Printed in Great Britain for the Proprietors and Publishers Data Publications Ltd., 57 Maida Vale, London W9, *by* A. Quick & Co. Ltd., Oxford House, Clacton-on-Sea, Essex. *"The Radio Constructor" is obtainable abroad through the following:* Collets Subscription Service, Continental Publishers & Distributors, Ltd., William Dawson & Sons Ltd. *Australia and New Zealand:* Gordon & Gotch Ltd. *South Africa:* Central News Agency. *Registered for transmission by Magazine Post to Canada (including Newfoundland).*

SYMBOL OF QUICK SERVICE

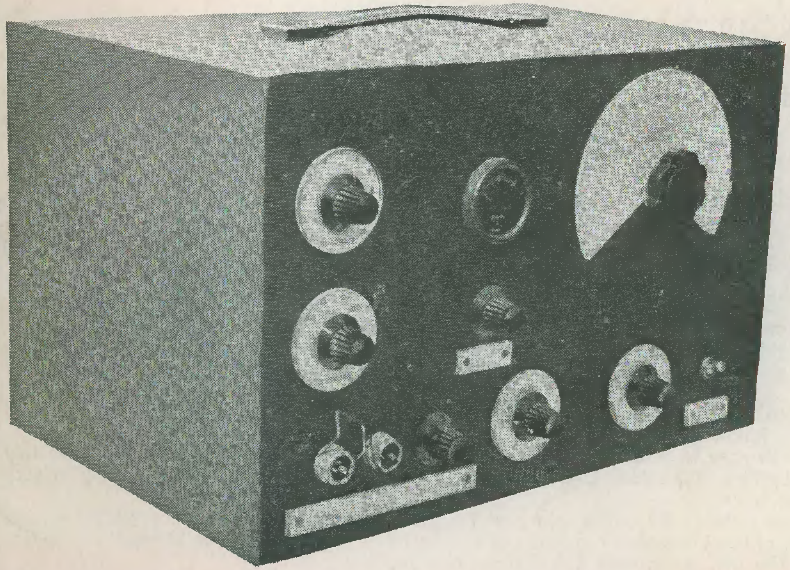
Volume 7
Number 9
APRIL
1954

The RADIO CONSTRUCTOR

incorporating The Radio Amateur

for the Radio and Television Enthusiast

SINE-WAVE SQUARE-WAVE GENERATOR



By
R. A. SEAL

covering 17 c/s—175 kc/s

ALSO IN THIS ISSUE

1/6

THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS OF BRITISH & AMERICAN TECHNICAL BOOKS

Basic Electronic Test Instruments. By R. P. Turner. **32/–.** *Postage 9d.*

Electronic Gadgets for the Constructor. By E. N. Bradley. **3s. 6d.** *Postage 3d.*

Tape and Wire Recording, *compiled by Radio Constructor & Radio Amateur.* **2s 6d.** *Postage 2d.*

T.V. Fault Finding, compiled by *Radio Constructor.* **5s. 0d.** *Postage 4d.*

Television Test Equipment. By E. N. Bradley. **5s. 0d.** *Postage 3d.*

Art and Science in Sound Reproduction. By F. H. Brittain. **2s 6d.** *Postage 3d.*

The Williamson Amplifier. By D. T. N. Williamson. **3s. 6d.** *Postage 3d.*

The Radio Amateur's Handbook, 1954 edn. Compiled by A.R.R.L. **30s.** *Postage* 1s. 3d.

Receivers, Pre-Selectors & Convertors. Compiled by *Radio Constructor & Radio Amateur.* **2s. 6d.** *Postage 2d.*

UHF Antennas, Convertors and Tuners—UHF I. By M. S. Kiver **12s.** *Postage 6d.*

A First Course in Wireless. By "Decibel." **12s. 6d.** *Postage 6d.*

Elementary Telecommunications Examination Guide. By W. T. Perkins. **17s. 6d.** *Postage 6d.*

R.S.G.B. Amateur Radio Call Book—Winter 1953. 2s. 6d. *Postage 3d.*

Radio Data Charts. By R. T. Beatty, revised by J. McG. Sowerby. **7s. 6d.** *Postage 6d.*

Write or call for new catalogue

19-23 PRAED STREET (Dept. RC) LONDON W2

PADdington 4185

SCOTTISH INSURANCE CORPORATION LTD.

62-63 CHEAPSIDE LONDON, E.C.2.

TELEVISION SETS AND SHORT WAVE TRANSMITTERS

Television Sets and Short Wave Transmitters/Receivers are expensive to acquire and you no doubt highly prize your installation. Apart from the value of your Set, you might be held responsible should injury be caused by a fault in the Set, or injury or damage by your Aerial collapsing.

A "Scottish" special policy for Television Sets and Short Wave Transmitters/Receivers provides the following cover:—

(*a*) Loss or damage to installation (including in the case of Television Sets the Cathode Ray Tube) by Fire, Explosion, Lightning, Theft or Accidental External Means at any private dwelling house.

(*b*) (*i*) Legal Liability for bodily injury to Third Parties or damage to their property arising out of the breakage or collapse of the Aerial Fittings or Mast, or through any defect in the Set. Indemnity £10,000 any one accident.

(*ii*) Damage to your property or that of your landlord arising out of the breakage or collapse of the Aerial Fittings or Mast, but not exceeding £500.

The cost of Cover (*a*) is 5/– a year for Sets worth £50 or less, and for Sets valued at more than £50 the cost is in proportion. Cover (*b*) (*i*) and (*ii*) costs only 2/6d. a year if taken with Cover (*a*), or 5/– if taken alone.

Why not BE PRUDENT AND INSURE your installation—it is well worth while AT THE VERY LOW COST INVOLVED. If you will complete and return this form to the Corporation's Office at the above address, a proposal will be submitted for completion.

NAME (Block Letters) ....

(If Lady, state Mrs. or Miss) ....

ADDRESS (Block Letters) ....

....JB

BRITISH MADE

BRIMAR VALVES

more reliable than EVER!

Brimar's long experience in the manufacture of special quality TRUSTWORTHY valves is now being reflected throughout the entire Brimar range.

Improved production methods, new and better assembly jigs, tighter control on the composition of materials, and the closer supervision of vital processes have resulted in valves with more uniform characteristics, greater mechanical strength and a higher standard of reliability as shown in the 12AT7.

The 12AT7 is a very reliable frequency changer and is widely used in modern T/V receivers, VHF and UHF communications equipment. It is also frequently employed in industrial equipment, computors, navigational aids and test equipment.

Use the BRIMAR 12AT7

with improved performance at

NO EXTRA COST

BRIMAR	MULLARD	MARCONI OSRAM	COSSOR EMITRON
12AT7	ECC81	B152 & B309	12AT7

now is the time to

BRIMARIZE!

Standard Telephones and Cables Limited

FOOTSCRAY, KENT. FOOtscray 3333

Smith's of EDGWARE ROAD

Component Specialists Since Broadcasting Started

Invite all those interested in

ELECTRONIC COMPONENTS

(both Regular and Surplus)

to send for particulars of their

New Mailing List Scheme

H. L. SMITH & CO. LTD

287/9 Edgware Road London W2

Telephone Paddington 5891

Hours 9 till 6 (Thursday 1 o'clock)

Nr. Edgware Road Stations, Metropolitan & Bakerloo

ARTHURS HAVE IT!

LONDON'S OLDEST RADIO DEALERS

LARGE VALVE STOCKS

AVOMETERS IN STOCK

Avo Test Meters and Signal Generators and Taylor Meters
Leak Point One Amplifiers and Tuning Units.
Chapman Tuning Units.
Crystal and Moving Coil Mics.
Decca Replacement Heads and Pickups.
Goodman's Axiom 150 Speakers.
Partridge Output Transformers for Williamson Amplifier.
All Components for the Radio Constructor's 16″ Televisor.
Weare & Wright Tape Deck £35.

LATEST VALVE MANUALS
Mullard, Osram & Brimar No. 4 5/– each
Mazda 2/– each Postage 6d extra

TELEVISION SETS, WIRE AND TAPE RECORDERS ALWAYS IN STOCK
Goods offered subject to price alterations and being unsold.

Est. 1919

Arthurs first

Proprietors: ARTHUR GRAY LTD.

OUR ONLY ADDRESS **Gray House**
150-52 Charing Cross Road
London, W.C.2.

TEMple Bar 5833/4 and 4765 WRITE FOR LISTS

SOLIDAS LTD.

4 PRAED STREET
LONDON W2

DEFINITELY

THE CHEAPEST RADIO SHOP IN TOWN

Telephone **AMB 4670**

We have a very

LARGE SELECTION

of

Valves and Spares

at the

Lowest Possible Prices

We have a Large Selection of used but perfect C.R. Tubes. Every Tube carries a 6 week guarantee. Callers can see picture on premises.

9″	£4 0 0
12″	£6 0 0
15″	£8 10 0

Post, Packing and Insurance 10/-

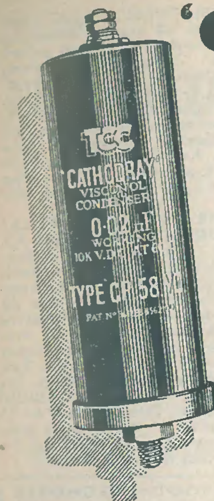
EHT Transformers 5·5 Kv. with U22 Rectifier **£1 12 6.**

URGENTLY WANTED

COMMUNICATIONS RECEIVERS.
TEST EQUIPMENT.
RADIOS—and TELEVISION SETS,
TAPE RECORDERS.

BEST PRICES GIVEN

Phone or Call



'CATHODRAY'
VISCONOL CONDENSERS

for the most stringent conditions

The 'Visconol' Process — exclusive to T.C.C. — means greater dependability and a longer useful life than ever before. It is the answer by T.C.C. research engineers to the insistent demand for condensers which will stand up to higher and still higher voltages. A selection from the range is given below. Features include: low power factor; complete dielectric stability; resistant to voltage surges; ample rating at higher temperatures; proof against breakdown or flash-over. Full details on request.

Cap. in µF.	Max. Wkg. at 60°C.	Dimens. (Overall)		T.C.C. Type No.	Price
		Length	Dia.		
·0005	25000	5 15/16	1 3/4	CP57HOO	18/-
·001	6000	2 3/4	27/32	CP55QO	6/-
·001	12500	3	1 7/32	CP56VO	10/-
·002	18000	5 15/16	1 3/4	CP57XO	18/-
·005	6000	3	1 7/32	CP56QO	10/-
·01	6000	3	1 7/32	CP56QO	10/-
·02	12500	6 1/8	2	CP58VO	20/-
·05	6000	5 15/16	1 3/4	CP57QO	18/-
·1	7000	6 1/8	2	CP58QO	20/-
·25	1000	3	1 7/32	CP56V	10/-

THE TELEGRAPH CONDENSER CO. LTD

RADIO DIVISION: **NORTH ACTON · LONDON · W.3** Tel: ACORN 0061

POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

City and Guilds Grouped Certificates in Telecommunications: A.M. Brit. I.R.E. Examination, Radio Amateur's Licence, Radio and Television Servicing Certificates, General Radio and Television Courses, Radar, Sound Recording, etc. Also Courses in all other branches of Engineering and Commerce.

The advantages of E.M.I. training.

★ The teaching methods are planned to meet modern industrial requirements. ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★ A tutor is personally allotted by name to ensure private and individual tuition. ★ Free advice covering all aspects of training is given to students before and after enrolling with us.

Courses from £1 per month

EMI INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation.

POST THIS COUPON TODAY

Please send without obligation your FREE book.
E.M.I. INSTITUTES, Dept. 179K,
43 Grove Park Road, London, W.4.
Phone: Chiswick 4417/8.

NAME ....

ADDRESS ....

....

SUBJECT(S) OF INTEREST ....

IC18

The Radio Constructor

INCORPORATING *The Radio Amateur*

VOL. 7 NO. 9

ANNUAL SUBSCRIPTION 18/–

APRIL 1954

Editorial and Advertising Offices
57 MAIDA VALE LONDON W9

Telephone
CUNNINGHAM 6518

Editor
C. W. C. OVERLAND, G2ATV

Advertising Manager
F. A. BALDWIN, A.M.I.P.R.E.

CONTENTS FOR APRIL

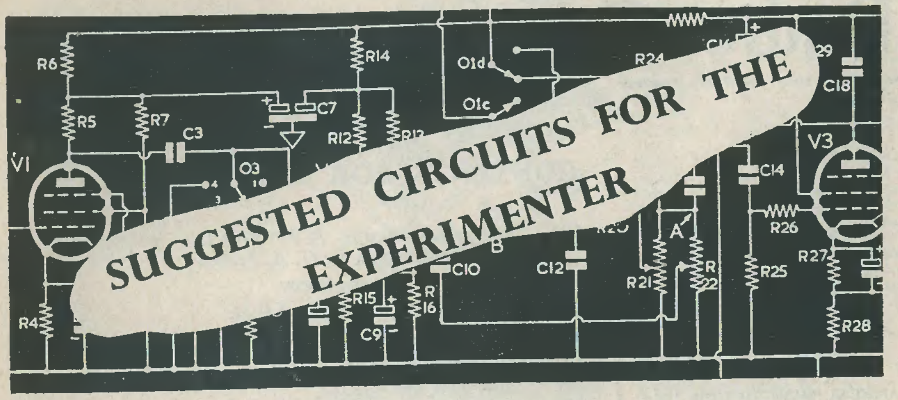
NOTICES

THE EDITOR invites original contributions on construction of radio subjects. All material used will be paid for. Articles should preferably be typewritten, and photographs should be clear and sharp. Diagrams need not be large or perfectly drawn, as our draughtsmen will redraw in most cases, but all relevant information should be included.

All Mss must be accompanied by a stamped addressed envelope for reply or return. Each item must bear the sender's name and address.

TRADE NEWS. Manufacturers, publishers, etc., are invited to submit samples or information of new products for review in this section.

ALL CORRESPONDENCE should be addressed to THE RADIO CONSTRUCTOR, 57 Maida Vale, London W.9 *Telephone* CUN. 6518.



The circuit presented in this series have been designed by G. A. French specially for the enthusiast who needs only the circuit and essential relevant data.

No. 41. A Portable Low Voltage Electronic Flash

As is well known, the respective sciences of photography and electronics are closely allied; the techniques of one often being called upon to facilitate progress in the other. This is especially true of recent developments in capacitor flash tubes, the operation and functioning of which are almost purely electronic.

Capacitor flash tubes consist essentially of three-electrode devices designed to take the place of conventional battery-operated photo-flash bulbs. The electrode assembly of a flash tube consists of an anode, a cathode, and a trigger element. The flash tube is prepared for operation by charging a capacitor connected across its anode and cathode. To initiate the flash, a voltage pulse is then applied between trigger electrode and cathode, this causing the tube to conduct and discharge the capacitor. The trigger voltage is usually derived from a suddenly-excited inductor. The outstanding advantage of the electronic flash tube is that it is capable of being used over and over again; whilst the conventional bulb may be used only once, after which it has to be discarded.

Energy

Owing to the transient nature of its working, it is most convenient to consider the light output of the flash tube in terms of the energy supplied to it during the flash period by the capacitor. The units used are Joules, (one Amp flowing through one Ohm in one second equals one Joule), and may be found from the following expression:—

$$\text{Energy (joules)} = \frac{\text{Capacitance} \times \text{Voltage}^2}{2}$$

To give an illustration of what is required in practice, a design appearing in *Amateur Photographer* for April 1953 utilised a circuit arrangement capable of offering 25 joules. Modern low-voltage flash tubes work from capacitors charged to voltages around 350, and such voltages are often obtained, as in the *Amateur Photographer* design, from a number of deaf-aid batteries connected in series. Deaf-aid batteries appear to be used, also, in some commercial designs. Otherwise, however, it is more usual to have the capacitors charged by means of a vibrator pack.

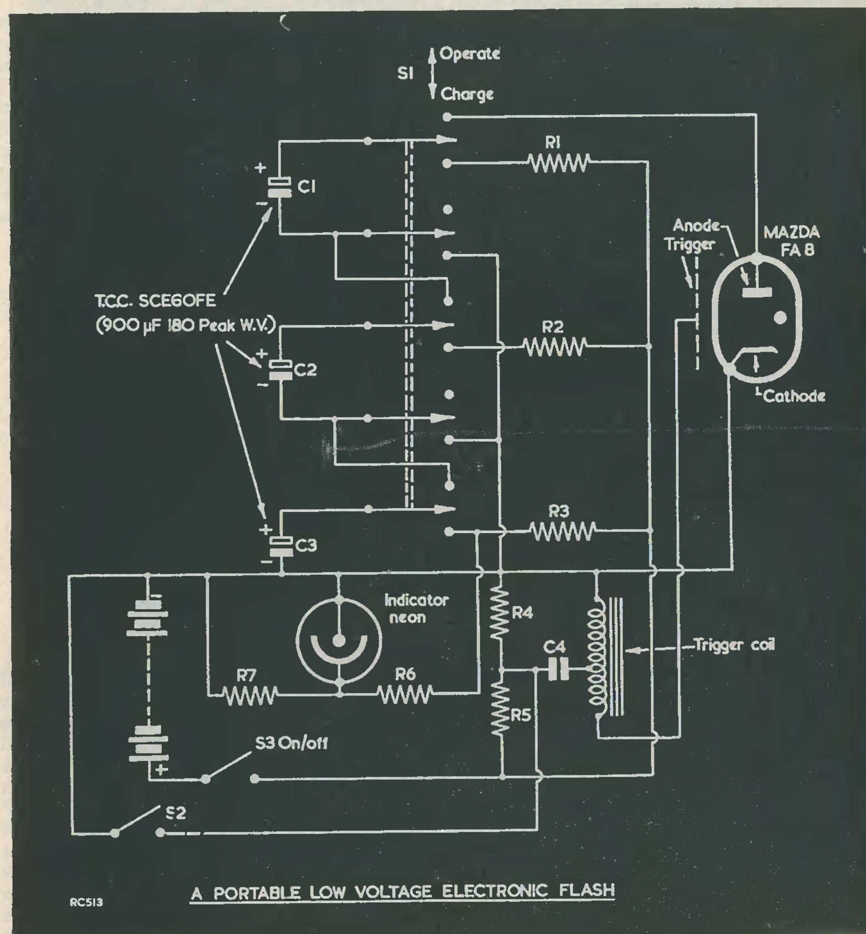
The capacitors used for flash tube operation have relatively large values of capacitance, and electrolytic components intended especially for this type of work have been developed by T.C.C. As an example of the values usually used, the *Amateur Photographer* design incorporated three 120μF capacitors connected in parallel and charged to 360V. The normal radio electrolytic capacitor, incidentally, is unsuitable for this class of work.

Power Supplies

It will be appreciated, from what has been mentioned above, that one of the greatest difficulties in designing portable photo-flash gear lies in the provisioning of a suitable charging voltage for the capacitor. Whilst deaf-aid batteries, for instance, appear to present the most obvious solution, they suffer from the disadvantage that a complete battery may be rendered useless by a single defective cell, and that the process of connecting the requisite number of units in series is rather tedious. Vibrator packs, on the other hand, may tend to be unreliable.

This month's circuit offers a suggested method of overcoming these difficulties. Although the circuit is intended ostensibly for use with the Mazda FA8 photo-flash tube and the T.C.C. SCE60FE capacitor, this application is meant to be illustrative only. The principle used may be applied to any other type of discharge circuit where relatively high voltages are needed.

The circuit is shown in the accompanying diagram. It will be seen that three SCE60FE capacitors (C1, C2 and C3), are used, these being connected, via switch S1, to the charging battery. This battery may consist of two conventional 67½ volt portable radio batteries connected in series to give a voltage of 135. When switch S1 is set to the "Charge" position the three capacitors are connected, via R1, R2 and R3, to the battery, and become charged, consequently, to the battery voltage. When S1 is set to "Operate," the capacitors are connected, in series, across the flash tube; offering therefore a



A PORTABLE LOW VOLTAGE ELECTRONIC FLASH

voltage of 405 at an effective capacitance of 300μF. This is sufficient to give a discharge of nearly 25 joules. The flash is initiated in the normal fashion by closing S2. S2 may, of course, be the synchro-flash contacts of a camera.

There are several points of interest in the circuit. Firstly, it will be noted that three resistors, R1, R2 and R3, are used in series with the individual capacitors, instead of having a single resistor serving all three. This has been done to obviate arcing at the switch contacts when S1 is returned to the "Charge" position. The arcing could be caused if the three capacitors were connected directly in parallel whilst they held charges of differing value. The neon indicator connected to C3 in the "Charge" position is conventional and gives warning when the capacitors are charged. It is disconnected in the "Operate" position.

Values for the resistors R1, R2 and R3 are not given, as these depend upon the type of capacitor and battery used. The manufacturer's advice should be sought on this point.

Advantages

The advantages of the circuit are obvious, and consist mainly of the convenience of using a low and dependable charging voltage.

There is also a disadvantage. This is given by the fact that it is necessary to operate S1 before the flash tube can be used. The writer has conferred with several professional photographers on this point, however, and has been assured that, in practice, this point will not entail a great deal of inconvenience.

Radio Component Show

There will be 130 exhibitors in the 11th British Radio Component Show to be held at Grosvenor House, London, from April 6th to 8th, 1954. This is more than ever before and includes six firms who have not previously taken part in this exhibition. This annual private exhibition — compact, bright and generally acknowledged to be of real value to the technical visitor — is organised as usual by the Radio and Electronic Component Manufacturers' Federation (22 Surrey Street, Strand, London, W.C.2) from whom invitations may be obtained. It crowds into the space of a few thousand feet in a comfortable hotel a representative display of an industry which employs 40,000 people and turns out nearly 1,000,000,000 components, valves and accessories a year.

The exhibits comprise British-made components for the radio, electronic and telecommunication industries, as well as gramophone components, valves and test gear.

While several manufacturers will not announce their new products until the opening day, it is possible to give some idea of the scope of the exhibits and trend of development. As might be expected, there will be a good many exhibits catering for the development of television all over the world and for its expansion in England to the higher frequencies. Several manufacturers will show multi-channel tuners for TV receivers, there will be valves for the new British TV frequencies and cathode ray tubes with improved focusing units. Some new instruments for television servicing will be shown and there will also be camera cables and television aerials for Continental as well as home use.

Resistors, capacitors and other components will be shown in new ranges, meeting still more stringent tests of efficiency under the most severe conditions of temperature and humidity, and there will be new applications of some of the latest plastics and other materials. Several firms will show tape recorders this year. Gramophone components, including a new ceramic pick-up, will be well featured, and there will also be new microphones and loud speakers. Printed circuits will also be seen.

IN YOUR WORKSHOP

In which J. R. D. discusses problems and Points of Interest connected with the workshop side of our Hobby based on Letters from Readers and his own experience.

My remarks the other day concerning the operation of radio and TV equipment from low voltage DC supplies has prompted yet another spate of letters from interested country-dwelling readers. These readers, living in districts not yet supplied by the normal electric mains, have shown the traditional ingenuity of the amateur in overcoming their difficulties; and their letters make extremely interesting reading. They also convey a great deal of information which I am happy to pass on to other readers.

Vibrator Supplies

Several of my correspondents state that they are using Power Units type 173 for HT. These, together with series heater arrangements, are similar to the circuits mentioned by N. V. Dinsdale in the previous article. Others obtain HT from American 28V input, 200V 60mA output, dynamotors of the "Command" type. The PU173 appears to be most popular, however, as it gives less interference.

On the other hand, F. W. Street of Southport is definitely "agin" vibrator packs since one of his broke down during his local club's Field Day after only eight hours' running. Fortunately, he says, a permanent magnet motor-generator was available and this, hastily pressed into service, saved the day. In preparation for the following year's Field Day, Mr. Street got ready a "Command" dynamotor. This gave 24 hours' continual service despite the fact that for the last ten hours it had a 75% overload due to a transmitter fault.

On this second occasion the receiver was supplied separately by an inverter with a 250V 50 cycle output. This inverter similarly gave trouble-free performance, but it took a heavy input current.

Another reader, W. A. Smith of Skerton, Lancs., has also written to me on this subject. As an example of what can be achieved with low-voltage supplies, he describes the installation he has fitted in a friend's house. This installation is, I think, the most comprehensive of its type I have ever heard of.

It all started off when Mr. Smith's friend moved into his new, mains-less house; and it was decided to use a temporary 12V system, whose wiring could be connected to the mains as soon as it arrived in the district. Lighting would then be provided by what Mr. Smith refers to, rather intriguingly, as "bus" bulbs.

However, the 12V system was soon changed to 24V; and it was planned to overcome the charging problem by obtaining a chore-horse or similar petrol-set generator.

Mr. Smith noticed, fortunately, that there was always a breeze blowing in the locality and so he decided instead to try a wind-charger. This he obtained from Lucas, who also supplied a propeller and charging board.

The wind-driven generator proved to be an unqualified success. It was mounted on an old Austin front wheel axle and brake drum; this being fitted, in its turn, on top of an ex-G.P.O. 30-foot telephone pole. The generator worked perfectly, a light breeze being sufficient to generate 5A, a normal wind up to 15A, and a gale 20A plus. (Mr. Smith's charging ammeter limits at 20A, and I understood that the end-stop is by now nearly worn away !).

Since the acquisition of the wind-driven generator guaranteed plenty of charging current, Mr. Smith next proceeded to look for ways and means of using it up. As a start, an electric razor was re-wound by the makers to work from 24V. Next, it was decided to convert a radiogram to work from the new low-voltage supply.

The radio chassis proper of this radiogram was soon modified to series-parallel heaters and dynamotor HT, and gave no trouble at all. Mr. Smith then tackled the motor itself. This he fed from a 250V AC motor-generator. He claims that this arrangement works perfectly, and does not suffer from wow, flutter, or any other defect. An interesting point, this, for others similarly placed.

After the radiogram came the vacuum cleaner ! This now also works from the 24V supply, the higher voltage being given by a motor-generator mounted on wheels and trundled from room to room as required. This motor generator is heavily overloaded and has to be switched off every quarter of an hour to cool off !

The TV set came next. This was an AC/DC model, and best results were given by driving an old DC 220V motor from a 24V generator. The motor now acts as a generator and the generator as a motor. Consumption at 24V is 9A and the picture is perfect.

"I know what you're thinking," comments Mr. Smith at this point in his letter, "poor old generator on top of the pole ! Well, it's driven that lot for over a year now and hasn't given one moment's trouble."

Mr. Smith's friend, incidentally, has no intention now of going over to the mains supply, even when it does arrive. As he says, he is getting "summat for nowt." I would certainly concur with that !

