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Volume 7
Number 12
JULY
1954

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for the Radio and Television Enthusiast

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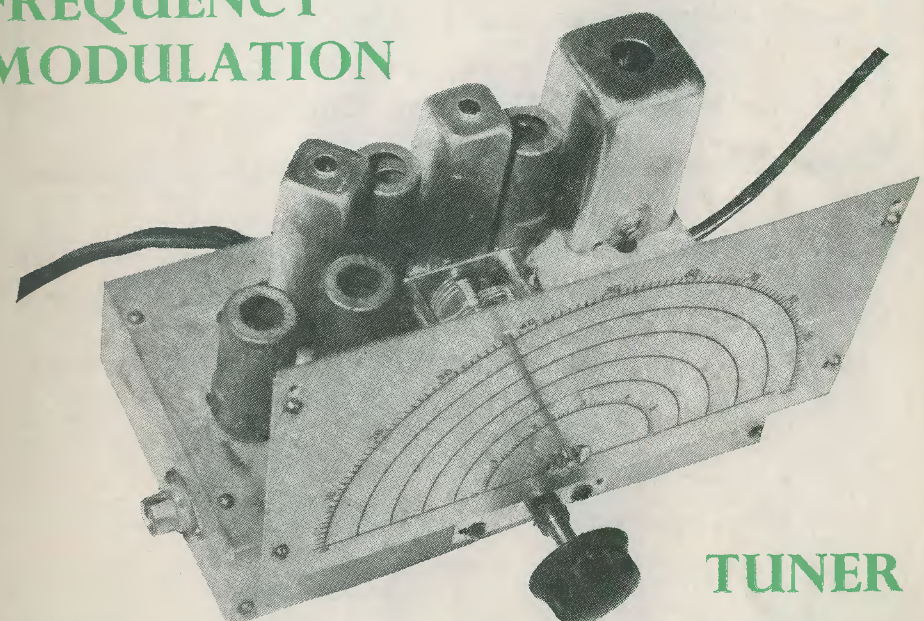

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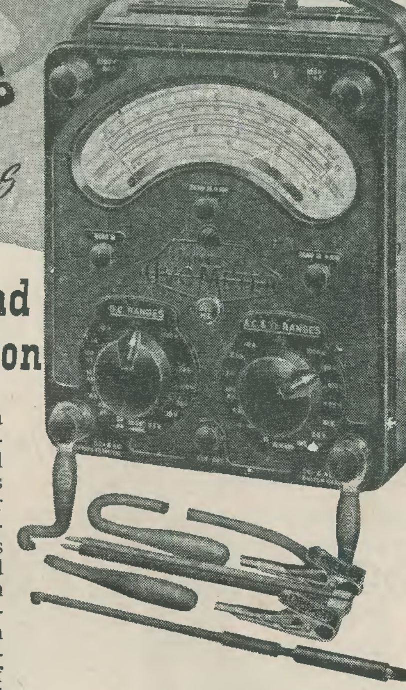

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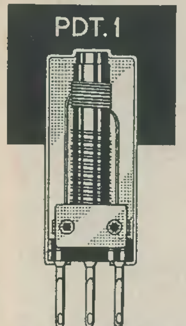

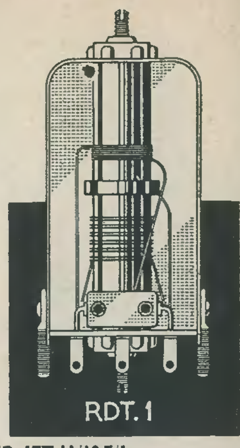

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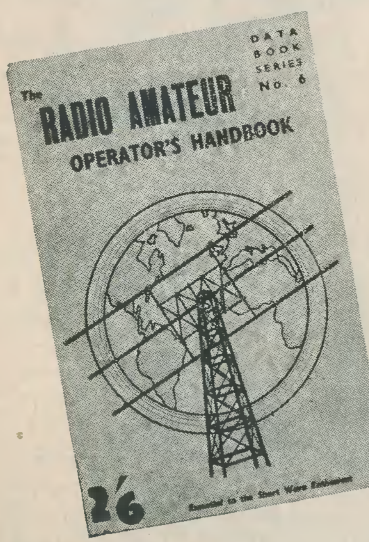

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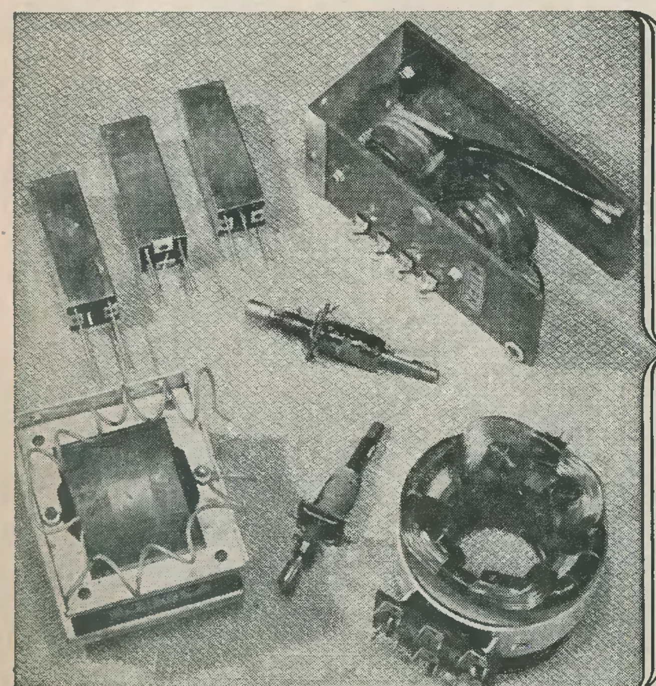

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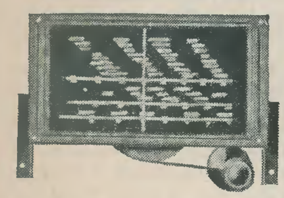

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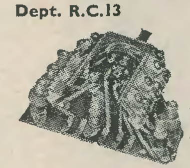

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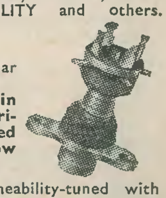

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VOL. 7 NO. 12

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CONTENTS FOR JULY

NOTICES

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

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

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

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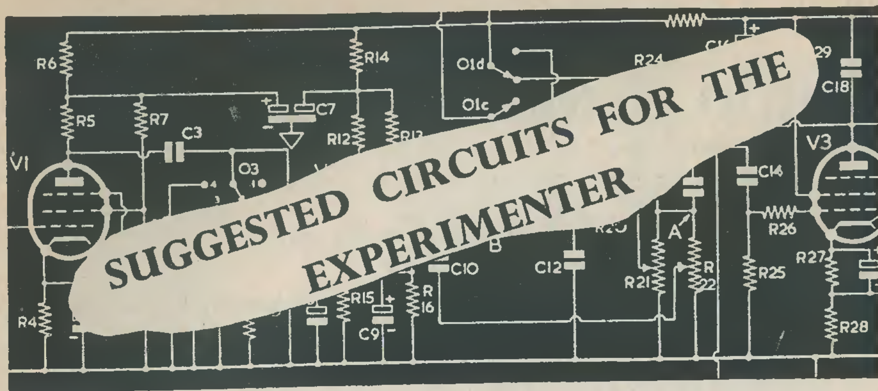


The circuits presented in this series have been designed by G. A. French specially for the enthusiast who needs only the circuit and essential relevant data.

No. 44 : OBTAINING LOW POWER HT VOLTAGES FOR PORTABLE EQUIPMENT

THE POSSIBILITY OF OBTAINING HT voltages from low-tension DC supplies has always held a certain fascination for the amateur. Whilst such requirements are nowadays usually met by a dynamotor or by a vibrator and transformer, these devices can only work from a low-tension supply of comparatively high Ampere-hour capacity. In cases where only low HT currents are required, both the vibrator and the dynamotor become too bulky and take too much LT current to be an attractive proposition.

The Circuit

The basic arrangement is shown in Fig. 1. In this diagram an LT battery is connected to a conventional buzzer which operates in the normal fashion. At the moment of connecting the battery to the buzzer the contacts of the latter are made, whereupon the full battery voltage is applied through them to the coil and sets up a magnetic field. This field causes the buzzer armature to be attracted to the core; thus breaking the contacts and removing the voltage from the coil. The magnetic field then collapses,

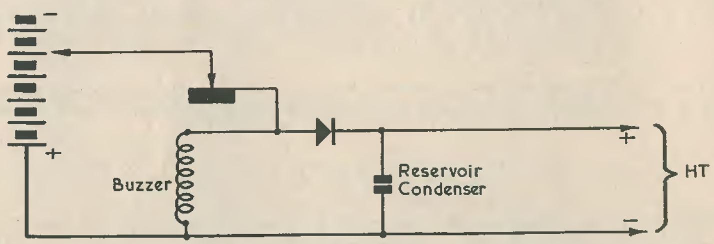


Fig.1

E23

This month's circuit introduces a novel method of obtaining low-power HT voltages, this being achieved by utilising the voltages induced in the coil of an ordinary buzzer.

inducing a voltage in the coil of opposite polarity to that applied by the battery. As the collapse is quick, and as there is no load imposed across the coil during the formation of this second voltage, its potential may rise to many times the value of that of the battery.

The high voltage induced by the breakdown of the magnetic field is applied to a rectifier and a reservoir condenser; with the result that, during successive repetitions of the initial buzzer cycle, the condenser charges up to the peak value of the voltage appearing across the coil. The process is largely similar to that occurring in a flyback EHT system.

rated at 270 volts 30mA (Westinghouse type 15C46); and the LT supply an ordinary 9-volt grid bias battery. It was found that a reservoir condenser of 0.5μF was quite adequate in this particular instance. Higher values may, however, give better results in some cases.

Using the circuit of Fig. 1 and the components mentioned it was found possible to obtain a peak voltage of about 95 volts off load, this dropping to approximately 60 volts for a current of 0.75mA. The input voltage was 6 volts, at a current of approximately 20mA. Input voltages in excess of 6-volts did not appreciably increase the HT voltage obtained. The setting of the buzzer contacts was not at all critical and could be varied over a considerable extent without affecting the output voltage.

For the circuit of Fig. 2 a miniature neon obtained from a surplus Bendix Radio Compass was available, and proved to be quite satisfactory. This has a striking voltage of 80. The series limiting resistance was 47kΩ. It was found that satisfactory operation of the neon could be obtained even when the LT battery voltage was as low as 4.5 volts.

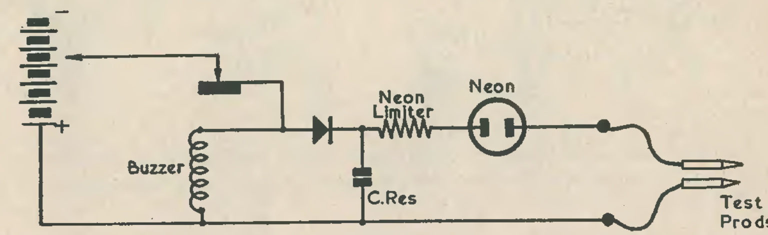


Fig.2

E24

Typical Applications

It will be realised that, whilst the arrangement shown in Fig. 1 has the advantage of considerable simplicity and cheapness, the HT supply obtainable from it is capable of offering only a relatively small current.

A typical application is shown in Fig. 2. In this circuit the buzzer is used to supply HT for a neon bulb in an insulation tester. Such a tester may be used for checking leakage in wiring or in condensers. Thus, differing values of resistance applied between the two test prods would cause the neon to glow with different intensities. A leaky condenser would cause the neon to flash on and off continually. The sensitivity of a leakage tester of this type can be made better than 10MΩ.

Other applications will suggest themselves to the experimenter; and it should be possible, in some instances, to use the buzzer for supplying HT to low-consumption valves.

Practical Considerations

To check the possibilities of the circuit, the writer assembled several experimental rigs. These used the circuits of Figs. 1 and 2. The buzzer employed was a nominal 6-volt component (Osbourne Radio), the rectifier was a conventional HT model

Alternative Connections

Before concluding, it must be pointed out that similar results are given if the rectifier and reservoir condenser circuit is connected across the contacts of the buzzer instead of across its coil. In this case, however, the secondary voltage from the coil passes through the battery. Also, due to the varying methods used to mark rectifiers of different make, this component should be reversed if the circuit does not, at first, appear to be functioning. [END

IN YOUR WORKSHOP

In which J. R. D. discusses Problems and Points of Interest based on Letters from Readers and his own experience.

At the time of writing the flowers in the gardens around me are beginning to bud, and the sun shines brightly through my window. There is a sense of vitality in the air; birds are singing and building their nests, girls are parading in their new frocks and bonnets, and *Wireless World* has just published a limerick.

Spring is here, indeed.

Spring-Cleaning

In the palmy days before the war when radio magazines used to appear once a week, spring-time was always heralded by very seriously-written articles urging the enthusiast to overhaul his gear and his aerial system, and to clear out all the debris he had collected during the previous year. (Looking back, I am not at all certain that they didn't use the same articles, slightly re-written, each year).

Really, however, the spring-cleaning idea was not too bad at all. Unfortunately, the process of going through the old junk boxes usually revives so many memories that one rarely gets beyond the first layer or so before forgetting that one really intended to clean it all up this time, instead of merely pottering around. One of the phenomenons of radio as a hobby is that if you throw something out, that is the thing which you will definitely be needing a week later.

Circuit Diagrams

I have recently been ploughing my way through a large number of fairly complex English, American and Continental circuit diagrams. Although these all applied to more or less the same sort of equipment, some diagrams were laid out sensibly and were consequently easy to follow, whilst others were laid out most illogically and could be read only with difficulty.

I realise that the professional draughtsman has his worries. Let us see what may happen if he is asked, for instance, to draw up the circuit of a television receiver. This is a typical example of a diagram which can be fairly complicated because, whilst such a circuit has several basic units, these are interconnected with each other and with the cathode ray tube to such an extent that the final layout employed for the drawing must inevitably result in a compromise. What is more, the draughtsman may be a busy man, who cannot devote as much time to the particular job before him as he would like to do. His prime responsibility is always to ensure that his drawing contains all the information needed by the engineer who is going to use it, and that it has no errors. The ease with which the drawing can be used then takes second place.

Nevertheless, the clarity of the drawing is still of considerable importance; and it is a fact that some drawings of such things as television receiver circuits are laid out in far better fashion than are others. The worst fault is that in which connections between different parts of the circuit are shown as a number of lines running closely parallel with each other over relatively long distances. Tracing one of these lines through to its destination often necessitates considerable concentration if errors are to be avoided.

Another easily-avoided detail which often leads towards confusion is given by the habit of dropping the HT positive rail below the chassis line instead of keeping it above the valves and components where it logically belongs. This method of presentation is common to almost all American circuits and to many English and Continental drawings as well. On the other hand, the mainly-American custom (not normally used in servicing drawings, however) of dispensing with the HT rail line altogether, and of terminating all HT points wherever they appear in the diagram with an arrow labelled "B+", assists considerably towards the final clarity of the circuit.

My own private bugbear in circuit diagrams is the detail needed to show the connections to the screen-grids of pentodes. These electrodes are almost always connected to the HT positive rail via a dropping resistor, and to chassis via a decoupling condenser; and have consequently become as unimportant, so far as information is concerned, as are the leads to the valve heaters. We nowadays omit the heater connections to valves in circuit diagrams, although we may put the heater wiring in a separate part of the diagram. Why not apply the same principle to pentode screen-grids?

As an example of what I mean, Fig. 1 shows an example of a typical IF amplifier stage. The screen-grid is drawn in normally.

Fig. 2 shows the simpler version. In this diagram the screen-grid is omitted from the valve envelope and is placed above the HT line where it is out of the way, and does not interfere with the logical progress of the eye as it travels along the diagram. All the relevant data is still present in the circuit; we know, for instance, that the valve is a pentode, and we know the values of the dropper resistor and the decoupling condenser. What is more, we can print these values near the components, as well as such information as the HT voltage to be expected at the screen-grid, without causing confusion in a crowded part of the circuit.

An alternative, and perhaps better, method of presenting the information could be given by including the screen-grid in the valve envelope, but leaving it disconnected. The circuit line to the screen-grid above the

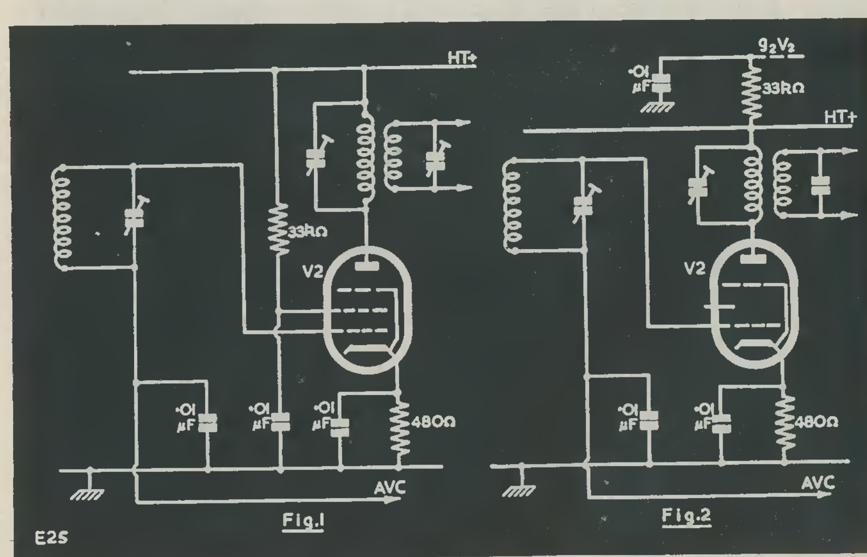


Fig. 1. A typical IF amplifier

Fig. 2. The amplifier of Fig. 1 re-drawn with the screen-grid components above the HT positive rail

HT positive rail could then terminate in an arrow labelled "g2, V2" (or whatever the particular valve may be).

If any reader's work obliges him to scribble a number of circuit diagrams from time to time, I advise him to try this different method of presentation. He will be surprised at the time it saves.

Taking the Mike

I had a good chuckle at Sid's cartoon the other day concerning my comment on the ease of TV construction. Sid's original sketch now takes pride of place on my mantelpiece.

However, my statement, in its context, still stands. If you can build a broadcast receiver, you can build a television set.

I'm pretty busy these days, but I think I am going to find time to take a correspondence course in sketching. So far as I can judge from the advertisements, it's childs play!

Frequency Modulation

From what one can learn, it appears that Band 2 FM will, one day, be helping out the medium and long wave BBC transmitters in ensuring adequate sound coverage of the country. When that day will dawn no one appears to know. So far as the authorities are concerned no one appears to be very bothered, either. In the meantime, Wrotham continues to transmit both AM and FM, and offers a source of programme whose fidelity is noticeably better than that at present obtainable on the broadcast bands.

I receive quite a few queries concerning FM receivers and discriminators, and so it might be of interest to give brief details here of some of the circuits most commonly encountered. One or two of these may be unfamiliar to the home-constructor.

Fig. 3 shows the well-known phase, or phase-shift, discriminator. V1 in this circuit is the limiter valve; this consisting usually of a sharp cut-off pentode run with purposely-lowered anode and screen-grid voltages. The function of the limiter is to ensure that no amplitude modulation reaches the discriminator; and this is normally achieved by over-driving its grid. Increases and decreases in amplitude at the grid cannot then appear at the anode, since the valve works at its maximum output all the time.

The limiter needs careful attention in practical designs, so far as wiring is concerned. This is because its output can approach a square wave, with consequent radiation of harmonics. All signal and decoupling wiring must therefore be kept short. Suitable limiter valves are: 6AU6 (Brimar), Z719 (Osram), and EF85 (Mullard)

The amplitude-constant signal appearing across the primary of the discriminator transformer is applied simultaneously, and with the same polarity, to the anodes of the double-diode via C3 and the centre-tap of the secondary winding. At the same time two opposing voltages are applied to these anodes via the secondary winding itself. At the centre frequency, these voltages are 90 degrees out of phase with that applied via C3. When the frequency deviates this phase difference alters, with the result that

Rufus
The Radio Constructor

"I'll take it if I can have the circuit diagram as well!"

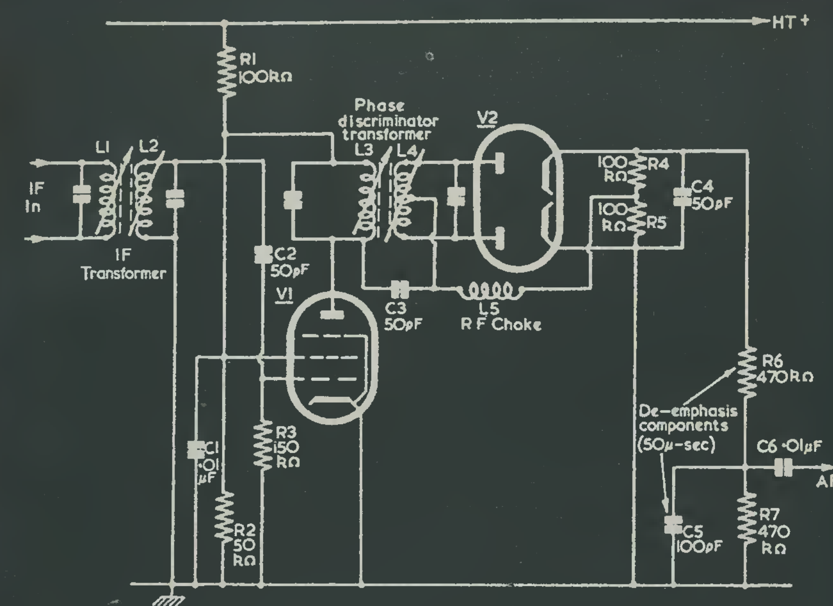


Fig. 3

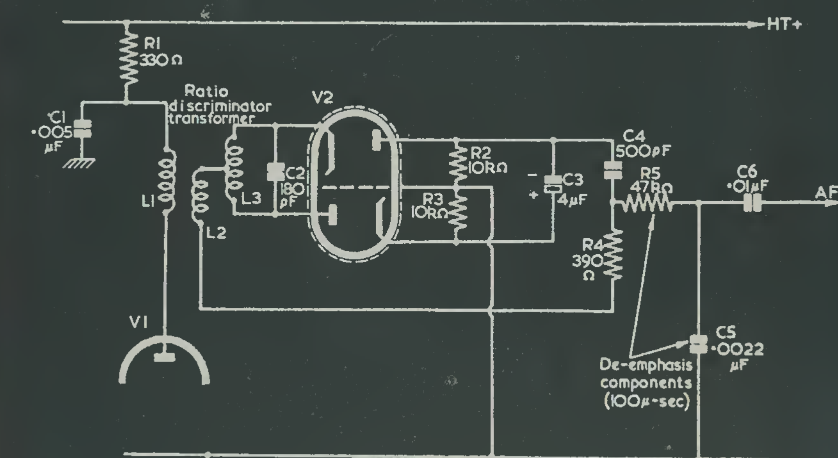


Fig. 4

Fig. 3. A standard phase discriminator with component values suitable for 10.7 Mc/s applications. The RF choke, L5, may often be short-circuited and removed without detracting from final performance

Fig. 4. A typical discriminator. The component values shown are those used in the Admiral 19 P1 television receiver, (cf. Radio-Electronics *for Jan., 1954); and are suitable for an (inter-carrier) IF of 4.5 Mc/s*

differing voltages are built up across R4 and R5 according to the vectorial sum of the RF voltages applied to the diode anodes. The voltages across R4 and R5 are then passed, suitably decoupled, to the following AF amplifier.

