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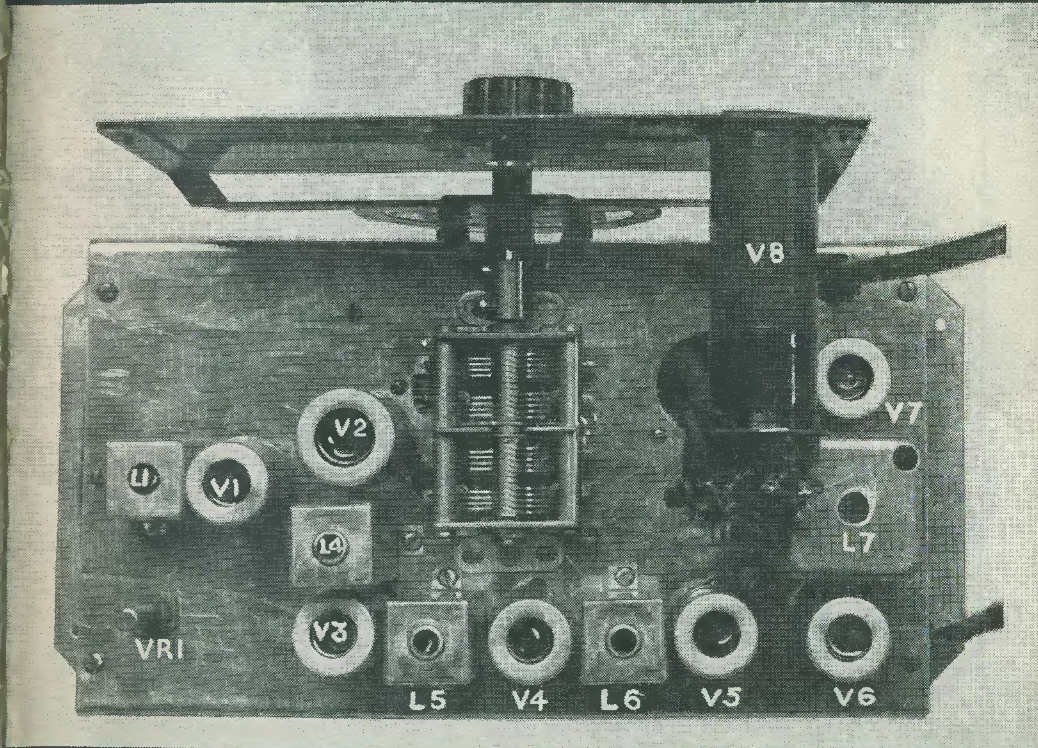
The RADIO CONSTRUCTOR

for the Radio and Television Enthusiast



IN THIS ISSUE . . .

QUALITY FM FEEDER UNIT

TIMEBASE FOR THE VCR517 · THE "MAGNA-VIEW" · RADIO CONTROL SERVO MECHANISMS · VARIABLE VOLTAGE POWER PACKS · Mains Operated Bridge, Calibration · Contrast Expander · Query Corner · National Radio Show Report · In Your Workshop, etc., etc.

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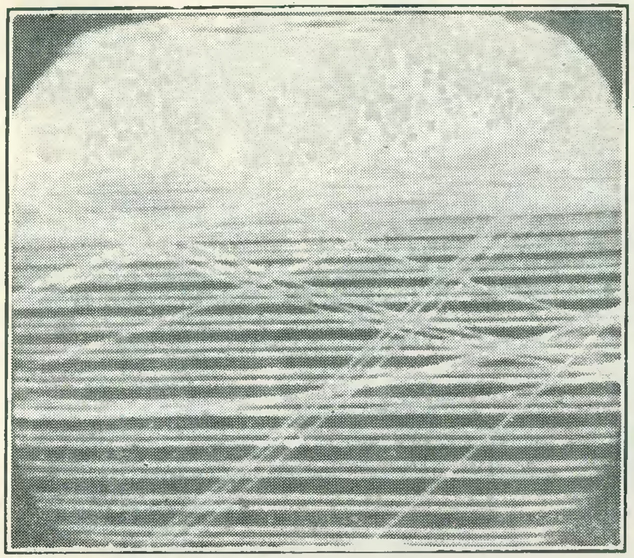

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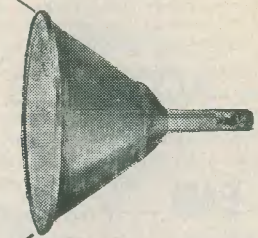

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Metal C.R. Tube

The
Radio Constructor

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Edited by C. W. C. OVERLAND, G2ATV

CONTENTS

NOTICES

THE EDITOR invites original contributions on construction of radio subjects. All material used will be paid for. Articles should 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 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 *Radio Constructor*, 57, Maida Vale, Paddington, London, W.9. Telephone: CUN. 6518.

A Companion Journal to THE RADIO AMATEUR

Suggested Circuits for the Experimenter

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

No. 23: A Contrast Expander

One does not hear a great deal these days of contrast expansion circuits, although there appears to be little reason why they should not achieve once more the popularity they enjoyed before the war.

Purpose of the Circuit

When sound is broadcast or transcribed, it is necessary to ensure that it has neither too high nor too low an amplitude, as it would then be unsuitable for the transmitting or recording medium. Thus, with music, and especially symphony music, care must be taken to reduce the volume of over-loud passages and to increase the volume of too-quiet passages. This process is known as volume compression, and is applied usually at the studio or place of performance. The purpose of a contrast expansion circuit is to restore the original volume range by offering greater amplification for loud passages and less amplification for quiet passages.

At first sight, therefore, it would appear that a receiver or record-playing amplifier fitted with a contrast expanding circuit should give greater realism so far as sound level is concerned than would one which is not so fitted.

It has often been stated, however, that the contrast expansion circuit suffers from the inherent disadvantage of having the volume level controlled by the sound amplitude appearing at the input of the circuit. The result of this is that, as the original compression is applied by an engineer, an electrical system of expansion does not necessarily restore the reproduced sound to the correct levels. Further, there is an inevitable slight delay before a change in input sound level causes the corresponding change in the expander volume controlling circuits.

It will be seen that this disadvantage is not of a technical nature at all, but is concerned instead with the aesthetic treatment of reproduced music. Whether it is considered that such a disadvantage precludes the use of an expansion circuit or not rests entirely with the user.

The Circuit

The circuit shown here is that of a simple but quite effective expander. The input voltage is fed to the grid of V1, whereupon it is amplified and passed to the diode V2. This valve rectifies, causing a voltage to be built up across R6, the " cathode end " of this resistor being positive. This voltage reduces the bias applied, via R7, to G3 of V3. If the input voltage were to increase, the voltage built up across R6 would increase also; the result being that the negative bias on G3 of V3 would be reduced still further. Thus, the greater the input voltage the lower the bias; and vice versa.

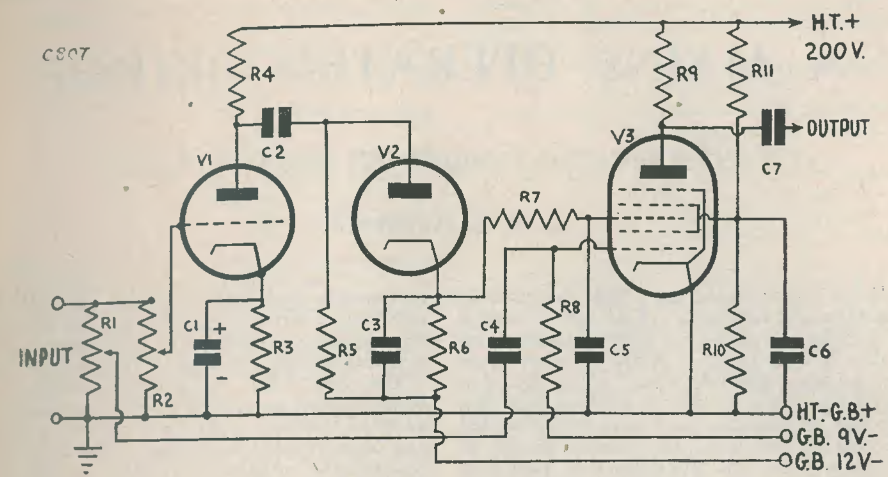
Apart from being fed to V1, the input is applied also, via R1, to G1 of V3. V3 amplifies, and the output to the subsequent AF stages is taken from C7. Contrast expansion is then achieved by reason of the fact that the amplification of V3 is controlled by the bias applied to G3.

Practical Details

In practice, the circuit should be quite easy to bring into operation. R1 is the normal volume control, whilst R2 controls the amount of expansion obtained. It might prove helpful to have R2 fitted with a scale.

V3 may be either a 6L7 or a 1612, (the latter being a non-microphonic version of the 6L7). The potentiometer R10, R11 is used to keep its screen-grid voltage fairly constant over differing conditions of grid bias.

To prevent overloading and distortion the input should be kept below 0.5 volts. The time delay of the circuit is approximately one tenth of a second.



A simple Contrast Expander

VALUES OF COMPONENTS

Resistors		R9	100 kΩ	C4	0.05 µF
R1, R2	500 kΩ	R10	20 kΩ; 1 watt	C5, C6	0.5 µF
R3	1 kΩ	R11	25 kΩ; 1 watt	C7	0.05 µF
R4	100 kΩ	**Capacitors**		**Valves**	
R5, R6	250 kΩ	C1	25 µF; 12 WV	V1	6C5, L63, etc.
R7	1 MΩ	C2	0.05 µF	V2	6H6, D63, etc.
R8	500 kΩ	C3	0.25 µF	V3	6L7 or 1612 (see text)

TRADE REVIEW

A coil pack which is now being marketed by the Deal Component Co., 105 Evering Road, London, N.16., has several features of interest to the home constructor.

It is an all-wave unit covering the conventional long, medium and short wave broadcast bands, with an IF of 465 kc/s.

Permeability tuned coils are used throughout to provide high efficiency and accurate tracking on all bands.

The compact construction ($1\frac{1}{2} \times 2\frac{1}{2}'' \times 2\frac{3}{4}''$), which is of particular value when chassis space is limited, is achieved without loss of accessibility. All tuning cores and trimmers are readily available for adjustment.

The wavechange switch when tightened to the chassis automatically provides completely stable " single hole " fixing. This makes it possible to fit the unit as a final assembly operation, thus providing the all-important " elbow room " during wiring and eliminating the possibility of damage to the coil pack. Only five connections, which are colour coded, need be made to incorporate the unit into the receiver.

All coils are fully impregnated for protection against damp, and the unit is pre-aligned for use with any standard J.B. dial and a 500 pF standard gang. The unit is reasonably priced at 38s. 6d.

A MAINS OPERATED BRIDGE

Further notes on Components and Calibration

by W. E. THOMPSON

When I constructed the bridge described in the May and June issues, I devised a method of initially calibrating the bridge without using a decade box, more as a matter of personal interest than anything else, just to see if it could be done. It will be remembered that the use of a decade box was recommended because it simplified the calibration, as it certainly does, and although the alternative method to be described here requires more time and a few extra components external to the bridge, the process is not too involved. One has to adopt a few "dodges" which rather turn the tables on the bridge, by making it do a bit of its own calibrating, so to speak. If the procedure set out is followed methodically, a reasonably close accuracy will be achieved; at the same time the constructor will gain early knowledge of handling the bridge and a ready appreciation of its capabilities.

At the time the manuscript for the main article was in preparation, it seemed debatable whether it was strictly necessary to include this alternative method of calibrating, for it made the article appear somewhat too long by virtue of the inclusion of a fairly long list of things which would have to be done. It also seemed to detract from the main theme, which was construction, so it was finally decided to delete this part. Since then, however, I have often been tempted to supplement the original manuscript, but somehow always came back to the thought that comparatively few readers would have need of it. Now that the article has appeared in print, the view-point has changed, and the fact that there is definite enquiry for such information has decided the matter. It is hoped that these notes will enable those who cannot get hold of a decade box to calibrate their bridge.

It has also been considered an opportune moment to say a few words about some of the components for the bridge. Since the main article was written, a considerable time ago, it is to be expected that certain items, which were obtainable from the surplus market, are now scarcer or even non-existent. Where it is thought that suitable items can still be procured, sources of supply will be quoted; in some cases suitable alternative components will be indicated. First of all, then, calibration.

The decade box, as most of us know, is really nothing more than a convenient form of variable resistor, often used as the variable arm in a Wheatstone Bridge. The box itself contains essentially four sets of resistors connected to four ten-stud rotary switches; there are nine resistors of 1.0 ohm each, 9 of 10 ohms, 9 of 100 ohms, and 9 of 1000 ohms. By means of the rotary switches, any value of resistance from 1.0 ohm to 9,999 ohms can be set up, in steps of 1.0 ohm.

To calibrate our bridge without this useful device involves using resistors of known values in such a way that we can duplicate its functions: at the same time we still want to spot all the calibration points, which at first sight seems to demand a whole box full of spare resistors. By applying some cool reasoning we can arrive at the desirable fact that we need only the following:—

A. Fixed resistors, 1 watt, 1% tolerance, 1 of 50 ohms, 1 of 100 ohms, 2 of 200 ohms, 1 of 500 ohms.

B. Variable resistor, 100 ohms wire wound, linear law.

C. Variable resistor, 1000 ohms wire wound, linear law.

D. Fixed resistors, ½ watt, 20% tolerance, 2 of 2.2 kΩ (in series to make approx. 4.4 kΩ).

By using various combinations of resistors A in series we can make up any value from 50 ohms to 1000 ohms, in steps of 50 ohms. These must be close-tolerance so that the accuracy of the final calibration is not unduly impaired. The resistors B, C and D are used as "artful dodgers," as will be seen later.

Calibration Procedure

The first operation uses the 100 ohm standard in the bridge, and by balancing various values of resistors A against it, points are set in steps of 50 ohms to obtain ratios from 1 to 10, in steps of 0.5.

1. (*a*) Set Measure switch to C&R, Range switch to 100 ohms.
(*b*) Connect A=100 ohms to Rx sockets.
(*c*) Obtain balance on ratio control R8, and mark point 1.
(*d*) Increase A to 150 ohms, balance with R8, mark point 1.5.
(*e*) Continue increasing A in steps of 50 ohms until A=1000 ohms is reached, balancing with R8 at each step to obtain points at 2, 2.5, 3, etc. up to 10.

Next, using the 10 kΩ standard in the bridge, the ratios from 0.01 to 0.1 can be set.

2. (*a*) Set Measure switch to C&R, Range switch to 10 kΩ.
(*b*) Connect A=100 ohms to Rx sockets.
(*c*) Obtain balance with R8, mark point 0.01.
(*d*) Increase A to 200 ohms, balance with R8, mark point 0.02.
(*e*) Continue increasing A in steps of 100 ohms until A=1000 ohms is reached, balancing with R8 at each step to obtain points at 0.03, 0.04, etc. up to 0.1.

