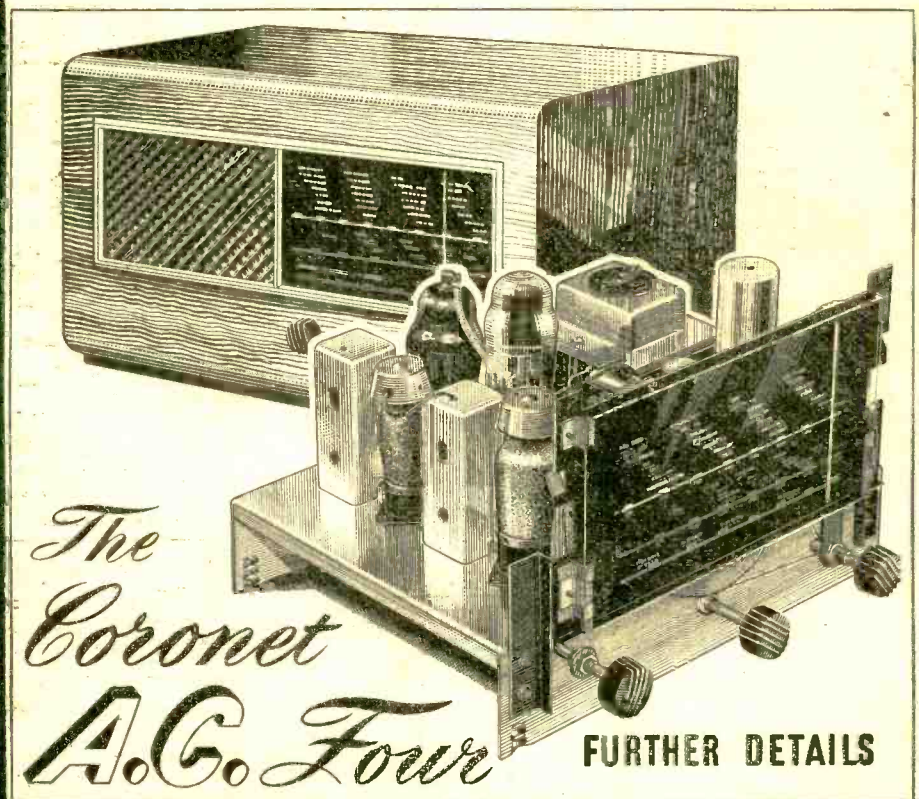
AN ECONOMY QUALITY AMPLIFIER

1/-

PRACTICAL WIRELESS

Vol. 29 No. 565
NOVEMBER, 1953

EDITOR:
F.J.CAMM



The Coronet A.C. Four

FURTHER DETAILS

IN THIS ISSUE :

A POLYPHONIC ORGAN
A 27 Mc/s. RECEIVER
EFFICIENCY MODULATION SYSTEMS
THE MINI-AMP.
ADDING A.V.C. TO STRAIGHT RECEIVERS

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A spotlight on just one of the range of Osmor "Q" coils.

H.F. CHOKE Type Q.C.1.

Frequency coverage 150 kc/s to 20 m/c. Iron dust core and single-screw fixing. Prototype tested and approved by M. G. Scroggie, B.Sc., M.I.E.E. Ideal as anode load in T.R.F. receivers for decoupling and general purposes.

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TWO for the Price of ONE!

The NEW OSMOR CHASSIS CUTTER

of entirely new design. Cuts two sizes of holes with any one reversible punch and die; and can be operated with a spanner or tommy bar. Blanks easily removed. For use on Steel up to 18 s.w.g. Brass and Dural up to 16 s.w.g. Aluminium and Copper up to 14 s.w.g.

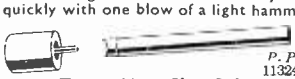
P. Pat. 11325/53

Type	Hole Sizes	Price
1	⅞in. x 1⅛in.	19/6
2	⅞in. x 1⅜in.	18/9
3	⅞in. x 1⅝in.	22/6
4	1⅜in. x 2in.	27/3

Post and Packing 1/- (any type).
Tommy Bars..... 1/3 each.

The OSMOR "JIFFY PUNCH"

For cutting smaller holes neatly and quickly with one blow of a light hammer.



P. Pat. 11324/53

Type	Hole Size	Price
1	¼in.	6/6
2	⅜in.	7/6
3	½in.	8/9

For use on Steel up to 20 s.w.g. Brass and Dural up to 18 s.w.g. Aluminium and Copper up to 16 s.w.g.

DIALS

Type A GLASS DIAL ASSEMBLY (as illus.), measuring 7in. x 7in. (9¾in. x 9¾in. overall) mounts in *any* position on or above the chassis and works with any type of drive. Choice of two 3-colour scales—G1 (L.M.S.) or G2 (M.S.S.). Price complete, **24/6.** Pulley assembly for right-angle drive, if required, **1/9**, extra. P. & P., 1/6.

METAL DIALS

Overall size 5¾in. sq., Cream background, 3-colour **Type M1**, L.M.S. waves. **M2**, L. & M. waves. **M3**, M. & 2/S. waves. Price **3/6** each. Pointer, **1/6.**
Drum, Drive, Spring and Cord for use with both types of dials, **3/2.**

We keep stocks of many radio components for use in published circuits, including:

"PRACTICAL WIRELESS"
3-Speed Autogram; Modern 1-Valver; A.C. Band-pass 3; R1155 Converter; Attache Case Portable; Modern High Power Amplifier 2; Beginners' Superhet, etc. etc.

"WIRELESS WORLD"
No Compromise T.R.F. Tuner
Midget Mains Receiver. Sensitive 2-Valve Receiver; Television Converter, (Special coils in cans available), etc. etc.

I.F.s. 465 kc. Permeability-tuned, with flying leads. Standard size 1⅜in. x 1⅜in. x 3¼in. For use with OSMOR coilpacks and others, **14/6** pair. PREALIGNED, **1/6** extra.

Dear Reader,
We can't mention all our products here but shall be glad to receive your enquiries for Chassis, Tuning Condensers, Switches, Volume Controls, and all other Radio Components. If it's top quality components and a speedy, courteous service you are looking for—try Osmor. We really shall do our best for you.

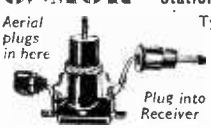
Keep those small components—etc., neatly stored yet visible by using an

OSMOR "JAR-RACK"

(If you're a generous husband you'll buy one or two for your wife's larder, she will appreciate somewhere to store her preserves.) Holds 1 lb. jam jars with or without lids. Easily removed, cannot fall out. Just the thing for the tidy "HAM" or Radio Dealer.
Type 1 for wall-fixing, 6/9 each, holds 8 jars. (Jars are not supplied but are easily obtained.)
Length 24in., enamelled olive green.
Type 2 (as illustrated) for screwing under a shelf, **5/9** each, holds 6 jars.
Length 18in., enamelled green.
Post and packing, 1/- (either type).
(Trade supplied)

OSMOR "Station Separator"

Aerial plugs in here



Plug into Receiver

Type	metres
1	141-250
2	218-283
3	267-341
4	319-405
5	395-492
6	455-567
7	1450-1550
8	410-550k/c

This is a device on the well-known "wave-trap" principle, which will reject an undesired signal when inserted in the aerial lead. Easily tuned to eliminate any one Station within the ranges stated. Fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

7/6 Post Free — Complete with full instructions—nothing to add.

FREE! *Send 5d. (stamps) for* **FREE CIRCUITS** *and full list of coils, coilpacks and radio components.*

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Practical Wireless

EVERY MONTH
VOL. XXIX, No. 565, NOVEMBER, 1953

Editor F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

Great Success of the "Coronet"

THE "Coronet," free blueprint which was given in last month's special Birthday Number was an immediate and outstanding success, more successful indeed than many of our pre-war receivers. The firms supplying the components report that although they had laid in heavy stocks they were rapidly absorbed. Arrangements have been made, however, for fresh supplies. In order to ease the situation regarding the coil pack we ourselves have made other arrangements, as announced in the further constructional details for the "Coronet" given in this issue.

We greatly value the thousands of letters and telegrams received from readers congratulating us on our Twenty-first Birthday Number, which rapidly sold out.

THE ADVANCE OF TAPE RECORDING

ONE of the outstanding features of this year's Radio Show was the large number of tape recorders exhibited and in which great interest was evinced by the public. It has become a new national hobby and it is now backed by a new and growing industry. Tape recorders must, of course, eventually replace wax discs, but that will not be for many years. Tape recorders will be considered as pieces of auxiliary equipment for many years to come. The combined radiogram and television receiver with recording apparatus may not, however, be so far away. There is a need for it in these days of cramped home conditions when it is difficult to find space for another piece of apparatus. A kit for constructors was on view and it will shortly be dealt with in this journal.

The use of tape recorders on a national scale raises complicated and interesting questions of copyright. An enthusiast may record a radio programme or a number of gramophone records and play them under conditions which would infringe the copyright laws and the rules of the Performing Rights Society. It may not be general knowledge that almost every public house which has a piano, radio or television set installed must pay an annual fee to the Performing Rights Society to cover copyrights. Those who, therefore, see in tape recording a ready-made means of providing entertainment at, say, a local hall, either as a part of a concert or to provice dance music, should take particular care over this matter by communicating with the Performing Rights Society.

THE ELECTRICIANS' STRIKE

THE early days of the Radio Show were marred by the strike of electricians which caused a number of stands to be unlit. In this respect we think that next year the Radio Industry Council should ask the Earls Court Authorities to seek assurances from all of the unions concerned that there will not be a strike during the run of the show. Strikes of this nature are attempts to make a rod of third parties—the exhibitors—in order to force employers to submit to claims.

After similar experiences a few years ago, when a strike commenced just before a show opened and lasted for some days after, we are surprised that these assurances have not been sought. One other point whilst we are dealing with the show; the seating accommodation is still inadequate and assurances should be sought also from the Earls Court authorities to ensure that their building is made acceptable to exhibitors and the public.

Apart from these points the exhibition was a great success; attendances were up and exhibitors reported good trade. The stands this year, too, were much more attractive than hitherto.

CAR RADIO LICENCES

THE Postmaster-General recently announced that the Ministry of Transport is co-operating with him by sending a note with motor-car licences setting out the wireless licence requirements. Motorists are being asked when they apply for vehicle licences to state whether their vehicle is fitted with a radio set and, if so, whether it has been licensed separately. A radio set which is installed in a car must have a separate licence, but a portable radio does not.

Car radios are now being sold in much larger quantities than before the war, but rectifier troubles are still common, and thefts of car radios are on the increase.—F.J.C.

ROUND the WORLD of WIRELESS

Atomic Energy Broadcast

IN the atomic city of Oak Ridge, Tennessee, U.S., WATO have been arranging to broadcast a programme on electricity generated from the atomic power station.

The trial transmission is expected to last no more than five minutes and, if successful, would be the first radio station in the world to broadcast on atomic energy.

Fight Broadcast

WE understand that a direct link-up has been arranged between the BBC and the razor-blade company that holds the copyright in New York on all broadcasts from Madison Square Gardens.

The link-up is to enable British listeners to hear the world middle-weight championship fight on October 21st between Randolph Turpin and Carl Olson. Those who do hear the relay will have to stay up until 3.30 in the morning by our time.

Contract for E.M.I.

RECENT orders from the BBC for E.M.I. tape recorders and associated equipment exceed £100,000.

This is part of a re-equipping scheme which the BBC have in hand for their recording department. The models supplied range from large studio recorders, including transportable versions, to the latest type lightweight portable battery-operated recorders now in use by BBC outside commentators. Over 50 of these portable machines have already been supplied.

Tannoy Director Marries

MR. DAVID G. FOUNTAIN, younger son of the noted West Norwood industrialist, Guy R. Fountain, and director of one of the Tannoy group of companies, was married recently to Frances Mary Smith, an occupational therapist, whose father farms The Grange, Elmbridge, near Droitwich, and is also a keen aviator.

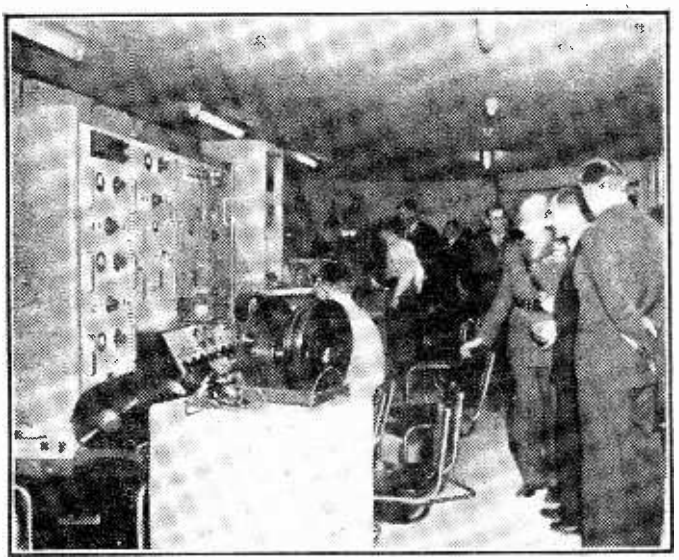
Mr. David Fountain, an old Alleynian, who is 23 years old, has now completed his second year at Oxford, and when he comes down from the university, contemplates staying for a few years in Canada.

The wedding took place at Elmbridge Parish Church.

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended July, 1953. The grand total of sound and television licences was 13,010,856.

Region	*Number*
London Postal ...	1,714,093
Home Counties ...	1,459,147
Midland	1,309,810
North Eastern ...	1,698,763
North Western ...	1,334,452
South Western ...	1,026,212
Wales and Border ...	664,692
Total England and Wales	9,207,169
Scotland	1,110,857
Northern Ireland ...	213,376
Grand Total	10,531,402



During his visit to this year's Radio Show, Field Marshal Viscount Montgomery in the Radio Industry Council Control Room, examined the Sound Reproduction Equipment designed, manufactured, installed and operated by Standard Telephones and Cables, Limited on behalf of the R.I.C.

Cable and Wireless Ltd. New Radio-telephone Service

A DIRECT radio-telephone service was opened on Tuesday, August 18, between Nairobi and Bombay.

It is operated between Cable and Wireless Ltd.'s station at Nairobi and the Overseas Telecommunications Service's station at Bombay. The service will be available to telephone subscribers throughout Kenya, Tanganyika and Uganda at one end, and throughout India at the other end.

"Prix Italia"

THE festival for the award of the "Prix Italia," the grand international competition for original broadcasting works, began at Palermo on October 1st. This is the fifth consecutive year of the festival.

Fourteen of the most important broadcasting Corporations of the world participated. They were in

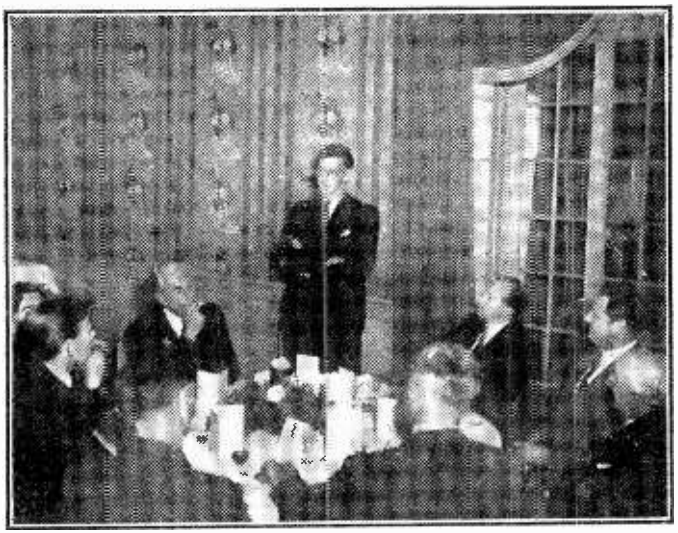
order of entry: Ravag (Austria), Radiodiffusion Egyptienne (Egpyt), Radiodiffusion et Télévision Françaises (France), BBC (England), RAI-Radio Italiana (Italy), Radio Montecarlo (Monaco), Nederlandsche Radio Unie (Holland), Emissora Nacional de Radiodiffusao (Portugal), Société Suisse de Radiodiffusion (Switzerland), Ente Radio Trieste, Institut National Belge de Radiodiffusion (Belgium), Suddeutcher Rundfunk (Germany), Naeb (U.S.A.), Radio Maroc (Morocco).

Miniature Radio

IT is reported that the American Army authorities have developed a miniature transmitter-receiver radio no larger than a normal wristwatch.

Sets for Bolivia

PYE, LTD., of Cambridge, report that they have received a "substantial order," amounting to several thousand pounds' worth, from Bolivia for a consignment of radio receivers.



Radio Officer of the Everest expedition, George Band, relates his experiences at a Savoy luncheon, given by Pye, Limited, who announced details of a new naval radio receiver, the 619 Admiralty set. Seated on the right of Mr. Band is Captain K. McCampbell-Walter, R.N., the Director of Radio Equipment at the Admiralty. On Mr. Band's left is Mr. P. M. Threlfall, a director of Pye, Ltd.

Show Boosts Sales

THE Manchester firm of Ferranti received so many orders for radio and television receivers during the first week of the National Radio Show that employees at the company's Moston factory have been guaranteed work for at least a year.

Production has been so completely outpaced by exhibition orders that some prospective buyers have been warned that delivery may be considerably delayed. Sales manager Mr. L. G. Hall reports "Business is terrific. Orders are pouring in."

Pye Records

MR. C. O. STANLEY, chairman of Pye, Ltd., stated at the recent annual meeting that the company intends to enter the gramophone record business.

He said that TV development in the United States had furthered interest in records and predicted that the same would happen in this country. "For a number of years," he said, "your company has wished to have an interest in the gramophone record business. We are at this moment actively planning to enter this new field of manufacture and selling, and we hope to be able to make a definite announcement in the very near future."

"Take It From Here"

ALTHOUGH one of radio's biggest laughter shows, "Take It From Here," is planned to return to the Light programme in November for a run of six months, it is not definite yet whether a successor to Joy Nicholls will be introduced.

Miss Nicholls returned to her home in Australia some months ago and producer Charles Maxwell and scriptwriters Frank Muir and Denis Norden are not sure whether one or two girls will be chosen to provide a feminine touch to the programme. It is believed that they may even introduce a different sort of girl that would change the shape of the series considerably.

BIRTHDAY GREETINGS

From Harry Richards (Managing Director, Wolf Electric Tools Ltd.).

"CONGRATULATIONS to PRACTICAL WIRELESS on reaching its 21st Birthday, and to Mr. F. J. Camm on seeing it through to this day. May they both still be going strong at the 50th anniversary."

Boxing Night

THE agreement recently concluded between the BBC and the British Boxing Board of Control will enable the big audience for boxing commentaries to hear regular fortnightly broadcasts in the Light Programme.

Beginning on October 13, there will be a forty-five minute Boxing commentary at 8.30 p.m. every other Tuesday until the end of the year. To allow for this, the Forces Show will be moved from 8 p.m. on Tuesdays to 7.30 p.m. on Wednesdays. The period from 8.0-8.30 p.m. on Tuesdays will be filled with a programme of light music. "The Name's the Same" will move from 7.30 p.m. to 9.30 p.m. and its place will be taken by "Ignorance is Bliss."

Autumn Drama

THE BBC state that radio drama this autumn will include "a strong and unusually varied selection of plays, the current output being augmented by the return of "Radio Theatre" and "Curtain Up"; an additional fifteen-minute serial on Saturday evenings, which it is hoped will appeal to the younger generation and, in the Home Service, a new serial on Thursday evenings."

The Beginner's Guide to RADIO

The Seventh of a Series of Articles Specially Written for Those Who Have Become Interested in Radio for the First Time. Explaining the Principles of Radio Transmission and Reception

By F. J. CAMM

FIRSTLY, let me deal with one or two points arising out of last month's instalment. I said that it sometimes becomes necessary to increase the ranges of voltmeters and ammeters by the inclusion of resistances. I did not make it clear that in the case of a voltmeter the resistance is connected in *series* and in the case of an ammeter in *parallel*. Also a typing error occurred in the paragraph on page 601 relating to "Increasing Range." The sentence commencing "As already stated the voltage range of *ammeter* . . ." should read "As already stated the voltage range of *a meter* . . ."

In order to dispel some doubts which exist in the minds of beginners concerning the functions of meters, I should point out that basically a voltmeter is the same as an ammeter, and thus it does in effect indicate that a current is flowing through the circuit, although by reference to the dial one reads off the voltage.

Current, Voltage and Resistance

I have already shown that current, voltage and resistance have a definite relation to one another, the relationship being known as Ohm's Law, and in any circuit knowledge of any two factors enables the other to be calculated. Now if a circuit is "opened" and an ammeter is inserted the needle will indicate the amount of current flowing. For example, if the meter is designed for a maximum reading of 1mA and it is inserted in a circuit so designed that one milliamp current flows, it is obvious that the needle will be fully deflected. This is known as *full scale deflection* or f.s.d. But if the voltage is higher or the resistance lower then a current greater than 1 mA will flow, and unless precautions are taken the needle will press hard against the stop pin and the meter mechanism will be damaged. In cases where we wish to take current readings beyond the full scale reading of the meter, we must arrange to by-pass the current which is in excess of that which will give F.S.D. of the meter.

When measuring a voltage the voltmeter is connected across the source or terminals to which the voltage is applied, and in this case if the voltage being measured will result in a current in excess of the full scale reading of the meter resistances will have to be connected in *series* with the meter, and the two are joined in *parallel* with the source. The values of the resistances are such as to limit the current again to 1 mA or less with the type of instrument just referred to. A parallel shunt direct across the meter would not function satisfactorily in this case as it would have to be practically a dead short-circuit, especially when measuring high values of voltage. Summed up, therefore, whether used for measuring current, resistance or voltage, we do, in effect, actually measure the current flowing through the circuit; and the basis of the ohmmeter or voltmeter is an ammeter. If the current to be measured is in excess of that for which the meter is designed the excess must be by-passed by a shunt-resistance; whilst if a voltage is applied which will result in excess current being passed through the meter the current is restricted by the use of resistance(s) in series with the meter.

I hope I have removed the confusion which has existed in the minds of one or two readers on this matter.

A Practical Test in Measuring

Now, last month I dealt with general testing and we can now proceed with a practical demonstration of these methods by testing the three-valve circuit which has already been described in this series.

The illustration on the next page shows the receiver in pictorial form, but with two meters added. These may be a single instrument in which by means of switches or plugs and sockets the instrument may be made to measure voltage or current. As explained already, voltages may be measured without interrupting the circuit whilst for current readings the circuit must be broken and the meter interposed.

First, then, the meter shown at the foot of the diagram is the voltmeter. The polarity of the leads must be observed, and the negative lead is clipped on to any point on the earth (H.T.—) side of the receiver. The positive lead may then be placed on the points indicated by a X, making quite sure that the setting of the instrument is suitable for the voltage being measured. To obtain the highest accuracy the meter should be set to the highest voltage range. The readings will indicate the voltages actually applied to the valves and thus prove whether the anode circuit is complete or short-circuited, and also the state of the bias circuit where one is fitted. This form of testing may be employed with any receiver.

"A" gives the L.T. voltage which should be checked with the valves switched on.

Next the current may be tested and the meter for this is shown at the top of the diagram. Here the two leads have to be interposed as already stated and to check each stage the circuit must be broken where the broken X is shown and, again, the polarity of the instrument must be observed The negative

lead should be connected to the valve side of the opened connection. It will be noted that the H.T. lead has been provided with a broken X and if this lead is opened and the meter is inserted it will indicate the total H.T. current taken by the receiver and when the set is switched off it will indicate whether or not there is any leakage. There should be no reading in the "Off" position. Similarly, by adding together the current shown at each stage this should agree with the total in the negative lead—any higher reading indicating a leakage or some additional point which has not been taken into account.

Testing Without Instruments

Certain simple tests can be carried out without the use of instruments. In the case of a simple battery receiver, it may be tested without any instruments in the following manner. Assume that the L.T., H.T. and G.B. batteries are in order. Disconnect the wire which is joined to the detector-valve anode or plate terminal of the valveholder. Connect up one lead of a pair of headphones to the terminal and take the other lead straight to H.T. positive. Switch on the set and see if signals come through. If there are no signals tap the glass bulb of the valve lightly with the tip of your finger. If no noise is heard the valve is broken. To ascertain this simply remove the valve and plug one of the other valves from the set in its place. Supposing that no matter which valve you plug in you can still hear nothing. Remove the wires which are connected to the F terminals of the valveholder and obtain two new pieces of wire and attach them to the "F" terminals and straight on to the accumulator. If the valve now works, then the filament wiring in the set or the leads from the terminal strip down to the accumulator are at fault.