It is usually considered that the phase discriminator of Fig. 3 offers the best performance of all the circuits available. It is capable of "following" a large frequency deviation with good linearity (e.g. up to ±350 kc/s and beyond with one 10.7 Mc/s discrimination transformer which I built myself). It is also very simple to align. It has the disadvantage, however, of requiring the extra limiter valve, and its AF output for normal frequency deviations is not very large.

Fig. 4 shows a ratio discriminator. This has the advantage of not requiring a limiter valve and is, apparently, particularly popular in American television receivers, where the omission of this valve represents a saving in cost. The component values shown in the diagram are typical of those encountered in such receivers. The operation of the circuit is somewhat complicated, and, according to Henney (*Radio Engineering Handbook*, 4th Edition), design is of the cut-and-try variety. The AF output of the ratio discriminator, like the phase discriminator, is low for normal frequency deviations.

Fig. 5 shows a recommended circuit using the Mullard EQ80. This valve has been specially developed for the job, offers frequency discrimination *with* AF amplification, and does not need a limiter.

Another valve which performs a similar function is the General Electric (American) type 6BN6. This is shown in Fig. 6 and it offers the same facilities as the EQ80.

Both these valves function by reason of the alterations in phase difference between two RF voltages when they are applied to different electrodes in the electron stream. With the 6BN6, the phase difference is achieved by feeding back the RF voltage built up across R3 to L3-C7, this being done via the Cag3 of the valve.

For effective limiting and discriminator action, both valves need an RF input in excess of 4 volts or so. Both are capable of working with frequency deviations of up to ±100 kc/s. The AF outputs of each valve may be taken direct to the grid of the subsequent output valve, as no intermediate AF amplification is required.

CLUB NEWS

Details for insertion in this section should reach us not later than the 8th of the month before publication.

HASTINGS AND DISTRICT AMATEUR RADIO CLUB

The Club will again be exhibiting at the Hobbies and Crafts Exhibition, to be held 3-10 July in the New Pavilion, Falaise Road, Hastings, in connection with Carnival Week. It is believed that the interest engendered by the Club stand last year helped to draw more "viewers," and so enable the whole exhibition to show a substantial profit for devoting to Charity.

At the time of writing these notes the transmitter for use at this year's stand is being constructed, and we are indebted to G3BDQ for design work. We shall use the 80-metre amateur band only. The Club station G6HH/A will be manned from 1000 hrs. to 2200 hrs. each day except the Sunday, 4 July. We shall welcome all contacts, and if you come to "Happy Hastings" do pop in and see us. For 6*d* entrance fee you will also be able to see many other interesting crafts and pastimes besides radio. R.S.G.B. Members are especially invited, since the Club Treasurer is Sussex C.R. and the Secretary is Hastings T.R.

CLIFTON AMATEUR RADIO SOCIETY

The membership of this Society is continually on the increase and each week sees one or two new members. The Clifton caters for all aspects of Amateur Radio from the Constructor to the Short Wave Listener and Licenced Operator. Programmes are arranged to suit all tastes for instance on May 7th club member D. Veasey gave a talk on Hi-Fi and demonstrated his home-built amplifier with standard and LP recordings whilst on May 21st another popular Junk Sale was held. On this occasion there was a record attendance of 48 and many pieces of equipment changed hands including, for the first time, a complete television set.

Constructional evenings were held on May 14th and 28th when members busily engaged themselves on building up new equipment or repairing faulty equipment.

During July it is proposed that the following meetings and events take place:

July	2nd	—	Junk Sale.
,,	9th	—	Constructional Evening.
,,	16th	—	Any Questions.
,,	18th	—	2nd D.F. Contest
,,	23rd	—	Constructional Evening.
,,	24/25th	—	Transmitting and Receiving Contest.

Meetings are held every Friday evening at 7.30 p.m. at the clubrooms, 225 New Cross Road, London, S.E.14. A warm and cordial welcome awaits visitors and new members.

Secretary, C. H. Bullivant, 25 St. Fillans Road, Catford, London, S.E.6.

NORWOOD AND DISTRICT R.S.G.B. GROUP

The May meeting was attended by 14 members and friends. The primary object of the evening was to make final arrangements, as far as possible, for this year's National Field day, during which the Group had two stations in action.

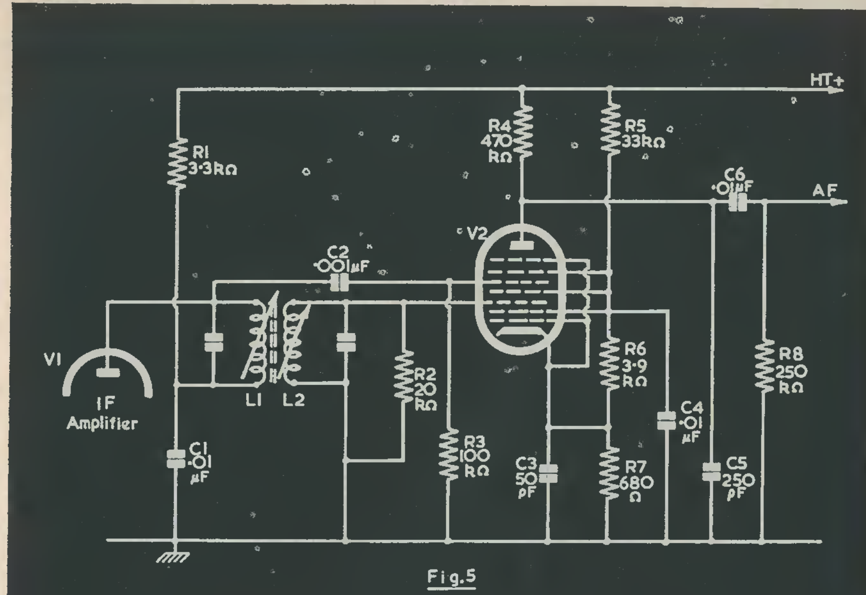
A Junk Sale has been arranged for the meeting to be held on July 17th, and all local members and non-members who feel interested, are invited to come along to Windermere House, Westow Street, Crystal Palace. The meeting commences at 7.30 p.m.

QRP SOCIETY

Arrangements are being made for the Society to hold its own exhibition next October.

The increased interest in V/UHF has warranted the formation of a special section to cater for those members who are active on 144 Mc/s and 70 cms.

More Local Clubs have joined the Society's affiliation scheme and it is proposed to run inter-club tests at the earliest opportunity. Full details of membership and activities are given in a Data Sheet which may be obtained by sending a stamped envelope (foolscap size) to the Hon. Sec., J. Whitehead, 92 Rydens Avenue, Walton-on-Thames, Surrey.



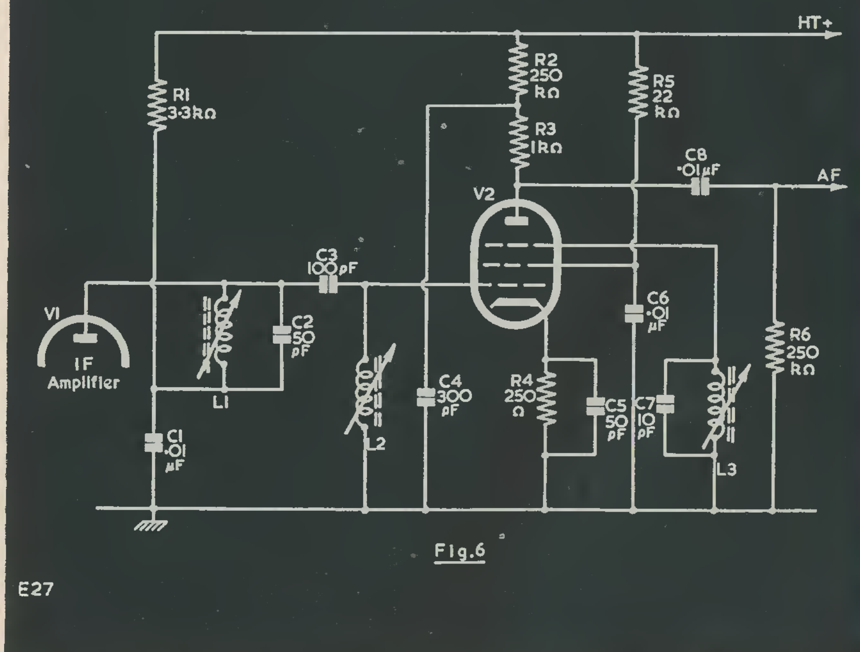
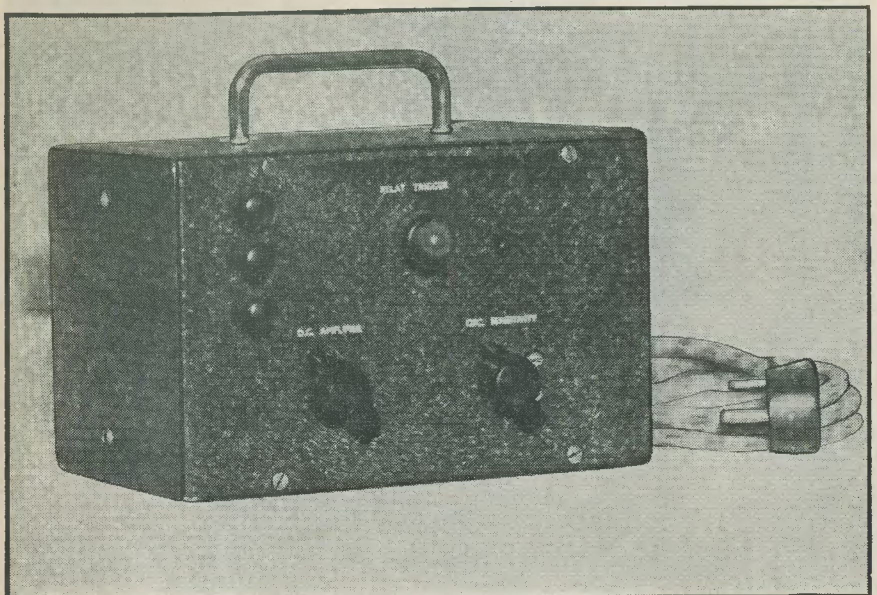


Fig. 5. *A discriminator circuit using the specially-developed Mullard EQ80. No de-emphasis components are shown. The IF is 10.7 Mc/s*

Fig. 6. *Another specially-developed valve, the General Electric 6BN6, is illustrated here. Again, no de-emphasis components are shown, and the IF is 10.7 Mc/s*

A NOVEL PROXIMITY RELAY



By **R. WILLIAMSON**

THE PROXIMITY RELAY is a comparative newcomer to electronics and is finding increasing usage in all branches of the industry. Basically, it is a device which is sensitive to changes in capacitance between the "probe" of the instrument and some other body, usually earthed. A typical application, for example, would be as a burglar alarm for valuable jewellery on open display. The "probe" would be connected to one of the pieces, and the relay adjusted so that should any attempt be made to touch the valuables it would operate and sound an alarm. Another application, and a typical example of its usefulness, is to prevent the accidental approach of any human being exposed to radio active materials to within the dangerous radiation area; a safeguard necessary in all branches of atomic physics.

Needless to say, such a device can be put to a number of uses by the radio enthusiast, and a description of a simple yet sensitive version follows. Primarily it consists of a Hartley oscillator working at some low radio frequency. By suitable choice of circuit values and including the "probe" in the tuned circuit, the output of RF becomes variable and dependent on the capacitance between the object connected to the "probe" and other objects in close proximity. This RF output is rectified, and the resultant DC fed to the grid of a single stage DC amplifier. The load of this stage is a standard PO relay.

Method of Construction

To preserve the sensitivity of the instrument, stray capacitance in the tuned circuit must be kept to a minimum, particularly the connection to the "probe" terminal (Fig. 3). The sensitivity control C1 must be isolated from chassis and adjustment made by an insulated extension (Fig. 1).

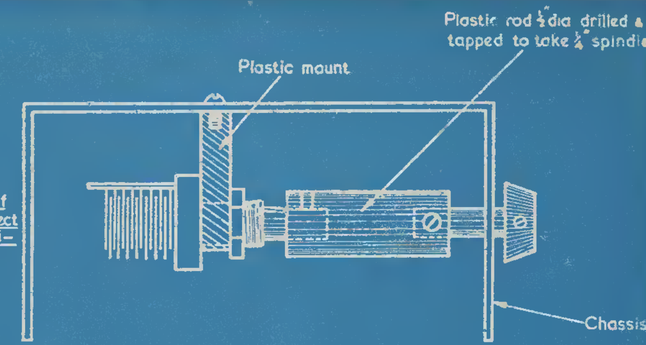


FIG.1 Suggested method of isolating C1 from effect of hand & stray capacitance

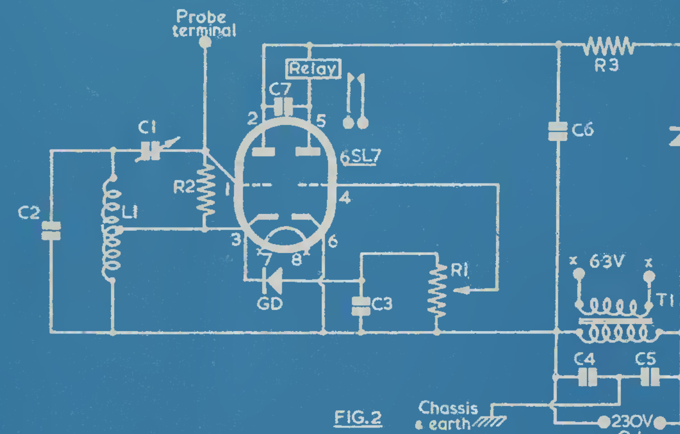


FIG.2

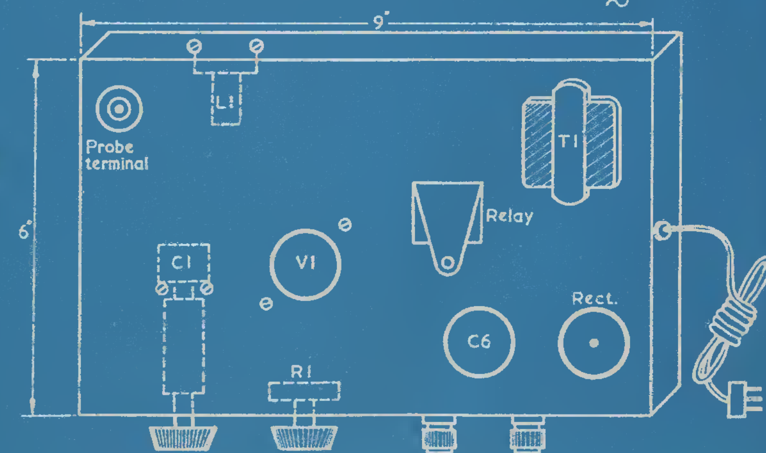


FIG.3 Layout of main components on chassis

E18

The "probe" terminal should be brought out as far away from the adjustment controls as possible. This ensures that the effect of hand capacitance is kept to a minimum whilst adjustments are being made. Wiring should be as rigid as possible and leads to the tuned circuit kept short.

Adjustments

Connect the "probe" terminal by a length of wire, say 3 or 4 feet long, to a metal object, e.g. a paraffin stove. Set R1 at maximum so that the full output of the diode is fed to the grid of the DC amplifier stage. Rotate C1 from minimum capacitance toward maximum. At some point the RF stage will begin to oscillate weakly, and this will be indicated by the release of the relay. R1 then should be adjusted until the relay just operates, and then rotated back till it releases again.

It will now be found that should an attempt be made to touch the stove, say by a young child, the relay will immediately operate. And if the relay contacts are connected to close a bell circuit, a suitable alarm will be sounded. This, as well as many other applications, will become obvious to the constructor. By careful adjustment of C1 and R1, the "operate" distance from the object may be made as much as 3 feet. To ensure long term stability, all adjustments should be made after the unit has been on for at least 15 minutes.

COMPONENT LIST

V1	6SL7
R1	1MΩ pot.
R2	12MΩ $\frac{1}{4}$W
R3	2.2kΩ $\frac{1}{2}$W
C1	100pF variable
C2	100pF
C3	0.01μF
C4, 5	0.01μF 350V
C6	60μF 350V
C7	0.5μF
T1	230V to 6.3V 1A
L1	200 turns pile-wound on $\frac{3}{8}$" former, centre tapped, dust cored.
GD	Germanium diode
Rectifier, 230V 80mA	
Relay, PO 3000 type, 5-15kΩ.	

SIR MILES THOMAS TO OPEN RADIO SHOW

SIR MILES THOMAS, chairman of the British Overseas Airways Corporation, is to open the National Radio Show at Earls Court, London, on August 25. The exhibition remains open until September 4 and there will be a preview for overseas visitors and other special guests on August 24.

The exhibition for the first time is to include a demonstration by the BBC of outside television broadcasts as well as studio broadcasts on sound and television. Television programmes from seven different sources – six of them within the exhibition – will be seen continuously on the screens of several hundred domestic receivers. Cameras used will include the small industrial types and the "roving eye" which is a self-contained camera and transmitting unit, making it free of cable connections.

This year the Royal Navy rejoins the Army and the Royal Air Force n the Services section. Radio-controlled models will be among the electronic "side-shows," the stands of the receiver manufacturers again forming the central feature of the exhibition.

The National Radio Show is organised by the Radio Industry Council under the patronage of H.M. The Queen.

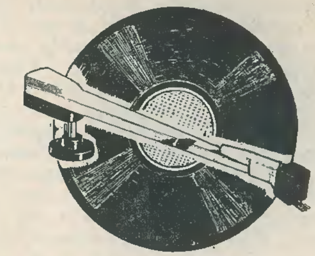
"THE MODEL ENGINEER" EXHIBITION

HIS ROYAL HIGHNESS PRINCE BERNHARD of the Netherlands has graciously consented to open "The Model Engineer" Exhibition for 1954, to be held at The New Horticultural Hall, London, from August 18th-28th. Model Engineers will appreciate this honour that has been accorded to them, the more so as Prince Bernhard is flying to England specially to perform the opening ceremony.

One of two new cups being awarded this year, commemorates the opening of the Exhibition by The Duke of Edinburgh in 1952. To be known as "The Duke of Edinburgh Trophy" it is a magnificent silver tankard and will be competed for by prize winners of previous competitions. Professor Low, well-known in almost every sphere of experimental engineering, has accepted an invitation to act as chief judge for this particular event.

The second trophy – "The Model Engineer Students Cup" for either individual or collective work, is to encourage schools, technical colleges and apprentices to enter examples of model engineering. Pioneer work in this field has been done at the 1952 and 1953 Exhibitions by the boys of the Cuckoo Hall School, and the organisers are hoping to receive other entries now that a special class has been created for this type of work.

REPRODUCING RECORDS



Part 1

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

IN THE GOOD OLD DAYS (now, alas, gone for ever) it was simplicity itself to reproduce a gramophone record. Beyond placing the needle in the groove there was nothing else to worry about. Unfortunately, the pace of progress is such that this is no longer so. In *fact*, of course, even in the past the high fidelity enthusiasts did use "equalisers" in order to obtain correct reproduction. As high fidelity pickups are now available to all, the question of "equalisation" now becomes of importance to every gramophone enthusiast.

"Equalising" circuits, in fact, aim at equalising the reproduction characteristic so that an overall straightline response is obtained. Let it be realised at once that this is *not* the same thing as "tone control"; in fact, even a quite elaborate tone control is not necessarily able to equalise some record characteristics. Unfortunately the position is a little confusing for the beginner, as basically there is no difference between "tone control" circuits and "equaliser" circuits. They use similar methods to perform very similar functions. The difference can best be seen by example.

Let us suppose we have a "HiFi" radio feeder unit. This produces a "straightline" output having a flat frequency response – or at any rate, provides as near an approach to that ideal as we can achieve or afford! We feed the output of our HiFi radio tuner unit into an amplifier with a tone control stage. The tone control we shall assume has a wide range of bass and treble lifts and cuts. On the radio reproduction side the tone control enables us to balance the reproduction "as we like it," and this in fact means that we compensate for the varying effects upon overall "balance" caused by the listening level we use, the loudspeaker characteristics, the room absorption and so on. Once set, however, it is not likely that we shall often need to adjust it.