We now bring in the "artful dodgers" and make them into another "standard" in order to fix more points on the scale of R8. This involves making use of the 'Match' facility provided on the bridge; it gives a good demonstration of the usefulness of this feature.

3. (*a*) Repeat procedure in 1(*a*), (*b*) and (*c*) to set R8 accurately at 1.
(*b*) Increase A to 1000 ohms; leave R8 at 1.
(*c*) Turn Measure switch to Match. Connect B and C in series, join to Rm sockets.
(*d*) Turn B back to minimum resistance, increase C to nearly balance bridge, *i.e.*, C=nearly 100 ohms. Now increase B to true up the balance. Leave B and C at these settings, *viz.*, 1000 ohms total.
(*e*) Reduce A to 950 ohms, re-balance with R8, mark point 0.95.
(*f*) Continue reducing A in steps of 50 ohms until 100 ohms is reached, balancing with R8 at each step to obtain points at 0.9, 0.85, 0.8, etc. down to 0.1. (Note that this last point should agree with the point found in 2(*e*)—this is a useful check, and it will be found that similar check points will fall in other parts of the calibrating process).
(*g*) Increase A to 200 ohms, to get a check point R8=0.2. Leave R8 in this position in readiness for the next step.

Resistors D are now brought into use to secure the remaining points required between 0.2 and 0.1.

4. (*a*) Measure switch at Match, R8 at 0.2, from previous test.
(*b*) Connect resistors D in series with B and C, joined to Rm sockets.
(*c*) Increase A to 1000 ohms.
(*d*) Adjust B and C as in 3(*d*) to balance the bridge, *i.e.*, D, B and C in series are now 5000 ohms total.
(*e*) As in 3(*e*), re-balance with R8, mark point 0.19.
(*f*) As in 3(*f*), re-balancing with R 8 at each step to obtain points at 0.18, 0.17, etc. down to 0.1. Leave R8 in the 0.1 position in readiness for the next operation.

We have now secured all the calibration points between 0.01 and 1, and now need to fix the points not already found between 1 and 100. A slightly different technique must be adopted. Proceed as follows:—

5. (*a*) R8 is set at 0.1, from (4*f*). Turn Measure switch to C&R and Range switch to 100 ohms.
(*b*) Remove all resistors from Rx and Rm sockets.
(*c*) Connect B and C in parallel, join to Rx sockets.
(*d*) Balance bridge by adjusting B and C, making coarse adjustment on B and fine adjustment on C. (The effective resistance of B and C is now 10 ohms).
(*e*) Shift B and C connections from Rx to Rm sockets.
(*f*) Turn Measure switch to Match.
(*g*) Insert A=100 ohms in Rx sockets; check that R8 now balances at 10.
(*h*) Increase A to 150 ohms, balance with R8, mark point 15.
(*i*) Increase A to 200, 300, 400, 500 and 1000, balancing with R8 at each step to obtain points at 20, 30, 40, 50 and 100. Leave A=1000 in Rx sockets.

The remaining points now required to be found, the sub-divisions between 1 and 3, are perhaps the most laborious to set up, since to secure fair accuracy it needs some care and maybe a few checks to ensure that all is well.

6. (*a*) With A=1000 in Rx sockets, from 5(*i*), turn Measure switch to C&R and Range switch to 10 kΩ. Check that R8 balances at 0.1 and leave in this position. (B and C need not be removed from Rm sockets for this purpose).
(*b*) Remove resistors A from Rx sockets.
(*c*) Shift B and C connections from Rm to Rx sockets.

(*d*) Turn Range switch to 100 ohms; check that bridge is still balanced. If adjustment is necessary, which is unlikely, it should be made on B and C only.

(*e*) Insert A=100 ohms in series with B and C (total 110 ohms), balance with R8, mark point 1.1.

(*f*) Increase A to 200 ohms, in series with B and C (total 210 ohms), balance with R8, mark point 2.1.

(*g*) Remove resistor A.

7. (*a*) Set R8 accurately to 0.2, adjust B and C to balance bridge.

(*b*) As in 6(*e*), balance R8, mark point 1.2.

(*c*) As in 6(*f*), balance R8, mark point 2.2.

(*d*) Remove resistor A.

This procedure is continued to secure points 1.3 and 2.3, 1.4 and 2.4, and so on until 1.9 and 2.9 have been reached. Check points will be picked up at 1.5, 2, 2.5 and 3 if necessary to prove the setting of B and C. The calibration of R8 is now complete.

By using much the same methods, the Power Factor control R4 can be calibrated. The first point on this scale is the 5 per cent. mark, and is fixed as follows:—

8. (*a*) Set Measure switch to C&R Range, switch to 100 ohms.

(*b*) Refer to table on page 388, June issue, for resistance required for 5 per cent. P.F., in this case 160 ohms. This is 1.6 times the standard, so set R8 at 1.6.

(*c*) Connect A=100 ohms in series with B, join to Rx sockets.

(*d*) Adjust B to balance bridge. (A and B are now 160 ohms).

(*e*) Short-circuit C5, the 1.0 μF standard in the bridge.

(*f*) Shift A and B to Cx sockets.

(*g*) Turn Range switch to 1.0 μF, and R8 to 1.

(*h*) Obtain balance with R4 (not R8), mark point 5 per cent.

(*i*) Remove A and B from Cx sockets.

Other settings are obtained in the same way, setting up the required resistance by means of a set ratio on R8, derived from the table, and getting a subsequent balance with R4.

The calibration of R4 does not need to be particularly accurate, so it is sufficient to set R8 to the nearest calibrated point on its scale to the figure given in the table. For instance, for the 35 per cent. point the resistance is given as 1190 in the table—R8 would be set to 0.12 and Range switch at 10 kΩ. The necessary resistances for these points on R4 can be made up from various combinations of A, B, C and D.

With reference to certain components, the following notes may be of assistance to constructors.

Close-tolerance resistors and capacitors. Most radio dealers can get these from the makers. Suitable resistors are made by Dubilier, Erie, Welwyn, etc., and capacitors by Dubilier, T.C.C., Erie, etc. Alternatively, Messrs. Tele-Radio (1943) Ltd., 177 Edgware Road, London, W.2. can usually supply from stock; they specialize in such items.

Mains transformer. The article specifies HT winding 200V, but the bridge is very little affected if the HT is as low as 150V; the higher voltage produces a sharper " shadow " on the magic-eye balance indicator. A transformer with a 150V HT winding together with other windings suitable for the bridge is the Partridge type WW.1. This is listed by Messrs. Watts Radio (Weybridge) Ltd., 8 Baker Street, Weybridge, Surrey, at 26/4 plus postage. A similar item used to be marketed by Messrs. Sound Sales Ltd., West Street, Farnham, Surrey, but I do not know whether they still supply it. Alternatively, several advertisers in radio journals undertake to make up transformers to customers' specifications, presumably at slightly higher cost.

Variable resistor, R8, 1000 ohms 10 watts. The Berco component mentioned in the article was readily available as an ex-Govt. item when the MS was written; supplies have now dwindled, but Messrs. Watts Radio may be able to help, though it is feared their stock must be almost gone. An enquiry to the makers some time ago revealed that they could supply, but that delivery would be 50 weeks from date of order. An alternative and suitable component is the Reliance type PIW potentiometer. Made by Reliance Manufacturing Co. (Southwark) Ltd., Sutherland Road, Higham Hill, Walthamstow, London, E.17, it is rated at 15–20 watts, is $2\frac{3}{4}$ ins. diam., and costs somewhere about £1. The linear-law type should be specified, and delivery is ex-stock.

Neon leakage indicator. It was stated that the small neon lamp was one of a pair taken from an S.B.A. indicator. This latter is an ex-Govt. item comprising two small moving-coil meter movements and two of the neons in holders, in a round bakelite mounting. The whole instrument is known as the Visual Indicator Type 3, and bears the code 10.Q/4. It can be obtained from several surplus stores, and it is noticed in a recent advertisement by Southern Radio Supply Ltd., 11 Little Newport Street, London, W.C.2. The neons themselves, if they can be obtained separately, are the Air Ministry type 10.E/6. They are $\frac{5}{8}$ in. diameter and $1\frac{3}{4}$ ins. long overall, with a single contact miniature bayonet cap. Some tests on a few I have on hand gave the following

average figures:— Striking voltage, 80 V; running voltage, 70–75 V; running current, 1.25 mA; minimum current, 0.3 mA; extinguishing voltage, 63 V. Types of neon tube other than this conveniently small one can be used if necessary, and those with relatively low running current should be chosen. A suitable tube is the ex-Govt. CV.1070 (commercial Mullard 7475). It should be remembered that a different type of neon tube will necessitate alteration to the value of resistor R14 in Fig. 5 of the article, the actual value being best found by trial and error, starting at a high value and reducing it until the tube strikes with the Leakage sockets shorted, then further reduced so that a satisfactory rate of flash is obtained. This neon indicator is, in any case, intended only as a rough guide to the condition of a capacitor, so too much trouble need not be spent on the circuit except to ensure that the running current is kept as low as possible.

From our Mailbag . . .

REGULATORS IN PARALLEL

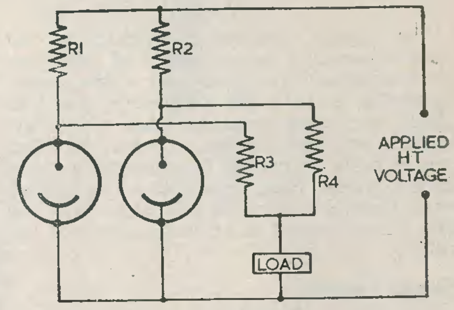
Dear Sir,

I was very interested to read W. E. Thompson's letter in the July issue, and am indebted to him for pointing out that it is impracticable to connect two regulator valves in parallel in order to provide a stabilised voltage at twice the current rating of a single valve. As he states, this is due to the fact that the striking voltages of the regulators are almost certain to be different; with the result that one strikes before the other and therefore carries the whole current.

There are, however, several solutions to this problem and I append two circuit diagrams to illustrate these.

The first circuit shows how two regulators could be connected when it is permissible to feed the load through a relatively large-value resistor. Each regulator has its individual feed resistor and is connected to the load through a further resistor. The arrangement is symmetrical, R1 having the same value as R2, and R3 the same value as R4. This circuit is workable when, after one regulator strikes, the voltage remaining across the second regulator is sufficient to enable it to strike also. The voltage which remains across the second valve is dependent upon the values of the resistors and the current taken by the load. In cases where the current taken by the load is the deciding factor which prevents the second regulator from striking, an additional switch could be fitted between the load and the junction of R3 and R4. The procedure of operation would then consist of first allowing both valves to strike, and then switching in the load.

When it is impracticable to feed the load after regulation through the fairly large resistors needed in the first circuit, the arrangement given in the second diagram provides a workable solution. In this case the regulators are first allowed to strike; after which the load is connected to them by means of the double-pole switch. To prevent momentarily overloading one of the regulators it would be

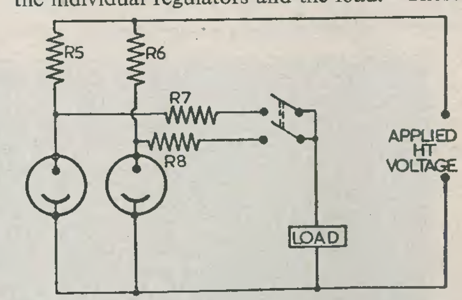


CIRCUIT 1

C763

necessary to ensure that both sections of the switch closed at the same instant. This requirement should be met reliably enough by employing a double-pole tumbler switch of good design.

It will be seen in the second diagram that two resistors (R7, R8), are included between the individual regulators and the load. These



CIRCUIT 2

C764

resistors are intended to accommodate any slight discrepancies in regulating voltages which might exist between the two valves; and they could have values as low as 100 ohms, or even less.

My thanks again to W. E. Thompson for raising this point; and I remain,

Yours sincerely,

J.R.D.

REMOTE CONTROL BY RADIO

Servo mechanisms and selectors for radio control

by F. C. JUDD, G2BCX

PART THREE

The signal from the transmitter to the receiver provides only a means of conveying the command from the operator to the model. In order to have the commands put into effect, the signal must be used to operate various servo-mechanisms attached to whatever is being controlled: for example, Rudder, Engine, Guns, Flag, Lights etc. The number of individual controls is limited only by the size of the model and the ingenuity of the owner.

Simple Controls

Up to 15 to 20 channels are possible, and practicable, but it is strongly advised that such systems are not only ambitious, but complex too, and should be left alone until experience has been gained with simple single, or at least two- or three-channel arrangements. A start should be made with a simple control for steering, in a model boat or aeroplane, involving only the receiver relay and a two- or four-pawl electro-magnetic escapement (sometimes referred to as actuators). There are one or two on the market which may be purchased at very reasonable cost. From this, and the experience gained in using it, modifications could be made to introduce some form of engine control either by mechanical or electro-mechanical means, or both. An E.D. light-weight escapement is shown in the photograph Fig. 6. These are powered by twisted elastic and are quite suitable for lightweight aircraft and model boats. A heavier clockwork escapement made by the same firm, has four pawls and, therefore, four operating positions which may be used, with a little modification, for at least two more channels and steering[1] as well.

Complex Control Systems

Where more complex systems are desired, some form of selector will have to be used

1 *The Model Ships and Power Boats* magazine, March 1952. 'Servo-mechanisms for Model Control' by F. C. Judd, G2BCX.

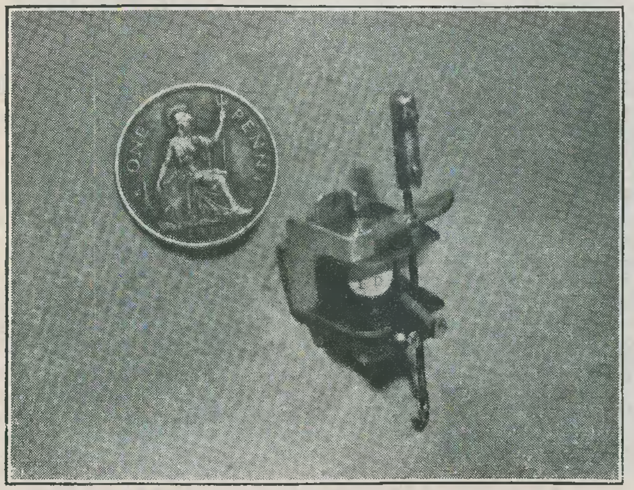


Fig. 6. E. D. Compact Escapement

(courtesy Electronic Developments Ltd.)

