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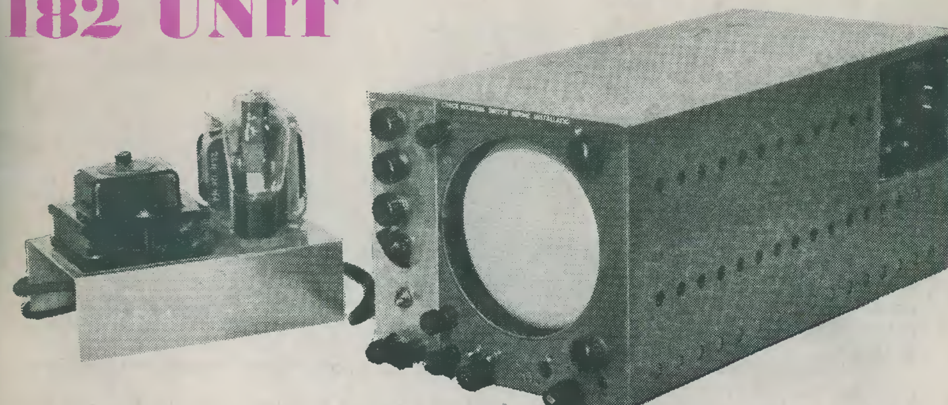
Volume 7
Number 10
MAY
1954

The RADIO CONSTRUCTOR

incorporating The Radio Amateur

for the Radio and Television Enthusiast

CONVERTING THE 182 UNIT TO AN OSCILLOSCOPE



ALSO IN THIS ISSUE

- LABORATORY EHT VOLTMETER
- BAND 3 CIRCUITS
- HANDIE-TALKIES FOR 28 Mc/s
- HT BATTERY REACTIVATOR · MODERN TRF RECEIVER
- VERNIER CORRECTOR FOR CLAPP OSCILLATOR
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Editor

C. W. C. OVERLAND, G2ATV

Advertising Manager

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

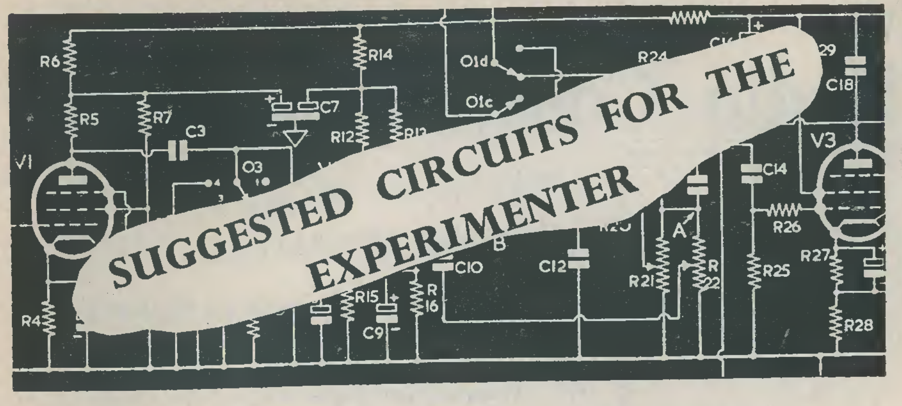
NOTICES

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

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

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

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



The 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. 42: EXPERIMENTAL HT BATTERY REACTIVATOR

SINCE THE WAR, the design of portable radio receivers and allied equipment has advanced considerably, this being effected mainly by the introduction of miniaturised components and valves which allow the use of circuits incurring low current consumption. On the other hand, whilst the battery problem has been partly offset by the manufacture of efficient cells of small physical size, the cost of battery replacement still remains an obstacle which has not yet been satisfactorily surmounted.

It is for this reason that considerable interest attaches to the possibilities of HT battery reactivation. If HT battery reactivation is feasible, the costs of running portable radio equipment naturally become reduced considerably.

Experimental work on dry battery reactivation has been carried on intermittently over a considerable number of years. An excellent summary of the research already undertaken, together with the results of further investigations, was published by R. W. Hallows in *Wireless World* for August 1953 in an article entitled "Reactivating The Dry Cell," and readers interested in the subject are advised to refer to this article.

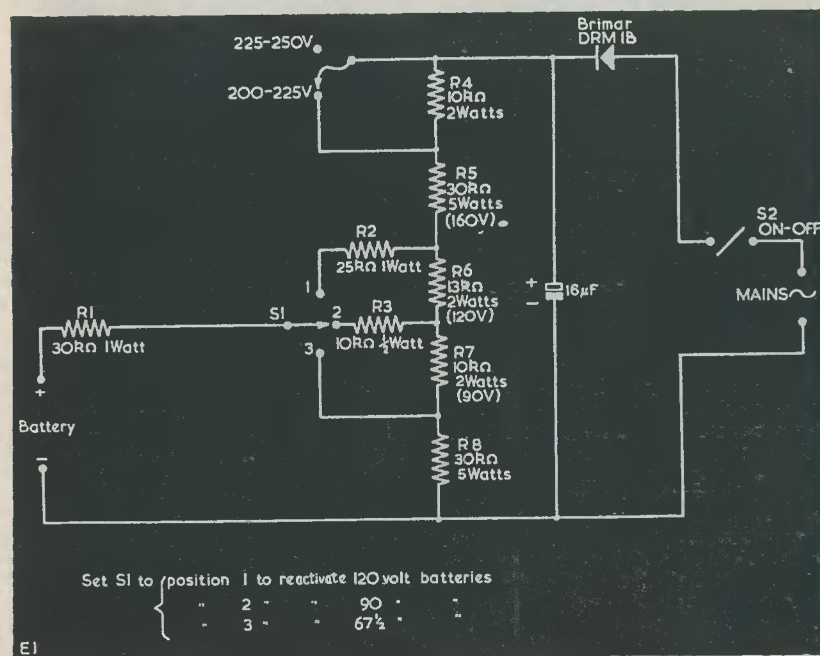
The circuit discussed this month is that of an experimental HT battery reactivator which should be capable of giving good results for the conditions of use met in most battery applications. It offers a low reactivating current for HT batteries of common voltage ratings; this current reducing proportionately as the terminal EMF of the battery being reactivated rises. It is emphasised that batteries which have been discharged at a low rate over a long period of time, or which have had a long shelf-life, may not be capable of being reactivated. A further point is given by the fact that it is possible for gasses to be formed inside the cells of batteries undergoing reactivation, with the risk of subsequent explosion. However, the reactivating current used in the circuit described here is extremely small and it is very doubtful indeed if it would result in the release of gasses. Nevertheless, this aspect of battery reactivation has to be stated, for obvious reasons.

The Circuit

As will be seen, the circuit is very simple, consisting essentially of a half-wave metal rectifier connected directly to the mains and feeding into a potentiometer network. The leads connected to the battery are consequently "live" to the mains, and care has to be taken accordingly. To obtain a stable and easily-calculated voltage, the metal rectifier is connected to a reservior capacitor of 16μF. The rectifier may be a Brimar DRMIB and the capacitor a conventional electrolytic component.

The potentiometer network consists of R4 to R8, and it takes a standing current of approximately 30mA. R4 is short-circuited for mains voltages of 200-225 volts in order to maintain the current flowing through the potentiometer and the voltages appearing at its tapping-points. These voltages are shown in brackets at the appropriate points of the diagram.

The reactivating current is applied to the battery via S1, R1, and, if selected, R2 or R3. S1 is set for the nominal voltage of the battery being reactivated. Since the terminal EMF of a reactivated cell rises to 2 volts, it may be seen that the reactivating current automatically reduces to a negligible value when the battery is fully reactivated. Assuming that the terminal EMF of each cell of the discharged battery is 1.1 volts when it is initially connected to the unit, the reactivating current commences at approximately 1.3mA for each setting of S1.



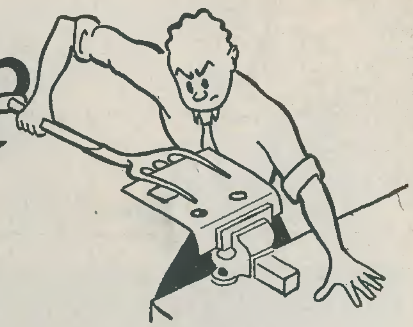
Limitations

It was stated above that batteries which have been discharged slowly over long periods, or which have had a long shelf-life, may not be capable of being reactivated. It should be pointed out also that there are other limitations, the most important of which is cell perforation. This is liable to occur in any cell of a battery, either during discharge or during reactivation, and it at once renders the battery useless. It should be possible, however, to obtain at least three or four cycles of discharge and reactivation from a battery before cell perforation occurs.

When a battery has been successfully reactivated, the terminal EMF of the individual cells is liable to be 2 volts or even more. The voltage of a battery after reactivation, therefore, should be carefully checked before the battery is returned to the equipment with which it is intended to be used. The excessive voltage should drop to the normal value after a period of waiting, or it may be reduced more quickly by discharging the battery through a high value of resistance until the requisite voltage is obtained. The latter process can be effected by leaving the battery connected to the reactivator for a short time with the mains supply switched off.

IN the advertisement for **Lee Electrical Equipment Supplies** on page 547 of the last issue the telephone number was given through a printer's error as Paddington 8198. The correct number should have been Paddington 8189.

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 news in the trade is that the sale of television receivers is down. This is to be expected and I, for one, am not in the least surprised.

Why have sales fallen ? Is it because sets are not being manufactured as reliably as they should be ? Is it because the definition of the picture on the screens of today is not sufficiently high ? Or is it because the size of the picture is still too small at its present maximum of seventeen inches ?

It is none of these things. Sales have fallen for the simple reason that people do not want to spend money on television when all they can receive is the appalling tosh which is transmitted by the BBC.

An indication of the public's opinion of BBC television programme lies in the recent outcry for a competitive service. Sound radio, even at its worst, never got so bad that sponsored programmes had to be introduced in this country.

All that can be said about the present situation is that the BBC, so far as television is concerned, has let the public down, and that it has let the industry down as well.

Band 3 Prospects

However, it is no use bemoaning the shortcomings of the BBC. TV transmissions on Band 3 will shortly be an accomplished fact, and it is up to us, therefore, to examine some of the techniques which will be needed for reception of these higher frequencies.

One of the first questions which are asked about Band 3 reception concerns the advisability of using a converter. Will it be possible to pick up Band 3 transmissions on a normal TV receiver by using a simple converter unit consisting of a frequency-changer and RF amplifier ? Such a unit would convert the incoming Band 3 signals to the frequency of the local BBC transmission, whereupon they would be amplified, detected, and reproduced by the existing receiver in the normal fashion.

At first sight, it would appear that a converter of this type is all that is needed to enable existing TV receivers to cope with Band 3. However, I have discussed the matter at length with a number of leading engineers, and they have all said that they do not think that a simple converter will solve the problems of Band 3 reception at all.

As an example of what is to be expected, here are the snags which would most probably arise in the London area if a converter were used. It is anticipated that, when Band 3 comes on the air, the BBC will be putting out a very strong signal indeed from Crystal Palace. The Band 3 signals will be much weaker than the BBC transmissions in most London districts, with the result that it is considered that IF breakthrough on the BBC frequency (i.e. pick-up by the TV receiver's signal frequency circuits and aerial wiring), will be so strong that it will be almost impossible to clear. Furthermore, it is also considered that the double superhet arrangement incurred by the use of a converter will almost definitely give rise to locally-generated interference on oscillator harmonics, and on the beat frequencies given between the oscillators, the IF's, and *their* harmonics.

To sum up, it seems that the use of the simple converter for Band 3 is not considered practicable at this stage by the experts; the main difficulties being those of breakthrough and local interference, as just mentioned.

I think, personally, that the main conclusion we can draw from all this is that the experts are being commendably cautious. After all is said and done, all we know about TV converters in practice are what we can learn from their use in America, where the scene is not entirely similar to that liable to occur in Great Britain. Nobody can tell with certainty how converters will behave in this country; mainly because they cannot, as yet, be tested in the field. No doubt, when Band 3 *does* come up, the converters will appear as well. *If* they prove to be practicable.

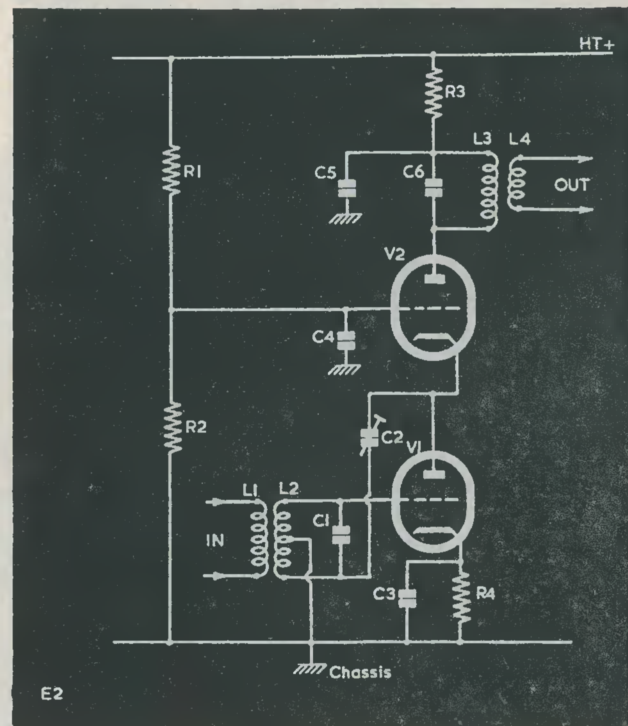


Fig. 1. The cascode amplifier, reduced to its simplest form

The problem of IF breakthrough when a converter is used with a present-day TV receiver is alleviated considerably if the signal frequency of the receiver can be altered. Thus, if the existing receiver is a five-channel job which can be easily *switched* to a different channel, converter problems are materially simplified. It is fairly safe to assume that a converter will be feasible if used with a receiver of this type; as all that is needed is to switch the main receiver to a channel different from the local transmissions before switching in the converter. This is, incidentally, possibly one of the reasons why converters have proved satisfactory in America. Practically all American VHF TV sets were fitted with channel switching as a front-panel control, and the problem of choosing a suitable converter output frequency to meet local conditions could be satisfactorily resolved by the simple process of setting the existing channel control to the requisite frequency.

"Front End" Circuits

Whilst the future of Band 3 converters is, at the time being, problematic, the choice of suitable circuits and valves for the "front end" of a receiver covering Band 1 and Band 3 has become settled and stable. Although, as is obvious, different designers will have their own ideas, it seems fairly safe to assume that most "front end" circuits for Bands 1 and 3 will employ a cascode arrangement for RF amplification and a triode-pentode for frequency-changing.

The cascode circuit is rather new to British TV since, up to now, the common-or-garden RF pentode has coped quite well for signal frequency amplification. When, however, we start thinking in terms of several hundred megacycles we find that the RF pentode suffers from serious limitations, the most important of which is a high noise level.

A valve which is capable of giving good gain at Band 3 frequencies with low noise generation is the neutralised, grounded-cathode, triode. This valve has the disadvantage, however, that it is very liable to instability. Another interesting valve is the grounded-grid triode. This is stable, gives good gain, but has a very low input impedance. This latter disadvantage has the effect of excessively damping whatever input tuned circuit is connected to the valve.

The cascode circuit uses both the neutralised triode and the grounded-grid triode; this being done in an ingenious arrangement by means of which the disadvantages of each valve are almost entirely cancelled out and their advantages are given full effect.

A cascode circuit is shown in skeleton form in Fig. 1. In this diagram, input signals are fed, via the tuned circuit L2-C1, to the grid of V1. V1 functions as a grounded-cathode neutralised triode, neutralisation being provided by the variable capacitor C2. The anode of V1 is connected directly to the cathode of V2, which is employed as a grounded-grid triode; the grid being grounded via C4. The low input impedance of V2 reduces the inherent instability of V1 considerably, thereby cancelling the main disadvantage of the neutralised triode. Similarly, V1 is designed such that its anode is capable of feeding directly into the low impedance offered by V2, thereby cancelling, in its turn, the greatest fault of the grounded-grid amplifier. The amplified output from the two valves is then built up across the tuned circuit L3-C6, which is connected in the anode circuit of V2 in conventional fashion.

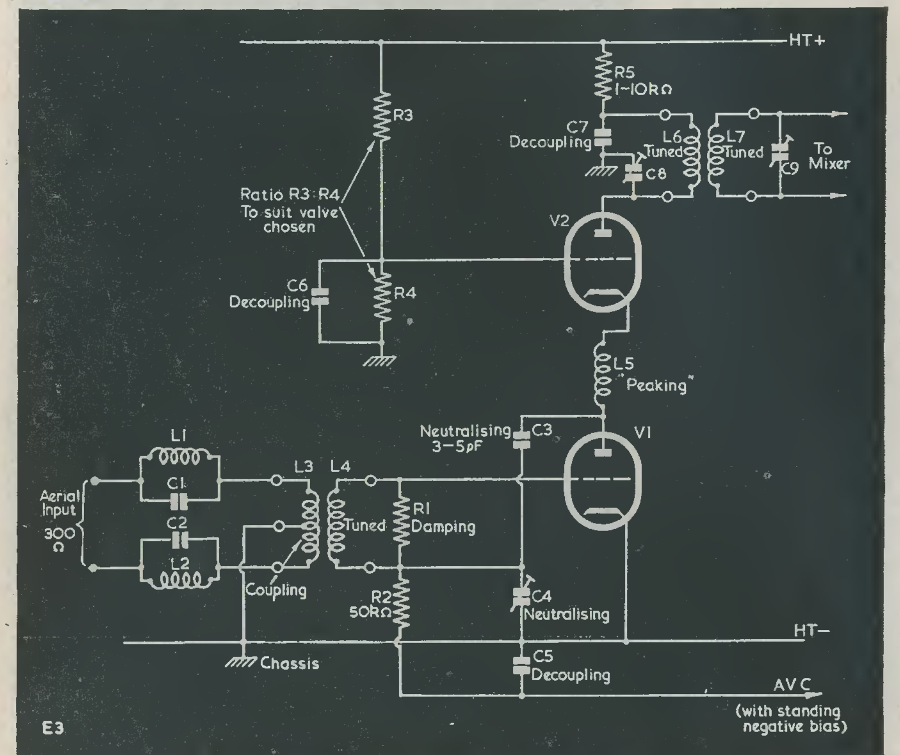


Fig. 2. A practical double-triode cascode circuit, suitable for Band 1 and Band 3. Where possible, suitable values have been shown; although these may vary for certain applications. C4 will need a final, adjusted, value lying between 0.5 and 10pF according to the valve employed. Decoupling capacitors, preferably feed-through, should have a value of approximately 800pF

There are several points of interest in the circuit. In the first place, it will be seen that the anode of V1 and the cathode of V2 have a potential lying somewhere between chassis and that of the HT positive rail. In practice, this potential is approximately half the HT voltage. It follows, therefore, that the heater-cathode insulation of V2 must be capable of standing this potential. This is, indeed, one of the points of design which has been given consideration by manufacturers when making valves for cascode operation.

The grid of V2 is biased by the voltage appearing at the junction of R1 and R2. These resistors need not be close-tolerance components as the series connection of the two valves will enable V2 to "settle down" to a grid bias approximately equal to its optimum value.

It is interesting to notice the effect of AVC voltage on the cascode. If an AVC voltage were applied to the grid of V1, this would naturally increase in negative potential in the presence of a strong signal. V1 would then take less anode current, with the result that the cathode of V2 would rise in positive potential. Thus (within limits), an AVC voltage applied to V1 affects V2 in the desired manner as well.