With all leads of the flexible variety having clamped-on spade connectors or similar devices, it often happens that the wire gets broken, but the connector is held in position by the cotton covering.

Now that leads have been checked over and found correct, there only remain the connections from the L.T. terminals on the set to the valveholder and the terminals on the valveholder itself.

Supposing when joining an accumulator direct to the valveholder nothing is heard in the 'phones. The only lead left which can cause this trouble is the H.T. negative lead and if this is joined to the set to one side of the fuse only, look at the fuse. If this is in order, remove the H.T. negative lead from the terminal strip and join it to the L.T. negative terminal.

Now take the case where on connecting the phones no signals can be heard, but the valve "pings" on tapping it. This shows that filament and anode circuits are correct and the trouble must lie in the tuning arrangements. Try a different coil, or, if some complicated switching arrangement is used in the set, wind or obtain a simple 60-turn coil and connect one side of it to aerial and one side to earth. Disconnect the aerial terminal to the tuning coil and also the lead from the tuning coil and/or condenser to the grid condenser. Join the aerial terminal to the grid condenser and again observe whether signals come in. If they do, then the tuning coil is at fault.

(To be continued)

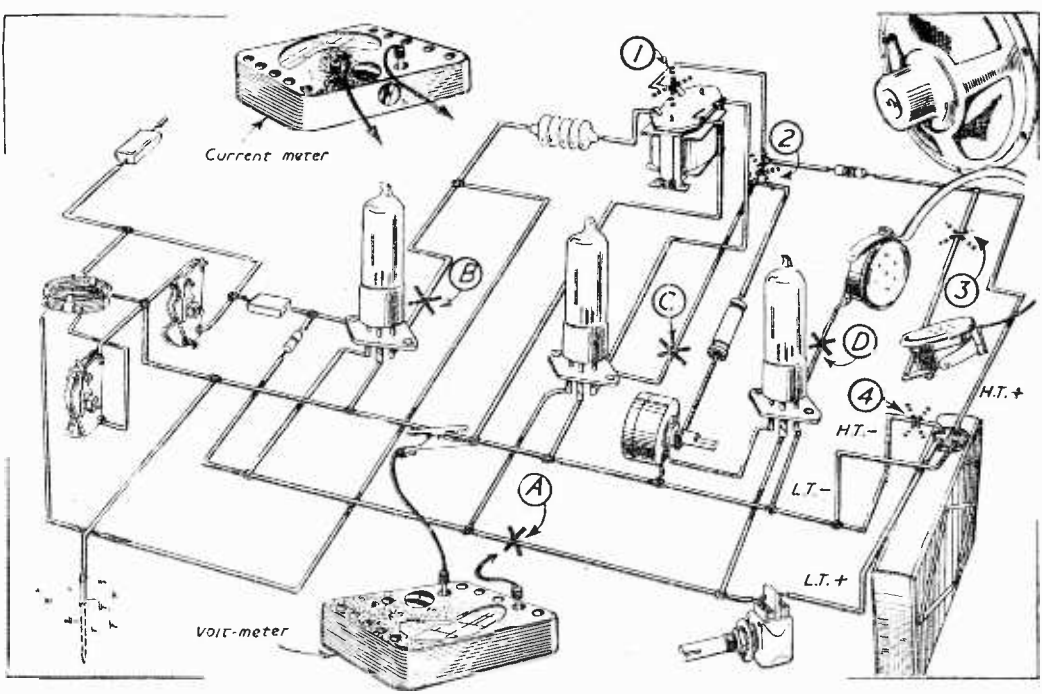
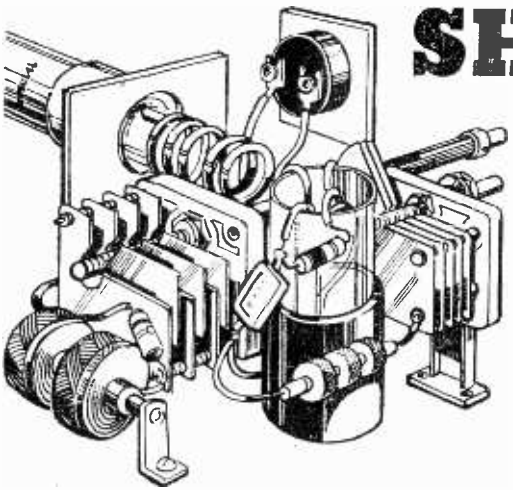


Fig. 31—The three-valve receiver circuit in pictorial form showing the points to which meters are joined for testing.



SHORT-WAVE SECTION

A MODULATION CONTROLLED 27 Mc/s RECEIVER

By F. G. Rayer

THE usual type of simple single-valve model-control receiver is not suitable for use with a transmitter where control is effected by modulating the transmitter carrier-wave. With a modulation controlled receiver, a number of advantages are present. The most important of these is to be found in the increased degree of control which is possible, and two or three relay circuits may readily be operated with a single transmitter and receiver. This is not so with " carrier only " receivers, where a single relay is controlled by switching on and off the transmitter carrier-wave.

A 2-valve receiver circuit is shown in Fig. 1, and this may be operated in a number of ways. The first valve is used in a self-quenching super-regenerative stage, the 50,000 ohm control enabling the degree of regeneration to be adjusted. High sensitivity is possible with a stage of this type, quenching being achieved by the development of a negative potential on the control grid. As a result, the valve goes in and out of oscillation at a frequency above audibility, in the manner which will be familiar to users of ultra-short wave equipment of this kind.

When the control of a single relay is wanted, the second valve has just sufficient bias applied to it to prevent anode current flowing, when no audio-tone is being received. When the transmitter carrier is modulated, the audio-tone is applied to the control grid of the second valve, which conducts during the section of each cycle when the grid is sufficiently positive. The resultant anode current closes the relay.

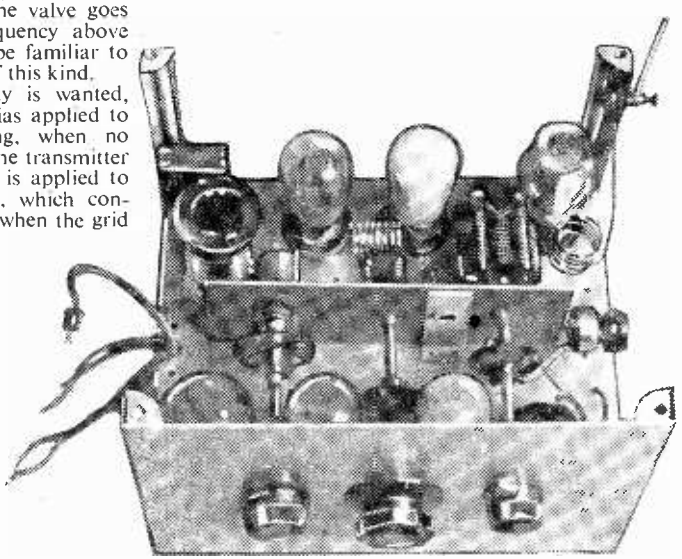
" Hard " or vacuum valves may be employed in such circuits, and have a normally long life, which is a great advantage over the use of " soft, " or gas-filled, valves, where the valve may have a life of only 15 to 20 hours, yet is essential to secure an adequate change of anode current at range. Using the circuit in Fig. 1, with a 1S4 valve as detector and 1T4 valve in the second position, adequate control of the relay was found possible. With about 6v. bias the 1T4 valve anode current was .1 mA (insufficient to operate the relay), rising to 1.5 mA when the carrier was modulated.

Correct quenching is essential for proper operation, as weak regeneration will cause lack of sensitivity, while violent oscillation will cause V2 to conduct during positive peaks. A quench frequency in the neighbourhood of 10,000 cycles per second is suitable, and phones may be included in the anode circuit of the second valve to check operation. If the quench frequency tends to reach V2, causing anode current to flow, this can be prevented by shunting a fixed condenser across the secondary of the coupling transformer.

This type of circuit can also be used with a tuned reed relay. This type of relay usually has three reeds or armatures, each of which is tuned mechanically to operate at a certain frequency. Accordingly, any of the reeds can be made to operate by adjusting the audio-tone radiated by the transmitter to a suitable frequency. In this case V2 only needs to operate as an ordinary amplifier, and excessive bias is no applied.

3-Valve Circuit

Fig. 2 is a development of the circuit in Fig. 1 giving increased range, and a suitable layout is shown in Fig. 3. Here, the audio signal is developed across



View of the Transmitter which was described last month.

the L.F. choke, and applied to the grid of V3. The control bias voltage arising in this way was found to be from about 15v. down, according to range.

With relays of other than the tuned reed type it is desirable to shunt the relay winding, as in Fig. 2, with a condenser of about .1 μF upwards, to prevent the armature responding to the audio tone, or "singing." The selection of a specific audio-tone may be achieved by using a L.F. choke of suitable inductance, so that it is resonant at the desired frequency. The circuit will then be unresponsive to tones of other frequencies which may be radiated to control other equipment. If the control of two or more relays of this type is required, the output stage should be duplicated, each valve being wired to a choke of different resonant frequency. The

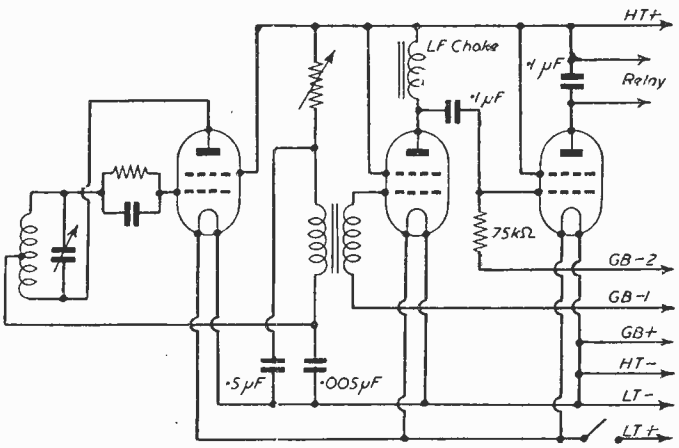


Fig. 2.—A three-valve circuit.

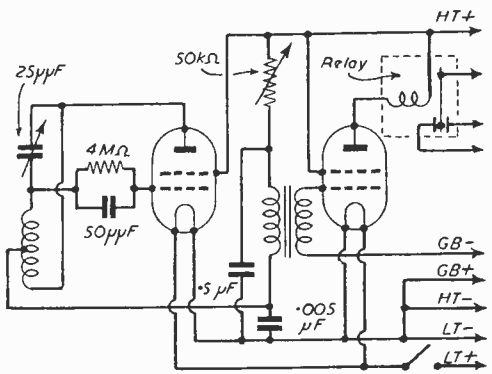


Fig. 1.—Circuit of a two-valve modulation controlled receiver.

various relays may then be controlled as desired by adjusting the frequency of the radiated audio-tone.

This 3-valve circuit can be used with a tuned reed relay, when ordinary bias is applied to V3. When used with the ordinary type of relay, sufficient bias is used to obtain cut-off of anode current, as explained.

Practical Considerations

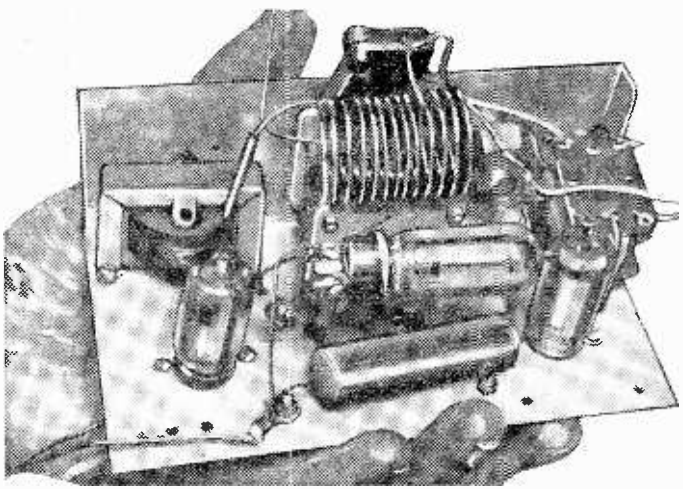
As mentioned, correct operation of the super-regenerative detector is essential for best results, and it is of great advantage to wire phones temporarily in circuit when initially setting up the receiver.

Details of the coil used will become apparent from Fig. 4, the completed coil being mounted directly above the butterfly tuning condenser in Fig. 3. Here, "A" on the coil is taken to the left-hand section of the condenser, and detector anode. The tapping (at the 4th turn) is taken to the condenser and transformer primary, while end "B" goes to the grid-leak and condenser.

The IS4 valve type, being intended for output purposes, oscillates most readily in this type of circuit. If a IT4 is used for detector it may be necessary to move the coil tapping nearer to the centre of the coil to obtain oscillation, and to wire anode and S.G. together to use the valve as a triode.

With the transmitter radiating a modulated carrier wave, the receiver tuning and regeneration control should be carefully adjusted for maximum volume in the phones. If the tuning condenser is fully closed without resonance being obtained, the coil may be slightly compressed. If, however, the condenser is fully opened without correct tuning being obtained, the coil should be pulled out slightly to reduce inductance.

When it has been assured that the correct frequency is tunable, the receiver may be removed to a distance of 50 to 100 yds., and regeneration care-



The size of the receiver may be judged from this illustration.

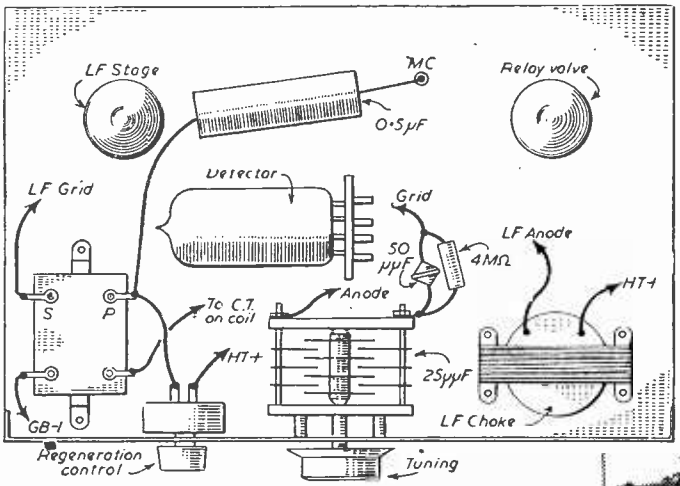


Fig. 3.—Layout adopted in the receiver.

fully adjusted to obtain maximum volume. With the phones wired in parallel with the primary of the coupling transformer, so that only one valve is in use, the transmitter note should be clearly audible at 100 yds. range.

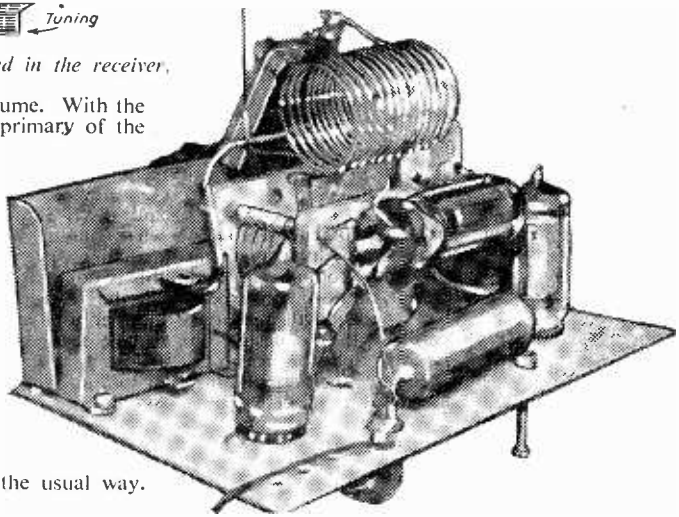
When correct operation has been obtained, the phones should be removed. This may make necessary some slight retuning and adjustment of the regeneration control. Final adjustments should be made by including a meter in the anode circuit of the relay valve, and obtaining the greatest possible change in anode current when the transmitter modulator is switched on and off. The relay is then adjusted to operate in the usual way.

Receiver Aerial

For experimental purposes where transmitter and receiver are close together, no aerial need be used on the receiver. For small ranges an aerial about 9 to 18in. long may be joined to the tuning coil. A stiff vertical wire is suitable. For maximum range a longer aerial should be used, and this may best be coupled by a two or three turn loop near the tuning coil. The free end of this loop is taken to the receiver chassis.

Regeneration

It is most convenient to adopt one or two aerials and retain them, since any change to the aerial makes necessary retuning and adjustment of the regeneration control. Long aerials, tightly coupled, will prevent super-regeneration. For normal purposes there is little need to use an aerial exceeding 3ft. in length.



Another view of the completed receiver.

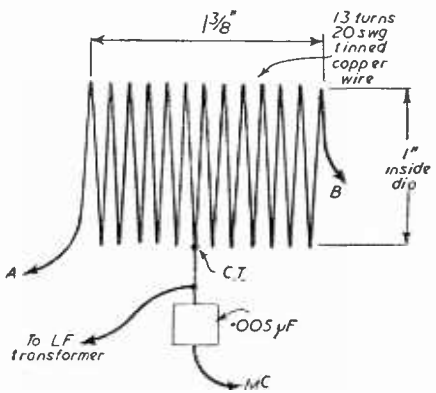
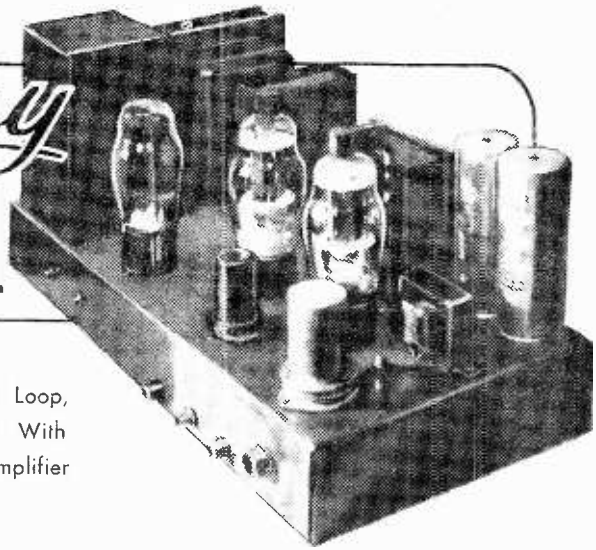


Fig. 4.—Details of the tuning coil.

AN Economy QUALITY AMPLIFIER



A High Gain, Low Cost, Four Feedback Loop, Main Amplifier. 6/8 Watts Output With Negative Feedback Tone Control Preamplifier

By C. J. White, Assoc.Brit.I.R.E

IN putting forward a new amplifier for the constructor, a designer has to first consider on what grounds this can be done and then to work out the performance to be expected from the considerations involved.

There are many commercial equipments available having a performance equal to anything that the amateur can produce, but both commercial and amateur face the same end result, they are very expensive. Now why is this? Leaving aside all questions of labour charges and dealing with the design on technical grounds alone, generally speaking it can be said to revolve around the design of the output transformer and the type of output valves used, together with the degree of negative feedback in the main loop. Taking the output transformer and feedback first, it can be seen that the more feedback that is used in order to reduce distortion, the more need for an expensive output transformer to keep down phase changes at the extreme ends of the audio frequency spectrum. If the number of stages in the normal main amplifier is reduced so that, say, a figure of 25db can be fed back; whereas with another stage 25db is sufficient to cause instability, one is faced with another problem, that of securing enough output from the tone-control pre-amplifier, without distortion, to feed the main amplifier fully.

In trying to defeat this vicious circle, the writer feels there are one or two weapons in our armoury which have tended to be ignored, at least in commercial designs, and only partly in designs for amateur use and that is the complete matching of the anode currents of the output valves and the use of a directly-coupled pentode, followed by the phase splitter. Even when an expensive output transformer with high-quality iron and a large cross-section is used, all this goes for very little when the time comes for a valve to be replaced, at which the anode currents can quite easily differ by 20 to 30 mA. There have been designs where matching has been recommended and provision made, but it is never made easy; what is required is that there should be provision for matching, plus an easy method of checking; if this is done then the iron content of the transformer can be reduced together with the price. There is another way in which the transformer requirements can be reduced, if by some means we can decrease the need for the numerous interleaving or separations of the windings. Now the reason for this separation of the windings is that it is necessary to reduce their self capacity in order to extend the frequency response and additionally when feedback is used to avoid or retard the changeover to positive feedback which occurs when the feedback is over a number of stages. In a nutshell if we can reduce the number of stages, then for the same feedback we can reduce the transformer requirements, for the feedback will easily take care of the slight droop in the frequency characteristic which would result if the transformer were used without feedback.

So far then the problem is to design a very high-gain minimum stage amplifier with a high degree of negative feedback. Now, it is well known that the maximum possible voltage gain of a pentode is never reached in practice because of the inability to provide an anode load in which this gain can be developed, but there is a way in which gains of up to 1,000 times can be achieved, and using this method we can obtain our desired result. Before going on to describe this high-gain system it would be best to consider what sort of an output stage we are going to require, for whatever it is the early stages have to provide the

TEST FIGURES

Input 0.4 *R.M.S. v. at* 1,000 *c/s per* 6 *watts output across* 15 *ohms.*

Hum level 90*db down* (50 *c/s and* 100 *c/s in proportion of approximately* 3-2).

Distortion measured on a wave analyser: at 1,000 *c/s—no detectable harmonic content; at* 50 *c/s less than* .05 *per cent. For* 6 *W. at* 1,000 *c/s distortion* .27 *per cent.* (*R.M.S. value of harmonic components*).

grid volts to drive it and it is no use having a high-gain input stage if it will not provide this voltage without distortion. Push-pull is a *sine qua non* for only in push-pull can saturation of the output transformer be avoided, but the question of how many watts is a very vexed question.

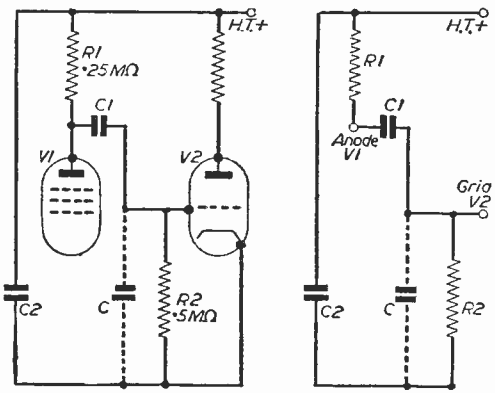


Fig. 1.—It can be seen that R2 forms part of a potentiometer R1 C1 which reduces the potential available at the grid of V2. Additionally at low frequencies the rising reactance of C1 and at high frequencies the stray capacitor C increases the loss.

Wattage Output

On technical grounds alone there is a very good case to be made out for a 15-watts output, but there is more to consider than technical grounds. If such an amplifier is to be used with a modern loudspeaker system so that on dance bands and symphony concerts loud passages cause the amplifier to reach its maximum, or even if the general level is much lower than this and the bass tone control is used to compensate for the ear's loudness contour, the general result is that it can be heard some 20 yards away, which is much to be deplored. Looking at the problem in this light it is suggested that an output of 6/8 watts would be ample with the corresponding advantage that the H.T. requirements would be very much reduced.

There are many valves available which will easily cover this output, but as this amplifier is to be an attempt to give a high-quality output at low cost, there is one which is very reasonably priced, very reliable and easily available, which will fit the case much better than the others, and that is the 12-volt equivalent of the 807, i.e., the 1625. To get our requisite 6/8 watts this valve will require a grid swing of approximately 33 volts, with an anode volts of 400. This in turn requires an H.T. line volts of approximately 450, which is just what we require for the first stage. Additionally, the current requirements of this valve are quite reasonable, for at the maximum usable output of 11 watts, using the bias arrangement adopted, the total current was 100 mA., which is very reasonable indeed. Assuming a maximum grid swing of 40 volts, i.e., a grid-to-grid volts of approximately 80, we can now go back to consider the first stage in more detail.