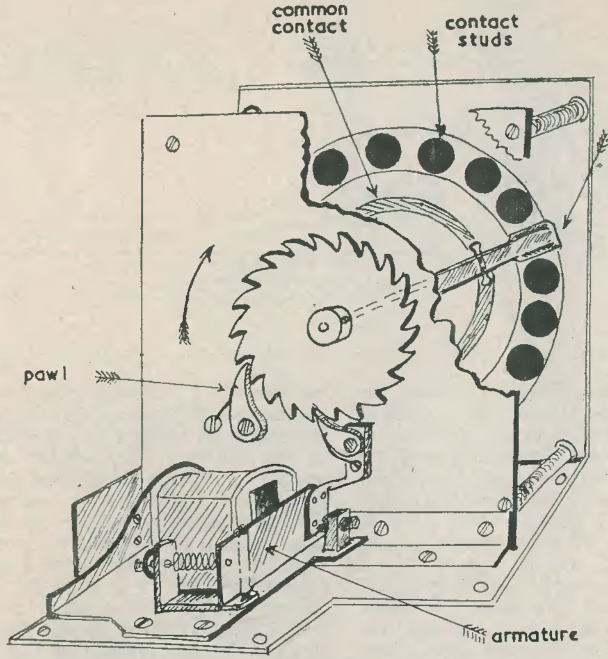


FIG.7
RELAY DRIVEN SELECTOR SWITCH

C788

and, although only a single channel receiver is necessary, selectors with up to 15 or 16 channels are quite practicable. There are several methods of driving a selector arm around a set of contacts, and the diagram of Fig. 7 shows a relay driven system. Here an arrangement of spring loaded pawls is used so that the selector arm travels only in one direction, returning each time, at the end of the travel, to zero. The selector arm is moved once only, from contact to contact, each time the relay closes. Some form of delayed switching must be introduced in the supply (via the selector arm) to the various servo-mechanisms so that unwanted controls will not come into operation each time a contact is made. A simple delay circuit is shown in Fig. 8 and uses a 3000 to 5000Ω relay with the condenser and resistor circuit providing for delays of up to approx. 1 second.

Other selector mechanisms may be constructed using a clockwork driven arm with an automatic self-zeroing arrangement. In this case a contact can be selected and held for a given period, and the selector quickly returned to zero when control is no longer required. Such a system requires two delay circuits, one for the servo mechanism supply voltage and one for a trip circuit for an automatic zero solenoid. A selector of this nature is difficult to construct since it involves accurately turned gears and well designed component parts.[2]

2 'Multiple Control Selector,' by N. A. Ough. *The Model Ships and Power Boats* magazine, Jan., 1952.

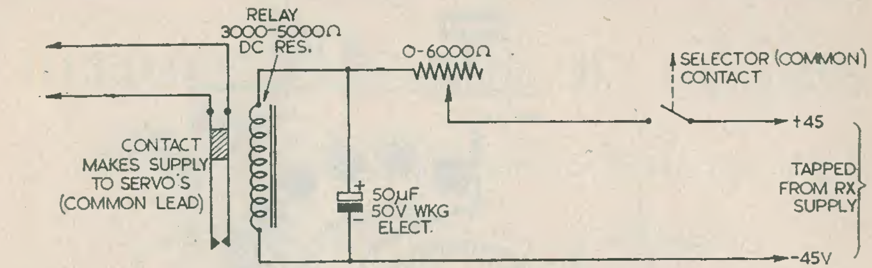


FIG. 8
DELAY CIRCUIT FOR UP TO 1 SEC.

C789

With a selector mechanism following the receiver it is necessary to have some method at the transmitter for counting and keying the number of impulses required to send the selector arm round to the desired position. Old telephone dials may be adapted for this, and a well designed selector should follow the rapid and short duration impulses quite easily. Alternatively, similar devices could be constructed without great difficulty in the shape of either a hand turned control, where the contacts are selected one by one until the return to zero, or the telephone dial, where the contact number is pre-selected, and the transmitter keyed when the dial is released. The transmitter, therefore, is keyed a given number of times, resulting in the same number of impulses being picked up by the receiver. The receiver relay responds to each impulse and the servo-mechanism selector moves round to the appropriate contact.

Servo Mechanisms

The combinations of electro-mechanical and motor-driven servo-mechanisms are almost unlimited, but one or two suggestions are given here, together with the illustrations of Figs. 9, 10 and 11. These will no doubt promote other ideas. Steering involves moving the rudder of either aeroplane or boat, and the writer has quite successfully constructed an electrically driven steering mechanism for a radio controlled model Foden lorry. For rudder control, one of the many midget electric motors now available, together with a reduction gear consisting of a worm and pinion, will provide continuous steering with a crank and loop arrangement as shown in Fig. 11. Where the rudder is geared directly to the motor an automatic stop contact for full right or left rudder may be used, together with a relay operated changeover switch for reversing the direction of the motor. In this case, a contact on the selector mechanism would pass current in one direction through the motor via the changeover switch, and the rudder would move over to, say, the left position stop contact and break the current to the motor. For reverse direction the selector is taken to another position, the changeover switch being operated so that current through the motor is reversed, with a consequent movement of the rudder to the right hand stop contact. For automatic 'rudder neutral' a contact for breaking the current to the motor could be introduced, with a third position on the selector to start it again by short-circuiting the neutral stop contact. For model planes and boats a rudder movement of approx. 15 degrees either side of neutral is all that is necessary to effect proper steering.

Engine control (electric motors) may be effected as follows:— for stop and start only, selector contacts are used simply to make or break the current to the motor. For reverse engine (permanent magnet motors), it is necessary to use a changeover switch operated from a contact on the selector. In this case the polarity of the supply to the motor is completely reversed. For motors with separate field windings it is necessary to reverse the connections to the field winding. Speed control may be obtained with motor driven variable resistors. An Electrotor or Mighty Midget electric motor coupled with a worm gear and pinion will move the wiper arm of a small variable resistor quite easily, and at a speed sufficiently slow to obtain gradual control of motor speed. By arranging for the wiper arm to be open-circuited at maximum resistance, engine stop and start control may also be effected. The wiper arm of the variable resistor should be arranged for continuous travel, otherwise it will be necessary to introduce a changeover switch to reverse the direction of the driving motor in order to go from fast to slow, i.e., from minimum to maximum resistance.

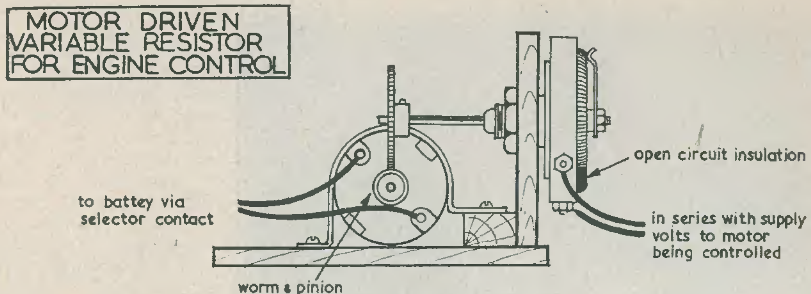


FIG. 9

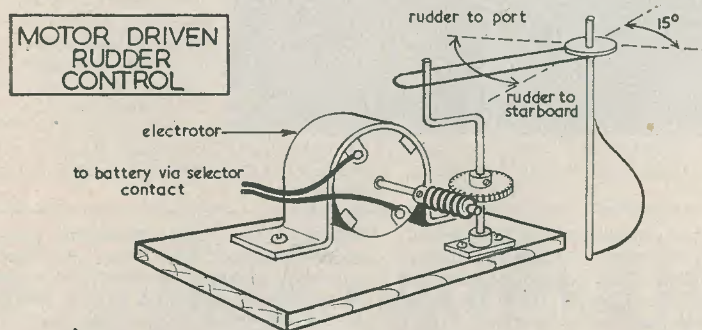


FIG. 10

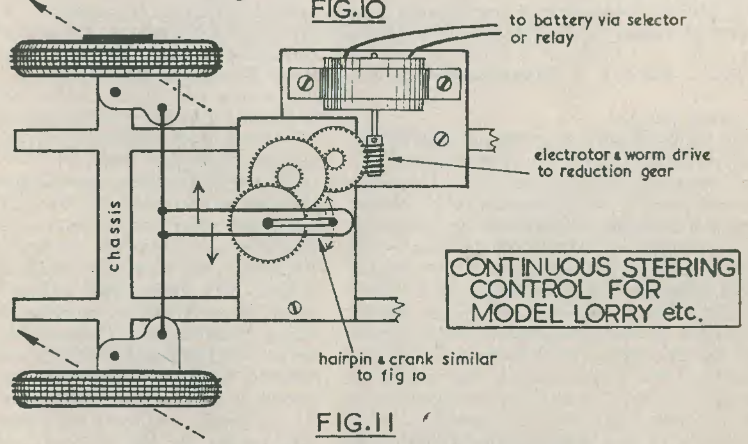


FIG. 11

SELECTION OF SERVO MECHANISMS

C790

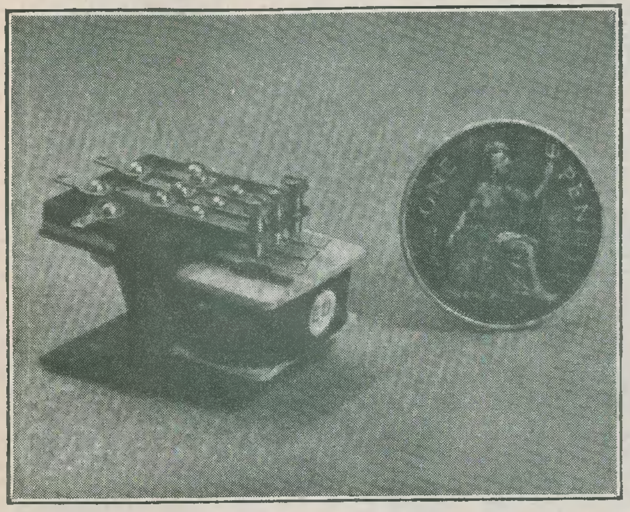


Fig 12. E. D. 3-Channel Reed Unit

(courtesy Electronic Developments Ltd.)

The value of a suitable resistor for variable control will depend on the voltage and current rating of the motor to be controlled, but will be generally in the region of 10 to 15 ohms, and it should be capable of carrying 1 to 2 amps. The actual resistance for slowing to a complete stop can be calculated from Ohms law; $R = \frac{E}{I}$ where E is the motor voltage and I the motor current.

Other forms of control are many and varied, and such items as tow line releases, lights and so on may all be operated from contacts on the selector or in conjunction with electro mechanical methods outlined in the foregoing. As an example of what can be done, the following is a brief description of a multi-channel control system installed in a 6-foot long model battleship built by N. A. Ough, well known to ship modellers for his magnificent models, many of which may be seen in the Maritime and Imperial War museums. A single channel radio control receiver is used, together with a 16 channel selector mechanism. From this, steering is controlled by midget electric motor with independent movement to port, starboard or amidships. Two propellor motors are used and both are controlled for stop, start, and fast and slow speeds. (Variable resistor control as outlined above). Provision is also made for laying and firing the guns and laying a smoke screen. The guns, although models, are accurately made with bored and rifled barrels, and fire real shells by means of a small piece of gun cotton inserted in the breach, which in turn explodes gun powder. The gun cotton is ignited by means of a spark gap at the base of the breach, the spark being generated from a small spark coil set of the type used for model petrol driven aero engines. The spark coil is, of course, controlled from a contact on the selector unit and the shells are fired with sufficient force to penetrate a piece of five-ply wood ! !

Attempts to effect more than two or three channel control should be made only when experience has been gained with more simple systems, but one other method of obtaining a multi-channel control should be mentioned. This is the tuned reed system which can be made to provide up to 4 to 5 channels by using audio tones to vibrate the reeds, these in turn switching power to the servo-mechanisms by means of relays since the reed contacts are not capable of carrying large currents. Home-made reed units are very rarely successful, owing to the difficulty of maintaining even and constant vibration of the various reeds and because of harmonic frequencies in the audio tones. One commercially made reed unit with three channels is available, and is shown in the photograph of Fig. 12. Other details of reed control are given in Part 1 of this series, but circuits for a receiver and transmitter may be obtained, and references are given at the end of this article.

The use of multi-channel receiver and transmitter circuits is impracticable owing to the narrow bandwidth allotted for model control, (29.6 to 27.1 Mcs and 465 to 465 Mcs) and the fact that super-regenerative receivers have to be used in order to keep the size of the receiving equipment to a minimum. Nevertheless, many interesting hours can be spent in devising methods of control, and for the ardent radio enthusiast the art of model making could be adopted as a equally interesting hobby. There are many local societies catering for model ship and aircraft enthusiasts, and anyone with radio knowledge is usually very welcome, especially among the radio controlled model fraternity. A list of references is given below, together with the names of one or two of the more popular model making magazines where details of local activity can be obtained.

References

1. *Model Control by Radio*, by Edward L. Safford. Gernsbach Publications. U.S.A.
2. *Radio Control for Models*, by G. H. Redlich. Model Aeronautical Press.
3. "*Radio Control for Model Boats*," by F. C. Judd, G2BCX. Series of six articles. *The Model Ships and Power Boats.* Magazine. Oct., Nov., Dec., 51. Jan., Feb., Mar., 52.
4. "*Radio Control*," by F. C. Judd, G2BCX. Series May, June, etc., 52. *The Model Maker.* Monthly magazine.
5. Papers issued periodically by the Radio Controlled Models Society.
6. *Radio Control Circuits*, by F. C. Judd, G2BCX. Obtainable from Flight Control, 783 Romford Road, London, E.12.
7. Recent series in this magazine by A. Gee, G2UK.

Acknowledgments are due to Messrs. Electronic Developments Ltd., for the photographs of the Light-weight Escapement and the Three Channel Reed Unit.

IN YOUR WORKSHOP

In which J. R. D. discusses Problems and Points of Interest connected with the Workshop side of our Hobby, based on Letters from Readers and his own experiences.

I must begin this month's article with an apology to those readers who have written to me recently and who have received belated replies. The reason for these delays is that I am not at present in the United Kingdom but am, instead, out in Malaya. It is difficult for me to say exactly how long I shall be remaining out here, and I may even be on my way home again by the time that this appears in print. In the meantime I am trying to keep my correspondence as up-to-date as possible, and I trust that readers will bear with me over any irritating delays that may occur.

PA Systems

Many amateurs are interested in the subject of public address; and quite a few have made their own amplifiers and gear for use by local dance bands and for similar functions. This is an interesting branch of radio and, for the home-constructor, has the added advantage of offering wide social contacts and interests.

