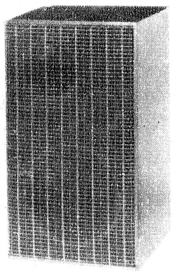
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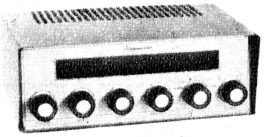
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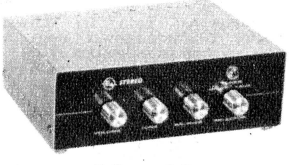
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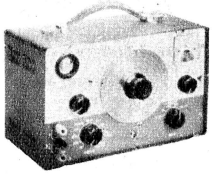
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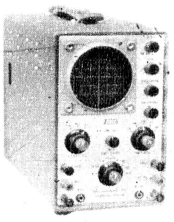
T. E. 46 RESISTANCE-CAPACITANCE

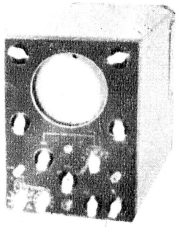
Bridge and Analyser. Capacity 20 pf to 2,000 mfd. Resistance 2 ohm to 200 megs. Also tests power factor, leakage, impedance, transformer ratio, insulation resistance to 200 megs. at 600V.

Indications by eye and meter.

$49.75

TEST EQUIPMENT



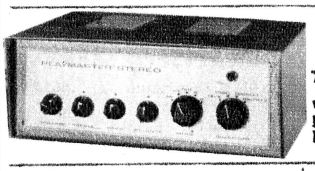


WIDE BAND OSCILLOSCOPE

5 Meg. Bandwidth Push-pull vertical and horizontal Amplifiers, 8 positions, high sensitivity vertical Amplifier, Frequency Compensated on all positions. Calibrated .02 to 600 volt. Hard time base, 20 cycles to 75K. Latest American R.C.A. circuitry. Complete with probe.

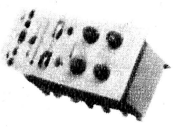
3-inch $102.75; 5-inch $118.75

T.O.2 2 INCH TV AID $64.50



PLAYMASTER 115

The new solid state Stereo-Amplifier. April issue.
Wired and tested $104.00
Kit Set $90.00
Pre-amp to suit magnetic cartridge 12.00



119 STEREO TAPE ADAPTER

Suits all Playmaster Stereo amplifiers and others that accept crystal P.U.

Kitset $79.00
Wired and tested $96.00

TAPE PLAYBACK KITSET

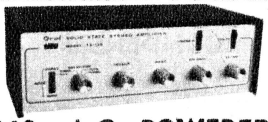
BSR deck with parts for transistor pre-amp and circuit.

$30.00

Post $1.25 N.S.W., $2.00 Interstate.
Easy to build. Mi-Fi quality.

TAPE DECKS B.S.R.

2 Track, 3¾ i.p.s.
$25.50
4 Track, 3 Speed Stereo.
$41.50



240v A.C. POWERED SOLID STATE STEREO

T.S.135

18 Transistor. 15-watt per channel. Inputs for Tape, Mag. P.U. Ger. P.U. Radio Aux. Frequ. Range 30c to 20KC. Max Sensitivity 3 MV. Speaker matching 4 to 15 ohms.

$78.00



A.2C. STEREO AMPLIFIER

5 WATTS PER CHANNEL.

Valve Unit. 240v A.C. Input for Crystal and Ceramic P.U. Radio and Auxiliary. Output for 4, 8, 15 ohms. Cross talk better than -40db. Sensitivity 50 MV.

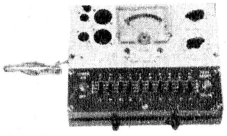
$47.50

UA 41A - 20-20

SOLID STATE STEREO

20 watts per channel. Inputs for tape, magnetic and ceramic P.U. Tuner and aux. Teak cabinet.

$88.00



VALVE TESTER

Tests all valves, diodes, rectifiers, checking filaments, shorts, Merit on direct reading. Good-bad meter. Complete with tube chart.

$27.75

Post., N.S.W., 25c: I'state. $1.25.

T.E. 50-99-5011

Checks, Nu Vistas, Compactrons, etc.

$34.95

Post: N.S.W. 25c: I'state $1.25.

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Post., N.S.W., 50c: I'state, 75c. T.E., 15 Transistorised, 7 Band, 360 Kc to 270 Megs.

$35.75

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E.A., Dec.
Wired, Tested.
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De Luxe Model TE—22D. Freq. range, Sine 20 cps—200 KC. SQ. 20 cps—25KC. Output voltage, Sine 7V. SQ. TV P.-P. Output impedance 1000 ohms. Acc. 5 per cent, Distortion less than 2 per cent. 4-range attenuation. 1/1, 1/10, 1/100, 1/1K. Printed circuit. 240V A.C.

$42.95

SIGNAL INJECTOR

Transistorised. Fountain pen-sized Unit for Signal Tracer in Radio, TV and Amplifier Service.
$5.75. Post. 25c.

TRANSISTOR AND DIODE TESTER

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Wired and Tested.
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KIT SET $48.00

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1 K.W. 2 to 20 Megs.

Rack mounted. Fully metered. Complete with vales and power supply.

New condition.

Ideal for SSB final.

Industrial heating, welding, etc.

Final — 4 x 813.
Modulator 2 x 813.
Weight approx. 10 cwt.

$125.00

NEW VALVES

1A3	75c	6AM5	75c
1A5	75c	6AN5	$1.25
1C5	75c	12SK7	80c
1C6	$1.25	12SL7	$1.25
1C7	50c	47	$1.25
1D5	55c	76	75c
1F5	$1.00	84/624	$1.25
1G4	75c	723A	6.00
1H5	75c	809	$1.75
1H4	75c	813	$7.00
1J6	$1.25	289B and Socket	$5.75
1K7	50c	866A	$1.50
1L4	50c	954	50c
1M5	50c	956	50c
1N5	75c	1603	50c
1Q5	50c	1616	50c
1S5	75c	1619	$2.00
1T4	$1.00	1629	50c
6AK6	75c	1050	$2.00
6AR6	$1.25	9006	50c
6AS7	$2.00	AV11	25c
6B6	75c	CA19	$10.50
6B8	75c	CK1013	$1.50
6BF6	$1.00	CV63	75c
6C8	75c	CV66	75c
6F6	$1.00	CV1102	75c
6G6	75c	CV1133	75c
6G8	$1.50	CV1136	75c
6J6	$1.00	EBC33	75c
6J7G	75c	EC70	40c
6J8	$1.75	ECH33	$1.50
6K6	75c	EF36	75c
6K7	50c	EF37	75c
6N7	75c	EF39	75c
6SA7 Metal	75c	EF72	40c
6SC7	$1.00	EF73	40c
6SH7	40c	EK32	$1.50
6SJ7	95c	EL91	$1.00
6SK7	$1.25	EM35	75c
6SN7	75c	KTW62/6U7	75c
6SS7	$1.25	RD27	$1.50
6X5	75c	VR65	80c
7C5	50c	VR75/30	$1.50
7N7	75c	VR105/30	$1.50
7W7	50c	VR150/30	$1.50
12A6	50c	VT502	$1.25
12AT7	$1.00	32	$1.00
12BE6	$1.00	45	$1.00
12C8	$1.25	37	$1.00
12SJ7	$1.25	49	$1.00
2A3	$2.00	CL4	$1.25
2C26	75c	EM1	$1.25
2X2-879	50c	TZ40	$1.00
3A4	$1.25	6AB7	75c
3B7	$1.00	6C6	$1.25
3D6	$1.00	6SC7	75c
5X4	50c	7A6	75c
5Y4	50c	9006	50c
5Z4	$1.00	6L6	$1.50
6AC7	75c	6AK5	75c
6AG5	95c	807	75c
6AG7	$1.00		
6AJ5	50c		
6AL5	75c		

GENEMOTORS

Input	Output		
12v 600v	300mA	New	$11.00
12v 1200v	200mA		$13.00
24v 540v	200mA	New	$4.00
24v 300v	250mA	New	$5.50
12v 275v	110mA		$7.50

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SIZES ⅝in, ¾in, ⅞in, 1in, 1⅛in with tapered Reamer and Carry Box.

$5.75

Post 50c. Interstate $1.00.

NEW POWER TRANSFORMERS

240-10V 1.3KA Auto	$21.00
124V Doubler 300MA	$6.75
130V Doubler 400MA	$7.75
145V Doubler 450MA	$9.75
150 x 150, 30 M.A.	$3.75
225 x 225, 50 M.A.	$4.25
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150v Doubler, 600 M.A.	$12.75

TYPE 62 TRANSCEIVERS

2 to 10 megs. NEW

$49.50

RELAYS

6V, 3-pole Miniature	$1.50
12 volts, DPDT, 5 amp	$2.00
12 volts DPDT	$1.25
100pf TX var. condensers	$1.00
Hi-speed Polarised relay	$5 00
2000 ohms	$1.25
1000 ohms	$1.25

PADDED DYNAMIC HEADPHONES

100 ohms — $3.00

With 50 ohm. Dyn. Mic.

$4.50

Post 50c.

OIL FILLED CONDENSERS

.5mfd 600V	35c
2mfd 600V	65c
1mfd 600V	65c
4mfd 600V	65c
4mfd 2.5K	$3.00
1mfd 3000V	$1.70
.5mfd 5K, .1 5K, .1 3K AC	
.25 4K, .5 2½K, ea.	$1.50
4mfd 3000V	$3.50
2mfd 3000V	$2.50
1mfd 3000V	$2.00
1.25mfd 600V	$4.50
mfd. 4000v.	$3.00
2 mfd. 2000v	$1.50
4 mfd. 1500v.	$1.50
1 mfd. 1500v.	$1.00
8 mfd. 60v.	$1.00
1 mfd. 1000v	$1.00

PYE

EX-TAXI RECEIVER.
Complete All valves, speaker, Mic.
Clean condition.

$32.00.

NEW C.R.O. TUBES

3AP1-906 3in	$2.75
CV112 5in	$2.00
VCR97 6in	$3.75
ACR10/VCR139A 3in	$3.00
CV1522 1¾in	$2.25

LIGHTING PLANTS

Johnson 1 h.p. Engine.
12V. 30 amp. Generator.
New condition. Tested.

$72.00

NEW HEADPHONES

5 Ohm	$2.25
2000 Ohm	$2.25
4000 Ohm	$2.50
American Lightweight	$1.25
Lapel Crystal Mikes	$1.25
Crystal Mikes with switch	$1.50
Telephone Contact Pick-up Units	$1.50

Post 25c pair.

100 YDS HOOK-UP WIRE

10 Assorted Colours.

$1.00

Post 25c

TYPE 1935 V.H.F. TRANSCEIVER

100 to 155 megs. New condition.

$29.75

BENDIX FREQUENCY METERS

New, factory fresh. Modulated units. With A.C. supply.

$75.00

TRANSISTORS

2N174	$5.00
2N422	$4.50
2N441	$4.00

High-powered units for 75-watt audio, 200-watt power units or transistor ignition.

2 H.P. ENGLISH

J.A.P. PETROL ENGINES.
Tested. Perfect order

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300W to 15V.
Tested. Perfect order.

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PORTABLE TRANSCEIVERS.
38 to 60 megs. RT.76/GRC.

$21.00

S.T.C.
F.M. TRANSCEIVERS.
Ex-Fire Brigade
Excellent condition.

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Signal Generators.
Laboratory Standard.
150 K.C. to 25 Megs.

$49.75

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LABORATORY MODEL.
Tested. New condition.

$99.00

COSSOR - 1049 DOUBLE BEAM

$170.00

NEW MOBILE R.F. LINEAR AMPLIFIERS

2 to 10 Megs.
200 Watt P.E.P. 12v Power supply.
Easily converts to other bands.
Suitable for SSB.
Silver. Variable. Inductance.
Sufficient reserve power for exciter.

$15.00

No. 19 TRANSCEIVERS

2 to 8 megs. 15 valves.
New condition.

$19.75

COMMUNICATIONS RECEIVERS

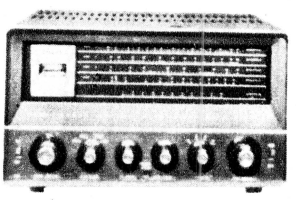
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A.R. 88	$199.00
3-BZ	$55.00
8C New	$90.00
A.R.7	$105.00
SX-28	$175.00
B-28	$125.00

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Communications Receivers.
Test equipment. P.A. Gear.
Large or small surplus stock.
Best prices. Call, write or phone any time.

NEW ELECTRO-STATIC 5KV VOLT-METER $49.00



NEW TRIO JR-200 KITSET

Dial assembled. Components mounted. Full instructions and circuit Complete in every detail. Freq. 550 Kc—31 Mcs, 4 bands. Electrical bandspread. A.N.L.-B.F.O.-A.V.C., M.V.C.-S meter R.F. Stage.
7 valves.
240v A.C Operation.

$95.00

Also available wired and tested, including matching Speaker and Cabinet.

$15.00 extra

AMATEUR BAND NEWS AND NOTES

Unlicensed transmitters raided in Sydney

Early in January, New South Wales Police and officers of the Postmaster-General's Department, Radio Branch, took action against operators of unlicensed radio transmitters.

By Pierce Healy, VK2APQ*

Sydney newspapers on January 12 and 13 carried headlines and reports on raids made by police and Radio Branch officers on 13 homes in various Sydney suburbs. During the raids a number of unlicensed radio transmitters were seized.

The operation, carried out simultaneously at a number of locations within the Sydney metropolitan area, was the culmination of intensive investigation by members of the P.M.G. Radio Branch. The investigation had been intensified following complaints of interference caused to emergency radio communication links during the recent bush fires in the Blue Mountains.

Police had also investigated a report that the life of a rigger had been endangered by false information being fed to him while in radio communication with the ground crew. It is not known if the interference to the emergency communication net was intentional or if those concerned in the raid were involved in these two instances.

Those questioned in the raids were referred to as "radio hobbyists" and were said to be operating on frequencies in the 27MHz band which is set aside for industrial and such short-range commercial communication requirements.

According to the "Sydney Morning Herald": "The raids included homes in Riverwood, Sylvania Heights, Birrong, Greenacre, Cowan, Granville and Bankstown. The raiding parties used direction-finders and other equipment to locate the transmitters. P.M.G. officers had been monitoring the transmitters for some time."

Under the Wireless Telegraphy Act, a fine up to $1,000 can be imposed on an operator who illegally uses a radio transmitter and the equipment can be forfeited. It is believed that the equipment being used was, in general, imported hand-held walkie-talkie units, which, under normal conditions and use, have a very limited range. However, due to sunspot activity and the use of more effective aerials, much greater range can be achieved and contacts have been reported as being made in some instances with the United States, South America, New Zealand, the Arabian Gulf and other international areas.

Similar equipment is widely used in the United States of America under what is known as Citizen Band permits. It is reported the Federal Communications Commission of the U.S.A. is concerned because of the improper use in some quarters, of this facility.

In Great Britain, the British Post Office is taking steps to prevent certain types of these units being sold to the general public, and regulations have been gazetted in regard to the licensing and use of approved types of low-powered transmitting equipment.

In Australia, Radio Telegraph Regulations do allow the licensing of certain types of hand-held units on a specified frequency. Details of these regulations may be readily obtained from the P.M.G. Radio Branch in all capital cities and major country centres. Officers of the department will provide persons desirous of using such equipment with full details of the conditions under which legal operation is permitted.

However, any action taken by the authorities to curb the activities of persons who operate unlicensed transmitting equipment, can only benefit the community generally. Such action is designed to prevent possible sources of interference to public utility, broadcasting and television services. It also helps to curb activities that tend to bring discredit to members of the amateur service who, over the years, have provided substantial assistance in times of emergency and who provide educational facilities and assistance to students who wish to extend their knowledge of radio and electronics.

It should be pointed out that the use of unlicensed radio transmitters is not condoned by amateur radio societies anywhere throughout the world. Therefore, such instances at these should not be connected with amateur radio and the legitimate use of amateur frequency allocations by licensed operators.

In a number of countries, provision is made in the national licensing regulations for various grades of licences to be issued. These are designed to assist those interested in furthering their knowledge in radio communication. Amateur radio societies, through their educational facilities, assist those with a genuine interest and desire to become licensed radio operators.

For many years in the U.S.A. there has been a system of novice licensing, and during 1968 the British Post Office announced their intention of issuing a similar form of licence.

In Australia the Wireless Institute of Australia has submitted proposals to the Postmaster-General that a novice type licence be introduced, but without success. Leaders in the W.I.A. Youth Radio Scheme have expressed an opinion that the introduction of the novice licence would provide a very practical means of gaining operating skills for members of Y.R.S. clubs while they are still studying for the full licence.

The extensive present day use of radio communication and the terrific impact the advances in the field of electronics has had on the everyday life of the community must excite the interest of all age groups. Therefore it is conceivable that a review of present day attitudes to what could be termed "Push-button talk-power" would provide answers that would encourage many more to obtain licences and not resort to illegal operation that may not be in the interest of the community generally.

It should therefore be considered that the term Novice Licensee would only apply to students. While the greater number of those interested may be in the younger age group, such a licence could provide an element in adult education schemes. No doubt the authorities will fully investigate the extent to which groups of illegal operators may have been encouraged by activities in other countries and seek the co-operation of other administrations in curbing such practices.

For those wishing to continue with their transmitting activities, but in accordance with the regulations, the facilities available through the Wireless Institute of Australia will enable them to obtain their amateur licence.

W.I.A. POLICY—NOVICE LICENCE

(a) Morse Code test, 5 words per minute.

(b) Elementary examination in Radio Theory (at a lower standard than required for the A.O.C.P.)

(c) Operation allowed on 3.5MHz, 27MHz and 28MHz using CW only and crystal controlled.

(d) Power maximum 10 watts.

(e) The A.O.C.P. exam must be taken by the end of 12 months, the licence not to be renewable except at the discretion of the P.M.G.'s Dept.

Note: The 27MHz band referred to is 26.96MHz—27.23MHz.

*** News and notes of Divisional and Club activities submitted for inclusion in these columns should be forwarded direct to Pierce Healy, 69 Taylor St., Bankstown, N.S.W., 2200.**

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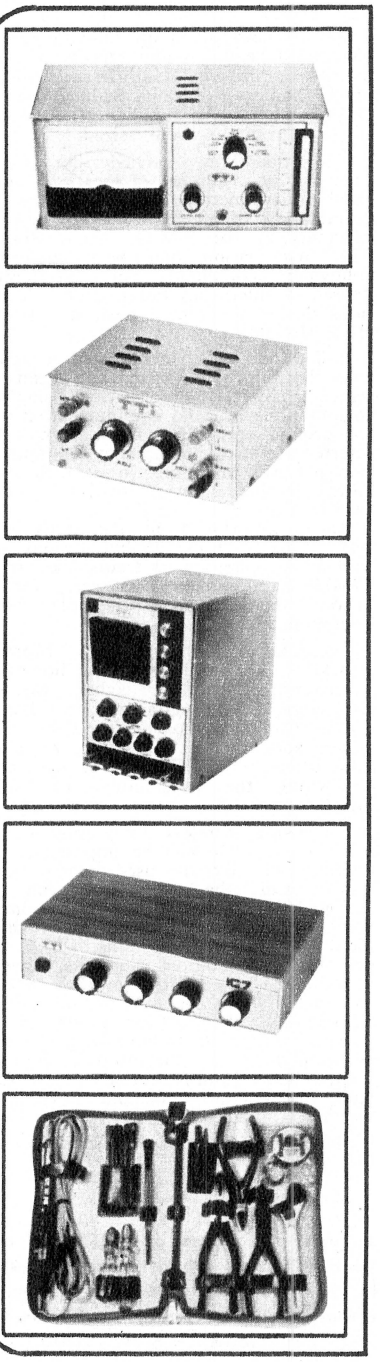
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WIRELESS INSTITUTE ACTIVITIES

The thirty-third Federal Convention of the Wireless Institute of Australia will be held in Canberra over Easter weekend, April 4 to 7 inclusive.