The Magic Box

A friend of mine recently had a rather annoying experience. Calling at an acquaintance's house one evening, he arrived in the middle of a TV programme. Such is the custom of the land these days that he had, perforce, to sit with the family until the end of the programme before anything approaching conversation could be embarked upon.

Whilst watching the programme, my friend noticed that the frame-hold was just "on the edge." Every now and then the picture rolled up. No one, however, seemed to be very bothered by this and, so far as my friend could make out, it was considered to be quite a commonplace phenomenon. Being a technical type, my friend offered to readjust the frame-hold. His offer was greeted with a suspicious assent and so he re-adjusted the set, which then settled down to correct working.

Now, here is the rub of this little story. A week or so after his visit to the house the set stopped working and was packed off to the local shop. The fault was the line output valve, and the repair bill came to the price of the new valve plus the service fee. Reasonable enough, one would think. But no. My friend was not only blamed for the whole business: it was even suggested that he should fork out the money for the repair as well ! The argument was that the set had never given any trouble till he started "messing around at the back," and so he was obviously to blame !

I know that this sounds a tall story, but it is quite true. And it only proves the moral that the best thing to do is to grin and bear an acquaintance's picture, until one is actually asked if one can improve it.

However, most families with TV sets have an accredited knob-adjuster within their own domestic circle, and so the case mentioned above does not arise. It is interesting, incidentally, how many instances one hears of where people prefer to have the focus control slightly off-set to prevent "that liney effect." There is, surely, food for thought here.

Whilst on the subject of the results shown on the TV screen, it is also surprising to note how common line transformer ringing is, even these days. This type of ringing shows up, of course, as a vertical bar down the left-hand side of the picture and is caused mainly by ringing of the EHT overwind after the line flyback period. Most efficiency circuits "squash out" the ring voltages, as it were, so that when ringing occurs it is not usually very noticeable. However, some commercial sets have quite noticeable line rings; and it is difficult to offer advice on methods of curing them, as so much depends on the individual circuit.

TV in Small Stages

Quite a few people have written to me recently saying that the only thing that prevents them from launching forth on wide-angle television is that they don't want to stand the initial charge of the large picture tube required. Many of these readers have nine or twelve inch tubes already on hand. I can assure these constructors that the wide-angle components specified for the *Magna-View*, etc., can be very easily connected to scan a nine or twelve inch tube, and supply also the reduced EHT required. So a constructor can build his wide-angle TV set around any nine or twelve inch tube he may already have, changing over to the larger tube when he feels prepared to do so.

The alterations to the scanning circuits consist mainly of reducing the line output HT rail voltage, and specific values and voltages may be obtained from the manufacturers concerned.

Beginning In Radio

I had a letter passed on to me by the

Editor the other day which, whilst at first glance being something that is easy to answer, has, in actual fact, given rise to considerable thought.

Here is the letter:—

"Dear Sir,

I've just finished with the Army, and I would like to take up radio construction in my spare time as a hobby, but I've never had any previous knowledge whatsoever. I was wondering if you could possibly tell me the name of some books dealing with radio principles and theory that I could get, and the best way to set about it.

I'll be very thankful if you can oblige me."

There it is. A simple question which demands a simple answer. But is it so simple ? To start off, let us take the question of books in its literal sense. There are, however, so many of these that can be recommended that it is difficult quite to know what to exclude. Some books are excellent. Scroggie's *Foundations of Wireless* is, for instance, about the best in its particular sphere. Another, taken quite at random, is the A.R.R.L. Handbook. This can also be of considerable value, even if the reader has no intention of becoming a ham. But these are only two publications in a very considerable field.

So far as magazines are concerned, the choice in Great Britain is rather limited for the beginner; and, of course, I can't say too much on this subject for the obvious reason that I am writing for a magazine myself. However, I can at least say that *The Radio Constructor* has created a reputation for articles which are factual and reliable.

The trouble in this instance is that I am not at all certain that every beginner really wants literature which gives him a lot of theory only. Wouldn't it be better, perhaps, if he were to start off by actually building himself a set, and let the theory, or at least, the more complicated theory, come afterwards ? I am convinced that a high percentage of the people who devote much of their time to radio these days, whether as a profession or as a hobby, commenced by making their own gear; and learned their theory "the hard way," by the actual process of getting that gear to work. After all is said and done, a radio chassis is little more than a circuit diagram in three-dimensional form; and if one has cured a case of, say, AF distortion by replacing a leaky coupling condenser, surely this is a simple piece of theory learned in a way which will be remembered always ?

I often think that it was all a lot simpler for the beginner in the times before the war. In those days all that was needed to get going was a two-volt accumulator, an HT battery, a pair of phones, and one or two simple valves. With these components it was easy enough to knock up a one or two valve receiver; whereupon one had then gained the experience and confidence necessary to carry on to more ambitious gear.

The days of the 2-volt valve are gone completely now, of course. The beginner, instead of relying on his accumulator and HT battery for power, now has to think in terms of mains transformers and rectifiers. Which are, admittedly, a little more difficult to construct from scratch.

I advise the reader whose letter prompted these paragraphs not to worry too much about the more complicated theory, at any rate. I suggest that he starts by making himself a simple set and getting it to go. Several small and easy-to-build sets have been described recently in this magazine and there are quite a few more "on the stocks" scheduled for future issues. The Rubicon to be crossed by the beginner is that of building the initial job. After that, there will be no holding him back !

"Calling all Guards . . ."

FRINGE AREA TELEVISION

By **J. GLAZER**

Part 4 **THE POWER SUPPLY**

As the sound, vision, and timebase units were built separately and work independently of each other, it was decided to construct the power unit in two separate parts; one feeding the sync and timebases, the other feeding the sound and vision units. Consequently the two power units are constructed on identical chassis, as the power required for driving the units is divided almost equally between them. Separate power units make adjustments to the individual units comparatively easy, as only one unit need be on at a time.

The requirements of the timebase power unit are 140mA max. HT current and, under 4 Amps heater current, while those of the sound/vision power unit are 130mA max., and a little under 5 Amps heater current. The full-wave rectification is carried out by a 5U4G in both power units, the smoothing for the vision unit being a little more elaborate than the rest. The EL33 output valve is located on the sound/vision power unit and is furnished with a grid stopper and a tone correction capacitor. This valve drives a ten inch speaker of 10Ω impedance, the matching ratio being 25:1.

One end of the 6.3V heater windings on both chassis is earthed, and a fuse is located in each HT negative line for safety measures against HT short circuits. The CRT bias is found for safety on the timebase power unit; any failure in the bias due to the failure of HT volts will be counteracted by the failure of the line timebase, and therefore the EHT. The CRT cathode has a minimum bias resistance of 10kΩ which is decoupled by a 0.5μF capacitor. The heater winding for the CRT is on the timebase power unit transformer, and the on/off switch for both power units is combined with the volume control.

Construction

Both power unit chassis are the same size and are made of heavy gauge aluminium, 15″ long by 6″ wide and 3″ deep. The mains transformers are sunk into the chassis and the rectifier valves are mounted close to them. The rest of the components are dispersed along the chassis, depending on the types and sizes used.

The CRT is mounted on a standard CRT carrier, which are fairly easy to obtain. All

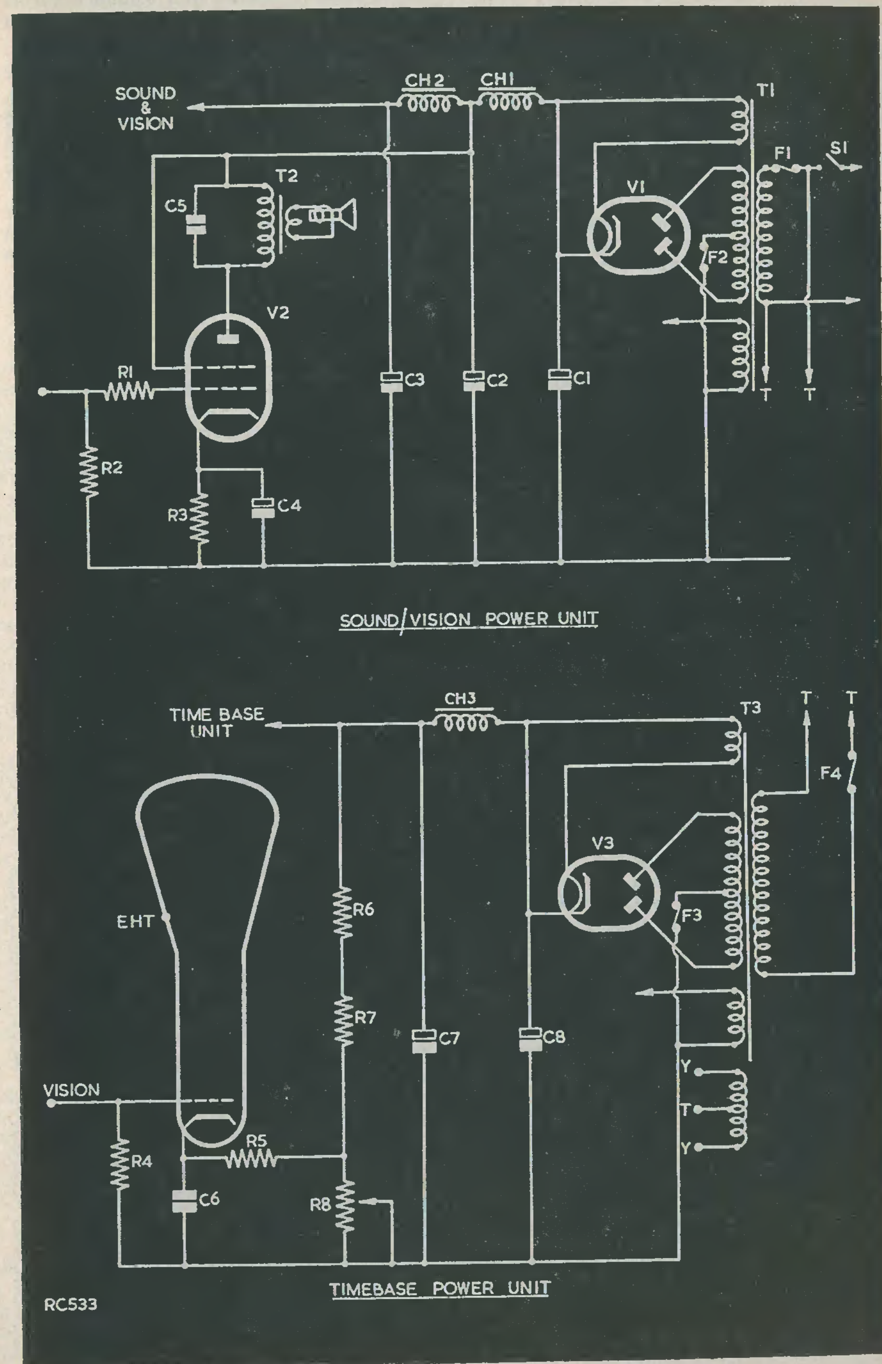
COMPONENT LIST

Sound/Vision Power Unit

R1	100Ω
R2	0.5MΩ
R3	150Ω
C1	16μF, 500V wkg. electrolytic
C2	32μF, 450V wkg. electrolytic
C3	32μF, 350V wkg. electrolytic
C4	25μF, 25V wkg. electrolytic
C5	0.01μF, 350V wkg.
V1	5U4G
V2	EL33
F1	2A cartridge fuse
F2	500mA cartridge fuse
CH1	5H, 150mA
CH2	10H, 100mA
S1	ON/OFF switch on volume control
T1	MAINS TRANSFORMER. Primary: 200-250V. Secondaries; 300-0-300V, 150mA; 6.3V, 5A; 5.0V, 3A.
T2	Sound output transformer

Sync/Timebase Power Unit

R4	0.5MΩ
R5	10kΩ
R6, 7	25kΩ, 1 watt
R8	20kΩ, wirewound variable (brilliance).
C6	0.5μF 250V wkg.
C7	32μF 450V wkg., electrolytic
C8	32μF 500V wkg., electrolytic
V3	5U4G
CH3	5H, 150mA
F3	500mA cartridge fuse
F4	2A cartridge fuse
T3	MAINS TRANSFORMER, Primary: 200-250V. Secondaries: 350-0-350V, 150mA; 6.3V, 4A; 5.0V, 3A; 0-2-6.3V, 2A.



the units have plugs and sockets for inter-chassis connections, as this makes adjustments and modifications to the individual units rather easier than if one has to unsolder and resolder leads. For this reason none of the units are bolted together, and all the controls are on leads.

The writer's cabinet is a console, the CRT being mounted on the top shelf and fastened by a single 2-BA bolt, for easy removal. The timebase unit is located to the left of the tube and the vision unit to the right. The power units are placed on the lower shelf with the sound unit and the loudspeaker. The brilliance, contrast and volume controls are mounted in an escutcheon in the side of the cabinet, on an oblong piece of bakelite. Long leads can be used on the brilliance control for an auxiliary armchair control. The writer used a permanent magnet focusing unit, but an electro-magnetic coil can be used, though it will be an extra load on the power unit.

Finally, if you have any VR65's upon the shelf, don't leave them there; throw them in the dustbin. (So much for the writer's opinions on this current-absorbing valve).

The QRP Society

SINCE ITS INCEPTION NEARLY five years ago, the QRP Research Society has progressively expanded, both in its membership and activities. Its functions now being much more comprehensive than when the title was originally conceived, the word "Research" is to be deleted and the Society will in future be known as The QRP Society. This will avoid any possible misunderstanding, for while appropriate importance will continue to be given to research, as hitherto, this no longer constitutes the sole aim of the Society, and the development of this branch will be left in the hands of those existing or future members whose knowledge and technical ability are best suited for the purpose.

The Society is now entirely flexible in that it can offer something of advantage to all, even to the beginner in wireless, for such a recruit will be placed "under the wing" of an experienced member. There is a new section which serves the large number of SWL's who find that the simple TRF receiver continues to give satisfaction, especially where sensitivity and ease of construction are of importance.

To interest the two-metre and seventy-centimetre man, there is the VHF section. This has a very enthusiastic following, and its own activity column appears regularly in the QRP Journal, together with many articles by members dealing with the construction and operation of VHF equipment.

There are also club contests for which some fine trophies are offered. One, the Kaleveld Cup, is awarded for the best three contacts made under QRP conditions on any band during a selected week in October of each year. In short, the Society's efforts are directed to extending interest in the low-power field of transmission and reception. This it endeavours to do by the development of QRP technique, and by demonstrating the capabilities of QRP equipment.

Through the pages of the monthly *QRP Journal*, members are kept informed of the latest achievements and are presented with a wide selection of circuits and constructional articles, both of a tested and experimental nature.

Full details of those sections of the Society and its contests not mentioned above, together with much other information of great interest to prospective members, will be forwarded with pleasure, on application to the Secretary, J. Whitehead, 92 Rydens Avenue, Walton-on-Thames, Surrey.

USING THE NEW 807

By **O. J. RUSSELL**, B.SC.(HONS.), A.INST.P., G3BHJ

FOR A VERY LONG TIME the amateur has been accustomed to a prolific flood of surplus transmitting tubes, and has been very much assisted by this state of affairs. However, it is as well to look to the future. Firstly, the flood of surplus items is drying up. The price of such tubes as the 832 and 829, for example, has soared over the last few years. Secondly, new and improved valves of special interest are appearing. These new valves are unlikely to appear on the surplus market for many years, and it is well worth considering, therefore, taking advantage of them. Furthermore, of course, the newer valve types offer several advantages. For example, at one end of the scale the new miniature "powerhouse" tubes offer the possibility of, say, an ultra compact topband rig. At the other end of the scale the various miniature tubes are invaluable and highly effective in the drive stages of VHF transmitters, and the new high power double tetrodes are rated for full output on 600 Mc/s. Power generation for 420 Mc/s is therefore now as easy, relatively speaking, as it was on 145 with the old-fashioned 832 and 829 tubes. In that respect, the 832 for example *is* an "old" tube, as it was introduced before the war. Similar improvements have taken place in other transmitting tubes, and some account of these may be of interest.

As a preliminary, therefore, readers may be interested in the latest successor, or successors, to the 807. *Brimar* have introduced a so-called "miniaturised" 807. Actually it is obtainable in two forms, one with top cap anode, and one with "single-ended" construction with the anode connection in the base. Also — although this is of less interest to readers — it is made in three heater ratings, one the usual 6.3 volt heater, and the others with a 12 volt or a 19 volt heater. For the moment we need only consider the 6.3 volt top cap anode connection version, which has the type number of 5B/254M.

A sketch of the dimensions and base connections are shown in Fig. 1. It will be seen that compared with the standard 807 it is extremely compact. Despite this, the "works" are capable of a full-sized 807 performance. In fact, the tube is capable of the *full* so-called Intermittent Commercial and Amateur Service ratings quoted for the 807. However, the *makers* do not quote these ratings. This is because the ratings they quoted are actually the Service ones

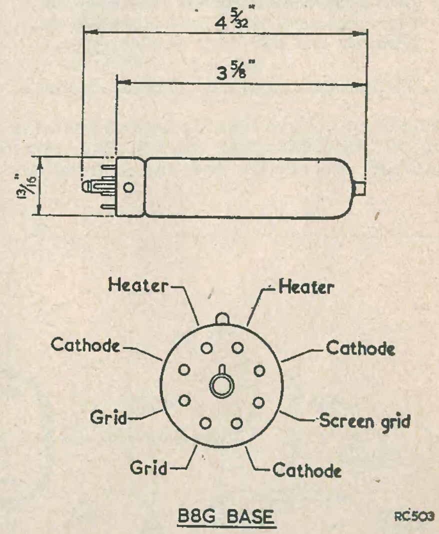


Fig. 1. Dimensions and base connections of the 5B/254M valve. Note that the base is B8G and not octal

which are extremely conservative. I am assured, however, by the *Brimar* valve laboratory that these new "miniaturised" 807s will operate at the ICAS ratings. In fact, one may replace 807s in all the usual functions by these new tubes and obtain identical results.

However, by utilising the *improved* design features of the 5B/254M, one can obtain *improved* results and efficiency — particularly at the higher frequencies. Some may be

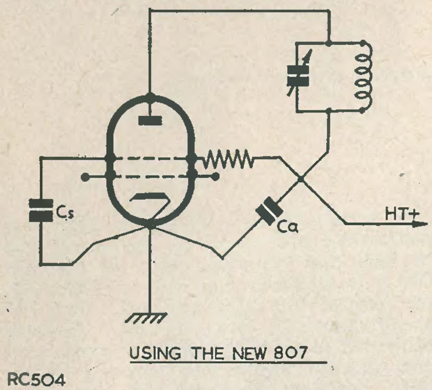


Fig. 2. The multiple cathode connections enable the screen bypass (C_s) and the anode bypass (C_a) to be made to the cathode independently, thus eliminating "common lead" inductance effects. Stability and efficiency are thus greatly assisted

puzzled to observe that the base connections of the 5B/254M show no less than *three* cathode connections and *two* connections to the control grid. This is not for the purpose of filling up spare pins, but has a definite reason. The object is to overcome the deleterious effects of the *inductance* of the cathode and grid leads. In this tube, the grid and cathode leads are in fact very short, so that inductance effects are already less than in the conventional 807 construction. However, the use of *multiple* connections enables even these small inductance effects to be further reduced. Take the case, for example of the anode and screen grid bypassed to the *same* cathode connection. The inductance of the common section of cathode lead inside the valve base acts as an unwanted coupling between the two circuits. However, by bypassing to separate cathode leads, each bypass path has its own separate circuit right up to the cathode. Similarly, *two* grid connections are very useful to enable a neutralising circuit to be used independently of the signal circuit drive applied to the other grid. To make this quite clear, Fig. 2 shows how the anode and screen circuits may be separately bypassed. Fig. 3 shows how neutralising can be effected by using the two grid connections. If neutralising is not used, the two grid connections should be *paralleled,* so that RF drive power has the lowest impedance path possible.

In all other respects, the tube can be treated precisely as an 807, and the maximum grid drive should not exceed 5mA as with the normal 807. In fact, the 5B/254M is excellent as a Zero Bias Class B tube, giving 120 Watts of audio with 750 volts on the anode. Definitely a valve worth trying !

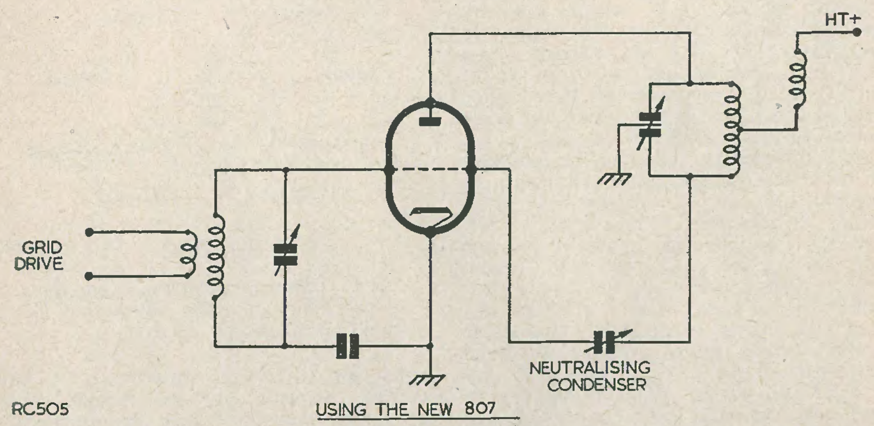


Fig. 3. The double grid connection comes in useful if neutralising is required. If unneutralised, the two grid connections should be paralleled

SEMI-CONDUCTOR DEVICES

by A. L. PARDEW

CRYSTAL DIODES, TRANSISTORS AND THEIR APPLICATIONS

An earlier article* gave a résumé of devices available or being developed in this very interesting new field. This part concerns itself with practical information about their use, particular attention being paid to the newer devices whose special advantages and limitations are not at all well known to the majority of amateurs.

Power Rectifiers

The plate or disc type copper oxide and selenium rectifiers are so well known that they will only be touched upon briefly. In general they are more expensive that valves, but being simpler and longer lived they are well worth using. Their practical advantage is that they need no separate winding or dropping resistance to supply a filament or heater. Even in half-wave circuits this is important, but it is still more so in doublers and other multiplier circuits. These rectifiers do not need series limiting resistors like some low impedance valves, but there is one operational point that does need watching, and that is keeping down the temperature. Metal rectifiers always pass more reverse current when the temperature rises and this, of course, generates more heat which in its turn increases the reverse current, so that the device can 'run away' and destroy itself. It is therefore necessary, especially when using these rectifiers near the limit of their range in compact equipment, to allow good ventilation.

A recent addition to the range of power rectifiers is the germanium junction type. This packs an amazing power handling capacity and excellent regulation into a minute space.

Crystal Diodes

Before taking individual applications, a few general points should be mentioned as a guide to their use. Their good points are their tiny size, low capacitance and lack of a heater. Their main limitations are their

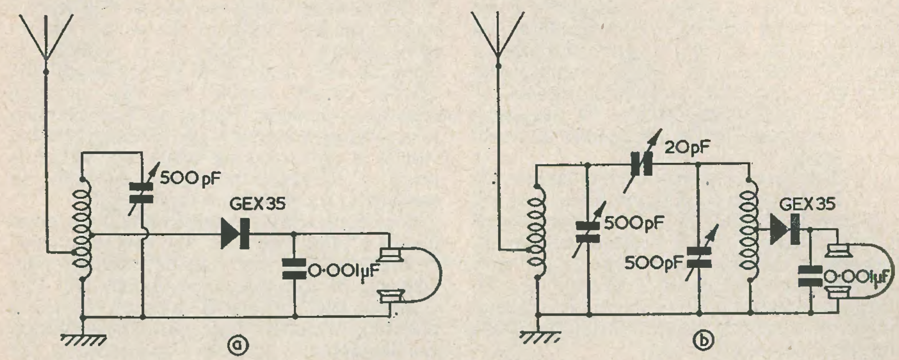


Fig.1. Simple crystal sets.

* *Semi-conductor Devices*, September 1953.

relatively low back resistance and voltage handling capability. Crystals are graded into types which differ a great deal in these characteristics and, therefore, a suitable type can be selected for any particular circuit. Incidentally, most of the crystals being sold as 'surplus' are rejects from all other grades and cannot, therefore, be expected to give satisfactory results in circuits demanding high back resistance or high back voltage.

One of the simplest applications of crystal diodes is to make an up-to-date version of the old-fashioned crystal set. Such a set makes a useful standby for emergencies, and children love listening to programmes in bed with headphones. Many circuit variations are possible but the general rules are:—

(1) The maximum loudness of the signal is governed by the goodness of the aerial used.
(2) This maximum may have to be reduced by selectivity considerations.

If there is no difficulty in separating stations in your locality with a single tuned circuit, then more elaborate arrangements will give no advantage and merely lose strength. If, however, selectivity is a problem, then careful design is needed to obtain it without throwing away too much power.

The true experimenter's set would include large coils with many taps so that every coupling could be adjusted for optimum results. It is certainly very instructive to make up a set of this type, putting a microammeter in the crystal circuit to be able to see immediately the effect of circuit variations. In this way adjustments can be made giving individual improvements too small to be noticed by the relatively insensitive ear, but which add up to a decided audible difference. Single circuit and double circuit arrangements are shown in Fig. 1 (a) and (b). For the coils 60 turns of 20 swg wire are wound on 3″ formers, and taps are taken out every 5 turns. Stranded wire would be better, but there is some difficulty in taking off tappings. The optimum tapping for feeding the crystal will usually be found somewhere near the half-way point, and is not very critical. It will be found that it is nearer the top as the capacitance across the coil is increased.

The position of the aerial tap will depend mainly on the length of the aerial, and to some extent on whether it is indoors or slung up well away from buildings. In the double circuit version the top coupling capacitor will control the compromise between selectivity and strength. A further variation which is worth trying when the aerial is large, is to place the tuning capacitor in series with the aerial and tuning coil.

Two final points. A good earth connection makes a lot of difference, and best results will be obtained with high resistance headphones. The use of low resistance phones will lose a good deal of signal strength unless a matching transformer is used. By replacing the headphones with a 47kΩ resistor, the crystal set can be used as a convenient feeder unit for a high quality amplifier. It should be remembered, however, that even a crystal can introduce harmonic distortion unless supplied with a reasonably large signal, so this arrangement should only be used for a strong local station.

Probably the commonest TV application of germanium diodes is as vision detector, where they have advantages over thermionic diodes. The circuit can be orthodox, but the lower capacitance of the crystal allows a few more turns to be added to the final coil and also helps the higher video frequencies to be maintained. It can be wired in the circuit in a very small space, and if placed in the final I.F. can it helps prevent the feedback of harmonics to the earlier stages.