First Stage

In the normal amplifier, with a pentode followed by another amplifying valve, any attempt to get high gain, say above 200 times, by increasing the anode load is doomed to failure because of the load presented by the grid cathode impedance of the following stage. (Fig. 1). This, then, is the crux of the matter, how to increase the grid/cathode impedance of the following stage. Now, in the amplifier under discussion this following stage will have to be the phase splitter, for one of the requirements is to keep the number of stages to the very minimum, and here in the phase splitter is the solution to the problem. One straightforward reliable phase splitter is known as the concertina (Fig. 2), where the anode load is split in two, with one half in the anode circuit and the other placed in the cathode circuit. Now, because of the feedback across the cathode load the grid/cathode impedance is approximately 10 times the value of the grid leak. Putting a value of 500 KΩ for this, we get a figure of 5 megohms, which is comparatively negligible compared with, say, 100 KΩ, a not unusual figure, particularly if grid current is permitted. It is possible to rearrange this circuit, combining with it the first stage whereby the grid/cathode impedance of V2 is actually the anode load of V1. (Fig. 3). In this way

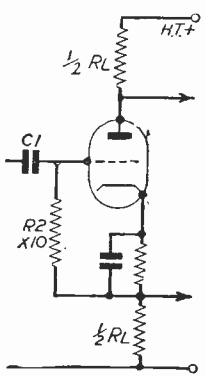


Fig. 2.—The "concertina" phase splitter circuit.

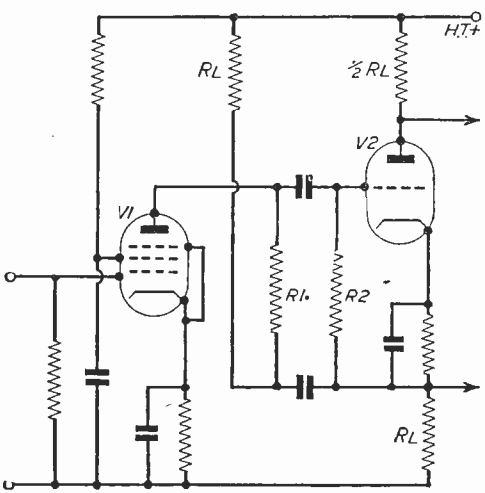


Fig. 3.—A rearrangement of the Fig. 2. circuit to combine the first stage.

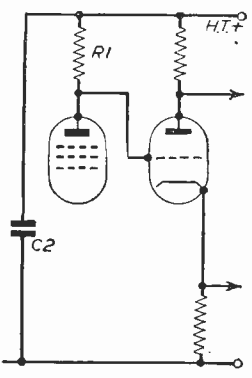


Fig. 4.—The coupling condenser has been eliminated here.

truly colossal gains can be obtained, particularly with modern valves, and a figure of 1,500 could be considered as average. For the purposes of this amplifier, however, this circuit has the disadvantage of containing two coupling condensers. We would be quite content with a gain of approximately 500, particularly if the coupling condensers can be avoided, and this it is possible to do with the circuit of Fig. 4. Here the only limit to the gain of the stage is the value of the anode resistor now that the loading of the following stage has been removed, with the added requirement that it must supply the 36 to 36 volts or so (that is Eg. 3.-Eg. 4), when combined with and multiplied by 0.9 (the gain of the phase splitter), required by the output valves.

One of the limitations of this type of circuitry was that as the anode load resistor was increased so the Miller effect and grid/cathode capacity of the following stage caused a serious droop in the high-frequency response, but in this case not only will this not be so but to ensure complete stability with long loudspeaker lines and the use of networks the capacity will be added to without the frequency response deteriorating.

Final Circuit

Assuming the foregoing to be possible, it can now be seen that our Economy Quality Amplifier should consist of one very high-gain pentode, directly coupled to the phase splitter, which, in turn, is fed to two 1625 valves in push-pull, using an output transformer that, though designed with a view to economy, is able to allow a feedback of more than 20db over the whole of the amplifier from the cathode of V1 to the loudspeaker with complete stability. Using an EF54 for V1, a 6L5 for V.2, and the 1625/807 valves for the output stages, a prototype was made up for the preparatory work.

In this work the major aim was that it should be capable of being reproduced by constructors without any test equipment whatever. This is indeed a difficult feat, for in any attempt to get high quality it follows that close tolerance components must be used. In the early work this was so but it has been found that except for two places they can be discarded with beneficial results, and even in these two places close tolerance is not called for—only matching—and good dealers will generally be able to do this if other things are purchased. At the end of this first work the amplifier was checked by an independent, non-com-

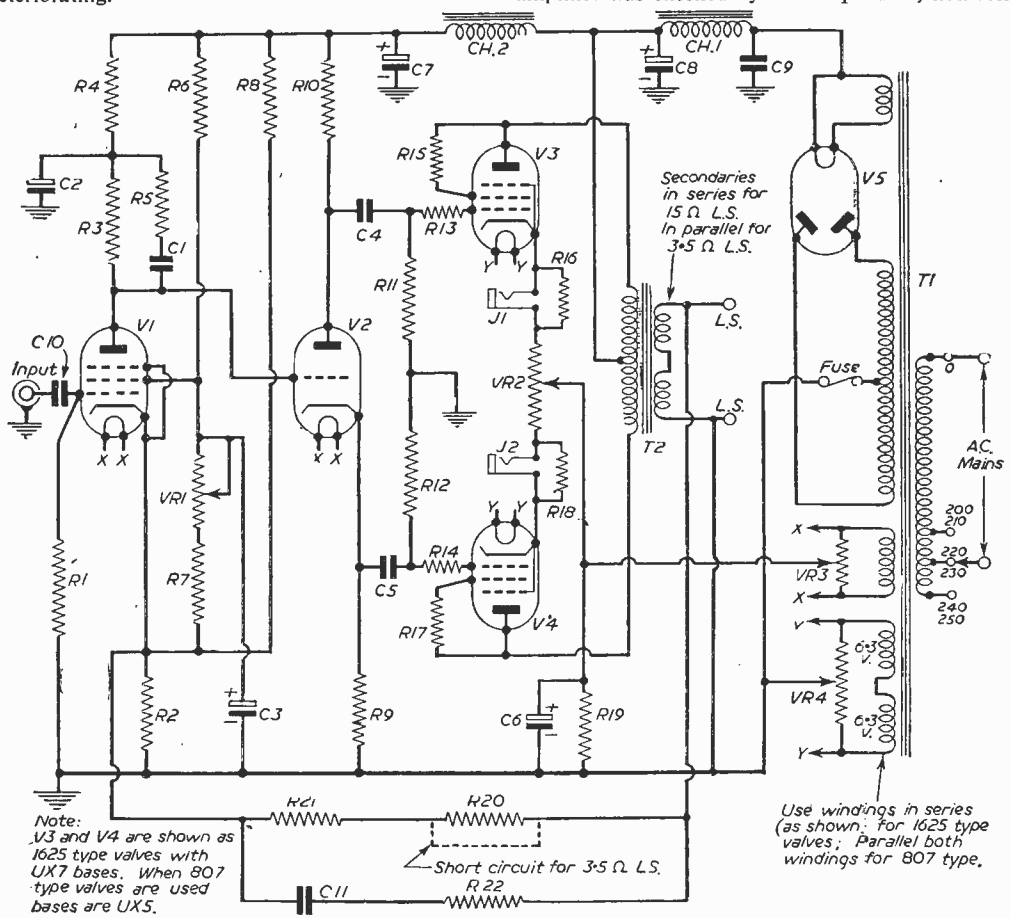


Fig. 5.—Theoretical circuit of the economy amplifier described in this article.

mercial physics laboratory, and using a reliable wave analyser the total distortion second, third and whatever there was of all the other harmonics, plus hum and noise, came out at 0.27 per cent. for six watts across 15 ohms. This was, indeed, an excellent result, and all this was for an input of 1.1 volts RMS and a total hum and noise of 90db below 6 watts.

(To be continued)

LIST OF COMPONENTS

TRANSFORMERS AND CHOKES

T1—Mains Transformer.
Primary 0-200/230/250
Secondary 1—425-0-425 at 150 mA.
Secondary 2—5 v. at 3 amps
Secondary 3—6.3 v. at 3 amps
Secondary 4—6.3 v. at 1 amp
Secondary 5—6.3 v. at 1 amp
(Wholly shrouded chassis mounting with fly leads. Radio Supply Co., Leeds.)

T2—Output Transformer.
Primary to match 1625 valves in push-pull. Balanced secondaries for 3.5 Ω and 15 Ω L.S.
(Chassis mounting with fly leads. Radio Supply Co., Leeds.)

C.H.1—Main Choke.
200 mA. 10 Henry (Chassis mounting. Radio Supply Co., Leeds.)

C.H.2—Secondary Choke.
30 mA. 5/10 Henry (Chassis mounting with fly leads. Radio Supply Co., Leeds.)

VALVES

V1—VR136—EF54.
V2—6J5 (metallised).
V3—1625/807.
V4—1625/807.
V5—5U4G.

RESISTANCES

R1—1.0 MΩ ½-1 watt Erie Type 8.
R2—150 Ω ½-1 watt Erie Type 8.
R3—470 K Ω ½-1 watt Erie Type 8.
R4—10 K Ω ½-1 watt Erie Type 8.
R5—10 K Ω ½-½ watt Erie Type 9.
R6—150 K Ω 1-2 watt Erie Type 2.
R7—5 K Ω ½-1 watt Erie Type 8.
R8—220 K Ω 1-2 watt Erie Type 2.
R9—15 K Ω 2-3 watt Erie Type 1. (Matched or ±
R10—15 K Ω 2-3 watt Erie Type 1. 5%. See text.
R11—220 K Ω ½-1 watt Erie Type 8.
R12—220 K Ω ½-1 watt Erie Type 8.
R13—5 K Ω ½-½ watt Erie Type 9.
R14—5 K Ω ½-½ watt Erie Type 9.
R15—100 Ω ½-1 watt Erie Type 8.
R16—15 Ω 2-5 watt W.W. Erie Silertex Type SKC2400-Y or Welwyn or equivalent
R18—15 Ω 2-5 watt W.W. Erie Silertex Type SKC2400-Y or Welwyn or equivalent
(Matched or ±2%. See text.)
R17—100 Ω ½-1 watt Erie Type 8.
R19—400 Ω 5-10 watt W.W. Erie Silertex Type SKC2400-Y or Welwyn or equivalent.
R20—1.2 K Ω ½-1 watt Erie Type 8.
R21—1.0 K Ω ½-1 watt Erie Type 8.
R22—500 Ω ½ watt Erie Type 8.
VR1—50 K. 1-2 watt Erie potentiometer. Linear preferred but not essential.
VR2—25 Ω 1-2 watt W.W. or equivalent (Humdinger type)
VR3—100 Ω 1-2 watt W.W. Humdinger
VR4—100 Ω 1-2 watt W.W., Humdinger
(Radio Spares)

CAPACITORS

C1—30 pF. T.C.C. Type SMWN or 40 SMP or equivalent ± 5%.
C2—32 μF 450 v. wkg. electrolytic tubular insulated.
C3—8 μF 450 v. wkg. electrolytic tubular insulated.
C4—0.25 μF 500-600 v. wkg. T.C.C. Type 645 or equivalent paper tubular.
C5—0.25 μF 500-600 v. wkg. T.C.C. Type 645 or equivalent paper tubular.
C6—50 μF 50 v. wkg. electrolytic tubular insulated.
C7—32 μF 500 v. wkg. 600 v. surge electrolytic tubular can with insulating washer.
C8—32 μF 500 v. wkg. 600 v. surge electrolytic tubular can with insulating washer and large solder tag T.C.C. CE15P.
C9—8 μF 500 v. wkg. paper can type.
C10—0.1 μF miniature T.C.C. Type 343.
C11—2500pF T.C.C. Type 701 or equivalent.

IRONMONGERY

1 chassis, 16in. x 8in. x 2½in. Radio Supply Co., Leeds.
1 Pye plug and socket (input), with large earth tag to fit or equivalent Belling Lee.
1 5-pin plug and socket (pre-amp power).
1 paxolin cartridge fuse holder.
1 250 mA cartridge fuse, Bulgin.
1 earth terminal with chassis insulator. Belling Lee or equivalent.
1 paxolin tag strip, 5 tag (mains).
1 paxolin tag strip, 5 tag, or Greco terminal block (H.T.).
1 4-terminal connector. Greco or equivalent (L.S.).
2 2-circuit jack sockets. Radio Supply Co., Leeds.
1 jack plug. Radio Supply Co., Leeds.
2 octal valveholders.
1 B9G valveholders with locking device.
2 UX7 valveholders for 1625 (UX5 for 807).
2 1625 anode connectors.
16 s.w.g. tinned copper wire, insulated sleeving, 3-core mains flex, 2BA, 4BA and 6BA round-head bolts and nuts, connecting wire, Multicore solder.

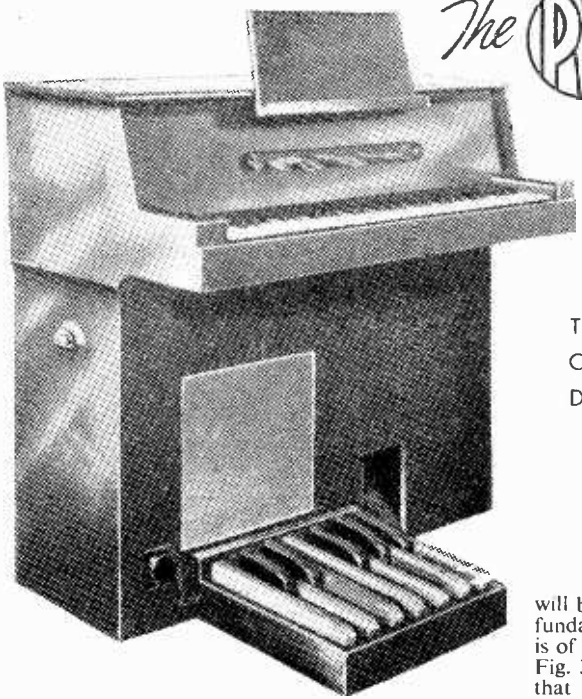
VOLTAGE AND CURRENT MEASUREMENTS

Taken with 20,000 Ω per volt meter and with 230 v. A.C. to 220/230 primary tap.

H.T. across C9	= 455 v.
H.T. across C8	= 450 v.
V3 and V4 anode to H.T.—	= 445 v.
V3 and V4 cathode to H.T.—	= 38 v.
Balance volts across R16 and R18 at jacks 1 and 2	= 0.75 v.
V2 anode to H.T.—	= 360 v.
V2 cathode to H.T.—	= 84 v.
V2 Eg/c	= 9.0 v.
V1 anode to H.T.—	= 75 v.
V1 screen to H.T.—	= 45 v.
V1 cathode to H.T.—	= 0.6 v.
Total current measured at fuse	= 110 mA.

RESISTANCE OF TRANSFORMERS AND CHOKES

Output transformer T2	
Primary 50 Ω—0—50 Ω	
Secondaries both in series	= 0.3 Ω
Mains transformer T1	
Primary 0-250	= 11 ohms.
Secondary 425-0-425 = 90 Ω—0—90 Ω	
Other secs. too low to measure with ordinary ohmeters.	
Choke 1	= 60 Ω
Choke 2	= 350 Ω



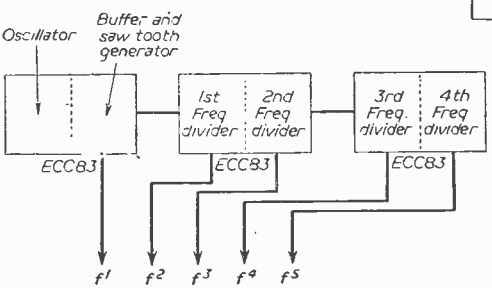
The PW FULL-COMPASS Electronic ORGAN

This Month the Main Principles of the Organ are Discussed, and Constructional Details are Given of the Mechanical Work Entailed on the Keyboard

By W. J. Delaney (G2FMY)

(*Continued from page 600 October issue*)

A FULL technical description of the organ would take considerable space and therefore only a brief outline of the arrangement will be given with more detailed information as each part is described. The entire scheme is outlined in block form in Fig. 1, from which it will be seen that the heart of the instrument is the note generator and frequency divider section. This is detailed separately in Fig. 2 from which it will be seen that three double triodes are used (Mullard ECC83's), the first as the oscillator and buffer, which incidentally converts the output from the oscillator to a saw-tooth waveform, which is the form taken by the output from each of the succeeding dividers. These three double-triodes produce five outputs, each one an octave lower than the frequency fed into it, and thus one chain of three such valves is required for each note of a single octave. For this essential section of the instrument, therefore, 36 valves are needed and these are disposed in groups of nine on four separate chassis, as will be seen later. The oscillator which generates the fundamental note (in the top octave of the keyboard) is of the phase-shift type (phase lag), and is shown in Fig. 3, which also includes the buffer. It will be seen that the standard circuit arrangement is used with a variable resistor between the phase-shift components (R1, R2, R3, C1, C2, C3, C4) and earth. This resistor, which has a value of 5,000 ohms, permits the frequency generated by the oscillator to be varied over a fairly wide range, and the condenser C5 is added to prevent interaction between adjacent oscillators. The second half of this first valve converts the output, which is held very constant by its stabilised H.T. supply, into a saw-tooth by the charging and discharging of condenser C9, and the output is taken from the anode through a blocking condenser (C8) in the usual way. The output is also passed to the next triode which is arranged as shown in Fig. 4, which again produces a saw-tooth output at half the frequency. This arrangement is extremely



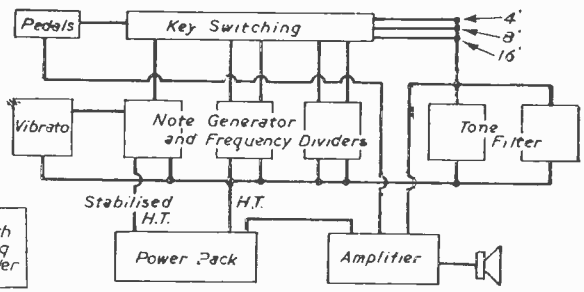


Fig. 1 (above).—Block diagram showing the essential arrangements of the design, and Fig. 2 (left) the manner in which the three double-diode triodes are employed for generating each note for five octaves. Twelve of these assemblies are used on four chassis.

simple and easy to adjust by variation of R1, and each subsequent divider is exactly the same. The arrangement was at one time used in the American Minshall-Estey organ, but has been replaced by a more effective circuit which, however, I have not found so simple for the amateur to set up. The scheme shown is very simple, has proved very stable and creates no difficulty in getting it working, and acknowledgment should here be made to the Minshall-Estey Organ company for permission to use the circuit and for assistance given in the design of this instrument.

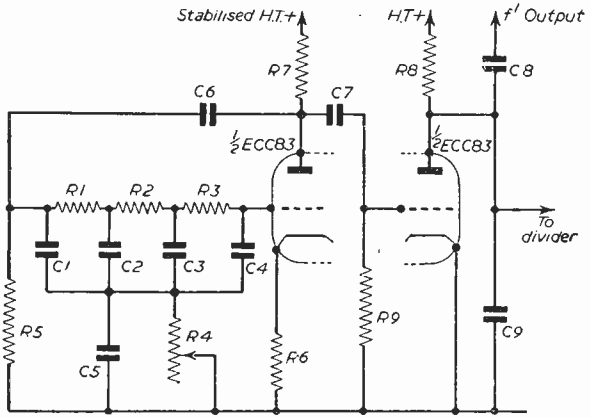


Fig. 3.—Theoretical circuit of the note generator and the buffer and saw-tooth converter. One of these is used for each of the 12 notes of the octave.

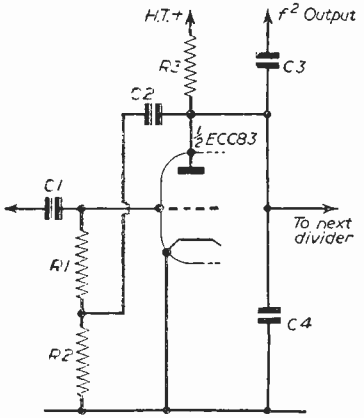


Fig. 4.—Theoretical circuit of the frequency divider. Four of these are used for each of the 12 notes of the octave, the only changes being in the values of condensers C1 and C4. Additional capacitors are used, as will be shown later, for coupling.

Keyboard Distribution

It will now be seen how an output for every note of the keyboard may be obtained and all that is needed is some method of switching. In this design three notes are fed to each key (except the upper and lower octaves), the fundamental and the octave above and the octave below. This is shown in Fig. 5, from which it will be seen that the outputs are also taken to separate octave busbars, thence to main busbars and finally to the main amplifier. Decoupling and click-filtering components are included as shown. The resistors shown broken are the remaining components in the various octaves, each complete octave being decoupled.

The majority of the construction is more or less standard radio practice, and the main difficulty will be found on the mechanical side. Each key must be arranged to open three contacts at the same time so that the fundamental and the two accompanying octaves are fed out. These, in turn, may be stopped or passed as desired by the switches marked "Range Switches." Therefore, a three-way switch must be attached to each key, and the outputs from the note generator and dividers must be taken to a three-way distribution strip, and this should be the first part of the work, as it is not possible to test the instrument or carry out any lining up until it is working properly. A keyboard must be obtained and there are various sources of supply for this, either the purchase of an old American organ or a visit to an organ builder who will be certain to have an old keyboard on hand. It may be of any type provided there are 60 notes. (The top C is not used and may be ignored or cut out.) Across the top of the key-

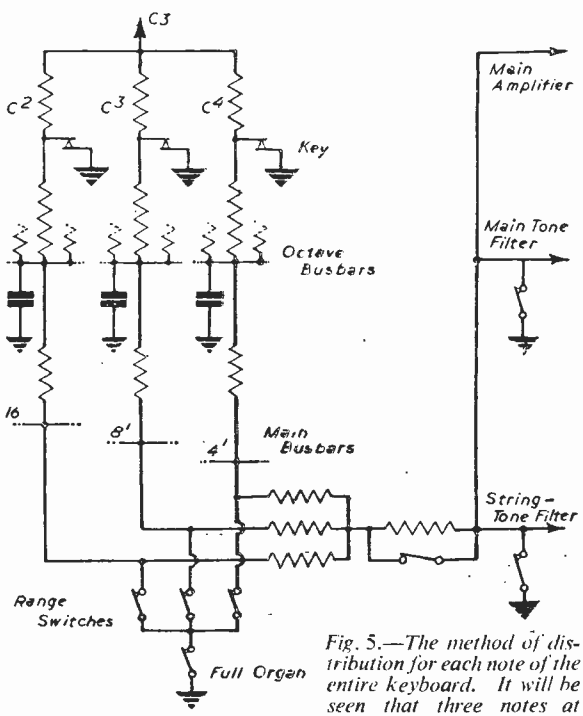


Fig. 5.—The method of distribution for each note of the entire keyboard. It will be seen that three notes at octave intervals are joined to each key which carries a three-contact switch.

board frame should be attached a board of either stout three-ply or stout hardboard, upon which may be mounted the distribution board and later the pre-amp. tone-filter and vibrato chassis.