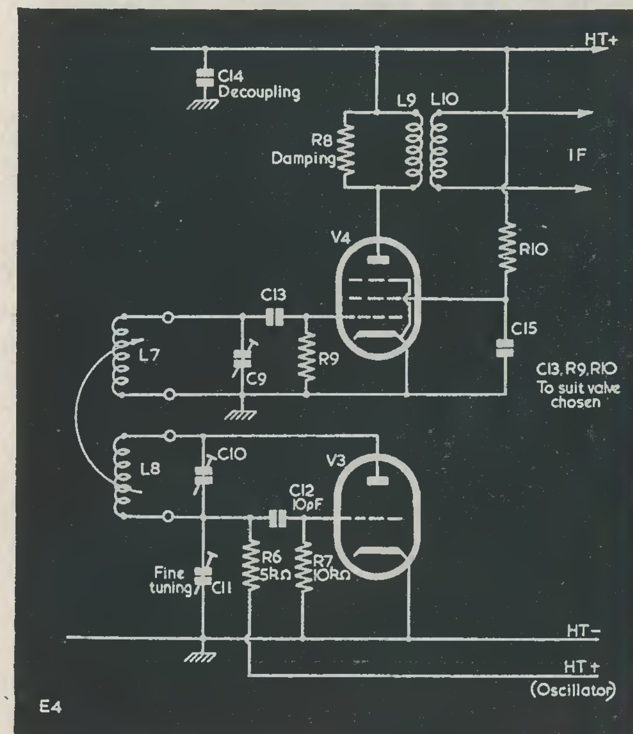


Fig. 3. A suitable triode-pentode frequency-changer for Band 1 to Band 3. Where possible, suitable values have been shown. L7, C9 correspond to the similarly-numbered components in Fig. 2. L7, L8, are inductively coupled

A Practicable Version

A practicable version of Fig. 1 is shown in Fig. 2. This circuit embodies most of the points featured in the cascode designs developed by British manufacturers and is similar to those employed in current American TV tuners. (Indeed, it is surprising to see how standardised cascode circuits have become. It seems possible that the basic cascode circuit of Fig. 2 will become as conventional in TV as has the four-plus-one circuit in sound radio).

Starting from the input terminals of Fig. 2, the aerial signal passes through the filters L1-C1, and L2-C2, before being applied to L4, the signal-frequency tuned inductor. L1-C1 and L2-C2 are rejector circuits tuned to the intermediate frequency and are intended to prevent IF breakthrough. (See paragraphs above concerning Converters).

L4 is tuned by stray capacitances including the Cag (via C3) of V1. L4 is nowhere connected to chassis but is "balanced" about chassis potential by C4, the Cak (via C3) and Cgk (via C4) of V1, and stray capacitances. Capacitor C3 is the neutralising capacitor, and its effect is varied by adjusting C4. Neutralising is controlled, therefore, by C4; which has the advantage of having one of its contacts at chassis potential. AVC is applied via R2. (It should be noted that if the AVC line does not have a standing negative bias, as shown in the diagram, V1 will need cathode bias).

Between V1 and V2 is connected a series "peaking" coil L5. The purpose of this coil is to keep the response of the cascode circuit reasonably flat over the range of frequencies amplified. L5 works in the same manner as do the "peaking" coils of video amplifier stages. For Band 1–Band 3 purposes, L5 should resonate at a frequency above 200 Mc/s. V2 amplifies as a grounded-grid triode in the conventional fashion, feeding into L6-C8, and thence, via L7-C9, to the mixer.

It should be noted that the circuit of Fig. 2 is such that L3, L4, L6 and L7 are capable of being separate coils in a turret assembly designed for channel switching. If this course is adopted, the turret switching contacts would be fitted at the points in the circuit where the connecting lines are broken by a circle.

The Mixer

As was just stated, the use of a triode-pentode for frequency-changing is becoming fairly standard practice these days. The arrangements used are quite conventional, Colpitts oscillator circuits being employed for the triode, and grid-leak mixing for the pentode. A typical example is shown in Fig. 3.

Special valves have already been developed by British manufacturers for use in Band 3. In the Mullard range, the cascode RF amplifier is the double-triode type PCC84, and the mixer is the triode-pentode type PCF80. In the Brimar range the corresponding types are the PCC84/7AN7 double-triode cascode amplifier, and the 9U8 triode-pentode.

It will not be long before these valves become as familiar to the home-constructor and radio engineer as are the present RF pentodes which are now in everyday use.

G3IHR . . *of Brighton*

The photograph shows the shack of G3IHR, H. R. Healy, of Brighton, Sussex, as it appeared last summer. At left is the speaker, and under this the receiver power supply in an RF24 Unit case. Next to this is the switch panel controlling supplies to both transmitters. On the extreme right is the PA, a single 807 running at 25-30W. The receiver is a much modified BC348, with alongside it the 1.7 Mc/s Tx. On top is the main Tx driver unit, a Clapp VFO with BA and FD. The aerial was a 120' long wire, end fed, and link coupled to the PA via a pi coupler.

MEASURING LOW IMPEDANCES & RESISTANCES

By **J.K.**

WORK IN THE LAB. often requires the measurement of low resistance to the order of from 0.01 to 10 ohms; above this the resistance can be measured by the normal ohm-meter, such as the Avo or Avo-Minor. At these low readings, by far the easiest way is to compare the voltage drop across the unknown with that across a standard. Fig. 1 will give the idea. The voltage in a circuit is directly proportional to the values of the resistors in the circuit — so that the ratio of Rs to R? will be proportional to their resistances. It is essential that the meter used is of high resistance compared with the resistors being used, and that the current employed is not so great that the resistors are overheated.

A simple and efficient instrument can be made for a few shillings. It requires a range meter or the battery is not overloaded. The double-pole, double-throw switch is included so that the meter can be changed from one side to the other and reversed at the same time. This ensures that the meter is correctly connected in the circuit. If it is required to use the device to measure impedances — of, say, chokes — a small modification has to be made.

A known AC voltage is used in place of a battery, and the values of the resistors can be made higher (say, 100, 300, 1,000 ohms) but it must be remembered that the resistance of the meter should be at least ten times this or large errors will be introduced. As AC is being measured, the polarity of the meter will not be critical and a simple change-over switch can be used as shown in Fig. 3. The unit is quite useful, and, if an

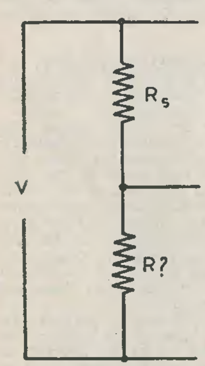


FIG. 1

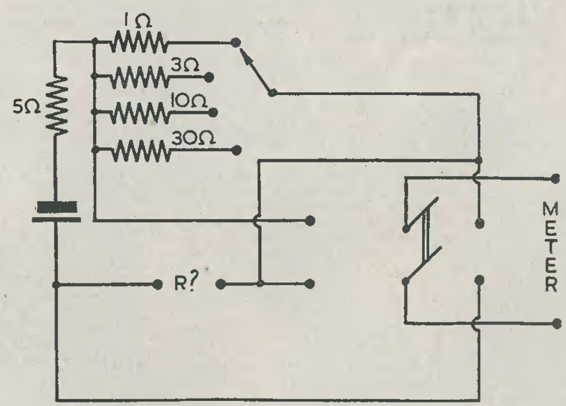


FIG. 2

of small accurate resistors of, say, 1, 3, 10 and 30 ohms, and a wafer switch, as shown in Fig. 2. The resistance in series is to keep down the total current so that the audio oscillator can be used instead of the 50 cycle mains, measurements can be made over a very wide range of frequencies.

One use for the instrument is the measure-

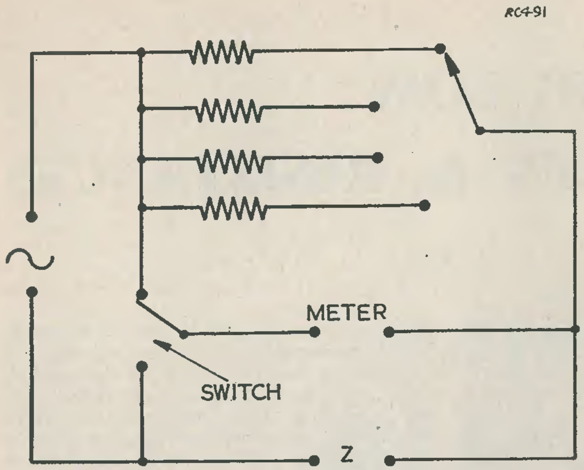


FIG.3

ment of the impedance of the voice coil of a loudspeaker; this can be done at a wide range of frequencies and a graph made. It should be pointed out that the impedance measured by the instrument can be resistive, capacitive, or inductive, and, providing that the meter does not require too large a current, the readings should be fairly accurate.

BOOK REVIEWS

RADIO CONTROL for Model Ships, Boats, and Aircraft. *By F. C. Judd*, G2BCX. 144 pages. 135 diagrams, illustrations and photographs. Price 8*s* 6*d*. Published by Data Publications Ltd., 57 Maida Vale, London, W.9.

A useful book admirably written by a development engineer and amateur radio operator who obviously has a sound grasp of a technique that is growing in popularity. The circuits, diagrams and text are presented in such a manner that newcomer and experienced experimenter alike can find interest and useful information in its reading.

The author's style is so pleasant and unobtrusive that one feels he is talking personally to the reader. The earlier chapters dealing with the underlying principles of model control and features of the components used provide essential information for the tyro, yet have none of that "silly-simple" air about them that bores the man who thinks he knows it all. This same happy medium prevails throughout the remaining chapters, in which one finds much food for thought and experiment.

Several approaches to transmitters show that simple gear which is easy to construct can be made to give good results with a minimum of expense. Frequency meters for the two model control bands are described in the fourth chapter.

Receivers are also dealt with fully, the chapter being in two parts. The first considers the theory, and goes on to some practical designs for simple receivers, whilst the second part proceeds to more advanced designs incorporating reed control. The next chapter is devoted to servo-mechanisms and control gear such as decoders, escapements, etc. Aerials, too, being of importance in model control, are dealt with both in theory and practice.

The last chapter describes the layout of apparatus in models, and provides some useful information on testing. Suitable power supplies are also discussed at this stage.

Clearly printed on good paper, this book forms a notable addition to the publisher's range of Data books for the radio enthusiast, at a price that will not distress one's pocket.

RADIO CONTROL OF MODEL AIRCRAFT. *By G. Sommerhoff.* 164 pages, 88 drawings and diagrams Price 9*s* 6*d*. Published by Percival Marshall and Co. Ltd., 19-20 Noel Street, London, W.1.

Presumably intended for the model maker who desires to learn about and understand the electronic control apparatus and its application to model aircraft, this book can also be very useful to the radio enthusiast who wants to find out more of the modeller's craft. The author devotes some considerable space to simple electrical theory which is very enlightening to the uninitiated, but the major part of the book is devoted to the construction of control transmitters, receivers and control gear, and contains much practical information on the building of auxiliary apparatus and model aircraft construction.

Many original ideas are published for the first time, and these have all been well tried by the author. The resourceful constructor should find no difficulty in applying these methods to other models, such as boats or ships. The author seems to have gone to great pains to make the whole subject quite clear to his reader, particularly in the setting up and adjustment of the electronic equipment. The printing and binding are pleasing, though radio men will perhaps wish that the drawings and diagrams used standard conventions instead of the rather 'liney' form they take. This small criticism should not deter one, however, for the book deserves full marks for its utility.

NORMAN CASTLE

LABORATORY EHT VOLTMETER

By **W. G. MORLEY**

Introducing an accurate instrument which can be built from stock components, and which may be calibrated in the constructors' home

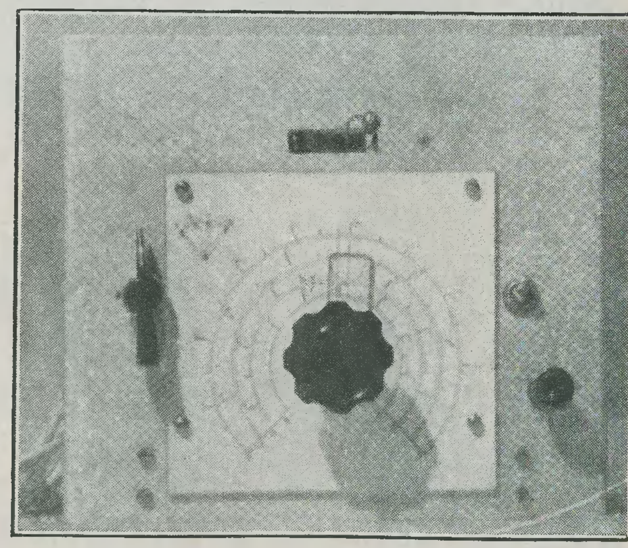
ANYONE WHO HAS EVER DEALT WITH the problems of television construction or servicing will have felt at some time the need for an accurate and reliable means of measuring EHT voltage. The instrument described in this and the succeeding article has been designed especially to meet this need. In accordance with accepted television design, it is intended for measuring EHT voltages which are positive with respect to chassis.

The instrument is built from standard parts and is relatively inexpensive. If constructed with care, it is capable of a very high degree of accuracy; yet, apart from the EHT series resistor, which can be made from readily obtainable parts, the only close-tolerance components required are four common-value resistors. The voltmeter has the special advantage that it may be calibrated in the constructor's own home, all that is necessary in the way of additional test-gear being a conventional voltmeter.

The instrument has four well spread-out ranges, these extending, with generous overlaps, from 1.5 to 19.5 kV. If desired, its coverage may be increased to read values of up to 29 kV, or even higher.

The Circuit

The circuit of the voltmeter is shown in Fig. 1. In this diagram, a high value of resistance, R1, is connected in series with a potentiometer network consisting of the fixed resistors R2, R3, R4 and R5. It will be apparent that, if the EHT voltage being measured is connected between the "Negative" and "EHT Test Prod" terminals, a



Front view of the prototype

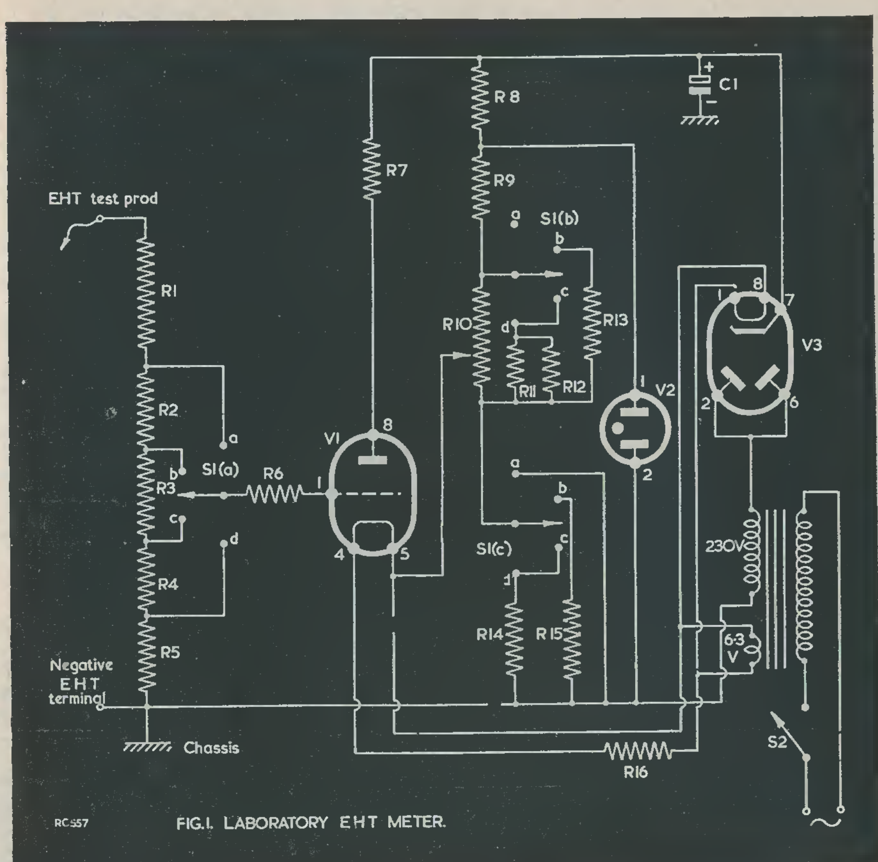


FIG.1. LABORATORY EHT METER.

COMPONENT LIST (*Fig.* 1)

R1	—	298MΩ	
R2	—	500kΩ	½ watt ±1%
R3	—	500kΩ	½ watt ±1%
R4	—	250kΩ	½ watt ±1%
R5	—	750kΩ	½ watt ±1%
R6	—	10MΩ	½ watt ±20%
R7	—	1.8MΩ	½ watt ±10%
R8	—	6kΩ	2 watt ±20%
R9	—	10kΩ	2 watt ±10%
R10	—	5kΩ	wirewound
R11	—	10kΩ	½ watt ±10%
R12	—	5kΩ	1 watt ±10%
R13	—	7.5kΩ	1 watt ±10%
R14	—	3kΩ	1 watt ±10%
R15	—	2kΩ	1 watt ±10%
R16	—	220Ω	1 watt ±5%

Capacitors

C1 — 16μF, 350 WV Electrolytic

Valves

V1 — DM70 (Mullard)
V2 — 150B2 (Mullard)
V3 — EZ40 (Mullard)

Valveholders

B7G — 1 (BM7/U, McMurdo)
B9A — 1 (BM9/U, McMurdo)

Transformer

Instrument Transformer
(Allen Components, Type MT214)

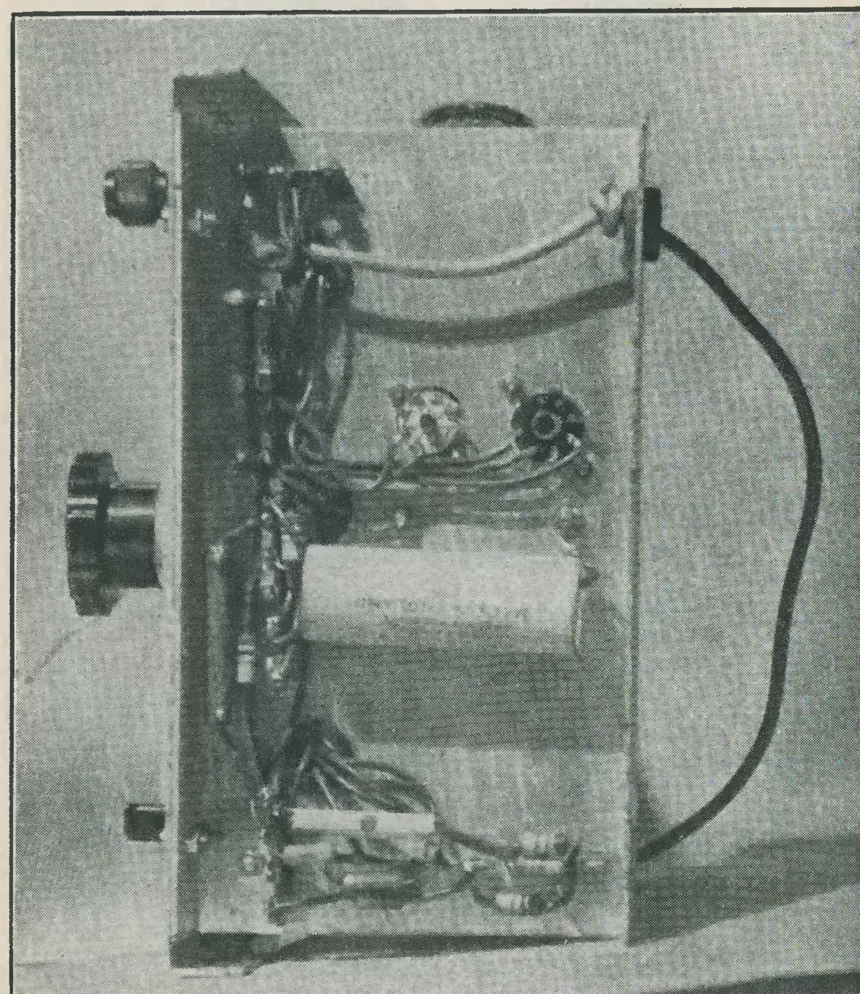
Switches

S1(a), S1(b), S1(c), 3-pole 4-way range switch
S2, on-off.

lower voltage, proportional to that of the EHT will be built up across R2 to R5. Switch S1(a) taps into this potentiometer network to provide different voltage ranges for the meter.

To measure the proportional voltage appearing at the arm of S1(a) this voltage is compared with that obtained at the slider of R10, indication of balance being effected by the miniature tuning indicator type DM70 (V1). R10 is adjusted until V1 gives an arbitrarily-chosen indication of balance, whereupon the EHT voltage may be read directly from a scale fitted to R10 itself.

The voltages appearing across R10 are selected, for different ranges, by means of S1(b) and S1(c). This is done by switching in various combinations of resistance either across, or in series with R10. It should be emphasised at this point that none of the



Underside of chassis, showing clean layout resistors used in this part of the circuit need have a closer tolerance than 10%. Any suitable resistors which may be on hand will prove satisfactory, the discrepancies being allowed for in the process of calibration. (R11 and R12 are connected in parallel to avoid the necessity of having to obtain a single awkwardly-valued 3.33kΩ resistor).