The original plan to hold the 1969 convention in Perth, Western Australia, was changed after the views of all Divisions had been expressed through the Federal Council and negotiations between Federal Executive, the New South Wales Division and the Canberra Radio Society.

Requests have been made to members of all Divisions of the Institute by the Divisional Councils, to submit details of any proposals relating to policy, administration, Region III I.A.R.U., I.T.U. and contests which they consider should be included as agenda items for the forthcoming Federal Convention.

NEW SOUTH WALES

At the January meeting of the New South Wales Division, the annual election for the office of Federal Councillor was held. Pierce Healy, VK2APQ, was elected unopposed, this being his ninth consecutive year to represent New South Wales at Federal Conventions. Also at the meeting, two presentations were made. The first was to Eric Warren, who had been awarded the prize for the Best Guest Lecturer of the year. The second was the Adams Trophy, awarded to Hans Ruckert, VK2AOU, for the best article by a member of the New South Wales Division, published in the W.I.A. magazine "Amateur Radio."

Convention Weekend

The Annual Convention and Field Day of the Division has been transferred from the Australia Holiday weekend to Sunday, March 23. The change has been made this year so that those attending may have the benefit of the March weather generally milder than that experienced in the Januarys of past years.

A full program has been prepared for the weekend, which will commence with the Annual General Meeting on Friday night, March 21. It should be noted that the monthly meeting has been brought forward one week.

On Saturday afternoon, March 22, a meeting of the area officers, invited to attend by council, will be held at Wireless Institute Centre, Crow's Nest. This will be followed by the annual dinner on Saturday evening at Windsor Gardens, Chatswood.

The convention-field day will be held at the Division's transmitting station, Quarry Road, Dural, on Sunday, March 23. A resume of the program is as follows:—

9.30 a.m.-10.30 a.m.: Mobile Scramble en route to VK2WI Dural (known as the Bob Winch Memorial Scramble).

10.30 a.m.: Registration.

11 a.m.-11.30 a.m.: VK2WI Divisional news broadcast.

11.30 a.m.-12.30 p.m.: Hidden transmitter hunt. Separate transmitters on 28MHz; 52MHz; 144MHz AM; 146MHz FM bands.

12.30 p.m.-1.30 p.m.: Lunch — visitors to bring their own picnic basket.

2 p.m.-3 p.m.: "Talk Tour" event around Dural using 7MHz, 52MHz and 144MHz bands. All instructions and questions will be given by radio.

3.30 p.m.-4 p.m.: Pulsed 144MHz "sniffer hunt." The transmitter will be pulsed on for one second and off for three or four seconds.

4 p.m.: Prize giving.

Attractions at Dural will include:

WICEN VHF mobile equipment clinic for out of town members. VHF Group display of amateur television including on air signals.
Display of VHF equipment.
Trade displays of amateur equipment.
Quizzes: Morse Code copying contest.
DX-type quiz.
Gents' quiz.
Ladies' quiz.
Morning and afternoon teas will be supplied.
Soft drinks and ice-creams.
809—for dehydration.
Raffles, gate prizes and lucky dips.

A small entrance fee will be charged. Come to Dural and renew acquaintances, meet old friends and participate in the art of eyeball QSO'ing.

Full details regarding the Annual Dinner may be obtained from the Administrative Secretary, Wireless Institute Centre, 14 Atchison Street, Crows Nest, 2065.

1296MHz Record

An Australian record for a two-day contact on 1296MHz was made on Sunday, January 5, 1969. The record now stands at 71 miles and was established by Dick Norman, VK2ZCF, operating portable at Shooters Hill, about 15 miles south of Oberon, in the Blue Mountains, to the west of Sydney and Bill Cox, VK2ZAC, at his home location in Narwee, a suburb of Sydney.

The equipment used by Dick, VK2ZCF, at the portable location consisted of: Antenna — ten-turn helix, one wavelength spacing and a solid metal reflector. The transmitter, a varactor multiplier with a power output of 9 watts, driven by a FM transmitter of 13W output at 432MHz. The receiver, a crystal locked converter fed into a tuneable IF channel.

The equipment at VK2ZAC's consisted of a quad-helix antenna 35ft above ground fed from a 7W output transmitter. The receiver was a crystal-locked converter ahead of a BC348 receiver.

Signal reports exchanged were: VK2ZAC was readable four, signal strength five and VK2ZCF was readable five, strength six.

Prior to this two-way contact, Dick, VK2ZCF, had on Saturday, December 28, 1968 established a 65-mile two-way contact with Barry Gerdes, VK2ZAH, at Hornsby. VK2ZCF was at that time being operated portable at Mount Gibraltar near Bowral, N.S.W. The portable equipment was the same as that described while Barry VK2ZAH was using a 4-foot dish antenna fed with 8W output from a 2C39. A crystal locked converter was used ahead of a much-modified BC348 receiver. Signal reports were: VK2ZAH readable five, strength six; and VK2ZCF, readable five, strength five.

Both these contacts were in excess of the distance of the 46.8-mile contact established in 1963.

Stations active on 1296MHz in the Sydney area are:

Bill Cox	VK2ZAC
Barry Gerdes	VK2ZAH
Dick Norman	VK2ZCF
Horrie Lapthorn	VK2HL
Phil Lockley	VK2ZPT
Ross Usher	VK2ZRU

Amateur Televion

Since the article on amateur television (ATV) was prepared, further progress has been made by the enthusiastic Sydney group. Grahame Wilson, VK2ZGW/T, reports that the first two-way ATV contact has been made in Sydney between Barry Gerdes VK2ZAH/T at Hornsby Heights and Vic Barker, VK2ZVV/T at Epping, a distance of a little over eight miles.

The final amplifier of Barry's transmitter was a QQE02/5 tube giving an output of two watts on 432MHz. Vic's transmitter had an output of 30W. Both signals were quite readable, despite a little noise. Another achievement is the reception by Lance Phillips, VK2ZKP, located at Granville, of Barry's television transmissions, the distance being 13 miles and at excellent signal strength.

A sidelight to that report is that Lance's wife, who had not seen Barry for some considerable time, recognised him from the televised picture being received. Contact was maintained with VK2ZAH/T on 144MHz from VK2ZKP, while intercarrier sound was used on the ATV transmission.

Signals from VK2ZVV/T are also being received by Lance, VK2ZKP, and Horrie Lapthorne, VK2HL/T, at Artarmon.

Another member of the ATV group, Richard Carden, is building a closed-circuit system. His philosophy is that when he has the system working to perfection, TV station standards, he will then go to air. The equipment he has built to date includes cameras, sync pulse generators and electronic test signal generators.

As items such as camera equipment, vidicons and photo-multipliers are rather scarce at reasonable prices, the members of the group are interested to hear of any local sources of supply.

Those wishing to make contact with members of the New South Wales VHF and TV Group are invited to attend meetings held on the first Friday of each month at Wireless Institute Centre, 14 Atchison Street, Crow's Nest.

REGION 1 NEWS

The International Amateur Radio Union Region I Division, plans to hold a conference in Brussels during the week commencing May 4, 1969. Arrangements are being made by the executive committee of the Belgian national society (U.B.A..)

The conference will be held in the Hotel Metropole, Brussels. It appears certain that the World Administrative Radio Conference to be held in the latter part of 1970 or early 1971, will be discussed at the conference.

Czechoslovak Golden Jubilee

During the period from October 1 to December 15, 1968, 410 Czechoslovak amateur radio stations were authorised to use the prefix OM instead of OK. To those who made contact with any of the stations using the OM prefix, special QSL cards will be sent.

The use of the prefix was to commemorate the Golden Jubilee of the formation of Czechoslovakia as an independent State on October 28, 1918.

Algeria

A very strict embargo on the transfer of funds for the purchase of radio equipment from abroad restricts the number of licensed radio operators in Algeria. At the present time there are only 15 licensed stations. Seven are held by Algerian nationals who have been issued with the prefix 7X2, five by foreigners (7X0) and three by club stations who use the 7X2 prefix followed by three letters.

The prefix 7X3 is available for the area of the Sahara, but no licences have been issued. Five of the stations are very active on 144MHz and contacts have been made across the Mediterranean Sea to France, Italy and Spain.

Bulgaria

To help instructors in amateur radio at district radio clubs, a 15-day seminar was held in Sofia, Bulgaria, during November, 1968. The seminar was designed to improve methods of teaching the theory of electronics. Constructional practice, VHF operating contests, fox-hunting as well as the organisation, conducting and judging of competitions were among the aspects discussed. A number of practical projects were also included.

FAMOUS ACUFINE AND DIAFINE

Film developers



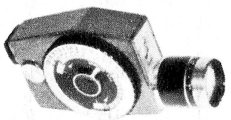
ACUFINE—For high resolution and finest grain. A maximum acutance, ultra fine grain film developer combining optimum quality with the highest effective speeds currently available with single solution developers. For instance ASA 125/FP3 Film is indexed at ASA 250 with Acufine development of 3½ minutes at 70 deg. temperature.

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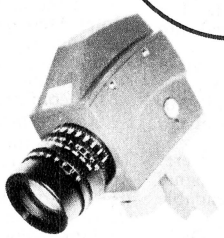
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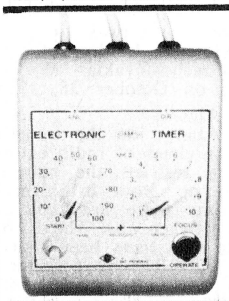


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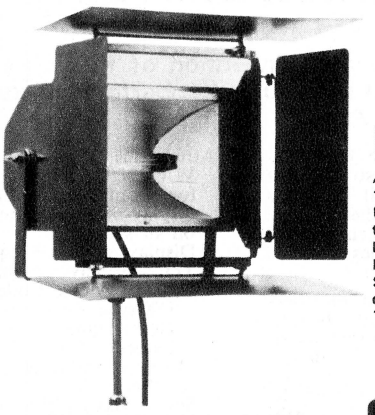


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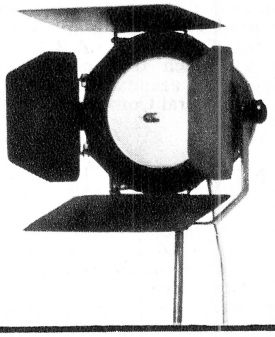
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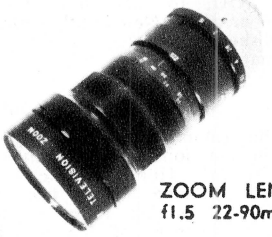
Beam 55 deg. with 800 watt. 4-11/16" long lamp. One stop stronger than broad beam. Light and portable. Heat-insulated handle, fully tiltable. Lamp head **$29.95.** Stand **$21.75.** Barn doors **$13.90.** G.E. lamp, 250 hours, **$13.50.** Jap. Ushio lamp **$7.80.** All prices plus Tax.

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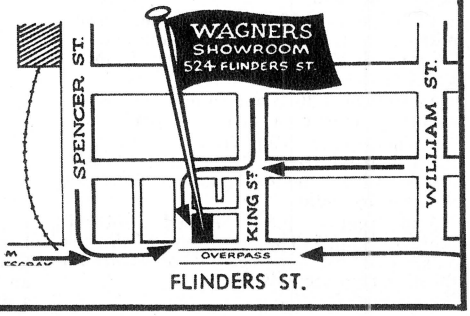
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During December, 1968, each of the 32 district radio clubs was represented by one member at a special 15-day course for fox-hunting enthusiasts, arranged by the Central Radio Club of Bulgaria in Sofia.

During the course each participant was required to build three standard combined transmitters operating on 3.5MHz and 144MHz, a set of transmitters necessary for conducting fox-hunting competitions. All the components were supplied by the C.R.C.B.

Faroe Islands

An activity contest for DX operators designed to enable points to be obtained for the various "WAOY Awards" was commenced on November 1, 1968, and will continue until April 30, 1969. It has been initiated by the F.R.A., the national amateur radio society of the Faroes. Activity covers all bands from 3.5MHz to 28MHz.

Germany

For the CW operator, an award designed to promote telegraphy activity — CW Speed Certificate — has been announced by the D.A.R.C., the national amateur radio society in Germany. The rules governing the award are as follows:

1. Available to all licensed radio amateurs and short wave listeners.
2. Transmissions are made on the first Saturday of the month (except July and August) at 1600GMT by DLOXX on approximately 3501KHz for C.W.S.C. at different speeds. Each text of three minutes' duration is transmitted at a speed of 50, 75, 100, 125, 150 and 175 letters per minute, representing a range of 10 to 35 words per minute. In each speed group, a maximum of three faults is permitted.
3. The basic certificate is issued for a speed of 10wpm with a sticker for higher speeds.
4. Further details can be obtained from Hans J. Trappenberg, DL10W, D-4018 Langenfeld, Flurstr. 36, W. Germany.

Another award is the W.D.R., available to licensed radio amateurs who can prove contact with the whole of the D.A.R.C. District "R." Further details can be obtained from Karl Tipp, DJ8CV, Wulfrath, Dusselerstr. 11, W. Germany.

NORWAY

The 40th anniversary of the N.R.R.L., the Norwegian amateur radio society, was celebrated in August, 1968. Representatives from Denmark, Faroe Islands, Finland and Sweden attended and discussed matters of mutual interest. Among the items discussed was "Amateur Radio In New And Developing Countries." Arising from the discussion the N.R.R.L. was authorised to investigate if any country in Africa is interested in receiving help from the Scandinavian societies in promoting amateur radio.

A fund instituted in 1966 by the N.R.R.L., known as "LA5LG's Hjelpefond," a fund with the object of helping handicapped persons to become radio amateurs, received a grant of $2,100 (U.S.) from the Norwegian Government. The money is to be used for a special project in a hospital for handicapped people near Oslo.

The N.R.R.L. announced that an amateur radio station with the call sign LG5LG, has been established in the "Free State Morokulien." This state surrounds the Peace Monument on the Swedish-Norwegian border between the villages of Magnor, Norway and Eda, Sweden.

The object of the station is to raise money for the "LA5LG's Hjelpefond" fund. To receive a QSL card from the station, foreign amateur operators are required to send three I.R.Cs., together with their own card (four I.R.C.s if they require direct QSL). Three hundred of the amateur operators who have contacted the station may also achieve "Honorary Citizenship of Free State Morokulien" and share in the station. This privilege will cost $3.50 (U.S.) or equivalent, and the donor will receive in return a certificate of citizenship together with a share certificate. Application should be made to "LA5LG's Hjelpefond," C/O N.R.R.R.L., P.O. Box 21, Refstad, Oslo, 5, Norway.

United Kingdom

The first formal recognition by an international professional body in recent times of the work of a United Kingdom radio amateur, was made during the closing session of the 16th International Communications Conference in Genoa, Italy, by the president of the Italian Ministers' Council.

The award, The Christoforo Colombo Prize for Radio Amateurs in the Technical Section for 1968, was made to Charles E. Newton, G2FKZ.

The citation reads as follows:

"For careful work carried out during the International Geophysical Year, for the study of the phenomenon of radio electrical propagation in the presence of aurora borealis and for the scientific work presented to high-level congresses, which are a clear mark that the radio amateur's work has already reached high scientific importance."

Reports from Abroad

FIVE BAND DXCC AWARD.

On January 1, 1969, a new challenge for DX-minded operators came into being. This was the inauguration of the A.R.R.L. Five Band DX Century Club Award.

Only contacts made on or after that date will count towards this new DX achievement. To be eligible for the award an applicant must submit confirmation of at least 100 countries in each of five bands. Full details of the award were published in the A.R.R.L. publication "QST," October, 1968.

PROJECT MOONRAY

Proposals to have placed on the surface of the Moon a small five-pound lunar amateur translator package are being investigated in the United States. If the authorities agree, it is hoped that the package would be carried on the third Lunar Module (LM-3). The astronaut responsible would level, aim and turn on the Moonray translator for what could well be the first amateur Moon to Earth contact.

Moonray bulletins and progress reports are broadcast on 14.09MHz on the first Monday of each month 2300-2330GMT using the call sign K2SS. The transmissions are made by radioteletype, followed at 2330GMT by a single-sideband transmission lasting half an hour.

Fuller details of Project Moonray can be obtained from Nicholas K. Marschall, P.O. Box T, Syosset, Long Island, New York, 11791.

SLOW-SCAN TELEVISION

Last month's notes gave details of amateur TV activity and brief mention was made of slow-scan technique now permitted in the U.S.A. and Europe.

News has just come to hand recording the first two-way transatlantic exchange of slow-scan amateur television pictures on June 24, 1968. The contact was between Art Backman, SM0BUO, of Stockholm, and Syd Horne, VE3EGO, of Ottawa, using a frequency of 14.18MHz.

Regular picture transmissions are planned by VE3EGO on 80-, 20- and 15-metre band.

The following frequencies have been allocated to Swedish amateurs for slow-scan amateur television work: 3.6MHz to 3.8MHz; 7050Hz to 7100KHz; 14100KHz to 14350KHz; 21000KHz to 21450KHz and 28100KHz to 29700KHz. These Swedish allocations are valid until June 30, 1969.

Canadian allocations valid until March 31st, 1969 are: 3725KHz to 3750KHz; 7150KHz to 7175KHz; 14175KHz to 14350KHz; 21100KHz to 21450KHz and 28100KHz to 29700KHz.