All amateurs who are interested in this sort of work naturally like to ensure that the results obtained from their gear is as good as possible. Unfortunately, this usually necessitates their being present whenever their equipment is being used in order to prevent it being incorrectly operated by non-technical people; and this is liable to take up rather a lot of spare time. A solution to this problem consists of using pre-set tone controls on the amplifier and, in addition, fitting a " master " volume control which is also pre-set. This latter, when correctly set up at the time of the original installation, then allows any operator to use the normal volume or mixing controls on the amplifier without fear of his passing beyond the ringing level. Using pre-set tone controls prevents also the habit of cutting top in order to get more apparent " volume " without acoustic feedback. The ringing level is, of course, that level, (slightly below the "howl level"), which is obtained when the gain is still sufficiently far advanced to produce an unpleasant ringing effect on loud noises.

Construction

Everyone has his own method of building a receiver, amplifier, or any other item of gear. Despite this, I have been asked to give a description of what I think, myself, to be the best method. What follows, then, is merely a description of my own system, and it is very possible that it may be different to those of readers. Everyone has his own preferences when setting about a job of this sort.

Unless I am going to make a simple receiver or carry out a "re-build," I usually like to start from scratch, especially so where chassis dimensions are concerned. I never start unless I have all the components on hand. This is mainly because I employ these components to help me obtain, provisionally, a rough mental picture of the best layout for the circuit I am using; and, finally, to help me obtain accurately the required physical dimensions of the chassis. The next job consists of marking out, drilling and bending the chassis. If the reader has a chassis-cutter for the valve-holder holes, these may be made after the chassis has been bent. Otherwise, it often proves helpful to make these holes before bending. All the main components are next mounted, after which I usually get the mains input connected up (if applicable) and get all the "routine" wiring (heaters, etc.,) finished.

I always look upon the work up to this point as being the necessary preliminaries to what is the most enjoyable part of the job, that of wiring up and getting the equipment working.

To do this, I first of all complete the power supply wiring and check it for HT and LT output. I then work back stage-by-stage, checking each stage after I have completed it. With most types of equipment the process of checking each stage usually takes very little time. In a receiver, for instance, it may consist merely of grid-tapping and tests for hum or instability in the AF stages, checks with a signal generator through the IF stages, and so on, until the receiver is finished.

Using this method one is always certain that everything that has been put in is above reproach. If faults occur as construction proceeds, it is easy to localise them. One has the feeling, indeed, that the equipment is growing under one's own hand.

Resin-cored Solder

Now that resin-cored solder is used universally, there seems to be a growing tendency amongst some people to consider that flux paste is obsolete. Although it is possible to obtain really excellent resin-covered solder these days, I still think that a tin of flux around the workshop is a virtual necessity.

Let us imagine for instance that, in repairing a receiver, we come across a cold joint. There may be plenty of solder on the joint, but due to, say, insufficient flux or something like a wire moving the instant of setting when the joint was being originally made, a poor joint has resulted. A cure which works nearly always consists of putting some flux on the joint and applying the soldering iron. The flux then breaks down whatever oxides there are, the existing solder melts, and a good joint results. Applying resin-cored solder would also result in a good joint being formed, but there would then be the disadvantage that it would probably have too much solder on it. Further, if excessive solder has been added, some of it might drop off and fall into an inaccessible place.

When it is necessary to solder in awkward corners, flux again shows its uses. Instead of taking both iron and solder to the joint it is merely necessary primarily to apply the flux, pick up a little solder on the bit, and apply the iron only to the joint.

Coils

I was recently interested to receive a sample from the new range of Osmor "Q" coils. These are individual coils having approximately the same physical dimensions as those used in the Osmor coil packs. The coils cover a wide range and readers will be interested to know that it is possible to obtain types both for mains receivers, using aperiodic (separate coupling coil) on short waves with bottom-end capacitor coupling on medium and long waves; and for mains or battery receivers where all the coils have aperiodic coupling. For the mains receiver coils there are three short-wave bands as well as a 70–230 metre shipping band. Further coils are offered for portable and TRF receivers.

A Magnetic Sound Recorder

by L. F. SINFIELD, A.M.I.P.R.E.

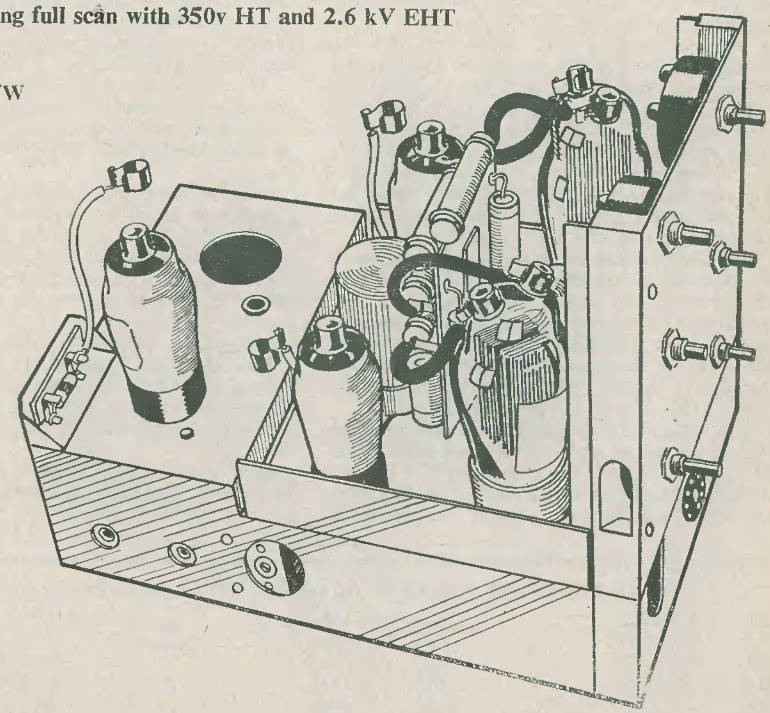
A further article in this series will appear in the December issue published next month

A TIMEBASE FOR THE VCR517

Providing full scan with 350v HT and 2.6 kV EHT

by

Ex-2BYW



Like so many others, the writer commenced TV using a VCR97 tube. The circuit was quite conventional and followed closely the original "Inexpensive Television" design except for the timebase. Being somewhat of a novice where these generators are concerned, a kit of parts was purchased for the well-known Miller circuit using SP61's in paraphase.

After some preliminary teething trouble had been cleared up, this job functioned quite well with the VCR97, giving a fair size picture on 2.6 kV although the top lines opened out rather like a five-barred gate. But the vivid green of the picture was not very popular with the lady of the house, who complained that everything looked pink after looking in for half an hour or so.

Resisting the temptation to offer this to mankind as a sure means of obtaining a brighter outlook on life, the writer cast around for a tube with a more acceptable colour. The VCR517 suggested itself, and one was acquired in an RF162 Unit. Having the same voltages and base connections, substitution was straightforward, and the resultant picture was a decided improvement both from colour and spot size considerations.

Unfortunately, it was very much smalle

and the proportions were all at sea. Some juggling with the anode resistors to the SP61's corrected the proportions, but no amount of experiment would enlarge the picture to its former size. It became obvious, therefore, that a new timebase was indicated, and first thoughts turned naturally to the push pull 6SN7 circuit described in "Inexpensive Television."

Possessing none of these latter valves with which to experiment, the writer had some doubts about paying out 15s. for a pair, with the possibility of finding that they would not do the trick. Furthermore, it had long been intended to raise the EHT by about 1 kV for a brighter picture, and when this job was completed the picture would be smaller still. Increasing the HT to the SP61's was considered, but as they were already on 500V this idea was ruled out and the writer cast around for a valve which could safely accept potentials in the region of 700V. This clearly indicated top cap anodes and 807's were considered, but as four were required they were ruled out on the score of cost and LT consumption.

An almost ideal valve was found eventually in a Manchester surplus dealers. Furthermore, it was wired up in a Type 6 Indicator Unit which had obviously been modified. The valve is a double triode with a common cathode and both anodes brought out to top caps. The CV number is 18 and civilian equivalents are the DET19 (MOV) and 4074A (STC).

The weakness is the common cathode, which makes this valve, and similar types such as the 6N7, less flexible than the 6SN7. As the writer was able to acquire two for half a crown each because of loose bases, the financial gamble was negligible and construction was started using a circuit very similar to that in "Inexpensive Television." The diagram is shown in Fig. 1, and an illustration of the general layout is also given.

If the writer might digress for a moment, the original SP61 timebase was generally satisfactory but, owing to the very compact nature of the layout, initial and subsequent faults proved difficult to rectify owing to the inaccessibility of certain components. This proved particularly trying when it was desired to experiment with changes of condenser and resistor values, and accordingly the new timebase was designed to make circuit changes more readily accomplished without any substantial increase in overall size.

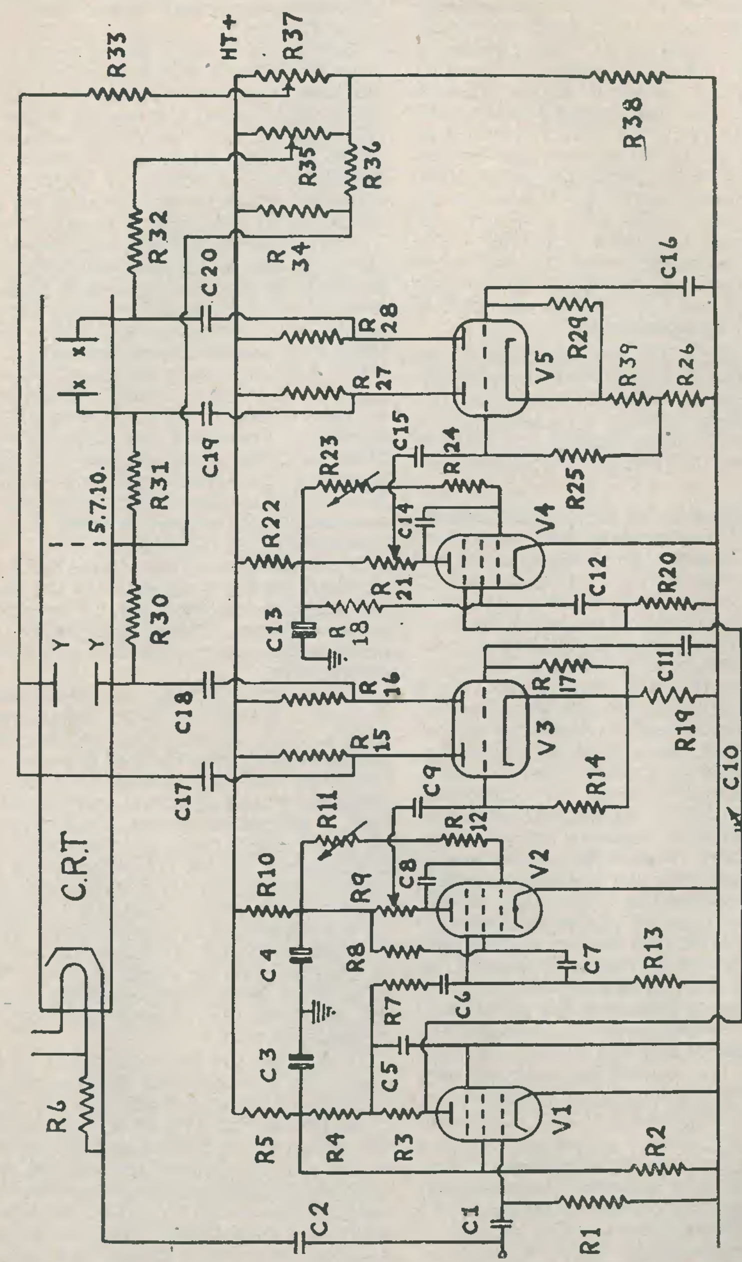
The chassis was a 26V Unit, which is a tuner with a large tapped coil, plus a beautifully made variometer, plus a spiral track tuning dial and accommodation for two 807's on the rear platform.

Incorporated on the chassis is a square aluminium screening box which fills the front deck. This was cut up to provide the tray shaped deck on which the four timebase valves are situated. The reason for leaving sides of about $1\frac{1}{4}''$ was to enable the writer to fit any auxilliary potentiometer which experiment might prove necessary. Although the final circuit no longer requires any of these appendages, during the "trim and try" stages various potentiometers and trimming condensers were bracketed to the sides, or flanges as they should be called.

The layout should be clear from the general illustration and the underside plan, Fig. 2. On the front panel, which is cut from the

COMPONENT VALUES—All resistors ½W unless otherwise stated

R1	1 MegΩ	R21	50 kΩ pot	C1	0.01 μF
R2	50 kΩ 1W	R22	12 kΩ 2W	C2	0.005 μF 2.5 kV
R3	20 kΩ 2W	R23	2 MegΩ pot	C3	8 μF 450V
R4	20 kΩ 2W	R24	500 kΩ	C4	8 μF 450V
R5	47 kΩ 2W	R25	1 MegΩ	C5	0.1 μF
R6	4 MegΩ	R26	20 kΩ 1W	C6	0.05 μF
R7	47 kΩ	R27	150 kΩ 2W	C7	0.06 μF
R8	100 kΩ	R28	150 kΩ 2W	C8	0.01 μF
R9	50 kΩ pot	R29	1 MegΩ	C9	0.1 μF
R10	68 kΩ 2W	R30	1 MegΩ	C10	60 pF variable
R11	2 MegΩ pot	R31	1 MegΩ	C11	0.1 μF
R12	500 kΩ	R32	1 MegΩ	C12	100 pF
R13	20 kΩ	R33	1 MegΩ	C13	8 μF 450V
R14	2 MegΩ	R34	47 kΩ	C14	100 pF
R15	150 kΩ 2W	R35	500 kΩ pot	C15	0.01 μF mica
R16	150 kΩ 2W	R36	47 kΩ	C16	0.25 μF
R17	2 MegΩ	R37	500 kΩ pot	C17	0.1 μF
R18	50 kΩ	R38	100 kΩ	C18	0.1 μF
R19	20 kΩ 1W	R39	3 kΩ 1W	C19	0.1 μF
R20	20 kΩ			C20	0.1 μF



VCR517 Timebase Circuit—Component values above.

aluminium box, are mounted the six potentiometers R9-11-21-23-35 and 37. Immediately behind are the two CV18's, separated by the electrolytic condenser C13. Next comes a paxolin panel, mounted upright, and on to which are wired the four anode resistors R15-16-27-28, and the deflector plate condensers C17-18-19-20. It should be stated at this point that the writer uses an earthed positive EHT, which enables the use of 500V working deflector capacitors. If you use an earthed negative EHT, then you must fit capacitors rated to handle your full EHT. Behind this assembly comes the two SP61 scanning generators, separated by another electrolytic C3 and C4. On the rear deck is situated the sync separator V1.