To ensure that the comparison voltage applied to R10 remains constant for different values of mains voltage, a regulator valve, V2, is employed. The valve chosen by the writer was the Mullard 150B2.

HT for the voltage comparison network and the DM70 tuning indicator is obtained in a conventional rectifier circuit using an EZ40 and a 16μF reservoir capacitor. An instrument transformer (Allen Components type MT214) ensures that the HT supply is isolated from the mains input.

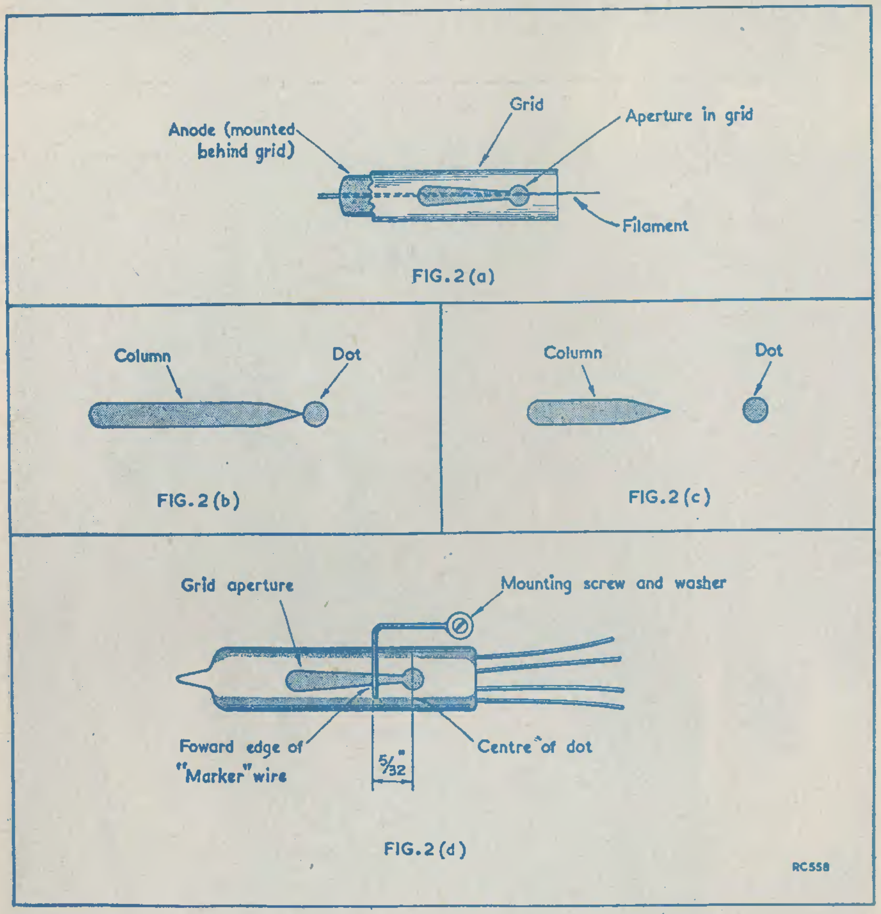


Fig. 2 (a) A simplified diagram showing the internal structure of the DM70 tuning indicator
(b) The indication given by the DM70 when its grid has the same potential as its filament.
(c) The indication given when the grid of the DM70 is several volts negative with respect to the filament.
(d) Showing the position of the "Marker" wire in relation to the DM70 structure.

As was mentioned above, to compare the voltage obtained from R10 with that appearing at the arm of S1(a), R10 is adjusted until the DM70 gives a previously-chosen indication. This occurs when the grid is several volts more negative than its filament. It will be noted that, as the DM70 grid is negative with respect to its filament at the point of balance, no current is then drawn from the EHT potentiometer network. This fact may be temporarily checked by short-circuiting R6, whereupon the indicator should

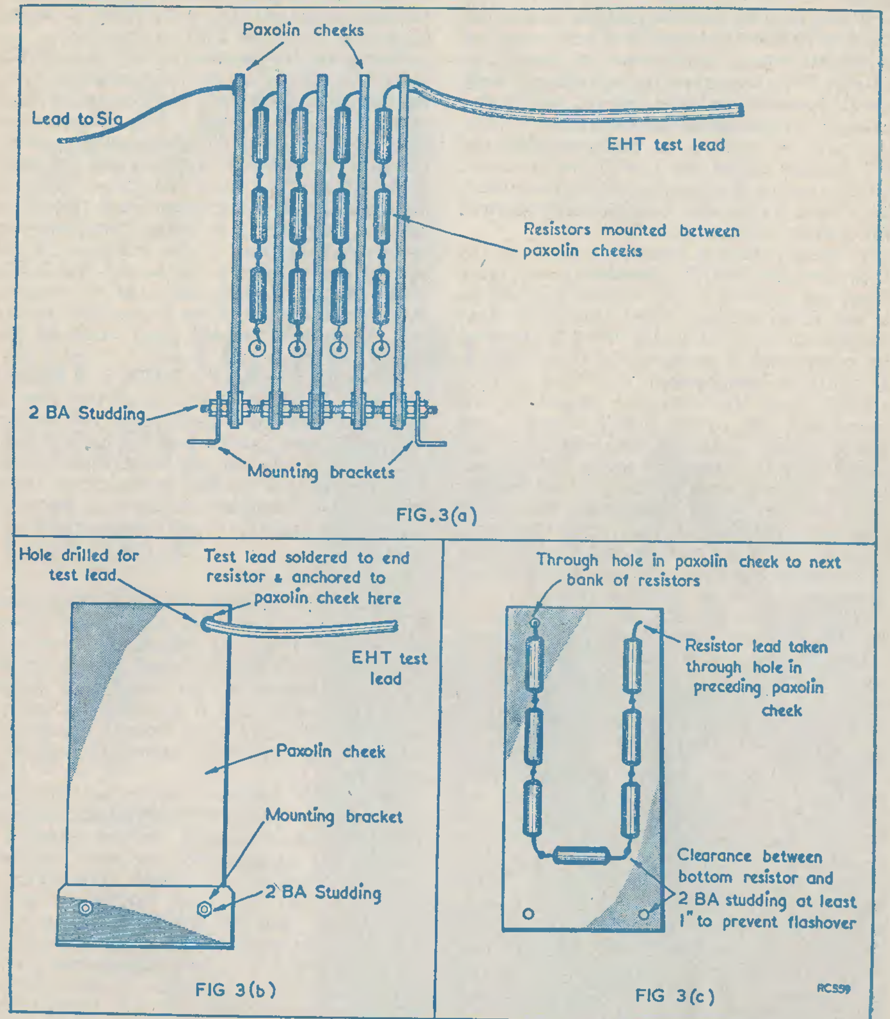


Fig. 3 (a) Side view, showing a suggested method of mounting the resistors which make up R1. The number of paxolin cheeks used may be selected by the constructor to suit the resistors obtained by him.
(b) End view of the resistor assembly.
(c) The method of stringing the resistors between the paxolin cheeks. The number of resistors fitted between individual pairs of cheeks depends mainly upon their physical size and the space available.

exhibit no change whatsoever. The normal purpose of R6 is, of course, to prevent the flow of excessive grid current when the slider of R10 is below the potential of the arm of S1(a).

It will be seen that the cathode current of the DM70 flows through R10 and whatever other resistor is connected in circuit by S1(c). This current is comparatively very small, however; and it is allowed for, in any case, in the process of calibration.

It will be noticed, in addition, that the HT voltage across the DM70 and its series anode resistor R7 varies as R10 is adjusted. This variation is also automatically allowed for during calibration.

A further item of interest is given by the fact that the DM70 filament is operated from the same 6.3 volt heater winding as is the EZ40 rectifier. The correct filament voltage for the DM70 (1.4 volts) is obtained by connecting in series a 220 ohm resistor. It must be emphasised that this resistor should have the tolerance shown in the component list, or the DM70 filament may suffer damage. It will be seen also that adjusting R10 causes the mains transformer heater winding, and the heater of the rectifier itself, to vary in DC potential. The heater cathode insulation of the rectifier is more than adequate to prevent any discrepancies in readings, however, and this point should cause no trouble in practice at all.

The resistors R2, R3, R4 and R5 must, as shown in the component list, be close-tolerance types. It is necessary to use close-tolerance resistors here in order to ensure that the voltages built up across them are in correct proportion to the total EHT.

The DM70

Readers who are familar with the DM70 will need no further introduction to this very useful little valve. For those who have not yet encountered it, a few words of description will not be out of place here.

The internal structure of the DM70 includes a flat anode coated with a fluorescent material which is mounted behind and roughly parallel to a flat grid having a central aperture somewhat in the form of an exclamation mark. In front of the grid is a single filament wire. See Fig. 2(a).

When the filament is heated, and suitable supplies are connected, its emission causes a fluorescent image to appear on the surface of the anode, as viewed through the grid aperture. Assuming that the grid has the same potential as the filament the shape of the grid aperture then causes the fluorescence to assume the appearance shown in Fig. 2(b); that is, a tapering column ending in a dot. If the grid is made negative to the filament, its aperture reduces the filament emission to the anode, with the result that the fluorescent image becomes altered, resembling that shown in Fig. 2(c). It may be seen from this that varying negative voltages on the grid result in varying lengths of the fluorescent column appearing on the surface of the anode. This point is taken advantage of in the EHT voltmeter.

Owing to the presence of R7, the DM70 is, in this circuit, at its most sensitive when its grid is only a few volts negative with respect to its cathode. This corresponds to a "column length" approximately three-quarters of the full length given by zero grid voltage. To ensure that the voltmeter is balanced to the same point each time it is used, a simple marker made from thin wire is mounted in front of the indicator in the approximate position shown in Fig. 2 (d). The voltmeter is then adjusted by rotating R10 until the point of the fluorescent column just "touches" the left-hand edge of the marker wire.

Although the use of a DM70 as a balance indicator in an arrangement of this type is unconventional, it is practicable and simple. Objective tests carried out by having non-technical people set the voltmeter to the balance position resulted in no errors being made due to misunderstanding or to parallax. Indeed, the method of indication is quick and reliable.

The Series Resistor

The series resistor R1 is a component which requires some care in its construction. As shown in Fig. 1, its value is 298 megohms. It is impossible for the home-constructor to obtain a resistor of this value as a single unit, of course, and it becomes necessary, therefore, to make it up from a number of conventional high-value resistors connected in series.

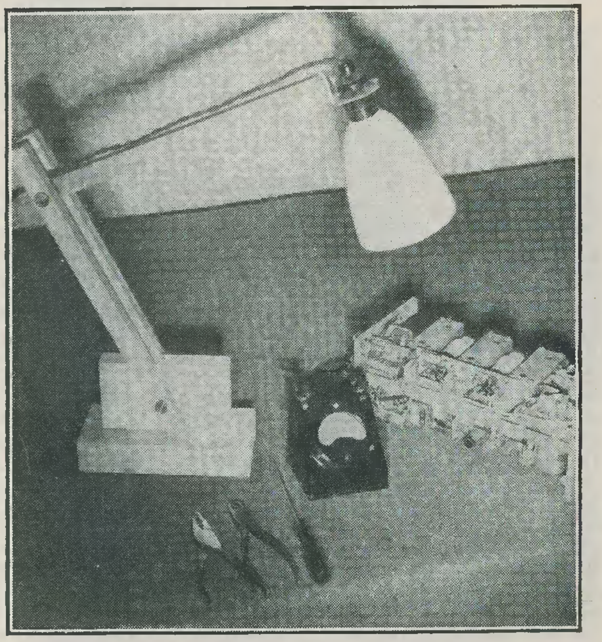
The reader will not need to be reminded that the best source of high-value resistors will also, up to a point, be the cheapest! The writer constructed his own resistor from a quantity of 10MΩ components obtained from Electronic Precision Equipment, Ltd., and he understands that this firm now has good stocks of close-tolerance 12MΩ resistors at a very reasonable price. The quantity required — twenty-four — obviously necessitates an eye being kept on their cost. The odd ten megohms "left over" after the twenty-four have been connected may be made up with a single ten, or two five, MΩ resistors. (However, the error introduced will not be excessive if twenty-five 12MΩ resistors are used, adding up to 300MΩ, instead of 298). The reader may remember that a fairly high value, 10MΩ, is needed also for R6.

A very simple way of mounting the resistors is shown in Fig. 3(a). This method of construction uses a number of paxolin cheeks of similar size between which are sandwiched chains of resistors connected in series, these being joined to the paxolin sheets at holes drilled in the top. The paxolin cheeks, whose approximate dimensions are 5 inches high by 2½ inches wide, are held together at the base by two lengths of 2BA studding fitted with suitably-spaced nuts and washers. Simple angle brackets fixed to the studding allow the whole assembly to be mounted to a chassis. Fig. 3(b) shows an end view, and Fig. 3(c) the method of stringing the resistors between the paxolin cheeks.

Due to the possibility of corona discharge, considerable attention must be paid to rounding off all solder joints in the resistor chain; care being taken especially at the "EHT end." The writer was fortunate in being able to wax-dip his resistor assembly after it was built. Although the constructor may find it difficult to do the same, no harm would result if, as an alternative, the assembly were given a coat of anti-corona or polystyrene varnish after completion. It should be borne in mind that corona discharge at any point in the resistor chain will cause inaccurate readings.

(To be concluded)

AN ADJUSTABLE BENCH LAMP



By

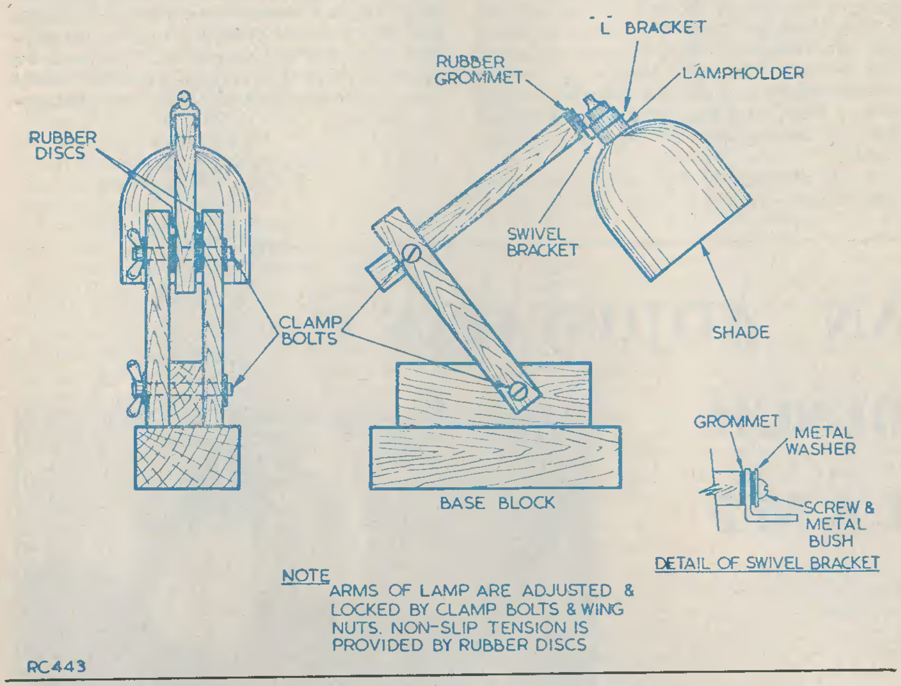
R. E. HOGBEN

A GOOD LIGHT IN THE RIGHT SPOT is not always to hand when required. To fill this need, a bench lamp as shown in the illustrations was built, from ordinary materials such as are to be found in the average workshop. The result, a simple yet versatile lamp, is almost as good as an "Anglepoise," at a fraction of the cost.

Construction

The two blocks of wood forming the base are screwed together, and a hole drilled in the top block to take the clamp bolt which holds the adjustable lower arm. The latter is clamped by means of the bolt, a metal washer each side, and a wing nut.

The upper adjustable arm is similarly clamped, but with the addition of two rubber washers as shown in the sketch. The lampholder is fastened firmly to an "L"-shaped bracket made out of aluminium bent to shape. The bracket is held to the arm by means of a large rubber grommet. The latter is fastened to the arm by a screw passing through a metal bush in the centre of the grommet, and a washer under the head of the screw. This allows the bracket, and hence the lamp, to be swivelled to any convenient angle.



The lampholder and the shade are fixed in the usual manner; do not forget to instal an adequate length of flex. (The base could be improved by fixing wooden moulding around it, so leaving a hollow into which lead could be melted, and a really heavy bottom obtained which would not overturn at the crucial moment!—Ed.)

Materials Required

1 Hardwood block 8″×3½″×1⅝″
1 Hardwood block 6″×3″×1″
3 Hardwood strips ⅞″×¾″×14″
1 Switched lampholder
1 Lampshade, preferably spun aluminium (A small pudding basin is ideal)
3 yards of flex
2 rubber discs ¾″×¼″
2 Bolts with wing nuts and washers
Woodscrews, paint or varnish, etc.

The Editor invites . . .

articles of a practical nature from readers.

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

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

R.E.C.M.F. EXHIBITION

Every year the R.E.C.M.F. Exhibition becomes bigger and better. Housed this year in the Great Hall, Grosvenor House, it attracted a considerable attendance; this being so large that at times the floor resembled rush-hour in the Tube. Rumour has it that next year's Exhibition will be held in a larger hall, or over a longer period.

Band 3 TV is always news, and its imminence has given rise to much development work by manufacturers. In many cases, this development work is still in a state of flux, so that the concrete *fait accompli* tuners exhibited at the show deserved special attention. 13-channel turret tuners were shown by Sidney Bird (Cyldon), Ediswan-Clix, and Plessey. These three tuners have removable coil sections, with the result that the turret may be supplied to the manufacturer fitted with only those frequencies which are immediately needed; later frequencies being added by the service engineer. All used a circuit similar or equivalent to the cascode, triode-pentode arrangement described in this month's *In Your Workshop.*

Another 13-channel tuner (also cascode, triode-pentode) was exhibited by N.S.F.-Oak, this using coils and coil segments spaced around switch wafers. As the switch is rotated it brings in further steps of inductance. The increases in inductance required for the 5 Mc/s separation between channels on Band 3 are too small to be served by wound coils, and the inductances between switch positions for this band are given by flat strips integral with the contacts themselves.

Fine oscillator tuning is provided on all 13-channel tuners shown by means of a spindle concentric with the switch spindle. Tuning is capacitive, being achieved by a rotating cam-shaped disc of insulating material between two fixed plates. The dielectric constant of the insulating material differs from that of air, with the result that the capacity between the plates varies according to the area of insulating material between them.

Also shown on the N.S.F.-Oak stand was the nationally-advertised Pye 13-channel tuner. This is a Pye development and uses N.S.F.-Oak wafers.

If the 13-channel tuners exhibited at the show were offered to the home-constructor, they would probably cost some £8 to £15 retail. It is extremely doubtful if such a thing would happen, though, since the process of setting them up requires expensive gear, and there is, as yet, a considerable lack of experience with them in the field. However, these are early days yet.

Newcomers to the cascode and triode-pentode stable, already occupied by Brimar and Mullard, were the Mazda 30L1 and 30C1 and the Osram B319 and LZ319.

21 inch TV picture tubes were shown by Mullard and Brimar, these being the MW-53-21 and the C21FM respectively. The latter is aluminised. Both tubes are rectangular, both have an external conductive coating, and both employ 70 degree deflection. So existing scanning circuits will cope if they can supply the slightly higher EHT required. Availability to the home-constructor ? Not yet !

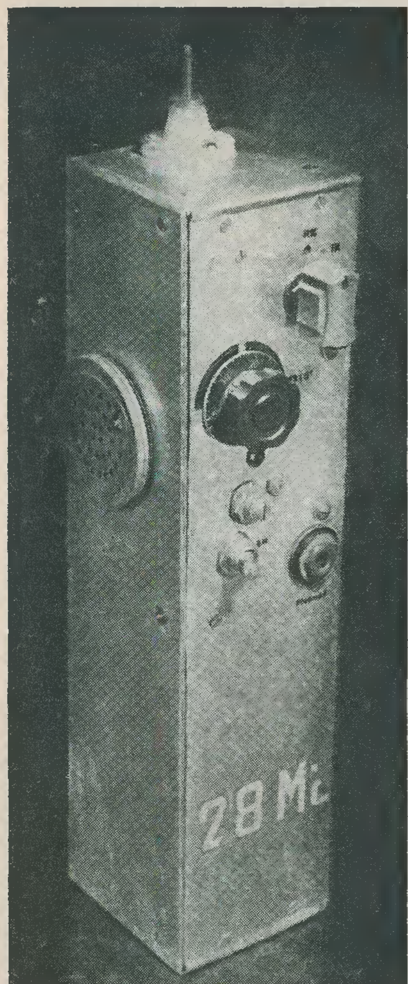
Mullard also showed their OC10 and OC11 transistors (for experimental work), and their OC70 and OC71 (currently used in a hearing-aid). Brimar exhibited their 3X/100N, and their 3X/101N; and Osram their GET1 transistor. The latter was shown actually in operation as an oscillator. The power supply was given by two dissimilar metals inserted in a lemon !