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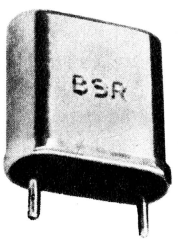


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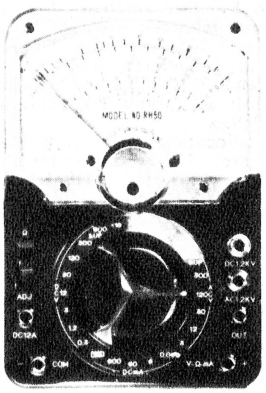
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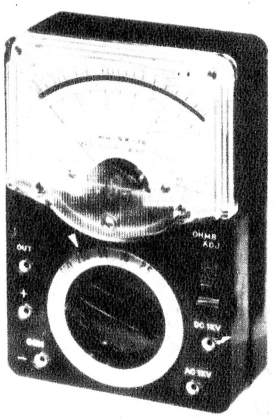
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30,000 Ohms per Volt DC.
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SPECIFICATIONS:
DC VOLTAGES: 0-0.25-1-2.5-10-25-100-250-500-1,000 V at 30,000 ohms per volt.
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DC CURRENTS: 0.05-5-50-599 mA, 9-12 A.
Resistance: 0-60K-6M-60M (350, 35K, 350K at mid-scale).
Decibels: Minus 20 to plus 56 dB (0 dB equals 1 mW, 600 ohms).
Audio Out: Capacitor in series with AC Volt ranges.
Short Test: Internal buzzer.
With leather case, **$38.** Postage **50c** to **$1 extra.**
Accessory: 1 pr. heavy test leads.
Batteries: 1 (1.5V), 1 (15V).
Size 3 5/16in x 6 5/16in x 2¼in.
Weight: 1.4lb approx.

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30,000 Ohms per Volt DC
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Specifications:
DC Volts. 0.5, 2.5, 10, 50, 250, 500, 1000 V
AC Volts. 10, 50, 250, 500, 1000 V
DC Current. 50 uA, 5 mA, 50 mA, 500mA
Resistance: 7 kΩ, 70 kΩ, 700 kΩ, 7 MegΩ
Decibels. —10 +62 db
Accuracy. DC±3%, AC± 4% (of full scale)
Batteries. Two 1.5 V dry cells. Size AA, "Eveready" 915
● Overload-protected by dual silicon diodes. ● Mirror scale.

$22.50 ***Postage 50c.***

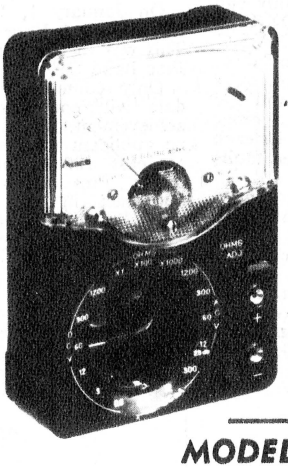
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DC volts 0-15, 0-150, 0-1000.
AC volts 0-15, 0-150, 0-1000.
DC current 150 MA.
1,000 ohms per volt, sensitive and clear scale for accuracy. Posted **$8.50** anywhere, with test leads and internal battery complete, ready to use. Size 3¼ in x 2¼in.

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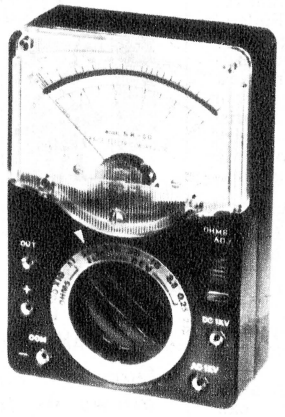


30,000 Ohms per Volt DC
14,000 Ohms per Volt AC

SPECIFICATIONS:
*DC Volts: 0.6, 3V, 12V, 60V, 300V, 1200V (30,000 ohms/V).
*AC Volts: 12V, 60V, 300V, 1200V (14,000 ohms/V).
*DC Current: 60 A, 12mA, 300mA.
*Resistance: 10K ohm, 1Meg ohm, 10Meg ohm.
*Decibels: —10db +23db.
*Meter Sensitivity: 23 A.
● Overload-protected by dual silicon diodes. ● Mirror scale.

$20.00 ***Postage 50c.***

MODEL RH-60



50,000 Ohms per Volt DC
10,000 Ohms per Volt AC

Specifications:
DC Volts: 0.25, 2.5, 10, 50, 250, 500, 1000 V
AC Volts. 10, 50, 250, 500, 1000 V
DC Current. 25 uA, 5 mA, 50 mA, 500 mA
Resistance: 10 kΩ, 100 kΩ, 1 MegΩ, 10 MegΩ
Decibels. —10 +62 db
Accuracy: DC±3%, AC± 4% (of full scale)
Batteries. Two 1.5 V dry cells. Size AA, "Eveready" 915
● Overload-protected by dual silicon diodes. ● Mirror scale.

$25.00 ***Postage 50c.***

NOTICE

The 6-8 Royal Arcade address will close down in June 69 during the re-building of the Arcade.

RADIO HOUSE PTY. LTD.

306-308 PITT STREET: 6 ROYAL ARCADE & 760 GEORGE STREET, SYDNEY

This achievement improved upon the December, 1959, record when Copthorn McDonald, WA2BCW, transmitted slow-scan pictures across the Atlantic to be received in the United Kingdom.

The United States Federal Communications Commission adopted new rules permitting slow-scan television in portions of the amateur bands, 3.5MHz and above. The segments chosen are those which after November 22, 1968, were restricted to holders of Advanced and Extra Class licences.

On bands below 50MHz the bandwidth will be limited to that occupied by a single-sideband voice transmission and above 50MHz to that of a double-sideband voice transmission.

MOONBOUNCE CONTACT

Between 0650 hours and 0710 hours GMT on September 9th, 1968 the first two-way 144MHz contact was made between Sweden and the United States of America. The stations making the contact were SM7BAE and K6MYC. SM7BAE reported that the signals from K6MYC were audible for twenty minutes. A second contact took place two days later.

RTTY BROADCASTS

At 2030 hours GMT every Friday evening PA0AA, the V.E.R.O.N. headquarters station, transmitts an RTTY broadcast in English for 30 minutes on 3.6MHz and 14.1MHz. Reports and print copy should be sent to the organiser, Piot van Weerlee. PA0YZ, Julianalan 62, Veerhout, Holland.

MAURITIUS

In Mauritius there are 22 amateur stations licensed by the Telecommunications Department. Only one class of licence is issued and this requires a Morse code speed of 12 words per minute. The lower age limit is 14 years and licences are issued on an annual renewal basis. Third party traffic is not permited.

Amateur television, mobile, and maritime mobile operation is authorised on application to the Telecommunications Department. Frequency bands available are 1800KHz-2000KHz; 3500KHz-3800KHz; 7000KHz-7300KHz; 14000KHz-14350KHz; 21.0MHz-21.45MHz; 28.0MHz-30.0MHz and on request 144MHz-146MHz. The power limit is 150 watts.

The official address of the Mauritius Amateur Radio Society (M.A.R.S.) is P.O. Box 14, Curepipe, Mauritius.

JAMBOREE-ON-THE-AIR

The centre pages of an English magazine, which did not have the title given, but which was obviously a Scouting group's publication, was received recently. The article told the story of how interest was stimulated in amateur radio among a group of Ranger Guides, and bore the heading—"GB3CRG calls VK2YA."

The story, by Mrs G. H. Arnold, a Ranger Guider, relates how while on holidays in Austria in June, 1967, with her husband they met Rex Black, VK2YA, at that time Federal Co-ordinator of the Wireless Institute of Australia Youth Radio Scheme, who was touring England and Europe. Their mutual interest in youth work resulted in discussions on the interest that amateur radio could provide to Scouting and Guiding.

On returning home, Mrs Arnold followed up ideas formulated from the discussions and the Canterbury Ranger Guides became interested in amateur radio. A local Army group arranged Morse code and voice procedure instruction classes. Radio amateurs in and around Canterbury assisted in the project. The Ranger Guides group affiliated with the Radio Society of Great Britain and the W.I.A. Youth Radio Scheme.

The climax to their work was their participation in the 1968 Jamboree-on-the-Air. With the assistance of the University Radio Club, the Simon Langton Boys' School and other amateurs in Canterbury, the Canterbury Ranger Guides had three stations operating during the whole 48 hours of the event. The G.P.O. issued a special call sign for the Jamboree weekend — GB3CRG (Great Britain 3 Canterbury Ranger Guides).

A total of 120 different stations was contacted during the weekend. They were not successful in making contact with VK2YA in Australia, but they had an enjoyable weekend.

Several of the Rangers are studying for the Amateur Operators examination and the group is looking forward to the time when they will have their own amateur radio station.

CHRISTMAS ISLAND

To those who have difficulty with the wire loops of a Quad antenna breaking, here is a tip from Don Reed, VK9DR, on Christmas Island in the Indian Ocean. Don reports that they have not had a broken wire in three years and do not expect to ever have one. By using 14-gauge copper wire with a small loop at each corner and attaching the wire to the bamboo spreaders with a couple of inches of nylon fishing line, the nylon line takes all the movement strains.

Here is another tip for a three-element Quad. The formula for using 50-ohm co-axial feed line is 98/f(MHz), therefore the two bays may be set closer together, say 4ft apart, 3ft 6in being optimum for 28MHz. The bamboo spreaders are then bent at the top with a bend of about 18 inches. This will give a spacing of 7ft, which is optimum for 14MHz; the 21MHz lies between the two with a spacing of 4ft 6in.

Don says it works out fine and may be of interest to the mainlanders to whom he sends his 73.

W.I.A. YOUTH RADIO SCHEME

The management committee of the New South Wales Division, Youth Radio Club Scheme, is very grateful for the generous assistance given by Mullard-Australia Pty. Ltd. in producing the Information Manual of the W.I.A. Y.R.C.S.

The Manual, containing 25 pages, gives details of the origin, objectives and administration of the scheme, information on awards, examinations and points on starting a club that would be of assistance to club leaders and persons wishing to join the scheme.

Copies of the Information Manual may be obtained from the Secretary, W.I.A. Y.R.C.S., N.S.W. Division, who is Mr J. Flynn, 30 Sharp Street, Belmore, 2192.

Plans are being formulated for the issue of a series of certificates in three grades for short wave listeners. These certificates will require the applicant to attain a proficiency standard equal to that required for the regular technical certificates already being awarded to successful students.

Youth Radio Club Scheme broadcasts are made from the Wireless Institute Centre, Crows Nest, on the third Friday of each month at 7 p.m., EST. The frequency used is 3595KHz and the call sign VK2AWI. This broadcast is directed to members generally and call-backs are invited from any Club station or interested amateur operator.

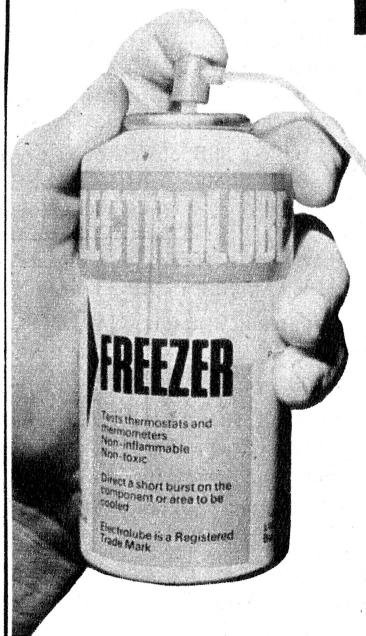
Penrith High School

Since returning from his overseas tour early in 1968, Rex Black, VK2YA has been stationed at the Penrith High School. During the past 12 months Rex had organised a very keen group of boys in the school radio club. The club now has the call sign VK2AVV and should be on the air by the time these notes are published. Two of the students of the Penrith High School Radio Club who left school are now employed in the electronics field. One is employed in radio and TV servicing and the other is an electronics apprentice in the Royal Australian Navy.

Rex also passed on news of some of his students of earlier years, who are now

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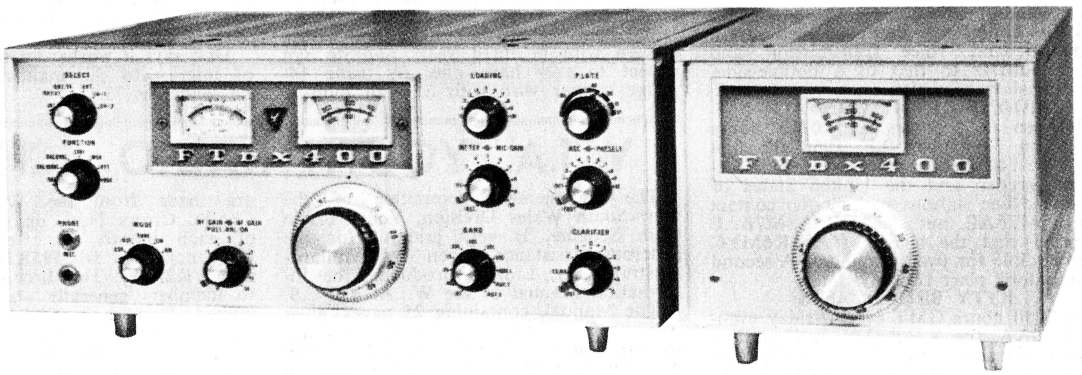
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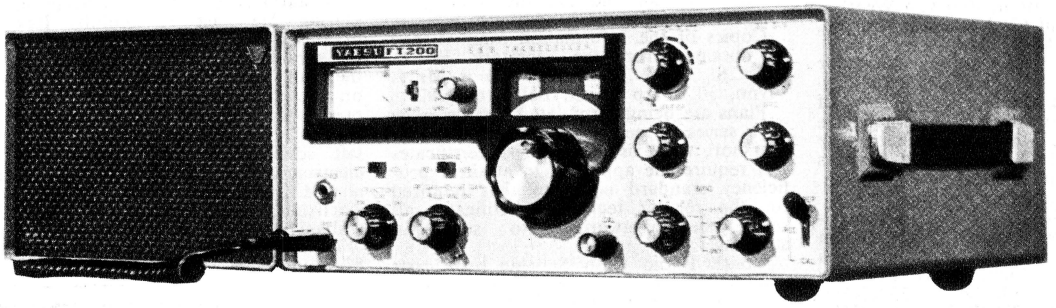
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following electronics careers. Those mentioned were: Greg Dunn, from Kingsgrove High School, the only Youth Radio Scheme member to gain the Y.R.S. Senior Certificate, has just finished his first year with the Department of Civil Aviation, coming second in the radio school course; Greg Waller also from Kingsgrove High School has completed his first year as an Overseas Telecommunications Commission technical trainee; John Thyrd and Bruce Lewis, both from Kingsgrove North High School have completed two years with the Department of Civil Aviation successfully; Roger Adams, Canterbury High School, has gained his Bachelor of Engineering (Elect.) Degree at the University of New South Wales. Roger has his Amateur Operator's Limited Certificate of Proficiency, and gained his interest in electronics as a member of a Y.R.S. school radio club.

Westlakes Radio Club

The Westlakes Radio Club commenced its activities for 1969 at the beginning of February. Classes for the P.M.G. Amateur Operator's Certificate of Proficiency are scheduled for each Wednesday evening. Junior and elementary Youth Radio Scheme classes will be held each Saturday.

Full details of the club's activities can be obtained by writing to the Secretary, P.O. Box 1, Teralba, N.S.W. 2284.

Bruce Morley, secretary of the club, has at last received his callsign and can now be heard on the air signing VK2ZNB. His first contact was on 146MHz FM when operating mobile, with VK2AJY at Toukley only a few miles away. His next was from a portable location near the club, when he made contact with VK1ACA operating portable near Canberra, a distance of 228 miles. This constitutes a record for operators in the Newcastle area. Congratulations to Bruce for such a fine debut as a VHF operator.

Another two members of the club have gained Youth Radio Club Scheme certificates. They are Robert Day of Booragul, who was successful in the January examination for the Junior Certificate, and Allen Legge, a foundation member of the club and former Booragul High School Club member, who has won the eighth Radio Telephony Operator's award issued by the Y.R.C.S. The certificate was issued as a result of Allen's good operating record established with the club's equipment.

Maitland Radio Club

Hon. Allen Fairhall, Minister for Defence, officially opened the new club rooms of the Maitland Radio Club on Saturday afternoon, February 1. In doing so he paid tribute to the achievements of the club during a relatively short period. He also pointed out the growing need for more technically trained personnel in the field of electronics. In congratulating members on the progress made, he said that clubs such as the Maitland Radio Club are promoting interest in the field of electronics and are helping the community in general by introducing young people in particular to the ranks of amateur radio.

The Minister, a patron of the club, spoke briefly of some of his own experiences on the air as VK2KB, adding that amateur radio operators come from all walks of life.

The Mayor of Maitland, Alderman W. J. Harvey, welcomed the ninety visitors to the opening ceremony which was held at the club's headquarters in Maize Street, East Maitland.

Other speakers included the club president, Kev Watson VK2ZKW, club patron, Dr R. H. K. McKerihan, and New South Wales State Supervisor of the Wireless Institute Youth Radio Club Scheme, David Jeanes, VK2BSJ, who also represented the president of the N.S.W. Division W.I.A.

Guests included, officer in charge of Maitland Police Station, Sergeant C. V. Cahill, representing officer in charge of Maitland Police Sub-District, Inspector G. Godfrey; Alderman and Mrs N. Unicomb; Federal Co-ordinator W.I.A. Y.R.C.S., Jim Webster, VK2ZCW; N.S.W. Secretary Y.R.C.S., Jack Flynn; retiring Queensland State supervisor Y.R.C.S., Danny Dwyer, VK4ZDD; District Radio Inspector, Frank Hinks, representing the Superintendent Radio Branch, P.M.G. Department; President Muswellbrook Radio Club, Les Baber, VK2RJ; Westlakes Radio Club secretary, Bruce Morley, VK2ZNB; President of the Hunter Branch, W.I.A. Rodney Prout, VK2CN; Mr H. Smith, Maitland R.S.L.; Mr A. Hasselmon, East Maitland Rotary Club; Mr J. Smith, Hunter Valley County Council; Boy Scouts District Commissioner, Frank Gerard and Ron Miller.

The afternoon proceedings were chaired by Bill Plant, VK2AMM, Maitland Radio Club public relations officer.

After the opening ceremony the visitors inspected the club's installations and viewed the sound-colour film "The Maitland Radio Club Story" depicting the history of the club.

A visitor to the club in recent weeks was the president of the Ipswich Radio club, George Lloyd, VK4ZLG.

Club members were pleased to learn that they now have over 600 books and magazines to choose from in the library. The job of installing shelves to house the books will commence during the next few weeks.

Recent achievements by members: Phillip Lawrence, holder of the Elementary and Junior Y.R.C.S. certificates, has completed a mains operated receiver covering the broadcast and short wave bands; Ken James has received the one hundredth Junior Certificate issued by the Y.R.C.S., gaining a Credit Pass. He was also awarded three technical books for his achievement. More than 40 certificates have been issued by the Y.R.C.S. to members of the Maitland Radio Club since its formation.

The first two members to gain their amateur licences following their participation in the clubs A.O.C.P. classes have received their call signs. Allen Counsel, VK2ZFH, has constructed a transmitter for the 52MHz band and has been working interstate stations. Ray Johnson VK2ZVR, principal of the Maitland Technical College, is constructing equipment and expects to be on the air soon.

Members who attended the first class in 1969 were treated to a screening of the film "The Power of Progress" lent by the Shortland County Council. This is a promotional film for the Newcastle, Lake Macquarie and Hunter Valley, region.