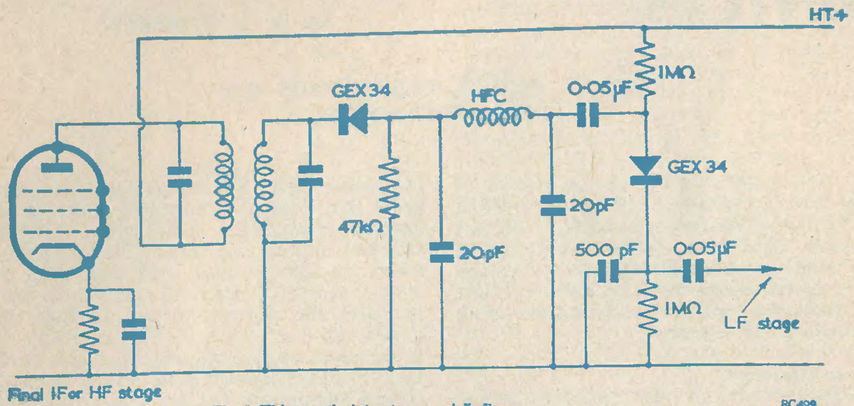


Fig. 2. TV sound detector and limiter

Another convenient use is as sound detector and limiter. A typical circuit is given in Fig. 2. Very effective clearing up of ignition noise is given by this circuit, which is very easy to incorporate in an existing set.

Although germanium crystals are recommended as spot limiters their use needs certain precautions. If used on the output side of the video stage they have to withstand quite a high voltage amounting to the full peak-to-peak swing of the signal (vision plus sync pulses). Many crystals will do this quite comfortably, since several types are rated at 75 volts and many of them are, in fact, quite happy at 100 volts. These ratings, however, are at 20°C. and do not hold good at higher temperatures. The crystal should, therefore, be placed in a cool part of the set, which is usually easier in home constructed gear than in a commercial job where the smallest possible cabinet is used and temperatures sometimes rise to surprising figures.

Extremely effective spot limiting is given by the circuit in Fig. 3. It not only gives better spot suppression than a thermionic valve but it also adds so little capacitance to the circuit that resolution does not suffer. An alternative arrangement is to use the limiter in the grid circuit. There is then no question of overloading the crystal, but limiting is not so complete.

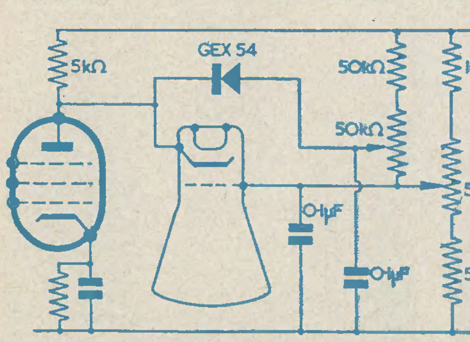


Fig. 3. TV spot limiter

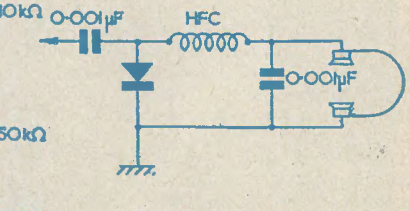


Fig. 4. Signal tracer

A few miscellaneous applications will be touched on without going into much detail, and they may possibly suggest others on the same lines. A signal tracer of extreme simplicity can be made with nothing other than a crystal and a pair of high resistance phones connected in series. This must be restricted in its use to cases where it can be connected directly across a tuned circuit with the coil providing the necessary DC return path. For more universal use the more complicated circuit shown in Fig. 4 may be used. This can be applied to any point at which there is a signal, but it is a little more trouble to make up in a convenient form.

A crystal in series with a DC meter enables it to be used on AC up to high frequencies. Calibration will vary somewhat from one crystal to another, but this can be carried out against any AC meter at 50 cycles and can then be taken as accurate over the whole of the video range, and sufficiently accurate for most purposes up to several megacycles. It will give readings even above 100 megacycles, but they will need correction.

Although not intended to be power rectifiers, crystals are sometimes convenient for providing a small amount of current at moderate voltages. For instance, for bias supplies or for small pieces of equipment such as oscillators or valve voltmeters. If the safe PIV of the better varieties is taken as 60V, then generally speaking 20V RMS is the maximum voltage that should be rectified.

Crystals can, of course, be used in series to handle higher voltages. Where a small voltage is wanted from a high voltage supply a resistance can be used to reduce the value, but this will not reduce the back voltage when the crystal is not conducting. A second crystal connected as in Fig. 5 will remove this reverse voltage satisfactorily. This would make a convenient source of negative bias for output valves and avoid the subtraction from available HT caused by auto-bias.

Transistors

This section is included in the hope that some transistors will be available on the amateur market by the time these notes appear in print. Point contact types will be dealt with mainly, since junction types appear to be further off.

good phone strength almost anywhere in the British Isles on a small indoor aerial. The capacitor C2 gives reaction. No separate winding is needed.

To give LS results, this should be followed by an LF stage, and a suitable circuit is given in Fig. 7. Note that a separate bias supply is used. To get sufficient output power the HT has been raised to 16 volts. For additional sensitivity an HF stage can easily be added, and a circuit is given in Fig. 8. Reflex circuits are doubtless possible but should not be attempted until experience has been gained with straight circuits.

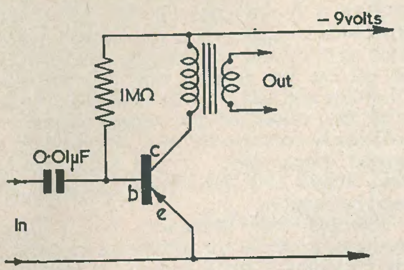


FIG.9. P-N-P JUNCTION TRIODE AS LF AMPLIFIER.

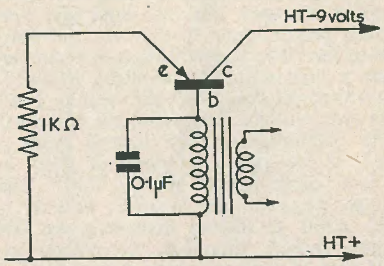


FIG.10. LF OSCILLATOR USING POINT-CONTACT TRANSISTOR.

RC502

First, a few words about their characteristics and how they affect circuits. For the purpose of comparison the emitter of a transistor can be compared to the grid of a valve, the base to the cathode and the collector to the anode. This comparison should not be pushed too far, but it is convenient up to a point. Now for the differences. The collector must be fed from a negative supply instead of a positive, and the emitter instead of a negative voltage bias has a positive current bias. The input impedance is only a few hundred ohms, whilst the output impedance is about 20,000 ohms. This low input impedance means that for LF coupling step-down transformers are used — they step up the current and the transistor is a current operated device, so this does not sacrifice gain. For HF the best arrangement is a tap on the coil.

The circuit shown in Fig. 6 uses one transistor with an HT supply of 6-9 volts. Since some transistors are not so efficient in the MW band, it is suggested that in the first place the long wave Light Programme should be tried. This circuit will get Droitwich at

More than one LF stage is not advisable, because point contact transistors are rather noisy in the LF region — this is a reason for hoping that junction types, which are better from this viewpoint, will soon be available.

The type of circuit used with junction transistors is shown in Fig. 9. It will be seen that the base is used for input instead of the emitter, thus raising the input impedance, and no separate bias supply is needed. This type of circuit cannot easily be used with point contact types because of instability.

Point contact transistors make excellent low power oscillators, and all that is necessary is to put the tuned circuit in series with the base electrode. A typical LF oscillator is shown in Fig. 10. The tuned circuit consists of an output transformer primary tuned by a 0.1μF capacitor. The secondary can be used to feed the oscillation to an amplifier under test or a bridge. The same type of circuit can also be used for HF and makes a useful test oscillator.

Commencing next issue . . .

CONVERSION OF THE 182 UNIT TO A 'SCOPE

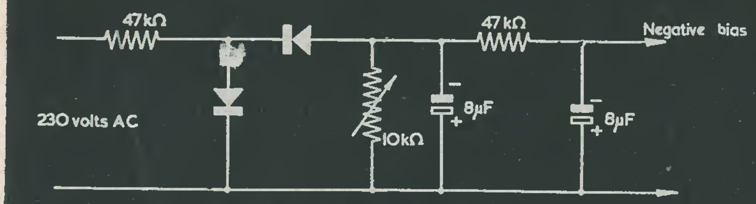


FIG.5. BIAS SUPPLY USING CRYSTAL RECTIFIERS.

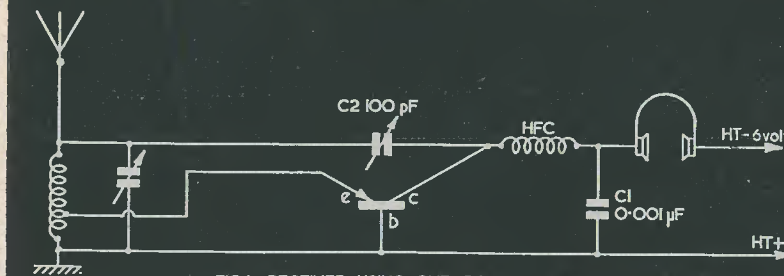


FIG.6. RECEIVER USING ONE POINT-CONTACT TRANSISTOR.

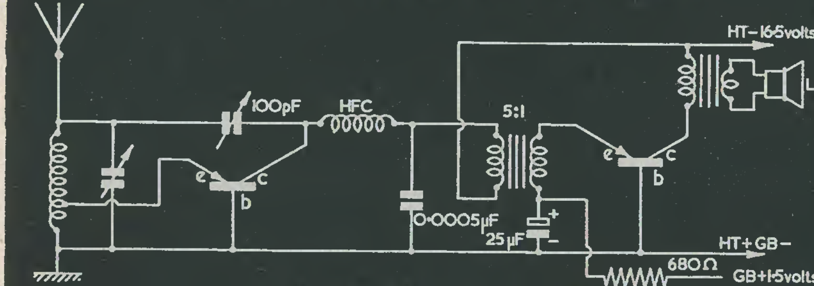


FIG.7. DET-LF USING TWO POINT-CONTACT TRANSISTORS.

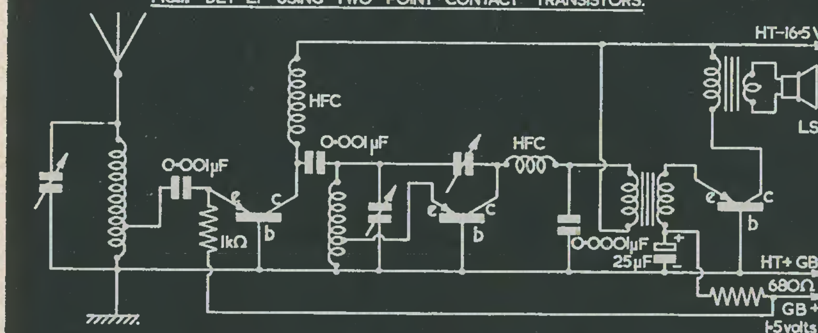


FIG.8. HF-DET-LF USING THREE POINT-CONTACT TRANSISTORS.

RC501

GROUNDED GRID INTERSTAGE COUPLING AT VHF

By **H. E. SMITH,** G6UH

These notes are primarily intended to assist the novice to obtain maximum results from a 145 Mc/s Pre-amplifier. Some of the points dealt with may also be utilised with advantage in the construction of TV Pre-amplifiers.

The Grounded Grid Pre-amplifier using EC91 valves has been almost exclusively adopted throughout the country for 145 Mc/s operation, and in many instances as a TV pre-amp. The low noise figure of this valve makes it eminently suitable for VHF use.

While the stage gain from a single EC91 is little better than 5 dB, its usefulness lies in the fact that, apart from the low noise, matching from low impedance feeder ceases to become a problem. Because of the somewhat low amplification from a single stage, it is usually necessary to use two stages in order to secure adequate gain. The important point about using two stages is the method used to couple the anode of the first valve to the cathode of the second.

The Grounded Grid stage has a low impedance input characteristic, and a high impedance output. A glance at Fig. 1 will show that the circuit is impracticable as it stands because of the terrific impedance mismatch between the anode of V1 and cathode of V2. The modified circuit in Fig. 2 (as specified in some American Handbooks as late as 1953) does little to improve the matching, and there is still a high impedance existing at the connection to the isolating capacitor "C".

The generally accepted method of obtaining a fair degree of matching is to use a capacitive potentiometer as shown in Fig. 3, TC being a 3-30pF trimmer and C a 20pF fixed capacitor. This method *does* provide reasonable matching, but as the output voltage is "potted down," only about one third of the available signal is passed to the cathode of V2, and this much gain is lost. Fig. 3A is almost identical to Fig. 3, but will give a better performance if the position of the cathode tap is adjusted with care on weak signals.

A circuit which will provide maximum stage gain with excellent matching is given in Fig. 4. On test, this arrangement has given an improvement of at least 4 dB in signal level over Figs. 3 and 3A, with no increase in the noise level.

Choke....19 inches of 30 DSC close wound on a 1MΩ ceramic resistor.

L1....6 turns of 16 swg tinned copper wire on a $\frac{3}{8}$" former, each turn spaced $\frac{1}{16}$". This coil is tuned to resonance (145 Mc/s) with a brass plunger.

L2....4 turns of 16 swg on same sized former with similar spacing between turns, tuned with a dust iron plunger.

The link coil consists of 2 complete turns on a former approximately $\frac{1}{2}$" in diameter, i.e., just large enough to slide over L1. The ends of the link coil are soldered to a short length of flexible 50 ohm feeder (about 6 inches will do). Fig. 4A shows the assembly of the two coils, and the link.

The tuning procedure is as follows:—

Trim L1 to resonance *on a signal* with the link coil "sitting" on the earthed end of L1. Adjust TC1 for maximum signal. With the aid of an insulated rod, push the link up the coil slightly, at the same time retrimming with the brass plunger. When the peak signal level has been obtained, secure the link to L1 with durofix.

Note. Do not attempt to make these adjustments on noise alone. The correct trimming point for maximum signal is *not* that which produces the highest hiss level.

Coupling Grounded Grids to Neutralised Triode

The circuit given in Fig. 5 shows a 6AK5 triode-connected, preceded by a Grounded Grid stage. Here we have the reverse effect in impedance matching, as the impedance of the Grounded Grid output is lower than the input to the 6AK5. Transformation is effected by tapping the output of V1 down the grid coil of V2.

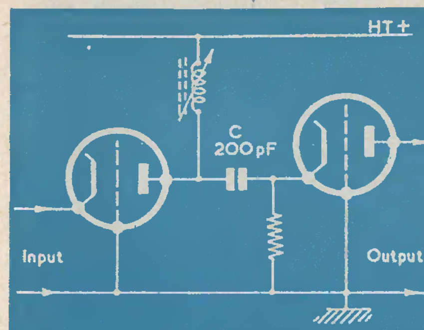


FIG.1. Two grounded grid stages, badly mismatched

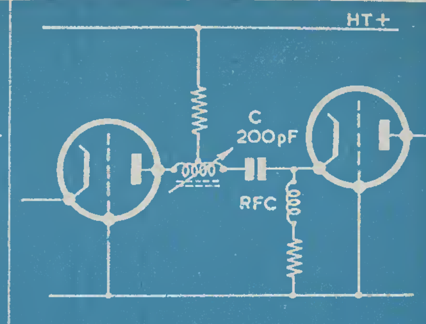


FIG.2. Typical American method of coupling. This system is as badly mismatched as FIG.1.

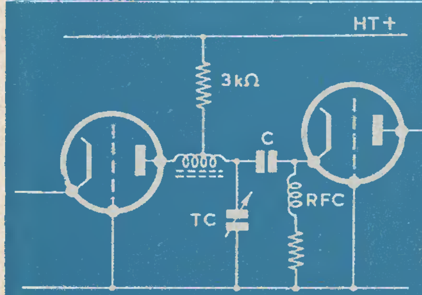


FIG.3. Reducing 'C' to 10pF and adding 'TC' (3-30pF trimmer) forms a 'capacitive pot' and allows for correct impedance match. Main drawback is that use is only made of about ⅓ of signal voltage

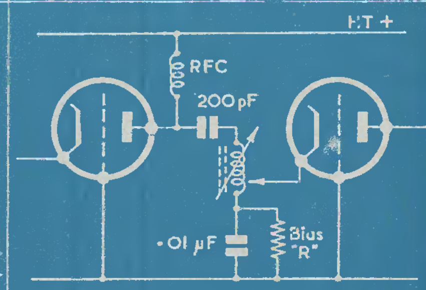


FIG.3a. Modified arrangement of FIG.3. Somewhat better performance. Position of cathode tap is fairly critical for best signal/noise ratio and gain

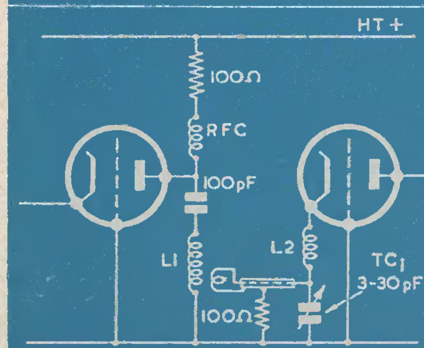


FIG.4. A circuit which will ensure maximum transfer from anode of V1 to cathode of V2. At least 4dB improvement in gain over FIG.3, with no increase in noise figure

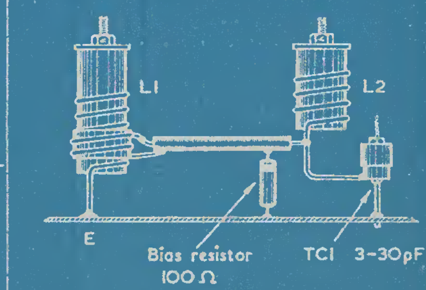


FIG.4a. Pictorial representation of L1 & L2 with coupling link

This is a highly effective circuit, and it is recommended where something "a little better than usual" is required.

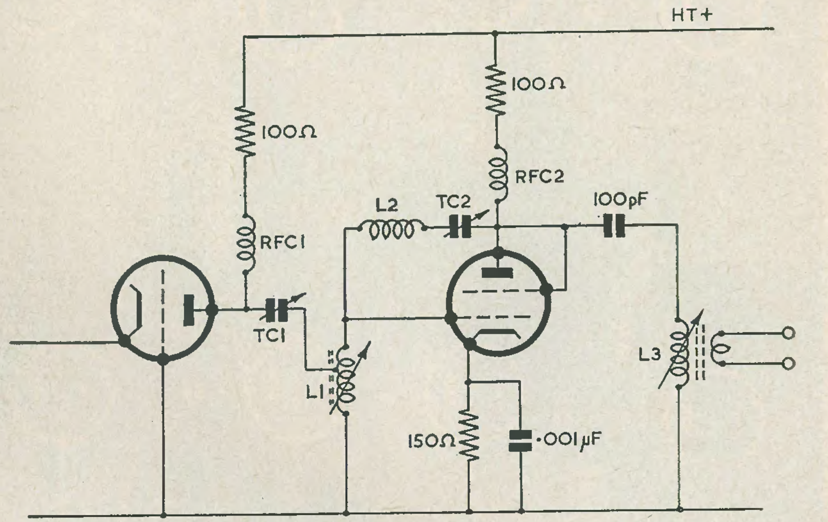


FIG. 5. A highly efficient circuit for a grounded grid stage followed by a 6AK5 neutralised triode

RC488

Chokes....As per Fig. 4.

TC1....50pF variable air spaced trimmer (both sides "hot" to RF).

L1....4 turns of 16 swg on $\frac{3}{8}''$ former, each turn spaced $\frac{1}{16}''$. Tuned with a dust iron plunger. (Tap 1 turn from grid end).

The Neutralising circuit L2/TC2 consists of 7 turns of 16 swg on a similar former, spacing the same, but with no plunger, and a 25pF air spaced trimmer with both ends well insulated from earth, as per TC1.

L3....same as L1.

Tuning procedure:—Adjust L1 trimmer, on a signal, for peak response. Adjust L3 trimmer for maximum signal. Carefully trim TC2 for minimum *noise*. (This is best observed by watching an output meter fitted to the LS terminals of the main Rx).

Comparisons

Some figures obtained with the various circuits mentioned above may be of interest.

Gain:	Fig. 3,	14 dB.
	Fig. 3A,	14 dB.
	Fig. 4,	18 dB.
	Fig. 5,	20 dB.
Noise:	Fig. 3,	6 dB.
	Fig. 3A,	5.5 dB.
	Fig. 4,	4.8 dB.
	Fig. 5,	5 dB.

The main conclusions to be drawn from these notes are:—

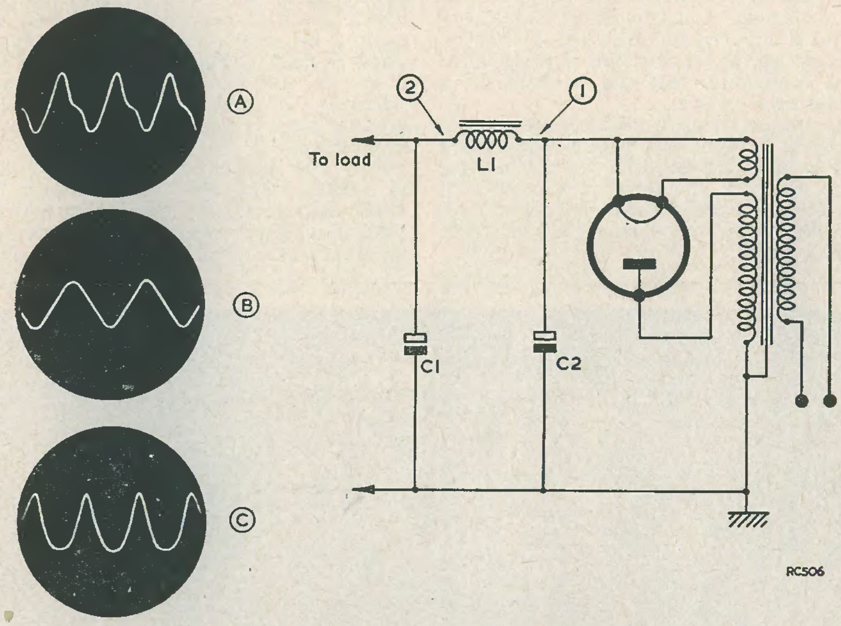
(a) That the interstage coupling method has a direct influence on the overall noise figure of the pre-amplifier.

(b) That both the noise figure and the gain may be improved by paying special attention to the interstage impedance matching. Whether the 2 dB increase in gain of Fig. 5 over Fig. 4 is worth while, considering the 0.2 dB worsening of the noise figure, is a matter for debate and conjecture. Experience has shown that a noise figure of 5 dB or less is a sign of an efficient converter, so we give our vote to Fig. 5.

(All the above figures were taken using an ECC91 push-pull mixer).

OSCILLOSCOPE TRACES

By **A.B.**



No. 8: THE HALF-WAVE RECTIFIER

WAVEFORMS ENCOUNTERED IN HALF-WAVE rectifier circuits differ considerably from those experienced in the full-wave case.

Choke input will produce waveform A when the oscilloscope is connected to point **1**. Inserting C_2 into the circuit will modify the trace to that shown at **B**. Except that the frequency in this case is 50 c/s, there is a strong similarity between this wave form and that obtained for a full-wave circuit.

Trace **C** is the result of connecting the oscilloscope to point **1**, removing L_1, C_1 and C_2 and substituting a resistive load.

When carrying out these checks, care should be taken to ensure that the amplifier input coupling capacitor is of a sufficiently high voltage rating to withstand the applied DC.

The Editor invites . . .

articles of a practical nature from readers.

He is particularly interested in contributions dealing with Radio Control and Test Equipment, although other subjects are, of course, always of interest.

Articles should preferably be typewritten, but in any case should be double-spaced. Drawings should be clear, but need not be elaborately finished. Photographs should either be large (half-plate), or the negatives available for enlarging by us.

ECONOMICAL PERSONAL RECEIVER

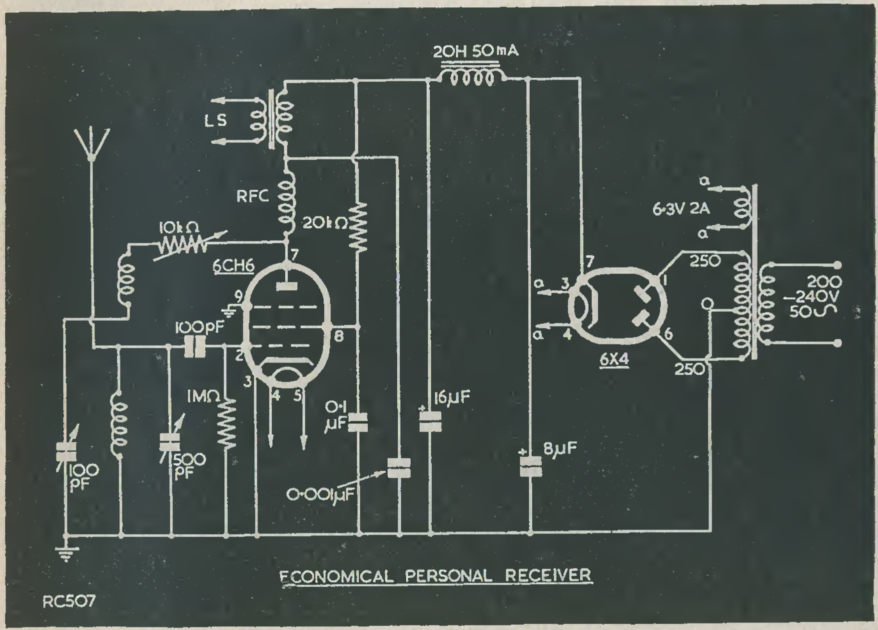
By **S. A. MONEY**

THE USUAL REQUIREMENTS of a personal or bedside radio are that it should receive the Home and Light programmes at a reasonable volume, and should not be too expensive. It is completely unnecessary to use a superhet for this class of receiver. The receiver to be described is perhaps the most economical that can be built for a similar performance.

Two valves are used, a 6CH6 video pentode acting as detector and output stage and a 6X4 as full-wave rectifier. The 6CH6 has a slope of 11mA/V. and is quite capable of delivering ½-1 watt of audio on local stations. This was found to be ample volume for a bedside radio.

Various aerials were tried with the receiver. A good outdoor aerial gave the best results, whilst quite good signals were obtained on a picture rail aerial. It was found that the indoor aerial gave better selectivity at the expense of some volume. If an outdoor aerial is used, it may be necessary to tap down the coil in order to get sufficient selectivity. A good earth should be used if possible, since it increases the sensitivity of the receiver.

A 6″ PM speaker was used and matched to 5,000Ω. The RF choke between the anode and the speaker transformer and the 0.001μF condenser to earth were included to remove hand-capacity effects around the speaker.