For the distribution board obtain some $\frac{1}{8}$in. paxolin sheet and cut strips $1\frac{3}{4}$in. wide—either one or two strips to the total length of the keyboard. The strip should be drilled as shown in Fig. 6, and small mounting brackets made to stand them upright on the keyboard cover board just mentioned. Another strip or strips should now be made exactly the same size and long enough to stretch from one end of the keyboard to the other, and it should be drilled with a row of $\frac{1}{8}$in. holes as shown in Fig. 7. Each group of three holes should be the width of the keys, and therefore it is probably best to lay the strip across the keys and mark the positions in pencil before drilling. Some phosphor-bronze strip is next needed for the contacts and contact strips, and if any difficulty is experienced in obtaining this, Atomic draught-excluder strip may be used, obtainable from most ironmongers and builders' merchants. This is sold in rolls of 20ft. (and multiples of 20) and is 1in. width. It is easily cut with ordinary scissors and may be made as springy as desired by bending, as shown in the upper part of Fig. 7. Cut one strip as shown for each of the keys, and two dozen of them should be given two "fingers" by making a central cut, and the remainder split into three. Drill as shown, and

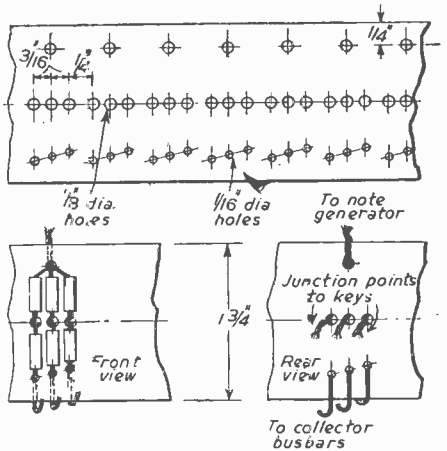
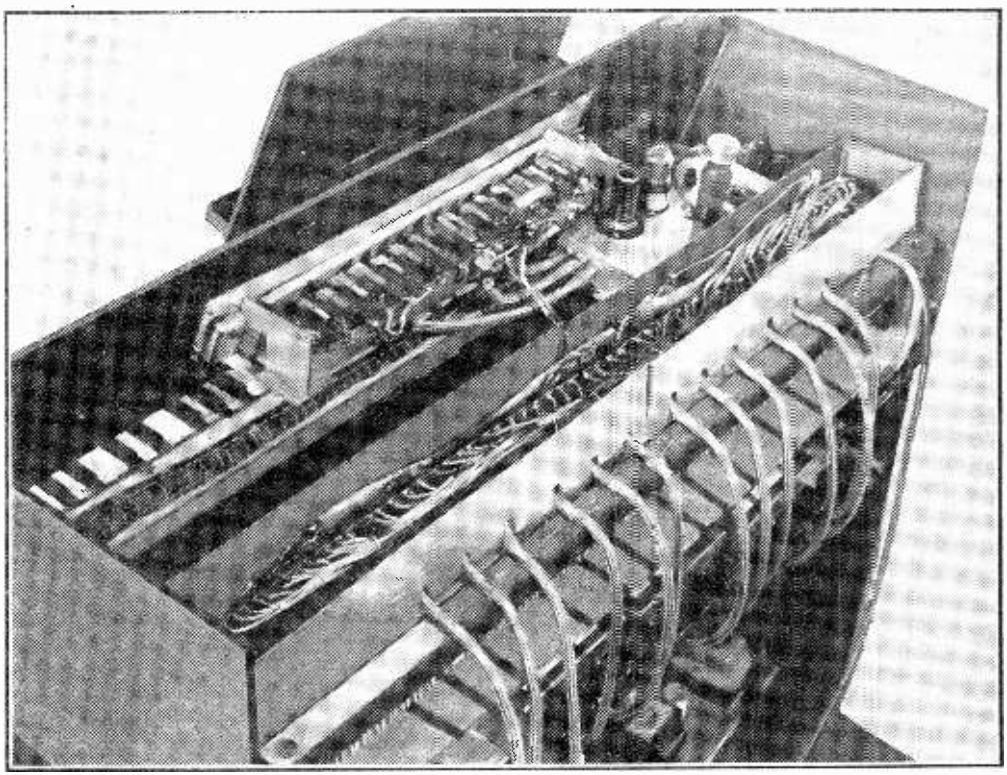


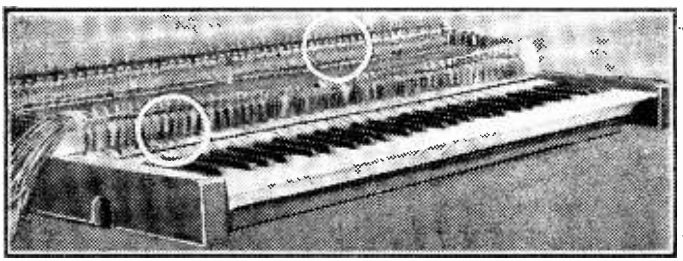
Fig. 6.—Details of construction of the main keyboard distribution board, seen at the rear of the keyboard in the illustration below. Dubilier type BTS resistors are wired as shown in the lower sketch.

bend to make them have an upward tendency when screwed down. 156 short pieces $\frac{1}{2}$in. by $\frac{1}{8}$in. should next be cut off, and the tips bent round with a small



This illustration shows the keyboard with distribution board, main key tabs and the small pre-amp, vibrato and tone-control valve chassis. Twelve screened five-way cables convey the outputs from the tone generators to the distribution board.

pair of thin-nosed pliers, the turn-over being pushed through the holes in the strip and clamped with flat pliers. The strips should be just wide enough to have to be forced through the holes, when the edges will just cut into the sides of the hole and they will not have a tendency to turn. This strip of contacts should now be attached to a 1½in. by 1in. length of batten, the ends of which should be cut if necessary so that it may be screwed to the keyboard frame with the contacts just reaching about ¼in. above the keys. The contacts should be approximately 2in. back from the ends of the ivory or celluloid covering of the keys, or the rear edge of the black notes (Fig. 8).



In this illustration of the keyboard during construction, the upper circle indicates the position of the distribution board as shown in Fig. 6, whilst the lower circle indicates the position of the arrangement shown in Fig. 8.

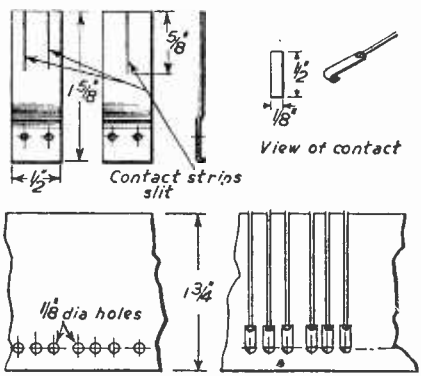


Fig. 7.—Details of construction of the key contact strips and the contacts.

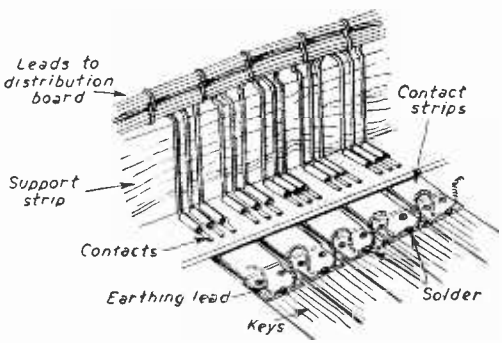


Fig. 8.—Details of the assembly of the key contact mechanism.

Contacts

Next attach the contact strips to the keys by means of two round-head No. 8 ¼in. brass screws, bending the cut ends upward so that they are approximately ¼in. above the keys. A length of wood strip may be rested on the frame to indicate roughly where the contacts will come, and the ends of the strips should be fairly well aligned to provide an even action. The two-contacts strips should be mounted on the end 12 notes at each end of the keyboard, the remainder on the rest of the keys. A length of fine copper braid should now be soldered to the top note and looped for about 1½in. and attached to the next note proceeding down the keyboard from note to note as shown in Fig. 8. At the extreme left, leave 2 or 3in. for subsequent earthing.

Attach the support strip to the keyboard frame and run along the keys to make certain that the edges of the contact strips touch the small contacts, and that they open when the key is depressed. Check with a battery and meter or bulb. This action is critical and for an even touch and response some time should be devoted to obtaining a nice even action. Lengths of 22 or 24 S.W.G. double-cotton covered wire must now be soldered to each of the contacts and made long enough to pass from the contacts out to the edges of the frame and round to the corresponding position at the back where the distribution board will be mounted. If you can obtain a length of Post Office multi-core cable this will serve admirably as it is colour-coded, but it is not essential. Before soldering to the contact strips slip a 1in. length of insulated sleeving over the end, and after soldering push this back over the soldered joint which will enable the entire assembly afterwards to be made rigid by pouring wax across the strip into the angle formed by the rising lead as shown in Fig. 8. The wires should be laced for neatness.

(To be continued).

On Your Wavelength

By Thermion

My Radio Show Ramble

MY annual pilgrimage to the Radio Show this year was undertaken with rather more than my usual zest and relish. It was a celebratory visit, for our twenty-first birthday number was widely acclaimed by all of the exhibitors, who wanted to waylay me and inveigle me into those back recesses of their stands where various bottles are provided for the delectation of honoured guests. Had I partaken of but a tithe of these generous invitations I fear that I should have seen little of the Show. It was nice, however, to receive so many congratulations, sincere and well meant. These came not only from members of the trade but from callers at our stand. Nostalgia at that stand was the keynote this year. Interest in set-building is as great as ever, although there were general comments on the absence of component manufacturers and our advertisers. I hope next year something will be done to bring them in.

The Show itself was very much better than last year and although the deplorable strike caused many of the stands to open unlit, the public nobly responded and attendance figures this year were up on last year. The stands were most attractive, but I cannot refrain from the comment that it is high time that the exhibition authorities co-operated with the R.I.C. and made the inside of Earls Court more attractive. At present it looks like a half finished factory which has been hastily thrown together. The recent Brussels Exhibition was tastefully decorated and furnished inside and provided a fit setting for the attractive stands. At Earls Court the attractiveness of the stands is not supported by internal decorations. The impression was that of some choice period furniture set in the middle of a cow shed. Exhibition authorities should realise that they have a duty to the industries which stage shows. They should not just take the money from exhibitors and plough none of it back.

Although there was some improvement in accommodation it was inadequate. I noticed women loyally traipsing behind their menfolk, weary footed and unable to be seated when, after waiting in a queue, they obtained a cup of tea. The lack-lustre look of most of the women showed that they are not really interested in the technical aspects of radio. One, however, did brighten up at the mention of the word "interlace." She thought it was some new fabric.

There were no startling developments in radio, and the accent was very naturally on television. Altogether the Show was a great success and, although I was able this year to visit it more often than last, I parted from it reluctantly when it closed its doors on September 12th.

Parlour Games on Radio

I AM sick and sated with this plethora of parlour games which have been plugged year in and year out on radio and television. "What's My Line?," "Down You Go," "Twenty Questions," are examples of the childish nonsense with which we are being fed on both sides of the BBC service. One comedian in one of these programmes is even making a living out of rudeness which he thinks is wit. One of these days, I suppose, they will discover the old games of Postman's Knock and Musical Chairs: These stupid programmes always remind me of that frightful bore to be found at any home party who wants to organise party games. Surely there should be some more originality in the BBC with their vast personnel, large numbers of whom are not kept fully employed?

Tape Recorders

THE Radio Show revealed a great advance in interest in tape recorders and one was shown in kit form for the constructor. This was demonstrated to me and I must say that I was most impressed with its quality and especially with musical recordings. I think it can be taken that wire for this purpose is on its way out, not only because of the poor quality of reproduction on music, for which it is quite unsuitable, but because of the ever-present risk of wire breakage. The wire is usually .003in. thick and frequent stopping and re-starting soon causes fatigue in the metal, which is constantly being bent round the spool. One point I have noted about wire recording is that it is not permanent. I made some records on wire and found that a few weeks later they were too faint to be audible.

Tape, on the other hand, is robust. It may be used for speech and music and it is cheaper. Sales of tape recorders are on the increase. They are not only useful for entertainment purposes (one can record one's favourite records, equivalent to over an hour's playing time, and play back without the bother of changing needles) but also for business purposes. One can dictate to it when a typist is not present. This method of recording must eventually oust the gramophone disc. At some time in the future our radio gramophone, tape recorder and television will be housed in one cabinet. Shall we ever dial GRAM on the automatic telephone and have played over to us for recording on our own tape one of our favourite tunes or concertos?

Tape recording has, indeed, become a hobby ancillary to radio and many thousands of them are being built.

Thanks!

I EXPRESS my thanks to those many readers who have written me personal letters of congratulation. They are too numerous for me to reply to individually, but they have all been read and their sentiments treasured.

An Electrically-operated Coil-winder

FITTED WITH A TURNS COUNTER, THIS INSTRUMENT WILL WIND LAYER OR WAVE-FORM COILS

VARIOUS types of coil winder have been described in these pages from time to time, but a power-operated unit appears to be the most popular. As back numbers describing a versatile motor-operated winder are now out of print, we are, by popular request, reprinting below the essential constructional features.

The main features of the machine are :

(1) A variable speed control.
(2) An automatic reversing clutch for the wire guide.
(3) A turns counter.
(4) A wire tensioning device.
(5) An attachment for wave winding.
(6) Facilities for winding back on to a wire spool.

Operation

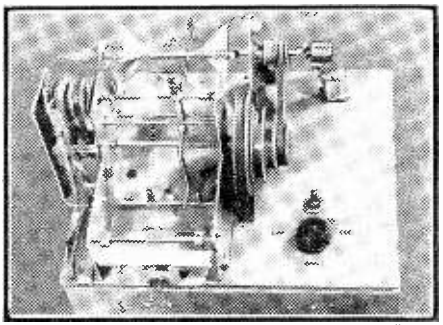
For layer winding the winder works as follows :—

The motive power from the main driving shaft is conveyed to the bobbin shaft by belt drives, so that the bobbin or former to be wound is rotated at the desired speed. At the same time the driving shaft is turning the main clutch pulley, which in turn drives the forward pulley or the reverse pulley according to the position of the clutch, the action of which will be described later. These pulleys rotate the 4 B.A. screwed rod in a forward or backward direction, moving the wire guide, and thus the wire, to the right or left. When the wire approaches the end of the bobbin being wound, the clutch reverses and the wire is wound back in the opposite direction. This action is repeated indefinitely, and so even layer-wound turns may be built up.

For wave-winding, the clutch mechanism is rendered inoperative by loosening the screw which secures the main clutch pulley to its shaft. It is then a simple matter to fix the wave-winding attachment in place, the action of which is self-explanatory from the illustrations. A large pulley is fitted to the bobbin shaft in order that a uniform wave-wound pattern may be produced.

Clutch Action

The action of the clutch mechanism is as follows:—After switching on the motor, assume that the wire guide is travelling from left to right. The cranked rod on the wire guide is approaching the reversing stop, finally makes contact with it and gradually pushes the clutch operating rod to the right. This in turn



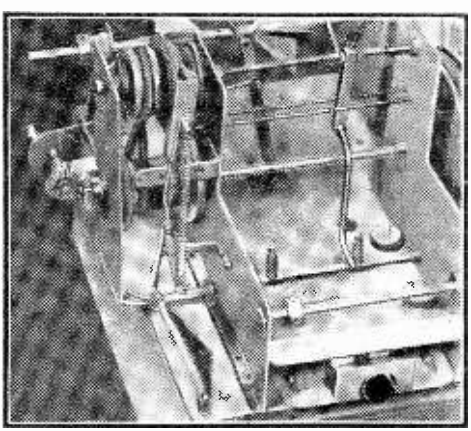
slowly pulls the first toggle until, at dead centre, the toggle clicks over and, by means of the fork at its end, pulls the second toggle over instantaneously to its opposite position. This action slides the moving clutch plate to the left and so pushes the reverse clutch pulley against its plate. This engages the catch pin and turns the reverse plate and the screwed rod in the opposite direction. At the precise moment when the reverse pulley is engaging, the forward pulley disengages itself from its forward drive plate due to the spring interposed between the two. The wire guide then traverses from right to left until the cranked rod engages the left hand reversing stop and again operates the clutch, and so on.

The reversing stops are adjustable and may be set to any desired length of winding. For construction see Fig. 1 and Fig. 3.

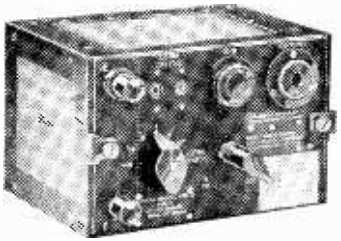
One may imagine that a single toggle would be sufficient to operate the clutch mechanism, but what is needed is an instaneous changeover. Due to the gradual movement of the first toggle (before it gets to dead centre) one would find that the engaged pulley would disengage itself but the other pulley would not engage until the toggle is finally pulled over. Consequently both pulleys would be running free on the spindle for a while and the wire guide would remain stationary whilst the bobbin would be piling up turns in one place.

This unwanted time-lag is overcome by means of the fork at the end of the first toggle engaging the lower arm of the second toggle at the moment when it (the first toggle) clicks over.

(*Continued on page* 685)



A detailed view of the clutch mechanism.



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1LN5	6 6	6CD6	11 6	7D8	8 -	77	7 6	KT63	8/6
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6AC7	10 -	6SL7	11 6	12SQ7	9 6	EF50	5 6	VU111	3/6
6AT6	8/6	6SN7	10 6	12Y4	7 6	EF54	5 6	VU120A	
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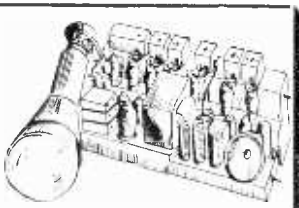

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Construction

Although at first sight the machine appears to be somewhat complicated, construction is not really difficult and in actual fact all the materials were collected from odds and ends that happened to be available. Naturally, a little care and patience are required in the construction of the various parts but this is amply repaid in the finished product. A plan view of the machine is shown in Fig. 1. For convenience, and in order to keep it out of harm's way and free from dust, the motor and its associated components are mounted below the brass plate upon which the winder is built. The plate is hinged at its back edge to a wooden box measuring 3¾in. deep. This was actually part of an old portable gramophone case that was available. The base plate measures 12in. by 11in. and is of any suitable metal about 3/64in. thick.

It is essential that the plate provides ample rigidity. The side plates are of similar metal 1/16in. thick. Their size and shape is shown in Fig. 2. These form the main supports for all the rods and shafts except the bobbin shaft. This is held by separate supports, which may be designed according to material at hand. Those shown in the photographs happened to be available. The bearing centres are approximately 2½in from the base plate.

At this point it may be mentioned that although, in most cases, sizes of the various parts are given, it should be realised that quite a large amount of freedom is permissible in this direction. It is advisable, however, to adhere to the specification of the main pulley bank, the bobbin shaft pulley and the toggles, as the dimensions of these items have proved suitable.

The three shafts may be rod of any suitable metal such as German silver, steel, brass, etc., and those shown are approximately 3/16in. in diameter. Bearings for these, except the reel shaft, are made from tubing to fit the rod, and ¼in. lengths soldered into the side plates and bobbin shaft supports is sufficient. A simple method of ensuring that the bearings are true is first to drill the side plates and supports and mount them firmly on the base plate. Slip the bearings (longer than required) on the shafts and fit them all in their relative positions. The bearings may now be soldered, after which the shafts are removed and the bearings trimmed to the desired length. By this means it is impossible for them to be out of alignment. The same applies to the clutch-actuating rod which is square (so that it cannot rotate around its own axis) and has square tubing to fit, as bearings. This rod *must* have a relatively easy action and should, of course, be lined up with the end of the first toggle. The rod is connected to it by a stout wire link, one end of which is bent accurately around the

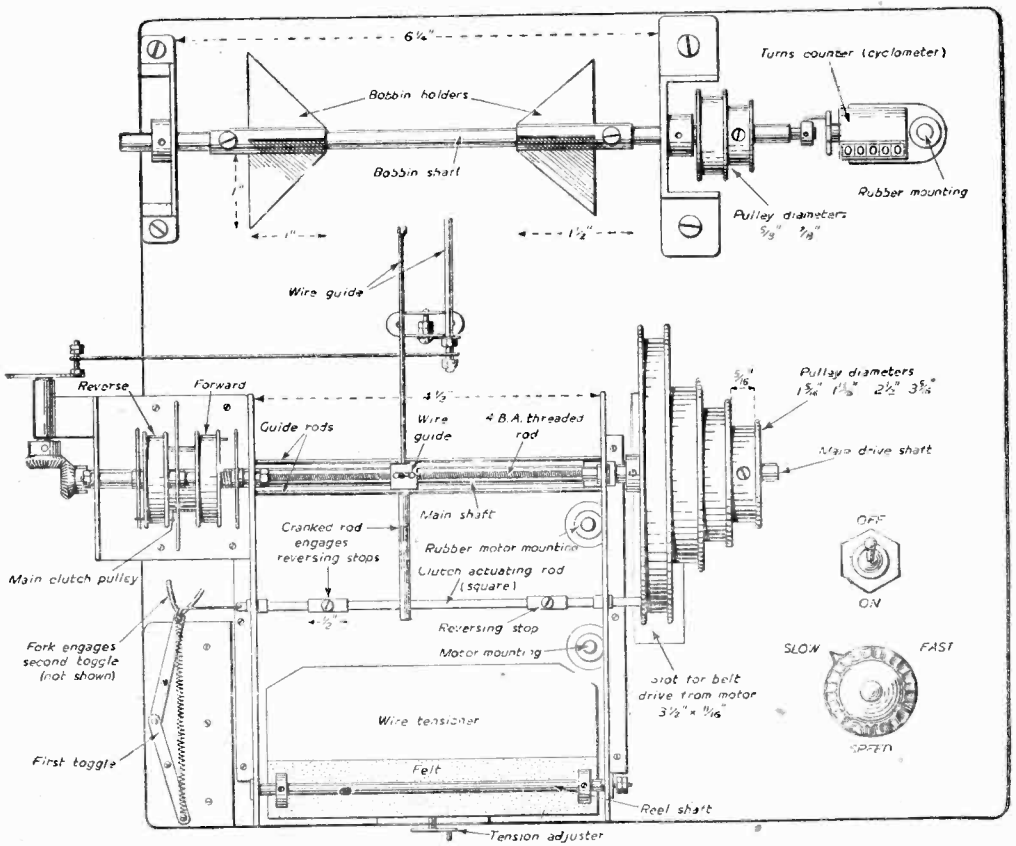


Fig. 1.—Plan of the complete machine with all parts identified.

spacer on the end of the toggle, the other end being bent down to a right angle and inserted into a small hole in the end of the rod.

The reel shaft has a type of quick release method of fixing. A bearing hole is drilled in the left-hand side plate and then a little plate is soldered over the outer side of the hole. The right-hand side plate is similarly drilled and a small swinging plate is arranged to slide over the outside. The shaft, cut to the length of the distance between the outer edges of the side plates, is thus firmly held in position when the moving plate covers the hole. A fixing collar each side of the reel prevents any sideways movement.

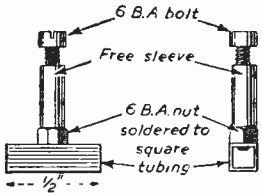


Fig. 3.—Details of construction of the reversing stops.

The construction of the wire guide is shown in Fig. 4, and is self-explanatory. The 4 B.A. threaded rod upon which the wire guide travels must be long enough to pass through the tubing which forms the shaft for the forward and reverse clutch pulleys, etc. A nut at each end of the shaft serves to lock it to the threaded rod. A short length of tubing is soldered to the other end of the 4 B.A. rod so that it may revolve freely in a suitable hole or bearing in the side plate.

The two guide rods serve to keep the wire guide running in a perpendicular plane and may be of small diameter.

Bobbin Holders

The bobbin holders (see Fig. 1), are made by soldering four triangular pieces of metal equidistantly around the axis of a length of tubing which will fit over the bobbin shaft. Fixing to the shaft is provided for by drilling a 4 B.A. clearance hole, soldering a nut over it, and fitting a 4 B.A. bolt.

In use the holders are more or less universal and a round or square bobbin is easily centred and securely held.

The four-bank pulley on the main shaft and the two-bank pulley on the bobbin shaft are both made from sheet Perspex. Diameters are shown in Fig. 1. Material 5/16in. thick was used to form the actual pulleys and ⅛in. for the flanges. The procedure is to mark out all the discs required and run a pilot hole through each centre. Then cut out the discs with the aid of a hacksaw or keyhole saw and file the edges true. If facilities are available, the discs are fastened to the chuck of an electric grinder or polisher and trued up with file and sandpaper. In any case great accuracy is not essential. The discs which form the flanges should have rounded edges. Next drill each disc centre to the diameter of the main drive shaft. *Note.*—Unless care is exercised in the drilling of Perspex the drill is inclined to wander. For this reason the pilot hole is suggested before cutting out. Next, line up the discs on a length of rod and fix each together with Perspex cement, or if preferred, countersunk machine screws—although this will entail drilling and tapping. When set, drill the centre of the whole pulley bank to a diameter *very* slightly smaller than the diameter of tubing which fits the main shaft. Then taper the end of a length of tubing and, after heating, push the tube slowly and accurately right through. This will " fuse " the bearing nicely in position. A little experimenting is advisable when heating the tubing, for if too cool it will not slide through and if too hot it will burn and enlarge the hole in the Perspex.

Finally, a shaft fixing is provided for by drilling and tapping through the radius of the smallest pulley and on through the bearing tube.

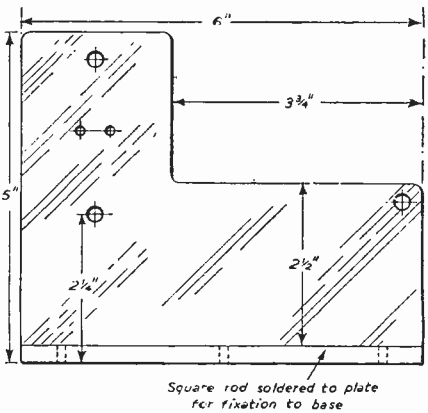


Fig. 2.—Shape and sizes of the sideplates. Two are required.