All enquiries regarding club membership fees and club activities should be directed to the Secretary, Maitland Radio Club. Box 54 P.O., East Maitland, 2323. ■

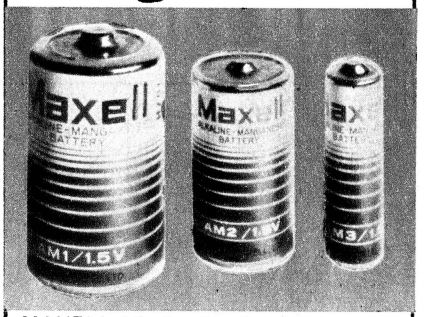
Notes and Errata

KEYLESS ORGAN (January, 1969): A .01uF capacitor connected between the wiper of the volume control and the base of T4 has been omitted from the circuit diagram on page 41. The wiring diagram is correct.

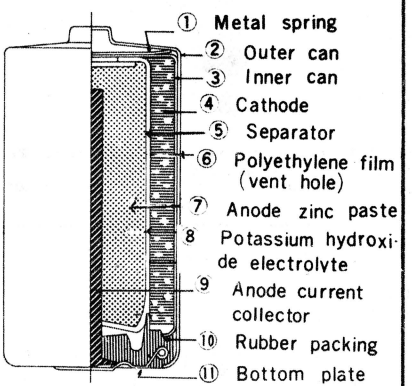
PLAYMASTER 117 GUITAR AMPLIFIER, July 1967. A link between the junction of the 470pF and .0022uF capacitors and the grid (pin 7) of the 12AY7 was omitted from the wiring diagram on page 55.

10 PLUS 10 STEREO AMPLIFIER, NOVEMBER, 1968. The parts list shows 2 x 200uF/15VW capacitors; this should read 2 x 250uF/15VW to agree with the circuit and wiring diagrams. In fact, either value would be satisfactory. ■

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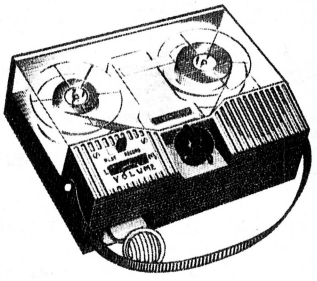
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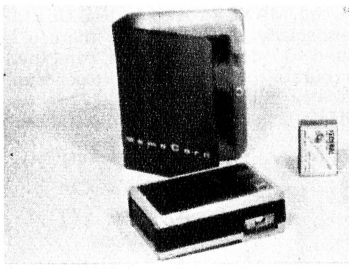
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AM2 ..... 50c
AM3 ..... 40c

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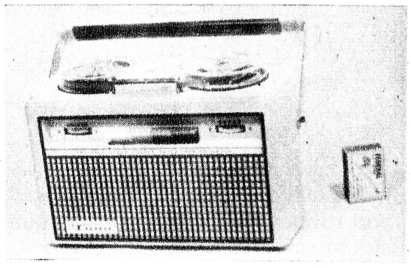
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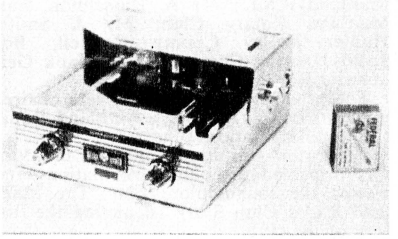


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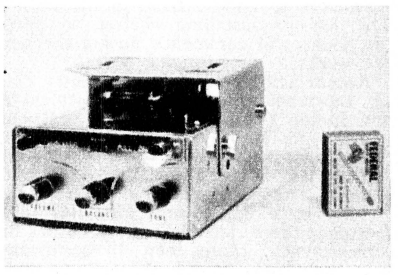


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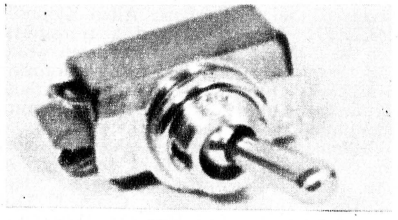
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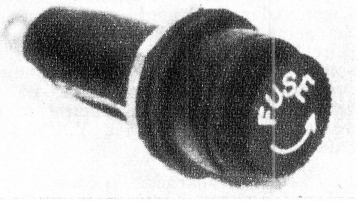


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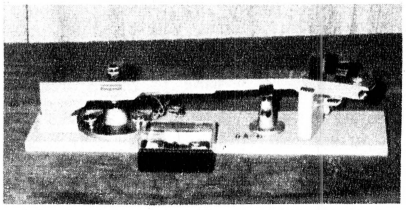
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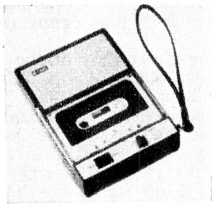
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ARCTIC EXPEDITION KEEPS IN TOUCH



A Plessey PR155 LF/MF/HF radio receiver is providing a key link in the chain of communications with the British Arctic Expedition now on its 3,500-mile trek across the Arctic Ocean.

The PR155 was first located at Point Barrow in Alaska. When the party was about 500 miles along its way, the radio link was moved to T3, an American research station located on an ice island near Canada's Elizabeth Islands group. The PR155 not only receives signals from the ice trekkers, but also from the Cove Radio Station, situated at the famous Royal Aircraft Establishment at Farnborough in England, a distance of 8,000 miles.

It has been an excellent test for the PR155 and its reliability in this case has backed up its manufacturer's claims that it was capable of operating over the widest range of temperatures and humidities. The PR155 has already been exported to 25 countries, and proved itself in tropical climes.

The PR155 provides reception of SSB, DSB, CW and MCW signals over the range 15KHz to 30.1MHz, and can be rapidly tuned to any frequency.

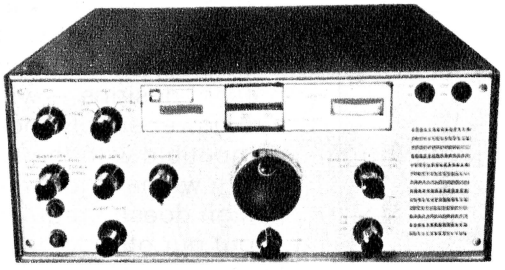
Scientists at the Royal Aircraft Establishment in U.K. regard the expedition as an opportunity of learning more of the propagation characteristics of HF signals from northern latitudes. Their Cove Radio Station is using a 3KW linear amplifier with a beam aerial consisting of horizontal sloping vees with selectable steering in azimuth in 20 degree steps. This gives, typically, 10dB gain over a dipole on the frequencies in use. These range from 8 to 23MHz, with optimum frequencies at the moment proving to be close to 14MHz.

Five amateur radio stations in U.K. are providing a back up service for the official communication arrangements, including the R.A.F Amateur Radio Society station. The call-sign allotted is G7AE. All stations in the link-up have been authorised to use frequencies outside the amateur bands.

The main transmissions for the expedition are the daily weather observations. The expedition makes four observations each day, but only one transmission. This, in turn, is relayed through normal channels, from the member of the link-up to all meteorological services in the northern hemisphere.

An aircraft rescue beacon is also being carried by the sledge party. This transmits on both the UHF and VHF distress frequencies. Recently, when the party wintered down, it was dropped two small HF receivers made specially for receiving time and meteorological transmissions.

The 3,500-mile journey from Pt. Barrow, in Alaska, to Spitsbergen, Norway, is expected to take 16 months in all. The party expects to complete the trip in May or June this year. Sponsored by Britain's National Geographic Society, the expedition is primarily for scientific observations. The expedition is using eight sledge boats which can be pulled by dogs on land or converted into boats when necessary. ■



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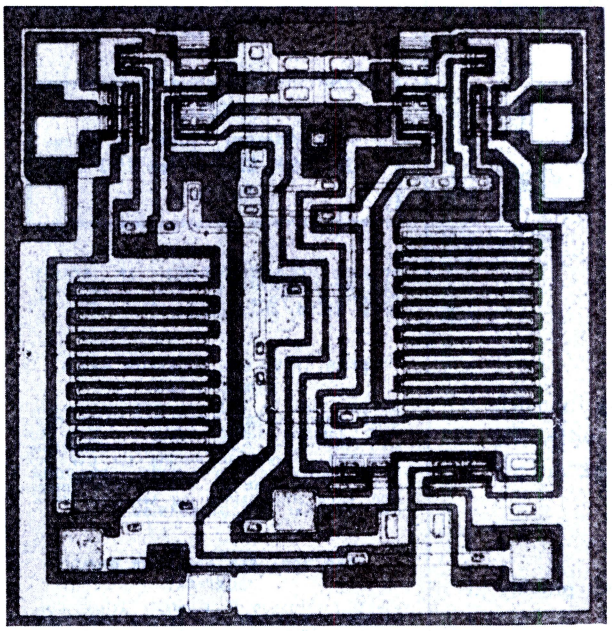
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Propagation Delay		2.0	ns	
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LISTENING AROUND THE WORLD

Art Cushen's monthly report on long-distance short-wave, television and broadcast band reception.

B.B.C. Announces Award for Reception Reports

The B.B.C., London, is to make an award to those listeners who correctly report the reception of B.B.C. signals fom Britain and from each of the three relay bases.

For nearly half a century listeners have been reporting their reception to broadcasters. In return, the B.B.C. and other broadcasters have sent cards to verify correct reporting. The card issued by B.B.C. External Services is well known throughout the world as the "Big Ben" card.

Now, for the first time, the B.B.C. is offering an award to listeners who correctly report on a number of B.B.C. transmissions received from different transmitting sites. The reports will be analysed by their engineering staff, and certificates issued by the "World Radio Club" program. This Award scheme applies to the one frequency schedule period only — March 2 to May 3 — though it is possible that the scheme will be repeated.

To qualify for the award, listeners must give evidence of reception of three B.B.C. transmissions from each of the following: Great Britain, and the Atlantic, East Mediterranean and Far Eastern relay stations. These 12 reports (which must be received in one envelope before the end of May) should contain the following information: location, date, time, frequency and a few words about program content. In return, the award will contain the four verifications required by the serious DXer.

To be eligible for the award, a DXer must be a member of World Radio Club, the program for DXers and short-wave enthusiasts broadcast in B.B.C. World Service at:

0930 Sunday 15070, 17790, 21550 KHz;
1245 Thursday 11750, 15070, 17790KHz.

Other broadcasts are timed for Friday at 2345GMT and on the North American Service on Mondays at 1515 GMT. To become a member, write to World Radio Club, B.B.C., Bush House, London W.C.2.

1000TH DXERS CALLING

The 1000th program of "Sweden Calling DXers" was broadcast recently from Radio Sweden in Stockholm. Undoubtedly the most popular DX session on short-wave radio, the station has an average mail of over 70 contributors to its weekly session. From this a 10-minute program of news is selected from the contributions from listeners in all parts of the world.

"Sweden Calling Dxers" was opened in 1948 by Arne Skoog, still its editor. To celebrate the 1,000th broadcast Radio Sweden has issued a new verification card.

The new card has the familiar sign of the Sveriges Radio "SR" in the centre, at the top it has "Sweden Calling DXers," and across the base "1,000th Session." The colours are dark blue, yellow and white. The new card is to verify reception reports sent to Radio Sweden, S-10150, Stockholm 1, Sweden. Free program schedules are available, and those listeners who send contributions to the "Sweden Calling DXers" programs receive copies of the scripts free of charge by airmail each week.

FREE CALENDAR

The "Happy Station" program of Radio Nederlands, P.O. Box 222, Hilversum, Holland is offering a free calendar to anyone who writes. The program celebrated its 40th anniversary this year, and the calendar has a series of pictures of events of the 40 years of the Happy Station program with Edward Startz. Readers who write for this free calendar will also receive the latest Radio Nederlands schedule from Edward Startz.

BROADCAST FROM BELGIUM

The present schedule of Radio Television Belge at Brussels is as follows:

GMT	KHz
1000-1200	21525, 17860, 21590
1215-1300	21525, 17860, 15335
1445-1545	11965, 6010, 17860
1600-1715	11715
1715-1730	21525, 17860, 21590
1730-1815	21525, 17860, 15335
1815-1830	17860, 9740
1830-2100	11715, 17860, 6010
2115-2205	15445, 9550, 6010
2205-2215	15445, 9550, 6010
2215-2300	15445, 9550, 6010
2315-2400	11940, 6125, 6010
2400-0050	11940, 6125, 6010
0050-0100	11940, 6125, 6010

RTB broadcasts in English at 2205-2215GMT on 15445, 9550, and 6010KHz.

CALI USING 4750KHz

A new Colombian station has been heard with 24-hour-a-day operation on 4750KHz. It broadcasts from Cali, Colombia, using the slogan "La Voz del Rio Cauca" and is affiliated with the CARACOL Network. The station has been heard in New Zealand from around 0600 to after 1000GMT. The station carries typical Latin-American music, and on the hour has the CARACOL Network theme and announcement. This new station has not been listed previously on any other frequency, and as yet callsign and other details are not known.

The address for Network reports is CARACOL, Apartadao Aereo 9291, Bogota, Colombia.

ENGLISH FROM WARSAW

Radio Warsaw in Poland has retimed its service to the Pacific, and is now heard 0700-0730 on 7125KHz. The English programs of Radio Warsaw are now broadcast according to the following schedule:

GMT	KHz
0700-0730	9550, 7125
1100-1125	15275, 11840
1830-1900	9525, 7145
1930-1955	7145, 6135
2030-2100	7145, 6135
2100-2130	11955, 9540, 7125, 5995

BROADCASTS FROM DELHI

All India Radio at Delhi has a transmission in English to Europe from 1745-2230GMT. Frequencies in use are:

GMT	KHz
1745-2230	7215
1745-2030	11620
1945-2230	9912
1830-2030	6025
English to Africa	
1945-2045	9690, 11775
North-East Asia	
1000-1100	15105, 17800, 21485
Australia and New Zealand	
1000-1100	15205, 15420, 17820, 11725

RADIO JAPAN DX NEWS

Radio Japan is now broadcasting the DX News fortnightly: to Europe, Australia, New Zealand and North America in the "Listeners Corner"; to Asia and Africa in the "Tokyo Mailbag." It can be heard in the service to Australia and New Zealand on the second and fourth Saturday. The transmission is on the air 0930-1030 on 11875 and 15235KHz with the DX session being heard at 1005GMT.

IVORY COAST RADIO

Reception of Radio Abidjan, Ivory Coast, has been received on three frequences in recent weeks. In New Zealand the signals are being received on 6015KHz from 0630GMT with the morning program. At 0645GMT, the station has a short interval signal of drum beats, and then follows news in French for ten minutes. At 0655GMT, announcement and station identification in French is followed by light music.

ENGLISH FROM BUDAPEST

Radio Budapest, in Hungary, has broadcasts in English as follows:

To Europe

GMT	KHz
2130-2230	17890, 15160, 11910, 9833, 7220, 7100, 3995
2330-2400	6234, 3995

To North America and New Zealand

0030-0130	15160, 11910, 9833, 9755
0300-0400	15160, 11910, 9833, 9755
0430-0500	15160, 11910, 9833, 9755

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27	270	7500	68K	750K	15 meg
33	330	8000	75K	800K	16 meg
39	560	13K	80K	820K	18 meg
47	800	15K	220K	1.2 meg	22 meg
56	820	18K	270K	1.8 meg	24 meg
68	2400	22K	330K	3.9 meg	27 meg
82	2700	25K	390K	5.6 meg	
120	3900	27K	400K	6.8 meg	
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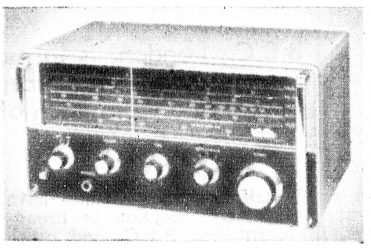
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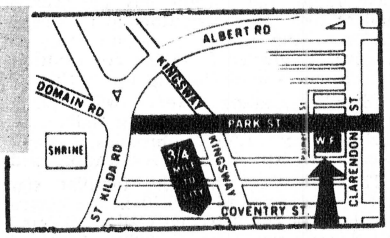
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The station verifies reception with a card showing a map of Africa, and frequency and schedule details. The frequencies shown are: 11920KHz (100KW), 7215KHz (1KW), 6015KHz (100KW), 4940KHz (25KW), 3242KHz (10KW).

SABC CHANGES

The SABC in Johannesburg has been heard with its domestic programs on new frequencies. Reception on 6150KHz has been possible at 1700GMT when a news bulletin in English is received. Commercial programs follow at 1715 but at 1730 the frequency is blocked by the BBC with a relay of the Voice of America programs. Another new frequency 15395KHz has been heard around 0800GMT also in English.

GMT	KHz	KW
	English	
0430-0720	4965	20
1510-2115	4965	20
0430-0730	7195	100
1515-2115	7195	100
0720-1510	9680	20
0730-1515	15395	100
	Afrikaans	
0430-0715	4875	20
1520-2115	7260	100
	Springbok	
0300-0700	4945	20
1530-2200	4945	20
0300-0730	6150	20
1500-2200	6150	20
0700-1530	9720	20
0730-1500	15415	20
	All Night Service	
2200-0300	4945	20

DECREASE IN SUNSPOTS

The continuing decrease in sunspot activity will be welcomed by those readers who enjoy medium wave listening, as the improvement will be noticed on this band and the lower shortwave bands in the coming months. Following the peak in May, 1968, the sunspot count has decreased, and the predictions from the Swiss observatory at Zurich, and its stations in Locarno and Arosa, are listed below.

February 98
March 96
April 94
May 92

BROADCASTS FROM DENMARK

Radio Denmark in Copenhagen is being received on 15165KHz with English at 0815GMT in a program to the Pacific. The present schedule of Radio Denmark is as follows:

GMT	KHz
To North America	
0100-0145	15165
1200-1245	15165
0145-0215	9520
1245-1315	15165
To South America	
2200-2245	15165
2245-2315	15165
To Greenland	
1130-1155	15165
1730-1815	15165
To Africa	
1830-1915	15165
1915-1945	15165
To South Asia	
1400-1445	15165
1445-1515	15165
To Far East	
0730-0815	15165
0815-0845	15165
Test Transmissions	
1015-1100	9520

ENGLISH FROM MONGOLIA

Radio Ulam Bator in Mongolia has two English transmissions each day except Monday. They are best received in the transmission at 1220GMT. The station is very pleased to receive reception reports from listeners.

GMT	KHz
1220-1250	7340, 9540
2200-2230	11810,11850

NEW SCHEDULES OPERATING

The Radio Club Mozambique, Lourenco Marques, has made some changes in its schedule.