Reaction was applied to increase the sensitivity and selectivity of the circuit. The 10kΩ potentiometer between anode and reaction coil serves to give smoother reaction. Some adjustment will be required here, since the value of resistance required depends on the aerial loading. Reducing the resistance will give fiercer reaction.

The 6X4 is used in a normal full-wave power supply and gives 200-250 volts HT. It will be found that the receiver works quite well on 200V HT.

6CH6 and 6X4 valves are readily available at about 7/6 each on the surplus market. The rest of the components are easily obtainable and the total cost is very moderate.

A SINE-WAVE AND SQUARE-WAVE GENERATOR

Covering 17 c/s—175 kc/s

By **R. A. SEAL**

PERHAPS ONE OF THE MOST ESSENTIAL requirements for the seriously minded engineer interested in the design of equipment covering the audio and video range of frequencies is the signal generator.

In the past there have been a number of articles in the technical press discussing the merits and demerits of known circuitry with a view to designing a generator involving as little constructional work as possible. Whilst the majority of these are often adequate for a number of purposes, they do not as individual instruments cover a wide enough range for the average designer.

There are, of course, limits as to what can be achieved with average workshop facilities, and this had to be borne in mind when considering the design of a suitable instrument.

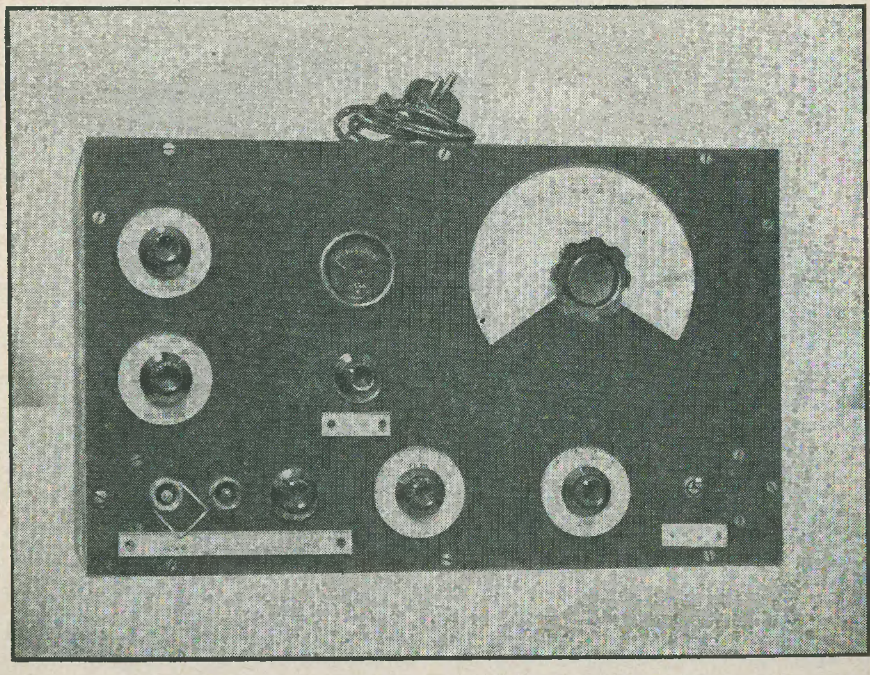


Fig. 1. Front view of the completed instrument

Another factor which seriously influences any design is that of component cost and availability, thus any circuit that calls for decided on the method to be adopted, the following broad specification was laid down as a guide to the final design.

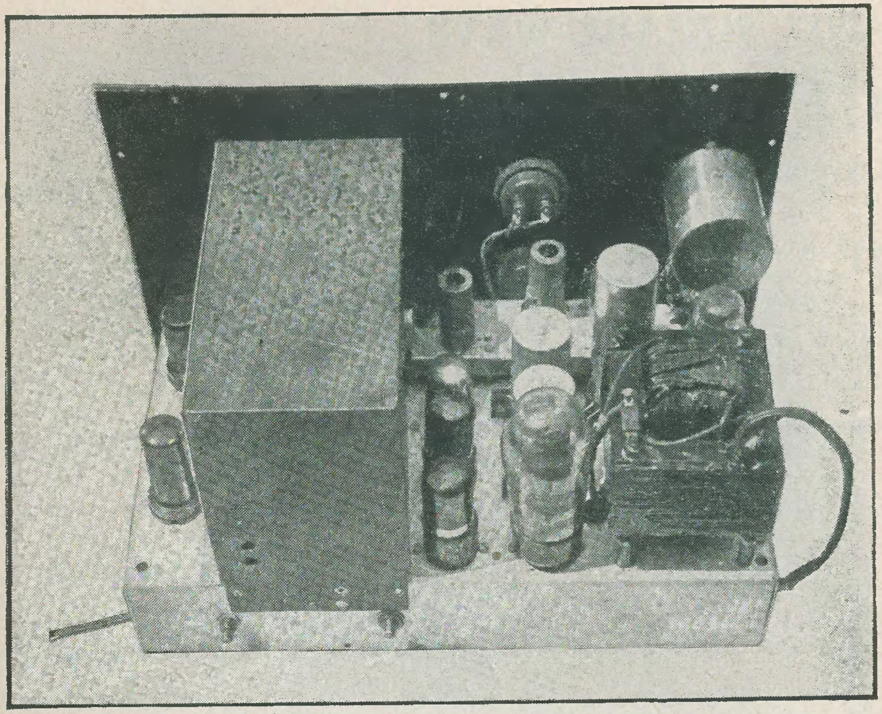


Fig. 2. Rear view

specialist components is usually of no use to the majority of constructors. Taking all these points into consideration the following instrument finally took shape.

Before deciding upon the form of circuitry to be used, it is first necessary to lay down a broad specification and then endeavour to meet this specification in the final instrument.

There are perhaps two ways of obtaining suitable frequency coverage for the testing of both audio and video amplifiers. The first is to have a straightforward sine-wave oscillator covering approximately 20 c/s to 3 Mc/s, and the second to have a sine-wave and square-wave generator covering 20 c/s to 200 kc/s. With a time of rise on the square-wave better than 0.1 microsecond. After careful consideration it was decided to adopt the latter method, using a low distortion sine-wave oscillator feeding two independent output channels. After having

Frequency Range — 20 c/s–200 kc/s.
Sine-Wave output — Max. 1V into 600 ohms.
Distortion — Max. 1% at 1,000 c/s.
Calibrated attenuator in either millivolts or dB.
Square-wave rise time on highest frequency better than 0.1 microsecond.
Square-wave output 10 volts approximately.

The first essential problem was the choice of oscillator, and after a careful study of all the known types it was decided to use a Wein bridge with two stage amplifier. The use of a Wein bridge involves as the main frequency control two ganged variable elements, either C or R. For stability and low hum level it is usually found preferable to use two potentiometers as the variable elements, as it is possible to keep the impedance in the grid circuit very much lower.

However, for smoothness of control there is no doubt that a variable capacitor is the answer. It was decided to see whether a suitable variable capacitor was available, and finally a Polar type, four-ganged unit with ceramic spindle was chosen. The unit selected had four sections of 532pF each, which when connected in pairs gave two sections of 1,064pF each. A small variable air-spaced trimmer is connected across the top section to balance out the stray capacities to earth. The effect of this trimmer is more important if it is necessary to use a variable capacitor without a ceramic spindle, as then the whole of the rotor sections and the metal frame are at V1 grid potential, and there exists a very high stray capacity to chassis.

be well screened to avoid hum pick up. Any screening employed must be well spaced from the capacitor, to avoid as much as possible high stray capacities which will upset the bridge balance and restrict the upper frequency limit of each band.

The resistors used in the bridge circuit are of the High Stability type with tolerances of $\pm1\%$. It is preferable for these to be in matched pairs, although not essential if the 1% tolerances are strictly adhered to.

Automatic amplitude control of the oscillator is accomplished by the use of a Thermistor. This has proved by far the most satisfactory method of amplitude control, and dispenses with the necessity for using complicated feedback circuits and

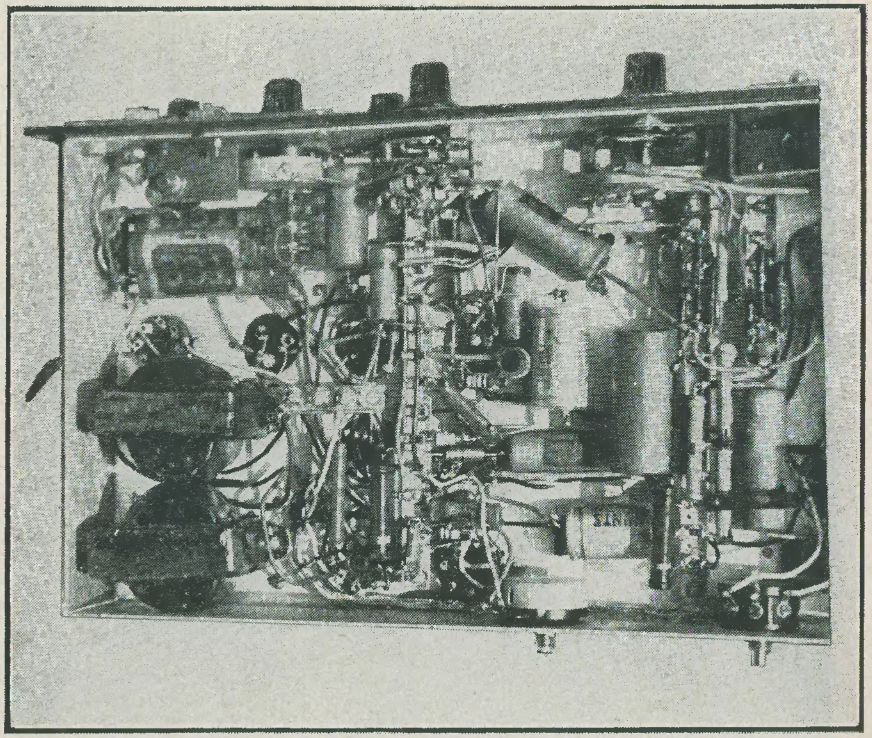
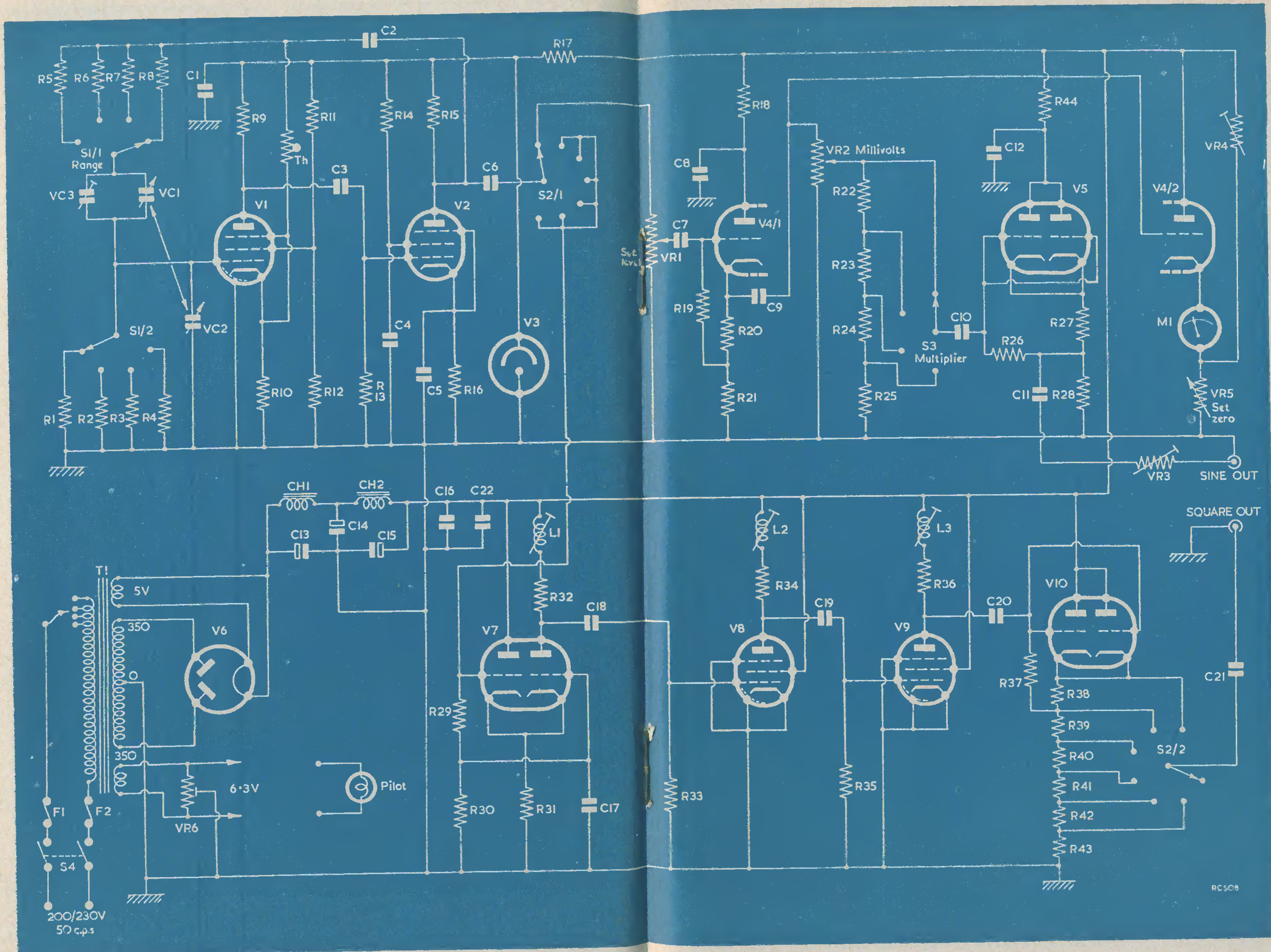


Fig. 3. Underneath of chassis

In view of the high impedance of the grid circuit on the lower frequency range, it is necessary to use a bandswitch incorporating ceramic wafers to avoid leakage. It is also most important that the tuning capacitor

the use of special lamps. The VR150/30 stabiliser keeps the HT+ potential to the oscillator constant, and greatly improves stability. Full theoretical details of Wein bridge oscillators can be found in most


C2
R17
R5
R6
R7
R8
C1
R9
R11
R14
R15
Th
S1/1
Range
VC3
VC1
C3
C6
S2/1
V1
V2
C4
S1/2
VC2
V3
R10
R12
R
13
C5
R16
R1
R2
R3
R4
CH1
CH2
C16
C22
C14
C13
C15
L1
T1
5V
350
V6
O
350
R32
C18
V7
R29
6·3V
Pilot
VR6
F1
F2
S4
R30
R31
C17
200/230V
50 c.p.s
R18
VR2 Millivolts
R44
C12
VR4
C8
R22
V5
V4/2
C7
V4/1
Set
level
VR1
R23
C9
R19
R20
R24
C10
S3
Multiplier
R26
R27
M1
R21
R25
C11
R28
VR5
Set
zero
VR3
SINE OUT
SQUARE OUT
L2
L3
R34
R36
C19
C20
V10
V8
V9
R37
R38
C21
R39
R40
S2/2
R41
R42
R43
R33
R35
RC508

COMPONENTS LIST

Resistors

Desig.	Value	Tolerance	Watts Rating	Type	Remarks
R1	8.2MΩ	± 1%	¼	Hi-Stab.	
R2	820kΩ	± 1%	¼	”	
R3	82kΩ	± 1%	¼	”	
R4	8.2kΩ	± 1%	¼	”	These resistors should preferably be matched in pairs and be within 1% of the nominal value
R5	8.2kΩ	± 1%	¼	”	
R6	82kΩ	± 1%	¼	”	
R7	820kΩ	± 1%	¼	”	
R8	8.2MΩ	± 1%	¼	”	
R9	56kΩ	± 5%	½	Standard	
R10	4.7kΩ	± 5%	½	”	
R11	68kΩ	±20%	½	”	
R12	68kΩ	±20%	½	”	
R13	470kΩ	±20%	¼	”	
R14	10kΩ	±10%	1	”	
R15	5kΩ	± 5%	6	Wire Wound	
R16	820Ω	± 5%	½	Standard	
R17	6.8kΩ	± 5%	6	Wire Wound	
R18	6.8kΩ	±20%	1	Standard	
R19	560kΩ	±20%	¼	”	
R20	100Ω	±20%	¼	”	
R21	10kΩ	± 5%	1W	”	
R22	910kΩ	± 1%	¼	Hi Stab.	If possible select for 900kΩ
R23	91kΩ	± 1%	¼	”	” ” 90kΩ
R24	9.1kΩ	± 1%	¼	”	” ” 9kΩ
R25	1kΩ	± 1%	¼	”	
R26	1MΩ	±20%	¼	Standard	
R27	100Ω	± 2%	¼	Hi Stab.	
R28	1kΩ	± 2%	½	”	
R29	1MΩ	±20%	¼	Standard	
R30	22kΩ	±20%	¼	”	
R31	10kΩ	±10%	2	Standard	
R32	2.7kΩ	±10%	1	”	
R33	2.2MΩ	±20%	¼	”	
R34	1kΩ	±10%	1	”	
R35	2.2MΩ	±20%	¼	”	
R36	1kΩ	±10%	1	”	
R37	2.2MΩ	±20%	¼	”	
R38	100Ω	± 5%	¼	”	
R39	100Ω	± 5%	¼	”	
R40	100Ω	± 5%	¼	”	
R41	100Ω	± 5%	¼	”	
R42	47Ω	± 5%	¼	”	
R43	47Ω	± 5%	¼	”	
R44	2kΩ	±20%	1	”	

Capacitors

Desig.	Value	Tolerance	Rating	Type
C1	16μF	—	250V	Electrolytic
C2	24μF	—	250V	”
C3	0.5μF	±20%	250V	Paper (Non-inductive)
C4	8μF	—	250V	Electrolytic
C5	0.0047μF	± 2%	250V	Silvered Mica
C6	0.5μF	±20%	250V	Paper (Non-inductive)
C7	0.5μF	±20%	250V	Paper (Non-inductive)
C8	16μF	—	450V	Electrolytic
C9	0.5μF	±20%	350V	Paper (Non-inductive)
C10	0.5μF	±20%	250V	Paper (Non-inductive)

Capacitors—*continued*

Desig.	Value	Tolerance	Rating	Type
C11	100μF	—	50V	Electrolytic
C12	16μF	—	450V	”
C13	8μF	—	450V	”
C14	16μF	—	450V	”
C15	32μF	—	350V	”
C16	100μF	—	350V	”
C17	0.1μF	±20%	350V	Paper
C18	0.5μF	±20%	350V	”
C19	0.5μF	±20%	350V	”
C20	0.5μF	±20%	350V	”
C21	100μF	—	50V	Electrolytic
C22	0.005μF	±20%	350V	Silver Mica

N.B.

C1and C4 In one can. C3, C6, C7, C9, C10, C17, C18, C19 and C20 Metal cased.
C8 and C12 In one can. C13 and C14 In one can.

VC1 & 2	Four-gang condenser 532pF per section wired in 2 sets of 2 sections each. Rotor sections isolated. Ceramic spindle. (Wingrove & Rogers)
VC3	Air-spaced trimmers 3.8 — 50pF.
VR1	50kΩ wire wound potentiometer.
VR2	Special switched potentiometer 20 positions. Total value 100kΩ, each section 5kΩ ±1%. (Painton, or Electronic Components).
VR3	5kΩ Carbon track.
VR4	500kΩ, 1 watt. Carbon track, pre-set.
VR5	50kΩ. Wire wound.
VR6	Humdinger.
S1/1 & S/2	Rotary switch. Single ceramic wafer. Double-pole four-way.
S2/1 & S2/2	Rotary Switch. Double ceramic wafer. Single-pole seven-way.
S3	Rotary Switch. Single paxolin wafer. Single-pole four-way.
S4	Mains Switch. 2-pole on/off.
T1	Mains Transformer. Pri. 200/250V. Sec. 1 350-0-350V 100mA. Sec. 2 5V. 3 Amps. Sec. 3 6.3V. 3 Amps.
CK1 & CK2	Smoothing chokes. 10H, 100mA. R, less than 200 ohms.
L1	Inductance, 35μH. 55 Turns 20 swg on ⅜" dia. former.
L2 & L3	Semi-variable Inductance, 3.5-7μH. 17 Turns 28 swg on ⅜" dia. former, fitted dust core.
Th.	Thermistor. S. T & C. type A.5412/100.
f1 & f2	Fuses ½ Amp.
M1	0-500μA.

Valves

V1	6SJ7, Oscillator	V4/2	6SN7, Meter Valve.
V2	6AG7, Oscillator	V6	U52 or 5U4G, Rectifier.
V3	VR150/30, Stabiliser	V7	7F8, Squarer.
V4/1	6SN7, Cathode Follower.	V8	Z77, Clipper.
V5	6SN7, Sine Output Cathode Follower	V9	Z77, Clipper.

V10 7F8, Square-wave Output Cathode Follower.

---

standard reference books, so it is not proposed to deal with them in this article.

The output from the oscillator section is taken via the "Sine/Square" switch on position 1 to the "set level" control and thence via an isolating cathode follower V4/1 to the voltage dividing network. This consists of a special stepped potentiometer VR2 with 20 steps of 5,000 ohms each, making a total of 100kΩ, fed into a four-position multiplier section. The potential dividers are calibrated in millivolts, but if desired a dB scale giving dB loss on 1 volt RMS can be included. A line is taken from the top of the potentiometer to the meter valve, which is set to give a convenient arbitrary figure with one volt across the output (loaded with 600 ohms). If required, the meter can be marked X1 or X2 thus doubling the effective output voltage.

To maintain the accuracy of voltage calibration over the entire frequency range it is essential that all circuitry following the potential divider should have a flat frequency response within ± 0.5 dB over the whole range covered by the oscillator, and to this end stray capacities must be kept to a minimum. The reason for placing the attenuator system at this point rather than in the actual 600 ohms line was to avoid the use of expensive constant impedance attenuator units.

The output stage comprises a 6SN7 with both sections in parallel. This in conjunction with the 1,000 ohm cathode load resistor gives sufficient amplitude linearity over the whole range of input voltages to enable the accuracy of calibration to be maintained over practically the complete frequency range covered by the instrument. As the output stage is required to have a flat frequency response from 50 c/s–200 kc/s, the use of an output transformer becomes impracticable and an alternative output circuit had to be used. The use of a CR output circuit feeding into 600 ohms presents quite a problem, and some compromise had to be made. As a result, a small error of voltage calibration is noticeable at frequencies below 50 c/s due to the increase in reactance of both C11 and C12. The change in C11 is somewhat compensated by VR3, which should be used at as large a value as possible. In practice this works out at around 1,200–1,500 ohms. The error can, of course, be further reduced by increasing the value of C11 and C12.

Square-waves are obtained by amplifying and shaping the output from the sine-wave oscillator section.

The sine-waves are taken via position 2–7 on switch S2/1 and are fed into a 7F8 squarer. The mark space ratio of the square-wave is mainly governed by the amplitude of the sine-wave fed into V7, and the value of the cathode load resistor R31. To obtain a steep leading edge on the wave shape it is advisable to leave the input at maximum and adjust R31 to give a unity mark space ratio. As a point of interest, it is possible to produce pulse outputs by adjusting L1 to a much higher value. L1 is normally adjusted to give optimum frequency response.

V8 and V9 are two over-driven clipper stages which have the effect of progressively improving the time of rise. Both stages are shunt compensated by means of L2 and L3, and adjustment of these components should give optimum compensation on the highest frequency range.

The output from the clipper stages is fed to a cathode follower V10. It was not possible to feed the square-waves through the attenuator and associated circuits on the sine-wave channel, as this would have degraded the square-wave to such an extent as to make it unsuitable for video testing. If difficulty is experienced in obtaining 7F8 type valves, it is possible to replace them by valves type 6J6, although the slightly lower gm of the 6J6 would slightly degrade the square-wave. It must be pointed out that whereas the 7F8 was a "Loctal" base, the 6J6 uses the B7G base.

If different attenuator ratios are required for the square-wave output, the values of R38-43 can be modified, but in no instance should their total value exceed 500 ohms.

A useful accessory to the generator is a termination unit, and this can either be built into the instrument or used separately. In the writer's case, a small unit was made up in a screening can — see Fig. 4. This is invaluable, as it includes an accurate 600 ohm load for the sine-wave section and a straight-through condition for use with the square-wave section.

The unit incorporates a rotary switch and necessary components. It is fitted with plugs and leads suitable for connection to either sine- or square-wave outlets.

The power supply for the unit is fairly conventional, except that it employs a two-section filter and the main smoothing capacitors total at least 132μF. This is necessary to preserve a reasonably flat top to the low frequency square-waves. Of course, a great improvement could be obtained by fitting a regulated power supply, but this makes the unit too large and reduces its portability.

The actual construction of the unit is quite straightforward, as will be seen from the illustrations. Fig. 1 shows the layout of the front Panel, and it will be seen that it is possible to obtain a symmetrical layout with convenient grouping of the controls. The dial markings can be marked or type-written on pieces of white card and then covered by perspex blanks of suitable shape. The front panel is preferably made of ⅛" dural-sheet and the whole instrument housed in a wooden case with suitable ventilation.

Fig. 2 shows the chassis layout. On the left can be seen the two oscillator valves, and next to them the four-gang capacitor in its housing. On the right-hand side of the condenser can be seen the small sub-chassis upon which is mounted the squarer unit. It is essential to build up the squarer in this fashion so that cross screens can be fitted underneath across the valve bases.

This prevents any trace of HF instability which might otherwise occur if the stages were mounted unscreened on the main chassis.

If there is any trace of hum in the output it is advisable to fit a fully screened mains transformer or, alternatively, to fit a copper screening ring round the existing transformer.

The underchassis view given in Fig. 3 shows the compact layout of the instrument. The components are, in the main, supported on ceramic stand-off tags, although this is not strictly necessary except for the resistors R1, R2, R7 and R8, in the oscillator circuit. In the bottom left-hand corner can be seen VR3, which is adjusted by means of a screwdriver inserted through a hole in the wooden cabinet.

It is advisable to use first-class components throughout, and to pay special attention to coupling capacitors, especially C18, 19 and 20. Any doubtful components should be tested before use, and all capacitors "megggered" to their full working voltage. This is very important if old or government surplus components are being used.

The Thermistor is mounted in a small rubber grommet, supported on a stand-off tag, and this method has proved entirely satisfactory.

The instrument was subjected to a number of stringent tests, and in the main came well within the original broad specification. The actual measured figures were as follows:-

Frequency coverage 17c/s–175 kc/s.