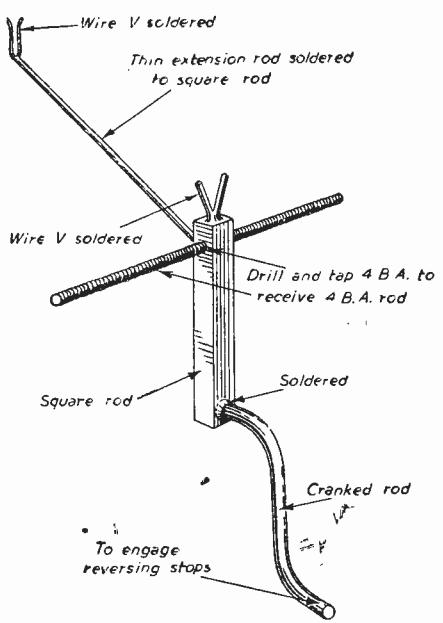


Fig. 4.—Constructional details of the wire guide.

The Toggles

The construction of the toggles is shown in Fig. 5 and 6, and if made up accordingly will operate satisfactorily. It should be realised, however, that the holes around which each strip swivels should be slightly elongated in order to allow of a free action

through dead centre. In addition, all moving joints should have a free action. With regard to the second toggle it will be seen from Fig. 6, that it is held by brackets A and B, fixed to the side plate. The object of this toggle is to slide the moving clutch plate to the right or left. This is achieved by the one-piece metal tongue attached to the top of the toggle arm and has a swivel joint. The tongue may be bent up from light aluminium and is arranged so that the prongs or tongues engage the outer diameter of the moving clutch plate but do not obstruct the pulleys.

The main clutch pulley which is driven by the main shaft is 1in. diameter, 1⅜in. long and has a flange of

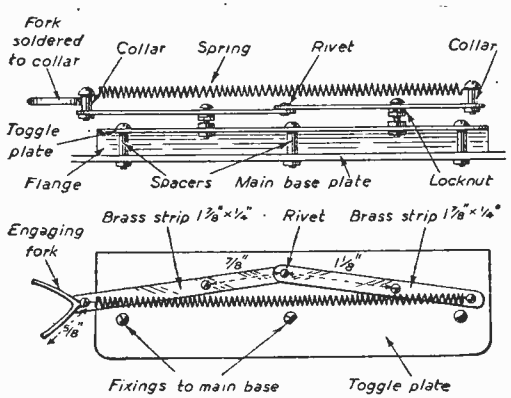


Fig. 5.—The first toggle seen in plan and elevation.

some ⅛in. The size of this pulley, however, is not important and something approaching this size will suffice. The one shown was a wooden wire spool or reel which was available. A bearing made from tubing to fit the shaft was pressed through the centre and fixing to the shaft provided for as previously explained.

Fig. 8 (which will be given next month), shows the arrangement of forward and reverse pulleys, their associated drive plates and the moving clutch plate. They are shown spaced for clarity and are mounted on a shaft of tubing of a size that is a good fit over 4 B.A. rod. The drive plates are identical in size and shape, but one is mounted in reverse in respect to the other.

They are both fixed to the spindle either by means of a driving fit or by soldering. The pulleys measure 1 1/16in. dia., with small flanges and are ⅛in. thick. Those shown are small wooden wire spools. Here again the actual diameter is relatively unimportant, so long as something approaching these sizes are used. The pulleys are bushed with tubing to fit the spindle, *but not carried right through* so that a recess of a little over ⅛in. is formed (see Fig. 8). Into this recess fits the spring (when compressed), so that the pulley, when engaged, may lie flush against its drive plate. A catch pin to engage the drive plate is fitted to the outer edge of both forward and reverse pulleys and may be achieved by driving a little brass pin into the pulley and removing the head. The edge should be slightly rounded so that it disengages freely. These pulleys run free on the spindle.

The moving clutch plate is merely a disc of stoutish gauge metal 2½in. dia. It is free running on the spindle and bushed so that it may slide either way in a true perpendicular plane.

Belts

Rubber bands or belts are fitted between the main clutch pulley and forward and reverse pulleys, that to the latter being twisted to effect reversal of direction. Due to the pull of these belts it was found necessary to provide a bearing plate for the two spindle ends. This is shown in Fig. 7. It is just a stout, right-angle bracket, bolted to the main base plate. The wire tensioning device consists of two pieces of metal 4in. x 2½in., hinged along the 4in. edge. The

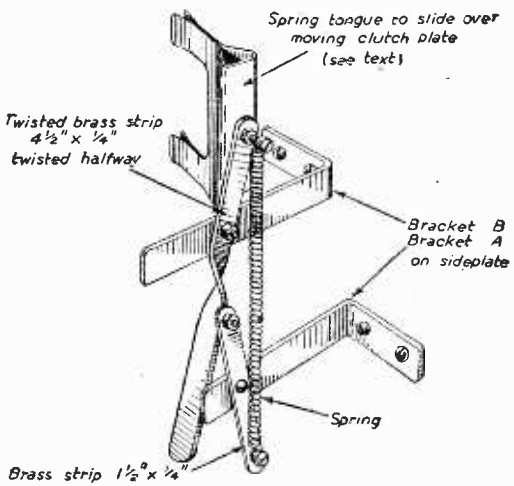


Fig. 6.—Details of the second toggle.

upper plate has a piece of felt stuck to the area that engages the flanges of the wire-reel.

The lower plate lies flat on the base plate and is secured to it by two 4 B.A. bolts screwing into tapped holes. The holes in the wire tensioning plate are elongated to the extent of about an inch so that it may be moved forward or backward, depending on the size of the reel being used. This is the coarse adjustment. The fine adjustment consists of a small, three-sided metal flange of] section made to move inside the angle formed by the two plates.

(To be continued.)

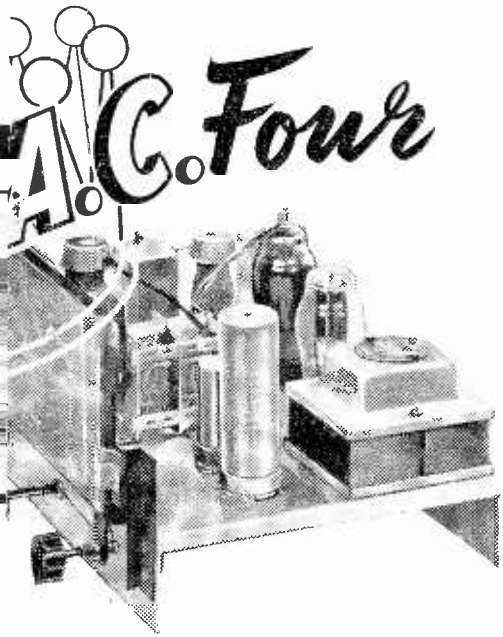
F. J. CAMM'S Coronet

FURTHER CONSTRUCTIONAL AND LINING-UP DETAILS WITH ALTERNATIVE COIL-PACK SUGGESTIONS

LAST month we gave full details which will enable most amateurs to construct the receiver and obtain satisfactory results. There are, however, a few points which have apparently presented difficulty to some of the more inexperienced constructors. First, the complaint has been made that no top-of-chassis wiring diagram was included on the blueprint. Actually, there are only two leads on the upperside of the chassis—excluding the lead to the top cap of V3 which was indicated on the chassis underside, and to which a top-cap connector is fitted. The two leads in question are to the top caps of V1 and V2, and that for V2 is already provided in the I.F. transformer. It projects from the top of the can and is joined to V2 top cap. The other lead is soldered to the top connecting point on the ganged condenser and provided with a screened top-cap connector subsequently fitted to the top of V1. To assist those who wish to check the performance of the receiver we give below a table of the voltages found at the essential points of the circuit. It must be emphasised, however, that it may not be possible in every case to duplicate these voltages. It is for this reason that we do not give them in all of our constructional articles. First, the actual meter will govern the exact reading which is obtained.

In the case of our measurements, for instance, they were taken with a meter having a resistance of 10,000 ohms per volt. If a low-priced meter having a resistance of only 1,000 ohms per volt is used, however, the readings will be lower. The reason for this is that the meter acts as a shunt across the points measured, and if it takes a current approaching that taken by the circuit being measured, it will obviously give the total reading at that point when the meter is in circuit, but not the reading of the voltage when the meter is removed. Similarly, if the meter has a higher resistance than the one we used it will show a higher reading.

This illustration of the completed receiver shows the two top cap leads.



Therefore, these readings must only be taken as guides. Obviously, if, in the case of the screen grid of V2, a voltage only 80 or so is registered, this will indicate a fault, as the meter could hardly account for such a large difference.

Loudspeakers

Whilst at the Radio Show many readers came and discussed the receiver with us. A point which seems to have given some difficulties is in the choice of a loudspeaker. We recommended a W.B. and these are available in a range of models. The receiver itself will deliver a reasonably high standard of reproduction, but obviously in such a simple design it makes no pretentions to being a high-fidelity receiver. Accordingly there is no justification for purchasing an expensive high-fidelity loudspeaker. The specified 8in. model, a standard Stentorian, will give quite a good standard of reproduction and only costs a little over £1. The hi-fi model costs over £3, and this will, of course, influence the total cost of the receiver. In this same connection arises the question of the parts specified. It has been our policy as readers know, to specify exactly the parts which we used in the prototype, and it is these which are listed in the published list of components. In many cases, however, some deviation is quite permissible. For instance, in this particular model we listed in the condensers two .1 μF condensers type CP46S. This reference or type number indicates that the particular condenser was a super tropical " Metalpack " in an aluminium case and that it was designed for a working voltage of 500 at 70 deg. The physical size of this type of condenser is not of great importance in the receiver under consideration, and thus the principal consideration is the working voltage. It would, therefore, be quite in order to use a Type 645 or even a Type 543, but we would not recommend the use of a condenser with a lower voltage rating in the interests of reliability. Similarly, in the case of the main smoothing condensers we used a 30 + 30 type CE37LA electrolytic. This condenser has a peak working voltage of 350 and a surge rating of 400 volts. It would be quite in order to use a 32 + 32 of similar rating, or even two separate 32's.

Lining Up

As mentioned in the issue last month, the main feature of the Roding coils is that they are pre-aligned, but the overwhelming demand has resulted in these being in short supply, and readers who are interested in the general design features have asked whether an alternative could not be used in this position. It must be emphasised, of course, that the fact that the coils are pre-aligned takes away the main drawback to many constructors—namely, the necessity for using a signal generator.

However, provided that a signal generator is available, and that one is prepared to go to the trouble of lining up, a coil pack such as the Osmor Type HO could be substituted. This, also, is a three-band unit and is complete with the 'necessary' tracking condensers. There are no coloured leads on it, however, and these will have to be attached to the five tags on the unit. To facilitate this change the following table shows the comparison—the first column giving the colour code used on the blueprint, and the second column giving the tag number on the Osmor coilpack

RODING	OSMOR
Black	1
Brown	2
Yellow	3
Red	—
Blue	4
Green	—

It will be noted that there are no corresponding numbers for the red and green leads on the original pack, and the 10 kΩ resistance joined to the point marked Green on the blueprint should be connected to terminal 5 via a 100 pF silver-mica condenser, and the .1 μF condenser ignored. The lead marked Red (the triode anode) should then be joined to the junction of the 10 kΩ resistance and the 100 pF condenser.

Some constructors may like to go over the receiver with a signal generator after construction with the original coils or with the substitute pack, and the procedure should be as follows. First, the generator should be set to 465 kc/s., and with a suitable termination to the generator output leads—dependent upon the particular make—this

TEST VOLTAGES

The following voltage readings were obtained on the receiver with a test-meter having an internal resistance of 10,000 ohms per volt, set to the 500-volt range.

V1—Anode 190 v. G2—120 v. Triode anode 150 v.
V2—Anode 200 v. G2—120 v.
V3—Anode 195 v. G2—200 v. Cathode 5 v. (25 v. range).

(*Concluded on page* 694)

TRANSMITTING TOPICS

EFFICIENCY MODULATION SYSTEMS

By O. J. Russell, B.Sc.(Hons.). G3BHJ

NOWHERE is the term "efficiency" more abused than in the electronic field. Various arrangements are almost invariably described as being "very efficient," modern valves are "more efficient" than other types and so on. Mostly, of course, the term "efficiency" is used in a very loose sense, and the expression "a very efficient circuit" usually means no more than a "very convenient" or a "very economical" arrangement. In fact, many radio devices are extremely inefficient. For example, a radio receiver may use up some 50 watts of power from the mains to produce one or two watts of audio-frequency power. This is an efficiency of, say, 2 per cent. to 4 per cent. conversion of energy. Further, this audio-frequency power is then fed to a loudspeaker which has an efficiency of, say, 5 per cent., so that the overall efficiency of mains power supplied to actual sound power output is some .01 per cent. to .02 per cent. Efficiency is thus a relative term, and one that could be used with more discrimination!

The amateur transmitter, however, is less likely to be confused about "efficiency," as the final P.A. stage running under Class C conditions may easily have an actual efficiency of between 50 per cent. and 80 per cent., with 66 per cent. as a nice convenient round figure to represent a good average. The "efficiency" in this case refers to the efficiency with which the D.C. power applied to the anode is converted into radio-frequency power. Thus a Class C power amplifier of 66 per cent. efficiency when drawing 100 watts of anode input, has an R.F. output of 66 watts. The situation is not altered if for telephony working anode modulation is considered, as an anode-modulated power amplifier operates under normal Class C conditions. However, the beginner is quick to notice that an anode modulator is required to produce large quantities of audio-frequency power, and requires a large and expensive modulation transformer to handle high audio power. In fact, anode modulation is expensive if one is thinking of modulating a 100 watt transmitter. The beginner may then be drawn to consider the "efficiency modulation" systems, which offer the attractive feature of enabling a 100 watt P.A, to be modulated by a watt or so of audio. A modulator for an "efficiency" system can in fact, be constructed using ordinary receiving components, and will give excellent results. The cost of a modulator for such a system is very low, particularly as the components are usually to hand in the spares box. Moreover, the term "efficiency modulation" has a reassuring sound, somehow implying that "efficiency modulation" is, in fact, a system of "high efficiency." The earnest enquirer is, in fact, somewhat disconcerted to find that the actual R.F. output available from an efficiency modulated P.A. stage is much less than can be obtained from the P.A. stage under Class C telegraphy conditions. Moreover, the actual R.F. output as compared with the D.C. power input is less. Thus a P.A. stage drawing 100 watts D.C. anode power, under efficiency modulation conditions, will give about 33 watts of R.F. carrier power output. This, then, seems to imply that "efficiency modulation" systems are *not* "efficient."

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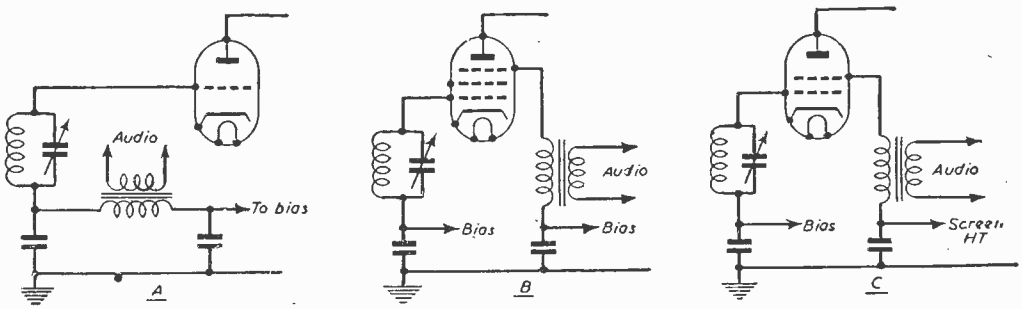

Fig. 1.—(A) Basic grid modulation circuit. (B) Basic suppressor modulation circuit. (C) Basic screen modulation circuit.

What It Means

However, it would not be correct to reject "efficiency modulation" systems on the grounds of "low efficiency" without further consideration of all the factors. In the first place, the term "efficiency modulation" really means that the efficiency of the modulated stage varies with modulation. In fact, under 100 per cent. modulation the efficiency varies from full Class C efficiency down to zero efficiency, By this means, the 100 per cent. modulation condition in which the R.F. output swings from peak output to zero output is achieved. What is also to be appreciated is that the D.C. input to the modulated stage *also* varies with modulation. Thus, in an amplitude-modulated stage the instantaneous peak output on 100 per cent. modulation peaks is actually *four times* the R.F. carrier level. In an efficiency-modulated stage the efficiency is doubled and the D.C. input is doubled on modulation peaks, thus achieving the instantaneous fourfold increase on modulation peaks. This *immediately* gives the clue to the carrier-operating conditions of an efficiency-modulated stage. The *unmodulated* ("carrier") condition is given by running at *half* the normal Class C efficiency and at *half* the normal Class C input. Thus a P.A. stage capable of 100 watts input at 66 per cent. efficiency for C.W. conditions would be operated at 50 watts input and 33 per cent. efficiency under efficiency modulation conditions with the same H.T. supply. Thus the "efficiency modulated" stage gives only one quarter of the R.F. carrier that can be obtained under Class C telegraphy operation. Providing this limitation is realised, efficiency modulation systems are capable of good quality modulation. In fact, efficiency modulation systems are quite widely employed, particularly in television transmitters for the Video channel. Trouble usually arises in amateur practice from the delusion that increasing carrier output by deviating from the above efficiency modulation conditions will give greater "efficiency." One cannot, of course, obtain something for nothing, and the modulated output of an efficiency modulated stage is obtained by sacrificing the standing carrier efficiency in the unmodulated condition. Thus. if we attempt to modulate a stage running at its full Class C efficiency of 66 per cent., we can only modulate *down*wards, thus creating appalling distortion. The absurdity of modulating to an efficiency of "132 per cent." on positive peaks is obvious.

Three Systems

Three main systems of simple efficiency modulation are used. These are grid modulation, screen modulation, and suppressor modulation. Screen modulation is the most popular method in amateur use, and is somewhat easier to adjust than grid modulation. However, as grid modulation can also be used with triodes, some pointers on adjustment are in order. Similar considerations apply also to screen and suppressor modulation.

For successful grid modulation it is, of course, essential that no high impedance at audio frequency is included in the grid return path. If a grid leak is employed it should have a condenser of some .1μF connected across it so as to provide a low-impedance path to audio frequencies. In grid modulated stages it is advisable that the bias be supplied mainly from a fixed battery or a bias pack of low impedance. In any case it is essential that the bias voltage be readily adjustable. Further, owing to the wide variations of grid impedance, a triode modulator or a pentode with heavy negative feedback is advisable in the modulator. A further refinement is to resistance load the secondary of the modulation transformer. If the secondary is loaded with some 10,000 ohms, and the transformer arranged to match this load to the modulator, it will be found easier to obtain good modulation behaviour. A final refinement is to load the grid R.F. tank circuit with some 15,000 ohms of resistance to improve the R.F. driver regulation.

Setting-up

With the above precautions a start can be made upon modulation adjustment. Initial setting up can very well be made using an artificial aerial load to the transmitter, as until good modulation is achieved it is poor "ham spirit" to inflict tests upon the air. It is, in fact, surprising that advocates of some modulation systems capable, when wrongly adjusted, of causing the most excruciating distortion, do not advise the use of preliminary artificial aerial tests to enable the "feel" of adjustments to be obtained without radiating interference. However, whether a radiating aerial or an artificial aerial is in use, a useful guide will be given by an R.F. ammeter indicating R.F. output current. Starting with normal Class C telegraphy conditions, the first step is to increase the D.C. grid bias to some two and a-half to three times the usual Class C value. The R.F. drive should then be adjusted until the R.F. ammeter indicates approximately half the reading obtained under Class C telegraphy conditions. Under these

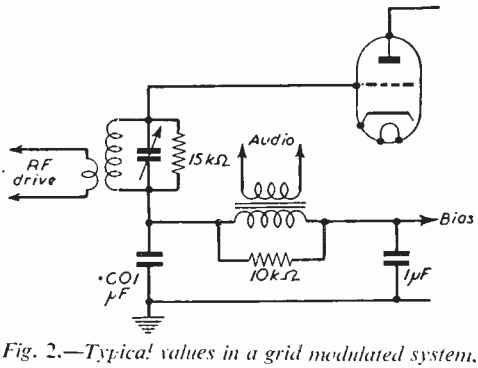

Fig. 2.—Typical values in a grid modulated system.

conditions the P.A. should be drawing approximately half its usual current. In any case one can now apply audio to the modulator, and the audio should be increased until upward kicks occur on the R.F. ammeter. If downward kicks appear on the R.F. ammeter, either the D.C. grid bias is too low *or* the R.F. drive is too high. Similar indication will be given by the P.A. plate current meter. Upward plate current kicks indicate too high D.C. bias, and downward kicks indicate too little D.C. grid bias. The D.C. grid bias should accordingly be adjusted in accordance with the plate meter indications until the plate meter is nearly steady under modulation. The R.F. drive may then be increased, until plate kicks again occur, and the bias can be adjusted to minimise the plate kicks. However, very high grid bias will necessitate a high R.F. drive, so that practically some three to five times cut-off bias is employed

with grid modulation. When a good depth of modulation can be achieved, the aerial coupling to the P.A. should be carefully adjusted. The final aim is to achieve a reasonable approach to the state in which the R.F. aerial current is approximately half that of the Class C telegraphy condition, and the D.C. plate input is also approximately half. D.C. bias and drive should be adjusted so that little or no plate current "kicking" occurs on modulation peaks. The difficulty with grid modulation adjustment is that both audio and R.F. are applied to the grid. Thus any adjustment of D.C. bias requires a corresponding change in R.F. drive.

With screen and suppressor modulation the same care has to be taken over the R.F. loading of the P.A., as distortionless modulation again depends very much upon the R.F. loading conditions. However, adjustment is very much easier, as R.F. and audio voltages are applied to different electrodes. Thus the R.F. drive adjustments do not interact very much upon the audio adjustments. For suppressor modulation a negative bias (usually specified by the makers) is applied to the suppressor. Here, upward plate kicks on modulation indicate too high suppressor bias, while downward kicks indicate too low a bias. In the case of *screen* modulation the screen voltage is generally reduced to half the value used for Class C telegraphy operation. For screen modulated stages, upward plate kicks indicate too low a screen potential, and downward plate kicks indicate too high a screen potential. Suppressor and screen modulated stages require care in drive adjustment, and generally drive must be reduced below the normal Class C telegraphy value. In all these systems the use of a cathode-ray modulation indicator is invaluable, as the precise effect of adjustments can be readily discerned. The cathode-ray tube allows of trouble-free adjustment for optimum modulation percentage and R.F. output. This is difficult to achieve in any other way except by trial and error methods.

Finally, with so much trouble to take, are "efficiency modulation" systems worth while? Taking the case of the owner of a 150-watt station, under anode modulation conditions, an input of 150 watts would give some 100 watts of R.F. carrier. A stage running at 150 watts input under efficiency modulation conditions would give a carrier output of 50 watts. Ideally then only some 3 db. or half an "S Point" of signal strength would be sacrificed. Moreover, the modulator would only be a question of a tetrode capable of some five to eight watts of audio output. The saving over a high level anode modulator would thus be appreciable. However, it would be necessary to use a P.A. stage valve capable of dissipating 100 watts on the anode, and furthermore such a valve would then be capable of an input of some 300 watts under Class C telegraphy conditions. The economy in audio equipment is thus obtained by having to provide for a P.A. valve capable of high peak R.F. output. This admittedly is cheaper than a high output audio modulator.

A further point is that where only *one* power pack is available to drive both P.A. and modulator, the final R.F. output available is about the same for an efficiency modulated stage taking the full power of the pack, and an anode-modulated stage and high level anode modulator sharing the full output of the power pack. It is thus clear that while "efficiency modulation" systems do not provide "something for nothing," there are certain attractive features. Perhaps their chief attraction is for the C.W. man who occasionally requires 'phone for local "rag-chews." The dyed-in-the-wool high-power 'phone operator is certain to want the utmost R.F. output possible, and will accordingly use high-level anode modulation. For obvious reasons, no reference is made to certain "high efficiency" types of "efficiency modulation" systems, which, in skilled hands, can produce modulated R.F. at similar efficiencies to an anode modulated stage at the cost of greater complexity and some difficulty in adjustment.