GMT	KHz	KW	GMT	KHz	KW
0430-2100	737	50	1815-0315	3218	25
1630-2100	4925	10	0300-0730	4855	20
0430-1800	6115	25	1500-2200	4855	20
0430-2100	11820	25	0415-1745	6050	25
0600-1600	15295	10	0800-1400	9620	20
1500-0500	917	50	0300-1845	11780	7.5
0500-1500	1358	0.25	0930-1200	11845	100
1500-2200	1358	10	1530-1930	11845	100

RADIO BERLIN INTERNATIONAL

English broadcasts from Radio Berlin International, Berlin, East Germany, are directed to all areas of the world, and are frequently reported by readers. The station operates in English as follows:

GMT	KHz	Area
1730	6080	Europe
2017	6115	Europe
2200	7185, 7300, 9730	Europe
0100	9500, 9730	North America—east coast
0230	9500, 9730	North America—east coast
0330	6080, 9650, 9730	North America—west coast
0345	11875	Africa
0615	9570	Africa
1215	21600, 21475	Africa
1315	21450, 21475	Africa
1815	15390, 15145	Africa
2000	17700	Africa
0645	21465	South-East Asia
1115	21540	South-East Asia
1200	17880, 21540	South-East Asia
1330	21540	South-East Asia
1430	15150	South-East Asia
1515	15150	South-East Asia

RADIO PRAGUE, CZECHOSLOVAKIA

Radio Prague's present schedule, valid until May 4, is as follows:

GMT	KHz	Language
EUROPE		
0800-0930	6055, 9505	German
0930-1100	6055, 9505	German for Austria
1100-1200	6055, 9505	French
1200-1300	6055, 9505	Italian
1200-1230	9560, 11960, 15285	English
1230-1330	6185, 11960, 15285	Spanish (Saturday and Sunday only)
1300-1430	6055, 9505	Italian (Saturday and Sunday only)
1630-1700	5930, 7345	English
1700-1730	5930, 7345	Spanish
1830-1900	5930, 7345	Spanish
1900-1930	5930, 7345	English
AFRICA		
1500-1530	6055, 9600, 11990, 15285, 17840, 21700, 21735	Czech and Slovak
1530-1630	6055, 9600, 11990, 15285, 17840, 21700, 21735	English
1630-1730	9600, 11990, 17840,	Arabic
1730-1830	5930, 7345, 9600, 11990, 17840	English
1830-1930	9600, 11990, 17840,	French
1930-2030	5930, 7345, 9600, 11990, 17840	Arabic
2030-2130	5930, 7345, 9600, 11990, 17840	French
SOUTH AND CENTRAL AMERICA		
2130-2230	5930, 7345, 9600, 11990, 17840	Portuguese
2230-2300	5930, 7345, 9600, 11990, 17840	Czech and Slovak
2300-2400	5930, 7345, 9540, 9630, 11990	Spanish
0000-0100	5930, 7345, 9540, 9630, 11990	Portuguese
0200-0300	5930, 7345, 9540, 9630, 11990	Spanish
NORTH AMERICA		
1330-1400	15448, 17840, 21450,	Slovak and Czech (Sunday only)
1400-1500	15448, 17840, 21450,	English (Sunday only)
0100-0200	5930, 7345, 9540, 9630, 11990	English
0300-0330	5930, 7345, 9540, 9630, 11990	Czech and Slovak
0330-0430	5930, 7345, 9540, 9630, 11990	English
FAR EAST AND AUSTRALIA		
0700-0800	6055, 9505, 9575, 11800, 15310, 21450, 21700	English



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FLASHES FROM EVERYWHERE

AFRICA

ALGERIA: Radiodiffusion Television Algerienne is heard in French on 15200-KHz, on Saturdays at 1200-1700 and Sundays 0900-1700GMT. 9510KHz has been heard around 1745GMT with good signals.

TUNISIA: Radio Tunis has been received on the new frequency of 15215KHz at 0600GMT and again at 2100GMT. Reception in New Zealand is best at 2100GMT, but the station suffers some sideband interference from Melbourne on 15220KHz. Another good signal, which carries the same program in Arabic, has been noted on 11900KHz at the same time.

EGYPT: Radio Cairo has been noted on 7215KHz when a program in Arabic is carried on the frequency. A time clock is relayed at 0630GMT, and the same program is heard on 11980KHz. News in Arabic is presented at 0630-GMT. Another frequency 21695KHz is being heard between 1100 and 1300-GMT beamed to Indonesia.

LIBERIA: Radio ELWA at Monrovia has a program to Central Africa in English 1530-1645GMT on 11975KHz. From 1700 to 2000GMT ELWA uses 15155-KHz. Another frequency 17760KHz is also reported to carry this program, which is in English, French and other languages.

LESOTHO: A letter from Maseru states that the transmitters are located 5 miles from the studios at Maseru, and the mast is 300 feet high. Transmitted power is 660 watts and it is planned to increase the power to 2KW in the near future.

TUNISIA: Radiodiffusion Tunisia, Tunis, is now using two new frequencies for the service in Arabic. The transmitters are using 11900 and 11970KHz, and have been heard around 1000GMT with a relay of the home program.

ASIA

YEMEN: Radio Sanaa has been received with Arabic transmissions from 1700-2230GMT. The station has been heard in the United Kingdom on 5805KHz at fair level. Yemen has frequently been heard also in the Pacific area, but is notorious for its non-verifying policy.

IRAN: Radio Teheran, using 7064KHz has been received at 1500GMT in its local program. The station has also been observed on 11700KHz at 1900GMT with a station announcement in English. The service on this frequency is for its international audience.

PHILIPPINES: Radio Veritas, in Manila is testing on two frequencies. At 1030-GMT an announcement in English has been observed on 15170 and 11845KHz. The station has been noted to sign off at 1120GMT, and at times runs as late as 1230GMT with its program, which is mainly of classical music.

LAOS: Radiodiffusion Lao, at Vientiane, has been reported at 1200GMT when heard with a session of lessons in English on 6130KHz. The station in addition can be heard with a news bulletin in French at 1315GMT.

RYUKYU ISLANDS: According to Bob Padula of Melbourne, Vic., the Voice of the United Nations Command continues to provide good signals, and is noted on 14460 and 9840KHz in parallel at 1005GMT. At this time the station is heard with English identifications during a musical program.

SAUDI ARABIA: Radio Jeddah transmits its home service in Arabic on the new frequencies of 6000 and 7200HKz, and operates 0100-0600 and 0930-2100GMT. Power on both frequencies is 50KW.

IRAQ: Radio Baghdad, is now using 9555KHz at 1900GMT, and carries the same program, as on 6030KHz. Another frequency 3960KHz has been noted with English at 2100GMT.

CHINA: Radio Peking broadcasts an English program beamed to North America.

GMT	KHz
0000-0100	17673, 17855.
0100-0200	17900, 17715, 9780, 7120
0200-0300	17900, 17715
0300-0500	15095, 17675, 17795

CEYLON: Radio Ceylon, at Colombo, is using the new frequency at 15120KHz according to the Ceylon Short Wave Listeners' Club. The frequency is used at 0130 to 0500GMT with programs in Hindu beamed to India. The same program is also carried on 11800 and 7195KHz.

NEPAL: Radio Nepal, Kathmandu, now operates as follows:

GMT	KHz	KW
0220-0420	7105, 11970	5
0720-0920	7165	100
1220-1520	11970	5

BURMA: Rangoon, Burma, broadcasts in English at 0130-0230 and 1430-1600-GMT on 5040KHz, and at 0700-0730 on 7120KHz. The power on both frequencies is 50KW. The address is Burma Broadcasting Service, Prome Road, Kamayut P.O., Rangoon.

THE AMERICAS

GUATEMALA: Radio TGQB, Quezaltenango, is being received on 11700KHz. The station seems to have increased in power from the listed 500 watts, as reception in the United States at 2300GMT is said to be good. The station has been heard requesting reports on the reception of this transmission.

BRAZIL: A service for the local farming population is carried on Radio Maua, Rio de Janeiro, on 11885HKz. The program is on the air from 1700-0100-

(Continued on page 164)

ENGLISH FROM MOSCOW

Radio Moscow has a series of transmissions for reception in Australia and New Zealand which are carried on both medium and shortwave. The schedule in operation until April, 1969, is as follows:

GMT	KHz
1100-1130	11870, 9780, 620
1130-1200	9780, 1470, 620
1230-1300	15150, 11690, 9760, 1470, 620
1330-1400	9780, 6160, 1470, 620

"Moscow Mailbag" is broadcast on Saturday and Sunday at 1115 and 1245GMT.

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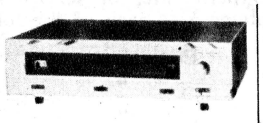
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5" 600ft $1.80
5" 900ft $2.35
5" 1200ft $3.50
5¾" 900ft $2.65
5¾" 1200ft $3.25
7" 1200ft $3.00
7" 1800ft $4.10
7" 2400ft $4.97
7" 3600ft $6.65

PHILIPS TYPE CASETTES
C60 60 min $1.95
C90 90 min $2.75
C120 120 min $3.50

TAPE DECKS AVAILABLE
With or without pre-amps. BSR, VAN DER MOLEN, COLLARO.

GUITAR AMP. KIT
All solid state. 70W. RMS. Bass and treble, etc. $102, plus tax.
Also available, modules for Reverb., Tremolo, Fuzz, etc. Plus Playmaster amps.

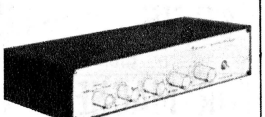


NEW WIDE BAND TUNER
Based on Playmaster design. Ceramic filters. Tuning meter, whistle filter, etc. $52, plus tax. Teak cabinet, $6 extra.

TRANSISTORISED TUNERS
New, low-priced model, wood grain finish. Without power supply.
ONLY $19.50, plus tax.
UNIT 10—with RF stage and power supply, 8 Kcs bandwidth — $31, plus tax.



PEAK 7W Stereo Amplifier. 50-20,000 Hz in oiled timber cabinet. $34.50, complete.



AMPLIFIER KIT
STC 20W RMS STEREO AMPLIFIER
Complete to last nut and bolt plus full instructions. $72, plus tax.

TAPE RECORDER KITS
UNIT 14, Tape Pre-Amplifier. Unit 15, 60/90/ Kc/s push-pull transistorised bias erase Oscillator Module. Unit 16, Transistor Tape Recording Amplifier Module. Used with Unit 14. Unit 17, Tape Kit. Complete with Controls and Switches. $16 50, plus tax.



NEW 1969 6 TRANSISTOR RADIO KIT
Silicon Transistors and complete with instruction book, carrying case and earphone. Special Price. $11.25. Wired $13.50.

Unit 2 Illust.



TRANSISTOR MODULES
Unit 1, 25W RMS Amplifier.
Unit 2, 10W Amplifier.
Unit 3, 10W RMS Amplifier.
Unit 4, Pre-amp tone control stage.
Unit 11, 65W HI-FI Amplifier.

ALSO ALL COMPONENTS, TAPE, FILM, ETC.
SEND S.A.E. FOR DETAILS AND LIST.

S. E. WILLIS TRADING CO.
38 Riversdale Road, Camberwell Junction, Vic., 3124.
Phone 82-5787. Please Include Freight Sorry No C.O.D.

NEW RANGE OF RESISTORS, CONDENSERS AND POTENTIOMETERS

WE HAVE JUST PURCHASED THE COMPETE STOCK OF RESISTORS, CONDENSERS AND POTS. OF A LARGE MANUFACTURER AND CAN OFFER SAME AT LESS THAN 25 PER CENT OF LIST PRICE.

The resistors are mainly I.R.C. and Morganite and are in a wide range of values from 200 ohm. to 3meg. in ½, 1 & 2watt also included are I.R.C. 3watt wire wound 2,200 ohm. 3,300 ohm 4,700 ohm. etc.

List price **$9.00** per 100 our price **$2.00** per 100 post & packing 25c extra.

The condensers are in most popular makes and include Polyester, Paper, Mica, Ceramic & Electrolytic in standard values including 4mfd, 8mfd, 16mfd 300V etc.

List price **$11.00** per 100 our price **$2.00** per 100 post & packing 50c extra.

The potentiometers are all current types and include switch pots, dual concentric, 1meg. tandem, ½meg switch, tab pots etc.

List price **$12.00** per dozen our price **$2.50** per dozen post & packing 50c extra.

FREE With each lot of resistors, condensers or pots, we will supply free one new valve type 6U7G, 6X5GT, 1T4, 6K7G, or 12AT7. Resistors, condensers and pots are in packs of 100 or 12 and we regret we cannot supply to individual Lists of values or types.

NEW SELENIUM RECTIFIERS

New Selenium Rectifiers, 6 or 12 volt at 4 amp., $3.75. Post, N.S.W., 20c; Interstate, 20c. Transformer for above rectifier tapped for 6 to 12 volts, $4.75. Post, N.S.W., 75c; Interstate $1.00.
As above, 6 or 12 volt, at 2 amp., $2.75. Post, N.S.W., 35c; Interstate, 45c. Transformer for above, $3.75. Post, N.S.W., 35c; Interstate, 45c.

TRANSISTORISED SIGNAL INJECTOR $5.75

A MUST FOR QUICK TROUBLE SHOOTING Using TWO Transistors, complete with instruction sheet and battery. Post free.



NEW VALVES AT BARGAIN PRICES

7193	25c	1T4	45c	6H6G	35c	6SS7 equiv. 6SK7	85c	1A7GT	75c
807	$1.75	3Q4	75c	6K7G	45c	6U7G	45c	1L5G	95c
1C7G	30c	3S4	$1.00	6K8G	68c	6X5GT	75c	12SK7	80c
1D8GT	95c	5V4G	$1.00	6SA7GT	95c	7C7	35c	12A6	80c
1K5G	40c	6C8G	50c	6SJ7	95s	12AT7	$1.00	12K8	50c
1K7G	49c							12SH7	80c
1M5G	40c							866	1.50
1P5G	25c							954	25c
1Q5G	25c							955	25c
								EK32	68c

Please add postage on all valves.

NEW ENGLISH and AMERICAN TRANSISTORS AT 1/4 LIST PRICE

Ideal for the experimenter or service man.
Each package of 12 contains 3 of each of the following types.

PACKET OF 12 FOR $3.00

Mazda XA101.	Equivalent:	OC45 R.F. Transistor.
Texas 2N1108.	"	OC44 OSC. Transistor.
Texas 2N1111.	"	OC75 General purpose
Texas 2N1110.	"	OC45 R.F. Transistor.

THESE TRANSISTORS CAN BE SUBSTITUTED FOR MANY OTHER TYPES.

Post and Packaging 20c extra.

New Electrolytic Condensers

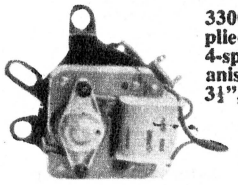
These condensers are miniature pigtail type insulated new stock in packets of 12, each packet containing; 3 16mfd 300 V.W., 2 32 mfd. 300 V.W., 1 25 mfd. 450 V.W. and 6 low voltage electrolytics. **$2.50.**

Post and packing 20c extra.

NEW IMPORTED 4" P.M. SPEAKERS

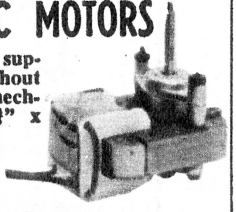
Available with a 4 or 16 ohm voice coil. **$2.00.**
Post and packing 30c extra.

NEW 240V ELECTRIC MOTORS

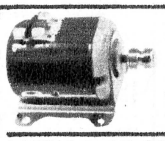


3300 R.P.M. can be supplied with or without 4-speed reduction mechanism. Size 3¼" x 2¾" x 3¼", including spindle.

$2.75



plus 60c. postage.



NEW MINIATURE MOTORS

Ideal for models, toys, etc. 1½ to 3 volts, 6,000 r.p.m. 39c each or $3.50 per doz. Post 10c.

NEW MIDGET POWER TRANS. $3.25

40mA prim., 240v. Sec 225 x 225 with 6.3v Fil. Winding. 30mA 240v Prim. Fil. Winding. **Postage: N.S.W. 25c; Interstate 45c.**

150 x 150v. Sec. with 6.3v. **Postage: N.S.W., 35c, Interstate 60c.** **$3.25**

NEW AMERICAN TWIN TELESCOPE TV AERIAL Extends to 36in, each section can be used singly for car or portable .. .. **$1.50.** Post 20c.
SINGLE TELESCOPIC Aerial 12in extends to 33in. 60 cents .Post 10 cents.

NEW B.S.R. TAPE DECKS

These new 3-speed B.S.R. Decks are fitted with a digital counter and will take 7in spools, 2 Track, $35, 4 Track $40.

A PREAMP FOR MAGNETIC PICK-UP OR TAPE HEADS

SUITABLE FOR USE WITH THE COLLARO OR B.S.R. TAPE DECKS

Using 3 silicon transistors as featured in October Electronics Australia complete with kit of parts including transistors mono **$7.50**, stereo **$13.00**, 240 power supply for above **$7.00.**
Please specify if required for pick-up or tape heads.

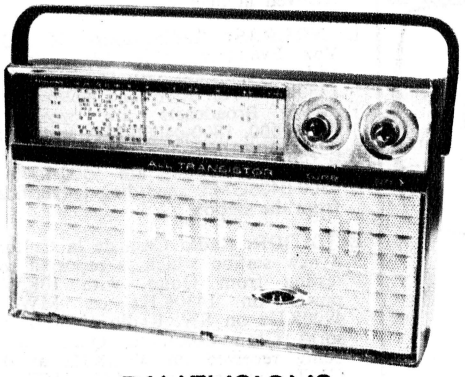


NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

NEW TRANSISTOR 8 KIT SET

SPECIAL PURCHASE ENABLES US TO OFFER THIS KIT SET AT $24.00



DIMENSIONS
9" x 5" x 3" DEEP

(WIRED AND TESTED $6.00 EXTRA)

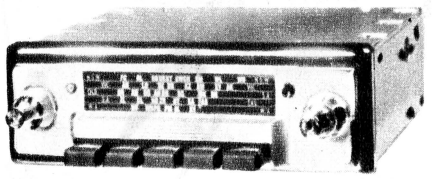
- Complete kit of parts with circuit and full instructions
- Eight transistors.
- Magnavox 5X3 speaker gives excellent fidelity.
- High sensitivity, suitable for city or country use.
- Heavy duty battery for economical operation.
- Modern design, plastic cabinet with gold trim.
- Dial calibrated for all States.
- Available in colours of off-white, red, black or light green.

Post & Packing extra. N.S.W. $1.25, Interstate $1.75.

NEW TRANSISTOR CAR RADIO

New transistor six car radios with R.F. stage, of Aust. manufacture using A.W.A. components and transistors.
Available in manual or push-button models with dial calibrated for all Australian States.
Supplied with speaker (5", 6", 5" x 7" OR 6" x 9") and lock-down aerial.

MANUAL MODEL $43.00
PUSH-BUTTON MODEL $48.00
Post and Packing N.S.W. $1.50, Interstate $2.50.

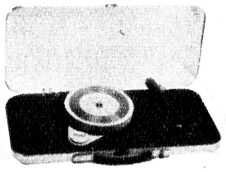


Suitable for 6 or 12 volts for positive or negative earth. Please state type required.