The writer does not follow the method shown in " Inexpensive Television " of incorporating the phase inverter and DC restorer on the timebase chassis, but has these components fitted to the 1355 vision chassis, the inverter standing where the original cathode follower was fitted.

Voltage supplies are led in at the rear through the medium of a Jones plug. The sync pulses are led in at the side of the chassis near to the separator valve by means of a plug and socket, the latter already existing on the 26V chassis. At the front end of the chassis, a circular hole will be found which can easily be opened up to accommodate an octal valveholder to which are wired the deflector plate leads. Final connection is by octal plug, the writer having found that plug connections enable the speedy uncoupling so necessary when experimenting.

Turning to the circuit proper, it will be noted that slight variations occur in component values compared with the original published circuit, as regards the separator and generator sections. These differences exist simply because they gave the best results in practice, and were arrived at after a great deal of trial and error. It is highly probable that any reader who builds off this diagram will find that he, too, may have to try modifications, and for that reason it is not recommended that too permanent a job be made of the initial connecting up of resistors and condensers. Get the desired picture first and then go all over the whole of the connections, making them sound. This advice should not be interpreted to mean that the first effort can be thrown together.

Concerning the two big amplifiers, differences here are to be expected, although they are few and exist mainly in the cathode circuits. The anode resistors differ, and are of 150 kΩ, simply because the writer happened to have spare four such components. The job might work just as well using 100 kΩ loads; the writer has not tried them, preferring to leave the bigger ones in as they help to keep the HT load down.

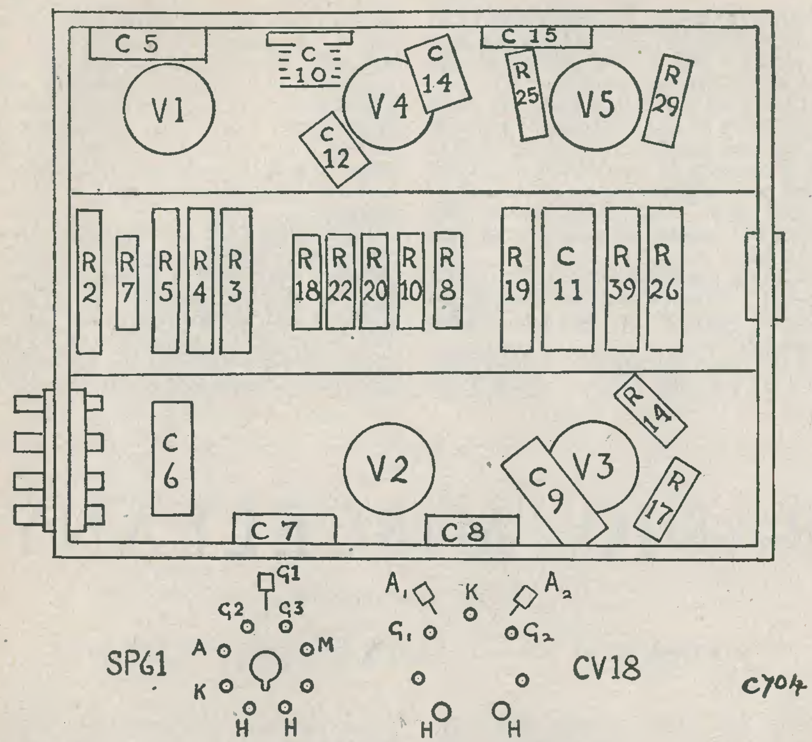
If reference is made to the 6SN7's in the original circuit, it will be seen that although they possess separate cathodes these electrodes are coupled together. It was this feature which prompted the writer to try the internally connected valve, but experiment showed that some modification was necessary. Starting with a common cathode resistor, the resulting picture was found to suffer from chronic fold-over on the line. The modification suggested in the second edition of the book was tried, that is, earthing the cathode direct and feeding the second half of the amplifier from a tap off the anode load of the first half. This did not effect a cure, and it was decided to try " wangling " it in the cathode circuit.

Referring to Fig. 1, it will be seen that there are two resistors in the cathode leg of the line amplifier. The values were arrived at by first fitting a 25 kΩ potentiometer—wire wound, of course—and after satisfactory results had been obtained, measuring the values and fitting the nearest fixed resistors to these values. It completely cured the fold-over.

The frame scan was not afflicted by fold-over, although the slight expansion of the top lines which is fairly common with the simple Miller circuit is evident. So far no attempt has been made by the writer to correct it as it is not too objectionable.

The anode loads to the SP61 scanning generators are shown to be 50 kΩ potentiometers. This is according to the original circuit, but as there were none in the workshop when this job was tackled substitutes were obtained by using 25 kΩ fixed resistors in series with 25 kΩ potentiometers, the former being at the HT end of the load. When the job was first switched on, the pots were turned to the " hot " end and an HT of 500V was applied to the two amplifiers. Using the tuning signal for the first try-out, it was found that the clock face just about filled the screen, the rest of the picture disappearing round the sides of the tube. Had the tube makers obliged by coating the walls, the result would have been three dimensional TV ! !

Turning the size controls back to their full extent left a picture still far too large, and optimum results were finally obtained with the 25 kΩ pots at the HT end of the anode loads and with the HT dropped to 350V. Needless to say, picture brilliance has suffered, as it is bound to do, and the next job will be to raise the EHT by about 1 kV. This increase must result in a considerable reduction in picture size, but the writer considers that there is an adequate reserve of deflecting power available to restore the position.



Underneath layout of timebase

One final modification in the signal feed to the tube was carried out and, whilst it has no bearing on the timebase proper, it was included in the circuit drawing as it proved most convenient to arrange the lead along with the connections to the deflector terminals on the tube holder. This modification takes the form of feeding the sync pulses to the cathode of the CRT, when the latter is grid modulated. Credit for the idea must go to an unknown author of TV experimenting, and this writer can personally vouch for the fact that it results in a very marked increase in tube sensitivity.

The feed condenser is C2, which has to be rated for the full EHT. Starting with an 0.1 μF which produced pictures with intense contrast—real soot and whitewash, in fact—the optimum results were obtained with a 0.005 μF after trying various sizes. This gave a decided picture improvement without weakening the sync pulse, and eliminated completely the fine haze which had previously been accepted as the price of long distance reception. The cathode must, of course, be disconnected from the heater of the CRT, if such connection has previously existed, and the two electrodes may be coupled through a 2 MegΩ resistor. It should be remembered that this resistance is a load on the sync pulse and must, therefore, be as high as conditions will permit.

In conclusion, the writer would offer the following comments,

(1) Condensers can make or break any timebase. After much trouble with the first job, every fixed capacitor was tested for leaks on a " Weemegger " before it was wired into this job. This instrument is not the ideal meter for the purpose, but was all there was in the shack and, judging by results, did a good job. 70 per cent. of the 0.1 μF condensers tested were discarded as their DC resistance was less than 1 MegΩ.

(2) Still on capacitors, the diagram shows an air spaced variable for C10. As this is a close spaced model, a fixed tubular of 0.001 μF was wired in series to remove the DC.

(3) It has been stated that the anode loads of the oscillators V2 and V3 are mixed potentiometers and plain resistors. It will save a lot of trouble if you stick to the original circuit and fit 50 kΩ pots, forgetting the combination of 25 kΩ pot and 25 kΩ fixed resistor. To encourage this course, the diagram has been drawn to suit.

(4) From the published figures on the CV18, a fairly heavy current drain was expected. In practice, the timebase takes less than the one using six SP61's.

(5) If the reader decides to try this circuit, it is not advised that he buys specially the resistors R26 and R39 at the values shown in Fig. 1. Experience has shown that results will vary between valves, and for a start a single 20 kΩ resistor is advocated, with the grid resistors R25 and R29 tied to the top end. If distortion exists, then replace the 20 kΩ with a wire wound potentiometer of similar value, with R25 connected to the centre terminal. A fully insulated pot is, of course, essential.

(6) Finally, if the unit construction method with plug-in leads is adopted, do not run the deflector plate leads in twisted flex, and keep them as short as possible. In an effort to obtain a neat job, the writer tried running his in a 5-core cable. It didn't work, as the line pulses were injected into the frame leads by inductive and capacitive effects, and vice versa.

RADIO MISCELLANY

CENTRE TAP talks about

CONTINENTAL TV — TRADE REVIEWS — RAMP?

I expect that many readers who have spent their holidays on the Continent this year have made a special point of seeing the higher definition TV systems in operation over there, and comparing them with what they are accustomed to seeing at home. Having seen TV in France, Germany, Holland and Denmark, I am far from satisfied that, for ordinary viewing purposes, the higher definition systems have any very real advantages.

With the B.B.C. lower definition transmissions, when seen at the normal viewing distance the lines on a properly adjusted receiver are lost. True, when one gets very close to the screen they are easily visible, and with the higher definition systems the tiny details look just that much better, but in actual practice one never sits that close to the screen.

Quite a number of returning holiday-makers enthuse over the picture quality of Continental TV, but in practically every instance one finds they are comparing Continental demonstration models with their own not-always-perfectly-adjusted domestic sets, which is a far from fair comparison.

On the 12″ tube on my home-built TV, I can practically eliminate the lines when viewed close up by using a slightly enlarged spot and, in doing so, still retain a sharpness that at a viewing distance of 3 feet is not perceptibly inferior to the definition given by "pin-point" spot focusing. With tubes over twelve inches, a spot wobbler (which necessitates the addition of only one valve) seems a very complete answer even for those curious people who seem to think the proper position for looking-in is to sit with their knees stuck right up to the set.

Unlicensed Viewers

Perhaps the luckiest viewers in Europe are the Swedes in the Malmo area who get their programmes for nothing. They have no transmissions of their own, so they look in on the Copenhagen programmes. The Danes joke that the Swedish viewers outnumber those of their own nationals, and judging by the number of aerials (horizontally polarised) which one sees in that area, this might well be true. English viewers would be rather surprised at the extent of its popularity, especially since the programmes are limited to three 1½-hr. transmissions per week. As the programmes are in the evening, they are all Studio affairs, and from what I saw of them they could have very well dispensed with the picture altogether. It certainly added but little to the entertainment value and, as far as I was concerned, it struck me that it was little more than sound broadcasting with a picture thrown in for luck. For that matter, some of the B.B.C. programmes tend that way.

Of course, the number of aerials visible from the street can be misleading. In my own particular district very few outdoor aerials can be seen, yet most houses have a set. Hence the wide publicity given to the Post Office Detector vans—not that my neighbours are any more prone to piracy than yours. There has always been a suspiciously long lag between the number of receivers sold (plus a very high percentage of home-built sets) and the number of licences taken out. In many areas only those who became viewers three years ago or earlier have outdoor aerials. Over wide areas the field strength is adequate for even ground-floor indoor aerials, and the absence of visible ones is no indication of the number of viewers.

Extremes in Willingness to Pay

I was told that the Swedish viewers were eager to pay a license fee to the Danish broadcasting authorities. This the latter were unable to accept, despite a natural unwillingness to turn away good money. In view of our own high number of alleged pirates, it may seem odd that anyone should be anxious to pay for a licence for which he was not legally liable, but no doubt it was hoped that the revenue would materially improve the programmes and increase the present very limited number of hours of transmission.

Last month in Canada the boot was on the other foot, when Canadian TV made its official debut in the south of Ontario. There, viewers have for years had their day-long TV programmes free of charge—from Buffalo, New York State. With the inauguration of their own TV they now have to pay a 15 dollar license fee whether they want to look at the C.B.C. programmes or not.

Worked out in hard cash, fifteen dollars is five pounds plus, so if they decide they ought to have some return for their money they are put to the additional expense of having their aerials, now pointing to Buffalo, made rotatable !

On Test

A novel suggestion was put forward by a reader in a recent conversation. He considers that tests of new apparatus carried out in the Laboratory, or by the Editorial staff of a radio magazine, are not always adequate from the user's point of view. In fact, he goes so far as to hint they often read like the sales-talk handed out by the manufacturer or his agent.

He proposes that the new receiver or component under review should be named in advance, and the opinions of ordinary purchasers be invited for publication some three months or so later. By this method, he suggests, intending purchasers would have a better opportunity of determining the merits and limitations of the apparatus as it behaved in semi-skilled hands after a more prolonged usage, and under more widely varying conditions.

He considers such a scheme would give intending purchasers more confidence as well as providing a truer indication of reliability under working conditions.

Many people harbour a suspicion that articles submitted for review are specially selected for that purpose, and thus he urges his scheme would eliminate such beliefs. Items "drawn from stock" through normal trade channels would be representative of the average, rather than the super-finished models used for exhibition or review purposes. Neither would the final report be limited to perhaps a single occasion, nor would it be assisted by expert adjustment.

While such an idea might well have advantages when reviewing such things as receivers, converters, etc., the "normal-user" valuation for many items of radio gear might on occasions prove more misleading than helpful.

The Garden Path ?

I have received a letter concerning a retailer —NOT an advertiser in *Radio Constructor*— who sent out postal circulars offering a most attractively priced ex-W.D. bargain. The reader duly forwarded his remittance and instead of the bargain he ordered, he received a brief note stating that the special line had been sold out and that his money had been placed in a credit account. Perhaps he would like to order goods from an enclosed list ? This list contained standard lines only—at standard prices, plus postage !

He wonders whether the original bargain was merely a bait, particularly as no other Surplus appeared in the lists.

This, of course, might well have been a genuine offer. I personally know of a recent bargain of which the advertiser sold the entire large stock within three days of the advertisements appearing. On the other hand, if it is a trick to induce custom for lines which might be bought far more conveniently locally, I will, on hearing from others who have been similarly "caught," take it up with the firm concerned.

Report on the

NATIONAL RADIO SHOW

by A.S.T.

The gradual disappearance of the component exhibitor at this exhibition was discussed in these pages last year. It is with some considerable perplexity that it must be stated that the eclipse is now virtually complete. Your writer can find no reason whatsoever for this. Probably at no previous time have so many amateurs followed the fascinating study of radio, television and electronics. Despite this, the radio show had deteriorated into a furniture display; one could wander around for hours before discovering anything to interest the constructor.

One redeeming feature of especial interest to our readers was the public appearance of the "Magna-View." We trust those of you who visited Earls Court were able to inspect the three models on view.

Two were complete in cabinets and working for all to see. The third, on the English Electric stand, was in chassis form, and a first-hand impression of its mechanical layout was thus available.

Representing the first large screen TV design presented by a radio periodical for the home constructor, it is not surprising that considerable interest was shown in these models. Northern and Scottish readers should take note that a demonstration model will appear in their areas; details will be given in this magazine when available.