Distortion, Sine-Wave, 0.5% max. at 1 kc/s

Time of rise on Square-Wave — 0.085 microseconds.

Oscillator amplitude stability, ± 2 dB over whole range.

Although it was found that the oscillator did not quite reach the desired upper limit, it is hoped, by reducing still further the stray capacities in V1 grid circuit, that a satisfactory conclusion will be reached.

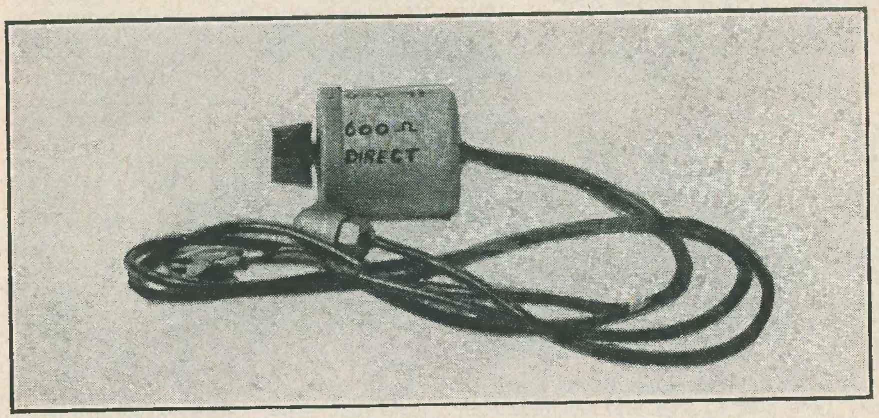


Fig. 4. Termination Unit

The ranges covered were as follows:—

Range 1. 17 c/s — 200 c/s.
Range 2. 170 c/s — 2 kc/s.
Range 3. 1.7 kc/s — 20 kc/s.
Range 4. 17 kc/s — 175 kc/s.

In view of the fact that ranges 1–3 are in decades, one scale will suffice for these three ranges, but it is preferable to include a second individually calibrated scale to cover range four.

There are a number of ways of carrying out frequency calibration, and perhaps the simplest is to provide a simple oscillator with only rough calibration and an oscilloscope. Calibration can now be carried out using lissajou figures and starting with the 50 cps. mains supply. By switching from one oscillator to the other the signal generator can be accurately calibrated over its entire range.

Termination Unit

In position 1 the output is straight through. In position 2, a 600Ω ±1% load is connected by the yaxley switch in parallel with the output. In position 3, the 600Ω is in parallel, and a 0.5μF is connected in series with the output, on the output side of the switch after the 600Ω resistor.

Radio Miscellany

RADIO AMATEURS IN THE UNITED STATES can look back with pride on a long record of public service in which their equipment and operating skill has enabled them to maintain a network of communication in times of emergency. Happily, in this country we rarely suffer from hurricanes, earthquakes, dam-breakdowns, widespread flooding, forest fires or blizzards. In such emergencies American amateurs have often been the sole means of keeping communications open.

On a few odd occasions British amateurs have been able to step into the breach in minor incidents, but in the past there has always been an obstinate complacency when any attempt has been made to organise a network capable of coping with any large-scale disaster. Nor have the R.S.G.B. given solid support to such a plan, and in the past a few of its leading members have officially played it down. They even suggested the "G.P.O. would not permit it" or "the need was too rare to justify it," and one even said "it couldn't be done."

After the East coast floods of Jan./Feb. 1953, Dr. Arthur Gee, G2UK, campaigned for an emergency network on a national scale. Rather belatedly the R.S.G.B. also took action, and things very quickly got humming. The G.P.O. raised no difficulties and numerous civic authorities, including the Police, asked for co-operation.

As a result, the Radio Amateurs Emergency Network has been formed, and many hundreds of amateurs are participating or standing by in readiness to help. While we all fervently hope there will be no occasion for them to have to go into action other than for practice purposes, they will at least serve as a valuable insurance policy and stimulate interest in QRP and portable design. The resourceful enthusiast who can get on the air *sans* electric mains, either with a hand-driven generator or a few odd batteries, is a valuable man in times of emergency. As the amateur movement is rich in this type, properly organised they will render a good account of themselves should the occasion arise.

VHF

Discussing lines of action with some of the members of the R.A.E.N., I found they were virtually unanimous in the choice of 144 Mc/s as the most suitable eventual band. Some groups will, of course, be on the lower frequencies, at least to start with.

The 2-metre band has a charm of its own. It gives a consistent 30-mile upwards ground wave, free from noise, clear of jamming, and almost predictable DX possibilities. There is also plenty of room for dozens of stations to be operating at the same time within close range without mutual interference, and large scale exercises can be carried out without the slightest interference with TV viewers. Its only drawback is the scarcity of valve types which perform with reasonable efficiency above 50 Mc/s. The position is still worse with battery types, but one or two amateurs, particularly GM6LS, have proved what can be done with a half-watt walkie-talkie.

Even the old-timers coming to 2-metres discover that it means virtually acquiring a new technique — I know I did — but with a little patience and a few specialised oddments, results soon begin to come.

Amongst ourselves, we agreed that in the past interest in VHF had always been patchy, and many of those who have successfully operated on "two" deserted it after a year or so. I was rather surprised at the unanimity of the reasons given for this. The approach to VHF by the radio press has been faulty. One quarter has been particularly guilty in encouraging a spurious, highly competitive spirit, with "Ladders," certificate collecting, and "stations-worked" mania. To make matters worse, even the *Bulletin* thoughtlessly copied this silly business and one magazine worked itself into a frenzied headline about bouncing signals from the moon, which turned out to be nothing more than an All-Fools-Day joke. No wonder 2-metres has come to have a reputation of being the unfriendliest and least Ham-spirited of all the amateur bands.

No one would deny competition and DX-chasing is great fun in its proper place, but it is not the be-all and end-all of the hobby.

Even the columns of those magazines which have been most guilty of provoking this situation, frequently quote their readers as complaining of the "work-you-once-to-add another-to-my-list" attitude and bewail the lack of activity and spasmodic interest.

Happily, 2-metre interest is still going along nicely with those who are not made miserable and dissatisfied because there are no new counties to be worked. Nor can serious interest be sustained by pretending to start all over again and counting only counties worked since last Michaelmas.

I am fully aware that I am liable to incur unpopularity in certain quarters by quoting from this discussion, but to any of the VHF fraternity who would disagree with them I would say, prove those who hold these views wrong by weighing in and doing your bit with the R.A.E.N. VHF with battery gear and a dipole on your back, is quite a different affair from using a super-converter, multi-element arrays and electric mains.

Centre Tap talks about R.A.E.N. — VHF — G.P.O. — HI-FI

The Punishment Fit the Crime

Most readers will have seen the newspaper accounts of the pirate listener of Hounslow who was fined a couple of pounds and had his receiver confiscated. The right of the GPO to apply to have the receiver impounded was not, until it was exercised on this occasion, generally realised. As a form of punishment it obviously varies in its deterrent effect. There is a world of difference between losing a 100-guinea radiogram and being relieved of a box of old junk you'd have to pay anyone else to take away!

When I heard the incident discussed by a couple of listeners, one brightly suggested getting a friendly neighbour to run in an extension speaker. To do this, of course, also requires a licence. The bright boys who make a living by devising regulations are sure to have prepared for a thing like that. Those who remember me telling the story of the start of relayed radio could tell you that at one time it was actually forbidden! At least, the bright boys found it was when they carefully checked over the regulations they had drafted.

Occasionally we get queries from readers about the licence position of portable receivers built for fitting to their cycles or cars. The licence for a fixed address also covers the use of a portable set, not only by the licensee but also by any member of his household. A receiver which is fitted in a vehicle is not considered to be portable in the sense that it is a "portable receiver," and therefore an additional licence must be taken out.

Larger Than Life

Recently I commented on the small amount of steam radio listening I have done in recent years, and to my surprise one or two indignant letters arrived from the anti-TV types. One even suggested sarcastically that this column should be re-named TV Miscellany and confine itself to comments for the other stupid clods, like myself, who have no soul for serious music.

Funny, that! When I weigh in with strong opinions on controversial issues, no one says a dicky bird — as the Cockneys have it — but after an innocent remark like that, two or three scorching letters turn up.

I can at least console myself with the thought that I have always secretly suspected these "quality merchants" are often queer birds. Not that I have any right to suppose these particular correspondents are — but you never know. They might be, and I have met some of them. In fact, you don't meet them. They meet you, and before you know quite what is happening they get a judo-like grip of your arm and you are yanked off to hear their latest super-duper amplifier. They then carefully position you in front of a loudspeaker dressed up like the back end of a battleship (coffin shapes are also highly esteemed) and you are literally blown backwards by an avalanche of sound which hurls out of the opening.

Apart from the nervous feeling you get from seeing all the ornaments on the mantelpiece dancing about crazily, there is something terrifying about reproduction that is nearly three times as loud as the original. That little demonstration is merely to let you know that the amplifier is capable of giving enough undistorted output to fill the Albert Hall, but even a life-size Symphony Orchestra is too much for a drawing room.

You utter a few words of gratitude to merciful Providence that he doesn't live nearer to you, and you no longer wonder why he is hardly on speaking terms with his wife.

Gramophonemanship

It is baffling how these hi-fi types manage to get their wives to consent to their keeping enormous labyrinth speakers and acoustic chambers in the drawing room. It can only be that these chaps are determined characters who secretly believe their poor wives are putting on an act when they shut themselves up in the airing cupboard as soon as the pile of gramophone records is produced. Even there they know no safety. Torrents of undistorted power pour in under the door.

Concert Hall volume isn't the only thing they have to endure. The drawing room furniture is dwarfed by gigantic oven-like speaker cabinets which are tightly packed with bags of sand and solid concrete blocks.

In the corner of the room stands the control panel, with so many knobs and dials that it begins to look like the cabin of a space-ship. Thus the treble, middle and bass can be cut, lifted or boosted as required and the needle hiss amplified or suppressed to taste. Usually the record is all over long before the hi-fi fiend has obtained what he considers to be the right balance. That, however, is only a detail — it's the quality that matters.

Maybe these vitriolic correspondents are not really like that, but as I have already hinted, I've got my suspicions ——.

(Well, well ! — *Ed.*).

Those Close-ups

Referring to my recent hints on taking close-up photographs of gear and gadgets, a reader reminds me I did not mention the use of extension tubes. Actually this was no oversight, but as so few cameras have a readily detachable lens, I thought it hardly worth while.

He also sent specimens of some remarkably fine large-as-life photographs of rare, or unusual, stamps — not being a philatelist I cannot be sure which — using this method.

The idea of extension tubes is an easy approach for those who possess cameras which have an easily removable lens mount. The extension ring simulates the idea of the extending bellows, and the depth of the ring (for those good at lathe-work) can well be ascertained by the method I formerly suggested.

Can Anyone Help?

Dear Sir, Can any fellow reader help me with details of American equipment AN/ARR-2X, particularly receivers R3/ARR-2X and R3A/ARR-2X?—C. W. Falkner, "Thames Mead," Abbey Drive, Laleham-on-Thames.

* * *

Dear Sir, I would be extremely grateful if you would spare me some space to enquire whether anyone would be willing to sell, lend or exchange information on the W.S.38 and 21 sets. If possible, I should like circuits and component values, if not manuals. —N. W. Bean, Ellesmere College, Salop.

* * *

Dear Sir, Can anyone help me with the loan of the circuit of the Homelab Signal Generator, 100 kc/s–130 Mc/s. The one I have is one of the type first introduced by the makers about three years ago.—L. Lynch, 37 Poplar Avenue, King's Farm, Gravesend, Kent.

Dear Sirs, I have a Radiovision V55R receiver for which I would very much like service data — I wrote Radiovision of Leicester and reply was "completely out of stock for V55R." I particularly wish to know the identity of the trimmers, and any alignment data.—O. Adams, 18 South Parade, Whitley Bay, Northumberland.

* * *

Dear Sirs, In the October 1953 issue, Mr. David Millard of Tipton, Staffs, asked for information re the 666H Triplett Test Set. FSD is 400μA, meter resistance 250Ω. If anyone has any further information about this Test Set, i.e. wiring diagrams and component values, I should be very much obliged.—B. Whatmore, 37 The Woodlands, High Road, Finchley, London, N.12.

* * *

Dear Sir, Will you please assist me by asking in your columns for circuit diagrams on sale or loan of the American receiver models RU-19 and RU-16.—S. Bradley, 55 Wood Lane, Newsome, Huddersfield, Yorks.

ELECTRONIC SELECTIVITY FILTER

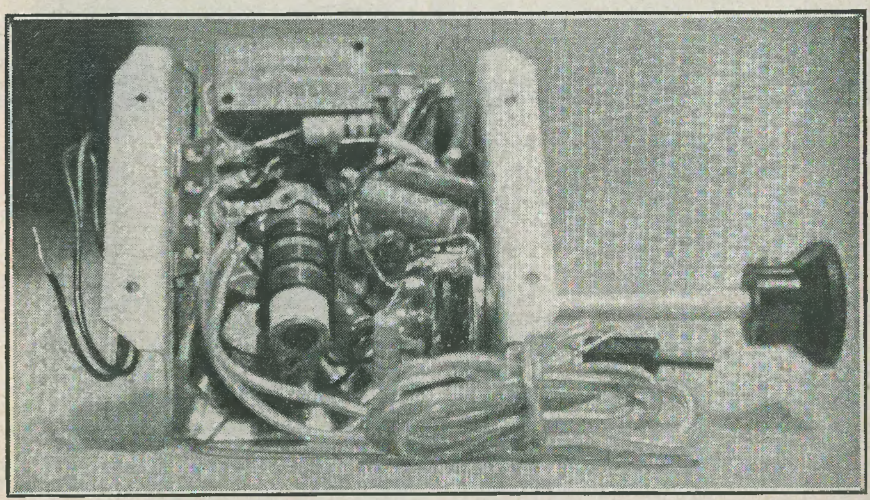
By **F. A. BALDWIN,** A.M.I.P.R.E.

In which the author describes two methods of constructing an "Electronic Crystal Filter" using the Mullard ECC40 double triode, together with standard components currently available on the market.

For those who are in possession of a communications receiver, either of the home-built, commercial, or surplus varieties, which are not fitted with a crystal filter, the latter item must seem a most desirable addition to the circuit. The advantages and effectiveness of a *good* crystal filter are well known and will not be discussed here.

Unfortunately for the home constructor, there are many difficulties to the fitting of such a filter, even if one has access to reliable matching IF transformers, and this, together with the cost of a crystal unit, tends to make the project somewhat fearsome — from many points of view. There is, however, a way out of the foregoing objections by the method about to be described, and the average enthusiast may construct and fit an "electronic crystal filter" which has all the properties of a *good* crystal.

This unit is relatively cheap — many of the components would already be to hand; easy to construct — taking a couple of hours



Showing construction of version "B"

and expensive test equipment. Apart from the constructional and lining up troubles which one must inevitably encounter, there is the very real problem of obtaining suitable only; simple to fit; easy to align; and it may on completion be used either as an internal unit or as an outboard addition to the receiver. A further advantage is that the completed unit, once aligned, is very much easier to operate than the normal type of crystal filter, where operation of the phasing condenser will alter the shape of the band-

have used it in RF and IF feedback circuits for years, but the difference here is that the unit is much more efficient than the norma methods and is a completely separate

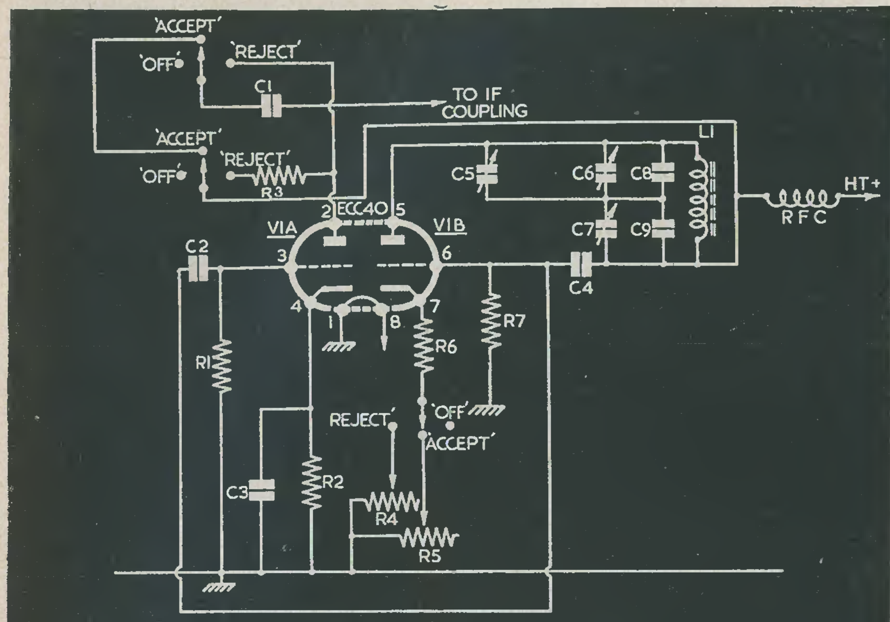


FIG.1
CIRCUIT OF ELECTRONIC CRYSTAL FILTER
465 Kc/s

COMPONENT LIST

R1	1.8MΩ ½ watt ±10% Dubilier	Switch	Yaxley type, 3-pole, 3-way.
R2	10kΩ 1 watt ±10% Dubilier	C1	5,000pF mica, T.C.C.
R3	33kΩ ½ watt ±10% Dubilier	C2	5,000pF mica, T.C.C.
R4	5kΩ pot. wire wound, Colvern	C3	0.01μF tubular, T.C.C.
R5	5kΩ pot. wire wound, Colvern	C4	500pF mica, T.C.C.
R6	1.5kΩ 1 watt ±10% Dubilier	C5	100pF variable, Eddystone
R7	1.8MΩ ½ watt ±10% Dubilier	C6	500pF variable mica dielectric variable
L1	See text, Teletron Co., type FXI.	C7	500pF variable mica dielectric variable
V1	Mullard ECC40	C8	500pF mica, T.C.C.
RFC	Teletron Co.	C9	1,500pF mica, T.C.C.

pass curve. With the electronic type of filter, operation is much easier — the accept and reject positions being selected by means of a Yaxley type switch.

Circuit Operation

The high selectivity is obtained from Q multiplication derived from the positive feedback employed. There is, of course, nothing new in this idea; most of our readers

circuit. A tuned circuit with a multiplication factor of 20 to 40 applied, results in a Q as high as a good crystal filter[1].

Off resonance, the impedance of the tuned circuit shown in Fig. 1, when connected to the existing receiver IF strip, is low and

1 O. G. Villard, Jr. and W. L. Rorden, *Flexible Selectivity for Communication Receivers*, Electronics, April 1952, p. 138. K. S. Champlin, *Flexible IF Channel Selectivity*, CQ, October 1953, p. 31.

therefore attenuates IF signals; the opposite effect, however, takes place when the tuned circuit is at resonance. By virtue of the very high impedance achieved when resonant, a very highly peaked IF band-pass results; see Fig. 2. The actual resonant frequency of the tuned circuit effectively determines the position of the peak within the IF band. After adjustment of the circuit (described later), this position is controlled by the operation of C5, which may be brought out to the front panel. The phase shift at resonance is zero.

Having briefly described the operation of the "accept" circuit, the "reject" circuit probably requires some explanation. Here, negative feedback is used to control the anode resistance of V1A and this, a Mullard ECC40, has a high anode resistance compared to the impedance of the IF circuit. The multiplier V1B controls the negative feedback of V1A. With the multiplier at resonance, the phase shift through V1B is at zero and therefore a high negative feedback results in V1A. The resulting low anode resistance of V1A effectively attenuates the IF signals. At non-resonance, the negative feedback lessens, thereby raising the anode resistance so that IF signals pass through the IF circuit with practically no attenuation. The sharp "reject" position curve is shown in Fig. 3.

Circuit (Version "A")

This is shown in Fig. 1, where it will be seen that V1A is the negative feedback amplifier and V1B the multiplier which, in conjunction with V1A, produces the IF "reject" condition. The Yaxley type switch selects the "accept," "reject" or "off" positions, and in this latter condition, the original IF band-pass shape is unchanged, (see Fig. 2). The cathode variable resistors R4 and R5 control the positive feedback of V1B, and should be of the wire-wound type. The variable condensers C6 and C7 are of the type normally used for reaction control (mica dielectric) and these are so adjusted that constant feedback throughout the range of C5 is achieved. The cathode resistor of V1A (R2), together with the associated condenser (C3), effectively ensures that V1A has a high anode resistance.

The coil L1 is a special inductor made to the writer's specification by the Teletron Co.— see advertisement pages. This coil, Type FX1, is small, compact and highly efficient. The RF choke is also important, and has also been made for us by the same company.

Connection to the receiver IF strip is made via C1, which may be connected to the grid or anode of the first IF stage. The prototype was connected to the anode but,

whichever is preferred, some adjustment of the appropriate receiver IF core will be required when the filter is in the "off"

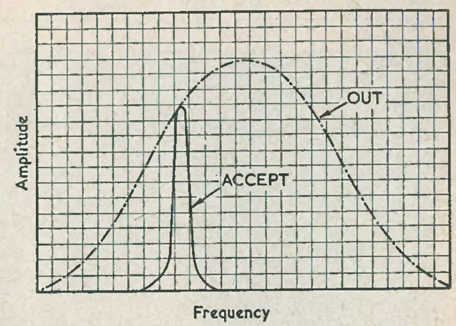


FIG.2 "ACCEPT"

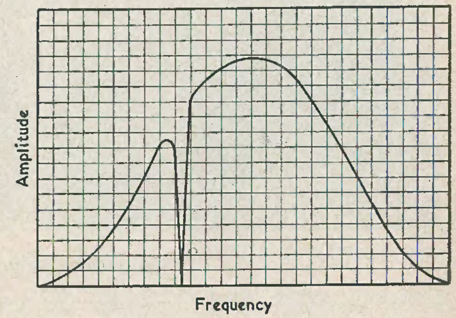


FIG.3. "REJECT"

I.F. BAND-PASS CURVES

RC535

position, in order to allow for the capacitance of the connecting wire. This would be particularly important where the unit is operated as an outboard accessory, in which case the connection should be via a short length of co-ax cable in order to avoid stray coupling. When used as an integral part of the receiver, the filter should be mounted as near to the appropriate IF stage as possible, with the switch and C5 brought to the front panel via extension spindles.

All condensers, except of course the variables, and C3 should be of the mica type, and all resistors should be close tolerance types of ½ watt rating, except R2 and R6 which are of 1 watt rating.

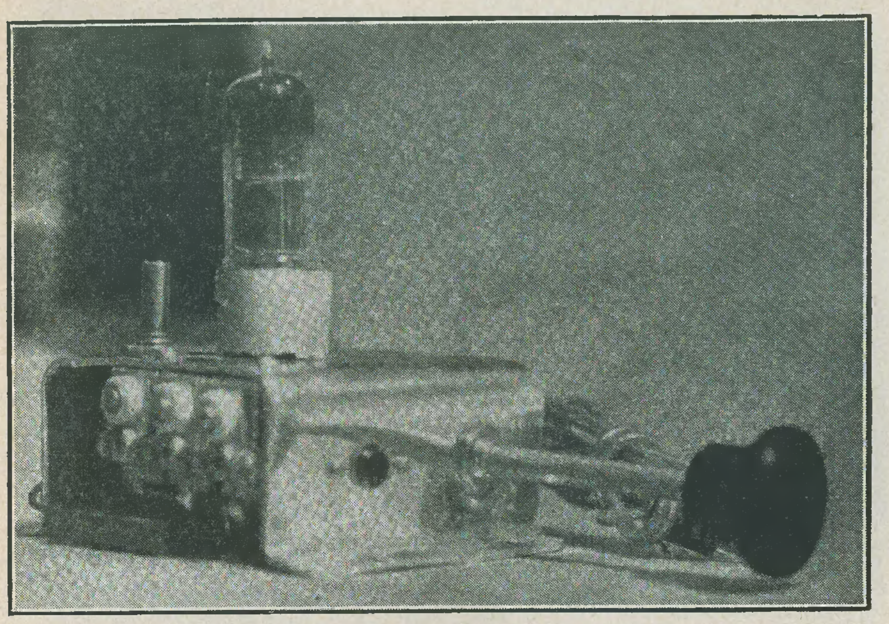
Aligning the Unit

This is simple, and requires no test equipment of any kind.

With the filter switch in the "off" position, tune a signal into the centre of the IF band. Re-align receiver IF (see text).

Operation

The operation of the "electronic crystal filter" will be found to be much simpler than that of a normal type of crystal filter, where the phasing control must be altered to find either the "accept" or "reject"



Three-quarter front view of version "B"

Set C5, 6 and 7 to mid-capacity and then switch to the "Accept" position, when the signal will disappear.

Set R5 just below the point of oscillation and adjust the core of L1 until the signal reappears. Some adjustment of C7 will also be required here.

Slowly moving C5 backwards and forwards, adjust C6 and C7 so that oscillation is constant.

The final setting of the "Accept" circuit should be made with C5 in the mid-capacity position and R5 just below the point of oscillation, the whole now being tuned to the middle of the IF band pass.

For adjustment of the "Reject" position, the switch should be set at "Reject" and R4 set at a position, found by trial and error, where the signal disappears. This position is critical and rather sharp.

The setting up is now complete and no further adjustments to the pre-set controls are necessary.

notches. Here, these are automatically selected by means of the switch, and judicious use of C5 will allow the operator complete control of the IF band-pass and therefore the signal desired. With a phone station, an interfering adjacent heterodyne will completely disappear when the "reject" position is selected. On CW the unwanted station is rejected and the wanted signal accepted, without changing the pitch, simply by varying C5.

The circuit (Fig. 1), is intended for an IF of 465 kc/s only (plus or minus the usual variation); for other IF's the coil L1 and associated components would, of course, have different values from those shown. In conclusion the writer wishes to state that no claims to originality are made with respect to this circuit; the basic idea is not new, but readers wishing to considerably improve the selectivity of their receiver could do no better than to construct this cheap and efficient "electronic crystal filter."

Version "B"

This version is that seen in the illustrations included with this article, version "A", of course, being the prototype. The circuit is substantially the same as that for the previous version, except that the condensers C5, 6, and 7 have been replaced with a bank of three 100pF trimmer type condensers seen mounted at one end of the small sub-chassis. This method has several advantages over the previous model in that (a) only one panel control is necessary, thus saving all-important panel space, (b) a considerable saving is made in cost and (c) greater ease of operation results.