If we now wish to change over to "gramophone," we obviously need a straightline or flat frequency input characteristic from the record and pickup. If we have this desirable state of affairs, then we have no need of a change of our tone control settings. However – believe it or not – even with a completely flat super-highfidelity pickup – we shall *not* get this state of affairs. This is because *all* gramophone records are made with a deliberately *unflat* response curve. In fact, there are at least *three* major characteristics employed for records commonly available. Moreover, unless these characteristics are corrected, the overall balance will be very poor. The usual tone control is, in fact, not suited for this task, as the requirements are often very different from the type of correction curve used in record manufacture. Moreover, the continual fiddling with both treble and bass controls to correct for several widely different record characteristics would be an intolerable business. This is where the "equaliser" comes in. Briefly, the equaliser is a fixed or switched circuit that corrects the gramophone record characteristic to a flat frequency response. This can be played straight into our HiFi amplifier, and no twiddling of the main tone controls is necessary.

Fig. 1, therefore, shows in block form the sort of set-up we need if we are to reproduce records without trouble, and with correct tonal balance. To illustrate this more clearly, consider Fig. 2, which illustrates the type of ideal record characteristic which is used. The equaliser clearly must have the *inverse* of this characteristic, so that the overall combination is the required flat frequency response. Incidentally, in practice the curves are not made up out of straight-line sections, but are actually more gentle curves, as shown in Fig. 3. These are, in fact, the typical curves obtained by suitable simple correction circuits, which can be produced without much complication. In fact, Fig. 3 is a fairly good impression of the Decca FFRR recording characteristic.

The curve of Fig. 3 illustrates the typical aspects of *all* gramophone record characteristics. There is always a considerable degree of *low frequency cutting*, and very often boosting in the upper frequency portion. Where different makes of record vary, however, is in the frequencies at which boosting or cutting occurs, and also in the *amount* of boosting or cutting, measured in decibels.

To illustrate this, Fig. 4 shows three main types of characteristic in outline. The HMV and EMI group of 78 r.p.m. records use only a bass cut, with a level top response. The Decca FFRR type of characteristic uses (for 78 r.p.m.) a bass cut, and a *mild top boost* starting only above about 3,000 cycles. The USA records, 78 r.p.m., and the long-playing types of both English and USA records, use a violent bass cut starting at about 1,000 cycles, plus a violent degree of top boost also starting from 1,000 cycles. This USA and LP characteristic has in fact almost no straight portion at all. It is obvious that these three types of characteristic need very different degrees of correction, and that correction suitable for one type of record may be useless for another.

Thus a circuit giving an overall flat response with HMV and EMI Group records, will give a somewhat boosted top when used with Decca FFRR records. If we play EMI records with FFRR equalising there will be a slight deficiency of top. With either type of correction, however, the USA and LP records will give vastly exaggerated top and very little bass. If we play EMI or Decca FFRR records on USA equalising, the reverse holds – we shall have vastly accentuated bass and violent cutting of top. The term "violent" is no exaggeration, as on the USA recordings there is some 40db difference in recording level between extreme bass and extreme top!

The reader will thus appreciate that the question of correct equalising is of the greatest importance in the proper reproduction of all records. It should be noted, of course, that all these record types can be satisfactorily reproduced if the appropriate equalising circuit is used for the appropriate type of record characteristic. The dire results of using the wrong equalising have already been discussed. There is a warning, also, as in some cases records with USA type characteristics are issued by British companies. This applies particularly in the case of recordings actually made in the USA and issued here on a British label. In fact, an enquiry to one Company which specialises in records made by USA artists revealed that even the manager did not know what actual recording characteristics was used on their records! From later information it then transpired that a number of characteristics were used ranging from USA to FFRR types of recording curves, but even then it was not known which of the past records had a particular characteristic! This in fact may apply to other Companies as well! The extreme nature of the "USA" and "LP" type of recording characteristic makes this important, as this has extreme degrees of both cut and boost.

The above discussion of recording characteristics may be somewhat of an eye-opener, as for some reason record manufacturers are very loth to reveal their recording characteristics. Moreover, the very big differences between the British and the USA curves causes many record critics to discourse learnedly on "inferior balance," "accentuated top register" and similar matters. Unfortunately, in many cases this only means they are not using the correct equalising circuits. To save the earnest record enthusiast sleepless nights, however, we can reassure him that in practice only a three-position switch is necessary to give correct equalising for the recording characteristics mentioned. The circuits to enable this to be performed are also perfectly simple and will be discussed in the next issue.

[to be continued

The Editor Invites

articles from readers, of a nature suitable for inclusion in this magazine. Articles submitted for publication should preferably be typewritten, but ordinary writing is acceptable if clearly legible. In any case, double spacing should be used, to allow room for any necessary corrections. Drawings need not be elaborately finished, as they will usually be redrawn by our draughtsmen, but details should be clear. Photographs should preferably be large (half-plate) but in any case the focus must be good. Much useful advice to prospective writers is given in our "Hints for Article Writers," which will be sent free on request.

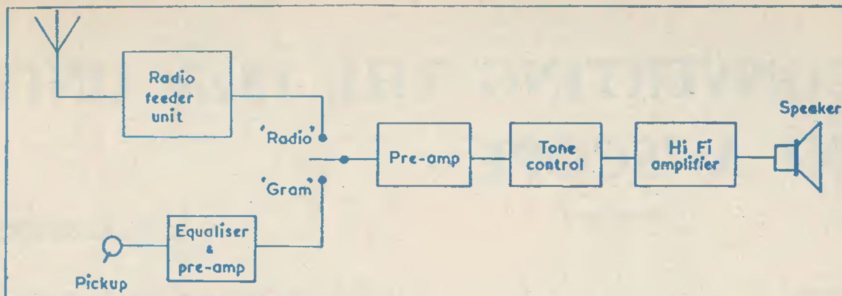


FIG. 1. To avoid fiddling with tone controls when changing over to records, an equaliser circuit provides a fixed and exact correction for the gramophone recording characteristic. This gives a 'straightline' frequency output similar to that from a Hi Fi radio tuner unit

FIG. 2. An 'ideal' recording characteristic showing the top boost and the bass cut which are features of most recording curves

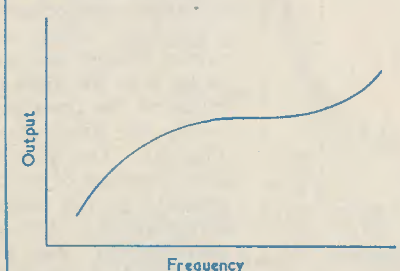


FIG. 3. In actuality, the recording characteristics are more curved in the 'cut' and 'boost' portions. The above illustrates the Decca FFRR type of curve

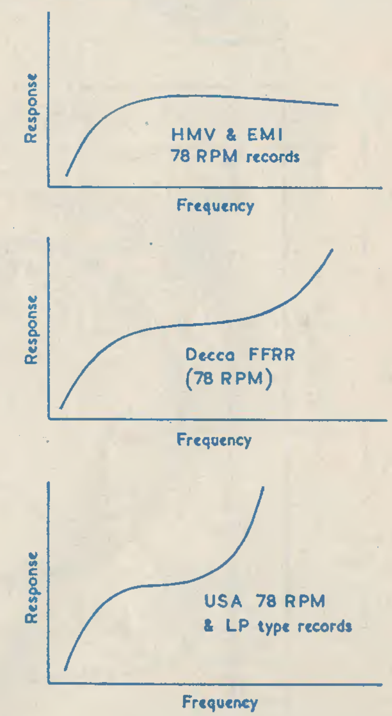


FIG. 4. Typical types of record frequency characteristics

REPRODUCING RECORDS

CONVERTING THE 182A UNIT TO A 'SCOPE

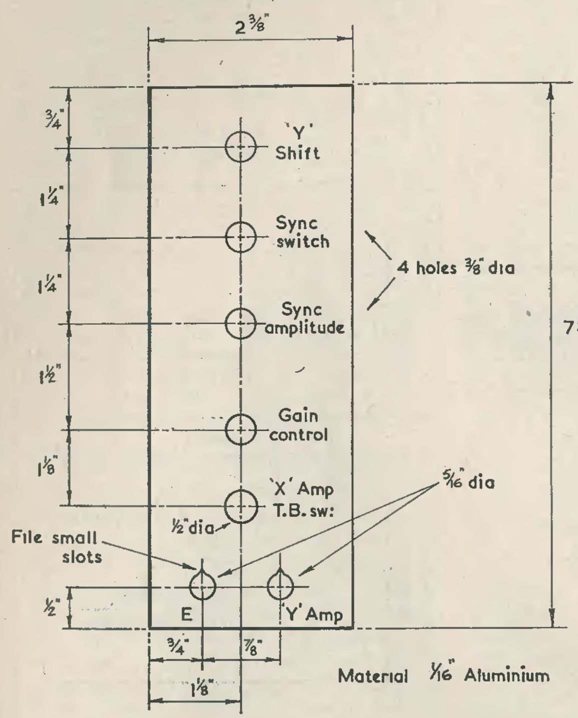
Part 3

By **A. BLACKBURN**

Wiring

Some of the existing wiring, associated with the CRT, may be used without modification. The focus potentiometer R_{54} and brilliance potentiometer R_{57} are already mounted on the Tufnol bar on the underside of the chassis. The layout of the tagboard (above chassis behind R_{54} and R_{57}) containing the remaining resistors in the EHT chain is shown in Fig. 18. It is important to note that all EHT wiring be provided with adequate insulation.

The diode V_{11} is mounted in its holder on the base of the CRT holder. A 16 swg wire, about 1″ long, is soldered to pin 1 (G_1) of the CRT holder, and another similar wire soldered to pin 4 (H). These wires which are sufficiently robust to support the diode and its holder, are then soldered to the anode and one of the heater pins of the diode holder, making two electrical connections at the same time. The holder should be of the cradle type in which the valve lies horizontally.



RC524 FIG.11. FRONT PANEL STRIP

The heater wiring for the VR91 and the CV118 valves will be found to be complete. All that is needed is the connection to the power supply.

The Y amplifier wiring is perfectly straightforward

C_{19}, the input condenser, should be wired direct from the input terminal on the front panel to the tag provided (see Fig. 10). The positions and mountings of the gain control R_{26}, the compensating coil L_1 and bias potentiometer, R_{40}, have already been described. Coupling condensers C_{30}, C_{31} from the output anodes to the plates will be found mounted on a tagboard above the chassis just in front of the CRT holder bracket. All existing wiring should be removed from these components. Notice particularly that these capacitors are not connected directly to the CRT plates, but through links on the terminal panel at the side of the instrument.

The valve line-up from front to rear is: V_5, the input valve, V_4, sync amplifier, V_6 and V_7.

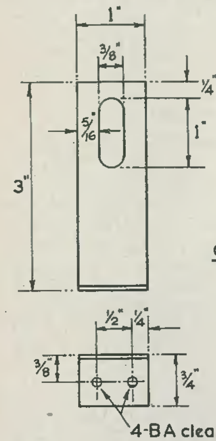


FIG.12. GAIN CONTROL BRACKET

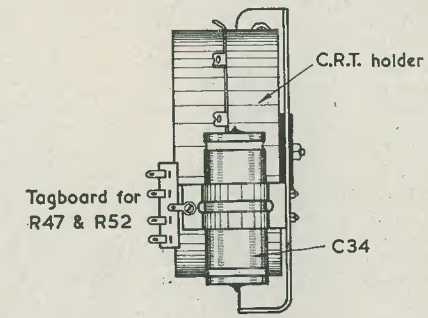


FIG.14. TAGBOARD FOR CRT COMPONENTS

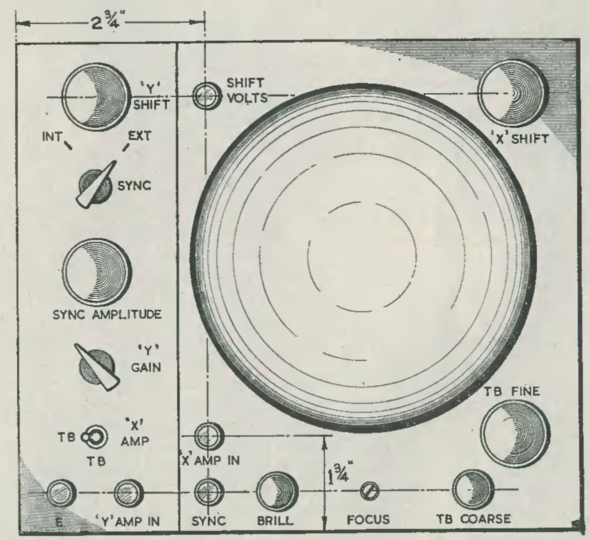


FIG.13. FRONT PANEL

RC526

All leads should be kept as short as possible, particularly the resistors R_{33} and R_{34}, which should be mounted as close to the valveholder as possible. The timebase wiring presents one or two minor problems. One is finding room for the great number of capacitors associated with V_1. For the smaller values (up to 1,000pF) small ceramic components may be used. These can be safely wired direct from the switch to the appropriate pin on the valveholder of V_1. The larger values, C_8 and C_2, are held on tagboards. C_2 is the capacitor mounted above the chassis on the VR91 side, already mentioned in section 6 of the preliminary construction details. C_8 is on the tagboard shown in Fig. 16.

The large tagboard in the centre of the underside of the chassis contains the majority of the remaining time-base components. This tagboard is shown in Fig. 17. Some small components may be mounted direct on to the valveholder pins. The valve line-up from front to rear is: V_1, the sawtooth oscillator, V_3 cathode follower, V_2 inverter valve. CRT plate resistors and the attenuator resistors may be mounted behind the CRT terminal panel, these components being supported by their own wire ends.

In the author's instrument the power cable was not fitted with plugs and sockets, and was, therefore, wired permanently at both ends. Entry to the instrument is made via a small slot at the front of the case. The cable then runs the length of the instrument and is finally anchored at the rear under the chassis.

Care should be taken to ensure that no wiring on components under the chassis stand proud of the edge of the chassis, otherwise they may be damaged when the case is fitted.

Some of the components required are already in the instrument or will have been removed in the preliminary dismantling.

The Case

Two holes have to be cut in the outer case. The small slot for the power cable entry and the hole to allow access to the CRT terminal board are shown in Fig. 19.

The gauge of the metal used in the case is sufficiently light to allow the use of tin snips to cut the holes if no suitable saw is to hand.

Setting-Up

No critical adjustments are necessary to any of the circuit except the amplifier. The bias applied to the output stages is adjusted by R_{40}. The procedure is to apply a small sinusoidal signal to the amplifier input, say 6.3V from the valve heaters, and adjust R_{40} until the maximum undistorted deflection is obtained on the CRT screen.

There is, of course, no reason why the amplifier gain control should not be calibrated. A suitable method would be to apply a voltage of, say 50V to a potentiometer and measure the voltage from the slider to one end of the potentiometer with an ordinary AC voltmeter. This voltage should then be applied to the amplifier input. The output of the amplifier can then be measured by measurement of deflection voltage on the CRT, using the shift voltage as described under "Operation." Now, the meter will read RMS (the waveform should be sinusoidal, otherwise the method is inaccurate), but the voltage measured on the screen will be peak-to-peak. The output voltage should therefore be divided by $2\sqrt{2}$. The formula for calculating gain is, therefore:

$$\text{Gain} = \frac{\text{Output Voltage}}{1.4 \times \text{Input voltage}}$$

This procedure should be repeated for a number of settings of the gain control, and a dial marked with the results mounted behind the gain control knob.

No trouble should be encountered with the time-base if the wiring is correct. Full deflection of the tube will be obtained if the HT and EHT voltages are approximately those indicated. If the trace is very short, the inverter valve V_2 should be removed. If no change in trace length is observed, it indicates a fault in the valve or a component associated with it.

There should be no trace of fly-back on any range except the fastest where, if the brightness is turned fully up, the fly-back may appear very dimly.

Sychronisation may be checked by applying a signal to the amplifier and the sync input terminal simultaneously. Operation of the sync switch SW.3/1 should hold the picture steady in either position, provided the signal has an amplitude of more than about 3V RMS.

Operation: Voltage Measurement

Small signals should be connected to the amplifier input and the gain adjusted to give a comfortable sized picture. Always operate the gain at as low a level as possible in order to avoid the risk of overloading the output stages. If the deflection is too great for the extremities of it to be observed, even with the gain at minimum, connection should be made direct to the Y plate. This involves removing the link from one of the amplifier output-to-Y-plate terminals. If the signal is still too large, connection should be made to the attenuator terminal, and the attenuator output terminal linked to the Y_2 plate. Any signal connected to the Y_2 plate should not have DC superimposed upon it, otherwise the trace may be deflected off the screen, due to the DC coupling.

If either DC or AC voltages are to be measured, the following procedure should be adopted. The signal should be applied direct to the plate (Y_1 for AC, Y_2 for DC). Connect an ordinary voltmeter to the plug on the front panel and set the Y shift until no voltage is indicated on the meter. Mark the vertical extremity of the waveform on the screen of the tube, then operate the shift control until the other extremity of the waveform coincides with the mark. The

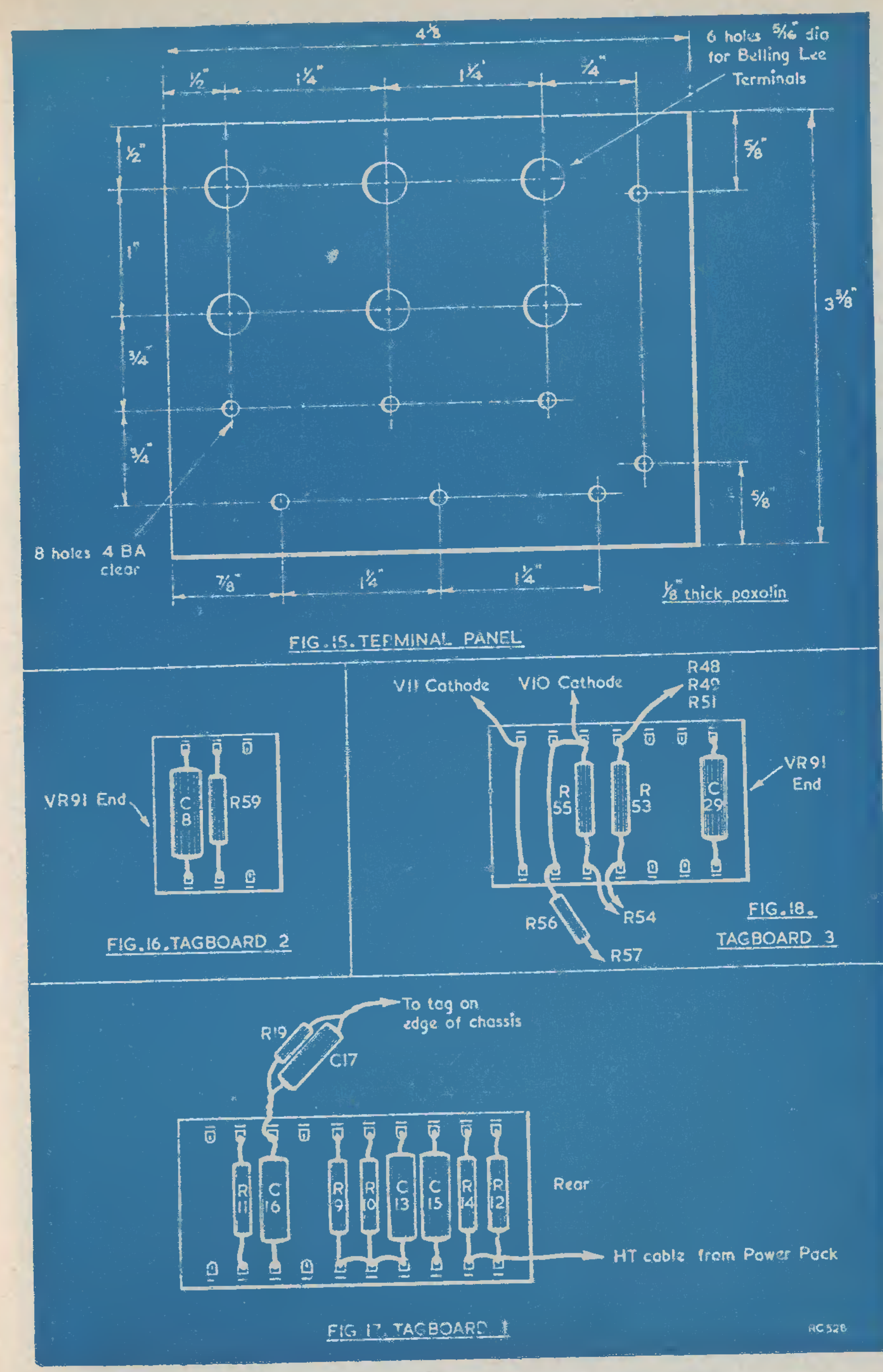


FIG. 15. TERMINAL PANEL

FIG. 16. TAGBOARD 2

FIG. 18. TAGBOARD 3

FIG. 17. TAGBOARD 1

voltage indicated on the meter represents the peak-to-peak amplitude of the waveform. If the shape of the waveform is sinusoidal, dividing the voltage obtained by 1.4 will give the RMS value. DC voltages, of course, will merely represent a movement of the trace, but the measuring technique is the same. All that is happening in effect is to measure the shift voltage required to overcome the applied voltage.

If the amplifier gain control be calibrated and the signal too small to give measurable deflection when connected directly to the plate, the signal should be applied to the amplifier and the same method of measurement used as before, except that the result must be multiplied by the amplifier gain represented on the calibrated control, for the setting used. The amplifier cannot be used for DC measurements, of course.

The meter used in this method should have a sensitivity of at least 1,000Ω/volt. If the attenuator is used, the result should be divided by the attenuation ratio, i.e. by 10.

Incidentally, the terminal panel at the rear of the instrument has only been fitted

The Time-Base

No sync phasing control has been incorporated in the time-base, but selection of phase, particularly on rectangular waveforms, is possible. The sync signal obtained from the amplifier is out of phase with the signal at the input of the amplifier. If the amplifier input and sync input terminals are connected together and the sync switch set to external, the time-base will lock to one edge of the waveform. If, however, the sync switch is set to internal, the sync signal will be of opposite phase and the time-base will lock to the other edge of the waveform. The sync amplitude control should be turned (anti-clockwise) as low as possible, because too great a sync signal may stop the time-base oscillating.