As one might expect, television was the keynote of the Show again this year. It is surprising that projection TV seems to many manufacturers to be the solution to the search for large pictures. Surprising to your writer, because it is widely understood that in the U.S.A., where large sums of money were poured into projection, the public preferred large tube viewing, and in consequence projection had a speedy decline. Public reaction in this country must be judged, of course, by future events, and any improvements which may brighten the picture!

It is a definite conclusion of your writer that Earls Court sadly misjudged the public's interest in gadgets. There is no doubt that people do love action demonstrations, and the Show this year was sadly lacking in this respect. An exhibition of this type should show the "works," and the sponsors must realise that public interest is sustained to a large extent by items of "news value" in the Daily Press. But what did the public see? A "Radio Ideal Home Exhibition!"

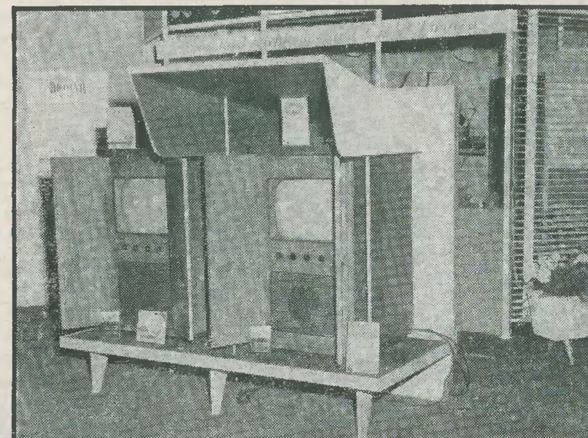
Nevertheless, there were some manufacturers possessed of enough vision to appreciate this trend. The three exhibitors of the "Magna-View" clearly expressed their realisation that the amateurs are well worth consideration. This was also confirmed to this magazine's representative by Officers of the Services on their stands. Quite clearly they were in no doubt of the value placed upon the amateur, and every facility was available explaining the highly technical and progressively scientific life in the Services today. As a side issue to Radar, Direction Finding, Guided Missiles, Communications, etc., readers will be interested to learn that "Ham" clubs are being formed in the Army; they already exist, too, in the R.A.F. Congratulations to Whitehall for possessing the vision to realise that a radioman's work is usually his hobby, too!

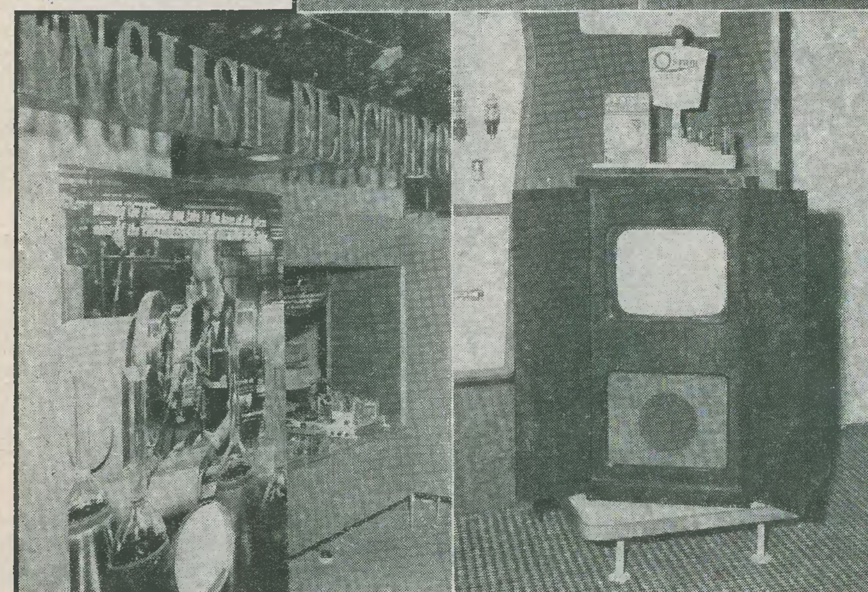
It was plainly seen that if a crowd collected, there was surely a gadget or a working demonstration. The Pye television phone and rotating camera, the G.E.C. demonstration of stereophonic sound, the Waveform CRT activater and emission tester, the Philips radio-controlled model boats exhibit, the Mullard assembly of ultra-miniature valves, the B.B.C.'s studio—all these were "crowd-pullers."

How nice it would be if there were an exhibition catering expressly for the radio constructor, in the same way as the R.S.G.B. show caters for the transmitting amateur!

THE "MAGNA-VIEW"

ON SHOW AT EARLS COURT





Top: Demonstration models on the Brimar stand. Bottom left: Chassis arrangements on view at the English Electric stand. Bottom right: Working model in the G.E.C. demonstration room.

D. COHEN

Radio and Television Components

MAINS TRANSFORMERS

These transformers are all famous radio manufacturers' surplus and are fully interleaved, impregnated and guaranteed.
Primary 200-250 v. P. and P. in each, **1/6** extra.
350-0-350 100 mA., 4 v. 4 amp., 4 v. 2 amp., upright or drop-through, **16/-**
300-0-300, 100 mA., 6 volt 3 amp., 5 volt 2 amp., **25/-.**
280-0-280, 80 mA., 6 v. 3 amp., 4 v. 2 amp., drop-through, **14/-.**
Drop-thro' 350-0-350 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., **14/6.**
280-0-280, semi-shrouded drop-through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., **16/6.**
Semi-shrouded, drop-thro', 280-0-280, 80 mA., 4 v. 6 amp., 4 v. 2 amp., **12/6.**

Auto-wound, H.T. 280 volts at 360 mA., 4 v. 3 amp., 2 v. 3 amp., or 6 v. 3 amp. Separates 4 v. 3 amp., rectifier winding (upright or drop-through), **10/6.**
350-0-350, 120 mA., 4 v. 4 amp., 4 v. 3 amp., drop-through, **21/-.**

Auto-transformer, various combinations of voltages including 110 v. 70 watts, and 3/4 volt windings at 1 amp., 2 volt 1 amp., drop-through or upright mounting, **10/6.**
250-0-250, 60 mA. 6 v. 3 amp., **12/6.**
250-0-250, 80 mA. 6 v. 4 amp., **14/-.**
Pri. 230 v. Sec. 200-0-200 35 mA. 6 v. 1 amp., **8/6.**
Pri. 200/250 v. secondary 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., **13/-.**

Heater Transformer, Pri. 2, 4, or 6 volts 2 amps, **7/6;** 230-250 v. 6 v. 1½ amp., **6/-;** 2 v. 2½ amp., **5/-.** P. and P. each 1/-.

P.M. SPEAKERS (Closed field)

	with trans.	less trans.
2½in.	—	**15/6**
3½in.	—	**13/6**
5in.-	**16/6**	**12/6**
6½in.	**16/6**	**12/6**
8in.	**18/6**	**15/-**

P. and P. on the above 1/- each. 10in., less trans., **25/-.** P. and P. 1/6.

R. and A. 8in. M.E. Speaker field coil, 1,600 ohms O.P. trans. 5,000 ohms, impedance, **18/6.** Post and packing 2/-. Rola 5in. P.M. with O.P. trans., **16/6.**

6½in. Energised Television Speaker by PLESSEY. Field resistance 68 ohms with hum-bucking coil. Will pass up to 300 mA., require minimum 200 mA. to energise. These are cheaper than a T.V. choke. **9/6** each, 2 for **18/-.**

Volume Controls, by famous manufacturer. Long spindle less switch, 50K, 500K, 1 meg., **2/6** each. P. and P. 3d. each.
B.T.H. Crystal Diode wire ends, **2/3,** post paid.
Expanded aluminium speaker fret, 13¼ × 9in., **2/-.**

Volume Controls by famous manufacturer. Long spindle and switch, ¼, ½, 1 and 2 meg., **4/-** each; 50 K, **3/6** each. Ganged control 3K and 5K, **3/6.** Post and packing 3d. each.

Trimmers, 5-40 pf., **5d.;** 10-110, 10-250, 10-450 pf., **10d.**

Ceramic P.F.S. 3 each of the following: 330, 220, 180 and 82, **2/6.**

Twin-Gang .0005 Tuning Condenser, 5/-. With trimmers, **7/6.** P. and P. 1/-.

WALNUT BAKELITE CABINET size 17¾ × 12 × 8in., complete with 3-wave band scale, size 8½ × 3½in., 5 valve superhet chassis with I.F., valve holder and transformer cut-outs, pointer, drum, drive spindle, 4 knobs, 2 scale clips, 3 pulley wheels, two brackets, scale pan and back. **DESPATCHED TO ENGLAND ONLY. 31/-,** post paid.

> SPECIAL OFFER—LIMITED QUANTITY
> **GARRARD THREE SPEED AUTOMATIC RECORD CHANGER UNIT,** Brand New Model RC72A, type RC72A/AC, A.C. mains 100/250 v. Complete with two pick-up heads. **£11/15/-,** post paid.

CONSTRUCTOR'S POLISHED CABINET. Size 10 × 6¾ × 5in. approx., supplied in flatted form, grooved and ready to glue together. Complete with plastic front, 3-valve chassis. size 8½ × 4 × 1½in., tuning scale, backplate and back. **10/-.** P. and P. 1/6.

TWIN-GANG AND PAIR OF TRF COILS with circuit to suit above, **8/6.**

EX-GOVT. MARCONI CR.100 COMMUNICATION RECEIVER COIL UNIT, 10-5,000 metres (approx.) in 6 bands complete with 4-gang condenser, 5 I.F.s, 1 BFO osc. coil and crystal, **27/6.** P. and P. 3/-.

MAINS TRANSFORMER, semi-shrouded drop-through 200/250 v. primary; secondary 280-0-280 250 mA., 6 v. 6 amps., 5 v. 3 amps., **29/6.** P. and P. 3/-.

EXTENSION SPEAKER CABINET in polished walnut. Size 15¼ × 13 × 7½in., complete with Elac 10in. P.M., **35/-,** plus 2/6 post and packing. This cabinet would accommodate 1155 power pack.

WATERHOUSE 5in. EXTENSION SPEAKER, complete with vol. control, in gold and green, **22/6.** P. and P. 1/-.

CONSTRUCTOR'S PARCEL comprising chassis 8in. × 4in. × 1½in., with speaker and valveholder cut-outs, 5in. P.M. speaker with transformer, twin gang with trimmers, pair T.R.F. coils long and medium, iron-cored, four valveholders. 20 K. volume control and wave-change switch, **23/-.** P. and P. 1/6.

6 IRON-CORED COILS on Aladdin formers 13.5-50 metres, 198-550 metres, 950-2,000 metres. Tuned with a .0005 gang, I.F. frequency 465 Kc. Complete with circuit, **8/6.**

> **MAINS OR BATTERY SUPERHET PORTABLE COILS.** Comprising medium-wave frame aerial and long-wave loading coil, used as aerial coils. Midget iron-cored screened L/M osc. coils, complete with circuit I.F. frequency 465 Kc., **9/6.**
> **465 K.C. MIDGET I.F.s.** Q 120, size 1½in. long, 1in. wide, ⅜in. deep by very famous manufacturer. Pre-aligned adjustable iron-dust cores, per pair, **12/6.** Both these items £1, post paid.

OUTPUT TRANSFORMERS. Standard type 5,000 ohms imp., 2 ohms speech coil, **4/9;** 42-1 speech coil 2-ohm with extra feed-back winding, **4/3;** Miniature 42-1 2-ohm speech coil, **3/3.** Multi-ratio 3,500, 7,000 and 14,000 2-ohm speech coil, **5/6.**
TWIN-GANG .0005 with separate 75 pf. on each section for S.W. tuning with feet, size 3¼ × 3 × 1⅝in., **6/6.**

TELEVISION CHASSIS: Size 9¾ × 9½ × 3¼in., 18 gauge steel cadmium plated complete with 5-coil cans size 1¼ × 1in. with iron-cored former. These are wound for television frequency, **6/6.** P. and P. 1/6.

PUSH-BACK CONNECTING WIRE. Doz. yds. **1/6** post paid.

STANDARD WAVE-CHANGE SWITCHES. 6-pole 3-way, **2/-** 4-pole 3-way, **1/9;** 5-pole 3-way, **1/9;** 3-pole 3-way, **1/9;** 9-pole 3-way, **3/6;** Miniature type, long spindle, 3-pole 4-way, 5-pole 2-way, 4-pole 3-way, **2/6** each. P. and P. 3d.

LINE CORD. 3-way 0.3 amp. 180 ohms, per yard, **1/3** per yard.

TELEVISION COILS wound in alican, size 2⅜ × ⅞in. with former and iron core, **1/-** each.