Further Brimar exhibits were their well-known germanium diodes and SenTerCel power rectifiers, and their germanium photo-cell type P50A.

Multicore, as always, put on a good show; this time having a machine on their stand which chugged away unattended and turned out solder rings by the hundred. It was, the writer was told, incidentally fulfilling a customer's order. Certainly no wastage there !

English Electric, in addition to their normal industrial valve range and their Image Orthicon camera tube, were showing their range of laminated "C" cores for transformers. These have the advantage, amongst others, of obviating the necessity of fitting individual laminations in the transformer bobbin. It's all done in one operation. "C" cores may be ousting conventional laminations to quite a considerable extent soon.

Eddystone and Jackson Bros. both had an excellent line in variable condensers and similar gear. Eddystone showed a bug key, which handled very nicely. In their extensive range, Jackson Bros. included several precision gang condensers, including one of 532pF with isolated rotors. This was available in 2, 3 or 4 gang.



HANDIE-TALKIES *for* 28 Mc/s

By **F. C. JUDD,** G2BCX

Fig. 1: Appearance of the 28 Mc/s transceiver described in this article.

We have pleasure in presenting herewith the first of our descriptions of equipment suitable for RAEN purposes. Those of our readers who are RSGB members will already know of the developments which are taking place in the recently-formed Radio Amateur Emergency Network. To those who do not know the details of its organisation, may we say that two main types of equipment are visualised. The first is of the more powerful, fixed-station type for communication on the 3.5 Mc/s band in the inter-county nets; the second is of the walkie-talkie type, for purely local working.

The 28 Mc/s equipment described herewith is of the latter variety, and we confidently recommend it to RAEN members, and to others who are looking for something which will give them local coverage with extreme portability.

May we remind our readers that anyone may join RAEN, whether a member of the RSGB or not; and whether he be a transmitting amateur or a SWL. Application for membership should be sent to The Radio Society of Great Britain, New Ruskin House, Little Russell Street, London, W.C.1, marking the envelope " RAEN."

DURING LAST SUMMER, some interesting experiments were carried out with low power portable Transmitter/Receiver equipment — often referred to as Handie/Talkie's or Walkie/Talkies. These were operated at 144 Mc/s and 28 Mc/s, those for the former frequency being of rather larger design with a transmitting input of approximately 2 watts. The 28 Mc/s sets were considerably smaller, employing only two valves for both *transmit* and *receive*, and operated with a total input of approximately half a watt.

These small sets are ideal for use in Radio Amateur Emergency Networks for maintaining two-way contact between parties on foot and nearby fixed or portable stations with longer range and may be used with great effect in built-up areas with a range of up to a mile. The circuits are simple, and power consumption is low enough to permit the use of the smaller types of HT and LT batteries. Although self-excited oscillators are used for both transmitting and receiving, the circuit is quite stable and no trouble has been experienced with quench radiation, which on a normal superhet receiver becomes inaudible at two or three hundred yards. With only 90 volts HT and using a *4ft 6in* whip aerial, two-way contact has been made even in underground subways, but as mentioned above the range is usually of the order of a mile. The two sets used by the writer have been constructed as Handie/Talkies, but recently a somewhat larger version has been built. As this set is carried by means of a shoulder sling, it might be better described as a Walkie/Talkie. A separate hand microphone and headphones are used.

The Circuit

The circuit is very simple and uses only two valves of the miniature 1.4V filament type with B7G bases. The photo Fig. 2 shows the inside of the writer's sets, which use the circuit of Fig. 3. The case is constructed from plywood backed with thin aluminium, which provides sufficient shielding against hand capacity and effectively houses the batteries. (See layout diagram Fig. 4). A GPO insert type of microphone is used and is mounted on one side of the case, and the aerial is attached to a stand-off insulator at the top. A headphone jack is provided on the front panel together with the on/off-transmit/receive switch, and the quench and tuning controls. Most of the components are miniature type specially selected

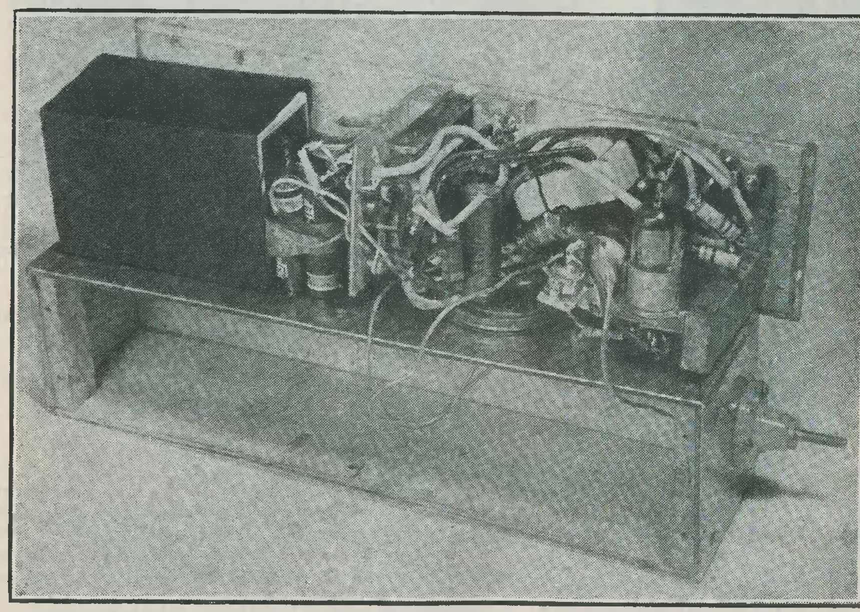


Fig. 2: View showing internal construction — see also Fig. 4.

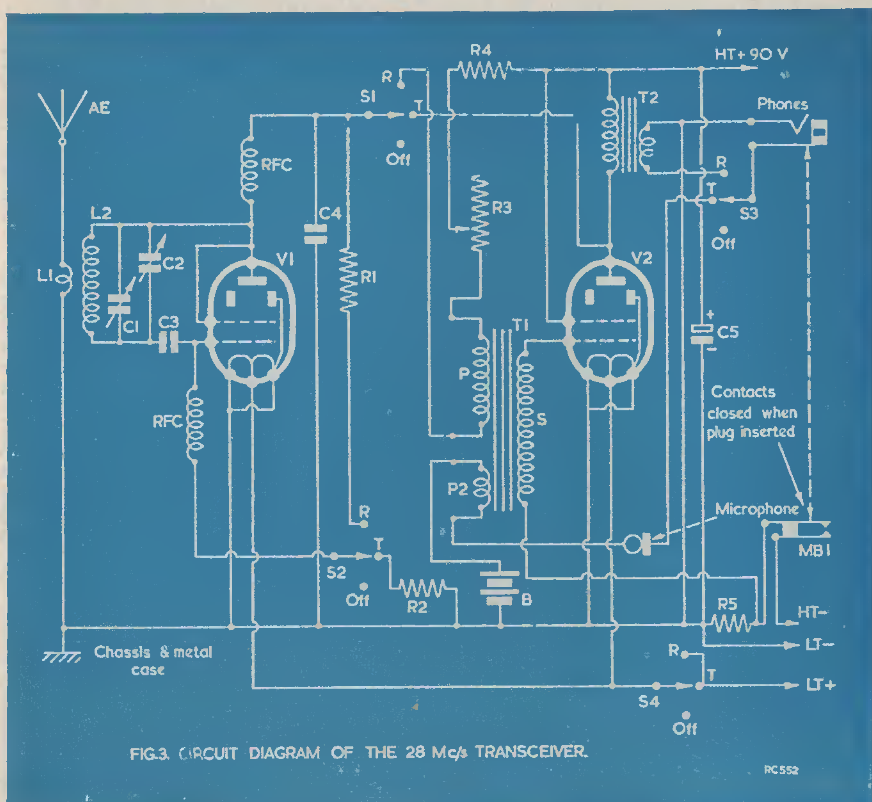


FIG.3. CIRCUIT DIAGRAM OF THE 28 Mc/s TRANSCEIVER.

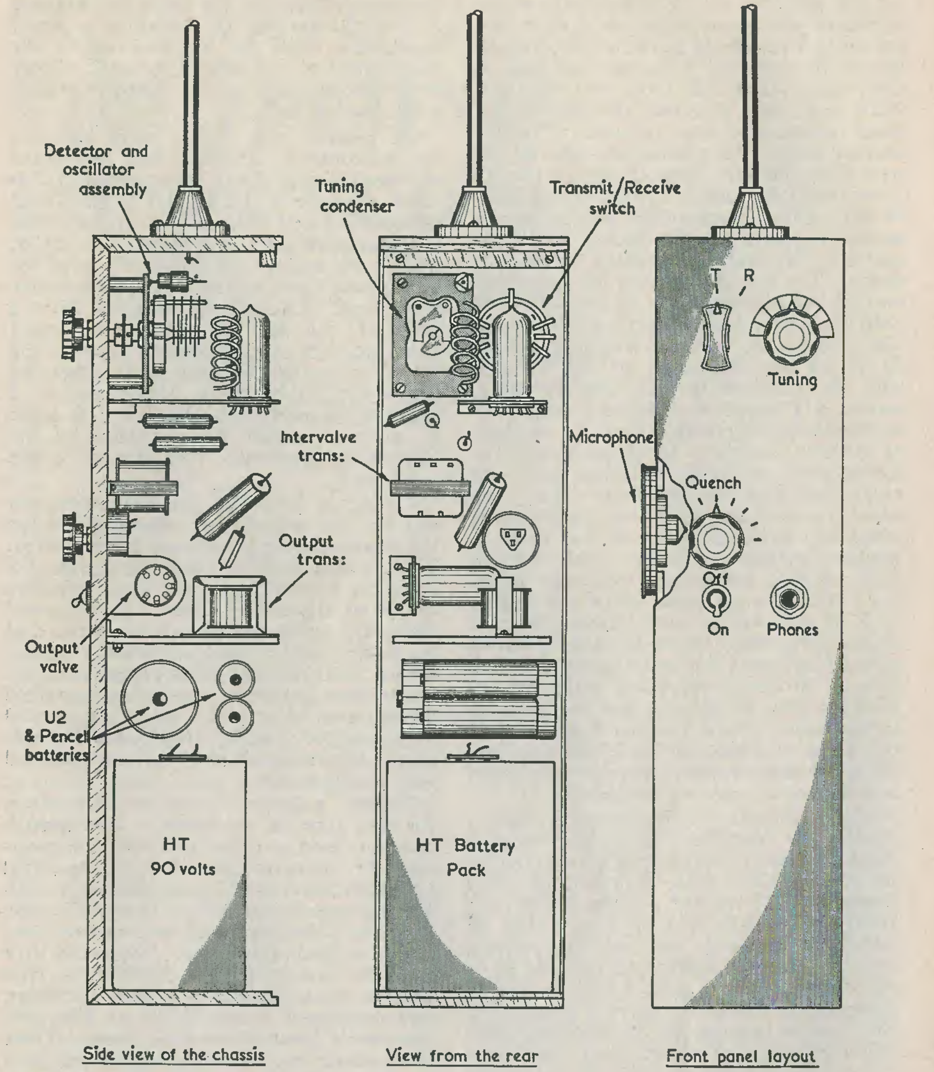
COMPONENTS LIST

L1	1 turn, centre of tank coil
L2	8 to 10 turns, 16 swg enam. wire ½″ dia., ¾″ long
C1	30pF beehive trimmer (for band-set)
C2	10-15pF variable. Main tuning and band-spread
C3	100-180pF. Grid condenser
C4	0.01 to 0.05 μF (see text)
C5	8μF electrolytic
R1	2 to 5MΩ (see text) ¼ watt
R2	10 to 15kΩ (depends on V1). ¼ watt
R3	50kΩ variable
R4	10kΩ ¼ watt
R5	250 to 500Ω (depends on bias for V2)
RFC	RF chokes as per text
T1	LF intervalve transformer. (With mic. winding)
T2	Midget output transformer
S1, 2, 3, 4	4-section single-pole changeover switch
MB1	See text.

Note

The microphone is switched in series with the headphones (low impedance type) for monitoring the speech on transmit. *The microphone battery B should be chosen to suit the microphone sensitivity required for maximum modulation.*

for this kind of equipment. Quite a number of variations of the circuit of Fig. 3 are possible, but all are fundamentally the same since the detector is a self/quench oscillator, which is necessary because self-excited oscillators are used for transmitting. The high rate of frequency modulation renders a quench receiver necessary because of its broad band tuning properties. A few other points on the circuit may be worth noting. The oscillator section has been designed around the Mullard DL94 (Brimar 3V4).



The size of the case is 12″x 3″x 3″. Approx 5½″ is allowed for the batteries mentioned in the text. Components should be as small as possible and chosen from the various miniature types at present available. The cover for the case slides over forming the back and two sides one of which carries the microphone. NOTE. The tuning condenser must be completely insulated from the chassis.

FIG.4. SUGGESTION FOR A PRACTICAL LAYOUT BASED ON THE CIRCUIT OF FIG.3.

RC553

On receive, the quench oscillation is maintained by returning the grid to positive HT via the grid-leak R1; if difficulty is experienced in getting the circuit to quench, the following tests should be made. Slacken off the aerial coupling; too tight coupling or too many aerial coil turns will stop the valve quenching at certain frequencies. A small value condenser (around a 100pF) shunted across the gridleak R1 will do the trick if all else fails. Smooth quench control s very desirable, and is effected by variation of R3. Other components which may be varied to obtain smooth quench oscillation are R1, C4, and the gridleak by-pass as above. The RF chokes play an important part in maintaining smooth oscillation at both fundamental and quenching frequencies. The chokes are wound close-spaced with 30 to 34 swg enamelled or silk covered wire on a former ½" dia. and 1½" long, leaving a ⅛" space at either end. All leads to the changeover switch must be as short as possible, especially those connecting the tuning coil, condenser, and the grid and anode wiring of the oscillator valve. The correct quench frequency and amplitude is when the thermal noise of the valve is loudest; an audible whistle in the phones indicates that the quench frequency is too low. The thermal noise stops completely, or is at least very greatly reduced, when a signal is received. At close range a strong signal will sound flat and slightly distorted because of the strong AVC action of the detector. The audio level will rise as range is increased. When a signal fades or goes completely the thermal noise will rise, and when two sets are switched to receive position interference whistles will be heard.

The audio side is quite standard, being a simple LF amplifier transformer-coupled from the detector, but having enough output for modulation when transmitting. The transformer T1 may be any small intervalve type with a ratio of 3 or 5 to 1 plus an additional winding for the microphone. This may consist of 50 to 60 turns of 30 or 32 swg covered wire wound over the top of the existing windings. Select a transformer that has a little space between the main windings and the surrounding iron core. The output transformer may be one of the midget types used in personal radios, the low impedance winding being used for the headphones, which must of course match. Separate headphones are helpful in keeping out external noise, but if desired a single headphone could be mounted above the microphone on the side of the case. Other constructors have in fact used complete telephone handsets.

On *transmit* the output valve becomes the microphone amplifier and modulator of the Heising choke arrangement. The valve may be a DL94, DL93 or DL92 (Brimar 3V4 and 3S4). HT is supplied from a Batterymax pack type B126 or similar, which with average use will have a good life as the total current drain is little more than 6 to 7mA. LT may be obtained from a single U2 cell, and the microphone current from one or two pencells. Note:—the extra contact which breaks HT– when the phone plug is removed. Either this or a separate HT switch should be fitted, in order to prevent current being passed by the electrolytic condenser when the set is not being used.

The actual layout of the circuit does not call for any special arrangement, providing the points already mentioned are observed. The drawing of Fig. 4 may be useful as a guide to a suitable layout for a Handie/Talkie as described. Other layouts — and these are quite varied — have been, and are being, used by G6HU, G3DSW, G3ALK, G4GA, G3FZF, and acknowledgements are due to these and others who have co-operated wholeheartedly with the writer. It should be mentioned that for RAEN use the sets should be reasonably watertight, or provided with plastic covers.

Finally, a few words on suitable valves for this type of equipment. For quench detectors used as power oscillators on transmit, the valves mentioned above, operated as triodes, will work quite efficiently with HT voltages up to 90V. On the LF side, the same valves are used as pentodes. For higher output and higher frequencies (for example 144 Mc/s) the DCC90 (a twin triode) operated as a push-pull oscillator, and modulated with a DL93 or 3D6, will provide a suitable combination. These three valves may be operated with up to a maximum of 135 volts HT. The miniature types used for Deaf-aid amplifiers are not particularly suitable, except as LF amplifiers, but it should be mentioned that a number of specially designed miniature valves have appeared, or will soon be appearing, on the market. Some of these are suitable for use as oscillators up to 500 M/cs. Much information on portable and semi-portable HF and VHF emergency equipment will be found in the 1945 ARRL Handbook, WERS section.

CONVERTING THE 182 UNIT TO A 'SCOPE

By **A. BLACKBURN**

IT WOULD BE POINTLESS to attempt to review in these pages how useful an oscilloscope can be to the radio amateur. While you are already well aware of its advantages, you are also equally well aware of its cost in relation to its range of application. What I wanted was a cheap but versatile instrument, and after a survey of the available units I decided to convert the easily obtainable Government Indicator 182. I estimated that about £9 would be a satisfactory figure to lay out on the complete conversion. I found just what I was looking for in Charles Britain (Radio), Ltd. in St. Martin's Lane, London. The instrument was in a very clean condition, and priced very reasonably. In deciding upon the following design, two important factors were taken into consideration. Close attention was paid to the fact that a wide range of sweep speeds, and a bandwidth of at least 1 Mc/s in the Y amplifier would be necessary for satisfactory use on TV waveforms. This requirement having been fulfilled, its use for more normal applications is covered automatically. Another decision had to be made. Should the power pack be incorporated in the instrument or be a separate unit? It would have been possible, using a shoehorn, to put the power pack inside the instrument, but three considerations dissuaded me. These were: the possiblity of unsatisfactory performance and constructional complications involved in such a design; and the advantage of portability and independence of the power supplies offered by the separate unit, thus enabling it to be used for other purposes when not operating in conjunction with the oscilloscope.

The cover photo (Fig. 1) shows the completed instrument with its power supply unit.

The Time-Base

Performance: 50 c/s to 100 kc/s
Symmetrical Sweep
Automatic flyback suppression
Provision for internal or external synchronisation.

The circuit used for sweeping the tube is a Miller-Transitron*, which provides a very linear sawtooth over a wide frequency range, and a reasonably fast flyback. The EF50 valve (V_1 in Fig. 2), already in the instrument, is particularly suitable for this purpose as its suppressor grid base is relatively short. Probably a better valve is the VR116, but the performance of the EF50 was so good that it was not considered worth while changing to the VR116 type. The switching of the Miller charging capacitor and the suppressor grid/screen grid coupling capacitors are ganged.

Sawtooth output from V_1 is fed to V_2, which inverts the sawtooth and has a gain of unity. The coupling network and feedback network form a paraphase stage. During the flyback period a negative-going pulse of the same duration as the flyback appears on the suppressor grid of V_1. This is fed to the grid of the cathode ray tube via a cathode follower, V_3. The purpose of the cathode follower is to prevent small hum voltages which appear on the grid of the cathode ray tube being fed to the suppressor grid and upsetting the operation of the time-base.