The time-base output voltages are, of course, available at the rear panel. This may be useful if the oscillator were ever used with a wobbulator, as the sawtooth for the reactance valve is readily available.

To use the X amplifier, connect the signal to the X amplifier terminal on the front panel, switch off the time-base (position

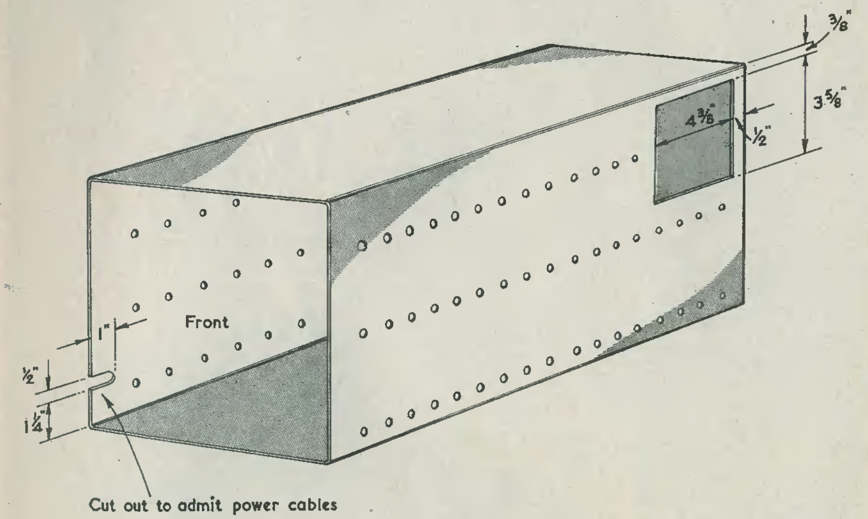


FIG. 19. CASE

with "nut and bolt" terminals for some plates because it was felt that Y_1 and X_1 plates would be required normally, and Y_2 and X_2 only occasionally. The latter plates have their connections made, therefore, to the nut and bolt terminals in order to save buying too many proper ones.

7 of SW_2) and adjust the gain to provide a comfortably sized picture.

Final Remarks

The instrument has been used very successfully for various purposes, including TV and radio experiments. Probably the most interesting feature was that when the oscilloscope was connected to the grid of the IF amplifier valve in a commercial superhet, 6 cycles of 465 kc/s signal were observed locked rigidly to the time-base, despite the presence of modulation. The receiver was tuned to the Home Service of the BBC and the location South West of London. TV signals can be observed particularly well if the time-base is locked from sync pulses after separation. It was found that TV time-base waveforms associated with an electrostatically deflected tube were too large for direct observation and the attenuator had to be called into service.

[END

BOOK REVIEWS

HOME CONSTRUCTOR'S HANDBOOK. Compiled by the technical staff of Roding Laboratories (Electronics). 50 pages. Price 2*s* 6*d*. Published by Roding Laboratories, Bournemouth Airport, Christchurch, Hants.

A useful booklet, well-produced on art paper, containing several well-tried circuits of receivers and associated equipment for home construction. Specifications and parts lists for each piece of apparatus are given. The designs presented include two superhet feeder units, one of which has an RF stage of amplification, a suitable power supply unit for them, a five-valve and a six-valve receiver, each of which has separate designs for AC and AC/DC operation, a 5-watt and a 10-watt audio amplifier, and a local station TRF quality feeder unit. Suitable designs for a signal tracer and a signal generator are also given. A design for a 4-valve AC operated superhet which appeared in a well-known radio journal is also reproduced.

The main feature of these designs is that the pre-aligned superhet tuning units, coils, and IF transformers manufactured by the publishers of the booklet are embodied in the specifications, and so greatly facilitate the constructor's task by dispensing with the need for a signal generator. A few pages are devoted to hints and tips, formulae and data. An abridged catalogue of parts for the designs given is found in the book. Complete "easy as A-B-C" working drawings for most items of equipment can be obtained.

NORMAN CASTLE

TELEVISION ENGINEERS' POCKET BOOK. Edited by E. Molloy and J. P. Hawker. 240 pages, 201 illustrations. Price 10*s* 0*d*. Published by George Newnes Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

A team of qualified engineers has written the material for this compendium which contains a great deal of information often needed by dealers and service men. Although its usefulness is by no means restricted to such specialists, its handy pocket size suggests that it is primarily intended to carry with one so that it is to hand when wanted. To coin a phrase, a book on the job is better than a dozen in the workshop.

It is not possible in this short critique to give a very detailed appreciation of all there is in this book, for much of it is written in a form that can best be described as elaborated notes. Some of the subjects dealt with are transmission standards, waveforms, receiver installation and operation, basic circuitry, projection receivers, recent circuit developments, servicing of receivers and fault tracing, testing equipment, aerials, and feeders, interference, receiver alignment, and so on.

There are some very handy tables giving intermediate frequencies of many popular receivers, details of picture tubes, equivalents, and replacement data. Base connections of valves used in the modern receiver are detailed in another table, and equivalents are also given. A unique table of receiver data for 31 makers' recent models provides essential design information, valve line-up and major component values in ready-reference form, and it appeals as a commendable feature. A further table gives some information on various types of feeder cables. Collected data of the characteristics of feeders is not often found elsewhere.

The inclusion of the Bedford Diagram in the chapter on interference is well-chosen. Those who have not studied it or seen it before will find it of considerable help in locating or predicting interference due to oscillator harmonics and/or second-channel responses.

NORMAN CASTLE

HOME RADIO, by F. G. Rayer. 32 pages, 19 diagrams. Price 2*s* 0*d*. Published by Astral Radio Products, 138 The Ridgeway, Woodingdean, Brighton 7, Sussex.

Reprinted from a series of articles that appeared in *Hobbies Weekly*, this booklet is admirably suited to the beginner who wants to construct simple apparatus that will give results right away. Commencing with a dual-wave crystal set, the book proceeds to a dual-wave single-valve receiver, a low-frequency amplifier and a high-frequency amplifier stage. The design of these is such that they can be added to each other as desired.

The author has given all the essential information required to make the apparatus and ensure its correct operation. The wiring diagrams will enable the beginner to understand better the schematic diagrams given for each design. For the purpose for which it is intended this little book is quite good value. It should certainly appeal particularly to youngsters taking up radio as a hobby with one eye on restricted finances, for the components needed to make any of the apparatus described can be purchased readily and cheaply.

NORMAN CASTLE

SECOND EDITION OF "MODERN SOLDERS" BOOKLET. Multicore Solders Ltd., Multicore Works, Maylands Avenue, Hemel Hempstead, Herts. Boxmoor 3636 (4 lines).

This takes the form of a second and larger edition of *Modern Solders* and is directed essentially to Manufacturers' Sales and Technical staffs. In addition to containing more than 50 illustrations, graphs and tables, it is a complete and up-to-date mine of information to Planning and Production Engineers.

Modern Solders gives precise information on melting points and characteristics of the various standard and non-standard alloys – tables of gauges, even down to 34 swg, with lengths per *lb* and tensile strengths, specific gravities and electrical conductivity of the whole range of Multicore Solders.

Pages are devoted to full details of the many fluxes available, including the new A.I.D. approved ultra high speed Type 362 Flux, of five core solder, the new automatic soldering machine and many other special products.

Dozens of photographs show Ersin Multicore Solder being used all over the world in many vastly different assembly applications and techniques.

Modern Solders is available to all Radio, Television, Electronic Equipment and other allied manufacturers although Multicore Solders Ltd. do not ask that the firm's letterheading should be used when applying. Other interested users are invited to write for complimentary copies of *Hints on Soldering*, and *Multicore Solders' Technical Summary*.

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CHASSIS CONSTRUCTION

By **NORMAN CASTLE**

ALMOST EVERYONE LIKES TO TURN OUT a professional-looking piece of equipment, but many find that chassis construction is something of an art to be acquired. Anything which enables neat workmanship to be obtained can usually be regarded as a boon to the constructor, so it is with this in view that this article appears.

The method to be described is most applicable to working in sheet aluminium, this being the material most favoured owing to its ease of working. However, due to its comparative softness, it is not always easy to get edges and holes which are free from burrs; these often spoil the appearance of the finished article and give it that "home-made" look. One way of getting a clean edge to sheet aluminium was mentioned by W. E. Thompson in his article on building a capacity-resistance bridge, and to "shoot" the edge with a plane as he suggests certainly seems to produce the desired effect. After trying his tip about shaving off the burrs round holes with a chisel, it occurred to me that there might be an even better method, for where a large number of holes has to be drilled, this involves quite a fair amount of work cleaning up the edges. Furthermore, if several groups of holes such as would be wanted for mounting a set of tuning coils are required, much care in setting-out and actual drilling is necessary to secure a neat job. An instance of this is apparent in G. Blundell's design for a Quality Feeder Unit for F.M. A study of the drawings for the chassis layout shows that groups of holes of various sizes are required for mounting coils and providing entries for coil connections.

It was some time ago that I first tried a different method of chassis working, at a time when crowds of holes were required for mounting ten Aladdin coils for a television set that was being made. A trial of the method on odd scraps of metal gave encouraging results, so the idea was extended so that it could be used for practically all holes required in sheet aluminium. It has also been used on tin-plate with equal success.

Like most other home-constructors, I use No. 2, 4 and 6-BA screws and nuts for mounting components, and occasionally holes have to be made for access to tuning-slugs, and the mounting of larger items such as Yaxley-type switches and variable resistors. For the screw sizes mentioned there are, of course, proper sizes of clearance drills, but for all except the most exacting work one can use clearance sizes of $\frac{3}{16}''$ for 2-BA, $\frac{5}{32}''$ for 4-BA, and $\frac{1}{8}''$ for 6-BA.

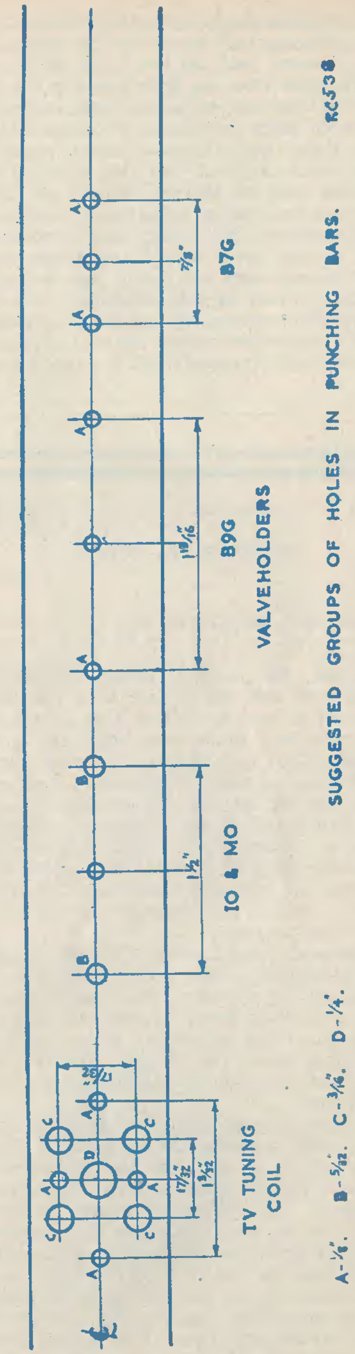
Some trials were made using short lengths of silver steel rod of these sizes to punch holes in sheet aluminium instead of drilling them, and of course it was soon found that to produce a clean hole a clear space was needed in which the punch and blanked-out piece could enter. At the same time a firm base around the edges of the hole was required to prevent bulging. Trying to punch into a drilled hole in a piece of steel bar as a backing-piece did not prevent the work being distorted, since support on the upper surface is also needed. Finally, two pieces of steel bar were clamped together and a hole drilled through both. The work was clamped between them and the punch driven through, and the result was a clean hole without distortion of the surrounding metal. It became obvious that if a group of holes was needed one had only to make these holes in the bars, and use them as punch guides to produce clean-cut holes in the aluminium.

Two lengths of bright mild steel were obtained, each 2*ft* long, 1″ wide by $\frac{1}{4}''$ thick. At each end, these were drilled through carefully so that the holes were on the centre-line. One piece was drilled 0-BA clear, the other piece 0-BA tapping, and an 0-BA thread was made in these latter holes. The two pieces were then clamped together with 0-BA $\times\frac{1}{2}''$ cheesehead screws, and the remainder of the drillings made were done with the pieces so clamped in order that all holed would be accurately aligned in each piece. Other holes for 0-BA tapping and clearing are required so that the pieces can be clamped at closer intervals for certain work, but these can be dealt with later.

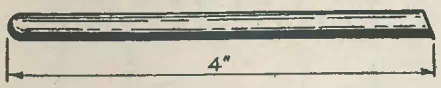
One can now decide what sets of guide holes are needed for punch work, and these should be carefully set out with rule and scriber. The accuracy of subsequent chassis work will depend on the care used in this setting-out, so it will pay to spend some time and patience on it. Centres for holes should also be carefully popped with the centre punch, and with the two bars clamped together all holes should be drilled right through both bars using a $\frac{1}{16}''$ pilot drill. If you have a bench drill, the job of drilling is a lot easier and far more accurate than doing it with a hand-drill. Drills of the correct sizes are used to enlarge the pilot holes to the diameters required, and this should be carried out with a slow feed on the drilling machine and a plentiful supply of lubricating oil. Do not turn the work over, but drill right through from the top-side — into a block of hard wood, of course — to prevent throwing a burr when the drill breaks through. By drilling right through like this, a perfectly regular hole is obtained; it might not be so if the wood block has a slightly sloping face. With some experience one soon gets adept at judging the "feel" of the drill when it is about to break through, and this is the signal to increase speed a little so that the drill is actually rotated right out of the metal. This gives a clean exit, a condition almost impossible to obtain if the drill stops and a forced start has to be made to complete the hole.

When all these holes have been made, the additional 0-BA tapped and clearance holes mentioned earlier can be made. The bars can now be parted, and the surfaces carefully cleaned off using fine carborundum cloth wrapped round a flat file, to produce a smooth flat surface with no trace of burr round holes. This ensures that the edges of the holes shall be sharp, and enables the punching of holes to be done more cleanly and easily. Some suggestions for groups of holes are shown in the sketches, and these will be found to cater for most requirements, but if need is found for other groups of spacings it is a simple matter to make such drillings in the bars as they are required.

In the groups of holes for valve-holders shown in the sketches, no size has been given for the centre holes. It is left to the reader to make such holes the size to suit his needs. If a tank cutter is used for making the large hole, a $\frac{1}{4}''$ hole will be required as a pilot, but if a tool like the Osmor chassis punch is to be used, either a $\frac{3}{8}''$ or a $\frac{1}{2}''$ hole will be needed through which to pass the draw-bolt. Although it is possible to make provision for such holes on the bars, it is perhaps better to make the centre hole $\frac{1}{8}''$, and use the appropriate Osmor "Jiffy" punch to open it out to either $\frac{3}{8}''$ or $\frac{1}{2}''$.



To produce the holes required in a chassis, it is necessary only to set out the work with rule, square and scriber, and using the chassis plan one can then position the two bars over the inter-sections of lines so that the group of holes required are located exactly over them, and then use short pieces of silver steel to punch out the holes. These punches can be lengths of rod 4″ long, with one end filed at a slight angle as shown in the sketch. The other end is rounded. The sloping ends should be tempered by first raising them to cherry red heat and plunging them in oil, polishing with fine emery cloth, and then letting down the temper until a mid-straw colour appears, when the punch is again plunged in oil to set the temper.



SILVER-STEEL PUNCH

RC539

In use, the punch is driven through the guide bars and work piece with one sharp blow of a hammer. The hole in the top bar acts as a guide and holds the punch upright. For best results the bench should be really firm, and if the work is positioned over one of the bench legs there is even less likelihood of any "bounce" when the blow is struck. The hole having been punched, the rod should be tapped right through the bars and extracted from underneath — that is the object of the top of the rod being rounded.

The work-piece has to be shifted for each group of holes, but it will be found that holes can be punched much more quickly than by drilling them. I have made a chassis for a five-valve receiver in about an hour, including setting out the positions of holes, punching them, and then bending the chassis into shape.

If some thought is given to the chassis plan before actually making holes, it should be possible to set out the positions of practically every hole required. Such things as holes for rubber grommets, securing points for tag strips, locations for supporting brackets, and other holes which are so often overlooked in the first place ought to be provided for. If this is done, the whole of the punching can be done before the sheet is bent and shaped into a chassis with sides. Should it be found that some hole or holes are required after the chassis is bent up, then they will have to be drilled out, for the punch bars can then no longer be used. On the other hand, there are some holes which are better made when the chassis is bent. If, for instance, one decides to make the chassis more rigid by bolting the ends of the longer sides to bent-up edges of the shorter sides, it will invariably be safer to punch holes in the ends of the longer sides, and use these as pilots for drilling holes to register in the turned ends. Although these holes *could* be set out and punched in the first instance, the chances are that some slight inaccuracy in bending the sheet will result in the holes not coming into correct register.

If more than one punch of each size is made, the accuracy of the work can be improved, since if two holes are to be made one can be driven through and the punch left in the hole while the remaining hole is made with another punch. This prevents slight movement of the work piece in the clamps, which could result in a small displacement of the second hole from its correct position.

It might also be mentioned that this punching method does produce a bit of noise, so don't go banging holes late at night when the neighbours have just gone to bed, otherwise there might be something said about it. Choose reasonable hours to wield your hammer!

When it comes to bending the chassis, the clamping bars can be pressed into service again. It is easy to fit the clamps so that they fall along the line of bending, and the screws can then be tightened. The clamps and work piece can thus be held in one hand and placed in the vice — a much easier process than trying to juggle the three separate pieces into correct position with one hand whilst trying to screw up the vice with the other! An 8″ or 10″ woodworker's vice is better for this job than the usual engineer's vice, since it gives support along a great length and has greater depth in the jaws. To make a bend, use a length of hard wood about 2″ square, placing one edge close down to the point of bending, and using the timber to lever the sheet over. Try to effect the bend along the whole length of metal, using plenty of weight in the effort. Once the initial rigidity of the sheet has been overcome the rest is easy. The sheet can then be pressed well down and the bend made finally sharp by beating along the edge with a mallet. For this, the blows should be struck on the hard wood, not direct on the metal, or the metal may be bruised by the mallet, leaving unsightly marks on the surface.

Four-sided chassis sometimes present a problem when it is realized that two sides can be bent over without trouble, but bending the other two sides is not quite so easily done. The remedy is to cut some strips of steel a little shorter than the inside measurement of these latter sides. When the metal is bent down, the sides already bent are permitted to pass over the ends of the strip steel. A few cut lengths of steel can easily cater for most of the chassis sizes one is likely to need.

By considering how best to make bends before actually making them, one can often produce intricate shapes by the judicious use of a few strips of steel, and perhaps a few blocks of hard wood to space the work out from the cheeks of the vice.

The use of bright mild steel is much to be preferred for the work described in this article, since this material has sharp, square edges. Ordinary black mild steel has rounded edges, a rough surface, and is softer. Furthermore, it is often far from straight. Bright mild steel is more costly and may be less easy to get, but it is worth going to some trouble to procure some if only for its superior strength and surface finish. As in most handiwork, good results come from the use of good tools, and in this respect bright mild steel for chassis work takes on the importance of a tool, since it directly affects the class of workmanship produced. [END

CAN ANYONE HELP?

Dear Sir, Can anybody supply me with *any* conversion details for the R.A.F. 1132A Receiver. I am willing to pay reasonably for same.—M. Mascard, 4 King Gardens, Waddon, Croydon, Surrey.

* * *

Dear Sir, Can anyone please inform me where I can obtain the circuit for the "Clifton Tape Deck M.Q.1." I will willingly pay for any expense involved.—E. F. Biddlecombe, 92 Cissbury Ring South, Woodside Park, London, N.12.

* * *

Dear Sir, I would be very much obliged if any reader could lend or sell me the circuit and alignment data for the Ferguson Model 904 AC.—J. A. Stephen, 18 Holehouse Drive, Knightwood, Glasgow, W.3.

* * *

Dear Sir, As a regular reader of *The Radio Constructor*, I wonder if any of your readers can give me any details regarding the Admiralty Receiver Pattern A2074, Receiver A/S324, Service No. G2232, made by C.R. Ltd. This receiver contains a 350 Volt output power pack with a 5U4G rectifier, also four 6K7G and a 6V6 output. I have the circuit but cannot understand whether it requires a further aerial unit or anything. I note that there are two small stabiliser valves in the input and a small rectifier in the output stage. Am urgently in need of this information and any expense borne by a reader will be fully reimbursed.—R. F. Smith, 7 Council House, Fivehead, near Taunton, Somerset.

* * *

Dear Sir, Could you please spare space to ask if any reader could lend or sell me a circuit for a timebase and CRT utilising the components as supplied by Messrs. Lasky No. 2 Construction Parcel.—D. Barclay, 17 Richmond Road, Manchester 21.

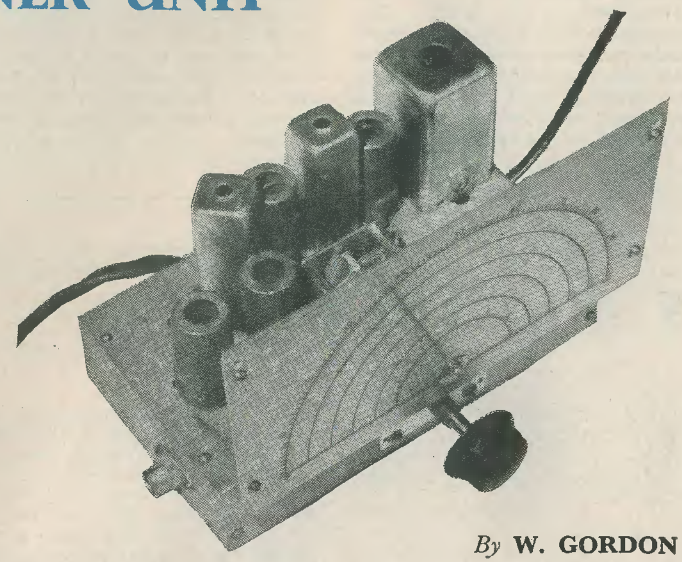
* * *

Dear Sir, Can any reader please supply details of the Control Unit Mark 111 ex-WD Receiver and Transmitter Amplifier Modulator, which controls Tx79 and Rx89. In particular, the ratio of the modulator transformer marked "161-37" and frequency covered together with any possible conversion details to the SEO zones on 70 cms.—John T. Hilton, 2 Junction Road, Bolton, Lancs.