32 mfd., 350 wkg.	2/6
16 × 24, 350 wkg.	5/-
4mfd., 200 wkg.	1/3
40 mfd., 450 wkg.	3/9
16 × 8 mfd., 500 wkg.	5/-
16 × 16 mfd., 500 wkg. extra	5/9
8 × 8 mfd., 450 wkg.	3/6
1 mfd., 500 v. wkg.	1/6
32 × 32 mfd., 350 wkg.	6/-
32 × 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	3/3
8 mfd., 500 v. wkg., wire ends	2/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v. wkg., wire ends	1/9
10 × 6 × 2 × 2 mfd., 500 v. wkg.	5/-
50 mfd., 250 v. wkg.	1/9
Ex-Govt. 8 mfd., 500 v. wkg., size 3½ × 1⅜, 2 for	2/6
60+100 mfd., 280 v. wkg.	7/-
16 × 32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
4+4+4 mfd., 350 wkg.	2/6
8 mfd., 150 wkg.	1/6

Frame Oscillator Blocking Transformer, 4/6.
Frame O.P. Transformer. Inductance 10 hy. ratio 10: 1, **9/6.**
Tube Mounting Bracket, size 9½ × 4¾in., with 4¾in. dia. cut-out, in 18 gauge cadmium plated steel and 12in. tube clamps, **2/-.**
Smoothing Choke, 2 henry 150 mA., **3/6.**
Smoothing Choke, 250 mA. 4 henry, **5/-;** 250 mA. 5 henry, **6/-.**
P.M. Focus Unit for Mazda tube, **15/-.** P. and P. 1/6. Similar to above with front adjustment, 2/6 extra.
P.M. Focus Unit for any 9in. or 12in. tube, 35 mm. neck, except Mazda 12in., state tube **12/6.**
Similar to above but with front adjustment, 2/6 each extra.
Ion Traps for Mullard or English Electric Tubes, **5/-,** post paid.
Pre-Aligned Midget 465 Kc. Q. 120, **9/-** per pair, post 6d.
465 Kc. I.F.s, size 2½ × 1⅜in. Q.110 removed from American equipment, **5/-** per pair.
Iron-Cored 465 Kc. Whistle Filter, 2/6.
Standard 465 Kc. I.F.S. Q.120, iron-cored, 3½ × 1⅜ × 1⅜in., per pair, **9/6.**
Television Masks. White Rubber, 9in. with glass, **7/6.** Cream rubber, 12in. with armour plate glass, **15/-;** 15in. white rubber mask, soiled, **12/6,** plus 1/6 P. and P.
Valve Holders. Paxolin international octal, **4d.** each. Moulded international octal, **7d.** each. EF50 ceramic, **7d.** each. Moulded B7G, slightly soiled, **6d.** each, B8A, **7d.** each.
Two-piece Octal Screening Can, 9d. P. and P. 3d.
Three-bank, 50 pf., **1/3.** Four-bank, 50 pf., **1/8.**
AMPLIFIER CHASSIS, 18 gauge aluminium, 5 valve holders, transformer and 2 electrolytic cut-outs, size 11½ × 7½in., sloping front, **4/-** each.
Twin Gang Midget .00037 with perspex, dust-cover and trimmers, **8/6.** Post and pkg. 6d.
Mains Droppers, 0.3 amp., 460 ohms, tapped 280 and 410, **1/6;** 0.2 amp., 717 ohms, tapped at 100 ohms, vitreous, **1/6;** 0.3 amps., 950 ohms, tapped 700 and 825, **2/6;** 0.2 amp., 1,000 ohms, vitreous, tapped, **2/6.** Vitreous .3 amp., 700 tapped 680, 640, 600, **3/6.** P. and P. on each 3d.
3-gang .0005 with separate 75 pf. on each section for S.W. tuning with feet, size 4¾ × 3 × 1⅝in., **7/6.**

> **AVAILABLE SHORTLY.** Kit of parts for Signal generator. Coverage 110 Kcs.–320 Kcs., 320 Kcs.–900 Kcs., 900 Kcs.–2.7 Mcs., 2.75 Mcs.–8.5 Mcs., 8.5 Mcs.–20 Mcs. Metal case 10″ × 6¾″ × 4¼″, size of scale 6½″ × 3¼″. 2 valves and 1 rectifier valve, AC mains 230/250. Internal modulation 400 cps to a depth of 30 per cent. Frequency calibration accuracy plus or minus 1 per cent. Modulated or unmodulated RF output continuously variable 100 milivolts. **£3/10/0,** P. and P. 4/–. This includes the return to us for checking and calibration, or we will build it for 15/– extra.
> Line E.H.T. Transformer EY 51 rec. winding 5Kv., and scan coils, low line high impedance frame removed from chassis. P. and P. 1/6, **25/–.** Smoothing Chokes, 40mA, **3/–;** 60mA, **4/9;** 100mA, **7/–.**

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/- up to 10/-, 1/6 up to £1, and 2/- up to £2. All enquiries and Lists. S.A.E.

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QUALITY FEEDER UNIT *for the* VHF FM PROGRAMME

by G. BLUNDELL

The receiver to be described in these articles is intended for the serious amateur or anyone interested in really high quality programmes free of interference.

This receiver requires a power pack, audio amplifier and output stage to make it complete. It is recommended, though, that a really good amplifier and speaker be used for quality results. The writer is using a Williamson type of amplifier and a double speaker consisting of two horns, one for high frequencies and the other for low. With this, on a good studio programme, the results are considerably better than those obtainable from any medium wave programme or any of the new gramophone records. A small amplifier giving about 6 watts output at very low distortion will be featured in a later article.

As the medium waves are already overcrowded, the local programmes of the future will be broadcast on very high frequencies of about 90 Mc/s. Due to the fact that there are no reflections of these waves from the electrified layers above the earth, stations using the same frequency and spaced about 200 miles apart will not interfere with each other. The overcrowding problem will therefore never arise. The area covered by the B.B.C. station at Wrotham is shown in Fig. 1, and is seen to be as large as from a normal medium wave transmitter.

The B.B.C. have recently announced their decision to use " FM " for local programmes, and so it is worth while summarising the various points of the controversy which has been going on for the last few years. In passing, it should be noted that the new television masts at Sutton Coldfield, Holme Moss, Kirk o' Shotts, and Wenvoe are all fitted with slot aerials capable of radiating three FM programmes simultaneously, and the area covered will probably be about the same as the television area.

The AM—FM Controversy

To recap a little, Frequency Modulation is the method of transmitting a programme by varying the frequency. Maximum frequency change or " deviation " corresponds to maximum loudness and is ± 75 kilocycles in the present system. Amplitude modulation, of course, consists in altering the power output of the transmitter to send the programme. Maximum power only occurs on the loudest passages, and so full use is not made of the transmitter. The FM transmitter, however, is always radiating full power. Since we are not interested in changes of amplitude, the FM receiver contains a limiter stage which is cutting the signal all the time. Interference behaves like an amplitude modulated signal, and if it exceeds the evel of the carrier it is chopped off in the limiter stage. Any interference left is then balanced out in the discriminator stage.

Impulse Interference

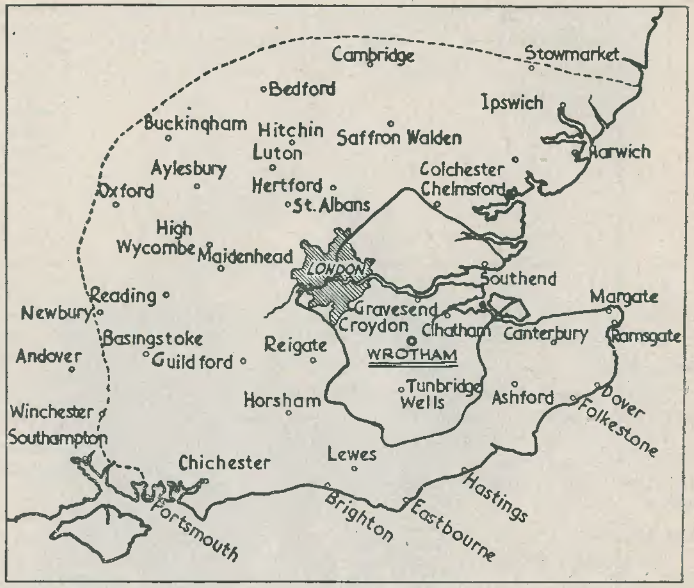
Until all forms of electrical appliances are fitted with suppressors (cars, switches, motors) this form of interference is annoying on either system of modulation. Good noise limiters which follow the shape of the programme modulation can be made to work very well on AM receivers. Under heavy interference both systems function about the same.

Under slight interference the FM receiver works very much better due to its capability of balancing out AM components.

Background Hiss

The FM receiver again is much better due to its AM balancing characteristics. Background hiss sounds like rain falling on a glass roof and may be thought of as consisting of random modulated frequencies. These frequencies have an FM component but this is much less troublesome. The only way to overcome this on the AM system is to provide a stronger signal by increasing the transmitter power.

Map showing the range of the FM Feeder Unit. Two IF stages are necessary in the area enclosed by the dotted line. One IF stage may be deleted, as described in the text, from receivers to be used in the area enclosed by the solid line.



C791

On these two points the FM system is considerably better than the AM system. It should be noted that an AM receiver fitted with a good noise limiter is as complicated and expensive as the equivalent FM receiver. On all the other points which are often brought up there is really very little difference.

Service Area

The FM receiver works well with lower signals than the AM set. However, an extra valve will probably be required to increase the gain, and if for example there were a large number of sets in the fringe area it might be cheaper to increase the power of the transmitter.

Bandwidth

FM stations use ± 75 kc/s, and to prevent mutual interference will probably be spaced 250 kc/s apart. This is a little different to the 9 kc/s spacing given to medium wave stations ! The AM station would, of course, need only ± 15 kc/s to send the programme, but the usual noise limiters rely on having a bandwidth much wider than this. When the effects of the drift of the oscillator frequency are also taken into account, the station spacing could not be much less even if AM were used.

Emphasis and De-emphasis

In a typical programme, the power at the high frequency end of the musical scale is much less than at the low frequency end. The high frequencies are therefore boosted at the transmitter and reduced again at the receiver. This top cutting at the receiver also reduces high frequency components of the background hiss and interference. The total response of the receiver is therefore still flat. In the past, results have been claimed for FM which were not entirely justified, as this method of reducing noise can be used on either system and should not, therefore, enter into the controversy.

Cost of the Receiver

A cheap FM set can be made without all the refinements of limiters and discriminators, and will probably be featured in a later article. A typical method is to detune one of the final IF circuits so the FM varies in amplitude as its frequency changes. A normal AM detector can then be used and there is then no difference in cost between the two receivers. This is, in fact, now being done on the FM system in use on the Continent. It is claimed that this simplified type of receiver is cheaper than a normal medium wave set. The advantage lies

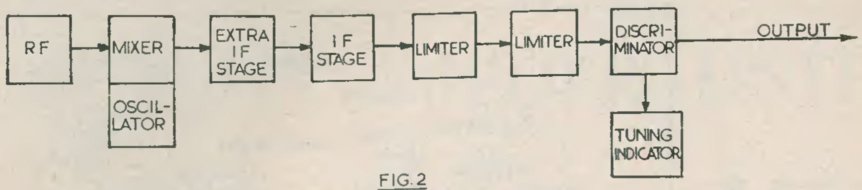


FIG. 2
BLOCK DIAGRAM

C792

in the fact that expensive sets can be used which will then do full justice to the system.

Distortion

Listening tests show very little difference in quality between the two B.B.C. stations on 91.4 and 93.8 Mc/s radiating the AM and FM programmes. However, we understand that the distortion is slightly lower on the FM system.

The Receiver

The block diagram, Fig. 2, shows the complete high gain receiver which is capable of working anywhere within the area enclosed by the dotted line on the map in Fig. 1. If the set is to be used in the area enclosed by the full line, an IF stage can be left out.

Although living 30 miles from the station, the writer is using 2 IF stages and getting very successful results on an indoor aerial lying on top of a wardrobe.

The double limiter stage is a refinement, but in the writer's opinion is well worth having.

Due to the high gain of the 2-IF set, a loud hiss can be heard when the set is not tuned to a station. This, of course, vanishes when a station is tuned in and does not matter. The second limiter, however, removes this hiss and makes the receiver quiet between stations.

The circuit diagram is shown in Fig. 3, and the boxed area indicates the section which may be left out, corresponding with the block diagram.

It is recommended that small high-gain valves are used, such as the Brimar 6AM6, Osram Z77, or the Mullard EF91. EF50's can be used, but trouble may be experienced with instability due to the longer leads.

One of the heater connections should be made through the chassis, and this is done by earthing Pin 4 in the B7G valve. This particular pin should be earthed as it helps to shield the heater wiring from the anode circuits; coupling along the heater circuit may otherwise cause instability.

The gang condenser and dial are available from Jackson Bros., Ltd., of Kingsway, Waddon, Surrey. The front double section of the gang condenser is used for the oscillator section, while only the middle half of the back section is used to tune the anode.

Care should be taken to keep all leads reasonably short, but special care must be taken in the layout of the oscillator and tuning section. The optimum coupling between the oscillator and mixer coils is achieved by spacing them ¼" apart.

The aerial coil is not tuned by the gang condenser. The loss of gain at the edges of the band is only slight, due to the heavy damping on this circuit by the aerial and also the grid of V1. The condenser marked "A" in Fig. 5 should not have appeared, the coil being connected straight to the aerial input socket as shown in the circuit.

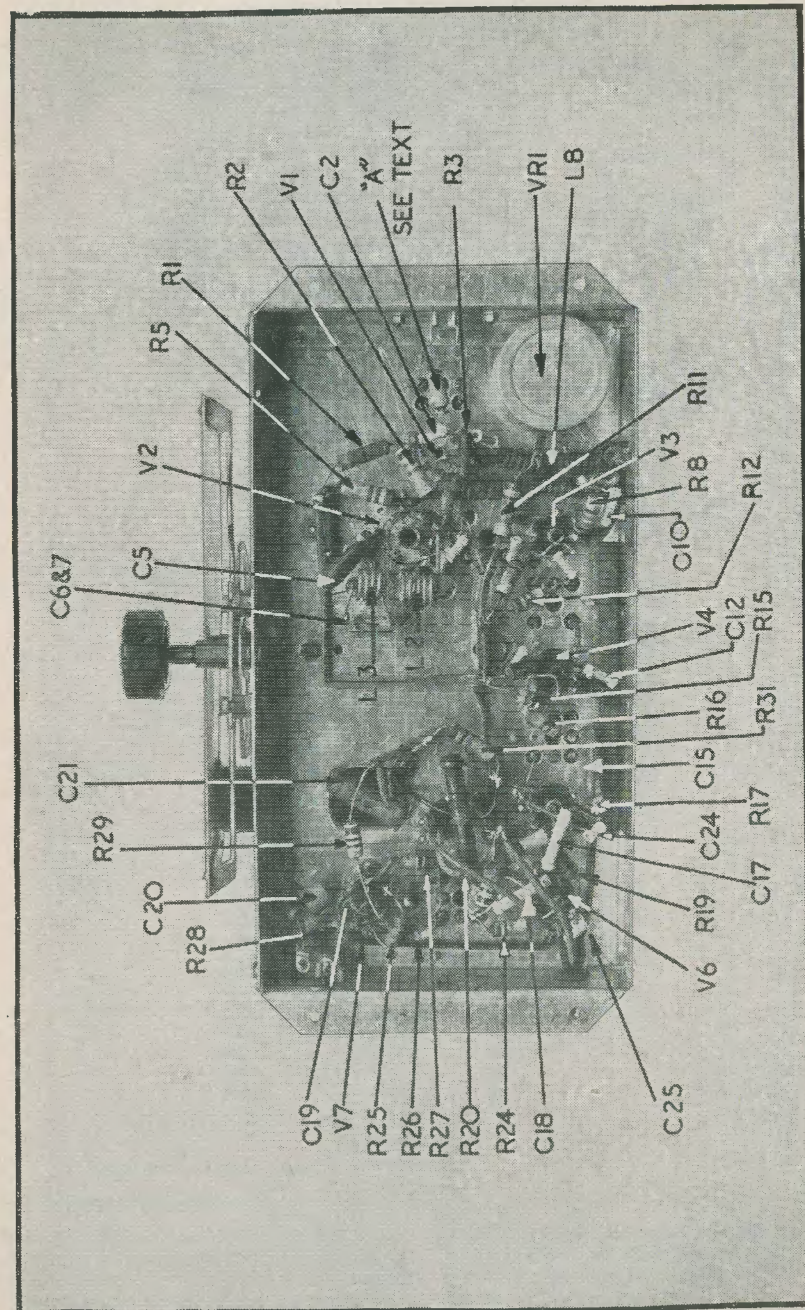
As some of the coils may be difficult to wind, we are pleased to say that they will be available from Radius Radio, 3 Homer Street, London, W.1.