Dealing with the latter advantage, the operator simply switches to the "Accept" position for maximum selectivity, which can be pre-adjusted to the centre of the IF band-pass. Unlike the conventional crystal filter, there are no phasing difficulties, and whereas in the prototype the operation of C5 was required, this also has been eliminated. One now has minimum selectivity (Off), maximum (Select) and the "Reject" positions.

This latter version is, however, slightly more difficult to align unless one has access to test equipment, although it is not impossible to do so provided a certain amount of time and patience are expended.

As a final note, the writer would express the belief that this little unit will largely revolutionise amateur home-built equipment, for it has all the advantages — and more — of the standard crystal filter, it is simpler to operate, easy to construct both in time and cost, and is just the thing for that new communications receiver which you, the reader, are planning to build.

Club News

NORWOOD AND DISTRICT GROUP—R.S.G.B.

At the Annual General Meeting of the Group, reports were given by the T.R. and other members of the Group, a point of note being that the average attendance had increased from 17 to 23 at each meeting.

For his outstanding work in connection with 1953 N.F.D., the "1952 Committee Trophy" was awarded to Ron Reed, G2DX.

Morse classes have now been arranged in the Area, and enquiries from interested persons should be directed to Don Hill, 9 Addington Grove, S.E.26.

Arrangements for the 1954 N.F.D. are well under way and it is expected that two stations will again be competing.

The April meeting is on 17th April, 1954, at 7.30 p.m., Windermere House, Westow Street, Crystal Palace, and all members are invited to a "Ragchew".

CLIFTON AMATEUR RADIO SOCIETY

Attendance remains at a high level and we have been pleased to welcome several new members during the past few weeks. Meetings continue to be held every Friday at 7.30 p.m. at the clubrooms, 225 New Cross Road, S.E.14.

It is hoped to run a series of DF events again this summer, when members will compete for the DF shield, and an evening will shortly be devoted to a talk, with hints and tips, by last year's winner. Transmitting and Listening contests continue to be popular, and the next is scheduled to be held in April.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Officers elected at the Annual General Meeting were:—Chairman, Mr. C. M. Swift (G3IUK); Hon. Sec., Mr. F. C. Ward (G2CVV); Hon. Treasurer, Mr. W. R. Chaffe (G2DLJ); Hon. Contest Secretary, Mr. F. Clay (G3IBL); Committee: Messrs. A. McCabe (G4CO); F. Cox (G3GRM); B. J. C. Brown (G3JFD); A. C. Rodgers (G3IIJ) and T. Darn (G3FGY).

The Chairman remarked on the recent success of the Local Top Band Contest organised by Mr. F. Clay. The Treasurer reported that the financial position was sound, the Society's Assets totalling over £75. In his report to the Membership, the Secretary stated that the present figure of 72 fully paid members was the highest on record. The Society's President, A. G. G. Melville, F.R.C.S., presided, and in thanking the Committee for their past work, regretted that it was necessary to cease publication of the Society's Magazine in favour of the *Newsletter*. Incorporation of the title (Derby Wireless Club 1911), (the first Wireless Club in the World) in the Society's name was discussed, and it was reported that necessary steps to preserve this title were in hand.

Hon. Sec., F. C. Ward (G2CVV), 5 Uplands Avenue, Littleover, Derby.

LANCASTER AND DISTRICT AMATEUR RADIO SOCIETY

It has been decided to give support to the Radio Amateur Emergency Network organised by the R.S.G.B. and it is hoped that some practical work will be undertaken in the near future.

Hon. Sec., A. O. Ellefsen, (G3FJO), 10 Seymour Avenue, Heysham, Lancashire.

TORBAY AMATEUR RADIO SOCIETY

G2GK has been appointed local ECO of the R.S.G.B. Emergency Network.

The Annual General Meeting, accompanied by the customary Junk Sale, will be held on the 17th April at the Y.M.C.A., Torquay.

Meetings are held on 3rd Saturday each month at 7.30 p.m., at the Y.M.C.A., Castle Road, Torquay.

Hon. Sec., L. H. Webber, (G3GDW), 43 Lime Tree Walk, Newton Abbot.

SOUTHEND AND DISTRICT RADIO SOCIETY

The meeting booked for the 19th March is rather special because we shall welcome again one of the pioneer members of our Society; Mr. G. T. Peck of D/F fame, whose promised talk on "Radio Control of Models," with the accent on CONTROL, is anticipated with interest. This is one of the meetings to which you are urged to bring your friends. We hope to see also members of the local Models Society, prepared to ask a lot of questions, feeling certain that Mr. Peck knows all the answers.

We have had an influx of new members recently, and we ask for more.

Hon. Sec., J. H. Barrance, 49 Swanage Road, Southend-on-Sea, Essex.

Let's Get Started

II : VOLTS, AMPS or OHMS?

By **A. BLACKBURN**

EVER SINCE MAN DISCOVERED HOW TO convert and develop nature to his own advantage, he has had to devise some means of measuring the property with which he is dealing. And he found it necessary, as he progressed, to standardise his measurements with some common guide, in order that following generations could continue research on the same basic assumptions. A typical example is, of course, the foot and span.

However, the greater the accuracy required, the less crude the instrument of measuring becomes. A foot that varied in length would

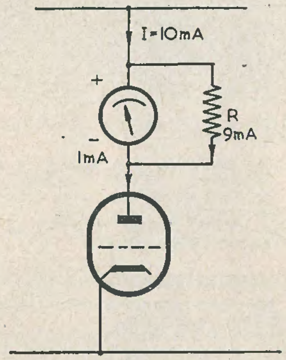


FIG.1
ADAPTATION OF 1mA METER TO READ 10mA

RC543

obviously affect the ultimate results more or less according to the limits of accuracy specified. The situation eventually arises when the development of the measuring instruments becomes as important as the equipment to be measured.

The science of radio is now sufficiently advanced to offer the engineer a range of apparatus specifically designed to provide him with all the information he normally wants of the quantities with which he is dealing, e.g. voltage, current and resistance. How and when this apparatus is used is the subject of this month's article.

Meters

Current and voltage are usually measured by means of pointer instruments, of which there are many types, each having a specific purpose. Of these, the one most commonly used is the moving coil type, since it has an excellent sensitivity in addition to low power consumption from the circuit under test.

Ordinary moving coil meters are available in sensitivities down to 5µA, full scale deflection. The less robust and more expensive galvanometer form of this instrument is capable of even greater sensitivity, but is not normally to be found outside the laboratory.

Range

Further on it will be explained why it is that the more sensitive a meter is, the less power it will take from the circuit under test. Why, in other words, the circuit is less affected.

Generally speaking, a sensitivity of 1mA FSD is common in radio work, since it combines the highest sensitivity with the lowest cost — a consideration not lightly to be dismissed by the amateur! As a general rule, the cost of the instrument increases with the sensitivity.

But, you will ask, how do you set about measuring currents in excess of 1mA? Since it is quite likely that currents up to 1Amp may be encountered, are we to assume that it is essential to have a number of instruments in order to cover this range? This would appear to be the answer, were it not for a simple device which has been developed to enable the same meter to be used for reading currents well in excess of its own full scale deflection value.

In Fig. 1 we have a 1mA meter connected in the anode circuit of a valve. The current flowing through the valve is 10mA. As a

result the meter is hopelessly overloaded, and the needle will be somewhere off the scale — probably bent around the stop! The solution to this overloading lies in including the resistor R in parallel with the meter. Its value must be such, in relation

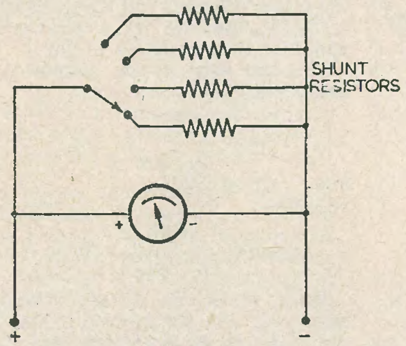


FIG.2a
METER WITH SWITCHED SHUNTS

RC544

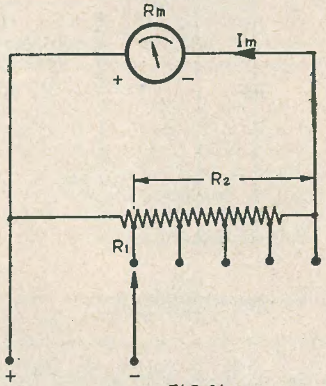


FIG.2b
UNIVERSAL SHUNT

to the resistance of the meter, that 9mA flows through it, leaving only 1mA to flow through the meter itself.

This can be more clearly explained in mathematical terms. Suppose the meter resistance is 100Ω, and we want only 1mA to flow through it. Then the voltage developed across it must be:

$$E = I \times R = 0.001 \times 100 = .1 \text{ Volts.}$$

However, the same voltage must be developed across R, through which we want 9mA to flow. The value of R must therefore be:

$$R = \frac{E}{I} = \frac{0.1}{0.009} = 11.1\,\Omega$$

As the meter will be reading full scale for 10mA instead of 1mA, we can say that we have reduced its sensitivity to a tenth or, alternatively, increased its range ten times.

We can, by this method, provide the meter movement with a number of additional ranges by switching a corresponding number of resistors, of suitably chosen values, in parallel with the meter.

The expression normally used for calculating the value of the shunt resistor R is:

$$R = \frac{Im}{I - Im} \times Rm$$

where Im = FSD of meter
I = current to be measured
Rm = resistance of meter.

If Im = 1mA, I = 10mA, and Rm = 100Ω as before, then

$$R = \frac{0.001}{0.01 - 0.001} \times 100$$

$$= \frac{0.1}{0.009} = 11.1\,\Omega\text{, as before.}$$

Universal Shunt

Fig. 2a shows a meter with switched shunts to produce a number of ranges. The disadvantages with this method is that the switch contact resistance is in series with the shunt resistor. For the higher current ranges the shunt resistor may have a value of 0.1Ω. If the switch contacts also have a resistance of 0.1Ω, the total shunt resistance becomes 0.2Ω, which would cause an appreciable error in reading.

To overcome this problem, a method of connecting the shunt so that the switch is outside the meter and shunt circuit is shown in Fig. 2b. This is known as the universal shunt.

The current to be measured is connected between the positive and negative terminals. As in the previous case, a definite fraction of the current flows through the meter, but since no switch contacts are inserted in the meter and shunt circuits, the likelihood of dirty or faulty contacts affecting accuracy is greatly reduced.

The maximum permissible voltage drop V across the meter must be decided before going ahead with the design of the shunt. A normal value is 0.1 volts. R_1 may therefore be calculated from the current to be measured, I, and the voltage, V, and expressed as:

$$R_1=\frac{V}{I}.$$

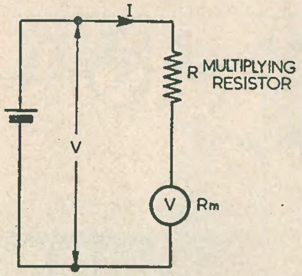


FIG.3
BASIC VOLTMETER

RC545

The value of R_2 is then derived from

$$R_1=n(R_2+Rm) \quad or$$

$$R_2=\frac{R_1-nRm}{n}$$

$$\text{where } n=\frac{Im}{I-Im}$$

If the multiplication factor of the current to be measured, I, to the FSD current, Im, is greater than 10:1 (e.g. 10mA to 1mA) then

$$n=\frac{Im}{I}.$$

Additionally, if R_2 is considerably greater than Rm, $R_1=nR_2$. Under these circumstances

$$R_1=\frac{Im}{I}R_2.$$

As can be seen from Fig. 2b, the total resistance across the meter R_1+R_2 is maintained constant for all ranges.

Voltage

The same meter movement that we used for current may also be used to measure voltage.

Suppose we were to connect the meter (100Ω internal resistance) direct to a 1 volt battery. By calculation the current through the meter would be:

$$Im=\frac{1V}{100}=0.01 \text{ Amps } or \text{ } 10mA.$$

We have already seen that the result of this is to considerably overload the movement. Placing a resistor in parallel would not help at all because, although the total current drawn from the battery would increase, the same current would flow through the meter, since there would be no change in the voltage applied.

It therefore becomes necessary to attenuate the voltage applied to the meter, because we have already found that 0.1 Volts across the meter produces full scale deflection.

Instead, we will try a resistor in series with the meter, as shown in Fig. 3.

We can express the voltage developed across the meter as:

$$Vm=\frac{Rm}{R+Rm}V,$$

and $Vm=ImRm$.

Therefore

$$ImRm=\frac{Rm}{R+Rm}V.$$

Since we know V, the voltage to be measured, and we know Im and Rm, we can evaluate R by rearranging the above expression to read:

$$R=\frac{V-ImRm}{Im}$$

From this we can give a value to R; reading 1 volt full scale,

$$R=\frac{1-0.001\times100}{0.001}=900\Omega$$

or, reading 10 volts full scale,

$$R=\frac{10-0.001\times100}{0.001}=\text{approx. } 10k\Omega.$$

Owing to the almost negligible effect that 0.001×100 has upon the final result in the last calculation, we ignore this particular term, and are left with a simplified version of the original expression:

$$R=\frac{V}{Im}$$

This applies only when the voltage to be measured is considerably larger than the voltage which, applied directly across the meter, would produce full scale deflection.

The sensitivity of voltmeters is very often expressed in ohms per volt. Thus our 1mA meter has a sensitivity of 1,000Ω/volt. To read 10 volts therefore, we have to introduce, in series with the meter, a resistance of $10\times1{,}000=10k\Omega$ — which, of course, agrees with the answer we have already obtained by calculation.

Errors

There is no infallible system of measurement. Even the most costly and complex are known to have a percentage of error, however small. But much can be done to reduce the margin of error, the necessary precautions taken being dependent upon the accuracy ultimately required of the instrument. It is obviously important to know the magnitude of error present in the instrument, since this can then be taken into consideration when making measurements. The seriousness of the error is then greatly diminished.

When measuring current the meter is, of course, connected in series with the circuit. But the following example indicates how the resistance of the meter (and shunts, if any) may alter the value of current flowing.

A 10 volt battery connected to a resistance of 10Ω would have to supply a current of 1 Amp. If a meter having a resistance of 2Ω were connected in series with the resistor the current flowing would be modified to approximately 0.8 Amps, which is the value the instrument would indicate. 0.8 Amps is the correct value *only while the meter is in circuit.*

Admittedly, this is an exaggerated case, because meter resistances are usually of the order of 0.1Ω for such currents, but it serves to illustrate my point.

Voltage measurements often produce serious errors. Fig. 4 shows a voltmeter connected between the anode of a valve and earth. Suppose the *true* anode voltage were 100V, the anode load 100kΩ, and the meter the same one that we have used before. The meter resistance at 1,000Ω/volt will be 100kΩ for full scale deflection on 100 volts. If the current through the valve and anode load is 1mA without the meter connected, it will be 2mA with the meter connected. The voltage drop across the anode load without the meter was $0.001\times100{,}000=100$ volts. When the meter is connected, 2mA will flow through the load resistor and the voltage drop will be $0.002\times100{,}000=200$ volts. In practice, of course, the valve anode voltage would have been modified to such an extent that it would draw a different current when the meter was in circuit. In spite of this, however, the fact remains that a considerable error will result if a meter is connected in a high impedance circuit, such as that shown in Fig. 4.

If the meter has a sensitivity of 20,000Ω/volt, it will have a resistance of 2MΩ on the 100 volt range, and will only draw 50μA for full scale deflection. The current drawn through the anode load in Fig. 4 would not be modified to any great extent, and the reading error would be less. For this reason it is an advantage to use the highest sensitivity meter available.

AC and DC

The meters so far described will only measure DC. With the moving coil type of movement a rectifier is necessary to convert the applied AC into DC. The circuit normally used is a bridge connected rectifier, shown in Fig. 5. The multiplying resistors for various voltage ranges are inserted between the input terminals and the rectifier system. The value of these resistors is 1.11 times lower than those used for DC voltage measurements.

The reason for this is tied up with the conversion of AC mean voltages to RMS. The meter deflection is proportional to the *mean* value of the applied voltage, but the quantity normally required is *RMS*. As the RMS value is 1.11 times the mean value, the series resistor has a value $\frac{1}{1.11}$, i.e. 0.909, times the value calculated for reading the same DC voltages.

Current measurements on AC are made by connecting the points A and B in Fig. 5 in series with the circuit under test, just as for DC. However, the range of the instrument cannot be extended merely by shunting the meter. Such a practice introduces errors of a very large order.

Instead, a 'current transformer' is incorporated in the circuit. The primary is connected in series with the apparatus under

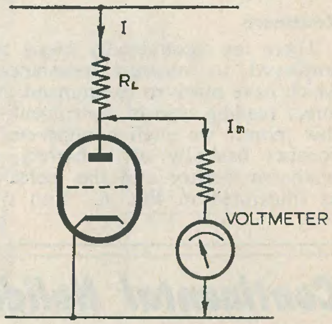


FIG.4
MEASURED ERROR PRODUCED BY METER CURRENT

RC546

test and the secondary is connected to the points A and B in Fig. 5. The current flowing in the primary of the transformer induces a voltage in the secondary.

The effect of this is to cause the meter to act as a voltmeter, and a deflection of the needle proportional to this voltage is produced. In practice, a resistor is inserted between point A and the rectifier to make the meter a true voltmeter, capable of reading a voltage of, perhaps, 10 volts. The transformer can be arranged to have a step-up ratio from primary to secondary to produce such a voltage. Primary windings with varying numbers of turns are used for separate ranges, the secondary winding and series resistors remaining unchanged for all AC current ranges.

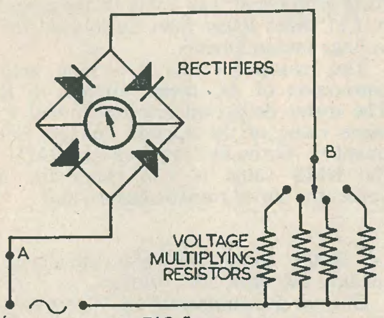


FIG.5
AC VOLTMETER

RC547

Resistance

There are undoubtedly many techniques employed to measure resistance, all of which have much to recommend them. The direct reading type of instrument, to which this month we shall confine our interest, consists basically of a battery, with the unknown resistor and the meter in series, as illustrated in Fig. 6. You will notice that the principle involved is a reversal of that used for measuring voltage. In this case we have a known voltage, V, and the current flowing through the meter is a measure of the resistance.

The disadvantage of this system is the non-linearity of the scale; that is to say, a given change in Ru does not produce the same change in pointer position at all parts of the scale. It is also to its disfavour that the zero ohms point is at the opposite end of the scale to the zero volts and current points.

The ballast resistor R is necessary because, for zero reading on the meter, the test terminals A and B are connected together. R may be calculated from the meter current and the battery voltage V, but remember that this point on the scale represents full scale deflection on the meter. For half scale reading, therefore, since the current will be halved, Ru will be equal to R_1.

The problem now arises that, as the battery runs down through use, the reading will no longer be zero when the test points are connected together, and inaccuracy of readings will result. The resistor Rz is added to overcome this danger. Rz is connected in shunt with the meter and is adjusted so that the current through the meter is modified.

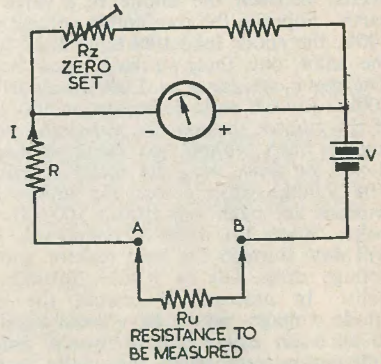


FIG. 6
AN OHMETER

RC548

In the event of the battery running down, the value of Rz is increased and zero reading of the meter is again ensured. The additional current through Rz must, however, be taken into account when calculating R.

Whilst this system for measuring resistance is the simplest, its standard of accuracy leaves much to be desired.

Continental Holiday

Arrangements are being made by G6MN and G2DUV for a fortnight's Continental Holiday commencing 24th July.

Amateurs, XYL's and YL's who would like to join the party, can obtain further particulars from Eric Martin G6MN, Castlemount, Worksop.

Those interested are asked to write as early as possible to enable the organisers to secure the most advantageous party-travel and hotel rates.

A CRYSTAL FEEDER UNIT

By **JAMES S. KENDALL,** ASSOC. BRIT. I.R.E., M.I.P.R.E.

IT HAS FOR MANY YEARS BEEN AGREED that the best form of detection and the one with the lowest noise level, is the crystal detector. For years the crystal was a troublesome thing that required adjusting just as the programme started and one just could not find the spot !! With the late war came the development of the germanium crystal, one of the latest of which is the Mullard OA50. This is, in the writer's opinion, one of the best detectors on the market. Not only is it very good but the price, considering it will last indefinitely, is very low.

Having decided on the detector, next came the consideration of coils, which had to be of high "Q". Several types were tried, but, as bandpass tuning had been decided upon, most were unsuitable. Eventually the Laboratory was sent samples of Dual-Range High-Gain coils, manufactured by Radio Experimental Products of Coventry. These have two windings, one (tapped in two places) for the tuned winding, and the other designed for a reaction winding. These coils were tested and found to be very selective. The output of the feeder unit was, with a good earth and under 20 feet of aerial, found to give enough power to drive an amplifier.

The first tuned circuit is tapped to allow the aerial to be fed into it via a 500pF condenser. The coupling between the two tuned circuits is done by link coupling, that is by joining the two reaction windings in such a way that the current induced in one coil induces a current in the second coil. The voltage across the second coil is again magnified by the "Q" of the coil. Here the average crystal set builder goes wrong, by connecting the 'phones from the top of the coil, thereby damping it and reducing the overall circuit "Q". In this circuit the output is taken from the tap and, although the audio output is slightly reduced, the selectivity is increased.

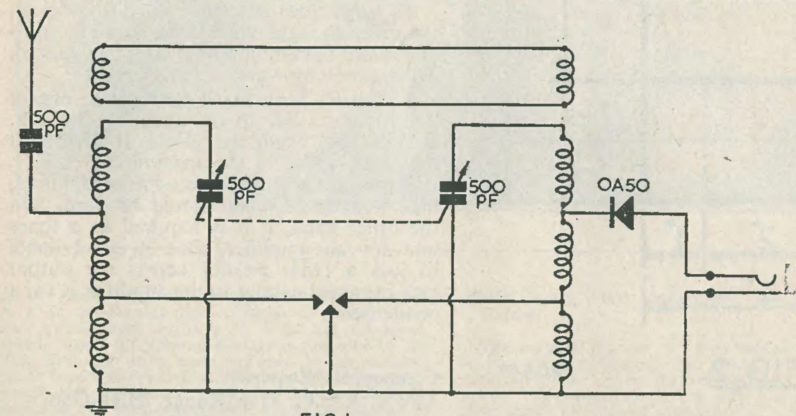


FIG.1

RC540

The chassis was constructed out of a piece of aluminium 8″ long by 4″ wide. It was then marked out, as shown in Fig. 2. The solid lines are "fold" lines, and when marking out these, it should be remembered that the lines should be on the inside of the folds, or the metal is apt to crack along the score mark. The writer finds the use of a woodwork marking gauge invaluable for such marking out, as it is so quick and easy to set. The terminals, jack and switch holes were each made 1″ in from both the sides and the ends, this giving a symmetrical layout. The drilling for the coils and the variable condenser depend on the latter component; the writer used the same fixing holes for both the tuning condenser and one side of the coils. The position of the hole for the other mounting screw for the coil was marked and drilled.

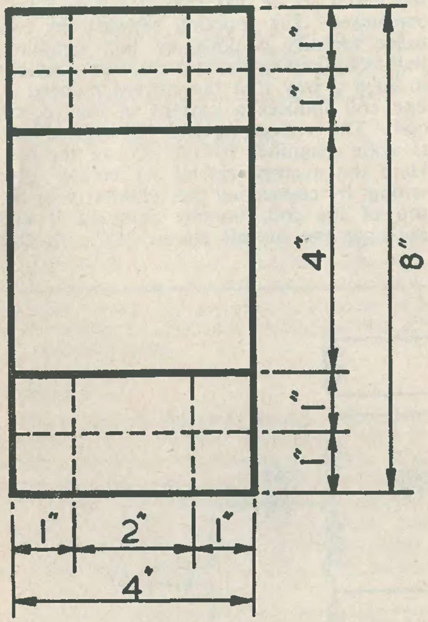


FIG.2 RC541

The actual sizes of the holes for the terminals (or sockets if used) will depend on the type and make chosen by the constructor; the same applies to the switch and the jack.

The coils should be mounted with at least 1″ between them or interaction with each other, with resulting loss of gain, or selectivity, will be apparent ! This also applies to the mounting of the coils, which should not be too close to the edges of the chassis.

The wiring of the unit is simple, the coil tags being of good quality and exceptionally easy to solder. The connecting wire should be thick and tinned; 18 swg was used in the prototype. Large Belling-Lee terminals were used in the original, but are a little expensive; a good socket on the other hand, is the OZ type made by the same firm. The earth terminal was anchored direct to the chassis. The Jack used was a Bulgin J6, which has the metal sleeve direct to the chassis. If a jack of the insulated type or earth terminal of the insulated type is used, it must be joined to the chassis by means of an earth tag.

The connections are:—Aerial terminal to Yellow of the first coil via the 500pF condenser; Blue tag to one of the tags of the wave switch; Black of the first coil to the Black of the second, then to the switch and finally to the chassis.

The two Blue wires are each taken to one section of the tuning condenser. The Red and Purple tags are joined to the corresponding tags on the other coil by a piece of twisted wire. Lastly, the OA50 diode is wired in, this having been left till last so that the risk of damage during wiring is lessened.

To align the unit, tune to a station on the medium wave band, then turn the trimmers until maximum audio gain is achieved. Tuning on long waves is fairly broad.

If a really good finish is required, one of the modern dial drives such as the J.B. Squareplane would be ideal. It gives just that extra finish to the appearance.

If the unit is to be used with headphones, high impedance types should be used. On the other hand, if it is required as a tuner unit for an amplifier, then it is advisable to join a 1MΩ resistor across the output jack in case the input to the amplifier is via a condenser.