* * *

Dear Sir, I have a Cossor "Melody Maker" TRF receiver using 4 Volt valves. Can any reader please supply me with a suitable converter circuit using a frequency changer and AC mains operated which will enable me to receive the 15, 20, 40 and 80 metre amateur bands.—J. N. Rippon, 22 Allenby Road, Maidenhead, Berks. [END

FREQUENCY MODULATION TUNER UNIT



By **W. GORDON**

BECAUSE FREQUENCY MODULATED transmission is established as the system of modulation of transmissions on the 90 Mc/s VHF Band II, *The Radio Constructor* is featuring this article on a suitable tuner.

The construction and alignment of such a tuner is no more difficult than if it were a normal medium-wave tuner, and most of the coils are easier to make.

The same number of stages would be used, and in this case only three stages would be required – Frequency Changer, IF Stage, and Ratio Detector. This tuner uses two more stages – RF and Limiter, the purpose of which will be described.

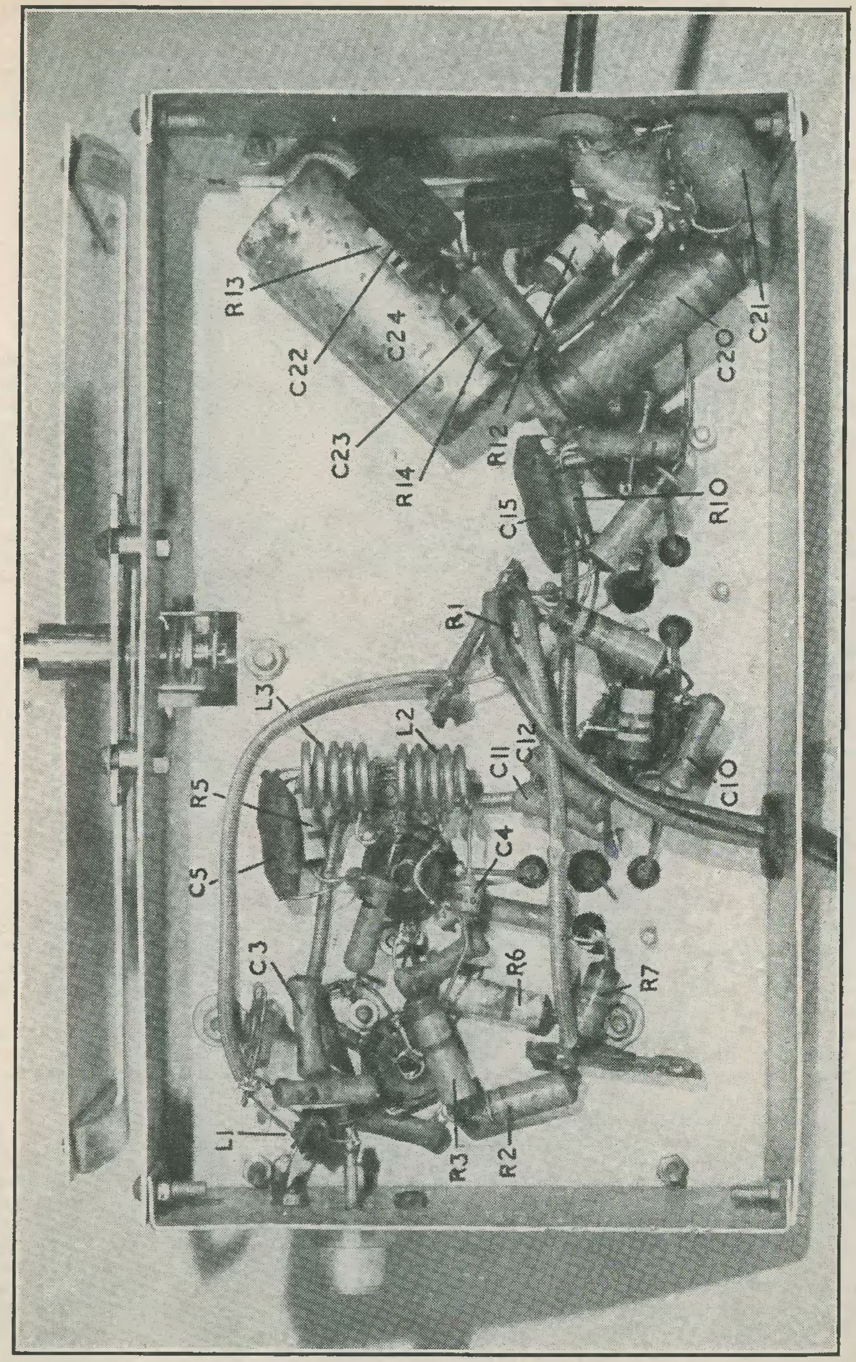
Why VHF?

The medium waves are, of course, already overcrowded, and even with a limited audio range a whistle filter must be used to intercept the carrier of the adjacent stations. Also, the sidebands of the adjacent stations will be heard and the background can never be really quiet except under very favourable conditions. VHF was therefore the only choice, and this has the advantage that the range of transmissions is not much greater than line of sight, and so stations spaced 200 miles apart can use the same frequency with no danger of interference. This does not mean that the service area of the VHF station is less than that of a MW one, since the latter will not give a first class service area much greater than that covered by line of sight, although of course poorer signals can be obtained at much greater distances; this is what causes the whistles.

Why FM?

The decision to use FM was nearly unanimous by the committee set up to study the problem. One point made against FM was that it was more complex and difficult to align, and to ensure the life stability necessary to achieve the best results. This, surely, is a challenge which will be met by manufacturers, and is met in the tuner described in this article.

Pre-war life-stability of 465 kc/s IF's was something of a problem when almost universal use was made of compression condensers for tuning, but with the advent of dust iron cores this problem has nearly



Layout of Major Components Below Chassis vanished. The simplest possible FM set is more complex than the equivalent AM set, but when the latter is fitted with the necessary impulse limiting circuits there is not much difference.

A simple listening test, though, at almost any position except, perhaps, within a couple of miles of the station, showed the stations. This is, in fact, the spacing chosen for FM transmissions.

FM transmission can use any nominal bandwidth; the choice of the BBC has been that ±75 kc/s deviation of the VHF carrier represents full modulation, and this happens at maximum audio amplitude at the frequencies normally encountered.

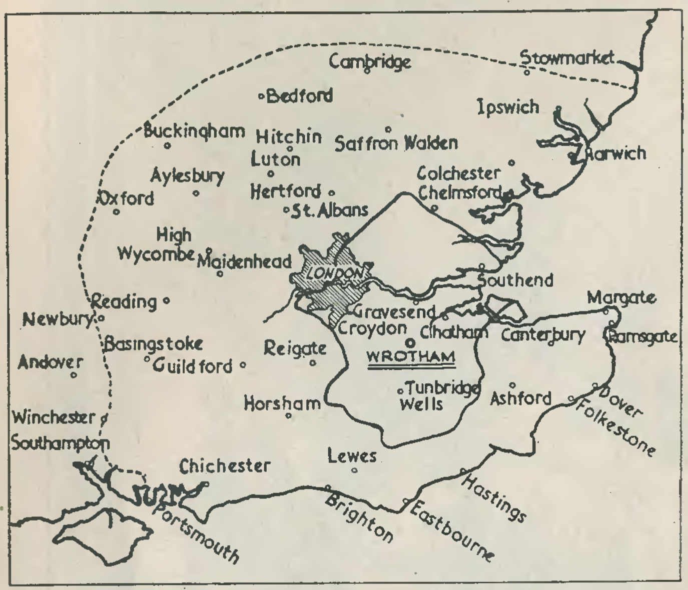


Fig. 1
Map showing the range of the FM Feeder Unit. Two IF stages are necessary in the area enclosed by the dotted line. One IF stage may be employed in receivers to be used in the area enclosed by the solid line.

superiority of the FM signal as regards freedom from impulsive interference and far lower background noise. Complex limiters on the AM receiver could, of course, improve the rejection of the impulsive interference, but there is nothing that can be done about the background noise. This test could only be made when the BBC were radiating the same programme on both FM and AM.

It might be expected that the AM transmission would require a narrower bandwidth receiver and that there could be more transmitters in the same band. Unfortunately, though, the complex limiters used relied, for optimum working, on having a wide bandwidth in the receiver in order to produce interference pulses with a sharply rising wave shape. When this is taken into account, and also one remembers that the stability of VHF oscillators is not so good as lower frequency types, one realises that the spacing could not be less than 0.25 Mc/s between

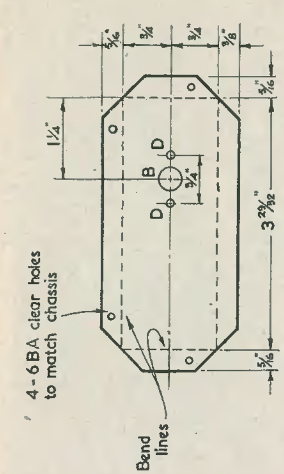
As Band II transmissions have approximately the same service area as Band I TV transmissions, it is interesting to note that most of the new TV aerials are fitted with slot aerials, which are capable of radiating three FM programmes simultaneously.

The service to be expected from Wrotham is shown on Fig. 1 by the thin black line.

The receiver will now be described stage by stage.

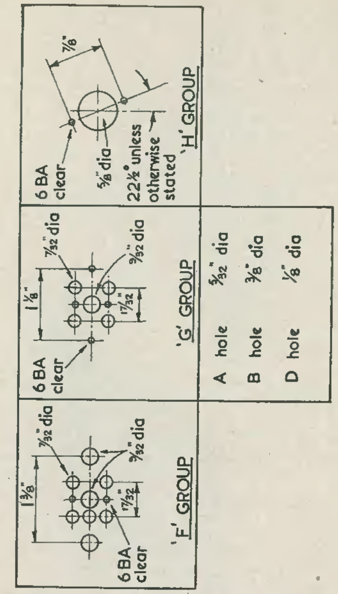
The RF Stage

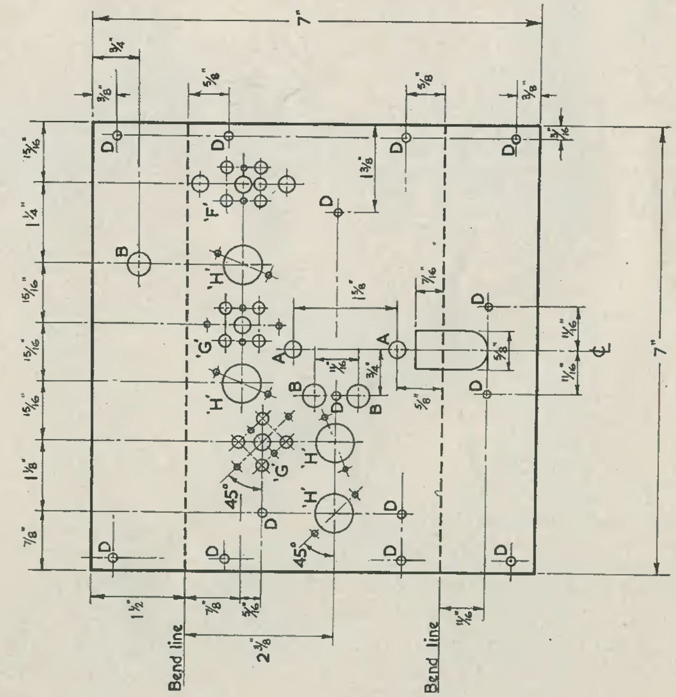
An RF stage is included for two main reasons, one being to prevent oscillator voltage getting directly into the aerial circuit and being radiated from the aerial to the annoyance of all local TV users. Another important feature is that the aerial circuit can be isolated from the frequency changer input, and optimum design achieved in each. The aerial coil is designed for maximum gain rather than selectivity. Both the aerial and grid circuit of the valve



END BRACKETS - OUTSIDE VIEW

The extra lip (not shown in photo) is useful for cabinet fixing purposes





CHASSIS DIMENSIONS BEFORE BENDING - TOP VIEW damp this coil, the two together being equivalent to about 800Ω across the coil. If the spacing of the aerial coil is set to minimise this damping, a loss in this coil of about 4 times would be found. In order to improve the signal-to-noise ratio, the maximum possible step-up is needed, since the valve is the first "noisy" item that the signal meets. The coil has been wound directly on the dust iron slug, and the aerial coupling coil wound as tightly as possible in the middle of this coil. This achieves a gain of about 3, and the tuning is so flat that there is no need to adjust this circuit. There is, therefore, no second channel rejection here, but this coil is very effective against direct IF interference. The coil in the anode circuit is not so heavily damped, and a fair Q can be achieved. The fact that the grid circuit is heavily damped makes this point ideal for the injection of the AVC voltage, since changes in the input capacity of the valve will have very little effect.

The Frequency Changer

The circuit shown was found to be the most effective ever tried at these frequencies. It may seem rather strange to mix in the oscillator valve and put the IF in its anode circuit, but it is really only the old hexode circuit brought up-to-date.

Various other types of circuit were rejected for the following reasons:—

1. *Normal triode hexode*

The triode valve is usually on top of the hexode section and so the leads are rather long. The internal capacities are much higher due to the mixing electrodes, and these points all make for poor frequency stability. The gain is lower and the noise figure higher than the circuit chosen.

2. *Twin triode frequency changer*

This is a good type of circuit for these frequencies, and until recently was the most common type to be found in American TV receivers. Oscillator stability is good, and channel changing by switches is easy. Conversion conductance is poor due to the heavy damping on both the RF grid circuit and the IF anode circuit due to the Miller capacity between grid and anode.

3. *Separate triode oscillator and pentode mixer*

Approximately equivalent performance to the circuit chosen, but of course, the separate valve is a considerable extra cost.

4. *Triode pentode frequency changer*

Approximately equivalent performance to the circuit chosen, but the valve is more expensive. This type is best of all where channel switching is required.

COMPONENT LIST

R1	100kΩ
R2	4.7kΩ ½W
R3	6.8kΩ ½W
R4	150Ω
R5	22kΩ
R6	47kΩ ½W
R7	4.7kΩ
R8	4.7kΩ ½W
R9	150Ω
R10	47kΩ
R11	47kΩ ½W
R12	100kΩ
R13	10kΩ
R14	10kΩ

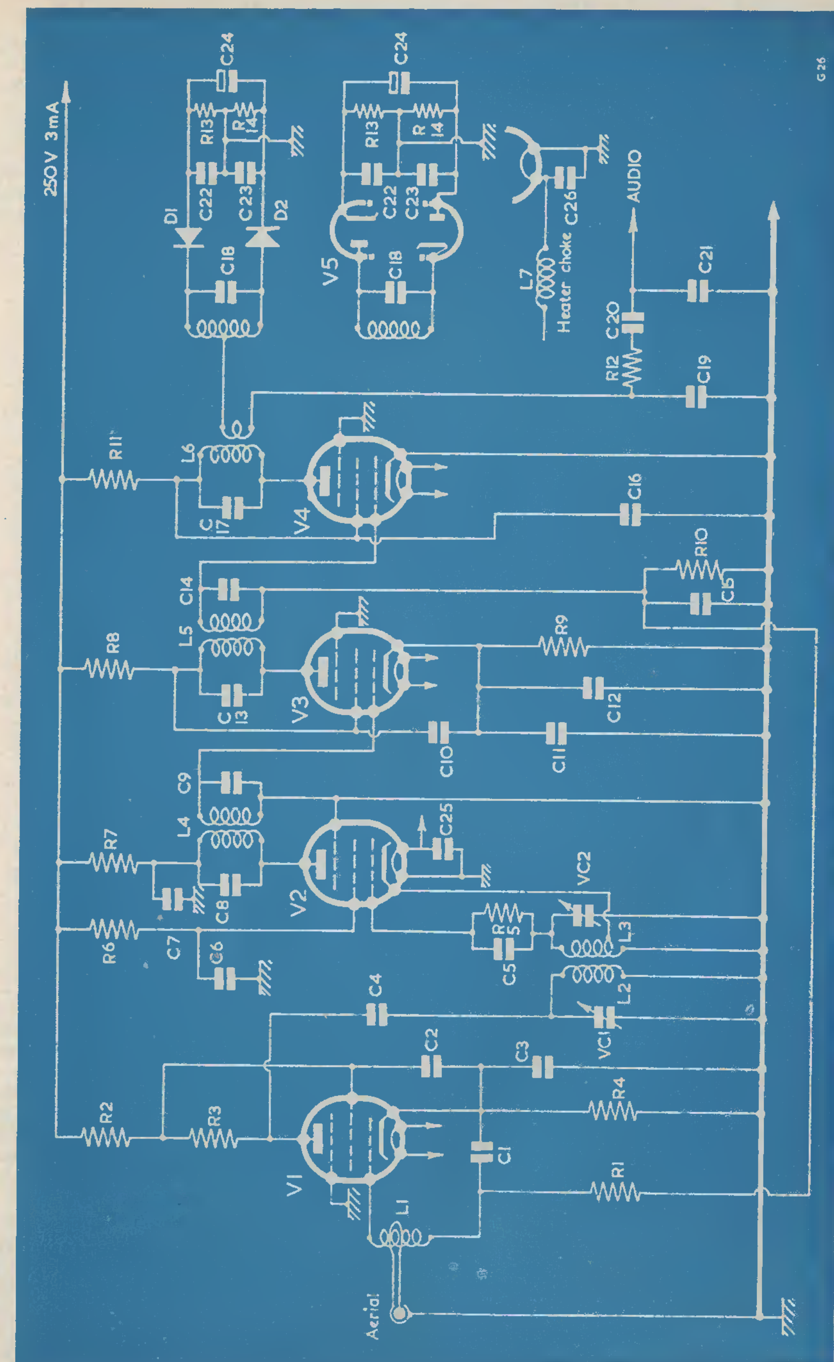
Resistors all ¼W unless otherwise stated.

C1	5,000pF ceramic
C2	5,000pF ceramic
C3	5,000pF ceramic
C4	5pF ceramic
C5	33pF silver mica
C6	5,000pF ceramic
C7	5,000pF ceramic
C8	15pF silver mica
C9	15pF silver mica
C10	5,000pF ceramic
C11	5,000pF ceramic
C12	5,000pF ceramic
C13	15pF silver mica
C14	15pF silver mica
C15	47pF silver mica
C16	5,000pF ceramic
C17	15pF silver mica
C18	47pF silver mica
C19	300pF mica or ceramic
C20	0.05μF paper
C21	500pF mica or ceramic
C22	300pF mica or ceramic
C23	300pF mica or ceramic
C24	8μF 150V electrolytic
C25	5,000pF heater V2 to chassis
C26	5,000pF necessary only when using V5 instead of crystal diodes.
VC1-2	Split stator 25pF+25pF, Jackson Bros. type U101.

Tag Strips

Dial	Jackson Bros., full vision drive type 2154 fitted with scale type 4838
Valves	V1, Osram Z77
	V2, Osram Z77
	V3, Osram Z77
	V4, Osram Z77
	V5, Osram D77 or germanium diodes

Chassis; Coils, complete with condensers. G. Blundell, 7 Sunnyside House, Child's Hill, London, N.W.2.



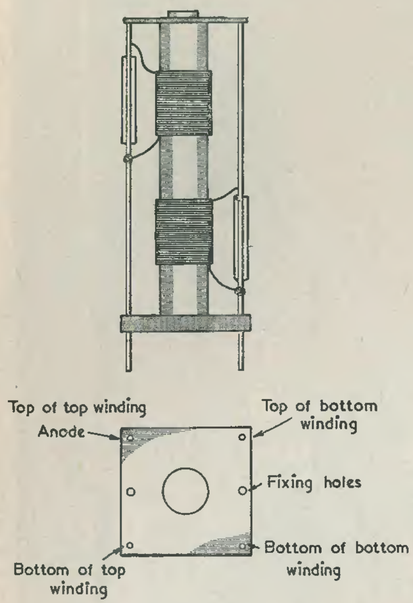
F.M. Tuner Unit Circuit

The Circuit Chosen

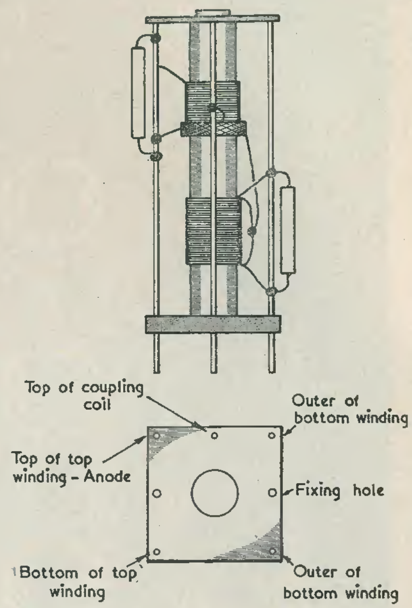
This type would be unsuitable for channel switching since it is very important to keep the inductance of the cathode lead low, and switching is not possible. Otherwise, this circuit is probably the most stable of all, as well as giving equivalent performance. The anode circuit is well shielded from the input circuits by both g2 and g3, and so there is no damping on this circuit. Since for drift and ageing. Automatic gain control is not used here since the resulting change of valve input capacity would adversely affect the frequency response and cause distortion.