A synchronising amplifier V_4 is incorporated, its anode load being shared by the screen load of V_1. Synchronising signals derived from either the Y amplifier or an external source are selected by a switch, SW_3. The amplitude of the sync signal fed to the

**Time Bases and Scanning Generators*, O. S. Puckle, 2nd Edition.

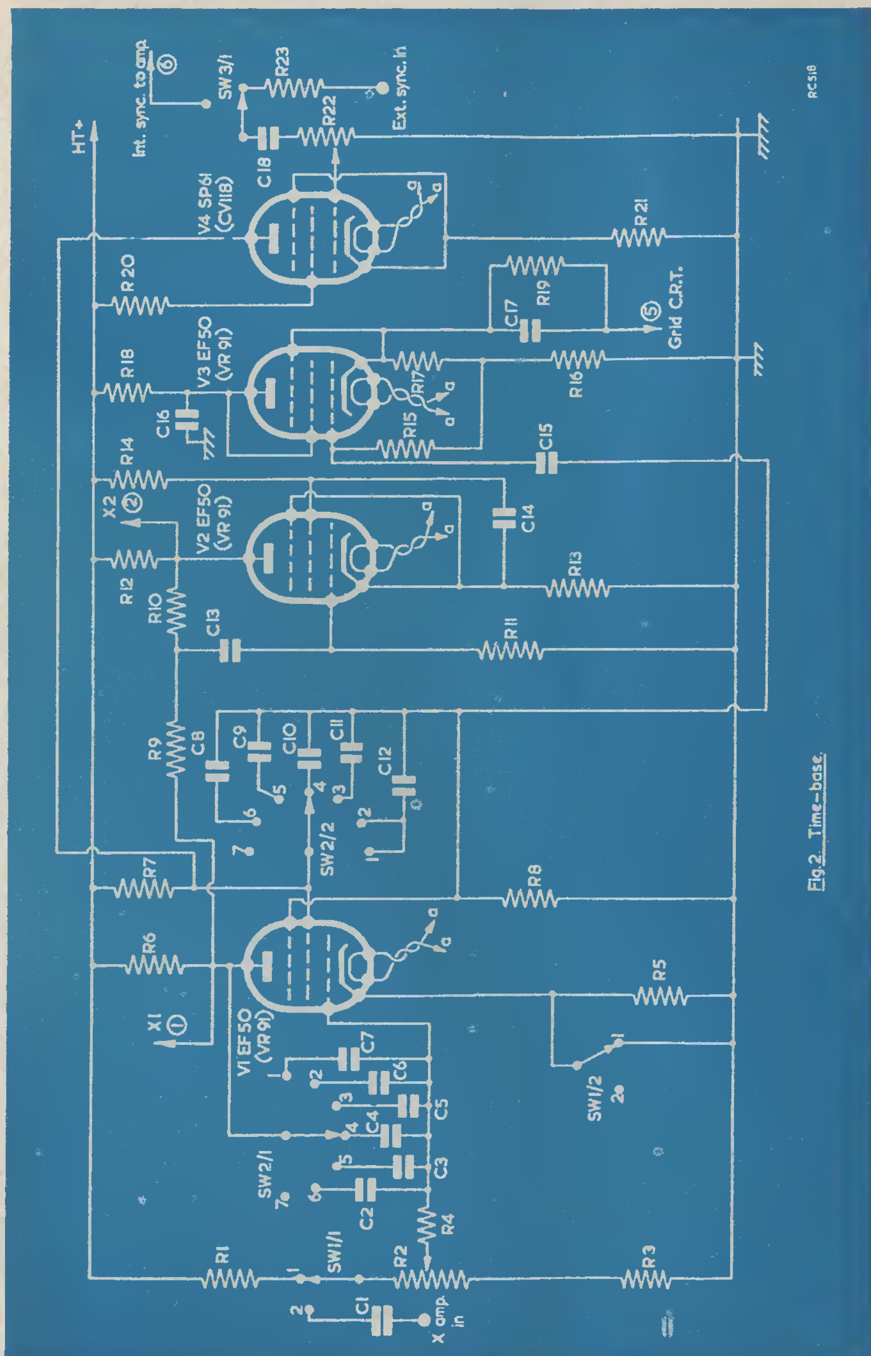


Fig.2. Time-base.

time-base is adjusted by means of the potentiometer R_{22}. Time-base speeds are selected by the switch SW_2, and a fine control is provided by the potentiometer R_2.

The X Amplifier

Performance: Gain — 250 approx.
Bandwidth — 50 c/s to 50 kc/s for 3 db down
Symmetrical deflection

The time-base circuit (Fig. 2) ceases to operate when the coarse speed control is in position 7. In this condition the c'rcuit

The Y Amplifier

Performance: Maximum gain 100 approx.
Minimum gain 3 approx.
Symmetrical deflection

At maximum gain, bandwidth is 3 db down at 25 c/s and 1 Mc/s. The bandwidth is somewhat better at the HF end at the minimum gain setting. Voltage output, plate to plate, 100V peak-to-peak. Maximum input voltage before noticeable overloading occurs, 33V peak-to-peak.

The Y amplifier is shown in Fig. 3. The gain control R_{26}, although not normal in

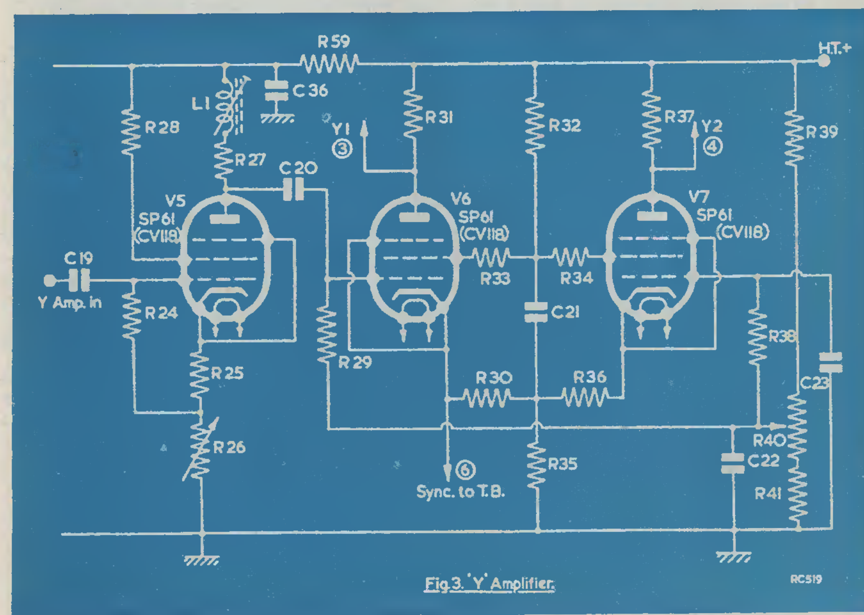


Fig.3. 'Y' Amplifier.

may be used as an amplifier. Switch 1/1 selects the X amplifier input terminal and the time-base fine control becomes a gain control. Switch 1 also removes a short circuit from the bias resistor R_5 of V_1 when in the "amplifier" position. Unfortunately, restricted bandwidth of the X amplifier is unavoidable, but it is very useful for displaying Lissajou figures. Due to the input circuit, the amplifier overloads on comparatively low signal levels and the gain cannot be turned down completely because of the resistor R_3. For most purposes, however, these shortcomings should not prove serious limitations to performance.

audio, is conventional in wide band amplifiers and has the advantage that the bandwidth does not diminish as the gain decreases. The anode load, R_{27} of V_5, is shunt compensated by the inductor L_1. This coil can be made from a coil already existing on the EF50 side of the chassis. Details of this modification will be given later. R_{59} and C_{36} are necessary as additional smoothing to prevent small hum voltages appearing on the grids of the output valves. The output stage is of the type known as the "long-tailed pair." Briefly the operation is as follows:

The output voltage from V_5 is fed to the

COMPONENTS LIST

RESISTORS

Circuit Ref.	Value	Watts	Type
R1	100kΩ	½	
R2	100kΩ	½	Potr.
R3	100kΩ	½	
R4	1MΩ	½	
R5	470Ω	1	
R6	47kΩ	1	
R7	20kΩ	1	
R8	100kΩ	½	
R9	680kΩ	½	±5%
R10	470kΩ	½	±5%
R11	1MΩ	½	
R12	47kΩ	1	
R13	470Ω	1	
R14	33kΩ	1	
R15	1MΩ	½	
R16	20kΩ	1	
R17	470Ω	1	
R18	33kΩ	2	
R19	100kΩ	½	
R20	47kΩ	1	
R21	220Ω	1	
R22	1MΩ	½	Potr.
R23	1MΩ	½	
R24	1MΩ	½	
R25	470Ω	1	
R26	25kΩ	3	Potr.
R27	5kΩ	6	W'wd.
R28	47kΩ	1	
R29	1MΩ	½	
R30	100Ω	½	
R31	6.4kΩ	6	W'wd.
R32	10kΩ	1	
R33	100Ω	½	
R34	100Ω	½	
R35	4.7kΩ	6	W'wd.
R36	100Ω	½	
R37	6.4kΩ	6	W'wd.
R38	1MΩ	½	
R39	30kΩ	1	
R40	20kΩ	1	Potr.
R41	10kΩ	1	
R42	470kΩ	1	
R43	1MΩ	½	
R44	1MΩ	½	
R45	4.5MΩ	1	1%
R46	.5MΩ	1	1%
R47	1MΩ	½	
R48	1MΩ	½	Potr.
R49	1MΩ	½	Potr.
R50	1MΩ	½	
R51	1MΩ	½	
R52	1MΩ	½	
R53	270kΩ	1	
R54	.5MΩ	1	Potr.
R55	47kΩ	1	
R56	10kΩ	½	
R57	1MΩ	½	Potr.
R58	1MΩ	½	
R59	10kΩ	6	W'wd.

CAPACITORS

Cir. Ref.	Value	Volts wkg	Type
C1	.1μF	500	
C2	.02μF	350	Paper
C3	.001μF	350	Ceramic
C4	470pF	350	Ceramic
C5	100pF	350	Ceramic
C6	47pF	350	Ceramic
C7	30pF	350	Ceramic
C8	.01μF	350	Paper
C9	.001μF	350	Ceramic
C10	680pF	350	Ceramic
C11	100pF	350	Ceramic
C12	47pF	350	Ceramic
C13	.1μF	350	
C14	.01μF	350	
C15	.1μF	350	
C16	.1μF	350	
C17	33pF	350	
C18	.1μF	350	
C19	.1μF	500	
C20	.1μF	350	
C21	.5μF	250	
C22	2μF	150	
C23	.5μF	150	
C24	4μF	500	Electrolytic
C25	8μF	500	Electrolytic
C26	8μF	500	Electrolytic
C27	.1μF	2.5kv	
C28	.1μF	2·5kv	
C29	.1μF	350	
C30	.5μF	500	
C31	.5μF	500	
C32	.1μF	350	
C33	8μF	350	Electrolytic
C34	.01μF	4kv	
C35	.01μF	2·5kv	
C36	8μF	350	Electrolytic

INDUCTORS

Cir. Ref.	Value	Current
L1	500μH	
CH1	20H	100mA
CH2	10H	100mA

SWITCHES

Cir. Ref.	Ways	Poles	Type
SW1	2	2	Rotary
SW2	7	2	Rotary
SW3	2	1	Toggle
SW4	on/off	2	Toggle

VALVES

Cir. Ref.	Type
V1	EF50 (VR91)
V2	EF50 (VR91)
V3	EF50 (VR91)
V4	SP61 (CV118)
V5	SP61 (CV118)
V6	SP61 (CV118)
V7	SP61 (CV118)
V8	5U4G
V9	VU120
V10	VCR517
V11	D1 (VR92)

PARTS LIST

10 Red Belling Lee Terminals
1 Black Belling Lee Terminal

grid of V_6 in the normal way. Assuming therefore that the grid of V_6 is just going positive, it follows that its cathode will move positive. The cathode of V_7, being common to that of V_6, will also move positive. The grid of V_7, however, is effectively earthed through the capacitor C_{23}. Because the grid is going positive, therefore, the anode of V_6 will go negative and, conversely, the anode of V_7 will go positive because its positive going cathode affects it in the same way as a negative going grid. An alternative explanation is that V_6 produces an output across its cathode load, R_{35}, which is coupled to the cathode of V_7, and as the grid of V_6 and cathode of V_7

are in phase, their anodes must be out of phase. The 100 ohm resistors R_{30} and R_{36} may be adjusted to overcome any discrepancy in amplitude between the two anodes. It is not possible to earth one end of the grid leak of V_6 direct because the current of the two valves causes so great a voltage drop across R_{35} that they would be almost cut off. The grid leak, therefore, is returned to a

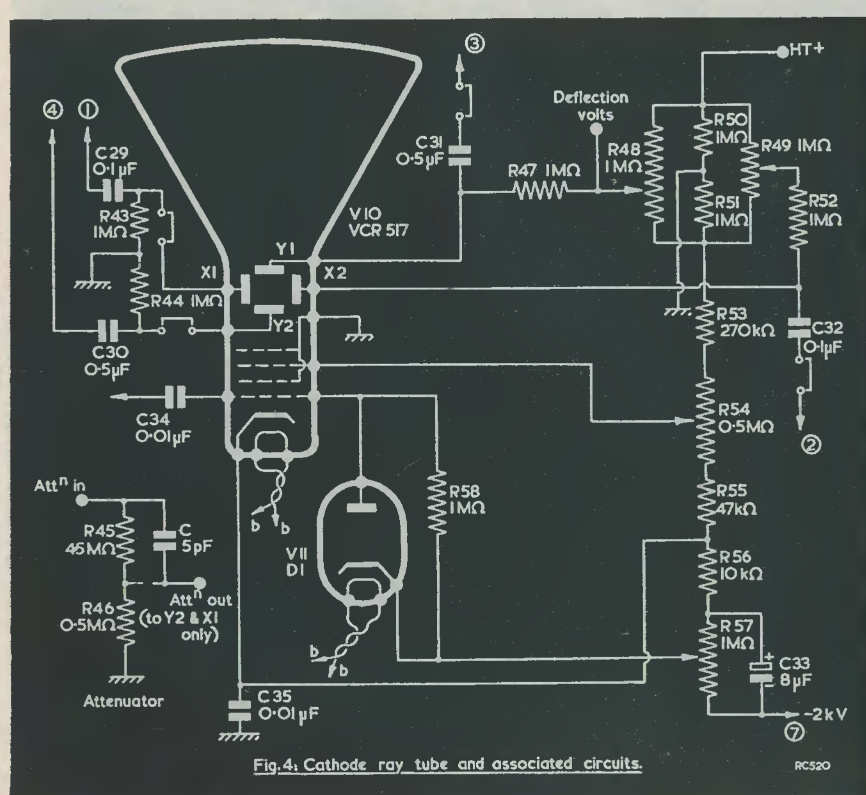


Fig. 4: Cathode ray tube and associated circuits.

chain across the HT supply and the correct balance of bias adjusted by R_{40}.

A connection to the cathodes of V_6 and V_7, which are of comparatively low impedance and therefore are not affected by any slight loading, ensures that there is no loss of bandwidth while obtaining the time-base synchronising signal from the amplifier. Small anti-parasitic resistors R_{33} and R_{34} are wired in the screen circuit of V_6 and V_7.

The Cathode Ray Tube

Performance: Sensitivity 14 V per centimetre approx. All plates directly available on a panel at the rear of the instrument, providing for DC or AC connection or attenuated. Shift voltage measurable at front panel.

The cathode ray tube V_{10} and its associated circuits are shown in Fig. 14. The EHT must be in the region of 2kV. Chain and shift networks are quite conventional and the grid, to which the black-out or flyback suppression is applied, is DC restored by the diode V_{11}. Particular attention has been paid to making all the deflection plates available for use when required. All leads from the time-base and Y amplifier are interrupted by terminals and links: by this means it is possible to apply signals direct to the plates, either DC or AC, whilst retaining the shifts, and the output of the time-base and amplifiers may be used if required. A 10-1 attenuator, capacitively compensated so that its attenuation remains con-tant at all frequencies, is also incorporated.

Power Supplies

A considerable amcunt of thought was given to the inclusion of all power supplies inside the cabinet, but a few experiments soon showed that, although it was physically possible, the difficulties due to hum pick-up, etc., were so great that it was decided eventually to make a separate unit. It was, however, considered too dangerous to exclude the EHT from inside the instrument, so a small unit containing the HT supplies only was constructed and connected to the instrument by a 5-way cable.

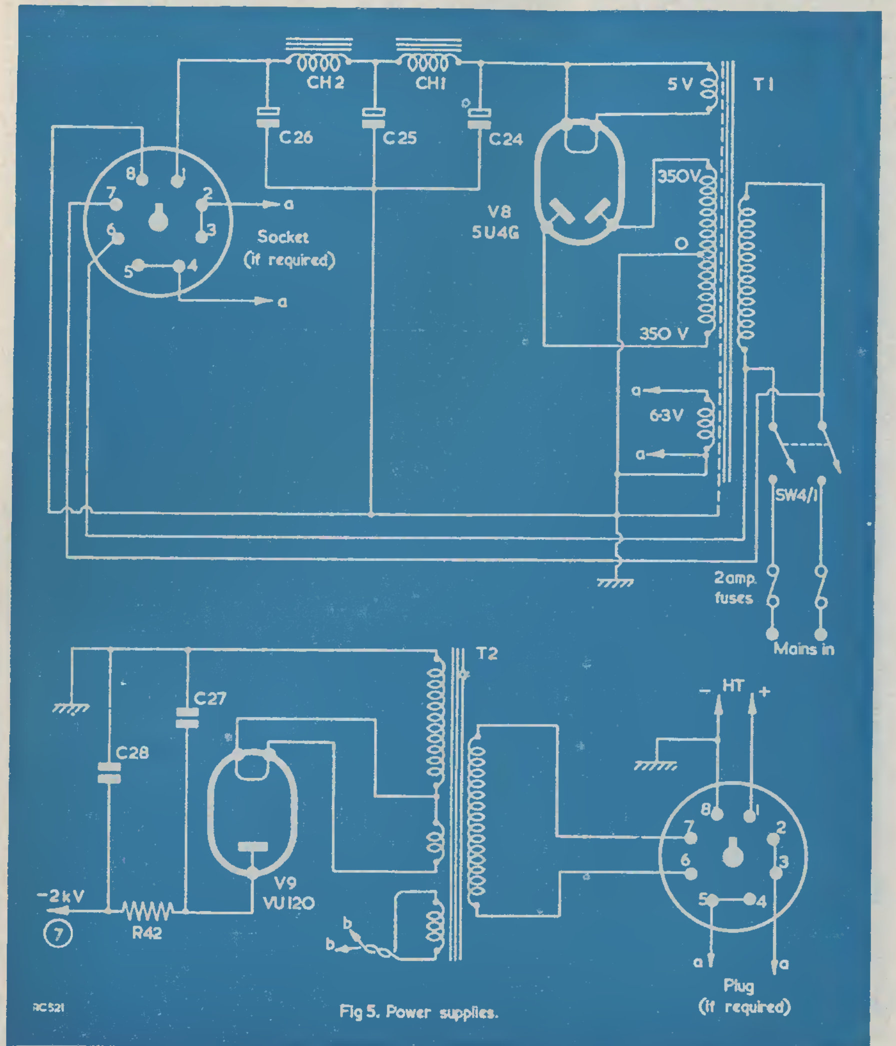


Fig 5. Power supplies.

Performance: HT unit 300V DC at 70mA. 6.3V AC at 3.5 Amps, and 5V at 3 Amps.
EHT unit—2kV DC at 2mA, and 4V at 1.2 Amps and 2V at 1 Amp.

The circuit in Fig. 5 shows how double smoothing has been used to overcome small hum voltages on the time-base HT line, which may otherwise cause imperfect stability of synchronisation.

Constructional Details

While the constructional work on the author's instrument is limited to cover necessary requirements for a clean and efficient job, the reader is at liberty to redesign the front panel if he thinks it worth while.

Before starting on the construction, however, there is a certain amount of dismantling to be done. Throughout this article the sides of the chassis will be called the VR91 and CV118 side, in order to avoid confusion between left and right.

(to be continued)

Can Anyone Help?

DEAR SIR, I should like to find out if any reader has a set of coils for the R1082 which he is prepared to sell. These seem to be practically unobtainable.—W. A. G. White, Ermine Lodge, Stiltor, near Peterborough, Northants.

* * *

Dear Sir, Could any reader assist me in obtaining either the circuit or relevant information (valve line-up, etc.) concerning the transmitter type T1403?—John C. Sharrocks, 6 Tewkesbury Avenue, Middleton, Lancs.

* * *

Dear Sir, I have quite a number of new valves for the ex-WD 1124 receiver, and will be grateful to any reader who can supply the address of anyone who will draw a circuit to build a receiver using these. —R. Sawyer, 59 Easton Road, Droylsden, Lancs.