NEW TRANSISTOR STEREO RECORD PLAYER

This Stereo Record Player is fitted in a durable and attractive vinyl covered case with silver trim and incorporates an 8-transistor Stereo amplifier with two Magnavox 5in x 3in speakers and B.S.R. record player (4-speed) with crystal pick-up. For 240 volt A.C. operation only. DIMENSIONS:— 21" x 10" x 3¼" WEIGHT 12lbs

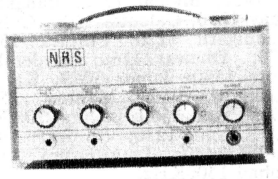
$38.00



Post and Packing extra N.S.W. ..... $1.50 Interstate $2.50

NEW 25 AND 35 WATT. P. A. AMPLIFIERS

THESE AMPLIFIERS ARE SUITABLE FOR INSTALLATION IN CLUBS, SCHOOLS, RESTAURANTS, HOTELS, FACTORIES, ETC., WHEREVER THE AMPLIFICATION OF SPEECH OR MUSIC IS REQUIRED.

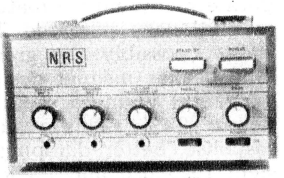


STANDARD AMPLIFIER

25W $61.00 SPECIFICATIONS 35W $71.00

Nominal power 25 or 35 watts. ● Inputs two microphone and pick-up or radio with separate controls and mixing facilities. ● Tone control. ● Microphone sensitivity 6MV. pick-up or radio 150MV. ● Frequency response 30 to 18,000 CPS. ● Output impedance Line output (100, 166, 250, 500 ohms) or can be supplied with V.C. output (2, 3, 7, 8, 15 ohms). ● Dimensions 11in x 6in x 8in. Weight 25W 23lb. 35W 26lb.

SEPARATE BASS AND TREBLE CONTROLS



AMPLIFIER WITH BASS and TREBLE CONTROLS

All amplifiers can be supplied fitted with a separate tone control stage with separate bass and treble controls and stand-by switch at $5.00 extra.
All amplifiers are too heavy to be sent by parcel post so can be sent by air freight or rail or road transport.

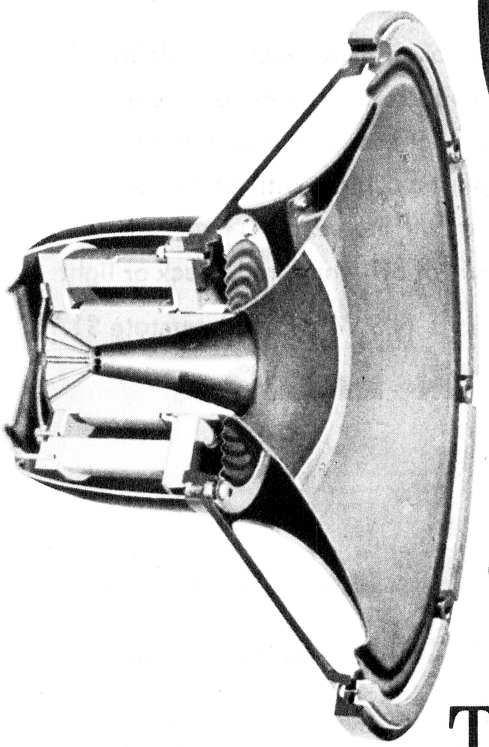
FREIGHT EXTRA.

NATIONAL RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE 56-7398

NOW distributed

by AWA



The range of world famous Tannoy *Monitor* dual concentric loudspeakers.

The "Monitor" series dual concentric loudspeakers are the culmination of over 30 years' continuous research and incorporate many unique features including the revolutionary patented Tannoy magnetic shunt (possibly the greatest advance in loudspeaker magnet design over the past 10 years) giving a useful flux increase of up to 20%. This results in smoother response, better damping, improved transient response and higher efficiency.

TANNOY

Distributed through the Consumer Products Division of

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

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42 Frederick Street, Launceston. 2 1804 • 123 Murray Street, Hobart. 3 3836-7

GMT. The station is also using 9750KHz, and both transmitters have the power of 10KW.

Radio Clube Paranaense, using 11935KHz has a new chief engineer, who is keen to receive reception reports. Snr. Jose Benito Lourenco will confirm reception reports with a pennant and card. The station call is ZYS35 and operates 0900-1700GMT. Signals are best received at opening.

HONDURAS: Radioemisore HRVC La Voz Evangelica, Honduras, with the address Apartado 370, Tegucigalpa, uses 1380KHz with 1KW and 4820KHz with 5KW. Broadcasts are week days 1100-1600, 1800-0400GMT, and on Sundays 1100-1600 and 1900 to 0400GMT. English broadcasts are 1500-1600 and 0300-0400GMT according to verification from the station.

ECUADOR: Radio Casa de la Cultura is a new station which is reported to be testing from Quito, with 10KW of power on 1430KHz on MW and 4900KHz on SW. Radio HCMJI, Emisoras Gran Colombia, Quito, is now being received on 4910KHz at 0500-GMT and as late as 0630GMT.

PERU: Radio Santa Rosa, Lima, using 6045KHz, is a new station and has the postal address of Camana 152, Lima, Peru. The station manager of Radio Tropical, at Tarapoto, is keen to receive reports on reception of the signals on 9710KHz. He requests reports to be sent to the station. The manager's name is Snr. Juan Pablo Mori.

NOTES FROM READERS should be sent to ARTHUR CUSHEN, 212 Earn St., Invercargill, N.Z. All times are GMT. Add 8 hours for Perth, 10 hours for Sydney and 12 hours for Wellington. All frequencies in KHz.

BROADCAST BAND NEWS

INDIA: Some changes have taken place with transmissions of All India Radio. Some new frequences have been put into operation, and some brand new stations have come into service.

Location	Old KHz	New KHz
Raipur	1000	980
Calcutta B	1130	1000
Calcutta C	1540	1130
Calcutta A	—	670
Jullundur A	710	890
Jullundur B	—	710

A report in the "New Zealand DX Times" states that the Jullundur B program takes Vividh Bharati programs which are also carried by Ahmedabad 1400KHz; Allahabad 1420; Bhopal 1200; Bangalore 820; Bombay 1230; Calcutta 1130; Calicut 1090; Chandigarh 1220; Cuttack 1350; Delhi 1370; Dhawar 1160; Hyderabad 1220; Indore 1590; Jaipur 1270; Kanpur 1440; Lucknow 910; Madras 1550; Nagpur 660; Patna 1500; Poona 970; Rajkot 1420; Ranchi 1230; Srinigar 1490; Tiruchirapalli 1480; Truvandrum 1140; and Vijayabad 1500KHz.

BELGIUM: The French 2nd program of Radio Television Belge in Brussels is now on the new frequency of 1043KHz in parallel with 1124KHz.

HAWAII: Radio Station KTRG in Honolulu operates on 990KHz with 5,000 watts. The station is frequently heard during early morning listening with telephone conversation with its listeners around 1500GMT. The station is keen to receive reports from listeners in Australia and New Zealand, and as well as sending a verification letter, also sends a bumper sticker. The station address is 227a Kala Kaua Avenue, Honolulu, Hawaii 96815. The station operates 24 hours a day. ■

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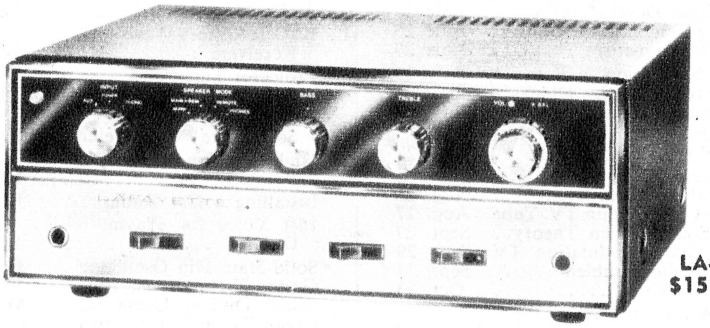
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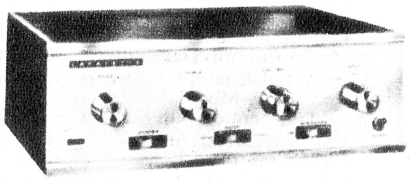


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LAFAYETTE Audio Equipment is also available from Hi-Fi distributors throughout Australia.

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Mortar Location—contd.

of the located mortar. The remainder of the unit consists of various switches for operating the radar, a tilt button to operate the radar beams and range and azimuth markers.

All three units are mounted on a four legged structure supported on screw jacks, but the display is operated remotely and can be carried by one man to a remote under cover position.

The whole structure is normally transported on a ¼-ton wheeled trailer, but it can be fitted into a long wheel base Land Rover. Alternatively the radar structure can be lifted on special slings by a helicopter, or, by fittings two carrier poles, can be carried by four or six men.

Its operation requires two men, but if necessary can be carried out by one man only. Its principle of operation is the same as that used in Green Archer.

While the radar is primarily intended for mortar location, the British army found the Green Archer was very successful in the adjustment of their own artillery fire and it is the intention to use Cymbeline in the same way. When firing at high angle the radar can detect the shell on its downward trajectory instead of its upward one and it can compute where it falls. When firing guns at low angle the method is slightly different and the gun fires an airburst instead. By obtaining the actual position of the burst, as observed by the radar, and comparing it with its theoretical position, as determined by the range set on the gun, the error due to meteorological and other conditions may be obtained. ■

Zinc-Air Battery—contd.

aspects of the Leesona system performance has left unanswered many questions which engineers with a use for batteries would want to ask. The article was not intended to finish up as a text-book on zinc-air batteries and it must be admitted that because the system is in its early stages of development, many of the answers still have to be determined. The complete characterisation of the system requires much more work, particularly on its use in secondary batteries where a wide variety of charging techniques still have to be explored to determine that best suited to cycle life and efficiency. ■

ANSWERS TO CORRESPONDENTS

When writing to us:—

- ***Please give your name and full postal address, including the State and Postcode.***
- ***Write the above information clearly or, for preference, print it in block letters. Your co-operation will facilitate delivery of replies by mail, where such are called for.***

NEWCOMER TO AUDIO: I became interested in the 3-plus-3 stereo amplifier described in the August, 1968 issue. I have not had much to do with audio and hi-fi equipment and I should appreciate it if you could suggest suitable literature on the topic and where I could obtain it. Could you suggest a reasonably priced turntable to suit the 3-plus-3? **(R.P., Ryde, N.S.W.)**

● We assume you are a fairly new reader of "Electronics Australia" or you would be aware that we regularly publish articles intended to assist those wishing to enlarge their knowledge of audio matters. An example of this is the series "Know Your Gramophone" published in 14 chapters, the last of which appeared in February, 1967. Since then, we have published regularly items of a similar nature, in our "Audio Topics" columns. We regret we cannot provide lists of books for reasons which we have explained many times in these columns. Readers must decide for themselves which texts suit their requirements, and all we can do is to review books sent to us by publishers for this purpose. Similar remarks apply to commercially made items such as turntables. We have reviewed several of these lately in our Trade Reviews and Releases columns.

DAMAGED FETs: When I constructed the Playmaster 115 10W all-silicon stereo amplifier, I damaged the two FETs in the preamplifier. I have been informed that FETs should be supplied with a shorting band around the terminals, and that this should be left on until they are soldered into place. When I purchased mine, this was not provided, and no mention of the shorting band was made in the article. Could you please clarify this point for me and perhaps other unsuspecting readers also. **(A.C., Sydney, N.S.W.)**

● The type of junction FET which is used in "Electronics Australia" projects is quite different from the delicate MOSFET which has to be protected from accidental damage by a shorting band around the terminals. Junction FETs are not more susceptible to accidental damage than a normal junction transistor. The damage to your FETs can therefore probably be attributed to mishandling. This can happen for example from the use of a soldering iron with a 240V element with poor earthing arrangements and above average leakage. Other possible causes of damage are excessive heat applied during soldering (avoided by using a heatsink attached to the lead until the solder cools) or wrong identification of terminals. These matters were not mentioned specifically in every article, because they are routine for all solid-state devices.

SIMPLE RECEIVERS: I have recently become interested in radio, and have had a couple of attempts to build receivers with not much success. Could you inform me where I could obtain some simple and self-explanatory receiver circuits to build, preferably using valves. **(L.Y., Bankstown, N.S.W.)**

● We have described many simple receivers suitable for beginners. The most recent designs of this type are: ABC Three, February, 1966; ABC Four, March, 1966; ABC Five, August, 1966; Three Band Two, October, 1966; and the Three Band Receiver with Output Stage November, 1966. Copies of the articles describing these projects are available through the Information Service for 20c each.

IC AMPLIFIERS: I am a newcomer to the electronics field and have not advanced much past studying your "Basic Radio Course" which I have found to be by far the most easily understood material on the subject. In a recent issue, I noticed mention of an IC 10W amplifier costing only $9, which seems to do everything a conventional amplifier does for a cost of $60.70. This must have a devastating effect on the sale of conventional amplifiers, etc. What about an IC version of your 10+10 amplifier? **(T.D., Ferntree Gully, Vic.)**

● Thank you for the nice remarks about the "Basic Radio Course," we tried to make it as easily readable as possible. When you see mention of an IC (integrated circuit) it normally refers to a basic group of active and passive functions, which may be the heart of a piece of apparatus but not the complete apparatus. A 10-watt audio IC would conceivably contain circuitry capable of delivering an output of 10 watts with an input signal of much smaller amplitude. Before it could be used as a complete consumer-style audio amplifier, it may have to be supplemented with input connection facilities, possibly an input preamplifier stage, volume control, tone control and signal switching facilities, external components to secure the desired performance from the IC, output connection facilities, power supply, overload protection, a chassis to mount it on and a suitably handsome panel and knobs to make it saleable. For stereo, many of the items would have to be duplicated or augmented. What this amounts to is that complete amplifier systems using ICs are no better than competitive at the moment with similar systems using discrete components. There certainly isn't any "devastating" difference.

SWEEP GENERATOR: As it is several years since you published an article on the construction of a sweep and marker generator, some of the parts of which are not procurable now, I should like to ask whether you plan to feature such an instrument in the near future. **(N.B., Pakuranga, N.Z.).**

● At present, no, but we will keep your suggestion in mind when considering future projects. Of necessity it will have to be based on quite different principles from the earlier ones.

FIRE BRIGADE RECEIVER: Connected with a fire brigade in the Dandenong Ranges, I am not always able to hear the siren at the local station. There may be many other country fire brigade members like myself, who would welcome the opportunity to construct a receiver which could be left running continuously on the net frequency, in the 160MHz band. Many old television receivers have now reached the junk box and these could provide IF transformers, &c. for a 5.5MHz IF channel. A squelch circuit would, of course, be necessary. **(J.I., Ferntree Gully, Vic.)**

● As you probably would appreciate, a straight conversion of the sound system

"ELECTRONICS Australia" Information Service

As a service to readers "ELECTRONICS Australia" is able to offer: (1) Photographs, dye-line prints and other filed material to do with constructional projects and (2) A strictly limited degree of personalised assistance by mail or by reply through the columns of the magazine. Details are set out below:

REPRINTS: For a 20c fee, we will supply circuit data, as available from our files. The amount of data available varies but in no case does it include material additional to that already published in the magazine. For complicated projects involving material extracted from more than one issue, an extra fee may be requested. As a rule, requests for circuit data will be answered more speedily if the circuits are positively identified and the request is not complicated by questions requiring the attention of technical personnel. Where articles are not on file, we can usually provide a photostat copy at 20c PER PAGE.

PHOTOGRAPHS, DYE-LINE PRINTS: Original photographs are available for most of our projects, from 50c plus 8c postage for a 6in x 8in glossy print. In addition, metalwork dye-line prints are available for most projects for 50c each; these show dimensions and the positions of holes and cut-outs but give no details of wiring.

BACK NUMBERS: A fairly good selection is available. On issues up to 6 months old there is a surcharge of 5c. On issues from seven to 12 months old the surcharge is 10c. Over 12 months, it is 20c. Package and postage is 10c extra in all cases.

REPLIES BY POST: This provision is made primarily to assist readers in matters relating directly to articles and projects published in "ELECTRONICS Australia" within the last 12 months. Note, however, that we cannot provide lengthy answers, undertake special research or modifications to basic designs. A 20c query fee must be enclosed with letters to which a postal reply is required; the inclusion of an extra fee does not entitle correspondents to special consideration.

OTHER QUERIES: Technical queries which fall outside the scope of "Replies by Post" may be submitted without fee and may be answered through the columns of the magazine at the discretion of the Editor. Technical queries will not be answered by telephone.

COMMERCIAL EQUIPMENT: "ELECTRONICS Australia" does not maintain a directory of commercial equipment, or circuit files of commercial or ex-disposals receivers, amplifiers, etc. We are therefore not in a position to comment on proposed adaptation of such equipment, or on its general design. "ELECTRONICS Australia" does not deal in electronic components. Prices, specifications or other assistance must be sought from the appropriate advertiser or agent.

REMITTANCES: These must be in a form negotiable in Australia. Where the charge may be in doubt, an open cheque, endorsed with a limitation, is recommended.

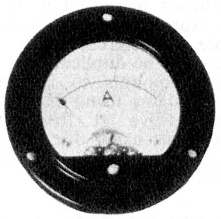
ADDRESS: All requests for data and information, as set out above, should be directed to The Assistant Editor, "ELECTRONICS Australia," Box 2728 G.P.O., Sydney, N.S.W., 2001. Other correspondence should be directed to The Editor. 9/67

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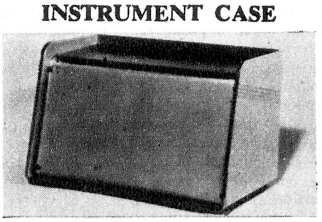
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500uA	$5.25	500 volts a.c.	$5.50
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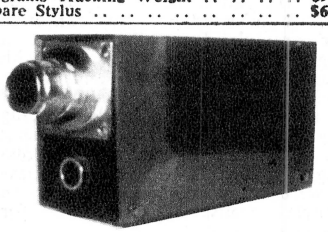
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ANSWERS TO CORRESPONDENTS—continued

of a television receiver would not be practicable, since these involve a double frequency change, dependent on the presence of two carriers 5.5MHz apart. A complete rebuild would be required, with the possibility that more 5.5MHz IF components would be necessary than are available from some TV receivers. This done, it is doubtful whether the receiver would have enough selectivity to keep out other services on nearby frequencies. If the IF response were sharpened up to reduce interference, stability of the local oscillator would become a problem. The kind of local oscillator which will serve a TV receiver, with its broad pass-band intercarrier sound, would almost certainly be inadequate for monitoring a narrow-band FM service. Frankly, we feel that your best plan would be to try to purchase a regular high-band FM transceiver of which large numbers are being discarded right now, because their specifications no longer meet PMG requirements for metropolitan services. Buy the appropriate crystal and the unit would be ready to monitor a high-band FM service forthwith. If there are a number of fire brigade members so involved, why not club together and see if you can buy a job lot?