The Limiter Stage

This tuner will perform quite well without this stage; indeed, many sets do not use one. But the use of this stage considerably



IF COIL DETAILS



RATIO DETECTOR

G29

the valve is oscillating, a voltage of about 5 is built up at the grid, and this is highly suitable for mixing. A gain of about 15 is achieved in this stage instead of about 5 if a normal miniature triode-hexode were used.

IF Stage

The intermediate frequency is 10.7 Mc/s, as this is becoming a standard IF for FM receivers. Coil winding is reasonably easy, and the frequency high enough to achieve a good second channel rejection in the RF stages. IF's of between 5 and 21 Mc/s have been used in the past.

The coupling is chosen to be slightly over-coupled in order to achieve a bandwidth of about 250 kc/s. This leaves ample margin improves the rejection of impulsive interference and also avoids the need for carefully balancing the ratio detector component values. Even when these components are carefully balanced the AM rejecting properties rapidly deteriorate as the set is detuned, and therefore frequency stability becomes more important. The use of this stage also makes the warming-up drift unnoticeable.

The Ratio Detector

The Ratio Detector was chosen in preference to the Foster-Seeley discriminator because of the better AM rejecting properties of the former. Winding instructions for this coil should be carefully followed as achievement of good balance and low capacities improve the circuit performance.

The operation of the Ratio Detector is as follows:

Two voltages appear at the diode anodes which vary in relative phase as the signal frequency changes, and this results in the appearance of an audio signal proportional to the original modulation appearing across C18, which is, of course, made large enough to integrate it into a continuous wave, but not so large that the high frequencies are affected. This phase difference of the signals derives from the fact that the voltage/current phase relationship in a tuned circuit varies as the frequency is altered, and are only in phase at the resonant frequency. Such a voltage is impressed on the diode anodes by the inductive coupling between the primary and secondary. Also impressed on the diode anodes is a reference voltage derived from a tightly coupled coil wound directly on the anode coil, and this is impressed equally on both diodes by being fed into the centre tap of the secondary coil.

COIL DETAILS

Formers and Cans

3 Formers $\frac{3}{4}''$ square base $\times$ $2\frac{1}{4}''$ high, Aladdin.
2 Cans to fit above.
1 Large Can $1\frac{3}{8}''$ square $\times$ $2\frac{1}{2}''$ high.

Coil	Circuit Design	Turns	Wire swg	Spacing	Condensers
Aerial	L1	4	24 DSC	—	—
RF Anode	L2	5 ($\frac{5}{16}''$ diam.)	16 TC	28 swg DSC	—
Oscillator	L3	5 ($\frac{5}{16}''$ diam.)	16 TC	Cathode tap one turn	—
IF1	L4	38	38 DSC	$\frac{3}{16}''$	C6 15pF s/m
		38	38 DSC		C7 15pF s/m
IF2	L5	38	38 DSC	$\frac{1}{8}''$	C11 15pF s/m
		38	38 DSC		C12 15pF s/m
Discriminator	L6 and coupling	29	40 DSC	$\frac{3}{8}''$	C15 15pF s/m
		15+15	38 DSC		C16 47pF s/m
		5	40 DSC		—
Heater Choke		100 $\frac{7}{16}''$ former	24 DSC	—	—

Coil Winding

The aerial coil is wound in the screw thread of the core and the ends tied together with cotton. After winding one turn of PVC the whole coil is "distrened." The core is $\frac{1}{4}''$ long and is a normal core cut in half. This length should be carefully followed in order to make the coil tune in the correct part of the band.

The oscillator and RF anode coils are wound on a $\frac{5}{16}''$ mandrel in a clockwise direction. They should be mounted about $\frac{5}{16}''$ below chassis, and one lead left long enough to go through the chassis to the condenser. The spacing should be approximately $\frac{3}{16}''$. The cathode tap should be soldered on before mounting, care being taken not to short turns of the coil.

The IF transformer calls for no comment except that the coils should be wound in the same direction, and the opposite ends are made "*live*" to the signal. Care should be taken that the condensers do not short to the can.

The Ratio Detector

The anode coil is wound normally, and then one turn of polythene tape or paper is wound over the coil. The coupling coil is wound at the earthy end of the anode winding. Normal clear office tape should not be used since the sticky side absorbs moisture, and will also attack the copper wire.

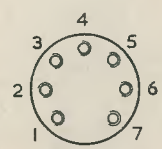
The closely coupled diode winding is produced by winding 4 wires 24″ long together, 15 turns being wound. The winding is fixed with polystyrene dope. After about 10 minutes two alternate wires are removed leaving a spaced bifilar winding. Do not lose patience with this, as a spaced winding is necessary to reduce the capacities.

ndicator. The cores are then set to produce the required bandwidth of 250 kc/s. To adjust the ratio detector, connect a meter across C24 and adjust both cores for a maximum reading.

Transfer the meter across C19 and then finally adjust L6 secondary for zero reading, with the generator still set to the intermediate frequency of 10.7 Mc/s.

Care should be taken that too great a voltage is not impressed on the crystal diodes, as they may easily be damaged. Particularly,

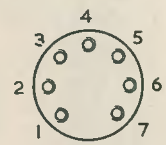
Z77



B7G Base

1 Grid G1
2 Cathode
3 Heater
4 Heater (earth this side)
5 Anode
6 Shield & G3
7 Screen G2

D77



B7G Base

1 Cathode No 2
2 Anode No 1
3 Heater
4 Heater
5 Cathode No 1
6 Shield
7 Anode No 2

VALVE BASE CONNECTIONS

G28

Valves

The Osram valve type Z77 has been found very suitable, together with crystal diodes type GEX34. A diode type D77 may be used with the ratio detector, but the leads will be much longer and this may cause feedback. A heater choke will also be needed to prevent harmonics of the IF from causing spurious inputs into the RF part of the receiver. Cathode-heater hum may also be experienced.

Alignment

A generator is needed to set the IF's. Feed in first across V3 grid to ground, and then at the grid across the oscillator coil. The oscillator coil will, of course, shunt the generator, but this will prevent instability which will appear if the oscillator coil is disconnected. A micro-ammeter or valve voltmeter should be used to act as an

do not use a smaller value of resistance for R11, otherwise the limiter valve will be able to produce too much voltage.

The aerial should now be connected, and the station should be found at about 20° on the dial. Another reading may be found higher up, but this should be ignored, as the low oscillator frequency is the one to be used. The RF coil is tuned by parting the turns with an insulated screw driver while watching the meter reading when connected across R10. It may, of course, be necessary to close the coil up a little.

Oscillator Stability

The low oscillator frequency of 80 Mc/s is used, and in practice it is found that after about 10 minutes the drift is almost nil. On switching on, say next day it will be found that the set is adequately in tune to prevent undue interference, and after 10

minutes, of course, the set will be perfectly in tune.

Note that the resistor R5 is connected across the capacitor C5 to prevent the capacity of the resistance appearing across the tuned circuit, and possibly causing frequency drift. Also C15 and R10 are connected in the bottom end of the tuned circuit for the same reason.

The cathode of V2 is live, and so a condenser from heater to ground is necessary to prevent oscillator radiation from the heater wiring.

The dipole aerial should be 5′ long (total) with ½″ spacing in the middle. The aerial should be mounted broadside on to the station as the waves are horizontally polarised. [END

ELECTRONICS EXHIBITION

THE NINTH ANNUAL ELECTRONICS EXHIBITION, organised by the North-West Branch of the Institution of Electronics, will be held at the College of Technology, Sackville Street, Manchester 1, on Wednesday July 14th (12 noon to 10 p.m.), on July 15th, 16th, 19th and 20th (10 a.m. to 10 p.m.) and on Saturday July 17th (10 a.m. to 7 p.m.).

The Exhibition will be officially opened on July 14th, at 2.30 p.m., by Dr. B. V. Bowden (Principal of the Manchester College of Technology).

The Exhibition will consists of two Sections, a SCIENTIFIC AND INDUSTRIAL RESEARCH SECTION (composed of displays from the Universities, Research Associations, Hospitals, etc.) and a COMMERCIAL SECTION (devoted to Manufacturer's products). It will include displays from more than 50 exhibitors.

A wide range of electronic products will be shown that will be of interest to visitors from all branches of Science and Industry.

An extensive PROGRAMME OF LECTURES will be presented, dealing with topics from all branches of Electronics, and will include lectures of general interest as well as those of a highly technical nature. FILM SHOWS, on subjects ranging from the *First Principles of Electronics* to the *Manufacture of Radio Valves and Television Picture Tubes*, will be presented three times daily.

VISITS TO THE MANCHESTER UNIVERSITY COMPUTING DEPARTMENT: Arrangements have been made for Visitors to the Exhibition to see the Manchester University Computer in operation. Visits (lasting about 1 hour) have been arranged for the afternoons of July 14th, 15th, 16th, 19th and 20th and for the evenings of July 16th and 19th. The Parties will be limited to 20 persons each and tickets for same (bearing the date and time of the visit) are obtainable as for the Exhibition Lecture Tickets.

EXHIBITION CATALOGUES containing over 100 pages of illustrations and descriptions of the exhibits – together with Time Tables for the Lecture and Film Show Programmes, and a complete Guide to the Exhibition – will be available from the Secretary early in July (post free 1/6).

LECTURE AND FILM SHOW PROGRAMMES were available (post free 4½*d*) in June.

Applications for EXHIBITION ADMISSION TICKETS and for LECTURE ADMISSION TICKETS should be made (enclosing a stamped addressed envelope) to the Honorary Exhibition Organising Secretary:—

Mr. W. Birtwistle, 78 Shaw Road, Thornham, Rochdale, Lancs., or, during the period of the Exhibition, by direct application at the Exhibition Reception Desk.

Among the many exhibitors of interest to our readers, are the following:—Advance Components Ltd., Automatic Coil Winder and Electrical Equipment Ltd.; A. C. Cossor Ltd.; Dawe Instrument Co. Ltd.; English Electric Co. Ltd.; Electronic Instruments Ltd.; Ferranti Ltd.; Kelvin and Hughes Ltd.; Marconi Instruments Ltd.; Measuring Instruments (Pullin) Ltd.; Mullard Ltd.; Philips Electrical Ltd.; W. G. Pye and Co. Ltd.; Siemens Electric Lamps and Supplies Ltd.; Standard Telephones and Cables Ltd.; Wayne-Kerr Laboratories Ltd.; Westinghouse Brake and Signal Co. Ltd., and Radio Society of Great Britain (South Manchester Group). [END

Radio Miscellany

SEVERAL TIMES RECENTLY I have heard from readers about "dead spots" – areas where radio reception is poor. Such areas are rather more common than is generally believed, and in recent years the BBC have fitted out a number of relay stations to adequately serve them. The dead spots that readers refer to are, however, small local areas – their own particular areas in fact. True, there are instances where a small district is, for some reason, "bad" for reception, but often on investigation it is found that the chief trouble is nothing more than thoughtless aerial siting or an insensitive receiver. Listeners who move to fresh districts often find their reception is poorer than at their former homes and tend to blame the area if they can find no hilly districts which might be blanketing them. Invariably their troubles are greatly mitigated by re-siting the aerial, or overhauling a receiver with a deteriorated performance, but even so they still retain a suspicion that the soil, the presence of mineral deposits or some other factor, makes their reception sub-average.

Right Turn

These points may have some bearing on the question, and listeners in low-lying, badly screened districts often have to put up with an attenuated signal and the consequential poorer quality. In the early days of radio "dead" spots showed up more prominently than they do now. Receivers were then far less sensitive, and there was no AVC to compensate for the effects of fading. At one time, with a small group of others, I started on an investigation of such cases to see if a definite pattern of behaviour could be traced. Unfortunately, we never got very far; more exciting developments came along too quickly, and in any case some of our theories were somewhat confused by muddled ideas about "earth" currents. In all cases we found that a little care in planning the aerial effected an enormous improvement. Quite a small change often makes a wonderful difference, and it is still by no means unusual to find someone with the aerial "end on" to the local broadcaster. Turned "broadside on," the signals often go up several hundred percent.

100 Watts (Dutch) = 1kW.

It is odd how long reputations for "blind" radio spots persist, and no doubt many readers have been told "This place is *notoriously* poor for reception." Often the residents seem genuinely surprised that you didn't already know all about it. I even found a chap who seemed quite proud that his district was famous for being a dead spot. He solemnly assured me that the BBC knew all about it, having gone into the question most thoroughly. It baffled their best brains, and they finally decided there was nothing they could do about it!

Conversely, every pre-War amateur can tell you all about the good spots. During the early thirties Croydon and Cambridge became almost legendary as the best areas in Great Britain for working Dx. Both these districts had a proportionately high number of licensed amateurs and among them there were several with very progressive ideas, and a few super-duper aerial exponents. Between them they worked everything that was going, and from this the Croydon and Cambridge traditions grew – and still linger in memory, if not in acceptance.

Once again, of course, it was the aerial which was the important factor. In those days all amateur transmissions were crystal controlled, and precise cutting was necessary to get the last ounce out of the lower power then used. Post-War everybody uses a VFO and 150 watts (nominal) and it is a simpler matter adjusting the oscillator to suit the aerial, rather than cutting the aerial to resonate at a single crystal frequency.

The crack about the nominal 150 Watts, by the way, is not intended for British amateurs. I have known only a very few who exceed their permitted power. A few other nationals are allowed to use more, but on the Continent there are quite a number who use a hundred and fifty "Dutch" Watts – to a pair of 813's.

Take Your Pick

The enterprise of the non-GPO Hull Telephone Service in laying on a recorded football score for subscribers, serves as a reminder that despite the progress in other electrical applications, the telephone service remains virtually static. On the Continent there are a variety of services available which are still denied U.K. subscribers. True, we can dial TIM, but in Germany you can get all sorts of services, including menus read at dictation speed, weather forecasts, local cinema programmes with times of last performance, etc., and an information bureau.

Visitors like myself merely dial the number and trust to luck that they can understand enough of it to make sense. I found it good fun, and no doubt other readers who have visited parts of Germany where these services are on tap enjoyed them as a pastime.

A couple of years back I visited a Swiss enthusiast who had an automatic recorder attachment. If the 'phone remains unanswered, the caller hears a voice repeating that a message will be taken. On his return home he can play back the message, but the real novelty of it lies in the fact that he does not have to return home. He can 'phone back his own house and hear it from wherever he might be. Nor can anyone else get the message either by design or accident – a combination of numbers known only to the subscriber has to be dialled before it is repeated. It was an expensive gadget, mark you. When I worked out the cost in Sterling I reckoned it would keep me in cigarettes for the rest of my life. Quite apart from its gadget value, it is a fine thing to show off to your friends – and one day it might come in for something really useful!

Most of the continental telephone systems have additional services, but the instruments themselves often look antiquated to us – those in Holland look almost Victorian. In several of the smaller countries the town (or Exchange) is part of the number. Sweden, too, has a similar service to the Swiss one I described, but it is not fully automatic. It is partly operated by "hello girls." You simply arrange to have your calls diverted, and they ring you back later with whatever messages are left for you. Nice for those who like the sound of pleasant voices, but no fun at all for a true gadgeteer.

No doubt many of our readers could contrive some ingenious devices, but the Post Office take a dim view of anyone who does that sort of thing.

Thinking of telephones reminds me of an amusing experience told me by a reader. Every time he 'phones his girl friend, he gets the Light Programme. I can only imagine it is picked up from a Relay service wiring which might run parallel. I wonder whether he is entitled to listen to it without taking out a wireless licence!

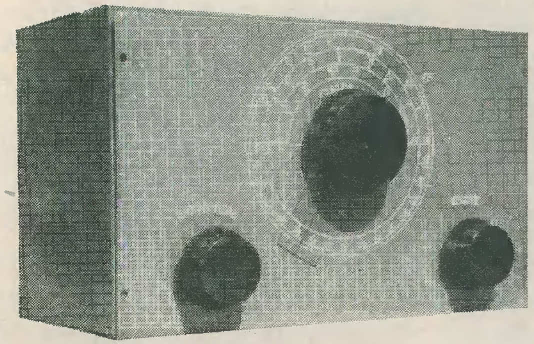
Pulling Together

Twice recently I have found cases where a second loudspeaker has been added without checking that they were correctly 'phased.' Two nearby speakers should always be arranged so that the cones move in the same direction at the same time. Out of phase, the sound waves set up by each tends to cancel out the other, and there is a marked falling off in reproduction, especially at the lower frequencies.

A simple method to ensure that this does not happen is to touch a 1.5V battery across the speech coil, when the cone will move either backwards or forward. Mark the lead which when connected to the positive of the battery brings the cone backwards (towards the magnet). The speakers can then be connected up properly phased in a matter of moments, even for occasional use. When used in parallel the two marked leads are joined together; and for use in series, one marked lead is joined to the unmarked lead of the second speaker. [END

Centre Tap talks about Dead Shots — G.P.O. 'Non-Enterprise' — Twin Speakers

BUILDING THE RCS BATTERY RECEIVER*



Part 1

A ONE-VALVER

By **JAMES SINCLAIR**

IN THIS, THE FIRST OF A SERIES OF ARTICLES, is described stage by stage how a battery receiver may be constructed by the veriest beginner. Most beginners in the art of home construction cannot read a circuit diagram, and have few workshop tools or equipment with which to carry out their plans. It is for this class of reader that this series is intended. The circuit diagram is included in order to familiarise such readers with this, with the help of the point-to-point layouts shown.

This first instalment features an O-V-O (one-valve) receiver with battery power supply. Following instalments will describe how to add two other audio stages, so that the final unit will be a three-valve receiver of pleasing appearance and design.

As a one-valve regenerative receiver, it is built on an aluminium chassis with all holes stamped ready for assembly. The panel is sprayed a dark battleship grey with a calibrated dial – see illustration. As received, all major components are colour coded for connection purposes, so that construction is simplicity itself. The valve used is the 954 acorn type and the receiver power consumption is very low – 6 volt at 0.15 amps LT and 30 volts HT at 1.5mA.

Assembly Instructions

By means of the bandspread condenser C4, secure the panel to the chassis and then mount the reaction condenser C3, *ensuring that no metal part of this component is in direct contact with the metal chassis or panel.* This is achieved by having two paxolin washers in position on the condenser spindle when it is placed in position and a further washer on top of the panel before securing the lock nut. Next, the coil holder should be secured by means of two nuts and bolts. The red-coloured socket should be nearest the bandspread condenser. The condenser C2 (the largest condenser) should now be fixed to the panel by means of the lock nut. *Both this and C4 must be earthed to the chassis and panel*, and this is done simply by direct contact of the metal parts once they are mounted securely.

The next component to be fitted is the valveholder. This is fastened to the chassis by two nuts and bolts, and it should be noted that the valveholder itself is supported above the chassis deck by two small paxolin stand-off sleeves.

The paxolin phone socket strip should now be mounted on the rear chassis wall.

* See advert on page 743

The blue and white tags should be nearest the bottom edge. The nut between the red and white connections should have a small soldering tag inserted underneath it before tightening, thus forming an earth connection in itself.

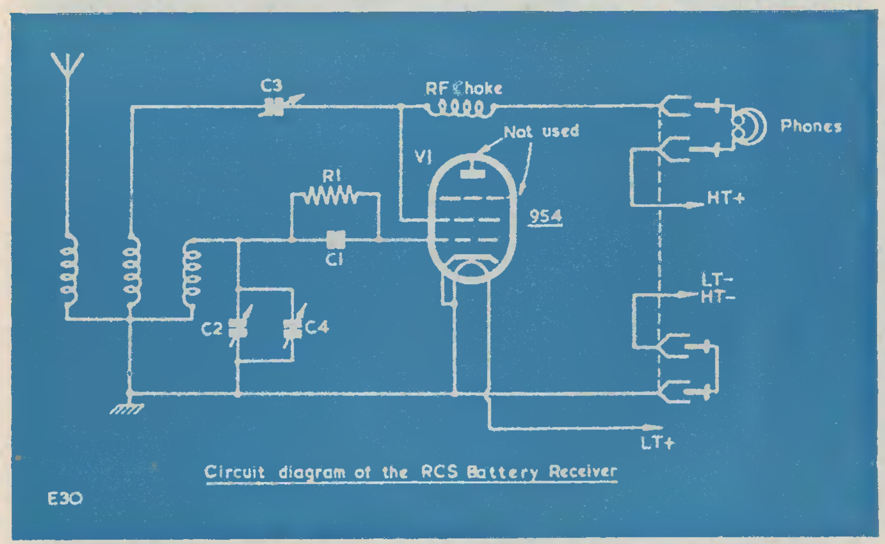
The other paxolin strip already in position as received is the external aerial and earth connections. The aerial terminal is insulated from the chassis, while that of the earth is, of course, in direct contact with the metal work. This latter connection, marked E in the photos, has a solder tag already in position. Lastly, the three control knobs should now be fastened in position; the larger one with the pointer attached should, of course, be secured to the spindle of C2.

This completes the assembly for a one-valve receiver, and we now continue with the actual wiring of the circuit. The only tools required are a pair of pliers with wire cutters incorporated, a small length of three-cored solder and a soldering iron, preferably of the electric type.