* * *

Dear Sir, Can any of your readers oblige me with a circuit and/or operating instructions for the Tester-Valve type 4.—A. Waller, 9 Brady Avenue, Loughton, Essex.

* * *

Dear Sir, Could you please spare a space to ask if any reader would lend, sell or otherwise provide any information, or a manual preferably, on the U.S. Signal Corps Receiver BC603D, and the Transmitter BC604D(M).—S/Sgt. Simms B (R.E.M.E.), 6 Roberts Road, Ludgershall, near Andover, Hants.

Dear Sirs, Could any reader lend me or advise where I can obtain, a circuit for an inexpensive, but fairly accurate signal generator for general radio coverage.—J. A. Harris, 107 Cromwell Road, Bristol 6.

* * *

Dear Sir, I would be very much obliged if any reader could lend or sell me the circuit and alignment data for the Ekco model B25.—H. Tabberer, 33 Blackstone Road, London Fields, Hackney, London, E.8.

* * *

Dear Sir, Can anyone supply the maximum HT current available from the power supply unit in the Modulator type 67, or details of removing the voltage control circuit from the Wee-Megger?—D. Byrne, Gosberton, Spalding, Lincs.

* * *

Dear Sir, I would be obliged if any reader could help me regarding the circuit and data, including value of IF, of the ex-Govt. Receiver R103A/ZA11053.—L. Cooper, 1 Walton Terrace, Carlingford Drive, Southend-on-Sea, Essex.

* * *

Dear Sir, Could you ask in your magazine for me, if anyone can sell or lend me a circuit with values and alignment data for the M.S.H. 914 AC Superhet, 4-waveband, serial number 30085, or give me any information on the IF and Double Diode circuit. —R. Wilson, 112 Bowman Street, Darlington, Co. Durham.

Radio Miscellany

A COUPLE OF MONTHS AGO I mentioned my own preference, if the final choice were left to me, between colour and enlarged issues at given intervals. Apparently I was not quite alone in this view, and several readers have written to tell me of their agreement. Perhaps I should say, in a few cases, of their qualified agreement. Some suspected there would be a danger of the extra pages being "wasted on the transmitting types" in which case they would rather have colour every time! Others were in favour only if the paper quality remained unaltered. Only two said they didn't like colour at all, but both were good enough to add that RC is their favourite journal despite the colour.

A few readers took it for granted that I should be able to talk the Editor round and started planning how the pages should be used! The only point of criticism was the occasional printing of circuits or component value lists "sideways." Reference to them is apt to cause the reader to lose his place in the text. Unfortunately this has to be done occasionally, especially with elaborate circuits, to enable the available space to be used to the best advantage. (The main reason is that it enables values to be checked against the circuit without causing a "crick in the neck."—*Ed.*).

Only one correspondent would approve of cheaper quality paper — and he is a new reader. Perhaps I should point out, for the benefit of those who have recently joined us, that extra pages have been regularly added during the past three years in *addition* to the colour, and it is an Editorial aim to achieve still greater enlargement.

(*As most readers have probably guessed, we have been experimenting with colour. We have now made our decision, which is that blue shall be used as the second colour — the cost of which is small compared to that of additional pages.—Ed.*).

Very many thanks to all those who have written, and while it has not been possible for me to reply to you all individually, you can be sure your ideas and suggestions have been carefully noted. It is gratifying to those on the Editorial side to know that their efforts are widely appreciated, and that readers feel that RC has markedly contributed in fostering a spirit of good fellowship among beginners and old-timers alike.

Death is so Permanent

Although this is a rather grim way of putting it, it is a thought which must always be borne in mind whenever one has occasion to test or service high voltage gear. There is always a danger of familiarity breeding contempt, and it is most particularly when you are concentrating that you are prone to forget your normal caution. It is safer to make a regular drill of switching off and shorting the capacitors, even if you do it the Army way, by numbers. Two or three times, in moments of forgetfulness, I've put my fingers on really "hot" wires and taken a couple of near-lethal charges — so much so that I once began to wonder if I had built up a partial immunity. Of course, it's plumb crazy to get too near to high current circuits, and having seen one or two nasty burns in sheets of steel I shudder to think of the result of a human making a path across them.

These rather morbid thoughts occur to me because the latest, and most ambitious, addition to the Data Book series might easily have remained unfinished when its author, Fred Judd (G2BCX) connected himself on to a high voltage source. Luckily he got away with a bad shock and a few burns.

It is a wise plan to give every other member of the household detailed instructions on how to switch off and just what to do in such an emergency. Their natural instinct is to run to the aid of the injured person, when they make matters worse by connecting themselves in circuit as soon as they touch the victim.

One amateur I know actually has a typewritten card on the wall of his shack on what to do and how to do it. That may prove helpful, but previous instruction is even more valuable. I remember in a large building, where I once worked, each room had a card printed in bold type on what to do in case of fire. Every employee knew that the instructions were there, but one day on a check-up it was found that not one person in ten knew the first two things they should do! So don't leave it to the card alone, and still more important, don't be complacent about it. However cautious one normally is, there is always the danger of a momentary lapse after you simply have to switch on to check some voltage point.

For myself, I try to remember that even if they might say nice things about me in a little black border marked "Silent Key" in the *Bulletin*, I prefer to postpone that day and enter the Hereafter in a rather more natural manner.

Centre Tap talks about COLOUR — SAFETY — RADIO CONTROL — RECORDING

Model Control

Readers who have already seen copies of F. C. Judd's new book *Radio Control for Model Ships, Boats and Aircraft* are joining with the critics in praising its completeness. It is certainly by far the most comprehensive work of its type that I have yet come across. Its author is no stranger to readers — he has already had some twenty articles on the subject published. Despite the fact that by profession he is an Electronic Engineer engaged on radar research, he spends most of his spare time in the evenings and at week-ends carrying on his own experimental work. For the most part he has built his own models too, planes, boats and a radio-controlled motor truck. By way of recreation he spends what little time he can spare in playing his self-built Electric Hawaiian Guitar. Incidentally, it is hoped that constructional details of this instrument will be appearing in future issues of RC.

Quartet for One

An obvious interest is, of course, amateur radio communications under the call-sign G2BCX, but he is currently active on top band only. The only amateur band I have never used myself, yet one, despite its disadvantages, which still attracts a loyal band of supporters. Perhaps the noise, cramped space and QRP frightens me off. The top band is more or less unknown to the general listener. Few commercial sets cover it, and all too often home-constructors leave it out altogether. Its popularity has increased in recent years, partly on account of the ease with which one can dodge TVI — and also there are less old fashioned receivers nowadays, which reduces the likelihood of BCI.

To get back to the subject — Fred Judd's other sidelines. I could call it tape-recording, only it is tape-recording with a difference. He has fun and games making up to four dubbings of his own playing on the tape. Those who have tried "accompanying" themselves know something of the difficulties of timing and synchronization. However, with an additional recording head the snags are being overcome.

For myself, being an earnest but somewhat indifferent instrumentalist, I made a similar sort of effort some couple of years back. I recorded the accompaniment first and tried to arrange a low volume play-back and at the same time make the second dubbing. It worked — near enough. Quite why I did it, I still don't know. Even my best friends can scarcely put up with me playing on one instrument, let alone two at a time. Anyway, it was good fun, and after all I haven't yet discovered what really is the use of all the tape-recorders we amateurs have built or are building — except for the fun of building it, getting it to work and then having a few evenings amusement playing with it.

One soon discovers that to record the voices of one's friends is no way to add to one's popularity. They simply won't believe their voices really sound like that. They either think you have "fixed" them or else a what - can - you - expect - from - that - heap-of-junk look comes into their eyes. When you give a playback of someone else's voice which they can recognise, they firmly believe the wretched thing worked reasonably well on that one occasion!

Vocal-genic

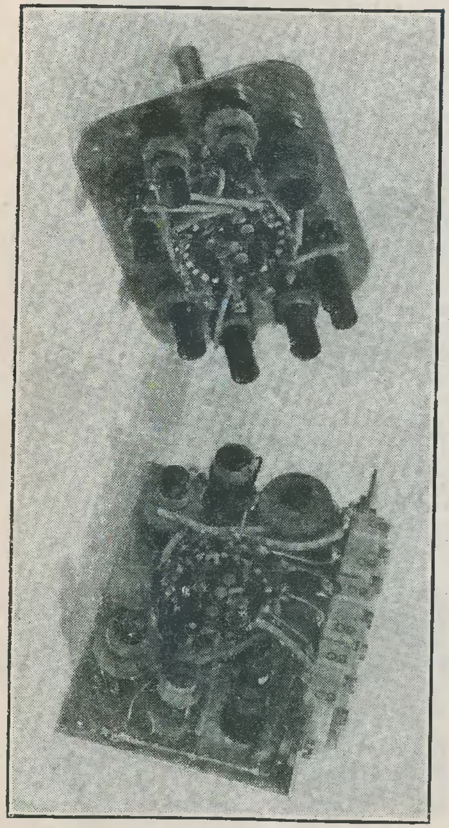
Seriously, though, quite a number of voices sound better when recorded than they do 'in the flesh'. We describe those who photograph well as photogenic, and with the increasing use of tape-recorders we shall soon need to have a word describing vocal-genic speakers.

The popularity of certain announcers proves something, I suppose, and people can be greatly attracted by a pleasing voice. I remember in the days of the "phoney" War, our servicing lads often used to call for a "Report my signals" test from an ATS operator at a local control station. They liked the sound of her voice so much that whenever she was on duty there were always far more calls for reports than were necessary. One of the boys got hold of her name in some way, and one night in a romantic mood he sent her a note making a "date" for the regimental dance. She accepted — and to say the boys were very disappointed would be putting it politely. Maybe some of the glamour has gone out of radio for the same reason — now we have seen many of its stars on TV !

For the Ether-Searcher

In writing recently of the sudden dearth of what's-doing-on-the-air reports for keen shortwave listeners, I was, of course, referring to periodicals on general sale to the public. For the guidance of newcomers to the hobby I should have mentioned that *Monitor*, the monthly News Letter of the International Short Wave League, very fully covers all aspects of both amateur communication and short wave broadcasting. This is available to members for quite a modest subscription, and those who feel the need for specialised information on DX-listening conditions can still look to this quarter to learn of the latest doings of their kindred spirits.

The League, which is now in its ninth year, offers a wide range of services and facilities to keen listeners, and Peter Bysh, the Hon. Secretary, will be pleased to forward detils to those interested. The address of the League HQ is 86 Barrenger Road, London, N.10. This applies as much to our many overseas readers as to those at home. Indeed, the promotion of international friendship is one of the League's main objects.



Trade Review

Denco (Clacton) Ltd. have supplied us with details of their latest coil packs, shown in the illustration. These measure 3¼″ × 2¼″ × 1″ deep, and are arranged for single-hole fixing.

CP4/L Four Station Pre-Set Coil Pack. Station selection is by an incorporated yaxley type switch, the four positions covering one Long and three Medium waveband stations. The ranges covered are 1,200/1,760 metres (250/170 kc/s); 349/480 metres (860/625 kc/s); 250/353 metres (1,200/850 kc/s); and 190/260 metres (1.600/1,150 kc/s). Colour coded tags are used for connecting the external wiring to any conventional type frequency changer. An accompanying leaflet gives a clear layout of the unit, a typical frequency changer circuit with values, and a useful list of stations and their wavelengths/frequencies. The price is 33*s* 4*d* including purchase tax.

CP4/M Four Station Pre-Set Coil Pack. This is ery similar to the above unit, the difference being that Medium waveband stations only are included. The ranges covered are 349/480 metres (860/625 kc/s); 250/353 metres (1,200/850 kc/s); and 190/260 metres (1,600/1,150 kc/s) twice. The price is again 33*s* 4*d* including purchase tax.

CP3/370pF Three Waveband Coil Pack. This unit is meant for continuous tuning, and recommended for use with it are the J.B. type MG370pF two-gang variable, and either the J.B. full-vision drive type 2154 or the J. B. SL8 spin wheel drive. Individual trimmers for each band are incorporated. The ranges covered are 800/2,000 metres (375/150 kc/s); 200/550 metres (1,500/545 kc/s); and 16/50 metres (18.75/6.0 Mc/s). The price is 42*s* 8*d* including purchase tax.

CP3/500pF Three Waveband Coil Pack. This is identical with the above unit, in all particulars, except that it is designed for use with a 500pF two-gang variable condenser. With both units a clear layout and typical frequency changer circuit with component values are again included. The price is again 42*s* 8*d* including purchase tax.

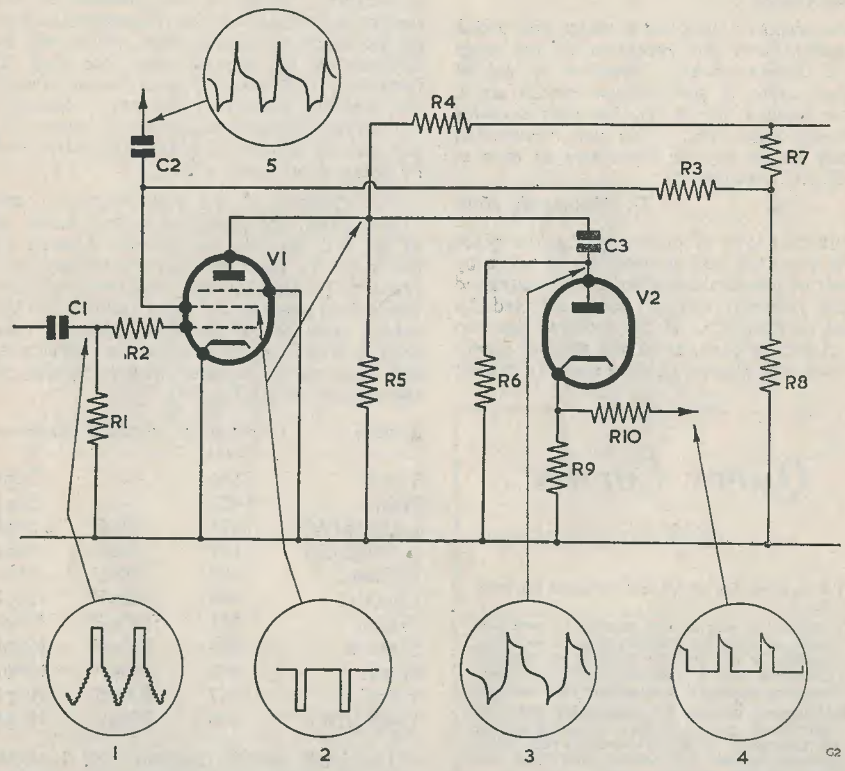
FRINGE AREA TELEVISION

By **J. GLAZER**

Part 5 **SYNC SEPARATOR DETAILED WAVEFORM ANALYSIS**

THE SIGNAL FROM THE ANODE of the last stage of the vision unit consists of negative video and positive sync pulses, (1). This signal is fed to the grid of V1 via the coupling capacitor C1. The DC level is restored by returning the cathode direct to chassis, the grid and the cathode thereby acting as a diode. The voltage pulses at both the anode and the screen grid of V1 are negative-going, (2). *The interlace diode is fed from the anode, and the line blocking oscillator from the screen grid (not the other way round, as stated in the March issue).* The capacitor C3 tends to differentiate the negative pulses, (3), the shape of this waveform depending on the values of C3 and R6. As MΩ×μF=seconds, it will be seen that this constitutes a 40 μsec. time constant. The negative part of the differentiated pulse is blocked by the diode, and only a positive-going sync pulse appears at the cathode (4).

The negative pulse from the screen grid of V1 is very sharply differentiated by the small capacitor C2. The line blocking oscillator is synchronised by the negative sync pulses, the positive "spikes" having no effect.



The author found that some types of germanium crystal diodes worked just as well as a thermionic diode, and that in some cases it was an advantage to insert a 22kΩ resistor between the junction of R6-R9, and the chassis.

Query Corner

A Radio Constructor Service for Readers

Preset Tuning

I am about to construct a tuning unit which is required only for reception of the local B.B.C. transmissions. Because of this I propose using a five-position switch as a station selector in conjunction with a series of pre-set capacitors. Can you recommend suitable values for the capacitors to tune in the B.B.C. stations ?

D. Wentworth, Hove

With this type of preset tuning, the place of the standard tuning capacitor is taken by a series of pre-set capacitors, the one adjusted to the required station being selected by means of a switch. If the receiver has two sets of tuning coils, as in the normal superhet, each will require its own series of pre-set capacitors. Much of the success of the system depends upon the frequency stability of the tuned circuits, a point which will be appreciated by anyone who has had to frequently re-adjust a pre-set circuit to keep the stations accurately in tune. Stability is achieved by rigidly mounting all capacitors, particularly those which are adjustable, and by using short stout wiring.

For stations at the low frequency end of the band, the capacitor is best made up of a fixed ceramic component shunted by the trimmer. Such an arrangement has been found to provide the best long term stability. The values given in the table assume that the tuning coils are of the type normally used with a 500pF variable capacitor; allowance has been made for stray wiring capacity in the region of 20pF.

Station	*Frequency (kc/s)*	*Fixed C*	*Trimmer T*
Third	1546	—	50pF
West	1457	—	50pF
Light (MW)	1214	33pF	50pF
N. Regional	1151	50pF	50pF
Midland	1088	68pF	50pF
London	908	100pF	50pF
Welsh	881	100pF	100pF
Scottish	809	150pF	100pF
North	692	200pF	100pF
Third	647	300pF	100pF
Light (LW)	200	150pF	100pF

The basic circuit diagram Fig. 1 shows the method of arranging the switch connections. For reasons of clarity, a 3-way switch is shown to give a choice of three stations. Many constructors will, however, wish to employ a larger selection. The switch is of the 2-pole type, but if it is required to select stations in both the long and medium waveband additional ways must be provided to allow for coil selection in the usual manner.

Query Corner

RULES

(1) A nominal fee of 2/6 will be made for each query.

(2) Queries on any subject relating to technical radio or electrical matters will be accepted, though it will not be possible to provide complete circuit diagrams, for the more complex receivers, transmitters and the like.

(3) Complete circuits of equipment may be submitted to us before construction is commenced. This will ensure that component values are correct and that the circuit is theoretically sound.

(4) All queries will receive critical scrutiny and replies will be as comprehensive as possible

(5) Correspondence to be addressed to "Query Corner," Radio Constructor 57 Maida Vale, Paddington, London, W.9.

(6) A selection of those queries with a more general interest will be reproduced in these pages each month.

Cleaning Switch Contacts

I frequently tackle radio service jobs, and find that in many of the older receivers the wavechange switches are giving trouble due to dirt on the contacts. What is the best method of cleaning these switches ?

N. Layson, Norwich

Dirty switch contacts frequently account for much of the noise which occurs with the older receivers, but because of the practical difficulties which are associated with replacing the complete switch assembly an attempt is usually first made to clean the contacts. This job when tackled in the correct manner often produces a permanent cure for the trouble. Before any attempt is made to clean the contacts, the switch should be carefully examined to determine if it is in good mechanical order. It sometimes happens that one of the contacts has become badly bent or even entirely broken off, in which case a replacement switch must be fitted. The same action is also desirable should the plating on the contacts have become very badly scored. To clean a switch which is in this condition is only rendering first aid, as no permanent cure can be expected.

The contacting or mating surfaces on a switch can appear quite smooth, but if examined under a microscope they will be found to have small undulations. This means that only the high spots on the surface will actually be in contact. After the switch has been in use for some time, the valleys in the contacting surfaces will be full of dirt which may force the contacts apart, causing the receiver to become inoperative. A few rotations of the switch and some of this foreign matter can be dislodged, allowing the contacts to close once more. This, of course, produces intermittent operation.