COMPUTERS AND LASERS: For many years I have been interested in computers and lasers. Can you provide me with circuit diagrams and data on how they work. If this is not feasible, can you tell me where I might find such information. **(W.D., Greenacre, N.S.W.)**

● You say you have been interested in these subjects for many years. Since we have no way of knowing your technical level we could not possibly provide lists of publications, even if we had the time to prepare such lists, which we have not. We can only reiterate what we have said in these columns many times already. Read the book reviews each month to see whether any suitable texts are covered. Our reviewers try to give an objective summary of each text received to establish their usefulness and the level at which they are aimed. We would draw your attention to the handbook prepared by our technical editor "An Introduction to Digital Electronics" which should serve as an introduction to some of the basic theory, and has some simple circuits to illustrate digital techniques. We have not published circuits for the construction of lasers, and we are unlikely to do so, since these devices can be dangerous in unskilled hands. There is also the problem of availability of suitable components.

STEREO SYSTEM: I have a popular three-piece radiogram using two locally made wide-range loudspeakers in separate vented enclosures, a well known brand of changer and a good ceramic cartridge. With this is a solid-state (12W total RMS) amplifier. This outfit gives generally good reproduction, especially of popular style music where there is plenty of brass and percussion. But in the classical field it falls down where there is a lot of strings or a choral accompaniment. I feel that this is probably due to the twin-cone loudspeakers, which are probably a compromise between bass and treble. Would a new, more expensive multiple loudspeaker system give the desired clarity? The cartridge and stylus are in perfect condition. **(K.C., Newcastle, N.S.W.)**

● Brass and percussion can sound impressive on any reasonable system and for this reason, we tend to bypass records of this nature when trying to assess the performance of a system. Tests with complex strings, voices and grand organ pipes are much more searching, as you have found out. Frankly, we think that your problem involves not one but three major items: (1) The ceramic cartridge; these can be quite good but, as a class, they lack the clarity of the best magnetics. (2) The amplifier; a 6W + 6W system is generous enough by radiogram standard but too easily carried to the region of discernible distortion by loud, complex passages. (3) The loudspeakers; these too are good by radiogram standards but likely to fall short of more expensive multiple loudspeaker units. We doubt the wisdom or the efficacy of simply replacing the loudspeakers. Your best plan would be to sell or trade your present system for one more appropriate to your present demands.

VLF RECEIVER: I noticed in a recent copy of your magazine a reference to a VLF receiver. I have been looking for such a receiver for some time now but have been unsuccessful. A simple 3-valve TRF would be just right for my purpose. It should have a frequency coverage from 150 to 550KHz. In regard to the crystal clock, I noticed a reasonably complex one in "Practical Electronics" for September, 1968. The article warns the constructor against the high cost of constructing a crystal clock, the cost of the crystal alone being £15/1/6 (sterling). **(T.R., Darwin, N.T.)**

● Thank you for your various observations. It is true that a crystal clock must look expensive against the usual mains operated unit but people still seem to want them!

UPDATED SMALL SETS: I am a member of that large army of hobbyists who, in spite of owning elaborate stereo equipment and the like, still derive a special pleasure from building small transistor sets. Back in June, 1957, you detailed a one-transistor receiver, recommending an OC44 or OC45 in preference to an OC70 or OC71 which "are not capable of amplifying efficiently the entire broadcast band." But in the following issue, you prescribed an amplifier using an OC71! How come? All this happened 12 years ago. How about some updated small sets for those of us who still find fun in building them? **(L.M., Melbourne, Vic.)**

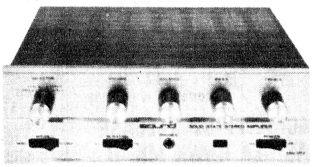
● Fair comment, L.M. The answer to your specific question is quite simple. The OC71 serves as an audio frequency amplifier and is called upon to amplify frequencies up to a few thousand Hertz only. If used as an RF amplifier or detector, it would have to operate at frequencies up to 1600KHz.

STENCIL CUTTER: I refer to the letter by your correspondent C.McL. of Broken Hill, which appears in the December issue of E.A. I, too, have thought of trying to build a stencil cutter. I will be watching your columns for other readers' comments. May I congratulate you also on the high standard of the magazine, which I have enjoyed regularly for ten years. I appreciate especially, the high ethical standard which you require of yourselves and of other people in the industry and the "friendly atmosphere" which has been maintained despite the increasing sophistication of equipment and your magazine over these years. **(M.D., Port Lincoln, S.A.)**

● To date, there has been no other reaction to the letter about a stencil cutter and we cannot foresee any article on the subject in the immediate future, unless one comes to hand from a contributor "out of the blue." Thank you, indeed, for your other comments. What you have summed up is the kind of magazine we try to produce, problems notwithstanding.

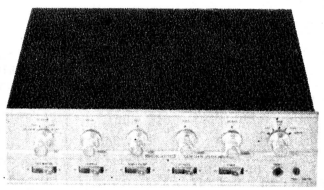
THREE POPULAR SOLID STATE STEREO AMPLIFIERS FROM THE SOUND/ENCEL STABLE!

With specifications that demand attention and most effective quality control in manufacture, it's not surprising that Sound stereo amplifiers command a high proportion of the markets in their respective price ranges. In Australia Encel prices make Sound amplifiers better value than ever. Ask for a trade-in valuation when you write or call!



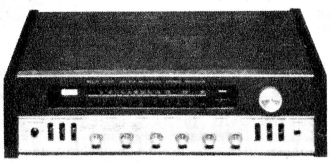
SOUND MODEL SAQ-203 SOLID STATE STEREO AMPLIFIER

Frequency response is 30-20,000 Hz. and input sensitivity suits magnetic cartridges at 3 mV. Output is 12 watts R.M.S. or 30 watts E.I.A. peak power. 18 low noise transistors. Headphone jack, all necessary controls, attractive front control panel. Speaker matching for 4, 8 and 16 ohm. speakers or speaker systems. An ideal compact amplifier for use with tape recorders or for building into cabinets and bookshelves. Inc. sales tax **$74.50**



SOUND MODEL SAQ-505X SOLID STATE STEREO AMPLIFIER

With an output of 25 watts R.M.S. into 8 ohm. speaker systems, the 505X represents outstanding value for money. Frequency response is 20-20,000 Hz. plus or minus 1 dB. and extends well beyond this range. Sensitivity is 3 mV. for magnetic cartridges and all desirable control facilities are incorporated. This powerful amplifier is bargain priced by Encel Electronics at only **$119.50**



SOUND MODEL SRQ-602X SOLID STATE STEREO TUNER/AMPLIFIER WITH OVER 100 WATTS MUSIC POWER OUTPUT

With an extremely flat frequency response of 20-20,000 Hz. plus or minus 1dB. and extending well beyond these figures, the Sound 602X incorporates 29 transistors and 19 diodes. Sensitivity is 3 mV. for magnetic cartridges, 50 mV. for crystal/ceramic cartridges and 250 mV. for auxiliary inputs. Sides of the cabinet are selected Danish teak and the modern design will blend with period or contemporary decor. Every desirable control facility has been incorporated . . . as well as loudness, rumble and scratch filters, a headphone jack and tape monitor controls. The AM tuner brings in distant stations easily and is remarkably sensitive. Encel price, inc. sales tax is **$189**

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257 Clarence Street, Sydney, N.S.W. 2000.
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Australia's Greatest Hi-Fi Centre

DIRECT DISPOSALS Mail Order Bargains with a MONEY BACK GUARANTEE

Money cheerfully refunded if not completely satisfied — from Australia's top mail order specialists — Established 23 years



12 months warranty

SPECIAL FIRST RELEASE 'TAS' SEA HAWK MK. II

The new 1969 version of the original Sea Hawk outboard. Powerful enough to drive a 12ft. boat at 10 m.p.h. 35lb. static thrust equal to 3 h.p. model of well known make. Uses only 1 pint fuel per hour. Weighs only 23lb. Spares will always be available. Write for full information.

NIFE BATTERIES—95c

(Pack, despatch and post 10c ea.)

Brand new! Nickel iron, spill-proof, leak-proof cells—Lasts forever, 4 A.H., 1.2 volts. Sizes 3½" x 2½" x 1". Couple together for any voltage—superb for spotlights, lamps, bells, flash equipment, etc.

Set of 10 gives 12 volts 4 A.H. $7.95 (Pack post $1); Set of 5 for 6 volts, 3.95 (Pack post 50c).

Large size 1.5 volt 15 amps. hours: 8" x 4" x 2" $2.75. Post 75c. Set of 8 for 12 volt $20. Freight $4. Set of 4 for 6 volt $10. Freight $2.50.

Famous E.M.I. TRANSFORMERS $6.50

Brand new! These were made for the British Admiralty, are tropicalised for indefinite storage. Primary 10 / 0 / 200 / 220 / 240. Secondary 300/0/300 volts at 150MA. 6.3v. at 3 amps. and 5v. at 3 amps. **Govt. cost $40.**

SPECIAL OFFER!

Brand new STEPDOWN TRANSFORMERS $1.50 (Post 30c).

240-volt input 2¼-volt output. 1.5 amps push-on terminal lugs with inbuilt heat relay. (Cuts off current if overloaded.)

English 240 volts to 14.5 volts at 11 amps. Stepdown Transformers. Also tappings for 31 volts at 6 amps., 7.2 volts at 10 amps., 8.5 volts at 5 amps., 7.5 volts at 6 amps.

Made by "COSSOR". Weight 16 lbs. Rail freight collect. $11

20 amp. SILICONE DIODE RECTIFIERS to suit; two needed. $1.20 each. A large purchase of these, factory fresh and brand new. Sold separately if required.

4 AMP 3-18 volt SELENIUM RECTIFIERS

Current English make. Brand new. Converts A.C. to D.C. $1.50. post 25c. **2½ AMP. 85c (Post 15c).**

Brand New 40-Piece

TAP & DIE Sets $9.95

Freight $1.50. 40-piece stocks and dies covering the full range S.A.E. and WHIT. in the one box. **TUNGSTEN STEEL** ¼"-½". Complete with dies stock, tap wrench, tap holder, pitch gauge, driver — in strong metal case.

Brand New 32-Piece

Socket Sets $3.75

Freight $1. Full range 3/16" to 15/16". Chrome-plated, drop-forged, alloy steel in S.A.E. or WHIT. Complete with 2 "L" handles, 2 ratchet handles, three-piece adaptor, flex handle, plug wrench, tommy bar . . . all in strong metal case. A bargain usually twice this price. Please state S.A.E. or WHIT.



BURGLAR SIREN $11.50

Post 75c. Comprises a very efficient, beautifully made rotary siren (can be heard up to ½-mile away); battery pack (with 4 1.5V "C" batteries); leads and manual switch, which can be positioned anywhere handy. Siren can be installed inside or outside of house — sounds for 3 hours on batteries (or until switched off). Easily installed in minutes. Ideal for properties, schools (lunch break, etc.) cars, boats.

Siren sold separately for 6V D.C. use $7.95 (post 50c).

Fire alarm temperature sensor operates siren when temperature reaches 135°F., extra $4.50.

MICRO door/window switch triggers siren when door is opened; extra $2.25 each.



"ABNEY" CLINOMETER LEVELS $9.50

Post 50c. A new and improved version of the well known reflection hand level. Provides highly accurate calculation of angles and degree of inclination. Makes an ideal topographic level that permits preliminary surveying with little experience necessary. Arc swings through 90° up and down. Graduated by degrees from 60 degrees in 1 degree steps either side of zero. Direct vernier reads 0 to 10 minutes. Precision make with fine prismatic system, adjustable bubble levels. Leather carrying case and shoulder straps included. 5" long, weighs 1lb. Ideal for ensuring accurate boundary lines and fencing, levelling, grading, irrigation, drainage, building and foundation work, etc.

BATTERY CHARGERS



$17.50 Pack, post $1.25

- **Charges 6V and 12V Batteries overnight**
- **High 4-amp. charge rate**
- **12 months written GUARANTEE.**

Top quality! Top performance! A fantastic direct deal from top manufacturer. They are usually sold at $30.00. Finest quality components; steel case. Charges 6v. and 12v. batteries from 240v. A.C. mains. Complete with fuse, ammeter, long lead with alligator clips for battery terminals and long flex with 3-pin plug. Units are brand new in carton and have passed strict electrical authorities test.

Use also for electric fences and electric model trains.

Special condensor for electric fences and electric model trains, extra $1.75.

TINY ENGLISH SUPER-SENSITIVE CONCEALABLE MICROPHONES 95c

Originally made for hearing aids. Size 1" x ¼". Extremely sensitive. Can also be used as miniature speaker. Use for tape recorders, guitars, etc. At a fraction of their original cost. Freight free.



$12.50 5,200 G.P.H. CENTRIFUGAL PUMP

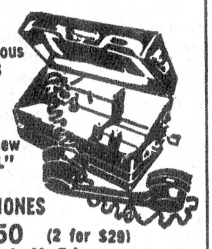
Freight $1

6 MONTHS' GUARANTEE

A real scoop! Direct purchase and top quality. 1¼" inlet, 1" outlet, corrosion proof (salt water proof), all metal centrifugal pumps. Capacity up to 5,200 g.p.h. pressure up to 60 P.S.I. Heavy duty bearings gives pump smoother running and long life. Handles heaviest loads and highest speeds — designed to pass solids such as sand, silt, dirt, etc., without damage. Heads to 120ft., suction lift to 25ft. A bargain never before offered in Australia. Spare parts always available.

Foot valve for ¾" hose $1.55; for 1¼" hose $1.85. Post 20c — if separate. 3" pulley to suit **$1.50**

Mail orders to DIRECT DISPOSALS 36 HELEN ST., VALLEY BRISBANE, 4006 3 shops Brisbane Phone 5 4833



Tremendous SAVINGS

Brand new Army "L"

FIELD TELEPHONES $15.50 (2 for $29)

Made by L. M. Ericcson

6 MONTHS' GUARANTEE

Pack freight $1 extra per phone. housed in completely rust proof metal case. Has long distance ringing generator complete with bell. As used by P.M.G. linesmen and the Army. Ideal for property to property, house to house or shed, line testing, fire fighting communications, etc. Range over 20 miles; use fencing wire (just insulate on posts). Absolutely brand new in original wax sealed cartons. Govt. cost over $100. Size 10" x 5½" x 5". Battery set 80c extra per phone.



Famous 200 H Model

20,000 OHMS MULTIMETERS $9.75

200H model with overload protection. Extremely sensitive, for use in laboratories, etc., and for checking any electrical apparatus; measures to 2,500 volts, etc., $9.75. Post 50c.

RANGES:— D.C. VOLTAGE: 5-25-50-250-500-2.5K (20,000 ohms per volt). **A.C. VOLTAGE:** 10-50-100-500-1000 volts (10,000 ohms per volt). **D.C. CURRENT:** 0-50 uA, 0-2.5 MA, 0-250 MA. **RESISTANCE:** 0-6K, 0-6mg. (300 ohm and 30K at centre scale). **CAPACITANCE:** 10 uuF to .001 uF, .001 uF to 1uF. **DECIBELS:** -20 to +22DB



Amazing Offer! FAMOUS→ TAS

1 HP PETROL ENGINES $27.50

With automatic inbuilt centrifugal clutch.

Made in Japan and brand new.

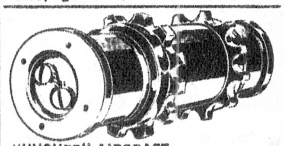
3 MONTHS WARRANTY

Pack, post 75c. A mighty little power plant made by the world famous TAS. Motor Co., "TAS" precision-engineering has produced this powerful, compact unit unrivalled for long trouble-free service. Spare parts will always be available even in years to come.

Specifications — • 2-stroke air-cooled by large fan. • bore and stroke 30x30 mm. • speed range 1,500-6,500 r.p.m. • max. power 1 h.p. at 6,500 r.p.m. • cylinder barrel-alloy with long life nickel chrome liner. • conrod bearings; large rollers in a precision-forged steel conrod. • main bearings — heavy duty ball bearings. • magneto—high intensity; tropic-proofed, fly wheel type. • will run in any position. • complete with instruction book, parts list and set of tools.

1h.p. motor as above with 3,300 r.p.m. gearbox and built-in centrifugal clutch $33.90.

Use for driving pumps, generators, go-karts, compressors, etc.



"HUGHES" AIRCRAFT

GEARED MOTOR $5.50

Post 50c. ½ h.p. geared motor made by Hughes Aircraft Co., U.S.A. for feeding ammo. belts to gun turrets. Has 2 sprockets turning at approx. 100 R.P.M. "A little power baby" with many uses; including turntables, small winch, etc. For 24/32v. D.C. use (works perfectly on 12v.).

TWIN MOTOR ACTUATORS $13

Made by "Lucas". Consists of two separately energised motors and gear units coupled together through a common "T" drive shaft unit at the centre. For 24V D.C. operation. 13.5lb./ft. at "T" shaft. Govt. cost $250

Sizes overall 19" x 8" x 5".

Drive shaft ½" dia. by 3" long.

Brand new freight $2.

AIRCRAFT ROTARY ACTUATORS $9.50

Pack, post 50c. New! Made by "Plessey" England. Size 6" x 4". Many uses including remote control turning of TV or radio antennae.

"ACOS" REPLACEMENT CRYSTAL CARTRIDGES, each brand new in box with STYLUS. Post 20c.

GP 91-2 high output MONO. Usually $6 — **now $2.50.**

GP 73-2A STEREO. Usually $7.50 — **now only $3.75.**



Brand new ENGLISH Electric PAINT SPRAYERS

$13.95

(Pack, Post 50c) Save $12. These famous English spraying outfits are usually $26. Comprises complete modern, electric spraying outfit complete with variable jet; adjustable by knurled knob. Has two containers, flex and plug. Built-in 240 volt A.C. reciprocating motor — for professional finishes to all paint jobs and enamels and spraying insecticides 1969 model new in cartons.

MULTIMETER DESIGN: Would you please publish a circuit for a multimeter using a 0-1mA meter movement. **(J.E., Seaford, Vic.)**

● We have published a number of multimeter designs which would satisfy this requirement, ranging from very simple designs to relatively complex ones. The last design was the Protected Multimeter of December, 1959/January, 1960. Reprints of the article are available for 20c.

REDUCING MAINS VOLTAGE: Is it possible to reduce the voltage of the power mains without the use of a power transformer? I wish to build a small receiver which was described in an American magazine, but the receiver is designed for the American mains voltage of 117 volts and I don't want to have two mains transformers. **(A.S., Hurstville, N.S.W.)**

● There are other ways of effectively reducing the mains voltage applied to equipment, A.S., but they are neither as safe nor as efficient as a transformer of either the separate-secondary or auto-winding variety, and we cannot recommend them. Do not despair, however, for there is an easier way out of your problem; simply substitute for the 117-volt power transformer specified a locally-made unit giving the same, or a close approximation of the required secondary voltages, but with a 240-volt primary. You would probably find it almost impossible to obtain the originally specified transformer here anyway, except perhaps on special order—so that this procedure is really the most practical solution in all respects. A chat with one of the larger trade suppliers, or with one of the electronic equipment transformer manufacturers, should quickly discover the locally made transformer nearest to the circuit requirements.

ENGINE NOISE: I have a car radio fitted in a car which has an AC generator. I find that it is not possible to suppress the engine noise with a 0.5uF capacitor on the generator and a resistor in the HT line. When so connected it makes the noise increase. Can you please tell me how this trouble can be rectified? **(J.P., Marrickville, N.S.W.)**

● We published an article in the February, 1969, issue which described how to install a car radio. This included hints on supressing interference. Copies of the article are available through the Information Service for 20c each.