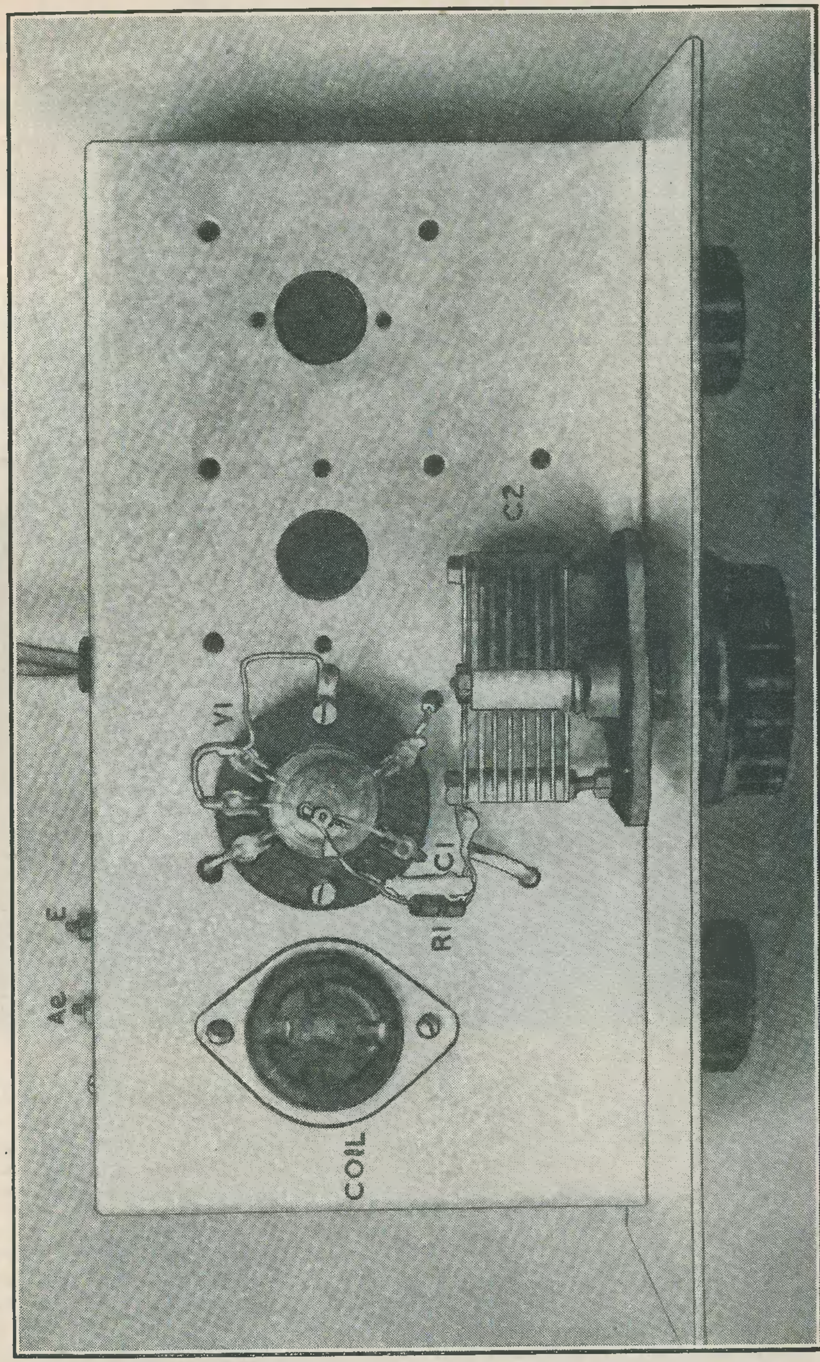
Wiring Instructions – Step by Step

NOTE: All wires must be insulated.

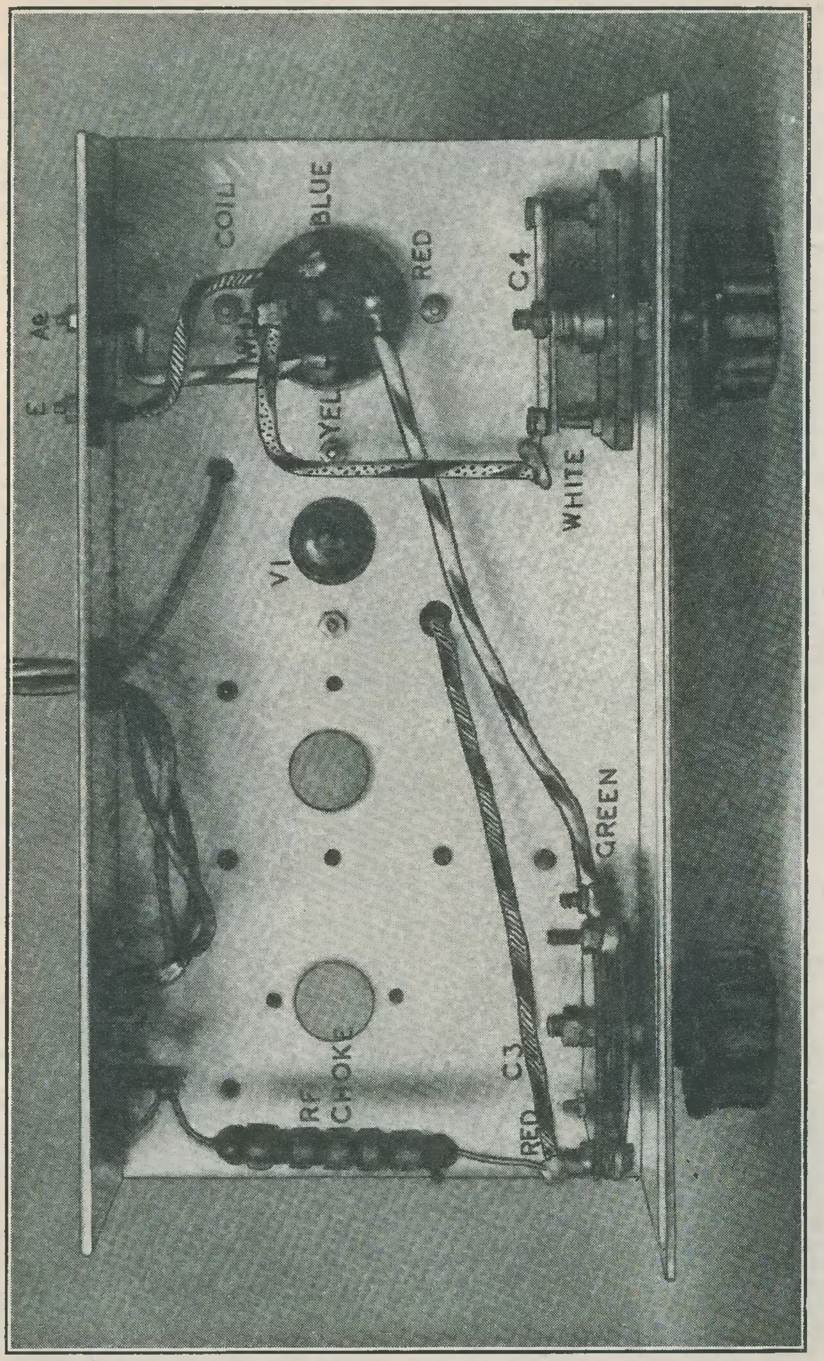
STEP No. 1. From Aerial Terminal to YELLOW on Coilholder.
,, No. 2. From Earth Terminal to BLUE on Coilholder.
,, No. 3. From WHITE on Coilholder to WHITE on Bandspread Condenser (C4).
STEP No. 4. From RED on Coilholder to GREEN on Reaction Condenser (C3).
,, No. 5. One end of RF Choke should be soldered to RED on Reaction Condenser (C3).
,, No. 6. Other end of Choke to RED on Phone Socket.
,, No. 7. From WHITE on Phone Socket to earthed soldering tag.
,, No. 8. One end of BLUE Flex and one end of BLACK Flex are joined together and soldered to BLUE on Phone Socket, and then passed through rubber grommet.
,, No. 9. Solder one end of RED Flex to YELLOW on Phone Socket and pass other end through rubber grommet.
STEP No. 10 Solder one end of ORANGE wire to WHITE on Valveholder, and pass other end through hole in Chassis, and then pass through rubber grommet.
,, No. 11. From RED on Valveholder to BLUE on Valveholder and then to Soldering tag as shown in photo. This soldering tag is earthed by the screw holding Valveholder to Chassis.



Circuit diagram of the RCS Battery Receiver



Top of Chassis Layout



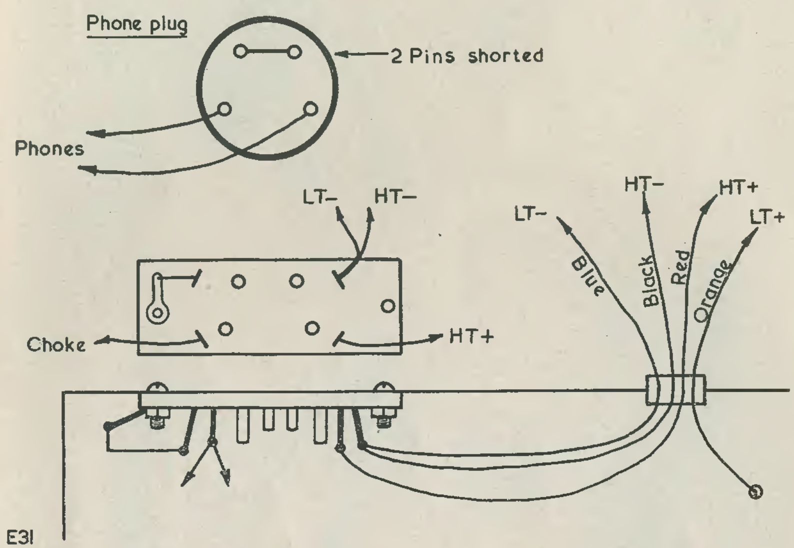
Layout Beneath the Chassis

Step No. 12. From YELLOW on Valveholder through chassis to RED on Reaction Condenser (C3).
,, No 13. From RED on Tuning Condenser (C2) through Chassis to WHITE on Bandspread Condenser (C4).
,, No. 14. Join one end of C1, and one end of R1 to RED on Tuning Condenser (C2).

aerial should be about 25 feet long, erected as high as possible.

The power leads should now be connected as follows:—Orange wire to LT+, Blue wire to LT–, Black wire to HT– and Red wire to HT+. Some 30 volts HT will be sufficient for this receiver.

The headphones should now be inserted into the phone socket; the act of plugging



Sketch showing the wiring of the phones – on/off plug and socket

Step No. 15. Join other end of C1 and R1 together and solder the Valve Clip supplied to this end of these.
No. 16. Connect Phones to Plug and join the other two pins, as shown on drawing.

Operating Instructions

The valve should now be inserted into the valveholder with the red end downwards, care being taken not to force the valve as it is easily broken. The clip connected to R1 and C1 should now be fastened to the pin at the top of the valve. Next, insert the coil into the coil holder and then connect the aerial to the insulated nut and bolt mounted on the rear chassis wall. The earth wire should be secured to the connection which is next to the aerial input. The external

in also switches on the power supply, and the set will not work until this is done. If connected correctly, the valve should now light up. The headphone plug should be withdrawn when the receiver is not in use, otherwise the batteries will soon run down.

With the set now working, the Reaction condenser (C3) should be rotated to the right until the set oscillates. This will sound as a gentle rushing noise in the headphones. C3 should now be turned back until it is just below oscillation point. The Tuning condenser (C2) should now be turned slowly until a signal is heard; the signal should be finally resolved by means of the Bandspread condenser (C4). The tuning is very critical and the controls should be rotated slowly for efficient operation.

[*continued on page* 737

Query Corner

A *Radio Constructor* Service for Readers

Gram Switch Suppressor

Having just completed a high fidelity record player, I am a little alarmed to find that if the volume control is left at its normal setting the motor switch causes a very loud bump from the speaker. I feel that this may damage the speaker in time and would like your recommendations on a suitable suppressor circuit.

D. Ainscombe, Barnsley

The gain of an amplifier which is employed with a high fidelity type of pick-up is of necessity high because of the relatively low output from this class of pick-up. Also, to obtain the most lifelike response the amplifier is constructed to pass the higher audio frequencies. These two facts combine to make the system particularly sensitive to impulse interference, it being possible to have a considerable amount of peak energy in the individual pulses. As our correspondent so rightly points out this may damage the speaker, particularly if the maximum output from the amplifier exceeds its handling capacity.

A simple surge suppression circuit across the gramophone motor switch is the solution to the problem. Such a suppressor consists simply of a resistor and a capacitor connected in series across the contacts as indicated in Fig. 1. The capacitor should have a working DC voltage of at least three times the mains supply voltage, it being usual to find a component of 1,000V DC rating in this position. The resistor should be of the ½ watt carbon type.

To avoid interference radiation from the motor supply leads, the suppressor should be connected as close as possible to the motor switch contacts. Finally, do not forget that the minimum of interference can only be obtained when the motor housing and motor board are effectively earthed.

Transformer Lead Identification

I have a mains transformer having colour coded flying leads. Can you help me to identify the various connections?

D. Chappel, Lancs.

Certain transformer manufacturers still employ the colour code as a means of identification for radio type mains transformers. The code will be clear from reference to Fig. 2. Before connecting up the transformer it is, however, as well to check the windings by means of a simple resistance measurement, as this will be an added safeguard against incorrect wiring. Any wrong connection in this part of the circuit can have expensive consequences, and one cannot be too careful. The two windings which have the highest resistance are the primary and HT secondary, and of the two the secondary will usually give the higher reading. The centre tap on this winding will have a resistance of about half the total when measured from one end, and

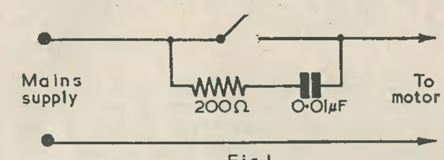


Fig.1
A gram motor switch suppressor

it is thus easily identified. Heater windings for valves have a resistance which is usually considerably less than one ohm, and if any doubt exists as to the voltage of such windings, it is advisable to make a direct measurement with the mains connected to the appropriate primary tap. When carrying out this test remember that the transformer is not on load, and the voltage readings may be some 20% up on the rated values.

It is impossible to provide any accurate indication of the winding resistance which can be expected as this varies with the type and size of transformer, but the following should act as a rough guide.

Primary	20–150 ohms
HT Secondary	100–400 ohms
LT Secondary	less than 1 ohm.

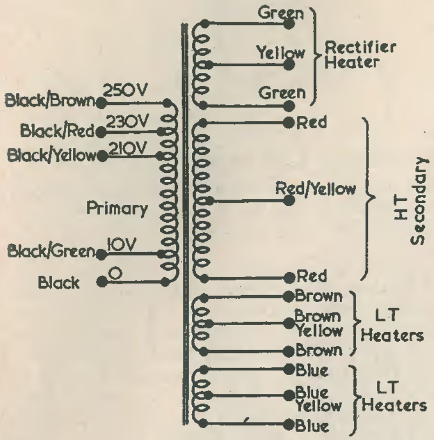


Fig.2
Mains transformer colour code

E20

Arcing in CR Tubes

A television receiver which I built some two years ago has functioned very satisfactorily, but lately some quite severe arcing has developed in the neck of the 12 inch tube. Is this likely to be due to the use of too high an EHT potential?

E. Swails, Andover

Internal arcing within the neck of a CR tube may arise from the use of too large a final anode potential. If a picture is still obtained, a very good idea of the EHT voltage can be derived from the size of the raster. Should the voltage be excessive, the raster will have decreased in size so that it is no longer possible to fill the mask. If, however, the voltage is to be measured the use of a calibrated spark gap is recommended. This type of voltage indicator is relatively cheap and has proved to be both reliable and reasonably accurate.

We have so far assumed that the cause of the arcing is the use of too much EHT voltage; this is, however, unlikely to occur in a receiver which has been functioning satisfactorily, and it is regrettably to be assumed that the tube is defective. A tube is likely to suffer from this defect if the vacuum has become impaired. A small reduction in vacuum may simply result in a very occasional internal flash-over coupled with some slight loss of focus. In its more advanced state loss of vacuum may result in continual arcing inside the tube, with the result that no raster appears on the screen. The symptoms lead us to believe that this is the cause of the trouble, and it is thus advisable to have the tube tested.

IF Breakthrough

Several readers who have built the Inexpensive Television Receiver, which is described in our Data Booklet No. 4, have reported interference patterns arising from a signal at or very near the intermediate frequency. The unwanted signal is usually picked up on the aerial system and finds its way through the RF side of the receiver to the high gain IF amplifier. Here it causes a beat note with the receiver IF signal, this in turn producing a quickly moving vertical or diagonal line pattern on the screen.

A complete cure for this trouble has usually been obtained by the inclusion of a series IF rejector in the aerial lead to the vision unit. The rejector consists simply of a parallel L-C combination connected at the point where the aerial enters the receiver. Fig. 3 shows the method of connecting in the circuit. The single layer coil consists of 30 turns of 40 DSC wire wound on a standard ⅜" television coil former. The turns are wound close-spaced in the centre of the former, and a dust iron core is used for tuning. The shunt capacitor is of the silver mica type and has a capacitance of 50pF.

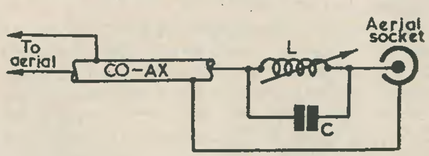


Fig.3
Connection for IF rejector in TV aerial lead

E21

Having connected up the rejector, it should be tuned to the interfering signal frequency (around 7.5 Mc/s) by means of the adjustable iron core. This adjustment is made by tuning for a position at which the interfering pattern on the screen disappears. [END

TRADE REVIEW

The Telegraph Condenser Co. Ltd. (Radio Division), North Acton, London, W.3.

Small Capacity/Close Tolerance Tubular Ceramic Condensers

This range of condensers, shown in Fig. 1, is primarily intended for the top end coupling of coils in Band Pass Filters, where condensers having these two characteristics are essential. The tubular bodies are made of low and medium permittivity ceramics, and are supplied with Type "B" wax finish.

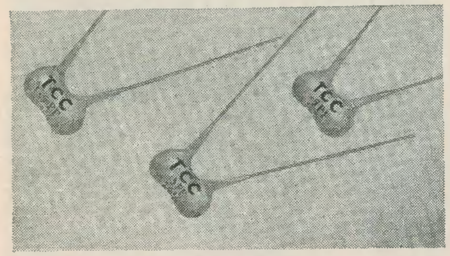


Fig. 1

The type number of this range is CC125S. Capacities in pF are 0.5, 1.0, 1.5, 2.0, 3.0, and 5.0. Working voltage, 500V DC. Test voltage, 1,500V DC. Insulation resistance – greater than 10,000 megohms. Tolerance of capacity, Standard ±20%, Special ±10% for all values except 0.5pF where Standard is ±30% and Special is ±20%. Dimensions, 12*mm* long by 5*mm* diameter (including wax coating). Terminations – Tinned copper wires, 38*mm* long (22 swg).

Sub-Miniature Electrolytic Condensers

The recent introduction of transistors has created fresh impetus to the design of ancillary components of comparable small dimensions. For this purpose, TCC Ltd. have produced this range which are believed to be the smallest of their type ever made. These diminutive condensers are equally suitable for use in

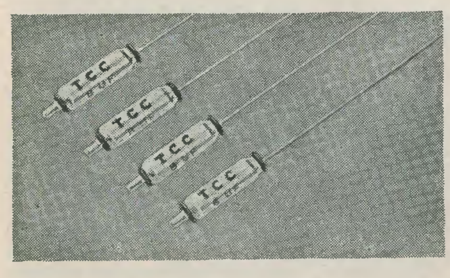


Fig. 2

miniature walkie-talkie equipment, hearing aids, and similar assemblies where every component is scaled down to the absolute minimum physical size (Fig. 2).

A feature of their construction is the plug-pin (¼" long), which forms one of the terminations, thus enabling them to be inserted quickly and easily. Two-wire terminations can also be obtained.

The temperature range is –30° to +60°C., and the tolerance of capacity –25% to +50%.

TABLE 1

Capacity in μF	Peak Working Volts	Dimensions in inches: Length	Dimensions in inches: Dia.	Type Number
6	3	.64	.18	CE68AA
8	6	.71	.2	CE69A
2	12	.64	.18	CE68B
4	12	.71	.2	CE69B
*8	15	.75	.26	CE67B
1	25	.64	.18	CE68C
2	25	.71	.2	CE69C
.5	50	.64	.18	CE68D
1	50	.71	.2	CE69D

* This condenser can only be supplied with wire terminations both ends.

Hi-K Miniature Lead-Through and Stand-Off Ceramic Condensers

These new additions to the range of Hi-K Ceramic condensers have been designed for Television Receivers incorporating Band 3 and Band 4 tuners. Their outstanding features are: extremely small series inductance,

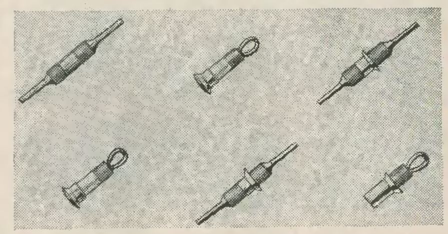


Fig. 3

efficient decoupling, and small physical size. The stand-off types are particularly suitable for cathode and screen decoupling.

The tubular bodies are a specially selected material of the barium-titanate group of ceramics with a dielectric constant of 3,000. The four constructions at present available provide two for lead-through purposes and two for stand-off purposes. The former have an 18 gauge tinned copper wire running through the body and protruding each end, whilst the latter have a looped termination at one end. Capacity 1,000pF. Working voltage 350V DC. Capacity tolerance –20% to +80% (Fig. 3).

Hi-K Ceramic Disc Condensers

These Hi-K Discs are intended for decoupling purposes in Television Receivers and spark suppression in small electrical apparatus. In both applications their effectiveness is greatly enhanced by their extremely low inductances (Fig. 4).

In common with other Hi-K ceramic condensers, variations in capacity due to temperature changes may be quite substantial; a fact that should be borne in mind when selecting this type of condenser, and when specifying the capacity required for a particular application. Where such fluctuations of capacity are of no great importance, these Discs may be used as an alternative to condensers using other dielectrics.

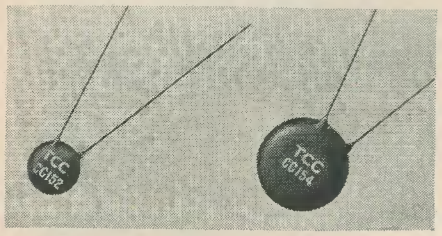


Fig. 4.

Maximum working voltage is 500V DC or 250V AC. Tolerance of capacity –20% +80%.