CORONET A.C. FOUR

(*Continued from page* 689)

signal should be fed into the grid of V2. The lead to the cap should, of course, be removed whilst this is done. The output from the generator should be kept as low as possible to keep down the A.V.C. action, and the volume control of the receiver should also be kept well down so that any changes are more easily heard in the speaker. Carefully adjust the two cores on I.F.T.2 for maximum response and then go from one to the other until both are exactly peaked. There will be slight pulling or changes made in one as the other is altered, but eventually they will both be so adjusted that the slightest movement on either core will result in a weakening of the signal.

Next, clip the generator output leads on to the grid socket of V1 and disconnect the blue lead from the oscillator grid. This is not an essential procedure, but many constructors find that the I.F.T.s may be more accurately aligned if the oscillator section of the mixer valve is rendered inoperative. Any other method may, of course, be used to stop the triode section from oscillating. Peak the two trimmers on I.F.T.1 in the same manner as before and when finally adjusted to maximum, turn one of the cores about a quarter of a turn forwards and the other the same distance in the opposite direction.

Tuning Coil Adjustments

Leaving the generator connected to the aerial input, reconnect the oscillator coil or do whatever is necessary to make the triode section function again, and then turn the tuning condenser to the low end of the medium-waveband and set the signal generator to, say, the Light programme. Set the signal generator to this wavelength or frequency, and adjust the oscillator pre-set condenser for maximum results. Then adjust the aerial pre-set condenser and in this way going from one to the other, obtain maximum performance. Then turn to the top of the medium-waveband and adjust the core of the oscillator medium-wave coil, then the core of the aerial medium-wave coil. This is the procedure on the remaining two bands—the pre-set condenser is adjusted at the bottom (low wavelength—high frequency) end of the dial, and the core at the top—high wavelength or low frequency. It will be found that there is a balance between the inductance of the coil, which is, of course, governed by the position of the iron-dust core, and the pre-set condenser, which will enable the dial to remain correct at all settings and also for maximum performance to be obtained right through the tuning range. If the core is not in the correct position, or the pre-set condenser is wrongly adjusted, the performance will vary at different settings.

VALVES

GUARANTEED NEW AND BOXED.

OZ4	6'-	6V6G	8'-	HL133DD	8 6
1A5GT	7 6	6V6GT	8 -	KT33C	11 -
1C5GT		6X4	8 -	KTW61	8 9
(DL/5)	8'-	6X5GT	7 6	KTZ41	6 9
1G6GT	6 9	6ZY5	7 6	KTZ63	6 6
1L4	7 6	7B7	8 6	MH4	5 6
1LD5	6 9	7C5	8 6	MS PEN	
1R5	8 -	7C6	8 6	(SP4)	5 -
1S4	8'-	7H7	8 6	OM9	9 -
1S5	8 -	7R7	8 6	Pen25	8 -
1T4	8 -	7S7	8 6	Pen46	8 -
1U5	10 -	7Y4	8 6	PEN220A	4 9
215SG	4 -	80	8 9	PL82	11 6
2X2	5 3	807	8 9	PY82	11 6
3A4	9 -	8D2	2 9	PY80	11 6
3Q4	9 -	954	2 -	R12	12 -
3D6	5 -	955	4 9	SP4B	9'-
3S4	9 6	956	3 6	U22	9 -
3V4	9 -	9D2	3'-	UB41	9 -
4D1	3 -	9001	6 3	UBC41	11 6
42	8 -	9002	6 3	UCH42	11 6
5U4G	8 6	9003	6 3	UF41	12 -
5V4	9 -	9004	6 3	UU9	9 -
5Y3GT	8 -	12A6	6 9	UY41	10 -
5Z3	8 6	12AT7	9 6	VR21	3 6
5Z4G	8 6	12C8	9 -	VR35	6 6
6A8G	10 6	12H6	5 -	EF39	7 6
6AC7	6 6	12J5	6 -	EB34	3 6
6AG5	8 -	12K7	10 -	EBC33	7 3
6AK5	9 -	12K8	9 -	EF36	7 -
6AL5	8 -	12SG7	5 6	EK32	8 -
6AM6	8'-	12SH7	5 6	SP61	3 9
6AT6	10 -	12SJ7	7 6	SP41	3 6
6B4	7 6	12SK7	6 6	P61	3 9
6B8	4 -	12SR7	7 6	EF50	6 -
6BE6	11'-	12SQ7	9 -	EF50 Syl	8 -
6C4	8 -	12Q7	9 -	EA50	2 -
6C5	7 6	12Y4	7 6	VR116	4 -
6C6	7 3	12Z3	8 6	DDL4	4 -
6D6	7 3	15D2	4 -	EF8	6 6
6F8G	7 6	25A6G	9 -	VR136	7 -
6F8M	8 6	25L6GT	8 6	VR137	5 -
6F8G	7 -	25Z4G	9 6	VR150 30	
6G6G	6 6	35L6GT	9 6		0 -
6H6	4 6	35Z3	9 6	EL32	8 -
6J5G	5 6	35Z4GT	9 -	KT44	7 6
6J5M	6 -	50L6GT	8 6	VT105	4 -
6J7M	7 6	AC6Pen	5 6	6R7	8 -
6K7G	6 -	CRP72	2 -	VT501	6 -
6K7GT	6 6	CV71	1 -	VP23	8 -
6K8G	9 6	DD13	4 6	VU39	8 6
6K8GT	9 6	DDL4	4 -	VU111	3 6
6J6	9 -	DH73M	9 -	VU120A	3 6
6L6G	10 6	DH81	10 -	VU133	3 6
6L7M	7 6	DL74M	9 6	W77	8 6
6N7	7 9	EB41	10 -	X66	3 -
6Q7G	9 -	EBC41	11 -	HD24	6 -
6Q7GT	9 6	ECH42	10 6	FL35	9 6
6SA7GT	9 -	ECL80	11 6	EL50	10 -
6SG7	8 9	EF36	7 -	HL1320	6 -
6SH7	6 -	EF41	10 -	HL21DD	6 -
6SJ7GT	9 6	EF50	11 6	1D6	8 -
6SK7	6 9	EL41	11 -	QP22B	8 6
6SL7	8 6	EM31	9 -	Z21	10 -
6SN7GT	10 -	EY51	12 -	SH1A	9 -
6SQ7	9 -	H63	7 9	W21	8 -
6SS7	8 -	HL23DD	8 -	77	8 -
6U5	8 6	HL41	8 -	18	8 -

MAINS TRANSFORMERS
3-way mounting type

	Each
MT1. Standard tapped Primary, 200/250v. Secondaries 250-0-250v. 80 m. a., 6.3v. 4 amp. 5v. 2 amp. Both filament windings tapped at 4 volts.. ...	17 6
MT2. As above with 350-0-350v. 80 m. a. H.T. winding..	17 6
MT3. Standard tapped primary 200/250v. Secondary 30v. 2 amps. with tappings at : 3v., 4v., 5v., 6v., 8v., 9v. 10v., 12v., 15v. 18v., 20v., 24v. ...	17 6
AUTO 0-10-120-200-230-250v. 100 watts	17 6

EX. GOVERNMENT VOLUME CONTROLS

500Ω, 600Ω, 10 KΩ, 20KΩ, 25 KΩ, 50 KΩ, 100 KΩ, ½meg.Ω, ½meg Ω, 1 meg Ω, 2 meg Ω ... each	1/-

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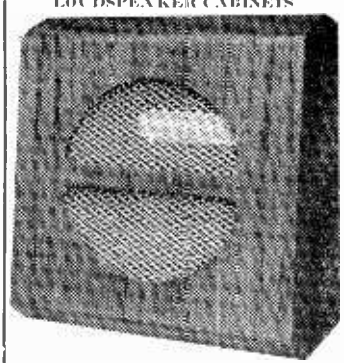
Pre-set types, 500Ω 200Ω, 1,000Ω ... ... each	1/9
Standard 5Ω, 200Ω, 1,000Ω 2,000Ω, 5,000Ω, 10 KΩ, 20 KΩ, 25 KΩ, 50 KΩ	2/-
Headphones, High Resistance Chr.	10/-
Headphones, Low Resistance Chr.	7 6
Yaxley Switch 1-pole 3-way... ..	1 6
Yaxley Switch, 2-pole 3-way... ..	1'-
Multicore Solder ... per packet	6d.
P.K. Self-tapping Screws No. 4 1in. ... ... doz.	3½d.
Rubber Grommets assorted ..	6d.
Microphone Transformer 60-1 ratio ... ... each	1 6
Paper Block Condenser 2 mfd. 1,000v.	1'-
Grid Caps Octal Push-on type doz.	6d.
Screened Grid Caps, British and U.S.A.... ... ... each	3d.
Yaxley Switch, 4-pole 3-way... ..	2 6
Yaxley Switch, 4-pole 2-way.. ..	1 9
Electrolytic Block Condenser, 4 mfd. 500v.	1 6
Crystal Diode	1 8
Bridge Rectifier, 12v. 3 a.	13 9
Single Gang .0005 mfd. Condenser	2 9
T.R.F. Switch	1 -
Standard Iron Element, 450 w. ..	1 8
Hydrometer, brand new in wood case	8 6
Bulgin Toggle Switch D.P.D.T. ..	2 3
Extension Speaker Vol. Control	1 3
Throat Microphones, 2 in box box	1 6
G.P.O. type Jack Plug ... each	1 3
Bell Push with Light	1 3
Car Bulb 6v. 18 watt	1 3
Car Plug Suppressors...	1 2

LOUDSPEAKER CABINETS



Available for 6½in. and 8in. speaker units. Polished walnut finish. A very attractive cabinet, at quarter of to-day's prices. Price, 6½in. type cabinet, 15 6 each.
.. 8in. .. 19/6 ..
See under Loudspeakers for suitable speakers units.

LOUDSPEAKER UNITS

	Each
3in. Plessey round type for portables	12 9
Elac 3½in. square type 2Ω to 3Ω ...	13 6
5in. Units by Lectrona and Elac ...	12 3
Truvox 6½in. Wafer Speaker. Only 1½in. deep	20'-
6½in. Elac with Output Transformer	16 6
8in. Units by Plessey and Elac ...	15 -

The MINI AMP

By R. Hindle

A VERSATILE MINIATURE AMPLIFIER AND ITS USE AS A BABY ALARM OR INTERCOM. SET

(*Concluded from page 592 October issue*)

FIG. 6 gives the other dimensions required. It will be seen that the main part of the chassis consists of a strip of metal bent into the shape of a letter "L" and of such dimensions as just to fit into the cabinet. A round hole is cut, 3in. in diameter, and central to the speaker position shown in Fig. 5 and the speaker itself is screwed to the front plate as low as possible. The power pack components are then mounted as indicated in Fig. 7, grouped round the speaker. The exact layout will depend on the actual dimensions of the components used, which must all be reasonably miniature if the resulting unit is to be no larger than the original. The power pack should be completely wired before fitting the upper shelf and three wires left for connecting power to the amplifier. A short piece of twin flex will be needed for the connection between the power pack and the on-off switch, which passes through a hole in the amplifier base-plate when this is mounted before being soldered to the switch connectors. Similarly, a piece of thin twin shielded flex such as is sold for pick-up connections is soldered to the speaker tags, one of which is earthed, and this also passes through a hole in the amplifier base-plate to be connected eventually to the "talk-listen" switch. There is not a lot of room for the two smoothing electrolytics, but it was found that one would fit along the top of the smoothing choke and the second fitted in along the top of the filament transformer.

Amplifier

The layout of the amplifier shelf is given in Fig. 6. The input transformer is one of the minature ones sold as output transformers for use with small battery valves and is mounted above the chassis so that it is shielded from the power transformer and choke. Before mounting the "talk-listen" switch this should be wired for the connections required between the tags as given in Fig. 2. To convert the three-way switch used for the prototypes for two-way operation all that was necessary was to turn up carefully a prong alongside the previously existing stop. This resulted in four connecting lugs around the switch being unnecessary for the job in hand. These were all connected together, however, and to the chassis and they formed a very convenient point to which the braiding of the connecting wire could be earthed. All the wiring of this switch and the leads to and from it were run in fine screened cable and the braid was soldered to this ring of earthed tags, anchoring the leads firmly as well as earthing them. Care must be taken, of course, not to damage the inner connector when soldering to the braid but if the iron is at the correct heat it will be found that the solder quickly runs and the iron can be taken away before the heat has penetrated.

With this switch in position the rest of the components can be mounted. Do not fasten the amplifier chassis to the main chassis at this stage or it will be impossible to get underneath. The amplifier should be completely wired, in fact, before assembling the two parts of the equipment. Nor should the change-over switch be wired to input and output until the amplifier has been made to work without it or it will complicate the process of tracing any fault that may be found present. Instead, first wire the amplifier as in Fig. 1, making temporary connections to input and output as shown and connecting longer temporary leads to the power pack output so that for first tests the amplifier can be kept apart from the pack so that its components are accessible.

A tag strip is mounted underneath the amplifier chassis at the output transformer end to take the power interconnections. Otherwise all components are wired directly to the valve tags concerned. They must all be small, of course, and must be fitted snugly so that they do not take up too much room. Care will be required in the placing of the three electrolytics, which are the only sizeable components

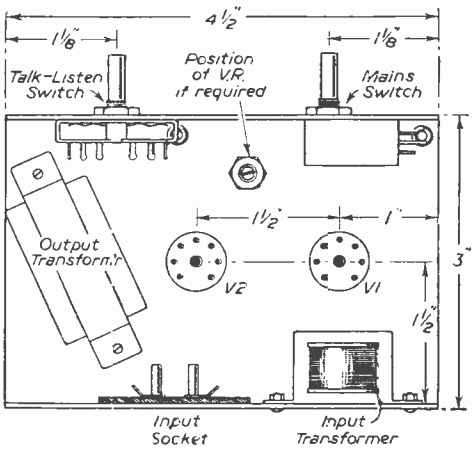


Fig. 6.—Amplifier dimensions and layout details.

used on the amplifier chassis. These were laid at the rear underneath the chassis and there they just cleared the components of the power pack.

At this stage the mains switch need not be fitted, but instead a length of flex should be connected direct from the heater transformer to the power supply. The temporary connections between the power pack and the amplifier can then be made, and the speakers to be used for the first tests should be connected direct to their respective transformers and not through the talk-listen switch. No difficulty should be experienced in getting the amplifier to work when so connected,

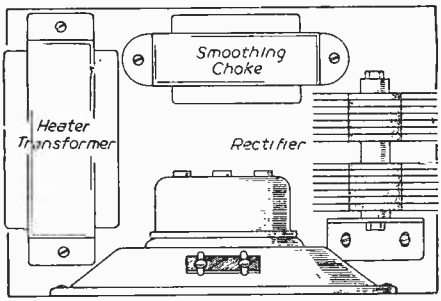


Fig. 7.—Details of the Power section layout.

but whilst working on the unit it should be borne in mind that the chassis is connected directly to the mains and care must always be taken to disconnect the mains completely by withdrawing the mains plug from the socket before making any adjustment or for any purpose touching the chassis.

When satisfied that the amplifier is in order the two parts can be brought together. The temporary leads are removed and wires for permanent connection are fixed to the power pack. As the two parts are brought together the mains lead from the heater transformer and the screened lead from the internal speaker are passed through the holes provided on the amplifier chassis. The amplifier is held on to the main chassis merely by the fixing nuts of the switches. That of the talk-listen switch is taken off, the spindle passed through the corresponding hole in the main chassis and the nut is then replaced to hold the two parts together firmly and in alignment. The mains switch can now be fitted. For use when the mains is connected to the chassis a two-pole switch is preferred, and to match the other switch a rotary operating mains switch is obviously desirable. The type actually used is the Bulgin type S256, which fits in very well. Make the connections to the mains switch at this juncture, but preferably give the amplifier another trial with the speakers connected direct to their transformers, and if all goes well so far the temporary speaker connections can be replaced by the switched connections of Fig. 2 and, if screening has been thoroughly carried out, no difficulty should be experienced.

A word might be said about C3. This should not be too large. Bass reproduction is not to be expected from such a small speaker and cabinet, and there is no point in trying to retain bass notes in the amplifier, particularly as hum is suppressed along with the bass notes. The suggested value is .01 μF. However, if it was decided to try the method of Fig. 4 to cancel hum a different problem is involved. To be of any use there must be a minimum of phase difference between the unwanted hum and the heater supply. If the hum is picked up in the first stage of the amplifier C2 will cause some phase shift, and to reduce this to reasonable proportions the condenser should be made as large as possible. Probably a miniature .1 μF will be the best that can be done.

For interconnection between the distant speaker and the unit lightweight twin PVC mains flex was found most suitable and can easily be run out wherever required. Some hum pick-up is to be expected from this lead, but as the connection is at low resistance it was not found troublesome.

The back of the cabinet will need to be drilled to allow the input plug to be inserted and for the mains lead to pass out. It should be remembered also that there will be more heat inside the cabinet than with the receiver for which it was originally designed, and it will be wise to cut away part of the back to allow ventilation, covering the aperture with fabric to keep out the dust. Another point is that the metal of the unit is connected directly to the mains and consequently precautions should be taken to prevent contact. A metal fabric is provided with the cabinet for the speaker aperture, but for this application it should be replaced by a piece of non-metallic material and the knob grub screws should be well sunk and the holes filled in with wax.

The Third Programme

Aerial Details

THE BBC announces that provisional arrangements have now been made for the Third Programme transmitter at Daventry, 464 metres, to resume operation using the main aerial. This transmitter has recently been operating at reduced power with a reserve aerial because of a fault which developed on the main aerial system.

Transmissions will, for the time being, continue at reduced power but with the main aerial in use there will be some improvement in reception—particularly for distant listeners who have been more affected by the reduction in signal strength.

The date on which the work on the main aerial is completed and the transmitter restored to its full power operation will be announced later.

Programme Times

It is also to be noted that the Third Programme now opens on Sunday afternoons at 3 p.m. To meet the additional cost the service will close daily at 11.30 p.m.

A full-length play or opera will normally fill the greater part of this extra three hours of programme time each Sunday.

Programme Pointers

By MAURICE REEVE

"The Immortal Bohemian"

THIS programme, which I looked forward to in my last article, has come and gone. Written and arranged by Spike Hughes from "The Life of Puccini," by Father Bante del Fiorentino, it occupied four episodes in the Light Programme, each of an hour's length. Though not all I had hoped it would be, it was quite an excellent series. Puccini was a figure ready made for Hollywood, Broadcasting House, Radio City, or where you will—a 100 per cent. entertainer—none of your metaphysical-cum-religious philosophical speculations as with Wagner, or your historical romanticism as with Verdi—an unashamed sensualist and the composer of some really magnificent music. That this has been dragged through the mire of cheap entertainment, and has suffered accordingly so that some of it is difficult to take seriously any longer, is partly its own fault. So have Handel's, Mendelssohn's and Chopin's marches through no faults of their own. And much else besides. It nevertheless intoxicates and spellbinds, even when it reminds us, through the association of ideas, with curried mutton and rice at a popular restaurant. Even the summer now closing has been referred to as a Madame Butterfly summer—One Fine Day.

The production rather fell down, I thought, on a shortage of operatic excerpts—a heaven-sent opportunity of which more might have been made. Also, James McKechnie as the maestro and Gladys Young as Elvira Gemignani seemed hardly Latin enough in their respective characterisations. Spike Hughes was his usual excellent self as commentator, and is to be congratulated on a fine and entertaining job. Malcolm Baker-Smith produced.

Voice of the BBC

I have frequently noticed that the reports we get in the news bulletins on different happenings, usually political and industrial, are word for word the same as those given by BBC political and industrial correspondents and experts in "Radio Newsreel." I suppose this is just one manifestation of the BBC's vice of repetitiveness in all it produces, of which it doesn't yet seem to be even conscious.

"Everest, 1953"

This was a thrilling presentation by Sir John Hunt and members of his great team—Tensing excepted through inability to be present—of their historic conquest of the world's highest mountain. Everest's 29,002ft., and the mystery of how, if at all, it came by the odd two, was, I think, the first item of general knowledge I came by as a child. It probably was with many another, too. Consequently, the doubts cast upon its exactitude from time to time, coupled with attempts at its correction, seem almost as acts of lese-majesty. The presentation of the story was all the more effective and acceptable for being almost entirely free of commentator's rust and clogging. Just a plain "Ladies and Gentlemen, Sir John Hunt," so to speak, and away we went.

"Portraits from Memory"

Bertrand Russell's new series, "Portraits from Memory," are as fine as everything this great man and excellent broadcaster gives us over the air. What a pleasure it is to listen to such a rich store of memories quietly and nostalgically unfolded.

Piano

Two piano recitals gave us some gorgeous and rarely-heard music. The "Goyescas" of Granados—both books—played by Eduardo del Pueyo very effectively, and the "Pictures from an Exhibition" of Moussorgsky, done by Rudolf Firkusny quite magnificently. Wonderful music.

"The Weekly Bind"

The new Murdoch-Horne-Costa, etc., feature, "The Weekly Bind," has got off to an excellent start. The first issues were packed with humour and well up to the best "Much Binding" standard. The cricket match report was enormously funny. How long can it be kept up?

History

"Bella Donna," by Howieson Culff, from Robert Hitchen's novel and G. B. Fagin's play, is an integral link in the chain of Egyptian history—Cleopatra, the Pyramids, Napoleon, the Suez Canal, Fashoda, Ruby Chepstow and so to Farouk and Neguib. Those of us who can remember Mrs. Pat and George Alexander as Ruby and Dr. Isaacson respectively, at the St. James's in days long past, had our memories usefully and agreeably revived. Mr. Culff was first rate both as the Jew doctor and the deriver for broadcasting. And Sonia Dresdel was coldly and ruthlessly lethal as Mrs. Chepstow. A good Edwardian example of liquidation.

Interviews

The series of unscripted interviews, "Frankly Speaking," continued with bringing Dr. Maude Royden before the microphone. This remarkable woman made a notable contribution.

I cannot refrain from condemning the "Ashes" Test Match comments given in "Radio Newsreel" the evening the game finished. I thought it was in the worst possible taste and more suitable to a revivalist meeting than a game of cricket. The speaker, in trying to be clever, failed lamentably.

Adding A.V.C. to Straight Receivers

A SIMPLE SCHEME FOR THE EXPERIMENTER

By T. W. Dresser

A "STRAIGHT," or T.R.F., receiver is easier to construct and to align than the most simple of superhets : it can be capable of a remarkably good performance using modern valves and iron-cored coils, and from an audio quality angle and that of a quiet background it definitely scores over the superhet.

The principal drawback, hitherto, to the T.R.F. short-wave receiver has been inadequate selectivity and the lack of A.V.C. Using good quality iron-cored coils the selectivity problem can be dealt with easily enough, and there then remains only the question of A.V.C. to be dealt with in order to bring the receiver, still retaining its initial advantages over the superhet, within reasonable measure of the latter in most other respects.

The provision of A.V.C. in a straight receiver is not quite as simple as it would appear on the surface. To begin with there are a multiplicity of detector types to be dealt with and such things as reaction to complicate the matter further. For these reasons, and possibly others, A.V.C. in straight sets has been avoided by the majority of designers and, in fact, in over ten years of perusing the technical journals only one design incorporating A.V.C. has been noted—that being in our pages in 1945.

Over the same period, too, the anode bend and infinite impedance detectors have come very much to the fore by virtue of their manifest advantages over other types, and this has some bearing on our subject. These types of detector, possessing as they do a high input impedance and, therefore, unlike the diode, not liable to affect the selectivity of their tuned input circuits, also have the additional advantage of being less liable to distortion on heavily modulated signals. Despite these definite virtues, however, neither type of detector has succeeded in attaining the popularity it merits and the reason is not hard to find. It is precisely that with which this article is concerned—the difficulty of providing A.V.C., more particularly as A.V.C., rightly enough, is regarded as a necessity in any modern receiver.

Results Obtained

Now if such a detector can be fairly simply combined with an A.V.C. circuit, it will be useful from all viewpoints : the signal quality and selectivity will be improved, fading reduced to a minimum, and listening pleasure greatly enhanced on account of these very factors.