Components Required

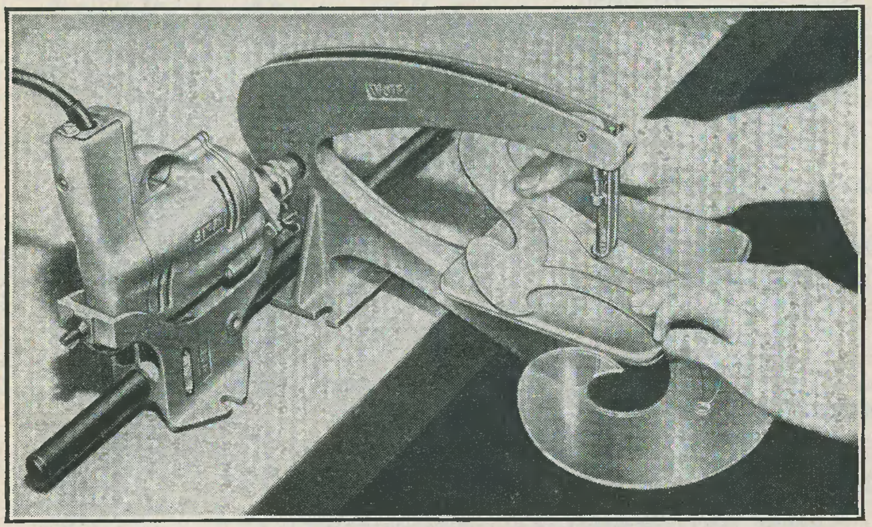
Two	R.E.P. Dual-Range High-Gain Coils
One	Two-gang 500pF Tuning Condenser, with trimmers, Kendall and Mousley
One	OA50 Crystal diode, Mullard Ltd.
One	Bulgin J6 Jack
One	Bulgin P38 Plug
One	Two-pole Toggle Switch
Two	Terminals, or Sockets
One	500pF Mica Condenser
One	Piece aluminium sheet, 4″×8″, about 16 swg.

TRADE NEWS

FRETSAW SET IS LATEST ADDITION TO WOLF CUB HOME CONSTRUCTOR EQUIPMENT

HANDYMEN, model makers and radio enthusiasts will be interested in the latest addition to the Wolf Cub range of home constructor equipment — a Fretsaw attachment for use with the Wolf Cub Drill.

The new Fretsaw is of sturdy construction, possesses an operating speed of 2,000 strokes per minute and a throat depth of 8″ enabling work to be cut to centre of 16″ circle. Cutting capacity in wood is ½″ thick or ⅛″ in non-ferrous metal. Blades of special design and special steel exclusive to Wolf are employed. Ample power for prolonged usage is provided by the Cub Drill, the drive being delivered by an eccentric arbor fitted into the Drill Chuck, through an ingenious rocker arm mechanism, thence to the saw blade by means of two pure nylon belts, which are claimed to last indefinitely.



Blade changing and tensioning is instantly and easily effected, and the work table of pressed steel measuring 6″ square is mounted on a machined platform. An adjustable guard and workholder is mounted on the top arm of the Fretsaw frame. This holds work down when cutting and protects the moving saw blade from breakage. Apart from occasional lubrication, no maintenance attention is necessary.

The Fretsaw No. 8 set is supplied complete with 12 high speed blades for wood, plastics, etc., and 12 for non-ferrous metals, and is low priced at £3 15*s* 0*d*. For those wishing to obtain the complete Fretwork equipment, a Fretwork Kit which includes Cub Drill, Bench Clamp and Pillar can be bought at a cost of £10 19*s* 6*d*. This latest addition to the Cub range now brings within reach of the handyman the means for drilling, sanding, polishing, wood turning, bench drilling, bench sawing, fretsawing, etc.

Starting with the Cub Drill, the necessary conversion sets for covering this extremely wide range of activities can be purchased in easy stages. The new Fretwork equipment is now available from all leading tool merchants, and all who are interested are invited to apply for full descriptive literature to Wolf Electric Tools Ltd., Hanger Lane, London, W.5.

JOHN BELL AND CROYDEN, 117 High Street, Oxford

The design of the new "F" type Belclere transformer is based on producing the smallest possible unit consistent with highest performance at a competitive price. The measurements are only ½″×5/16″×⅜″, and three forms are offered as follows:

FM-5V-41	Interstage coupling junction transistors Inductance 10 henrys at 0.4mA, 15 henrys at no DC Ratio 5 to 1.
FM-50V-42	Pentode to junction transistor coupling Inductance 50 henrys at max. 50μA. Ratio 50 to 1.
FM-10V-01	Crystal microphone input to junction transistor, Inductance 60 henrys at no DC Ratio 10 to 1.

For crystal microphone coupling, if a parallel-fed unit is employed, the transformer inductance is 25 henrys.

DATA *publications* LIMITED

57 MAIDA VALE LONDON W9
Telephone **CUNningham 6518**

ORDER FORM

Please supply the following

		Price	Postage	Qty.
DATA BOOK SERIES				
D.B.4.	Inexpensive Television	2/6	2d	
D.B.5.	T.V. Fault Finding	5/-	3d	
D.B.6.	The Radio Amateur Operator's Handbook.	2/6	2d	
D.B.7..	Receivers, Preselectors and Converters	2/6	2d	
D.B.8.	Tape and Wire Recording	2/6	2d	
D.B.9.	Radio Control for Model Ships, Boats and Aircraft	8/6	3d	
	Ditto (Clothbound)	11/6	3d	
RADIO REPRINTS				
R.R.I.	Car Radio	1/6	2d	
MISCELLANEOUS BOOKS				
	World Radio Handbook (*Johansen*)	8/6	3d	
	How to Listen to the World (*Johansen*)	1/9	2d	
	T.V. Picture Faults (*T.V. Times*)	3/6	3d	
	The Radio Amateur's Report Pad (*Data Publications*)	3/6	3d	
MAGAZINE				
	The Radio Constructor monthly	1/6	2d	
	„ „ „ 6 months sub.	9/-	paid	
	„ „ „ 12 months sub.	18/-	paid	

PLEASE TICK SUBSCRIPTION REQUIRED AND STATE FIRST ISSUE BELOW

Enclosed find Cheque/Postal Order/International Money Order £..................

NAME .... PLEASE USE BLOCK CAPITALS

ADDRESS..

....

ALL OUR PUBLICATIONS ARE AVAILABLE THROUGH YOUR LOCAL NEWSAGENT

TRADE TERMS AVAILABLE ON REQUEST

PLEASE CUT HERE

LEE

EASY TERMS SPECIALISTS

ELECTRICAL EQUIPMENT SUPPLIES (Dept. C) *Telephone* **PADdington 8198**
2 and 3 SALE PLACE LONDON W2
TERMS: Cash with Order (or C.O.D. on post items only) Packing and Postage (unless otherwise stated) up to £1—1/-: up to £10—2/-

TRUVOX TAPE DECK MARK III
Features include push button conirol three motors for fast, forward and rewind facilities and high impedance mu-metal twin track heads.
£23/2/- *carriage free*
Easy Terms £4/12/- dep. and 8 monthly of £2/12/6.

COMPLETE RECORDER INCORPORATING THE TRUVOX DECK—£44/13/-
Supplied as 3 separate units as follows: Amplifier **£16/16/-**, Truvox deck **£23/2/-**, Carrying Case **£4/15/-**. Speaker given free if three above units purchased together. **Easy Terms** on application for any one item or combination of items except carrying case purchased alone.

RECORDING TAPES

	300ft.	600ft.	1,200ft
Scotch Boy	12/3	21/-	35/-
Emitape	—	21/-	35/-

MICROPHONES
THE NEW ACOS 35-1
A crystal type hand microphone suitable for P.A. work, recording equipment and all general purposes. Response almost flat from 50 to 5,000 c.p.s. **25/-**.

Acos Mic 22 40-6,000 c.p.s.	£4/4/-
Acos Mic 16 30-10,000 c.p.s.	£12/12/-
Lustraphone C51 M/Coil	£5/5/-
LX/55 Crystal	£2/10/-
Reslo VMC M/Coil	£6/-/-
*RV Ribbon	£9/-/-

***Easy Terms** £2 dep. and 8 monthly of £1.

PICK-UPS

Collaro Studio 0 or P	£3/14/8
Acos GP30 Dual Stylus	£3/6/1
GP20 Hi-g	£3/8/8
Connoisseur Super Lightweight	£5/19/3

DARIO VALVES
LOWER PRICES — 12 MONTHS GUARANTEE. Ask for list

ENGLISH ELECTRIC C.R.T.'s
T901 16in. for Teleking, Viewmaster, Magnaview and Supervisor. T901A 16in. direct replacement for all 16in. AC/DC receivers.
Both types **£22/4/10** (No easy terms available).

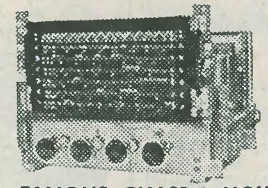
CONSTRUCTORS ENVELOPES

Viewmaster	7/6
Viewmaster Conversion... ...	3/6
Soundmaster	6/6
Teleking	6/6

All components for above available from stock. *Post Free*

TEST METERS

Pifco AC/DC Radiometer	29/6
Taylor Montrose 7-range Multimeter	50/-
Amplion All-purpose	£5/19/6



A FAMOUS CHASSIS NOW ON EASY TERMS!
DULCI
RADIO/RADIOGRAM CHASSIS
All chassis 11½in. x 7in. x 8½in. high Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 tone positions for radio and gram.
For A.C. Mains, 100-120 and 200-250 volts. Fully guaranteed. Double feature chassis have separate Power Packs

Model	*Price*
B3—*Long, Medium, Short* 5 valves. Output 3½ watt	£12/12/-
B3—*Plus Push Pull Stage* 6 valves. Output 6 watt	£15/15/-
B3–*Double Feature* with P/Pull & R.F. Stage. 7 valves. Output 6 watt	£18/18/-
B6–*Six Wavebands*. Med., Long, 4 Short (3 Bandspread). 5 valves. Output 3½ watt	£15/15/-
B6–*Plus Push Pull Stage* 6 valves. Output 6 watt	£18/18/-
B6–*Double Feature* with P/Pull & R.F. Stage 7 valves Output 6 watt	£23/2/-

All prices include Purchase Tax. Carr/pack. 7/6 extra.

Easy Terms

Cash Price	*Deposit*	*8 monthly of*
£12/12/-	£2/12/-	£1/ 8/6
£15/15/-	£3/ 6/-	£1/15/6
£18/18/-	£3/16/-	£2/ 3/-
£23/ 2/-	£4/12/-	£2/12/6

SPECIAL BARGAIN OFFER!
TRUVOX 12in. P.M. Speakers. 2-3 ohm Speech Coil. Limited quantity only 42/6

STEP-DOWN TRANSFORMERS
Ideal for model work, etc.
Input 210/250v, Rating 2 amps. Output 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 v. **22/6**, p.p. 1/-.

AUTO TRANSFORMERS
Tapped at 10v., 120v., 200v., 230v., 250v. 100 watt. 22/-, p.p. 1/-

C.R.T. ISOLATION TRANSFORMERS
For tubes with Heater/Cathode short-circuit.

HCS2 for 2v. heater ...	10/6
HCS6 for 6.3v. heater ...	10/6

SOLON SOLDERING IRONS

Latest lightweight ...	19/8
Standard Model ...	19/-

ELPICO 4-watt AMPLIFIER
Type AC/34. A small but very efficient 3-stage low frequency amplifier with 4 watt 2-3 ohm output. Uses valves 6SL7, 6V6, 573. Suitable for input from Radio, Gram Pick-up or Microphone. Volume and Tone Controls. Dimensions: Chassis only 7x5x2in. Overall height 5½in. Guaranteed for 12 months.
AC model ... £7/10/-
AC/DC model ... £6/13/-

S.T.C. METAL RECTIFIERS

R.M.1	125v	60m/A ...	4/6
R.M.2	125v...	100m/A ...	5/-
R.M.3	125v	125m/A ...	6/-
R.M.4	250v	250m/A ...	18/-

E.H.T. PENCIL RECTIFIERS

K3/ 50	4 KV ...	8/8
K3/100	8.5 KV ...	14/8

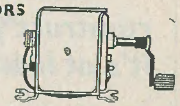
Ex-GOVT. BARGAINS
THROAT MIKES
ZA19734. Brand new boxed with lead and plug. 4/6. p.p. 9d.

MAINS NOISE SUPPRESSORS
Cut out mains interference on radio or TV. Complete in metal case at less than usual kit price. **4/11** p.p. 1/-

CONDENSERS 8 mfd.
750v. wkg., tapped at 5+3 mfd., with connecting link. Size 6x3¼x2in. Brand new. **5/6** p.p. 1/6.

L.T. F.W. RECTIFIERS
36v. ½amp. Unused. **4/6** p.p. 6d.

TELEPHONE HAND GENERATORS
Plessey Type C. YA2878. Unused.
12/6, p.p. 1/-



SCREENED MULTIWAY CABLE
Plastic covered. Colour coded. Carrying cap. 1 amp. per conductor. 10 way. **1/6** per yd. 15 way **2/-** per yd. 20 way **2/9** per yd. All post free. Minimum 5 yds.

AERIAL BASES
For use with fishing rod aerials. **2/6** p.p. 9d.

ARP 12 (VP23) VALVES
Brand new, limited quantity. Two for **5/-** p.p. 9d.

MORSE KEYS
A good quality key enclosed in bakelite casing. **3/6** p.p. 9d.

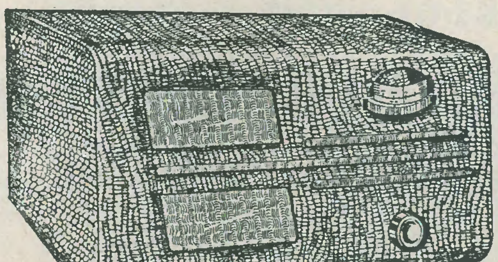
Easy Terms can be arranged on almost any item or combination of items provided that the list price of each item is NOT LESS THAN £9. We shall be glad to quote terms against your requirements.

"YOU CAN RELY ON US"

COILS
Wearite "P" Coils. All types in stock including AF.1. RF.1. Price 3/-.
Midget I.F. Transformers Type 800 21/- *per pair.* Standard Type 500/501 (465Kc/s) 20/- *pair*

HIGH IMPEDANCE HEADPHONES
NewEx-Government Price 12/6 *per pair.*

SCOTCHBOY TAPE
1200*ft* Reels 35/-
Spare Reels 4/3



COILS
Osmor Midget iron-cored "Q" Coils 4/- *each.* Leaflet on request.
Coilpacks Type H.O. 52/-. LM 43/4, MTS 54/2, TRF 43/4, all including Tax.

TRIMMERS
All new Postage Stamp Ceramic. 4-70pf 8d. 40-100pf 10d., 20-150pf 1/- 100-550pf 1/3.

LINECORD
3-way .3a at 60 ohms, per foot 6d *ft.*, .2a at 100 ohms per ft 8d ft.

The "MAXIMITE" AC/DC SUPERMIDGET SUPERHET — *Full Plans 1/-*

CATALOGUE No. 12 ***now available***

70 pages 250 Illustrations **Price 1/-**

NOTE OUR NEW ADDRESS

RADIO SERVICING COMPANY

DEPT. K 82 SOUTH EALING ROAD LONDON W.5

Telephone EALing 3757

PRACTICAL HOME COURSES IN TELEVISION & RADIO CONSTRUCTION

Here is the most interesting and economical way of learning T.V. or Radio while building your own set. Specially simplified lessons, tuition and equipment. After building your set you will know how to maintain it.

TELEVISION
Course with equipment
Suitable for 12″ or 15″ tube. Convertible to projected T.V. Stations (for small extra cost).
35 gns
or easy terms. Tube extra.

RADIO
Course with equipment from
7 gns
upwards

POST TO

LONDON RADIO COLLEGE
Dept. 179
43 Grove Park Rd.
London, W.4.

Please send details of the T.V. ☐ RADIO ☐ Courses:
NAME ....
ADDRESS ....
....

ELECTRONIC XTAL FILTER

We can supply the required inductance and RF Choke for this unit by return of post.

Type FX1 Inductance 3/6 *Post*
Type FX1 RF Choke 3/6 *Free*

As specified by the author *Frank A. Baldwin* A.M.I.P.R.E.
—see page 534 of this issue.

THE TELETRON CO.
266 NIGHTINGALE ROAD LONDON N 9

VALVES—OVER 3000 in Stock

2D21, EC91, 12AU7, 6BR7, 6CH6, 6BW6, 6SN7, 9/-. EL91, 6F33, 12AT7, EY91, 7/-. 6AK5, 7/6. EF91, 6J6, 12AX7, 6/6. 6AL5, 6C4, EAC91, EF92, 5/6.

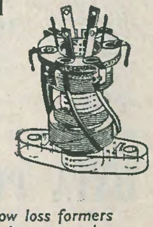
SKILLMAN
FRANCHISE STREET WEYMOUTH

REP HIGH GAIN COILS

Dual Range Miniature Crytal Set Coil with Circuit **2/6**

Dual Range Coil with Reaction with 2 Mains and 2 Battery Circuits **4/-**

Matched Pair Dual Range T.R.F. Coils with Reaction; with Battery and Mains Circuits **8/-** pair.



★ *All coils wound on low loss formers*
★ *Individually tested and guaranteed*
★ *Post 3d on all orders* · ★ *Trade supplied*

Radio Experimental Products, Ltd.
33 Much Park Street Coventry

MANUFACTURERS' SURPLUS T.V. COMPONENTS

Scanning coils. Low impedance line and frame 7/6

Scanning coils, Low imp. line and frame Aluminium shroud 12/6

Scanning coils. Wide angle. Low imp. line and frame, 19/6

Multi ratio frame output transformer 10/6

Focus coil. 35*mm* electro magnetic 12/6

P.M. Focus Magnets. All with vernier adjustor.
35*mm* Tetrode 15/-
35*mm* Triode 17/6
All types p.m. magnets. 35*mm* Less vernier 12/6
Goodmans, with ferroxdure core. For all wide angle tubes 25/-
Frame blocking oscillator transformer 10/6
Wide Angle Frame B/O transformer 10/6
Frame and Line B/O transformers (Auto) 4/6
Plessey width coils 6/6

SPECIAL—BRAND NEW TCC TV. CONDENSERS
32+100 mfd. 450 v.w. Type CE15PE . . . Price 7/6
0.04 mfd. 12.5Kv. Type CP59VO Visconol . Price 7/6

Resin Cored Solder 7/6 per lb.

TRIPLEX DARK SCREEN FILTERS
14 x $12\frac{1}{2}$ x $\frac{3}{16}$ins. 7/6
$15\frac{1}{2}$ x $13\frac{1}{4}$ x $\frac{3}{16}$ins. 9/6
Postage and packing 5/- per piece extra. *(This charge is necessary owing to extra packing required)*

GERMANIUM CRYSTAL DIODES
1/6 *each*

WIDE ANGLE CATHODE RAY TUBES

14″ MW36-22	£19	9	3
14″ C14B	£20	10	1
16″ MW41-1	£22	4	10
16″ T901	£22	4	10
17″ MW43-64	£23	12	8
17″ C17BM	£24	13	0

Carriage and insurance extra

ALLEN WIDE ANGLE COMPONENTS
D.C. 300 latest type Ferroxcube Coil 39/6
GL. 16 Coil 7/6
GL. 18 Coil 7/6
Focus Coil 31/-
FO.305 trans 21/-
Frame B.O. transformer 15/-
Line EHT. transformer 40/-

VCR97 C.R. TUBES
New unused. 35/-
Carriage 5/-

SCREEN ENLARGER
For VCR97. Filter type, 17/6. *Postage* 2/6.

EHT. CONDENSERS
.1 + .1mfd. 3.5Kv. 5/11

SOLON SOLDERING IRONS
220-250 volts.
Latest model instrument iron . . 19/8
Standard model. . 19/-

LARGE SCREEN T.V.
Every component in stock for the Magnaview, Tele-King, Viewmaster and Universal television receivers including all cathode ray tubes and valves.

Width and linearity controls. 3/6 each

Colver CLR.901 type pot/meters. Wire wound, most values. 2/6 each

Ion Traps. All types. Price 3/- each. State type number of c.r. tube when ordering.

SPECIAL OFFER
Magnetic recording tape, on Cyldon metal spools. By famous British Manufacturer
600 feet. 6/11, Post 1/6
1200 feet. 14/11. Post 1/6
LIMITED QUANTITY. Buy Now and Save Cash

CRT Rr. neck protectors 2/6

R.1132A RECEIVERS
With all valves.
Brand New . . . 79/6
Store Soiled. . . 49/6
Second Hand . . 39/6
Carriage 10/- *extra*

A.C. MAINS GRAM MOTORS — Synchronous
Shaded Pole. For use on 200-250 volts, 50 c.p.s. Rim and belt drive type. 9/6 *each.*
MANY USES.

THE "UNIVERSAL" LARGE SCREEN AC/DC TELEVISOR
by A. S. Torrance, A.M.I.P.R.E., A.M.T.S.
A 28 page booklet giving full instructions for building a Large 17 inch screen televisor *AC & DC Mains. *PM focusing *Mullard Valves and CR Tube *Five-channel Superhet *Table Model *Convertible into Radio-gram console *Incorporates all latest developments.
Reprinted from the *Radio Constructor* 3d post free.

TELEVISION CONSTRUCTORS PARCELS
No. 1. All brand new components by Igranic. Comprises E.H.T. flyback line transformer, 7-10Kv. with ferroxcube core and rectifier heater winding; scanning coils; frame output transformer; Elac focus unit with vernier adjuster, U37 E.H.T. rectifier and brand new 12*in* cathode ray tube with ion trap, mask and glass.
LASKY'S PRICE FOR THE COMPLETE PARCEL £15/19/6. *Carriage and insurance* 15/- *extra*

CYLDON 5-CHANNEL TV TUNER
Uses 2-valves: EF80 (6BW7) as R.F. amp., and ECC81 (12AT7) as freq. changer. Obtains instant and positive selection of any channel by switching incremental inductances. Power gain 24dB., I.F. frequency output 9·5—14 Mc/s., or 15·5 — 22 Mc/s. With full details. Supplied less valves.
LASKY'S PRICE 12/6d.
Postage 2/6d.

MIDGET 3-WATT AC/DC AMPLIFIERS
Uses 4 valves: 2 UL41 in push pull, 1 UCH42 and 1 UAF42. Input voltage 100/110 AC/DC, easily converted to 230 volts. Supplied with full circuit diagram and all valves. Size: 9x4x4 inches. Uses 2 metal rectifiers 1 each RM1 and RM2. Ideal for record players, tape recorders, baby alarms, etc. and for use on ships. Complete with all valves, fully assembled and wired.
LASKY'S PRICE 69/6d.
Carriage 3/6d. *extra*

Westinghouse WX6 Rectifiers. Wire ends. Price 1/6 each.

THE NEW ACOS MICROPHONE
A general purpose hand microphone, crystal type. Of robust construction with almost flat response from 50 to 5,000 c.p.s. Suitable for recording equipment, p.a. work etc.
PRICE 25/-

CATHODE RAY TUBES MASKS
New aspect ratio.
10*in* Double D . . 7/6
12*in* 14/-
12*in* Flat face. . . 15/-
12*in* Old ratio . . 9/6
14*in* Rect. . . . 21/-
16*in* Double D . . 25/-
17*in* Rect. . . . 21/-
12*in* Soiled . . . 7/6
12*in* Soiled, Cream, with safety glass . 11/6
12*in* Soiled, Black, with safety glass . 8/6

15 INCH CATHODE RAY TUBE MASKS
Cream rubber.
Latest aspect ratio. Overall dimensions: 17*in* wide, 13*in* high. Price 17/6.
Postage 2/- *extra.*

ARMOUR PLATE GLASS
9 x8 x½-inch. 3/-
13 x10½x¼-inch. 4/-
16½x13 x½-inch. 6/11
17½x15½x¼-inch. 7/11

COLLARO 3-SPEED AUTOMATIC RECORD CHANGERS.
MODEL RC3/521. Brand new and unused, in maker's original cartons. Finished in cream enamel and fitted with GP.29 hi-fidelity studio crystal turnover head.
LASKY'S PRICE £9/19/6.
Carriage FREE.

LASKY'S RADIO

Lasky's (Harrow Road) Ltd. 370 HARROW RD. PADDINGTON LONDON W9

(Opposite Paddington Hospital) *Telephones* CUNningham 1979 and 7214. All Departments.
Hours Mon. to Sat. 9.30 a.m. to 6 p m., Thurs. half day 1 p.m.

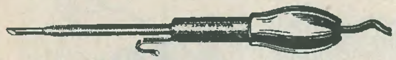
MAIL ORDER & DESPATCH DEPARTMENTS 485/487 Harrow Road Paddington London W10

Terms Pro Forma, Cash with Order or C.O.D. on post items only. Postage and packing on orders value £1—1/- ex., £5–2/- ex., £10–3/6 ex. Over £10 carriage free unless otherwise stated. All goods fully insured in transit

ADCOLA

(Regd. Trade Mark)

SOLDERING INSTRUMENTS



Reg. Design No. 860302 (British, U.S. and Foreign Patents)

Designed for wireless assembly and Maintenance

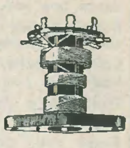
Supplied for all volt ranges from 6/7v to 230/250v 3/16″ Dia. Bit Standard Model **25/6**

Sole Manufacturers **ADCOLA PRODUCTS LTD.**

Sales Office and Works **Cranmer Court, Clapham High St. London SW4** (MAC 4272)

TELETRON SUPER INDUCTOR COILS

MINIATURE DUST CORE TYPES



Type. HAX. High frequency crystal transformer coil, triple wound for Germanium crystal diodes.
*Q 100. *Gain 33 Times. *No Overlap Performance unequalled. *each* **3/-**

DUAL WAVE T.R.F. COILS

Type. TRF. A/HF. AE. & HF. Transformer Rising characteristic to balance fall in circuit "Q." Matched pairs; Pre-Aligned. *pair* **7/-**

Super-Het Range for S.M&LW. AE&Osc., **6/-** *pair*
I.F. Transformers, Filters, Etc. *p.p. 3d.*

Stamp for Circuits & Data

THE TELETRON CO.
266 NIGHTINGALE ROAD LONDON N.9

62A INDICATOR UNIT, complete with 12-EF50's, 4-SP61's 3-EA50's, 2-EB34 and VCR517C or VCR97. C.R.T. Double-deck chassis absolute new condition. **99/6** *Carriage paid. Less tube* **69/6.**

PYE 45 Mc/s STRIP. Type 3583 Units. Size 15″x8″x2″. Complete with 45 mc/s Pye Strip, 12 valves 10 EF50, EB34 and EA50. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price **£5** *carriage paid.*

CRYSTAL MICROPHONE INSERTS

Ideal for tape recording and amplifiers. No matching transformer required. 8/6 POST FREE.

INDICATOR UNIT TYPE 182A. This unit contains VCR517C Cathode Ray 6″ Tube, complete with Mu-Metal Screen, 3 EF50, 4 SP61 and 1 5U4G valves. Offered BRAND NEW (less relay) in original packing case at **67/6.** *Plus* **7/6** *carriage.*

CATHODE RAY TUBES

VCR97 **40/–** *car.* **2/–**
VCR517C **35/–** *car.free*
VCR138 **30/–** *car.* **2/–**
VCR139A **35/–** *car.free*
GUARANTEED for TV

RECEIVER R1355. As specified for "Inexpensive Television." Complete with 8 valves VR65 and 1 each 5U4G, VU120, VR92, Brand New in original packing case, **55/–,** *plus* **5/–** *carriage.*

HENRY'S

(RADIO LTD.)