TABLE 2

Capacity in μF	Dimensions in millimetres		T.C.C. Type Number
	Diameter	Thickness	
.001	7.5	.6	CC.150
.0015	7.5	.6	CC.150
.002	10.0	.6	CC.151
.003	12.5	.6	CC.152
.005	15.0	.6	CC.153
.01	22.0	.8	CC.154

Approximately 2*mm* should be added to these dimensions to allow for the protective coating. Terminations are tinned copper wires 5*mm* long.

The dielectric is a specially selected material of the barium-titanate group with a dielectric constant of 3,000, and an insulation resistance greater than 5,000 megohms. A special non-cracking, heat resistant, protective coating is the standard finish. This thermo-setting compound adequately prevents the ingress of moisture and does not soften or crack at temperatures up to 100°C.; it also provides electrical insulation, thus enabling the condenser to be mounted in contact with the chassis or other components. Type numbers are shown in Table 2.

Arthur Gray Ltd. (Arthurs), of 150-152 Charing Cross Road, London, W.C.2, inform us that they are marketing the 6 Second Scope Soldering Iron, an Australian made quick-heating iron which has many good features and should become very popular.

Any supply between 2.5V and 6V AC or DC may be used. With the 4V transformer which can also be supplied, the heating-up time is 6 seconds, and the current drain approx. 30A. For intermittent operation as would normally be used, the Watt/Hour consumption is negligible. If the voltage on load exceeds 4V, an extension cable at the rate of two yards for each additional volt may be used. The iron itself must never be connected directly to the mains supply.

With a voltage of 2.5 on load, the heating-up time is 15 seconds. With 6V, it is only 4 seconds.

The iron is very easy and comfortable to operate. The handle is tubular in shape, and the switch is worked by a ring on the handle which is pressed forward, to switch on, by the thumb, using only a light pressure. On releasing the pressure, the switch automatically comes "off."

Maintenance is simple, and all spares are available. Two spare elements and one spare tip are supplied with each iron, which is fully guaranteed for three months from the date of purchase. Agents will service after this period, of course, if required to do so.

The price of the iron is £1 19*s* 0*d*. If the transformer is also needed, this costs £1 17*s* 6*d*.

A. T. Sallis, 93 North Road, Brighton, Sussex. This well-known radio firm have recently favoured us with the latest edition of their catalogue. This 76 page illustrated list is available direct from the above address, at 1/– post free inland. For those overseas readers who may be interested, the overseas seamail rate is 2/6.

It is our conviction that this mail order list is a worthwhile addition to the enthusiasts reference library, containing as it does literally dozens of bargains for those interested. All types of equipment are listed and the whole production is liberally illustrated.

A speciality is made of the supply of radio equipment for models, and an extremely varied selection of ex-Service equipment of all types.

Recommended to all our readers as well worth sending for – they are almost certain to find something listed which they need. [END

RADIO CONTROL LICENCES

Dear Sir,

As you are no doubt aware, licences will be required for the radio control of models as from June 1st (this being the date when the Wireless Telegraphy Act, 1949 comes into force). During the past few weeks, various negotiations have been taking place with the G.P.O., and the purpose of this letter is to put on record an account of these negotiations.

Unfortunately, owing to various staff changes at the Post Office, the Post Office lost track of their previous negotiations with the S.M.A.E. and the I.R.C.M.S., and they did not know of anyone to consult when drawing up the new regulations. The Post Office have apologised for this, and have since shown the greatest willingness to take our views into account.

The original G.P.O. licence proposals were somewhat restrictive, especially with regard to the low power permitted (0.3 watts E.R.P.), the restriction that only the licensee might operate the equipment, and the provisions with regard to frequency measurement. The I.R.C.M.S. therefore arranged for a meeting with the G.P.O. on Saturday, May 15th, the I.R.C.M.S. representatives being Mr. C. H. Lindsey, Mr. P. A. Cummins, Mr. G. A. Sommerhoff, and Mr. R. F. Stock. At this meeting, the G.P.O. gave concessions and interpretations (since confirmed in writing) on all outstanding matters except that of frequency measurement (which was not discussed on account of shortage of time, and because it was felt that the manufacturers should be consulted first).

In the meantime, the S.M.A.E. had contacted other branches of the model movement, and a meeting was held on Wednesday, May 19th at the Horseshoe Hotel, attended by about 15 people representing the S.M.A.E., the M.P.B.A., the I.R.C.M.S., and the three manufacturers E.D., E.C.C., and Amco. This meeting agreed that the concessions so far obtained covered all the outstanding problems except frequency measurement, which was then discussed in detail, it being decided that a further deputation be sent to the G.P.O. consisting of Mr. H. G. Hundleby (S.M.A.E.), Mr. J. H. Benson (M.P.B.A.), Mr. C. H. Lindsey (I.R.C.M.S.), and Mr. F. F. Wells (manufacturers).

This second meeting with the G.P.O. was held on Monday, May 24th. The matter of frequency measurement was discussed in detail, but further negotiations will be necessary before things are finalised.

The concessions and interpretations so far obtained are as follows. It is to be noted that the G.P.O. will not include in the licence anything but the barest legal essentials. Thus the final licence will differ from the first draft in two points only, and it must be read in conjunction with the explanations in this letter.

(1) Although the licence at present applies only to model vehicles, vessels and aircraft, the G.P.O. will be prepared to consider individual applications for it to be extended to other types of models (if any).

(2) The licence provides that operation must be limited to within 5 miles of the place specified in the licence, unless the Telephone Manager in the region where it is proposed to operate is informed previously. Note that it is only necessary to inform him. It is not necessary actually to obtain his permission (in fact, Telephone Managers will not even acknowledge these notifications unless there are exceptional circumstances). The object of this rule is to enable the G.P.O. to track down interference more easily. Even a five mile radius will give them a lot of ground to search.

Modellers may give these notifications for their regular ponds or flying grounds, and there is no need to renew them even when the licence is renewed. However, notifications should be cancelled if one proposes to stop making use of a particular location; otherwise the G.P.O. will be snowed under with them, and the regulations may have to be made more stringent.

It will be permissible for a collective notification to be given by the organisers of contests and other meetings, in lieu of notices by the individual licensees. Nevertheless, the licensee will be responsible for ascertaining whether the collective notice has in fact been submitted on his behalf (i.e. the contest organiser should announce prominently in all his contest literature that it has been done). Such collective notice should include an estimate of numbers, but need not give the names of the licensees involved. A collective notification of this type can also be used to cover the case where a Society holds regular meetings (indoors or outdoors) at which R/C equipment is likely to be demonstrated.

(3) The licence will permit operation by other people under the direct supervision of the licensee.

(4) The maximum effective radiated power (E.R.P.) on the 465 Mc/s band will be 0.5 watts.

(5) The maximum E.R.P. on the 27 Mc/s band will be 1.5 watts.

For a quarter wave Marconi aerial, the E.R.P. is the same as the actual power fed into the aerial. Both these E.R.P.'s are in excess of what conventional apparatus at the present time will give (with the exception, perhaps, of some transmitters that have more than 3 watts input). By conventional I mean the usual type of apparatus in which the aerial is connected directly to the oscillator, no power amplifier being used. The G.P.O. offered 2.5 watts input as an alternative limitation, but as this would in practice mean less output than 1.5 watts, the meeting on Wednesday decided to accept the output limitation. Output can be measured by measuring the aerial current, squaring, and multiplying by 36. Most people need not bother with this, however, as it will not be exceeded by most existing transmitters.

(6) In view of the short notice, etc., the G.P.O. have agreed to the following:—

(*a*) "That existing apparatus may be used at contests during the coming season provided that it complies with the present requirements.

(*b*) "That until the end of August the Post Office will not take action against anyone merely because they have not yet obtained a licence."

(7) Foreign competitors at the forthcoming international contests on July 10th and 11th will not require British licences.

(8) The licence fee of £1 for 5 years only just covers the G.P.O.'s expenses in running the scheme.

(9) The frequency measurement clause in the licence is intended to prevent trouble before it starts (since the G.P.O. already have sufficient powers to deal with offenders without this clause). If we want any modification of this clause, it is up to us to show cause why same would not lead to frequency drifting with consequent interference to other services. It is possible that we shall be able to convince them that commercial equipment is sufficiently stable to need no further checking, and in the case of home-made equipment we may be able to obtain modification of the stipulation that frequency must be checked every time the transmitter is used. At any rate, negotiations along these lines are proceeding. The G.P.O. say that they will not enforce this clause until the end of August (or maybe even later), and by that time the matter will no doubt have been thrashed out.

The G.P.O. will be issuing an explanatory leaflet (worded in similar terms to the actual licence), copies being obtainable from the Radio and Accommodation Department, Headquarters Building, G.P.O. St. Martin's le Grand, London, E.C.1. It is suggested that copies be handed round at contests etc. in order to spread the news.

The I.R.C.M.S. will be issuing an explanatory leaflet to the explanatory leaflet, which will set out the technical implications and the interpretation of the new licence in terms understandable to the modeller. The S.M.A.E. and other organisations may also be issuing similar leaflets. It is suggested that such leaflets be handed out along with the G.P.O. ones as above.

Copies of the I.R.C.M.S. leaflet (which will also be included in the next issue of the I.R.C.M.S. bulletin) can be obtained from me (anyone who wants a lot should let me know as soon as possible, so that they can be duplicated).

I will be very pleased to answer any queries arising out of this letter.

C. H. LINDSEY,
Hon. Secretary, International Radio Controlled Models Society,
55 Tenison Road,
Cambridge.

BUILDING THE R.C.S. BATTERY RECEIVER

continued from page 732

Batteries

For the LT supplies, two of the 800 type cycle batteries connected in series should give a long working life. For the HT, the Ever Ready type B105, which is a 30 volt battery, will last for some months and give excellent service.

Next month, we shall continue with instructions on how to add a further audio stage, thus making the set into a two-valve receiver. [END

ERRATA

VHF Aerial Input Circuits page 672 June issue. Second column, line 3, "*one quarter turn up*" should read "*one quarter up*".

RELAY CONTROL UNIT

for Main Station and Portable Contest Operating

By **JOHN PICKARD**

NOTHING IS MORE IRRITATING IN contest working than lack of speed in changing over the transmitting position to receive. With what the Author believes to be the laxity in operating procedure which takes place in many contests (and the failure of many operators to observe the terms of their licenses), points are frequently lost by the inability to read the first callsign given by a station whom one has called in response to a CQ. Unless a station is compactly constructed and of a fixed design it is difficult to design a manual change-over switch which can –

1. change the aerial from receive to transmit and vice versa.
2. break the HT to the oscillator if amplifier keying is in use.
3. mute the receiver input, and
4. perform other operations which add to the ease of manipulating one's station.

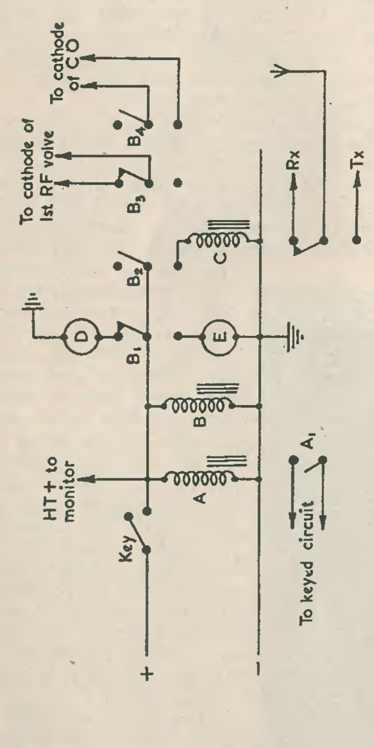
Consequently, the simple relay unit shown in Fig. 1 was evolved. As will be seen, this consists of a fast keying relay passing a mA or two at 12-16 volts in parallel with a "slugged" relay. It should be noted that the only method of delaying the break of a relay which is satisfactory for this idea is that in which a heavy brass or copper collar is used to cause a slow collapse of the magnetic field. The well-known method of using a high capacity condenser across the relay is not satisfactory as it will, of course, also retard the operation of the fast keying relay which is used to key the transmitter. The delay timing may be usually adjusted by a turn of the screw at the head of the relay, although in practice this may be accomplished just as easily by altering the applied DC voltage. For Field Day operation a six volt accumulator is placed in series with one of the 12 volt accumulators which are used for transmitter and receiver power supplies to give a selection of up to 18 volts for the unit. The constructor can, of course, easily decide for himself the functions which he requires the unit to perform. In the case of NFD it is suggested that these may be –

1. changing the aerial from the receiver to the transmitter.
2. muting the input of the receiver on transmit or breaking the cathode circuit of the first RF valve.
3. turning on the HT to the oscillator, or, alternatively, swinging the HT supply from receiver to transmitter.

It will be noted that a lead is taken from the relay supply through the key, so supplying an HT voltage of up to 18 volts to an audio-oscillator, the output of which is permanently wired to the 'phones. In such circumstances if the receiver is muted entirely, or if the receiver is tuned to a different frequency to that of the transmitter, a monitoring note is available. Many operators, however, prefer to listen to the signal actually being transmitted and this may usually be accomplished by using one pair of relay contacts to break the cathode of the first valve in the receiver on transmit, when a faint signal will be heard from the receiver if this is tuned to the transmitter frequency. However, the addition of a simple audio oscillator, adjusted to give a quiet note, enables the operator to hear something in all circumstances.

As a permanent home station unit, in addition to performing the functions mentioned earlier, additional relays may be brought into play and used, for example, as in the author's station –

1. to switch a red light on for "transmit" and a green light for "receive."



A Fast keying relay – contacts normally open

B Slugged relay – 4 S.P.D.T contacts

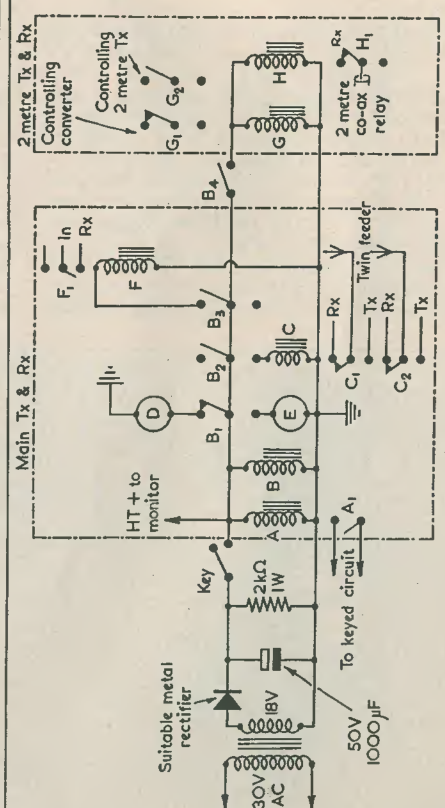
C Antenna relay S.P.D.T for single wire feeder D.P.D.T for twin feeders

D Green 'Receive' indicator bulb

E Red 'Transmit' indicator bulb

(Use fixed resistors to reduce voltage to the bulbs if applied voltage is excessive)

FIG. 1. SIMPLE FIELD DAY UNIT – ALL RELAYS SHOWN IN RECEIVING POSITION



F Muting relay in Rx – normally open if breaking cathode of any valves or screen supply. Normally closed if shorting aerial input to chassis

G & H Additional relays as required to control other receivers & transmitters

FIG. 2. MAIN STATION COMPLETE CONTROL UNIT

G33

2. for operating all transmitters in service, so that the key or 'phone switch is used to operate any transmitter installed permanently without any rearrangement of the wiring.

Various suggestions are shown in Fig. 2, but the constructor will be able to adapt these to his own requirements. The transformer supplying 18 volts was wound "in the shack" on a suitable core and primary of a transformer, the secondary of which was burnt out and subsequently removed. Many articles have recently been written on home built transformers, and the reader is referred to these.

Finally, in the luxury model, it is desirable to even out the rectified DC current being consumed by the unit on "transmit" and "receive" and this may easily be accomplished by wiring a suitable resistor across one or other of the indicator bulbs. If the heavier current is being taken on transmit (as is usually the case) the resistor should be shunted across the "receive" bulb. Its value may easily be calculated from Ohms Law; it being, of course, required to pass the difference between the two currents. If suitable voltage bulbs are not available, resistors may be placed in series to reduce the volts applied to the bulbs, and in this event the "current equalising" resistor should be placed across both dropping resistor and the bulb. [END

From our mailbag

Dear Sir,

The enclosed photograph was taken in the Malcolm Club No. 4 at Wahn where we have converted a spare attic-room into a "radio room." The radio and record programmes are relayed over loudspeakers from there to the club canteen and bar during the respective opening hours.

An old air-raid shelter door was used for the construction of the control desk, which is covered with hardboard taken from a disused partition screen.

The twin turntables and Vitavox 12/20 loudspeaker were purchased from the Decca Gramophone Co. The radio and combined gram' amplifier is an Armstrong R.F.104 chassis, but the moving coil mic. is of an unknown make. The microphone amplifier is a Pam 10 Watt. All necessary switching can be executed at the home-made control unit. The whole apparatus was wired by, and is being operated by myself and an assistant during off-duty hours.

Our record library consists of well over 200 labels, both in normal and long-playing records, lists of which are on show in the canteen. Requests are made from there direct to the radio room by means of a field telephone. Immediately the record number and title has been noted by the librarian, the record is selected from the rack and, together with the request slip, is handed to the turntable operator, who will announce and play the record over the network. When over six records are on hand a small red light fixed above the telephone can be switched on, indicating that no further requests can be accepted until those waiting are played. We have played as many as 50 record requests during one evening, which proves that the programme is indeed popular.

The station is in operation daily, including week-ends.

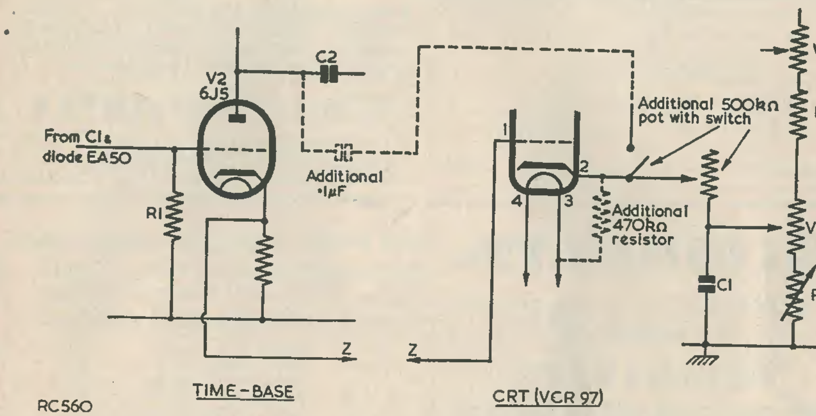
Cpl. N. Sparrow R.A.F.

'INEXPENSIVE' TELEVISOR *

Easy Modification for alternative GRID, or GRID AND CATHODE Modulation

By J. RODGER

Requirements:—1 470kΩ ½ watt resistor, 1 500kΩ carbon pot with switch, 1 0.1μF tubular condenser, 500V wkg.



OPERATION

For Grid Modulation only

500kΩ pot with switch in "off" position, so that slider of VR8 is connected direct to pin 2 of CRT holder via additional 500kΩ pot, with its slider at position of zero resistance. Circuit is simply that of "Inexpensive TV" timebase.

For Grid and Cathode Modulation

500kΩ pot with switch in "on" position, so that anode of V2 in timebase is connected to pin 2 of CRT holder via an 0.1μF condenser, and slider of additional 500kΩ pot is rotated sufficiently in its radius of travel in order to present an adequate "load" for picture to "lock".

Comment

This modification works well in an extreme fringe area (Kirk o'Shotts, 116 miles), giving handy control over a signal which varies from very good to less than average, and allowing swift, noticeable and useful variation of contrast.

Note

Video output of R1355 for vision 2×SP61 in parallel. Video output cathode bias variable through 0.01μF, 0.25μF and 50μF bias condensers alterable by single pole 3-way switch. [END

* *Data Book 4*

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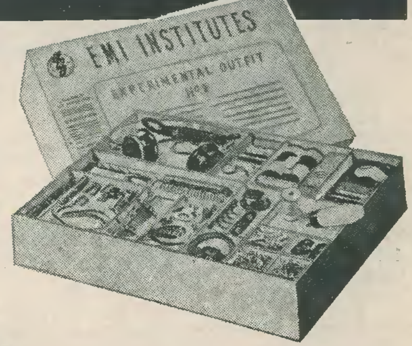

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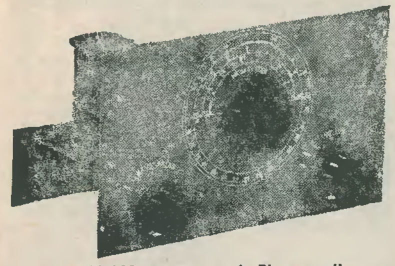

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[*continued on page 747*

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6AM6	7/6	6SN7	9/6	9006	5/6	PY82	10/6
6AT6	8/6	6SS7	6/9	AZ1	10/6	VR91	8/6
6BE6	8/6	6V6GT	8/6	AZ31	10/6	VR150/30	8/6
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SMALL ADVERTISEMENTS

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SMALL ADVERTISEMENTS

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OSMOR – for efficient coils, coilpacks, etc. Send 5*d* stamp for FREE circuits and lists. Dept. RCC, Osmor Radio Products, Ltd., 418 Brighton Road, South Croydon, Surrey. Telephone Croydon 5148/9.

JOIN THE ISWL. Free services to members including QSL Bureau, Translation, Technical and Identification depts. Dx certificates, contests, and activities for the SWL. Monthly magazine 'MONITOR' duplicated, containing articles of general interest to the SWL and League members, 10/6 per annum, post free. ISWL HQ, 86 Barrenger Road, London, N.10.

ANNOUNCEMENT A. Jerome Alcock, Cheadle, Stoke-on-Trent regrets that he is unable to accept orders for bookbinding until further notice, which will be published in this Journal.

PANL, the air-drying crackle finish. In black, green and brown at 3/6 per 1/8th pint can, post paid, from – G. A. Miller, 8 Kenton Park Crescent, Kenton, Middx.

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