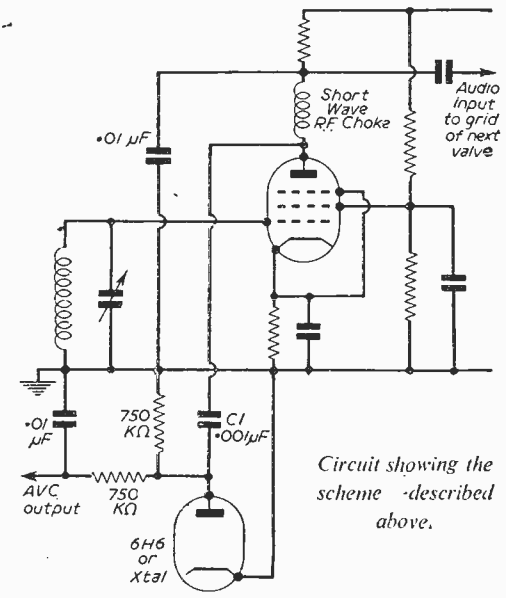
Probably it will not have escaped the notice of readers that in almost all such detector circuits an R.F. choke, together with its associated filtering condensers, is placed in the anode lead, and even where there is no choke invariably there is a resistor serving the same purpose. This gives us the clue to our A.V.C. arrangement. If R.F. were not present at the anode it follows there would be no need for a filtering circuit, but as there undoubtedly is, why not make use of it to provide an A.V.C. supply ?

The Circuit

A circuit, based upon these lines of thought, is given on the right, the detector in this case being of the anode-bend type. The R.F. choke in the circuit functions as a load impedance for the R.F. component of the detector output signal, and the voltage developed across it is applied by means of the coupling condenser C1 to a separate A.V.C. rectifier which may be either a diode valve or a Germanium crystal at the builder's discretion. The resultant A.V.C. is then applied to the grid or grids of the R.F. amplifier or amplifiers. In many cases it will be found that there is already an R.F. choke in the anode lead and all that is necessary then is to disconnect the decoupling condenser on the anode side and connect in its place one side of C1.

With an infinite impedance detector the procedure is just as simple. The choke is connected between the anode of the detector and H.T. plus, and C1 is taken off the anode as in the case of the anode-bend detector.

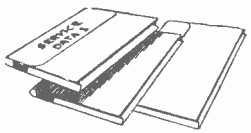
In conclusion, while the arrangements detailed here are very simple to carry out, they are very effective in every way. The high input impedance of both types of detector is not affected in any way and the A.V.C. action, due to the R.F. amplification in the detector (both these detectors are R.F. amplifiers, although poor ones) is excellent. It would seem that a receiver based upon this circuit would prove extremely good, using, say, two R.F. stages, an infinite impedance detector with A.V.C. as indicated in this article, a low power audio stage and push-pull 6F6's or KT61's in the output stage. Such a receiver would have just those advantages mentioned in the first paragraph—namely, excellent station-getting properties, constancy of signal and good audio quality, and from my own experience I know that those things can contribute much to the enjoyment of short-wave listening.



Circuit showing the scheme described above.

CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2 9 each. Colours available : Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10 -.



SERVICE DATA

100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makers are included : Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers " all dry," etc., which have been imported into this country. Names include Sparton, Emmerson, Admiral, Crossley, R.C.A. Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

SOMWEAVE

This really lovely loudspeaker fabric we offer at approximately a third of today's cost. It is 12in. wide and our price is 12/- per yard or panels 12in. x 12in., 1 9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

BE PREPARED

for a cold winter by making our low cost Electric Blanket. 27 yards of special heater wire and blueprint. 20/-. Blueprint only 1 6.

Complete kit comprises Hi-craft 40 watts control unit, starter lamp, lamp holders, clips and wiring diagram. Price less tube, 22 6, plus 1/6 post. With tube 30/-, carriage and insurance 3/6. Tubes 7/6 each, carriage free minimum quantity 6.

TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. 16 x 16 x 7 —walnut veneered and satin finished. Complete with 3 colour, 3 waveband glass scale at only 37 6, carriage and packing 3/6. We also have a limited quantity of the complete chassis to fit these cabinets, specifications 5 loctal valves, standard long—medium and short wavebands, A.V.C. 8in. speaker, A.C. mains operation. Price £9.19.6, plus 10 - carriage and insurance. H.P. terms £3.7.0 deposit, or with cabinet £4.0.0.

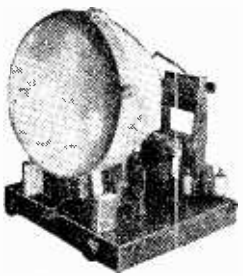
" MIDGETRONIC "
Radio Cabinet

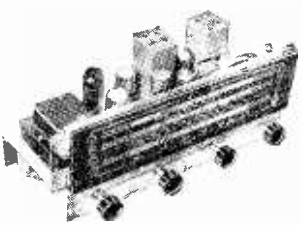
This pleasing small cabinet is in bakelite and is supplied complete with dial rinz, pointer as illustrated but less knobs, also included is metal chassis and hardboard back. Price 15 -, plus 2/6 postage and packing. Circuit of £3 radio to fit, 1 6.

THE SUPERIOR 15in.

Up to the minute TV for only £37-10-0.

A 20 valve televisor for the amateur constructor, all components, valves and 15in. Cossor Cathode Ray Tube costs £37 10.0 plus £1 carriage and insurance or £12.10.0 deposit and 12 monthly payments of £2.11.6. Constructor's envelope giving full details and blueprint 7 6. Returnable within 14 days if you think you cannot make the set.





This is a 5 valve A.C. superhet, covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. The latest type loctal valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9.19.6 complete with 8in. speaker. Carriage and insurance 10 -. H.P. terms £3 7 - deposit. Table model cabinet to suit—37 6 plus 3 6 postage and insurance.

THE MONTH'S SNIP

Superhet 5-valve three wave-band radio chassis made by BEETHOVAN. A.C. mains working (110 to 250 volts) all MULLARD valves, large illuminated dial, chassis size 9½ x 7½ x 8½ complete with ROLA speaker Ready to work, fully guaranteed price £7-17.6, carriage and insurance, 7 6.

ADJUSTABLE THERMOSTAT

250 v. heavy silver contacts can be adjusted to operate between 70 deg. -300 deg. F. These are suitable for aquarium heaters, electric blankets, etc., etc.

1 Amp. Model. 3/6.
2 Amp. Model. 5/6. 5 Amp Model 14 6. Post, etc., 6d. extra. Don't be cold this winter, make an Electric Blanket, blueprint 1/6 post free.

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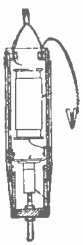
THE ELPREQ GENERAL PURPOSE AMPLIFIER

A self-contained A.C./D.C. mains operated amplifier which has 101 applications such as for dance-band in small halls, factory call system, gram. amplifier, baby alarm, etc., will drive 4 extension speakers. Complete with hand microphone and built-in speaker in portable carrying case, fully guaranteed. 9 gns., or H.P. £3 4 - deposit, plus 5/- carr. and insurance.

LAST FEW £3/19/6 LAST FEW

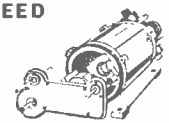
The Lectross warms room as it dries clothes. Size 3ft. wide, 3ft. high and 5in. deep. It has four stove-enamelled rails and works off A.C. or D.C. mains, consuming 650 watts. Fully guaranteed. Price £3.19.6, plus 7 6 carriage.

RADIO STETHOSCOPE



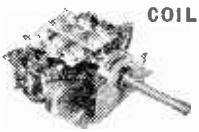
A novel device aptly called a Radio Stethoscope is described in a recent edition of the " Radio Constructor." With it in most districts a receiver can be checked from the grid of the first valve right through to the output. It is a complete fault-finder. The only parts needed to make the simple circuit tracer are a pair of crocodile clips, a germanium crystal, and a paper tubular condenser, and we will supply whole outfit for 6/6, post free, and with each outfit we will give reprint of the article as it appeared in the " Radio Constructor."

MULTI-SPEED MOTOR



Works off A.C./D.C. mains fitted with gearbox any speed from 1 r.p.m. 12 6, post and pkg., 1/6.

COIL PACK SNIP



Manufactured by quite a famous company, this 3 wave Coil Pack incorporates a Gram position and Long, Medium and Short wave band, designed for 465 k c s I.F. Brand new and fully guaranteed, complete with circuit only 19 6, limited quantity so act quickly.

The Other Side of Service

SOME INTERESTING EXPERIENCES BY A SERVICE ENGINEER OF OVER 30 YEARS' EXPERIENCE

By F. E. Apps

THE job of a service engineer can be most diverting and often amusing. The most interesting incident of any, to me, happened a few years before the outbreak of the last world war. At the time I was a field service engineer with one of our largest manufacturers, and on reporting one morning to our London depot, the manager sent for me. He informed me he was sending me on a most important job. He gave me a very impressive talk on how I must maintain the high reputation of the firm, etc. etc. I began to think that this is a Buckingham Palace job, or perhaps even the Kremlin! However, it turned out to be a visit to the Empire Nursing Home, and the client was the late His Excellency, The Marchese Marconi. He was on a visit to this country at the time and had been taken ill. One of our associated companies had lent him a set so that he could listen to Rome whilst in bed. This set had, unfortunately, broken down after a couple of days, and it was my job to put it right and ensure that it did not happen again. Of course, I felt rather proud of the assignment, but also a certain amount of trepidation, at having to service a set for, and in the presence of, the " Father of Radio."

His Excellency was in bed when I arrived and greeted me very cordially. The job was quite a simple one. Packing had been left inside the receiver and had shifted slightly, lifting the grid cap off the frequency changer. The D D T also had a slight heater-cathode leak. Changing the valve, replacing grid cap and checking over took only a few moments, and within a quarter of an hour of my arrival Marconi heard " Radio Roma " again. He was very pleased about this, and frankly informed me that he knew very little about present day receivers and could not possibly have serviced it himself. Having completed the job to his satisfaction, he then conversed with me for about half an hour. He told me that he had been conducting research into microwaves on his yacht *Electra*. He inquired of my experience in radio and was interested to know that I had used his first receiver, the " Magnetic Detector." whilst serving as an operator in the Royal Navy. It was, in fact, a very interesting half-hour, and one that I shall always remember. I have one regret about this job. His Excellency signed my job sheet as being very well satisfied. I had to return this but made application for at least a copy to keep. Somehow it apparently disappeared at the Head Office and could not be traced. Thus I missed having a service sheet signed with the magic signature—G. Marconi.

At St. Martin's

Of the amusing jobs I think the one at St. Martin-in-the-Fields was perhaps the most laughable. My job there was to completely overhaul and, if necessary, rewire the P.A. system of the church. It took a few days to complete, owing to the church being used quite a number of times for services. When these were not occurring, one had to move quite reverently about the church as people were continually calling in to pray. This meant that testing pulpit and choir microphones was somewhat difficult. However, the job was completed and a final test was necessary. In the crypt there was a receiver and amplifier that was used to broadcast the BBC services to the main church and this, of course, had to be checked. I switched on the receiver in the crypt and heard the BBC broadcasting some chamber music which I considered was not unsuitable for checking the speaker in the main church. I switched on the amplifier and then proceeded up to the church, but on my arrival was met by the verger who in a horrified voice said, " For goodness sake, switch off." I did so and then went to find out what all the trouble was about. Apparently, during the time between when I first heard the BBC and my arrival back at the main church, the programme had changed and hot jazz was being broadcast in the church to the consternation and horror of some old ladies who were praying there. I thought to myself, " I'm for the high jump here," but everything turned out all right. The Vicar, who I believe I am correct in saying was the late Dick Sheppard, came to the church to see me. He said : " What have you been doing in my Church ? " I explained it to him and he smiled and said, " It was unfortunate. Well you won't hear any more of this but I will. Probably for the next six months some old dears will remind me about it."

He was right, I never heard any more of it, but the memory of the looks of horror on the old ladies' faces will remain with me always.

Upsetting the Conductor

Another amusing thing happened when a bunch of engineers were installing a complete new set of equipment in the Royal Opera House. This was a rather complex job with many speakers and microphones with appropriate switches and fading apparatus. It was a rush job and we were working late one evening making the final touches. There was a certain amount of hammering going on, and a certain very well-known conductor was conducting a final rehearsal. Apparently, the hammering disturbed him, for he suddenly stopped the rehearsal and shouted out to us to stop everything until he had finished. There was complete silence for a moment, then from the speaker came a tremendous " raspberry." This was caused by the chap on the P.A. switchboard getting a bit panicky and not switching off in proper sequence. When the " raspberry " was heard, the conductor, who was well known for his temperamental ways, went almost white with anger, but the whole situation was saved when the chorus burst into laughter. By this time the conductor saw the funny side of it and he even deigned to smile. In the end he got his own back by keeping that rehearsal going as long as possible, thus keeping us working well into the night to complete the job.

Pot of Earth

Of another job I went on, I had heard many times but I did not believe it until it actually happened to

me. A caretaker in one of the big city business premises had purchased one of our sets which he said was faulty, as he was getting a lot of interference. On switching on his set it was certainly noisy, but this was definitely due to electrical interference. He had an indoor aerial, although he could easily put up an outdoor one, as he occupied a flat at the top of the building. I advised him to do this and then questioned him if the set was earthed. He said yes—and a good earth, too. I checked this and found the lead going to an earthenware vase underneath the table on which the set was standing. This was filled with earth and a copper earth rod embedded in it. He was really surprised when I told him that it was useless, and he informed me he had purchased the best leaf-mould possible. I am happy to say that when he had his outdoor aerial and an earth on to a rising main water pipe, most of his troubles disappeared.

At a Mayfair Flat

Another job that was very intriguing was at a small flat near Shepherd Market. A radiogram had developed a fault on the radio. The lady had a Scottish name, but when she opened the door to me she was Parisienne to the eyebrows. The flat was rather ornate and smelt to the heavens of scent, face-powder, etc. Some rather striking pictures were on the walls, the lighting was dim—in fact the place reminded me of something I had seen somewhere before. I tackled the set and found it was an intermittent fault in an I.F. stage, but before I could locate it, the lady requested me to leave for about half an hour as she had a gentleman calling. Being desirous of a cup of tea, I acquiesced. On returning I carried on with the job, but after about ten minutes I was again asked to leave for half an hour. I had to go, but rang up head office and explained the situation. They said carry on as customer desires. Well, five times I had to leave, but eventually after six hours on the job it was completed. I only hope that her gentlemen friends stood the charge for the time spent on that job.

A Valuable Bowl

One job that was tragic for me in the first case, but later turned out O.K., was when I was sent to install a large radiogram for an M.P. At the time this M.P. was the Chief Whip. An anti-interference aerial had to be fitted at the same time, so a man was sent to do this with me. I went up on the roof, which was easily accessible, and pointed out where the aerial was to be fitted and where the screened down lead was to run. I then went down to the set to remove transit bolts, etc., and check over. By this time the aerial engineer had rigged the aerial and run the down lead outside the room where the set was being installed. I instructed him to wait until I had inspected the aerial before bringing the screened lead into room. I went up to the roof wearing a raincoat and inspected aerial and down lead. Finding everything O.K., I came down, and my coat being wet (it was raining), I went down to the servants' quarters to hang it up. Whilst talking to the butler below stairs, we both heard a terrific crash from up top. On investigation we found that the aerial engineer had ignored my instructions, entered the room and knocked over a glass bowl. The pieces were swept up and I carried on with the job. When finished, I rang up head office and told them of what had occurred. They asked me to estimate the damage. I quoted 4s. 6d. Glass bowls of that description were approximately that price.

Two days later both the aerial engineer and myself were on the carpet. The glass bowl turned out to be a family heirloom, approximate value £2,000. Both of us were sacked by the London manager. Of course, I was not satisfied with this and immediately wrote to the M.P. in question, pointing out that it was in no way my fault as his own butler could testify.

The happy result was that this M.P. wrote to the firm to waive all claims if I was reinstated, and I am glad to say that this was done. So now, of course, I say M.P.s are sometimes quite useful.

Heir to Millions

I once had to make a service call on Barbara Hutton, who at the time was living at Hyde Park Gardens. At the time much publicity was being given her and her baby son. I was shown into a room by the butler and left to get on with the job. When it was completed the butler came back and asked me if I would like to see the baby which was just being taken out for an airing in the park by his two nurses. I went and saw him, but when the butler said "See how he smiles," I could not help saying, "Who wouldn't, if they were worth a couple of millions." The room where the radiogram was installed was practically empty except for a couple of sideboards and a cabinet, on and in which were what appeared to me to be some old vases and bowls. The butler informed me that these were real Chinese jade and worth over £100,000.

Book Received

"GUIDE TO BROADCASTING STATIONS," 7th edition. Published on September 1st, 1953, by Iliffe and Sons Limited. Size D16mo, 5¼in. by 4⅛in. 104 pages. Price 2s. (postage 2d.).

This useful little book has been fully revised and enlarged for its seventh edition, and now provides data (corrected to August 1st, 1953) on the world's broadcasting stations. The book lists first in order of frequency and then geographically all the European long- and medium-wave stations, and over 1,600 short-wave broadcasting transmitters working on a power of over 1 kilowatt throughout the world.

The long- and medium-wave list shows the channel allocated to the station under the Copenhagen Plan, the frequency, wavelength and output power. The short-wave list shows the frequency, wavelength, output power and call. Entries have, with the co-operation of the BBC, been checked against frequency measurements made at the Tatsfield Receiving Station.

Other tables give operating details of some 40 television stations in Europe, over 160 European metre-wave stations (four times as many as in the previous edition), consol transmitters and standard frequency stations. Another useful feature is the table of international call sign prefixes covering the world.

Volume Controls
Midget Ediswan type. Long spindles. Guaranteed 1 year.
LES8S Sw. S.P. sw.
3/- 4/-
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4/9
ALL VALUES. — 10K. to 2 MEG.

80 ohm CABLE COAX
STANDARD ¼in. diam. Polythene insulated.
PRICE
9D. A YARD
NOT Ex Govt.
COAX PLUGS, 1 2 each.
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BALANCED TWIN FEEDER per yd. 6d. | **80 TWIN SCREENED FEEDER per yd. 1/-** ohms

50 OHM COAX CABLE, 8d. per yd.

TRIMMERS, Ceramic. 30, 70 pf., **9d.**; 100 pf. 150 pf. **1.3**; 250 pf., **1 6**; 600 pf., **1 9.**

RESISTORS.—All values: ½ w., **4d.**; 1 w., **6d.**; 1 w., **8d.**; 2 w., **1/-**; 3 w. 1"., **2/-**; 2"., **1 6.**

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K. **1 9**; 10 w., 20 ohm to 6 K., **2/3**; 15 w., 30 ohm to 10 K., **2,9**; 5 w. Vitreous, 12 K. to 25 K., **3/-.**

WIRE-WOUND POTS. 3 WATT. FAMOUS MAKES.—Pre-Set Min. TV. Type Knurled, Slotted Knob. All values 25 ohms to 30 K., 50 K. and 100 K. (Carbon Track). **3/-** each. Standard Size Pots, 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K, **5/6**; 100 K., **6 6.**

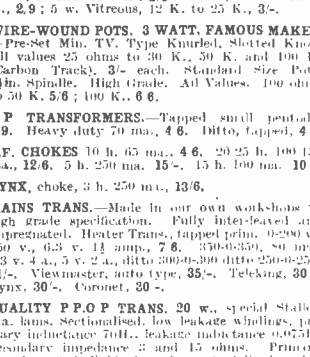
O P TRANSFORMERS.—Tapped small pentode, **3/9.** Heavy duty 70 ma., **4 6.** Ditto, tapped, **4 9.**

L.F. CHOKES 10 h. 65 ma., **4 6.** 20/25 h. 100/150 ma., **12/6.** 5 h. 250 ma. **15/-.** 15 h. 100 ma. **10 6.**

LYNX, choke, 3 h. 250 m.a., **13/6.**

MAINS TRANS.—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Heater Trans., tapped prim. 0-200 v./250 v., 6.3 v. 1½ amp., **7 6.** 350-0-350, 80 ma., 6.3 v. 4 a., 5 v. 2 a., ditto 300-0-300 ditto 250-0-250, **21/-.** Viewmaster, auto type, **35/-.** Teleking, **30 -.** Lynx, **30'-.** Coronet, **30 -.**

QUALITY P.P.O P TRANS. 20 w., special Stalloy 4 a. lams. Sectionalised, low leakage windings, primary inductance 70H., leakage inductance 0.075H. Secondary impedance 3 and 15 ohms. Primary impedance to individual requirements, fully shrouded and terminated. **3 gns.** Ditto, as above 15 w. output, **2¾ gns.** Part Post and Packing (all Chokes & Trans.), 1 - extra please.



MIDGET WALNUT CABINET.—12in. x 7in. x 7in. complete with punched chassis, dial, back-plate, drum, drive, aging, pointer, etc. **28 6,** plus post 2 -.

TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., **16/9.**

EX GOVERNMENT UNITS.—Our selection, 3 different. All containing useful parts. TO CLEAR carr. paid, **15/-.**

TAG STRIPS.—2-way, **2d.**; 3 to 5-way, **3d.**; 6-way **9d.** PLATED Terminals, **6d.** each.

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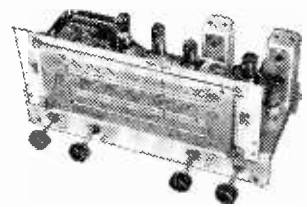
MARY ANN Vacuum Cleaner Flexible Hoses, plated ends, 1¼in. diam. fitting, **10 6.** 12ft. appliance lead, switched-connector and combination adapter, **6/9.**

EXTENSION LOUDSPEAKERS.—6½in. P.M. 3 ohm unit, less transf., attractive wooden cabinet, complete, **35/-.**

SCREENED GRID CAPS int. oct. or Mazda, **6d.** each.

TV. AERIALS.—Full range popular types in stock. Aerialite, etc. All channels. Indoor lort type Inv. T., **13/6.** Outdoor single dipole. **37 6.** H type with chimney lashings, etc., **92 6.** X type Dubilex. 7ft. mast and chimney lashings, etc., **88 6.** Fringe models available. Ask for quotation.

TOGGLE SWITCHES EX-GOVT. "On-Off," **9d.** M'core solder 60/40, 16G., **5/6** ½ lb.; **4d.** yd.; P.C. wire 18 to 22 s.w.g., per yd., **2d.** PVC Connecting wire, 10 colours. Single or Stranded, **2d.** yd. B7G Valveholder and Screening Can, **1 6.** V'holders, octal, pax., **4d.**; moulded, **6d.**: EF50, B7G, **9d.**; B8A, B9A, **1/-**; B12A (CRT), **1 3**, etc. 2 K. 5 w. H.D. w/w Pots, **4/6.** 10 K Colvern w/w Pot. 1in. spindle, **3/6.**



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3 WAVEBANDS **VALVES'**
LATEST MULLARD MIDGET SERIES
S.W. 16 m. — 50m. ECH 42, EF 41, EBC 41, EL 41, EZ 40.
M.W. 200m. — 550m.
L.W. 800m. 2,000m.
Brand New and Guaranteed, complete with 10in. P.M. Speaker. A.C. Mains 200/250 v. operation. Voltage selector. Parmeko Mains Transformer. Four position Wave-change Switch, Short-Medium-Long-Gram. Slow Motion Tuning. Provision for Ext. Speaker and Pick-up connections. High Q iron-dust cored coils, 465 kc/s I.F. Latest circuit technique incorporating delayed A.V.C. and Negative feedback. Power Output 4.2 watts. Supplied complete with High Flux 10in. P.M. Speaker. 3 ohms output transformer mounted on chassis. Heavy cadmium plated chassis size 13¾ x 5¼ x 2¾in. Attractive glass dial 10in. x 4¼in., horizontal or vertical type available. Edge lit by 2 pilot lamps. Background colour Black with distinctive colouring for station names. L.W. Green, M.W. Red, S.W. White. Four 1¼in. diam. Control Knobs supplied, either Walnut or Ivory to choice. Completely aligned and calibrated, ready to fit in Cabinet. PRICE **£10 15 0.** Carriage and Insurance, 4/6. (Without 10in. Speaker, **£9,15,0.** Carr. & Ins., 4,6.)