We have over 20,000 American and B.V.A. valves in stock.

ALL VALVES NEW AND GUARANTEED

OZ4A	7/–	6R7	8/6	954	6/–	GU50	12/6
IG6	6/6	6X5G	8/6	955	6/–	XP(2v)	4/–
IR5	8/–	6SA7GT	8/6	956	6/–	XH(1.5)	4/–
IS4	8/–	6SQ7GT	8/6	1299A	7/6	VU111	4/–
IS5	8/–	6SG7	7/6	TZ40	37/6	VU133	4/–
IT4	8/–	6SH7M	7/6	931A	50/–	VU120A	4/–
ILN5	8/–	6SK7GT	7/6	EA50	2/–	CV54	5/–
2X2	5/–	6SL7GT	9/–	EF54		S130	7/6
3V4	8/–	6SN7GT	9/–	(VR136)	6/–	7475(VS70)	
3S4	8/–	6SC7	10/–	EB34	3/6		7/6
5Z3	8/6	6SS7	7/6	EBC33	8/6	CV66	6/–
5U4	8/6	6V6GT	7/6	EF36	6/6	VR150/30	8/6
5Z4	8/6	7C5	8/6	EF39	6/6	CK510AX	5/–
6A7G	8/6	7S7	10/–	EK32	6/6	D1	2/–
6AC7	6/6	12A6	7/6	EF91	9/–	AC6PEN	6/6
6AG5	7/6	12C8	7/6	EL32	7/6	AC5/	
6A8G	8/6	12H6	8/6	EL33	10/–	PENDD	12/6
6AM6	9/–	12K7GT	8/6	EF50	8/6	PEN25	6/6
6B8	7/6	12K8GT	8/6	EF50 (Red.		PEN46	7/6
6C4	8/6	12Q7GT	8/6	Syl.)	10/–	QP25	6/6
6C5GT	5/–	12SA7GT	8/6	EF50		QP230	8/–
6C6	6/6	12SQ7GT	8/6	Ex-Units	5/–	SP61	4/–
6D6	6/6	12SG7	7/6	SP2	8/6	SP41	4/–
6F6G	8/6	12SH7	7/6	VP2	8/6	HL23/DD	6/6
6G6G	6/6	12SJ7	8/6	TDD2A	8/6	TP25	8/–
6H6GT	5/–	12SK7	8/6	DK40	9/–	VP23	6/6
6H6M	8/6	12SR7	7/6	UL41	9/–	VP41	7/6
6J5GT	5/–	14A7	8/6	UY41	9/–	U22	8/6
6J5M	8/6	25Z6GT	8/6	4D1	4/–	ATP4	4/–
6J6	9/–	25Z5	8/6	8D2	4/–	TP22	8/6
6AK5	9/–	35Z4GT	8/6	9D2	4/–	TH233	10/–
6J7G	6/6	25A6	4/–	15D2	10/–	41MP	7/6
6J7M	8/6	35LG	8/6	R3	8/6	42SPT	6/–
6K7G	6/6	50L6GT	8/6	D41	5/–	215SG	4/–
6K7M	7/6	42	8/6	D42	5/–	MS/PENB	
6K8G	9/–	43	8/6	D63	5/–		7/6
6K8GT	9/–	75	8/6	KT2	5/–	VT501	7/6
6L6G	8/6	78	8/6	KTW61	7/6	AC/PEN(7)	
1622	11/–	80	8/6	U52	8/6		10/–
6U5	7/6	866A	15/–	U19	10/–	PENDD-	
6U5G	7/6	9001	6/–	P2	4/–	4020	12/6
6L7	7/6	9002	6/–	MU14	8/6	FC13C	10/–
6N7GT	7/6	9003	6/–	PX25	12/6	VP4(7)	8/6
6Q7GT	8/6	9004	6/–	KT33C	10/–	1D5	8/6
6SJ7GT	8/6	9006	6/–	KT66	12/6	4THA	10/–

Send postage for new '53 comprehensive 23-page catalogue

Open Monday to Sat. 9 a.m. to 6 p.m. Thursday 1 p.m.

5 HARROW ROAD, PADDINGTON LONDON W2

Telephone Paddington 1008/9, 0401

SETS OF VALVES

Ten EF50 (Ex-Set Brand New Units) *5/–each* 45/–
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G 37/6
1RS, 1S5, 1T4, 1S4 or (3S4 or 3V4)...30/–
TP25, HL23/DD, VP23 PEN25 (or QP25) 25/–
6K8G, 6K7G, 6Q7G, 25A6G, 25Z5 or 25Z6G...37/6
12K8GT, 12K7GT, 12Q7GT, 35Z4GT, 35L6GT or 50L6GT 37/6
12SA7GT, 12SK7GT, 12SQ7GT, 35Z4GT, 35L6GT, or 50L6GT ...37/6
PX25, KT66, *Each* GU50 ... ...12/6
PX25's Matched *Pair* Pairs 25/–
TEN 6AM6 (EF91)80/–

RECORDING TAPE

G.E.C.

600 feet ... 10/–
1200 feet ... 17/6

R.F. UNITS

RF24 20-30 mc/s 15/– *Post free*
RF25 40-50 mc/s 19/6 *Post free*
RF26 50-65 mc/s 45/– *Post free*
RF27 65-85 mc/s 45/– *Post free*
ALL BRAND NEW WITH VALVES

"426" CONTROL UNIT. Containing 4-REDEF50, 2-SP61, 2-EA50, 1-EB34, 2-Single-gang .0005 Condensers, W/W, Vol/controls and Switches, etc. Size: 12″x9″x5″, 35/– *Carriage* 3/–.

SMALL ADVERTISEMENTS

Readers' small advertisements will be accepted at 3d per word, minimum charge 2/–. Trade advertisements will be accepted at 8d per word, minimum charge 6/–. If a Box Number is required, an additional charge of 1/– will be made. Terms: Cash with order. All copy must be in hand by the 5th of the month for insertion in the following month's issue.

PRIVATE

EXPERIMENTER offers the following bargains. For the VHF man, several new EC91's at 7/6 each, 2-ME/1001's (Disc Seal Triodes) £1/10/0 each, VHF GDO (E.M.I. type) £4/10/0. For the T/V constructor, Single valve pre-amp (London) complete with Z66 valve £1/10/0. Various line output valves, rectifiers, etc., all perfect. State your requirements, price will be quoted. For the Radio Constructor several new IR5, IT4, IS5, 3V4, etc. at 7/6 each. 6.3 volt Frequency changers X65 types, and various others all at 6/– each. Rectifiers U14, U50, etc. 6/- each. Lab type Everett Edgecumbe 50 M/A meter in Oak case (6″ Scale) £2/0/0/. Letter in first instance to Box No. D111.

WAVEMETER Class "C" 25/-. AN/APA Indicator Unit with 3BP1 tube, 11 valves brand new, 90/-. 2½″ Meters, 200mA, 5/- each. Carriage extra. SAE for List. Valves, Meters, Components, going cheap. G3JMU, 121 London Road North, Lowestoft.

TELEVISION RECEIVER, *Wireless World,* with or without Power Pack, Mullard 12 inch tube, Sutton Coldfield transmission. First class working order. Also Garrard 78 RPM Autochanger. Perfect condition. Box No. C115.

RECEIVER BC455, new ex-WD little used, converted Medium Wave, with mains Power Pack, headphones, circuits. Bargain £2/15/0, or near offer. Box No. D110.

VIEWMASTER Television set 9 inch GEC tube, solid oak console cabinet, £20. Hill 14 Woodway Crescent, Harrow, Middx. Tel: WOR 3080.

OSCILLOSCOPE excellent condition with circuit and instructions, £10 or offers. Wilkes, 58 Nelson Road, Whitton, Middx.

TAPE RECORDER New, little used Ferrograph Tape Recorder, £65, or near offer. Box No. D109.

BARGAINS Radio, Electrical spares. TR1196, TR9D, T1154, TR1366. Midget lamps ⅜″ × $\frac{3}{16}$″ at 3 volts, 2/- each. State wants. SAE.. Offers —exchanges. W. Brown, 87A Bevis Road, Portsmouth, Hants.

FOR SALE Eddystone S640 Receiver with S Meter, as new, £22/10/0. 12 Watt Push Pull 6L6 quality amplifier, £11. D. Carter, 14 Fletton Grove, Kings Heath, Birmingham 14.

FOR SALE Denco Line O/P transformer (WA/LOT1), Width Coil (WC), Linearity Coil (LC), Allen Scan Coils (DC300), Premier 6″ TV, Chan 4, cabinet and magnifier (Good condition). Gibson, 18 Woodside Avenue, Alsager, Stoke-on-Trent, Staffs.

RECEIVER Eddystone 740, very little used, £28, or near offer. Robson, 48 Queensway, Newcastle-on-Tyne 4.

RECEIVER R206 communications, 2 RF, 2 IF stages, 6 band coil turret 550 kc/s to 30 Mc/s, BFO, variable selectivity, etc., needs external power pack. Write in first instance, Leigh, 118 Dunlace Road, Clapton, London, E.5.

FOR SALE Eddystone S640 with phones, perfect condition, £18 or nearest. Roberts, 56 Haydn Road, Chaddesden, Derby.

AS NEW 10 inch Speaker, 2 Woden transformers, 2 Woden chokes, 7 assorted valves, condensers, resistors, pots, coils. Full details on request. £7, or near offer. Manchee, 2 Ravensbourne Gardens, W.13.

[*cont. on page 554*

G2ACC OFFERS YOU . . .

- **Aerial Wire.** 14 SWG hard drawn copper enamelled, cut to any length, **4d.** per yard.
- **Feeder Cable.** Belling Lee: L336 twin 80 ohm, **6d.** yd.; L600 coaxial 70 ohm **1/3** yd.; L1221 twin screened 70 ohm, **1/6** yd. Telcon: K25B twin ribbon 300 ohm **9d.** yd.; K35B twin circular low-loss 300 ohm, **1/6** yd. Samples free on request.
- **Coax Connectors.** Belling Lee L734 plug, **1/3**; L604 socket, **1/2.** L616 Line Coupler **1/6.**
- **"Disc" Ceramic Capacitors.** 500v d.c. (300v a.c.) wkg. Non-inductive for T.V.I. suppression, etc. 470 pF, .001 mfd, .002 mfd, .003 mfd, .005 mfd. **9d.** each; .01 mfd, **1/3.**
- **Constructional Manuals.** Envelopes with manual and large scale plans: Viewmaster **7/6**; Tele-King **6/–**; Sound Master **6/6**; Viewmaster Big Picture Conversion **3/6.** All components and individual lists available.

STOCKING BARGAIN LIST. No. 11 free of charge
CATALOGUE No. 8. 60 page illustrated catalogue free on application

Minimum postage & packing on orders under £2 is 6d.

SOUTHERN RADIO AND ELECTRICAL SUPPLIES

SORAD WORKS, REDLYNCH, SALISBURY

Telephone Downton 207

COMPONENTS

for the

"ORPHEUS"

TAPE RECORDER

Two speed Tape Desk assembled on correctly drilled top plate as shown. PRICE £20

Cabinet in rexine covered wood, as shown £3 17 6

Pre-wired colour coded master selector switch. — 18/6d.

Oscillator coil with selected condenser 7/6.

All carriage paid. *Cash with order*

TRUSOUND LTD.

196 KINGSLEY ROAD, HOUNSLOW MIDDLESEX

SMALL ADVERTISEMENTS

continued from page 553]

BARGAINS Modified R1155, IF, RF, stages, B7G valves. Variable selectivity, S Meter, Noise Limiter, internal Power Pack and Output stage, £8. Oscilloscope, £8. 28 Mc/s Converter 6AK5–6J6 45/-. 6SJ7M, VR150, 6SN7, 6SL7, 6SG7M, 6SK7M, ECH35, 6K8M, 5Z4M, KT66, 6L6M, EF91, 25L6, 5/- each. *Radio Amateur* 1952, 8/-. *Radio Constructor*, 20 copies, 8/-. Any offers? SAE all details to M. S. Gotch, Bridgett's, Widdington, Essex.

FOR SALE Williamson amplifier £12/10/0, Table model record player (78), built-in amplifier, speaker, £9/10/0. K. Gough, 12 Dalmeny Road, Carshalton, Surrey.

EXCHANGE R1155A, 6V6 output, less power pack. R103A Battery/Mains. Both first class, for Eddystone S640 or similar Eddystone Receiver. Nunn, 7 Hartslock View, Lower Basildon, Nr. Reading, Berks.

WANTED Aerial circuit diagram and/or Manual for BC348R receiver. Ilsley, Waterworks, Andover, Hants.

GENUINE CLEARANCE All new and perfect, e.g., Tape Recorder Amplifier complete in case, offers over £7; IOW. Quality Amplifier offers over £4; 4 valve superhet complete; veneered cabinets 10/- perfect. Many other items real bargain prices e.g., standard dust cored IF's new and perfect only 3/6 pair, 1/- post, or 4 pairs 14/- including postage. List, enquiries welcomed, SAE please. Box No. D105.

[*continued on page 555*

SMALL ADVERTISEMENTS

continued from page 554]

AMATEUR CLEARING SURPLUS. Trans. 375-0-375 250 m/a 6.3 at 7 amp. 4v 2 at 3 amp. 5v at 3 amp, £1/0/0. Parmeko, do, 700v at 20 m/a 4v winding—suit scope. 15/- new. T.V. sound unit Ex (Premier) £2/0/0/ A.P. with valves, £2/0/0. Pye—45 meg strip—uses V.R.65s included, make vision strip. £1/0/0. 8" Cossor E/static tube, little used (White) £3/0/0. C.R.M. 121a. With L/C trans. no burns. £2/10/0. Single valve type line transformer, 7Kv E.H.T. and circuit. 15/-. 0-600 voltmeter new 12/6. 0-500 m/a meter 5/- as new. R.F.27, new with valves 25/-, 2-203a units make T.V. Pre-amps, 45 meg. with 2 E.F.50, each 8/6. Res/Cap bridge, with phones, 25/-. 60 mixed pots £1/0/0, half lot 10/- some switched. Valves, (2) KT66 8/6 each. (2) 43IU. (2) E.F.37. (1) ECC31. (1) ECC32. (2) KTZ63. (3) 6SN7. (1) U50. (1) 6K7. (1) 6J8. (1) 6SH7G Pen 46. (2) 6V6. (1) 6J5. (1) 5Z4. (3) DAF91. (2) DL92 all at 5/6 each. (1) EF55 7/6. (8) EF50 red 4/- each 10 English 3/- each. 19 SP61 (VR65) 2/- each. (1) VR54 1/6. (1) 6H6 2/-. (1) CV63. (1) VR137. (6) VR92. (2) 7193 at 1/- each. (1) VT75 (KT66) 5/-. (1) VT 52 (EL32) 5/-. Spares box to clear at 1/- per *lb!* state wants. Approx. 20*lb.* Whitehall 5294. King, 4 Bridge House, Beeches Avenue, Carshalton, Surrey.

TO CLEAR: 560-0-560v., 500mA, 5v 2A, 6.3v 3A trans. 230v input, £1. Heavy duty smoothing choke to match 15/-. 4mfd 1,000vdc wkg capacitors, metal cased paper, 3/6. Ditto, 2mfd 2,000vdc wkg, 1/6. Valves: VR56, L63, DL2, DF33, DK1, at 2/6. EF50 and CV173 at 7/6. 6SN7 and 5U4G at 5/6. 6F6G at 4/-. T20, 801, 832, 829, CV52, 12E1, at 10/-. GPO type relays, various, 2/6. Cyldon 0.0002 variables 7/6. 0.0005 receiving type, 2/6. Wide spaced Txing variables, 50 and 25pF, 3/6. 0-3 amp H.W. RF meter, 3/6. 0-0.5 m/c ammeter, 5/-. Mic handset No. 7, m/c 5/-. Ditto, No. 4, carbon 5/6. Coil formers, 2¼" dia. x 8" long, plain and ribbed 2/6. Invicta Portable Radio, less valves, £3. 30" model seaplane tender hull, fitted prop and stern tube, ideal R/C 17/6. 160-80 CW table top Tx with valves, vfo, p.p. complete to go on air in b.c. cabinet 12"x8¼"x8", £7. "East Keal," Romany Road. Oulton Broad, Suffolk.

AMATEUR SELLING UP. Super receiving console Power Packs, receivers, Units, components, Valves. New boxed Z77 at 7/6, hundreds of others. Offers, in cash, exchange for Microscope, or Tape recorder. SAE for list, write for appointment to view. Aldridge, "Rio," Berkeley Avenue, Chesham, Bucks.

TRADE

PANL, the air drying crackle finish, in black, green and brown. 4/6 per jar, including postage. G. A. Miller, 8 Kenton Park Crescent, Kenton, Middx.

"GLOBE KING" (Regd.) Miniature Single Valve Receiver gets real Dx. Amateur Radio enthusiasts, should send for free copy of interesting literature and catalogue (enclose stamp for postage). Write to makers: Johnsons (Radio), 46 Friar Street, Worcester.

OAK SWITCH SERVICE. Multi-way switches made to specification. Approx. cost:—Ceramic Wafer 5/-, Paxolin Wafer, 2/-, Clicker Plate 2/6. Box No. C117.

BLUEPRINTS. High Gain 10 Meter Converter, with a de-luxe circuit comprising EF91 RF stage, ECC91 double triode mixer and oscillator, EF92 IF amplifier, with stabilised voltage supply via a 7475, 1*s* 8*d* post free with full instructions, A.S.W.P. 57 Maida Vale, London, W.9.

KENDALL AND MOUSLEY. Manufacturers of Laboratory Equipment, chassis and instrument cases, also suppliers of B.V.A. valves, Radio and T.V. components, 99 Dudley Port, Tipton, Staffs.

[*continued on page 556*

Radio Reprint No. 1

NOW AVAILABLE

PRICE 1/6 POST 2d.

DATA PUBLICATIONS LTD

57 MAIDA VALE W9

SELF ENERGISED MICROPHONES. On stand with switch and lead. No Batteries required. Sold elsewhere for 12/6. Our price **8/6**. Post 1/6.

RESISTANCE BOXES. Admiralty pattern as used on compass control equipment, containing one fixed resistance tapped at 200, 400 and 600 ohms and one slide resistance at 450 ohms, complete with large terminal block. Contained in steel case 5x6x20" long, Price **12/6**, post **2/6.**

VALVE CANS. Three section type. Aluminium. Price 9d. post 4d.

SCANNERS TYPE 83, 10AB/8022. Containing antenna, reflector 15" dia. covered with perspex dome 18" dia. 24v drive motor, position transmitter motor, relay and suppressor gear. Brand new in crate **£3/10/0**, carriage 10/–. Ditto with no perspex dome, store soiled **30/–**. Carriage 10/–. Ideal for building rotating beam.

CHASSIS & COVER. Steel chassis 7½"x10", front panel with handles 9"x8", suitable for mounting new front panel as existing one is over-drilled. Cover 8x7½x10¾" deep. Very clean condition. Price **3/–**, post 2/3.

PUSH BUTTON SWITCH UNITS. 7-way, as used in commercial type Receivers. Brand new, **2/6**, post 11d.

Our new 76-page illustrated Catalogue ready this month. Price 1/– inland post free, 2/6 overseas airmail

We welcome your enquiries. S.A.E. please

ARTHUR SALLIS (R.C.)

93 NORTH ROAD BRIGHTON SUSSEX

Telephone Brighton 25806

SMALL ADVERTISEMENTS

continued from page 555]

COILS, COILS, COILS. We can supply coils for all frequencies, RF Chokes, Filters, etc. Coils wound to specification—send details for estimate. Send SAE for circuits and Data. The Teletron Co., 266 Nightingale Road, London, N.9.

RADIO CONTROL THAT MODEL HANDBOOK 3/6, with unlimited advice. Carter, 101 High Street, Harlesden, N.W.10.

I.P.R.E. PUBLICATIONS, 5,500 Alignment Peaks for superhets 5/9. Sample copy *The Practical Radio Engineer* 2/-. Membership examination particulars 1/-. Syllabus of TV and radio courses free and post free. Secretary, I.P.R.E., 20 Fairfield Road, London.

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M.Brit.I.R.E. City and Guilds Telecommunications R.T.E.B. and other professional examinations. Train with the College operated by Britain's largest Electronic Organisation, Moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept. RC28, 43 Grove Park Road, London, W.4. (Associated with H.M.V.).

METALWORK, All types cabinets, chassis, racks, etc. to your own specification. Philpott's Metalworks Ltd. (Dept. R.C.), Chapman Street, Loughborough.

OSMOR—for efficient coils, coilpacks, etc. Send 5*d* stamp for FREE circuits and lists. Dept. RCC, Osmor Radio Products Ltd., Borough Hill, Croydon, Surrey. Telephone Croydon 5148/9.

FOR THE SIMPLEX. Valves, EA50 1/9. EB34, 6H6 2/3. 6SN7 8/6. VALVEHOLDERS, EF50 ceramic 7*d*, EA50, 4 contact 3*d*, Int. Oct. 5*d*, Mazda Oct. ceramic 4*d*. VALVES, IR5 7/-. IS4 7/-, IS5 7/-, IT4 6/-, 3A4 5/6, 3S4 7/-, 6FI 10/-, 6SN7 8/6, 7C5 7/6, 7C6 7/6, 7Y4 8/6, 10C2 10/-, 10FI 10/-, 12AT7 8/6, ECC91 11/-. SPECIAL OFFER: SET OF VALVES FOR BATT. S/HET 1R5, 1S5, 1T4 AND CHOICE OF 3S4, 3V4, 3A4 FOR O/P 25/-. MISCEL.: 2 Pole Toggle on/off switch, new 7*d*. Enclosed Morse Key, new 2/6. Trimmers 35pF Max. 70pF Max. Phillips Type 5*d*. Mail Order only. All Post Paid. A. Blackburn, 5 West End Lane, Kilburn, N.W.6.

EDDYSTONE etc., stockist. Smith, 98 West End Road, Morecambe. Send for lists.

SPECIAL OFFERS! 2C34 (VT61) Valves for "SIMPPLEX TWO" TRANSMITTER (*R.C.* March)–Three, complete with ceramic holders, for 9/6! Also useful as rectifiers or give 13 watts audio output Class AB2, or 16 watts R.F., Class C. ELECTROLYTICS 1953 T.C.C. –10mfd. tubular, wire ends, 450/500v, 2/- each; Large Ali Screw type, 8mfd., 600/700v 5/6 each. F. S. HENRY, A.M.Brit.I.R.E., 220b Canterbury Street, Gillingham, Kent.

APPOINTMENTS

WIRELESS STATION SUPERINTENDENT required by the NIGERIA GOVERNMENT Posts and Telegraphs Department for one tour of 18 to 24 months in the first instance. Option of appointment (a) on temporary terms with salary etc., according to experience in scale £864 rising to £1,392 a year and gratuity of up to £150 a year, or (b) with prospect of pensonable employment with salary etc. in scale £750 rising to £1,175 a year. Outfit allowance £60. Free passages for Officer and wife. Assistance towards cost of children's passages or grant of up to £150 annually for their maintenance in the U.K. Liberal leave on full salary. Candidates must have had wide practical experience of modern radio techniques and equipment, in particular V.H.F. equipment, and preferably also V.H.F. multichannel equipment. Write to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/28927/RN.

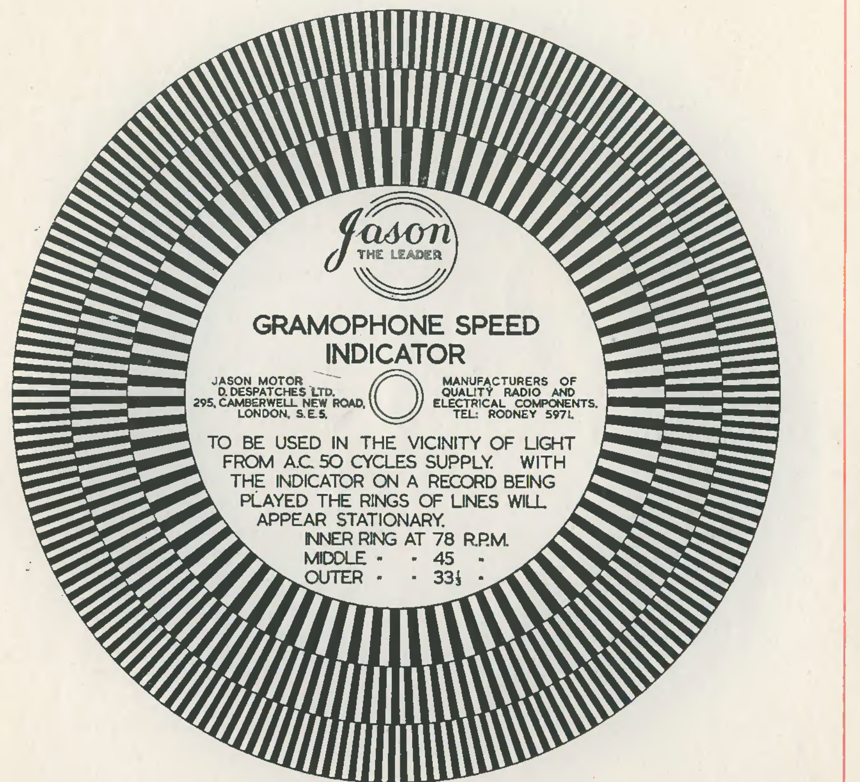
THE JASON 3-SPEED GRAMOPHONE MOTOR

A motor designed to suit the most critical taste at a reasonable cost. The cast aluminium turntable is accurately machined and is fitted to a hardened steel shaft turning on a steel thrust ball in a well bearing. The weight of the turntable ensures freedom from rumble and wow.

The speed selector for 78, 45 and 33 1/3 consists of an accurate rubber tyred idler wheel which engages a three step motor pulley. When the motor is out of use the idler wheel is withdrawn from the motor pulley and turntable to prevent deformation of the rubber, thus preventing the appearance of "flats."

A small variation allows the motor to be set to exact speed irrespective of mains voltage or frequency fluctuations.

The whole unit is mounted on a sturdy cast base and is finished in a stove enamel.



Price of complete unit **£12 10s. 6d.** This includes the cast aluminium base, turntable and drive unit and special motor.

All parts available separately.

Jason Motor Company (D Despatches Ltd.)

295 CAMBERWELL NEW ROAD. LONDON SE5

Telephone RODney 5971