MEGAHERTZ TO METRES: Have you ever published a frequency table for changing megacycles (megahertz) to metres or vice versa? I have a set with a short-wave range from 3.5 to 7.5MHz and am confused by shortwave schedules which are given in metres. **(P.G., Yallourn, Vic.)**

● The conversion you require is simple. A constant of 300 divided by frequency in MHz will give wavelength in metres. The same constant divided by wavelength in metres will give frequency in MHz. Incidentally, most short-wave schedules, including those published in our own magazine, are now given in frequency rather than wavelength, since frequency has long been the preferred system. We strongly recommend that you learn to think in terms of freqeuncy rather than wavelength.

ELECTRONIC CALCULATOR: I wish to build an electronic calculator capable of addition, subtraction, multiplication and division, and which includes a memory. I need a unit of this type for my job, yet the least costly commercial units on the market are around $1100 each. Can you supply the necessary circuits and constructional information? **(K. W.B., Elwood, Vic.)**

● To date we have not described a project along these lines, K.W.B., and to be frank we doubt whether we shall be able to do so in the foreseeable future. To be of much practical use, an electronic desk calculator of the type which you envisage tends to be more complex than a small general-purpose computer. This, together with a likely cost of at least half that of commercial units, suggests that a project along these lines would interest few readers, yet would involve our staff in considerable development time. We could be viewing the situation over-pessimistically, we admit; if subsequent to this reply we become swamped with letters from readers eager for a project along these lines, we'll have another look at the idea.

TRANSPORTA RECEIVERS: I would like to know the month and year, the volume and number of the issues that contained the "Transporta" receivers. **(E. J.L., Cairns, Qld.)**

● The "Transporta Four" was published in October 1959 (Vol. 21, No. 7), the "Transporta Six" in August, 1958 (Vol. 20, No. 5), and the "Transporta Seven" last appeared in December, 1963 (Vol. 25, No. 9). Copies of the articles describing the Transporta Four and Seven are available through the Information Service for 20c each. For a similar fee we can supply the circuit and other drawings on the Transporta Six.

DESIGNS WANTED: I must congratulate you on an excellent magazine, but since I began reading it I have not been able to find any sound television receivers or SSB transmitting equipment. If you have published such articles could you please tell me the dates. **(M.A., Woodville Gardens, S.A.)**

● Thank you for your opinion of our magazine, we do try to please as many readers as possible. We have not developed a receiver for television sound only, largely because the cheapest and easiest approach is to use a second-hand TV set, if necessary minus the picture tube and EHT. We did publish the "Fremodyne Four" in June, 1967, which can receive the TV channels, but it will not give high quality sound. We published the design of an SSB transmitter from December, 1966, to March, 1967, inclusive. Copies of these articles are available through the Information Service for the usual 20c fee.

COST OF PARTS: Could you please advise me of the approximate retail price of the parts used in the "Novelty Keyboard Organ" featured in the January, 1969, issue? **(S.M., Wahroonga, N.S.W.)**

● We are not in a position to quote prices for projects described in the magazine. We have stated this many times in these columns and we also mention it in the "Information Service" panel published each month in these pages. All inquiries regarding availability and cost of kits should be directed to the firms who advertise such kits. They are in a far better position than we are to quote prices.

LIST OF PROJECTS: Do you have a list of circuit plans which you have available from your files? If so, what is the cost of the list? **(R.W., Thames, New Zealand.)**

● We have on file, in one form or another, almost every project we have ever described since the inception of the magazine in 1939, and it can be readily appreciated how big a job it would be to list them all. We publish an annual volume index in March of each year and the "Construction" section gives a complete guide to the projects which have been described during that year. We suggest that this be used by all readers wanting to know what projects are available. Copies of these indices are available back to volume 15 (1953-54), but excluding volume 16. Price, 20c each. If earlier ones are required, we may be able to arrange a photostat copy.

FIELD SALES ENGINEER

ELECTRONIC COMPONENTS

Cannon Electric (Australia) Pty. Ltd. is looking for a Field Sales Engineer to operate in the Sydney area.

WHAT THE POSITION IS:
Selling the company's products to the electronic industry both at engineering and purchasing levels.

THE PRODUCTS:
Cannon Electric manufactures the well-known range of Cannon connectors in Australia and is also the sole Australian representative for:—

Motorola—Semiconductors.
Sprague—Capacitors.
Welwyn—Resistors.
Magnecraft—Relays.

and other top name electronic components.

WHAT WE WANT:
Ideally, we are looking for someone who has experience in selling electronic components, but if you have an electronic background and a desire to enter the selling field, we would like to hear from you.

THE COMPANY:
Cannon Electric has its head office in Melbourne and operates area offices in Sydney and Adelaide.
Our policy is to satisfy the requirements of the electronic industry for high quality components and we regard the field sales engineer as an important link in achieving our aim.
We are growing rapidly and opportunity for advancement is excellent.

INTERESTED?
Then write to the—

Marketing Manager,
Cannon Electric (Aust.) Pty. Ltd.,
P.O. Box 22,
BRIGHTON EAST, 3187,
VICTORIA,

giving us a brief resume of your personal details and your business and electronic background.

SOUND PROJECTORS

Cinevox Prefect and Hamour and Heath 16mm in good working order. 240v operated, complete with speaker and amplifier.

from $90.00

CIRCULAR SLIDE RULE

3¾in diameter. Will do the same work as the conventional slide rule. Instruction book included.

$1.25 each
Post 10 cents.

REFLECTOR GUNSIGHT

Contains these lenses:
1 Lens 1in Focus, 1¼in diam.
1 Lens 1 11/16in Focus, 1¼in diameter.
1 Air-spaced Lens, 1¼in diam.
1 Filter Lens. 1 Graticule.
1 Lampholder. **$1.85**
Post.: N.S.W. 30c; Interstate: 40c.

P.M.G. TYPE TELEPHONES

Standard desk type with magneto bell calling device. Range 30 miles. Uses standard batteries at each phone. Any number can be connected together on single line.

$23.00
(2 TELEPHONE SETS)

30c cartage to rail. Freight payable at nearest attended railway station.

Please note we are now able to include ½ mile of telephone cable FREE with each set of Phones.

BATTERY CHARGERS

240 volt A.C. Input.
Each battery Charger will charge either 6 or 12 volt batteries.
2 amp. without meter, **$13.75**
2 amp. with meter, **$15.75**
4 amp. with meter, **$19.50**
Post N S.W. 70c; Interstate 95c.

MINIATURE ELECTRIC MOTORS

1½ to 3 volts D.C Ideal for model boats, cars, planes, etc. Strong torque. Only
65 cents each or 10 for $4.00.
(Post 7c).

TRANSCEIVER

(2-way radio) R.C.A. America RT 68, 24 volt, operated 10 watt output 38-54 megacycles F.M. crystal locked. Transmitter and receiver using frequency synthesiser in 100 K/cs: step 10 channel per meg/cycle with power supply. Leads, mike and headphones **$90.00.** 60c cartage to rail. Freight payable at nearest attended railway station.

TRANSCEIVER

(2-way radio) 62 set ideal small ships, Hams, etc. 1.6 to 10 megs. Crystal locked or V.F.O. controlled 5 watt output. Complete with antenna, headphones and mike but not air tested. **$60,** air tested **$90.** Not tested incomplete (without accessories **$25**), 60c cartage to rail. Freight payable at nearest attended Railway Station.

HEAD PHONES

Low impedance moving coil fitted with rubber muffler to reduce external noise, fitted with press to talk, dynamic hand microphones. Ideal for use with all types of transceivers. $3.50 pair. Same with black felt muffler, $4.50 pair.
Post N.S.W 25c: Interstate 30c.

RECORDING TAPE SPECIALS

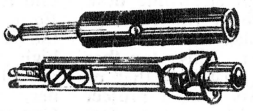
EMI TAPE at a fraction of the Retail Price, direct from one of Australia's leading Broadcast studios.
Used in good condition.
1,800ft, 7in spools, $2.75, post 25c
900ft, 5in spools, $1.68, post 25c
300ft, 3in spools, 65c post 13c

MINIATURE CRYSTAL EARPHONE

With Cord and Plug, **75c.** Post 4c.

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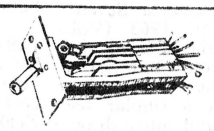
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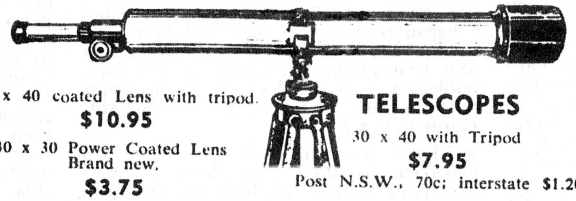
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ORGAN VIBRATO, TREMULANT

(Continued from page 69)

previous circuit of figure 2. This same output buffer, providing two times voltage gain, is also used in the present circuit (T7 and T8) following the third and last modulating stage, T6.

In a sense, the various units used in the three-stage vibrato can be considered as building blocks. By appropriate interconnection, various requirements of phase deviation and input impedance can be satisfied.

One other contribution to the flexibility of the unit has been made by increasing the specified supply voltage to 12. Allowing for decoupling, this permits the use of a 9V zener and supply for the signal frequency circuits and allows them to cope with up to 1V RMS at the input, without overloading the output stage. In these circumstances, the unit can be introduced into any convenient portion of the organ preamplifier circuitry, where the maximum anticipated signal level lies below 1V RMS.

The decoupling just mentioned is an inbuilt precaution against modulation of the signal circuit supply by the varying lamp current, with consequent and possibly deleterious amplitude effects. Its importance would vary with the impedance of the supply actually provided.

The current required was measured at 54 milliamps.

An article, entitled "Power Supplies For Transistors In Valve Equipment," was published in the October, 1968, issue. It was a general presentation of methods for deriving low voltages in valve equipment. There is sufficient information in the article for readers to construct a power supply for either vibrato circuit, using either the filament line in a valve equipment, or a supplementary transformer.)

Whatever the form of the supply, and despite the in-built zener diodes, reasonable filtering must be provided. Since the vibrato units operate ahead of the main power amplifier, undue ripple on their supply will inevitably produce a hum problem.

In terms of their construction, both vibrato units are similar and relatively simple. To a large degree the style of construction and layout can be altered to suit the requirements of particular applications. For the prototype units, we found that a length of "matrix" board served very well as a construction basis, enabling a workmanlike appearance to be achieved.

As will be apparent from the accompanying photographs, the wiring method is to simply push the component leads through the board and solder them, point to point, on the underside. For prototype construction this is a very easy and quick method and most home-builders will probably rate it as perfectly satisfactory for the finished article as well.

Alternative methods might include the use of the special metal pins for use with "matrix" board, miniature resistor panel or the more conventional tag-panel wiring. The primary requirements are correct electrical connections and well soldered joints.

The placement of components in the prototype units follows as far as possible the circuit progression. There should be little difficulty in recognising the various sections.

The layout sequence for the small unit begins at one end with the largest lamp-driving transistor followed by an associated current amplifying transistor. Adjacent to this pair are the two transistors and associated components in the phase shift oscillator. Separated from this section by the zener diode are the single modulating and output stages.

The LDR and lamp are assembled in a 1¼in length of tubing which can be cut from any convenient material, provided that it excludes extraneous light. We found that the aluminium cans from some discarded electrolytics made very satisfactory housing. Incidentally, their internal diameter was 9/16in comfortably enclosing the LDR. The lamp was inserted in the other end through a rubber grommet and pushed against the LDR encapsulation. The complete assemblies were then simply wired to the component board.

Although there are more components in the larger vibrato unit and the layout is a little more compact, the various sections can be seen quite clearly. Again the lamps' driving amplifier and phase shift oscillator are at one end of the board. Next to these sections, separated by a zener diode, is the output stage and then the last LDR/lamp complement.

Between the middle and last LDR/lamp complements is the second impedance buffer stage comprising transistors T5 and T6. Next, there is the middle can followed by the first buffer stage (T3 and T4), with the first modulating stage (T1 and T2) at the end.

The LDR/lamp cans in this unit were not wired down on the board. Instead, the rigidity provided by two bus bars supplying the lamps together with the LDR pigtails was sufficient to securely retain the cans in position.

Connection of the various function controls and input/output signal leads were made directly to the back of the component board. If desired, the heavier shielded leads could be tied down with light gauge tinned copper wire or form-tying plastic. ■

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LOW VOLTAGE FLASHERS

(Cont. from page 75)

of an astable multivibrator. The duty cycles are similar, the differences comprising a few minor variations of component values. For a brief description of circuit operation we will restrict our comments to the second high current version.

For convenience assume that initially the Darlington configuration of T2 and T3, which drives the lamp, is cut-off with collectors at full supply potential and lamp extinguished. This condition causes the 30uF capacitor to charge through the base of T1, holding that transistor conducting and in saturation till the capacitor has almost fully charged.

When charging current can no longer saturate T1, its collector voltage tends to rise to supply potential and the 500uF capacitor commences to charge into the base of T2. As before, the charging current causes the Darlington pair to saturate and light the lamp for the period it takes to charge the 500uF capacitor. When the capacitor is charged, T2 and T3 are returned to the cut-off condition, the lamp is extinguished, and the cycle repeats with T1 driven into saturation.

Darlington pair configurations have been used in both flasher circuits to reduce the level of saturating base current required by the lamp driving transistor. By emitter follower action T2 provides the large base current required by T3 to permit saturation with the low collector load resistance provided by the lamp.

Even with the large current gain achieved by compounding T2 and T3, the base current required by T2 is considerably larger than the saturating base current of T1. For this reason the 500uF capacitor coupling into the base of T2 is relatively large even though the on-time of T2 and T3 is very much less than T1. With only a single transistor driving the lamp, rather than the Darlington pair, the value of the base coupling capacitor would be many times larger than the present 500uF. So large, in fact, as to be impractical.

In some situations it might be convenient to have the flashers as described switched on and off by the ambient light conditions; for instance, on an unattended mooring buoy. This can be quite easily arranged by incorporating a light dependent resistor in the circuit. The appropriate modification, suitable for either flasher circuit is shown in figure 3.

An additional transistor is used in conjunction with the light dependent resistor to effectively hold the Darlington pair in a cut-off condition while ever light is falling on the LDR. When the LDR is not illuminated its resistance is very high, T4 cannot conduct, and the Darlington pair will become saturated. A 100K potentiometer is provided to adjust the level of illumination at which the flasher will commence to operate.

A modification for either circuit making them light activated is shown at right. The extra components required include a transistor, LDR, potentiometer and one resistor.

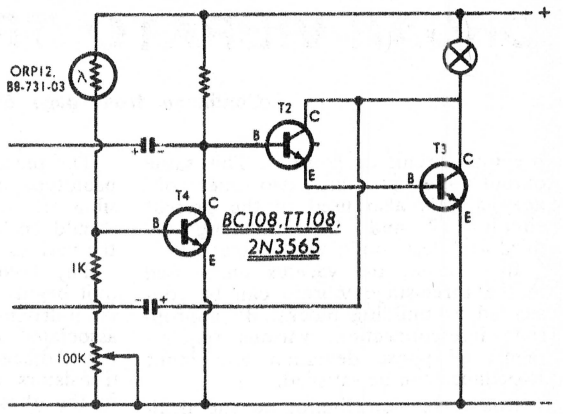


Figure 3 MODIFICATION FOR LIGHT CONTROLLED FLASHING

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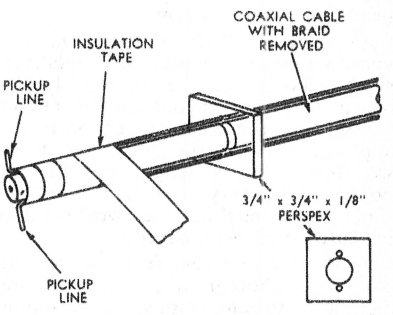
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A READER BUILT IT—continued

A simple jig to help in the construction of the "Standing Wave Ratio Indicator," published in "Electronics Australia" in June, 1965, has been submitted by Mr Bob Morton, 48 Dareen Street, French's Forest, N.S.W. 2086.

The design of the standing wave indicator calls for two pickup wires, of 18 gauge wire, stretched and taped diametrically opposite on the outside of the dielectric around a length of coax inner conductor. The taping has to be done tightly as the finished line has to be bent into an "S" shape to fit into the case.

The simple jig, shown in the sketch, was made to simplify the job of holding the wires in the correct position during taping. One end was taped, the jig slid to about an inch or two away and taping repeated close to the jig. The procedure was repeated until the whole length of line was completely taped. I hope the idea may be of some help to intending constructors. ■



BASIC ELECTRONICS

"Basic Electronics" is a quarto-size 128-page book published by "Electronics Australia." It is a revised edition of the former "Basic Radio Course," and is reviewed on page 137 of this issue. An advertisement for the book, including an application coupon, appears on page 77 of this issue.

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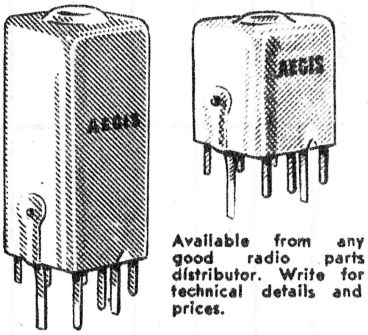
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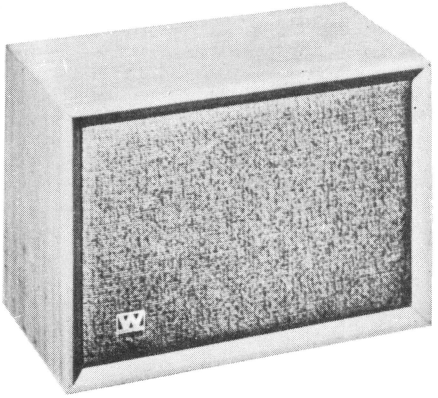
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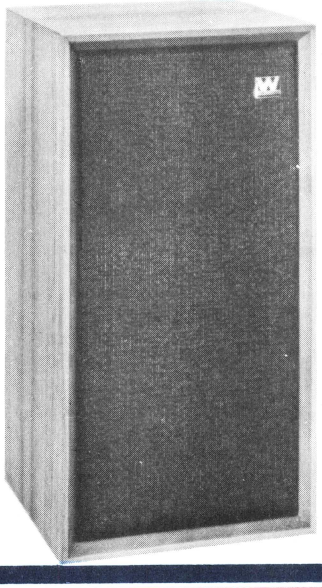
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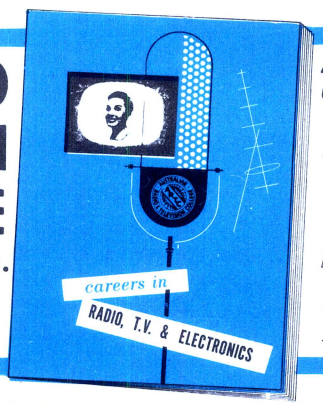
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