BARGAIN OFFER
RECOMMENDED FOR ABOVE CHASSIS
EDISWAN 73 r.p.m. Single-player Gram Unit, High Impedance Magnetic Pick-up. Press lever start for 10" or 12" records, auto stop. Listed 7gns. Our Price £4/10 Carriage 2/6

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1R5	9	6K7	6 6	15D2	9 6	Sylvania	
1S5	9/-	6K8	10,6	35L6	10 6	Red	10 6
1T4	9/-	6K25	12/-	35Z4	10 6	EF91	10,6
1S4	9,	EF80	10 6	45	8/6	EF92	9/6
3S4	9 6	6L6	10 6	50L6	9 6	EL32	9/6
3V4	9 6	6P25	15/-	76	7,6	EL41	10 6
2X2	5 6	6Q7	10'6	77	7 6	EY51	12,6
3D6	2 6	6SA7	8'6	78	7 6	EY91	8 6
5U4	10/6	6P28	19 6	807	10 6	HL23DD	
5Y4	9,6	6SH7	6,6	956	5 6		
5Z4	9'	6SL7	9/-	9001	7 6		7 8
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6AG5	7'6	6V6(Y65)		CV6	3'6	MS/PEN	6/3
6AM6	10 6		8,-	DET18	8/6	PY80	11'3
6AT6	12 6	6V6	9 6	DK91	9/-	PY81	11,3
6B7	7 6	6X5	9/-	DF91	9,-	PY82	10 3
6B8	7'6	6J6	10 6	DAF91	9/-	PEN25	8 6
6BE6	10 6	6AK5	10 6	DL92	9 6	8P41 Equiv.	
6BW6	10 6	787	9 6	DL94	9,6		4 6
6C4	7'6	807	10,6	EA50	2/-	8P61	8 6
6C6	7 6	9D2	5,6	EB34	1,6	8U2150	7/6
6D6	7 6	11D3	8 6	EB91	8,6	EF80	10/6
6F6	9 6	12A6	7 6	EBC33	9 6	U22	9 6
6F12	10 6	12AT7	10'6	EC91	7,6	VP23	7 6
6G6	6/6	12AX7	10 6	EF36	7 6	VR116	6 6
6H6	3/6	12K7	10'6	EF39	9,	ECL80	12'6
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Huge Stock B.V.A. Valves at 1951 low tax prices.

SPECIAL PRICE PER SET :
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VIEWMASTER. Set of 12 valves, **£6 10/-.** With EY51, **£7.** **TELEKING.**—Set 17 valves, **£9 10 -.** **LYNX.**—Set of 17 valves, **£9.** **CORONET.**—Set valves, **45'-.**
"J.B." DIAL ASSEMBLY. Type 8LB **20,6.**
LINE CORD —2a., 100 ohms per foot, 3a., 60 ohms per foot, 2-way **1 6** a yard, 3-way **1 8** a yard.
SLEEVING.—Various colours, 1, 2 mm. **2d.**; 3 4 mm., **3d.** yd.; 6 mm., **5d.** yd.
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REACTION COND.—.0001, .0003, .0005 mfd., **3 6** ea.
SURPLUS MAINS TRANS.—Prim. 0-200/250 v.; Sec. 275-0-275 v., 60 m.a. 6.3 v. 3 a., 6.3 v. 1 a., **10/6**; ditto, 260-0-260 v. 80 m.a., 6.3 v. 3 a., 6.3 v. 1 a., **12,6.** Oscilloscope Trans. Prim. 0-230 v. Sec. 800 v. 15 m/a., 5 v. 2 a., 5 v. 2 a., 4 v. 1 a., **17/6,** P.P. all Transf. 1/-.
BATTERY CHARGER.—200/250 v. Output 6 v. and 12 v. 1½ amps., in steel case complete with fuse and leads, ready for use. OUR OWN MAKE. FULLY GUARANTEED, **25 -.** P. & P., 1/-.
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C.R.T. HEATER ISOLATION TRANSFORMER.—Low leakage winding with 25% sec. boost, 2 v., **10/6**; 4v., **10 6**; 6.3 v., **10 6**; 12 v., **10,6.**
FUSES.—1¼in. all values 60 ma. to 10a., **6d.**
H.F. MIDGET CHOKES.—14 M.H. **2,6** each.
BRIMISTORS.—C'Z1 for .3 a. heater chains, **3/6.** CZ2 for .15 a., or .2 a., **2 6.**
COPPER ENAMEL WIRE.— ½ lb. reels 16 to 20, s.w.g., **2 -**; 22 to 28 s.w.g., **2,6**; 30 to 40 s.w.g., **3/6**
WIDE ANGLE SCANNING.—Full range Allen, Teleking, and Viewmaster. Also Soundmaster Components in stock. Instruction Envelope, **6/6.**
TWIN GANG STANDARD SIZE.—With feet, .0005 mfd., **8 6**; Ditto midget, **7 6.** 375 pf. midget twin gang, **6 6.** **BARGAIN** .0005 mfd. twin gang, slightly soiled, **5 6.**
RESISTOR TAG PANELS.—Clearance Bargain from Brand New Units. A fair mixture of ¼, ½, 1 and 2 w. and w w resistors (average number 45-50). Sold by weight—one price while they last, **3/-** per lb., P. & P. 9d. Satisfaction guar. or money refunded.
ALADDIN FORMERS and cores, ¼in., **8d.**; ½in., **10d.**
SLOW MOTION DRIVES.—Epicyclic ratio 4 : 1, 2 3.
LOUDSPEAKERS P.M., 3 OHM.
3in. Plessey. **12,6.** 5in. Plessey. **13,6.** 6½in. Truvox, **14 6.** 8in. Lectrona. **15 6.** 10in. Lectrona, **25'-.** 5in. G.E.C. Energised 700Ω field with trans, **19 6.**
WAVECHANGE SWITCHES.—2 p. 2-way, **2/6**; 3 6 2 p. 5-way, 4 p. 2-way, 4 p. 3-way, etc.
CRYSTAL DIODE.—Very sensitive. G.E.C., **3 6.** B.T.H., **2 6.** H.R. PHONES (S. G. Brown), **15/6** a pair.

BARGAIN VALUE
I.F. TRANSFORMERS
465 Kc/s Slug tuning Min. Circular Can, 2¼in. and 1¼in. diam. Fits octal V-holder cut out. Very high Q., ex Pye.
BRAND NEW 6/9 PAIR

OPEN TO DISCUSSION

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

The Beginner's Guide

SIR,—After 10 years thinking about radio I have at last been able to make a start through your series "The Beginner's Guide to Radio." Many thanks.—A. HOLT (Doncaster).

Double-triode Mixers

SIR,—Reading J. K. Bradley's letter in the July issue strengthened an opinion I have formed—that miniature valveholders are unsatisfactory. The heterodyne effect, of course, does not require critical conditions, so the probable explanation would be poor contact of the valve pins, put right by re-wiring and so moving the contacts slightly.

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

I have found that putting in a 12AT7 valve several times may result in loss of contact. One has to ascertain that both filaments are glowing and sometimes even to connect a milliammeter to make sure that the anodes and grids are in circuit.

Miniature valves should really all be made for direct connection by soldering, like deaf-aid valves. Transistors, no doubt, when they come will be soldered permanently in place, thus avoiding erratic contact and time wasted in tracing these faults.—W. CLELAND (Glasgow).

Early Readers

SIR,—With the coming of 25 years of PRACTICAL WIRELESS, I have been wondering just how many qualified engineers owe their grounding to the paper. In my own case I first started taking the paper in 1935, and although there were many things in it I did not then understand, I made my first valve circuit from it and it worked. A month or so later a complete article was devoted to reaction circuits, and I made them all with bits and pieces out of the junk box. In those days it was the regular thing to make your own coils, and what coils they were—perhaps 4in. diameter and wound with 20G wire. The "Q" must have been terrific, and I wonder if the modern so-called High "Q" coils will ever be as efficient, but then one can now make a complete receiver in the same space as the coil alone took up. I have never been over-thrilled with short-wave reception, but then my first short-wave receiver was an old PRACTICAL WIRELESS design with the H.F. choke wound on a test tube and mounted with a nail fixed through the cork, and it was really efficient. These circuits, like most of the PRACTICAL WIRELESS circuits, were ones that really did work if the instructions were followed.

Later I decided that I would like to get away from the amateur side of radio and really get down to the theory side so that I could do my own research and develop my own circuits. This study was not such hard work as the interest was there, and in many cases old PRACTICAL WIRELESS circuits gave good practical examples of applications of the theory. For instance, whilst studying meter design I looked up an old PRACTICAL WIRELESS and there, sure enough, back as far as 1936, was a series of articles of multi-range meter design, complete with all the calculations. That is but one example, and although I have progressed to the point where I am now able to write for others, there is one strange thing about the journal—it is always finding something new to teach me !!!!—JAMES S. KENDALL (Birmingham).

SIR,—May I offer my congratulations to PRACTICAL WIRELESS upon its 21st year of publication, and thank you for the many hours of pleasure I have derived from reading it and building apparatus described within its pages.

Like a great many readers I can claim to have bought PRACTICAL WIRELESS since its first issue in 1932, but if my memory serves me right, PRACTICAL WIRELESS is older than its first issue.

At the time of its birth I was a regular reader of *Hobbies Weekly*, which was then being edited by F. J. Camm, and PRACTICAL WIRELESS first appeared as a supplement to *Hobbies*, so I think I can claim that little bit extra.

The number of sets I have built over the years have been many, some very successful (when I kept to specified data) and some complete failures (when I wandered off by myself), but my greatest thrill was when I completed your electronic organ (built strictly to spec.).

Once again congratulations and may you give me the same pleasure over the next 21 years.—A. G. BRIDGE (Ilford).

[*The Editor and Staff wish to thank the hundreds of readers who sent letters of congratulation on the occasion of our 21st Birthday and for the good wishes which were expressed. A small selection of these is given above, but they were too numerous either to publish or acknowledge individually, and we therefore take this opportunity of expressing our thanks.*]

A Record Amplifier

SIR,—I feel that perhaps you sometimes like to hear from your readers the results of circuits published in your magazine, when built and used by the ordinary amateur such as myself.

May I, then, draw your attention to a rather modest-looking article, consisting only of theoretical diagrams, in the December, 1947, issue of PRACTICAL WIRELESS, which describes the building of a 6/12 volt amplifier and is headed as a Record Amplifier.

I consider that this is the finest little set that I have ever built or used.

I live in very rural surroundings where, in most village halls, mains electricity is not available. Every winter I receive any number of bookings for dances, etc., and I am pleased to say that I have never been let down by it, though I must confess I did have trouble once which was caused by the crystal breaking in the pick-up.

Just recently I was asked if I thought if it would be powerful enough for a local gymkhana, and on testing I found that the volume was perfectly satisfactory, and the audibility and quality of the speech excellent.

I now use a Marconiphone pick-up, type 14, and use a Ronette Coronation crystal microphone with a 1-valve pre-amp. The loudspeaker that I use is a Wharfedale "Golden" 10in. unit, which handles the 6½ watts output very well.

I might just add that I have now had this amplifier for over five years.—P. G. HILDEBRAND (Honiton).

R1132A

SIR,—I should like to contact any reader who uses one of the ex-R.A.F. 1132A U.H.F. receivers. I should like to compare notes on performance and the type of station received. I was not able to receive any signals when the set was in its original form, covering 100-124 Mc/s, and I should like to know who transmits on the fascinating low wavelengths from county to county.—R. PINCHES 12, Effingham Crescent, Torr Lane, Hartley, Plymouth).

An Effective Noise Limiter

SIR,—There are few amateurs or listeners who are not troubled by frequent interference from faulty electrical machinery in the neighbourhood. This circuit, although almost ridiculous in its simplicity, has proved surprisingly effective against such trouble. The circuit itself hardly needs explanation. The diodes of a 6H6 are strapped together and connected to the grid of the driver or output stage of the receiver. Likewise, the cathodes are connected to earth. This system causes a vast reduction in unwanted noise without interfering with the reception of the desired signal.

Hoping that this hint may be of some interest to your readers.—M. J. MURPHY (Cork).

A Valve Adaptation

SIR,—Readers may be interested in an adaptation that I have carried out.

I purchased a pair of 954 acorn pentodes at 2s. 6d. each and fitted each of them into bases of broken international octal valves, anode downwards, so that a top cap could be fitted on the grid. I then wired them up as 6K7s. They are now giving excellent performance in a three-valve T.R.F. receiver, using an EL42 in the output stage. These, therefore, were very handy for miniaturisation and I was able to make the set similar in size and design to the "A.C. Mains Midget" described in PRACTICAL WIRELESS.

The gain is slightly less than the 6K7 and it should be noted that the 954 is not a variable-mu valve.

Finally, I should like to congratulate all who contributed to the 21st birthday edition of PRACTICAL WIRELESS. I only wish every issue could be as large. —M. D. ECCLES (Welwyn Garden City).

A Plaintive Cry

OH, Mr. Camm Sir, whatever can I do?
You've given us another A.C. set and it looks a good one, too.
But I am on the D.C. mains which cover half this city,
Please Mr. Camm Sir, have a little pity!

(With apologies to the author of a similar plea in an early number of PRACTICAL WIRELESS.)—T. D. HACKNEY (Nottingham).

The Amateur Transmitter

SIR,—After reading Mr. Williams's letter in your birthday issue, one cannot but despair of any new approach to this question of the amateur transmitter. He says it is a privilege, not a right. Wasn't the same thing said about the parliamentary vote a number of years ago—yet to-day we all have this *right*?

It's all a question of how you look at it.

History is full of instances where men have had to fight privilege and dictatorship.

Yet here we have people who go out of their way to fight against a humble request for a frequency on flea power with crystal control.

And once again the old excuse is dug up for making one learn morse. But just to be nasty—let's question it. How often does this ham station jamming essential service station really happen, and why? Has it ever happened when using crystal control?

Why, if it is an essential service, hasn't the transmitter a modulator to be switched in in case of interference? (I imagine some of these E.S. stations use ancient gear.)

If a chap was playing around with a radio-controlled model, how would he be told to get off the air?

The answer to the last question is, of course, that they don't interfere—precisely why the morse test is unnecessary.

In any case, is it not possible to devise some simple signal such as —.—.—.—.—.—.—.—. continuously, which would mean "there is a station interfering, will it close down?" This would easily be understood by anyone and is all the morse one need know.

Incidentally, I notice it took Mr. Williams as long to learn morse as it did to learn the theory.

Personally, morse bores me to tears. I would certainly have a go at the theory examination, but what's the use?

Until TV came along I was gradually losing interest in radio, for one gets tired of building receivers. Now, however, I am just completing a TV and getting a good picture at about 90 miles. But this is getting away from the subject, and I would like to make one last request—I feel sure readers would like to know about licensing conditions in America: details of bands, morse speed required to get on the air, cost of licence, etc.—H. COLE (Workington).

(*Continued on page* 713)

SIR,—In all sincerity. I class myself as a reader, a regular reader, of PRACTICAL WIRELESS, endowed with the average amount of intelligence.

Imagine my disgust when I read letters pleading for a transmitting licence—but no morse, please!

I wanted a "ham" licence in 1947. I didn't have to learn morse because I already knew it—learned from scratch to 12 w.p.m. in 12 weeks; is that asking too much of anyone with average intelligence who *really* wants a transmitting licence?

Apart from being of some use in a case of emergency, I maintain that the morse code is our most useful and certainly most consistent means of communication. I'll go further and say that all licensed hams should sit a periodical morse test.

We have quite sufficient "natterers" *with* licences; without another brigade being formed. Thank you for a grand "bob's-worth" of "gen."—V. ROBERTS (Stoke-on-Trent).

SIR,—The argument for the amateur wishing to hold a transmitting licence, which was started by Mr. Hector Coles and backed by myself, tends to get rather distorted as the months roll on.

We are assured, in last month's issue, that if anyone holds a transmitting licence, no interference is likely from that person.

This is, of course, the view of Mr. V. G. P. Williams (G3FTY). Anyone who listens to the amateur bands will, I feel sure, think otherwise. Just listen to 80 metres, when it really gets going, when all these skilled operators (as Mr. Williams calls them) start punching the key. Talk about bedlam, with all the cheeps, bloops, chirps, clicks, thumps, etc., it ceases to be Communications, and becomes the survival of the fittest.

But to get back to the initial argument, I made it quite clear in my letter that I thought that the inspired amateur should not have to wade through so much restriction in order to get on the "air."

Mr. Williams says that my views are wrong. Perhaps I can put them a bit more plainly to him.

The Pass Slip from the Theory examination does not convince anyone that an operator will not cause interference to any other users of the air. A knock on the front door is probably the first indication that interference is being caused.

I maintain that with the seven rules I am going to suggest, a band for the novice could be created which would delight thousands.

1. Maximum power: 5 watts.
2. Crystal control with no exceptions.
3. Immediate confiscation of licence for deliberate misuse of station.
4. A five-pound licence fee.
5. The band to be used only by novices.
6. Amplitude modulation only.
7. Holder of licence to be 21 or over.

Now really. Mr. Williams, this isn't asking too much, is it? This band should be V.H.F. or U.H.F.

Mr. Williams makes an example of himself when he points out how "easy" it is to get a licence. All I can say is that he is either a genius, or he has plenty of time on his hands. My working day starts me out at six in the morning, and gets me home at eight at night, with a night shift every fortnight and, believe me, morse would not go down very well with that.

Were all these petty restrictions imposed on the great men who invented radio—Marconi (I beg your pardon, Sir Oliver Lodge) — the gramophone would still be the scoop of the day.

If, sir, my views are still considered wrong, why should model-makers, taxi-cab drivers, road patrol men, gas companies, etc., etc., get free use of the air, while young men who wish to do the same get the ball and chain?

I have heard every rule broken by amateurs. Last night I heard a chappie calling CQ on 4.2 Mc/s., and he wasn't a newcomer to ham radio. I can only think that probably he has spent a lifetime on the key and look what happened when he built a modulator.—C. ROBERTS (Worcester).

Club Reports

BIRMINGHAM & DISTRICT SHORT-WAVE SOCIETY
Hon. Sec.: F. C. Cook, 67, Regent Road, Handsworth, Birmingham, 21.

FOR the month of October the Society will have a discussion by one of their members during the General Meeting, and no doubt a further discussion will be made on the Field-day results held on September 20th.

All visitors will be welcomed, and further details of the Society's activities can be obtained from the Secretary.

LOTHIANS RADIO SOCIETY (EDINBURGH)
Hon. Sec.: L. Stuart, 38, Caledonian Crescent, Edinburgh.

MEETINGS take place on alternate Thursdays, October dates being 8th and 22nd, at 25, Charlotte Square, Edinburgh. An extensive programme of lectures, visits and social activities has been prepared for the 1953-54 session. Visits to Kirk o' Shotts have been arranged for October 11th and 18th. New members will be welcomed at any meeting.

THE WILLESDEN RADIO CLUB
Hon. Sec.: E. Mitchell (G3GZW), 5 Princess Road, Kilburn Park, N.W.6.

WITH the acquisition of new premises at Scout House, Willesden High Road (near bus garage), the club has re-opened with an election of officers:

Chairman, J. Theobald (G3EQM); Secretary, E. Mitchell (G3GZW); Treasurer, T. Stonestreet.

Meetings held fortnightly on a Wednesday at 7.30 p.m. as from September 30th onwards. Technical lectures and morse classes have been arranged. Junk sales will be held once a month.

New members will be welcome to call.

Other premises have been acquired for use as a workshop and shack for the club transmitter G3BFZ, which will be on the air in October.

THE GRAFTON RADIO SOCIETY
Hon. Sec.: A. W. H. Wennell (G2CJN), 145, Uxendon Hill, Wembley Park, Middx.

THE club has made arrangements with the local L.C.C. Men's Evening Institute for an official course of instruction for the Radio Amateurs' Examination to be held during the coming winter months.

Classes, including morse instruction, will be held at the Grafton L.C.C. School, Eburne Road, Holloway, London, N.7 (one minute from 'Nags Head"), on Monday evenings; application in the first instance should be made to the Grafton Radio Society secretary.

Club nights are Mondays and Fridays. A full programme of talks, demonstrations, etc., by leading "hams" and the trade are being arranged, and with the club transmitter on most amateur bands, Grafton look forward to a most successful season.

ACTON, BRENTFORD & CHISWICK RADIO CLUB
Hon. Sec.: R. Hindes.

WEEKLY meetings are held at the A.E.U. Rooms, Chiswick High Road, W.4, every Tuesday evening from 7.30 to 10 p.m., when the club transmitter G3IIU is on the air looking for QRP contacts in the 80- and 160-metre bands.

New antennas have been erected and an S640 receiver has been added to the existing club gear. The winter session of morse and general instruction is now commencing.

Membership is not confined to those living in the above three London areas only—all are welcome, "hams" and SWL's alike.

News from the Trade

Miniature Transformers

BEARING in mind the growing importance of transistors, readers will be interested in the two transformers, designed by the J. Bell & Croyden Co., now available for release.

The "O" type unit is, we believe, the smallest transformer at present in production in this country.

Its measurements are $\frac{3}{8}$in. x $\frac{3}{8}$in. x $\frac{1}{4}$in., and it is an inter-stage transistor transformer or general coupling transformer. The inductance is 4H at 0.4 milliamps over the normal A.F. frequency band. The step-down ratio is 4.5 : 1 with a D.C. resistance of 870 ohms primary and 170 ohms secondary. This transformer has a mumetal core, and can be supplied with a screening can if required.

The "A" type unit measures $\frac{3}{4}$in. x $\frac{9}{16}$in. x $\frac{7}{16}$in. across the bobbin.

It is an interstage transformer for matching a high gain pentode to a transistor, and has a primary of 125H at 50 microamps. The step-down ratio is 30 : 1 ; the D.C. primary resistance is 6,000 ohms ; the secondary resistance is 80 ohms.—John Bell & Croyden, 117, High Street, Oxford.

Complete Range of Mullard Noval Based Valves for Audio Amplifiers

TWO additional valves recently introduced by Mullard, Ltd., make possible the design of a complete audio amplifier using valves with the Services' preferred B9A (Noval) base. The new valves are the EL84 high-sensitivity output pentode and the EZ80 full-wave rectifier. The complete series now comprises the EF86 voltage amplifying pentode ; three double triodes, Types ECC81, ECC82, and ECC83 ; the EL84 output valve and the EZ80 rectifier. Details of these are given below.

Type EF86.—For use in the pre-amplifier stages, this valve now replaces type EF37A or EF40. Its mechanical construction has been designed so as to render the valve substantially free from microphonic tendencies, and the bi-filar heater reduces hum to a minimum. The characteristics of the EF86 are similar to those of the EF40, gains up to 180 being obtainable under the recommended operating conditions.

Double Triodes.—The three double triodes permit a choice of characteristics to suit various circuit requirements. Type ECC81 is a medium impedance valve, ECC82 has low impedance, and ECC83 high impedance. All three have independent cathodes and centre-tapped heaters which can be operated at 12.6 volts 0.15 amps or 6.3 volts 0.3 amps.

Type EL84.—This high sensitivity output valve is rated to dissipate 12 watts at the anode, compared with 9 watts for the EL41 which it replaces. The heater rating is 6.3 volts 0.8 amps. With a grid input of less than 4 volts, the EL84 will deliver over 5 watts of audio power at 10 per cent. total distortion. A push-pull pair of EL84's in Class AB1 will deliver 16 watts output.

Type EZ80.—The characteristics of this full-wave rectifier are identical to those of the EZ40. It is capable of a rectified output of 90 mA, the maximum input voltage being 2 x 350 volts r.m.s. The heater is rated at 6.3 volts 0.6 amps.—Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Sparks' Data Sheets

A CHASSIS section has now been added to the popular data sheet suppliers of Swanage. This makes it possible for those who obtain the data sheets to build the selected design on a ready-drilled chassis. It should be noted that in addition to the supply of data sheets for various types of receiver, Messrs. Sparks can now also supply all of the components specified in the sheets. To the latter have now been added, by special arrangement with Messrs. Mullard, practical constructional details and layout, etc., for the circuits contained in the Mullard booklet, "The Amateur's Guide to Valve Selection." The charts are full size, printed in black and white, complete with the theoretical circuit, all component values and prices. Most of the prints measure 22in. by 15in., but quite a few are larger than this. The prices of the majority are 3s. each and lists of designs are available from Sparks Data Sheets, 48A, High Street, Swanage, Dorset.

New Vidor-Burndept Appointment

H. T. TRAYNOR, formerly Press officer to Raleigh Industries, Ltd., and editor of the company's house journal, The Raligram, has been appointed P.R.O. to the Vidor-Burndept group.

Mr. Traynor started his newspaper career with Kemsley Newspapers, Ltd., in Scotland, switching to the Scottish Daily Mail in 1947.

During the war he was on the staff of Air Force News in Cairo.

While with Raleigh, Mr. Traynor was closely associated with former world cycling champion, Reg Harris, with whom he travelled extensively in Europe.

The address of Vidor-Burndept's recently established Press Office is 18, Abbey House, Victoria Street, S.W.1. Telephone : ABBey 1328.

Micrograms and Automatic Micrograms

AS from August 1st, the manufacture and sale of micrograms has been discontinued by the Collaro Company, and the sole manufacture and marketing of all portable electric gramophones under this trade-mark is to be made by Electric Audio Reproducers, of 17, Little St. Leonards, Mortlake, S.W.14.

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