A grease solvent is undoubtedly the best agent for removing the dirt from the contacts. The most effective of these solvents is carbon tetrachloride, but, if this is not available, one of the cloth cleaning preparations such as "Thawpit" makes an admirable substitute. The cleaning fluid is most conveniently applied directly to the contacts by means of a very small paint brush, care being taken to prevent it falling on adjacent components. Between applications of the cleaner, the switch should be rotated to allow any trapped dirt to be washed away. Unless the switch is in very bad condition this process will effect a cure, but the use of a strong grease solvent may easily cause the contacts to bind, and in turn this can result in severe distortion of the static contacts. Friction can be prevented by the

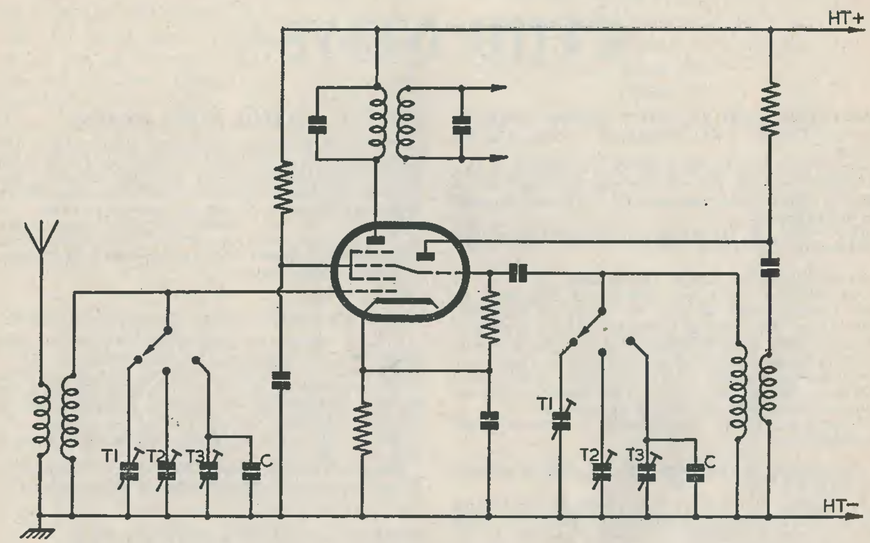


FIG. 1

A STATION SELECTOR SWITCH APPLIED TO A FREQUENCY CHANGER

RC549

application of a few drops of oil, and unless this is done the life of the switch will be severely reduced. Lanolin is an ideal lubricant for this purpose, but it should be applied sparingly so as to avoid soaking the insulation.

Zoom Lens

I have often heard of this type of lens being used by the B.B.C. Television Service. What is its particular function ?

W. Heather, Leeds

The zoom lens was first used by the B.B.C. in televising the Cup Final at Wembley in 1949. The arrangement consists of four separate lens mounted in a cylindrical tube carried on the front of a standard TV camera. Adjustment is provided to move the relative positions of the two inner lens, the effect of this being to increase the magnification whilst keeping the image in focus. This produces the illusion that the camera is being moved towards the scene. Many readers must recall the most excellent results obtained with this type of lens system during the televising of the Coronation. The zoom lens is also being used now in studio productions, where it enables close-up shots to be shown without the necessity of camera movements.

CLUB NEWS

SOUTHEND AND DISTRICT RADIO SOCIETY
Station: G5QK, H.Q.; Municipal College, Victoria Circus.

Please note that the date of the HAMFEST is now definitely fixed for 8th May in the Ballroom at the London Hotel; the entrance is in Tylers Avenue. Tickets price 3/6.

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

RAVENSBOURNE A.R.C. (Downham)

An exhibition of home constructed equipment by club members will be held on Saturday 8th May, from 4 p.m. The Club Tx G3HEV will be in operation. Meetings held every Wednesday evening from 8 p.m. at the Science Room, Durham Hill School, Downham. Memberships include G2DHV, G2W1, G3FTI and G3JWA. Morse instruction, RAE lectures included with constructional and testing equipment.

Hon. Sec., W. H. J. Wilshaw, 4 Station Road, Bromley, Kent.

LANCASTER AND DISTRICT AMATEUR RADIO SOCIETY

A meeting of the society was held at the George Hotel, Torrisholme on Wednesday, March 3rd when Mr. B. Archer G2CGQ delivered a lecture on his electronic organ, followed by a demonstration of the capabilities of same.

Growing popularity of our fairly young society has been evidenced once again by the enrolment of three new members this month, no doubt due to the excellent publicity afforded to us by the local press.

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

NORWOOD AND DISTRICT GROUP — R.S.G.B.

At the May meeting of the Group, to be held on May 15th (7.30 p.m.), at Windermere House, Westow Street, Crystal Palace, there will be a discussion about N.F.D. arrangements. All local members are invited to attend.

This year there will again be two stations in operation on National Field Day, representing the Group.

WEST LANCS. RADIO SOCIETY

The Annual General Meeting of the club was held on Tuesday, March 9th. Officers elected were: President, Mr. T. Searle; Secretary, Mr. S. Turner; Treasurer, Mr. F. Clasby.

The Society meets every Tuesday evening at 8 p.m., over Gordon's Sweetshop, St. Johns Road, Waterloo, Liverpool 22. New members and visitors warmly welcomed.

Hon. Sec., S. Turner, 5 Balfe Street, Seaforth, Liverpool 21.

CLIFTON AMATEUR RADIO SOCIETY

A number of visits to places of interest have been scheduled and in addition to the visit to Deptford Power Station arranged for May 1st, we have been fortunate in receiving an invitation from the BBC to visit their Receiving Station at Tatsfield in June.

Meetings of this Society are held every Friday at 7.30 p.m. at the clubrooms 225 New Cross Road, S.E.14 where visitors and new members are assured of a warm welcome.

YORK AMATEUR RADIO SOCIETY G3HWW

Officers elected at the A.G.M. for 1954 were: Chairman, E. Warwick G3GDE; Secretary, G. F. Nottingham G3DTA; Treasurer, P. S. Robson G3FYP; Committee, G. R. Foggin G3GRF; A. Horner G3FTS; M. G. Linfoot G3GCX; R. R. Wilkinson G3DSA.

Morse instruction is given for the first hour at each meeting.

Meetings:—Wednesdays 7.30 p.m., Clubrooms, Fetter Lane, York. (Facing rear of Queens Hotel).

TORBAY AMATEUR RADIO SOCIETY

Report of Meeting held on Saturday, 20th March, 1954, at the YMCA, Torquay:—

G2GK informed members of the RAEN of the frequencies used by the control station, and times at which to contact him.

G3JD continued making arrangements for the NFD of the RSGB.

G4RJ gave an interesting talk on the antenna system used by the Dartmouth group.

Meetings are held on the third Saturday each month, at 7.30 p.m., at the YMCA, Torquay.

THE QRP SOCIETY

A campaign is now being organised to encourage the use of low power by all stations participating in local nets. The Society considers that there is no longer any reason for stations to use the full 150 watts when 5 will adequately cover the neighbourhood.

Special arrangements are to be made for a gathering of the QRP membership to coincide with the next RSGB exhibition in London.

The Society wishes to contact all Clubs that are interested in QRP with a view to organising special contests and trials.

Further information on activities and services may be obtained from the Secretary, 92 Rydens Avenue, Walton-on-Thames, Surrey.

Let's Get Started

12 : WHAT IS Q ?

By **A. BLACKBURN**

Q IS THE MEASURE OF A COIL'S EFFICIENCY. It is a handy term which covers all the qualities which we look for in a coil.

What is Coil Efficiency ?

In the early days of radio, the amateur wound his own coils — and set himself a task which few enthusiasts would even consider tackling today. Up to 3″ in diameter, and of considerable length, each coil was wound carefully and painstakingly, and was regarded as the most important part of the construction. It was soon found that the large coil wound with thick wire gave the best results.

Since the arrival on the market of ready-wound coils of high efficiency and a fraction the size of their forebears, the gentle art of coil winding has become a historical, rather than actual, background to radio.

We have already touched upon this question of selectivity in the July, 1953 number, and stressed the necessity for a high degree of selectivity if we want reception free from interference.

Briefly, we decided that the tuned circuits must only accept the signal we require, and to reject that signal in favour of another without any overlap between the two. Ideally, the tuned circuit should be good enough to render inaudible any signal, however close in frequency it may be to the required signal.

Success or failure to get this result largely depends upon the tuned circuit.

The Tuned Circuit

The first thing we must do is to properly understand the tuned circuit. A typical series type is shown in Fig. 1.

The signal voltage, v, is represented by a generator which produces a voltage at a certain frequency, f. The resistance, R, represents the resistance of the wire forming the inductance, L.

Inductances and capacitances in AC circuits behave rather like resistors in DC circuits; that is, they impede the flow of current, the extent of their impedance being termed their reactance, just as the extent by which a resistor impedes a current is called its resistance. The reactance of a coil or condenser depends upon the frequency, and the values are given by:—

Reactance of an inductor=

$$X_L = 2\pi f L \Omega \text{ — (1)}$$

where f=frequency in c/s
L=Inductance in henrys.

Reactance of a capacitor=

$$X_C = \frac{1,000,000}{2\pi f C}\Omega$$

where C=capacity in μF.

Resonance occurs when the inductive and capacitive reactances are equal. In Fig. 1 therefore, at one particular frequency, V_1 and V_2 will be equal, because the current

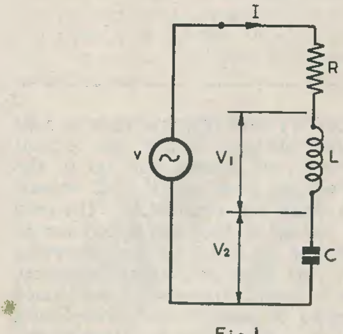


Fig. I

E6

is developing V_1 and V_2 across equal reactances. The value of these voltages is $I \times X_L$ and $I \times X_C$. The voltage which is developed across R is, of course, equal to $I \times R$.

There are important differences between these voltages and those that would be produced by three ordinary resistors in the circuit. This is illustrated in Fig. 2. The voltage developed across the inductor (V_1) is always a little ahead of that developed across the resistor, but the voltage developed across the capacitor (V_2) is always a little behind that developed across the resistor. Fig. 2 shows that V_1 and V_2 are so much out of step that adding the instantaneous

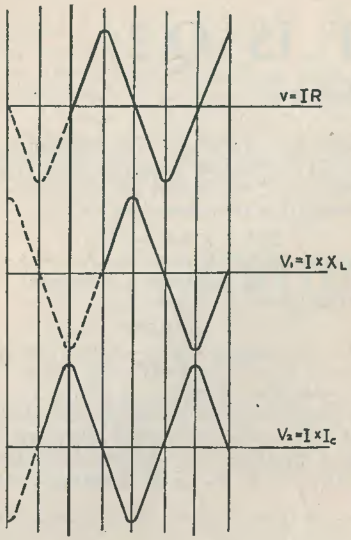


Fig.2

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amplitude of V_1 and V_2 produces a zero result. The voltages round the circuit (Fig. 1) should, of course, add up to the generator voltage, but as Fig. 2 shows, V_1 and V_2 cancel out completely. The only remaining voltage is that developed across R, which must be equal to the generator voltage, v. At this particular frequency, called the resonant frequency, the tuned circuit appears to consist of nothing but a pure resistance. The lower the value of this resistance, the greater will be the current in the circuit, and the higher the values of V_1 and V_2. Remember that V_1 and V_2 actually appear across L and C respectively, but that it is only when they are added that cancellation occurs.

The following argument produces a rather surprising result: we will take the inductance first:—

$V_1 = I \times$ the reactance, therefore, from (1)

$$V_1 = I \times 2\pi fL \text{ — (2)}$$

but we have seen that at resonance $I = \frac{v}{R}$, therefore, if this is substituted in (2),

$$V_1 = \frac{v \times 2\pi fL}{R} \text{ — (3)}$$

Let's see the result we get by putting in some typical values:—

$f = 1$ Mc/s, $L = 150\mu H$, and $R = 10\Omega$

$$V_1 = v \times \frac{2\pi \times 10^6 \times 150 \times 10^{-6}}{10}$$

$$= 100 \times v \text{ approx.}$$

In other words, the voltage across the coil is 100 times the applied voltage to the circuit!

Q

The ratio V/v, i.e. the 'gain' of the tuned circuit, is normally designated by the letter Q. Presumably this letter was chosen to signify quality as the higher the Q value, the better the coil.

In expression (3), you will have noticed that Q will be highest when L, the inductance, is highest, and R the resistance of the wire forming the coil, is lowest.

The inductance required to tune to a particular frequency with a chosen value of capacity is fixed, but the resistance of the coil can be made as small as possible, by using the heaviest gauge of wire that can be accommodated on the coil.

Q may be defined in a different manner to that already shown. Fig. 3 shows a graph of the voltage across the coil in Fig. 1, when the generator frequency is varied. At the resonant frequency, f_o, the voltage is a maximum. The voltage drops to 0.7 of this maximum value at the two frequencies f_1 and f_2, either side of f_o. It has been found that Q is approximately equal to

$$\frac{f_o}{f_2 - f_1} \text{ — (4)}$$

The term $f_2 - f_1$ is called the 'bandwidth', and the points A and B, where the voltage is 0.7 times the maximum, are called the 'half power points'.

For example, if f_o is 1 Mc/s and $f_2 - f_1$ is 10 kc/s, then

$$Q = \frac{1,000,000}{10,000} = 100.$$

When rearranged, this expression gives the bandwidth as

$$f_2 - f_1 = \frac{f_o}{Q}.$$

Taking two coils of Q values 50 and 150, we find that their bandwidths (for $f_o = 1$ Mc/s) are 20 kc/s and 6.6 kc/s respectively. You will probably have realised by this time that this bandwidth business is better known as selectivity. The difference between the two terms is that whereas selectivity merely represents the sharpness of tuning, bandwidth more specifically states how much less signal voltage is present when the circuit is detuned by a known amount.

Summing up, one may say that a high Q value means high 'gain' from the circuit and greater selectivity. High values of Q

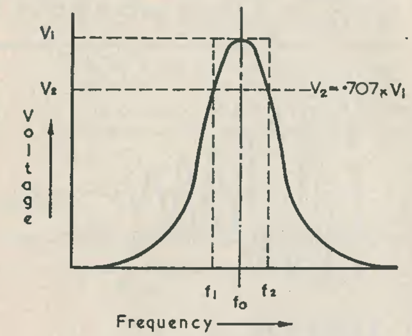


Fig.3

Resonance curve of tuned circuit

E7

are obtained by keeping the resistance of the coil as low as possible.

Coupling

The circuit in Fig. 1 is probably not as familiar to most readers as the parallel tuned circuit, where the tuning capacitor is placed directly across the coil. The little generator v in the figure may also give trouble.

In most radio applications, a coupling winding is used to transfer the signal from one part of the circuit to the tuning coil, as shown in Fig. 4.

A concise description of the action of this circuit would be that the signal currents flowing in the primary L_1 produce a magnetic field which cuts the turns of L_2 and induces a current into it. This current flows around the circuit composed of L_2 and C_1 as though a tiny generator were hidden in each turn of the coil. As these generators' inductance and capacitance are in series, the generators may be regarded collectively, and replaced by a single one as shown in Fig. 1.

In fact, the tuned circuit in Fig. 4 is a series circuit, despite the fact that on paper it looks remarkably like a parallel one.

Frequency and Selectivity

Another fact about tuned circuits is easily explained in expression (4). In an earlier article on the straight receiver it was mentioned that the selectivity varied as the receiver was tuned over the band. Let us assume that the Q of the coils in the set is 100 and two stations are to be received on 1.5 Mc/s and 0.5 Mc/s.

At 1.5 Mc/s the bandwidth $f_2 - f_1$ will be

$$\frac{1.5 \times 10^6}{100} = 15 \text{ kc/s}$$

but at 0.5 Mc/s

$$f_2 - f_1 = \frac{0.5 \times 10^6}{100} = 5 \text{ kc/s.}$$

The bandwidth has varied from 5 kc/s to 15 kc/s by tuning from one end of the medium wave band to the other. At the low frequency end of the band, the bandwidth is least, which explains why it is undesirable to choose too high an IF for a superhet.

So far we have assumed that the resistance of the coil remains constant at all frequencies. This, unfortunately, is not true. As the frequency is raised, the currents flowing in the wire of the coil tend to flow nearer the outside surface of the wire. This means that the area of wire through which the current flows is considerably reduced and the resistance to the current is increased.

As may be seen from expression 3, however, the Q rises as the frequency is raised. The resistance also increases at approximately the same rate as the frequency, so the Q and, therefore, the selectivity remain pretty nearly constant.

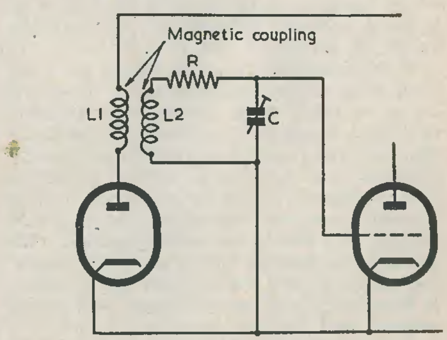


Fig.4

Coupling to tuned circuit

E9

Q of Capacitors

The tuning capacitor in Fig. 1 has, up to now, been completely ignored. In the explanation of that circuit, it was stated that the reactances of the inductance and the capacitor were equal at the resonant frequency. If follows that the voltage developed across them is also equal, but out of phase, as illustrated in Fig. 2. From our previous argument we can show that the Q of the capacitor is

$$\frac{1}{2\pi fCR}.$$

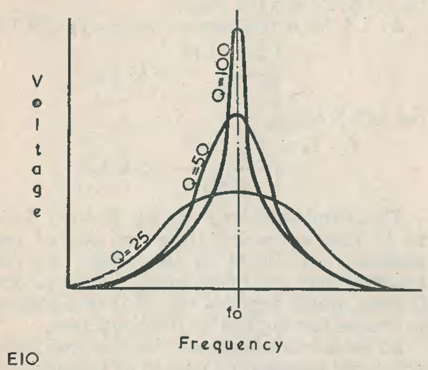


Fig. 5

For most practical purposes, the losses in modern tuning capacitors may be ignored. Some of the older types using insulating material between the plates have high losses, which result in poor Q. If high selectivity is to be achieved, components of this class should be avoided.

It is interesting to note that, in most cases, the output voltage from a tuned circuit is taken from across the capacitor. In Fig. 4 it can be seen that the resistance of the tuning coil interposes itself neatly between the coil and tuning capacity. This resistance, being so to speak 'inside' the coil, prevents connection being made to the coil alone. It is unavoidable that automatic connection be made to the capacitor, which in the wiring *looks* as though it is in parallel with the coil alone, and not in series with R.

Practical Coils

Many means have been devised for obtaining a high Q value. In the earliest days the gauge of wire used for winding the coil was very heavy, resulting in large bulky components. Later a type of wire was used which consisted of a number of insulated strands of fine wire twisted into a flex. This is called Litz wire (short for Litzendraht), and is used very frequently today. As the strands are insulated from one another, the high frequency currents flow toward the outer surface of each wire separately. At the ends of the winding, the insulation is removed and all the strands are soldered together. Litz wire results in a considerably reduced resistance in the winding and a corresponding increase in Q.

The most modern coils are wound in Litz wire, but a further method is used to improve the Q further. This depends upon increasing the inductance of the winding by placing a piece of metal in the centre. To attain a given inductance, therefore, less turns have to be used, accompanied by, once again, a decrease in the resistance. The metal core, as it is called, is normally made from fine iron dust moulded to the shape required. The dust is held together by a material which is effective in insulating each iron particle from all its neighbours.

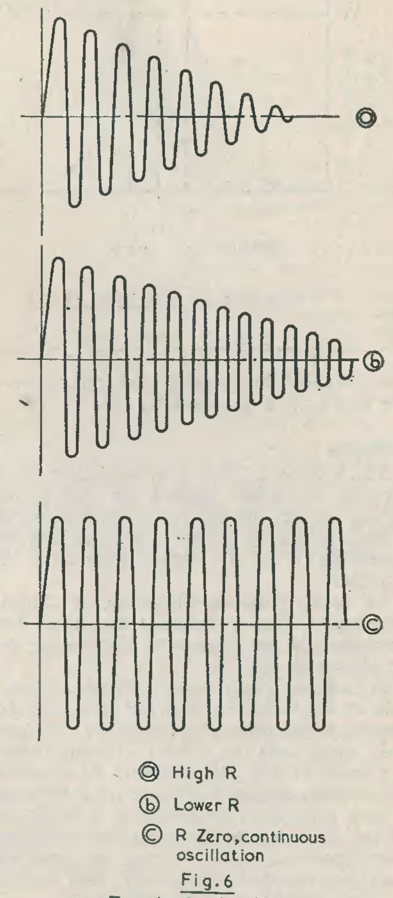


Fig. 6
Tuned circuit ringing

For modern miniature tuning coils, the Q value is normally of the order of 100; quartz crystals may have Q values of 20,000 or more.

Fig. 5 shows the resonance curves for a number of typical values met in radio work. Low Q coils are normally of most use in television reception, where wide bandwidth is required, instead of the sharp selectivity demanded by ordinary broadcast reception.

Reaction

One further method for improving Q is worthy of mention, reaction. When a tuned oscillator is adjusted so that the circuit is just below the point of oscillation, a negative resistance is presented to the tuned circuit. This negative resistance is another 'invisible' component, but even more so than R in Fig. 1. Its effect, however, is to cancel some of the natural resistance of the coil. The result, once again, is to increase the Q. Admittedly, this method is cheating somewhat, as it uses a valve to help the coil, but in most straight receivers, where reaction is used, the same valve performs the function of detector as well.

We have not, of course, completely covered the subject of selectivity in this short article. There are other considerations which we have not even mentioned — for instance, the effect of selectivity on quality of reproduction. These considerations need an article to themselves, however, and will be discussed in detail some other time.

RADIO AMATEUR EMERGENCY NETWORK

Dear Sir,

I feel it my duty to challenge the accuracy of "Centre Tap's" remarks about the Radio Amateur Emergency Service, which appear in your April issue.

I think your contributor should have taken more care to ensure that his statements accorded with the facts, before writing what is, in effect a most unjust attack on the R.S.G.B.

It is entirely untrue that the Society has not given solid support to such a plan or that leading members have played it down, or said it could not be done. It is also quite untrue to say that my old friend, Dr. Arthur Gee, whom you have placed in a most embarassing position, campaigned for a national network and thus made a reluctant R.S.G.B. sit up and take belated action !

As long ago as 1950, an offer was made to the Authorities to organise an Emergency Network. The Minister of Transport was then the competent person and the offer was turned down flat. In January 1952, after the disasters in Jamaica and Italy, I wrote an Editorial in the R.S.G.B. Bulletin drawing attention to our own lack of preparedness but at that time, the Lynmouth disaster was yet to come. After the great flood of the winter of 1953, I wrote the Editorial in the Bulletin which really started the R.A.E.N. Network and a Committee was formed by the R.S.G.B. Council to work out a scheme. Dr. Gee was invited to join this committee, because of the first-hand knowledge he had of flood relief on the East Coast and along with the other members of the R.A.E.N. Committee, has done a first rate job.

The report of the *ad-hoc* Committee appeared in the June 1953 Bulletin and the official announcement of the formation of R.A.E.N. was made by Mr. Leslie Cooper at the luncheon which preceded the R.S.G.B. Exhibition of 1953.

R.A.E.N. was formed without the blessing of the G.P.O. or any other official body but there is no doubt that it has been welcomed by Civic and other authorities with open arms.

The truth is that the R.S.G.B. has, for more than four years tried to get an emergency service started and R.A.E.N. although not confined to R.S.G.B. members, is entirely an R.S.G.B. concept, in the launching of which, the Writer probably played the leading part, as an officer of the Society.

Dr. Gee and I worked together from the early days not because he had forced a reluctant Society into action but because we were both aiming for the same goal.

Finally, your contributor says the G.P.O. has raised no difficulties, quite frankly, they were not asked for their comments. I imagine that neither they nor anyone else will stand on their dignity should another disaster strike.

Yours faithfully,
A. O. Milne, G2MI,
(*President*, R.S.G.B).

Vernier Corrector for the Clapp Oscillator

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

FOR VARIOUS REASONS, some means of providing a very small shift in frequency is often desirable with a VFO. That is to say, the provision of a vernier QSY feature which will provide for a total shift of only a few kilocycles. This is a great convenience in good operating, as after the VFO is made "zero-beat" with a Dx station, one can use a vernier tuning control to set the frequency a known small amount from zero-beat. Again, when working under heavy QRM conditions, particularly with the crystal filter in circuit, a vernier enables a precise, small QSY to be made. Frequently a station will request a QSY of one or two kilocycles, so that QRM may be avoided. UNLESS a definite QSY is made, the usual result is that contact is lost, for if a vernier is not available, a "small twist" on the normal main VFO control results in a shift of indefinite amount; anywhere from a few cycles to several kc/s. A vernier, therefore, is a very great aid to comfortable operating practice. A further feature is that a genuine vernier control enables the VFO calibration to be kept "spot on" to crystal check points, so that dial calibrations may be interpolated with confidence.

Unfortunately, however, the Clapp Oscillator generally uses a main tuning condenser of some 50 pF. Fig. 1 gives the usual constants as commonly employed in a practical case.

If we take the case of such a VFO covering, say, the 80 metre band from 3.5 to 3.8 Mc/s — a total sweep of 300 kc/s — then if this is covered by a tuning capacity variation of some 50 pF, we have some 6 kc/s variation for 1pF capacity change. Accordingly, if we were to use an auxiliary small parallel tuning capacitor to give the vernier QSY feature, a variation of a half pF each side of its centre position would give a vernier QSY of plus or minus 3 kc/s, which would be very nearly ideal.

Unfortunately, variable condensers of 1pF capacity are not a standard item. The mechanically-minded might improvise a midget tuner, or a small condenser could be stripped down to this value by providing very wide plate spacing. These alternatives are not too satisfactory, however. The use of a standard size variable with a small fixed capacity, say 2pF, in series, as shown in Fig. 2, is also unsatisfactory. Fig. 3 shows the type of tuning scale which the arrangement of Fig. 2 provides. It is highly non-linear, as for most of the condenser travel very little happens, and most of the frequency change is crowded into the last few degrees of travel.

The Clapp oscillator, however, DOES provide one solution to the problem. Valve capacity effects are very heavily swamped by the grid-cathode tapping fixed condensers. If a standard condenser of, say, 50pF is shunted across the tapping condensers, its effect upon the tuning range will be quite small, so that a QSY control of the right amount will be obtained. This solution does not require special small condensers, and has the advantage also that the addition of the QSY control has very little effect upon the "Q" of the main tuned circuit. It also causes very little disturbance to the calibration of the VFO. Once having made the necessary adjustment so that calibration is "spot on" with the QSY condenser in the centre of its travel, a dial can be added showing the kc/s variation "up or down" obtained over the QSY range of travel. With the constants shown in Fig. 4, which illustrates this arrangement, the total QSY for a 50 pF change will be some 6 kc/s or so, giving a plus or minus QSY of 3 kc/s if the "centre zero" is adopted. This will be quite adequate especially as a proportionally greater degree of QSY will be obtained on the higher frequency bands. However, even on 28 Mc/s the variation will still be only 24 kc/s either side of zero, so that a very smooth and precise QSY may be effected. In cases where a "carrier insertion" local oscillator is used for reception of Single Sideband signals, this device will enable exact tuning to be performed easily. A Clapp type oscillator is, of course, very popular in this application.

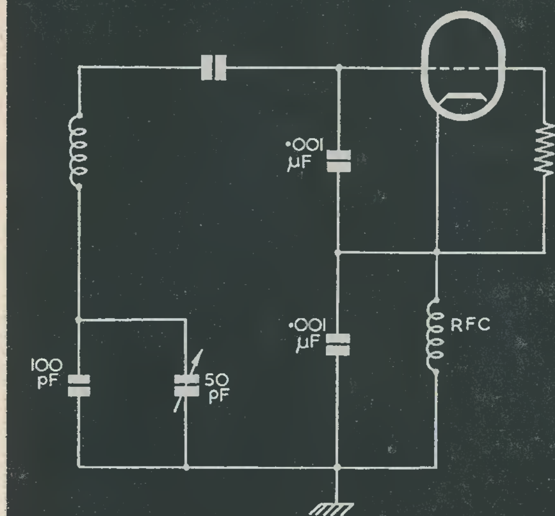


FIG. 1
USUAL ARRANGEMENT & TYPICAL CIRCUIT VALUES OF THE GOURRIET-CLAPP OSCILLATOR TANK CIRCUIT

FIG. 2
THIS IDEA IS OFTEN USED BUT IS NOT SATISFACTORY

FIG. 3
THE SERIES CONDENSER CIRCUIT OF FIG. 2 GIVES A VERY DISTORTED FREQUENCY SHIFT SCALE

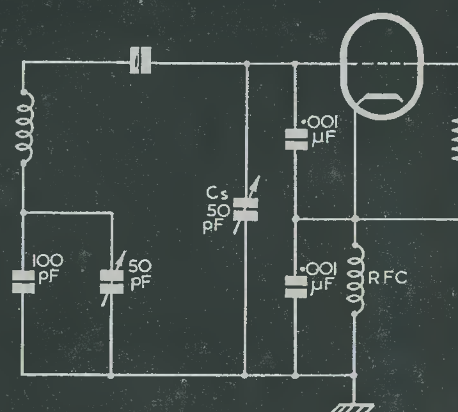


FIG. 4
THIS ARRANGEMENT GIVES THE REQUIRED VERNIER CORRECTION WHILE USING A 50pF NORMAL VARIABLE FOR Cs, THE QSY VERNIER

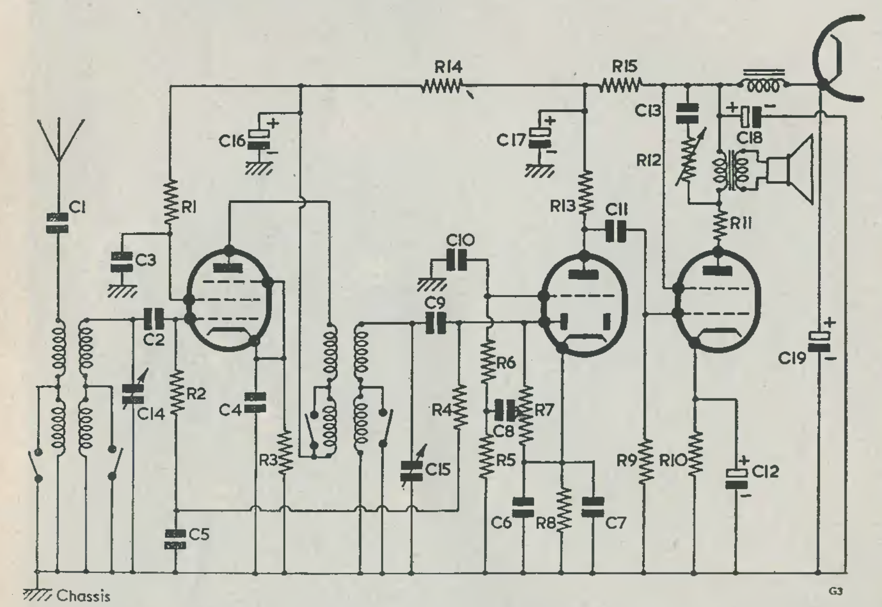
RC471

A MODERN TRF Receiver

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

MANY TRF RECEIVERS HAVE BEEN published during the last few years. The one to be described, however, is really up-to-date in using modern valves and coils. The latter are of the air cored type, with a reasonably high "Q".

In order to help keep the receiver small in size and neat in appearance, Dubilier octal type about the size of the older 6V6, but far more efficient. For the AC/DC version, all valves are B8A based, and consist of the 10F9, 10LD11, 10P13 and U404, with a heater current of 100mA. This low heater current is of some importance in the universal receiver, as it keeps down the amount of heat developed. With the 100mA



$\frac{1}{2}$W resistors were used in the original. They are very small, and measure only $\frac{1}{8}$" diameter by $\frac{3}{8}$" long. Condensers are of the metal "Minicap" type.

The valves chosen were Mazda 6F15, 6LD20, 6P25 and UU9 for the AC mains version; these, with the exception of the 6P25, are B8A types. The 6P25 is a large current, the heater wattage on 250V mains is only 25, as against 75W with the older 0.3A types.

While the chassis size and layout is not critical, a Kendall and Mousley type 10-6 was employed as it is of convenient size and shape. A straight line layout was used, as it seems to give the best stability.

The mains transformer was an Elstone SR/250; this is readily available and reasonable in price. Moreover, it can be mounted quite easily on top of the chassis and the leads brought down through the chassis through rubber grommets, thus avoiding the necessity of cutting a large hole as with the drop-through types.

The cutting of chassis holes these days is not a difficult procedure. For the volume control and wavechange switch holes, a neat job only requires a $\frac{1}{8}$" drill and an Osmor "Jiffy" cutter. With the latter, one only has to drill a small hole for the pilot, place the punch over the pilot, and then hit with a hammer. The holes for valveholders take only a little more time, again with the aid of an Osmor chassis cutter. These cover all sizes of base, and each will cut two different sized holes.

The smoothing condenser chosen was the Dubilier CRE2416850, a three-section type with value 24+16+8μF. It is less costly to buy this type of condenser than the individual ones; though the reader might well wonder if maintenance costs will be raised by this choice. The answer is that during the past five years the writer has only had to change one post-War Dubilier condenser, a twin-section type, and here the failure was due entirely to external conditions.

The dial drive used was the J.B. "Square Plane" type. This employs mechancial coupling between the shaft and the pointer — and this is trouble-free, which is more than can be said for most of the cord drive types.

The circuit itself is just a simple one, with an RF amplifier feeding a diode detector, which also supplies AVC. The audio section of the double diode triode is biased, although this entails the use of a few more components.

Tone correction of the "top-cut" type is used in the output stage, as this helps to reduce the "harshness" often associated with output pentodes. A certain amount of bass lift due to the resonance of the output transformer primary with the tone control condenser is also present.

The constructor will no doubt have noticed that both the AC and the AC/DC versions are basically the same, and that it is only the power supply arrangements that differ. Consequently, the same standard of reception can be expected with either circuit.

COMPONENT LIST

C1	100pF	R5	4.7MΩ $\frac{1}{2}$W
C2	100pF	R6	100kΩ $\frac{1}{2}$W
C3	0.01μF	R7	500kΩ pot
C4	0.01μF	R8	1.5kΩ $\frac{1}{2}$W
C5	0.01μF	R9	220kΩ $\frac{1}{2}$W
C6	0.01μF	R10	180Ω 1W
C7	50μF	R11	33Ω $\frac{1}{2}$W
C8	0.01μF	R12	25kΩ variable
C9	100pF	R13	47kΩ $\frac{1}{2}$W
C10	100pF	R14	20kΩ 1W
C11	0.01μF	R15	20kΩ 1W
C12	50μF		
C13	0.01μF	Wavechange switch, Yaxley type four-pole two-way	
C14, 15	500pF 2-gang		
C16	8μF	Chassis, Kendall and Mousley 10"×6"	
C17	8μF, see text	Coils, R.E.P.	
C18	24μF, see text	Valves, see text	
C19	16μF, see text	Mains transformer, Elstone SR/250, see text (AC version)	
R1	47kΩ $\frac{1}{2}$W	Dropper, 1300Ω 15W (AC/DC version)	
R2	1MΩ $\frac{1}{2}$W	Surge Limiter, 100Ω 1W (AC/DC version)	
R3	330Ω $\frac{1}{2}$W	Drive and Tuning Condenser, Jackson Bros.	
R4	1MΩ $\frac{1}{2}$W	Valveholders, to suit valves.	

CURRENT TOPICS

800 TV SETS A MONTH SELLING IN N. IRELAND

FROM THE IRISH NEWS AGENCY, we learn that the Radio Trade in Northern Ireland is puzzled at the great number of new TV viewers which is being recorded each month, in view of the fact that sound radio set sales are also increasing around the 3,000 monthly mark. A BBC official told the Irish News Agency that there was a general tendency for radio sound licences to increase all over Britain, which was surprising because of the increase in the number of TV sets being installed. In June last there were only about 3,000 TV sets in Northern Ireland, most of which were probably bought for the Coronation transmissions. At the end of February there were 9,536 TV licences issued by the G.P.O. in N. Ireland. On the same date, there were 219,958 sound radio licences in force — an increase of 3,000 on the previous month. The growth of popularity of TV in N. Ireland is even more surprising in view of the fact that the official service area of the Glencairn TV Transmitter extends over a radius of only 12-15 miles.

* * *

Venner Accumulators Ltd., have recently made known the fact that the E.M.I. Tape Recorders which are being used to record news and special programmes of the Commonwealth Tour are equipped with their 7.5 Ampere Hour Type H705/7.5/3 lightweight Silver-Zinc Accumulators, thereby enabling the equipment to be as portable as possible. These accumulators weigh only 40 ounces.

* * *

Brimar Valves for Band 3 TV Tuners

With the performance criteria of a good signal-noise ratio, low oscillator drift and radiation, minimum cross-modulation and IF breakthrough, Brimar have introduced the following valves for use in tuners in Band 3 TV receivers.

PCC84/7AN7

This double triode with separate cathodes and internal shielding between units has the high slope of 6 mA/V at the low anode voltage of 90 volts which is required to obtain optimum performance from the DC cascode RF amplifier used to achieve adequate signal-noise ratio. The use of cathode bias for the grounded cathode triode not only minimises variation of the input impedance with AGC but also extends the cut-ofl. This permits cross-modulation to be kept to a negligible level without resorting to a remote cut-off valve, which would affect adversely the signal-noise ratio by increasing the damping of the input circuit or by reduction of the gm. Minimum noise can be obtained, whilst maintaining low input damping, by strapping the two cathode leads of the input triode.

With a 0.3 Amp heater, this valve may be used in AC/DC equipment.

PCF82/9U8

This triode-pentode with separate cathodes and a 0.3 Amp heater, for use in AC/DC equipment, has a number of advantages over other mixer-oscillator valves designed for similar applications.

The high slope (8.5 mA/V) of the triode section permits the required oscillator voltage to be obtained with the minimum generation of oscillator harmonics and a low value of oscillator grid current.

Although it is necessary to have a high conversion conductance available for BAND 3 reception, this parameter is not so important as at low frequencies. One of the other factors which is of importance is the input impedance and its variation with frequency and bias voltage. The Brimar PCF82/9U8 has a high input impedance pentode which maintains an appreciably constant tuner gain over BANDS 1 and 2. The low anode-grid capacity of the pentode (.006 pF max.) and low pentode anode-triode anode capacity helps to keep the oscillator radiation to a minimum. Very low variation of conversion conductance is obtained by the use of combined grid leak and cathode bias.

Full details of operating conditions for these two valves may be obtained from the Brimar Valve Application Department.

Silver Medal for Children's TV Film Manager

The Television Society's Silver Medal, instituted in 1948 for rewarding outstanding artistic achievement in television, was presented to Mr. Donald Smith, Manager of the Children's Films.

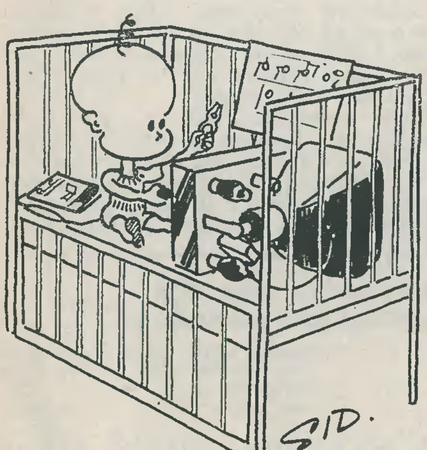
In making the award at the Society's Annual Dinner on April 2, the President Sir Robert Renwick, said that the popularity and quality of the Children's Hour films was well known and the Society was pleased to acknowledge the excellent work of one of the BBC's back-room boys.

Previous recipients of the Medal are Mr. George Moore O'Ferrall, the producer, Miss Annette Mills, Mr. Eric Robinson, and Mr. George Cansdale.

* * *

First of Six BBC VHF/UHF Transmitters for Experimental Work on Bands 3, 4 and 5

The first of six VHF/UHF Transmitters for experimental work by the BBC on frequency bands 3, 4 and 5 has recently been completed at the Mullard Research Laboratories, Redhill, Surrey. This particular transmitter is designed for operation on Band 3 (174-216 Mc/s). The development work on the remaining five transmitters — another for operation on Band 3 and two each for use on Bands 4 (470-585 Mc/s) and 5 (610-960 Mc/s) — has also been completed and production of the final equipment is well under way. (The full frequency ranges of the transmitters are 174-265 Mc/s, 470-600 Mc/s, and 600-960 Mc/s respectively).



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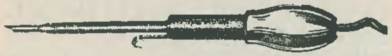

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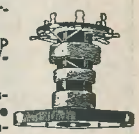

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[*continued on page 619*

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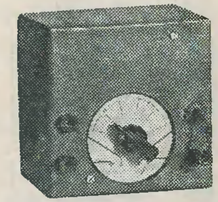

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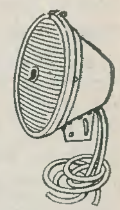

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SMALL ADVERTISEMENTS

continued from page 617]

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[*continued on page 620*

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SMALL ADVERTISEMENTS

continued from page 619]

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