In particular, the overall distortion of the receiver is governed by the accurate balance of the windings in the discriminator transformer.

A high IF frequency of 20 Mc/s has been chosen to minimise spurious responses. The high oscillator frequency is also used to put the second channel response in a region where there are not likely to be any powerful transmitters. For example, when receiving a station on 90 Mc/s, the oscillator frequency is 110 Mc/s and the second channel response is at 130 Mc/s. If the low oscillator frequency of 70 Mc/s were used the second channel would be at 50 Mc/s, just outside the London Television band.

The grid of the limiter valve is tapped down the limiter grid coil L6B in order to minimise capacitive changes caused by varying limiter voltages, and also to minimise the damping on this circuit caused by the grid current of the limiter.

When using two IF stages the sensitivity of the set is about 25μV for good limiting action of the limiter valve. This represents about 2



Underneath view identifying main components—the top layout is illustrated on this month's cover.

RECOMMENDED COMPONENTS

Condensers

C1	1000 pF	ceramic 350 VW	T.C.C.
C2	1000 pF	,, ,,	,,
C3	5 pF	,, ,,	,,
C4	1000 pF	,, ,,	,,
C5	47 pF	silvered mica	,,
C6	5 pF	,, ,,	,,
C7	5 pF	ceramic N780	,,
C8	1000 pF	,, 350 VW	,,
C9	1000 pF	,, ,,	,,
C10	4700 pF	,, ,,	,,
C11	1000 pF	,, ,,	,,
C12	4700 pF	,, ,,	,,
C13	1000 pF	,, ,,	,,
C14	1000 pF	,, ,,	,,
C15	47 pF	silvered mica	,,
C16	22 pF	ceramic 350 VW	,,
C17	4700 pF	,, ,,	,,
C18	4700 pF	,, ,,	,,
C19	50 pF	,, ,,	,,
C20	100 pF	,, ,,	,,
C21	0.01 μF	paper 350 VW	,,
C22	1000 pF	ceramic 350 VW	,,
C23	1000 pF	,, ,,	,,
C24	1000 pF	,, ,,	,,
C25	1000 pF	,, ,,	,,
C26	50 pF	,, ,,	,,

Resistors (all ¼W ± 20% unless otherwise stated)

R1	1.5 kΩ	Erie	Type 8
R2	4.7 kΩ	,,	
R3	150 Ω	,,	
R4	680 Ω	,,	
R5	20 kΩ ½W	,,	Type 9
R6	47 kΩ	,,	
R7	1.5 kΩ	,,	
R8	10 kΩ	,,	
R9	33 Ω	,,	
R10	100 Ω	,,	
R11	0.5 MΩ	,,	
R12	1.5 kΩ	,,	
R13	150 Ω	,,	
R14	10 kΩ	,,	
R15	1.5 kΩ	,,	
R16	47 kΩ	,,	
R17	47 kΩ	,,	
R18	4.7 kΩ ½W	,,	
R19	2.2 MΩ	,,	
R20	22 kΩ 1W	,,	
R21	10 kΩ ½W	,,	
R22	470 Ω	,,	
R23	47 kΩ ½W	,,	
R24	10 kΩ (already in can)		
R25	33 kΩ	,, ,, ,,	
R26	100 kΩ	Erie	
R27	100 kΩ	,,	
R28	470 kΩ	,,	
R29	1 MΩ	,,	
R30	1 MΩ	,,	
R31	20 kΩ ½W	,,	
R32	100 kΩ	,,	

Tuning Condensers (already in coil cans when purchased)

T.C.1	33 pF	silvered mica	± 20%
T.C.2	33 pF	,, ,,	,,
T.C.3	10 pF	,, ,,	,,
T.C.4	33 pF	,, ,,	,,
T.C.5	10 pF	,, ,,	,,
T.C.6	33 pF	,, ,,	,,
T.C.7	68 pF	,, ,,	,,
T.C.8	47 pF	,, ,,	,,
T.C.9	15 pF	,, ,,	,,

Gain Control
VR1 20 kΩ

Tuning Condenser
2 gang split stator 4–35 pF per section from Jackson Bros. (London) Ltd., Kingsway, Waddon, Surrey.

Dial
Full vision drive Cat. No. 2154 fitted with scale No. 4838, Jackson Bros.

Tag Mounting Strips
3 single, 2 double.

Valves

V1	Brimar	6AM6	Osram	Z77
V2	,,	12AT7	,,	12AT7
V3	,,	6AM6	,,	Z77
V4	,,	6AM6	,,	Z77
V5	,,	6AM6	,,	Z77
V6	,,	6AM6	,,	Z77
V7	,,	6AL5	,,	D77
V8	,,	6U5G	,,	Y61

Mullard EF91
,, ECC81
,, EF91
,, EF91
,, EF91
,, EF91
,, EB91
,, EM34
(not direct equivalent).

Coils
Radius Radio. Deal Component Co.

volts, and it may be measured by inserting a microammeter in series with the chassis end of R17. A small condenser should be connected across the ends of the meter leads close to the chassis. The reading should be about 40 μA. In practice this meter is not necessary, and the limiter current may be set by listening to the output and turning the sensitivity control just past the point where distortion vanishes.

(To be continued)

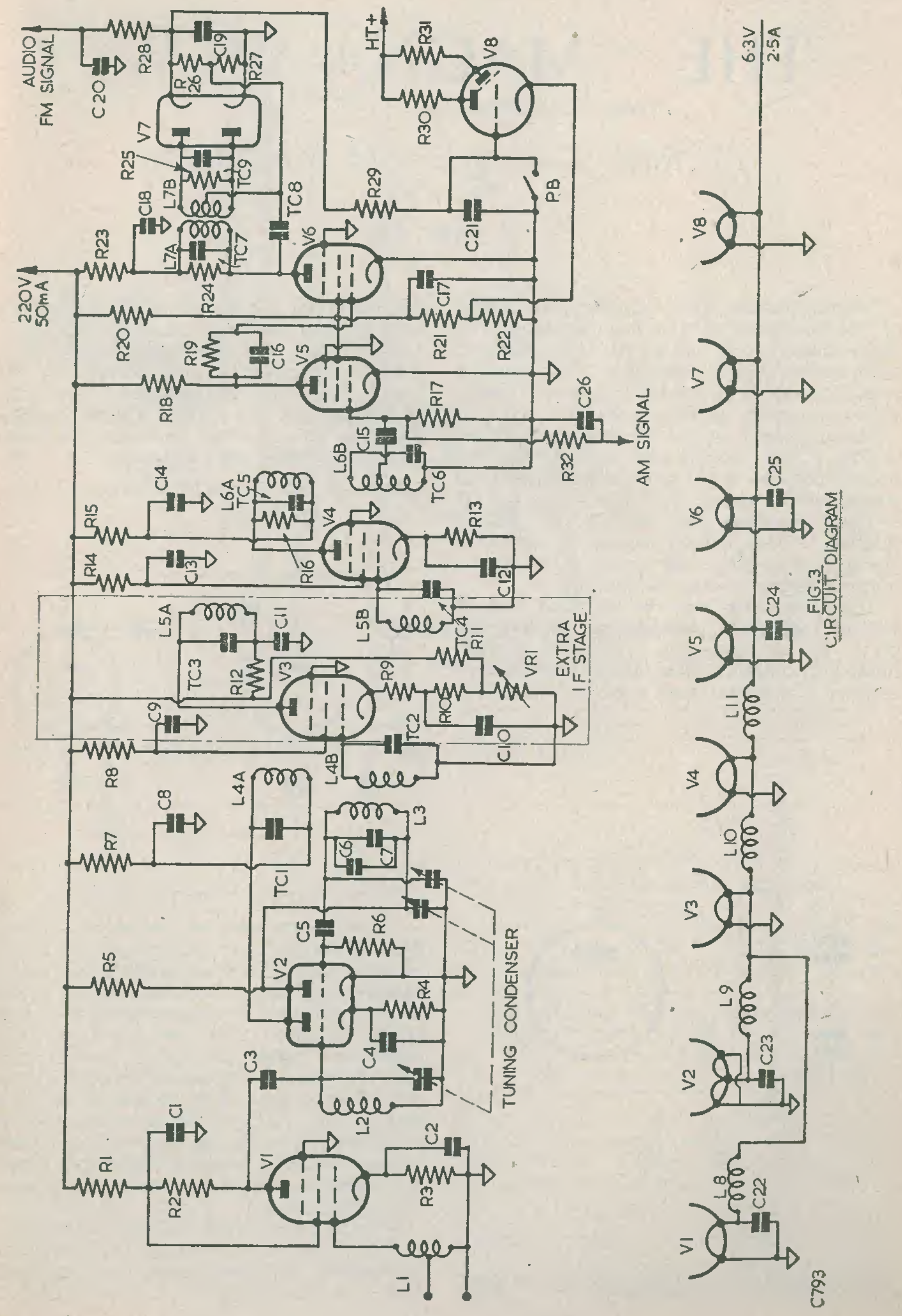


FIG. 3 CIRCUIT DIAGRAM

C793

THE "MAGNA-VIEW"

The Radio Constructor's 16 inch Televisor

PART 9

Several readers have requested an outline of the functions of the line oscillator and sync-separator. It is hoped the following brief review will at least give the interested ones the analysis for further reference to books with more space for these subjects.

The grid-input type of sync-separator shown in Fig. 1 relies on the grid current taken on the positive tips of the sync pulse charging the condenser C, causing the valve to be cut off by this negative bias during the picture interval.* This circuit produces negative-going sync pulses. The screen (G2) acts as a shield between input and output.

This procedure may be adopted just as well by feeding the cathode and earthing the grid. The grid now acts as a shield between input and output. Shielding in one form or another is essential, and it is for this reason that pentodes are usually employed as sync-separators in preference to diodes etc.

Referring to the sync-separator used in the *Radio Constructor's* Large Screen TV, now known as the "Magna-View," the anode voltage is kept low by the resistance divider R14 and R13 in order to make the limiting of the sync pulse more effective.

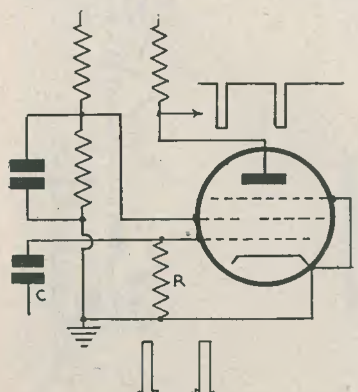
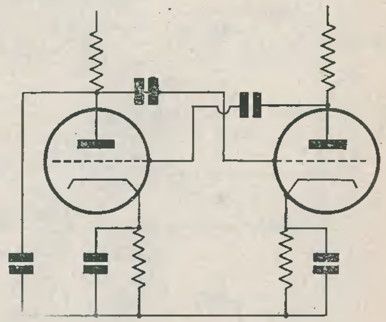


FIG 1. C801



C802

The disadvantages of the triode limiter is that the resistance in the cathode (R12) must be high to make the limiting effective. Unfortunately, this high value reduces the current in the valve and so makes only a low power pulse available at the anode. In order to make this pulse suitable a normal phase splitter is used. The values for R15 and R16 are chosen so that when the grid of the second half of the 12AU7 is connected to the sync valve anode directly, the current in the phase-splitter is normal, and as a result both positive and negative-going pulses are available across low resistances.

Referring now to the DC restoration section of the circuit, it can be seen at once that the relationship between cathode and grounded grid is in fact a diode.

*Readers should study detailed description of transmitted waveform in "*TV. Fault Finding.*"

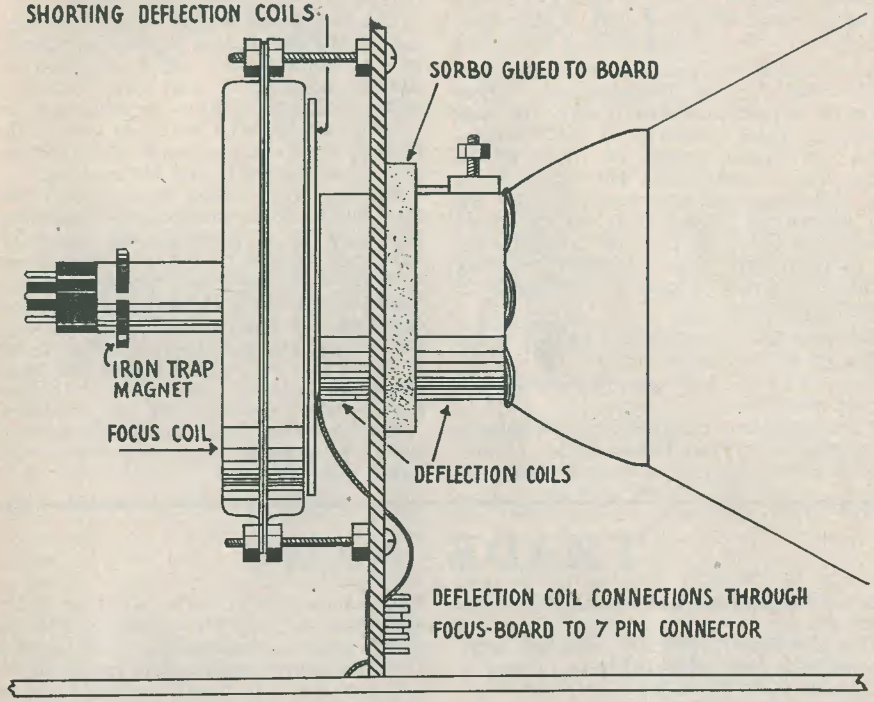


FIG.3. IMPROVED VERSION OF REAR FOCUS BOARD C803

Turning now to the time-base circuit, the line oscillator is, of course, the multivibrator type. The fundamental principle is shown in Fig. 2. In the circuitry used in the "Magna-View" the electrode connections have been re-arranged in order that one anode is available for charging and one grid for sync-pulse input. The efficiency of the time-base depends almost entirely on the Booster-Damper circuit. The 6U4GT rectifies the oscillation during the fly-back period, and provides the current for the following first part of the scan, and in addition the rectified voltage is joined in series with the normal HT rail supply.

Thus the driver valve is made efficient. The line output transformer is virtually an auto-transformer and it may be said that providing the rectifier filament is heated the drive winding is functioning. The EHT winding and rectifier could be reasonably tested by holding a neon bulb near the RF generated at this point. The neon will at once glow if these windings are intact.

Readers switching on for the first time may be concerned by the interaction of controls in the time-base. This is due to the various points deriving the additional supply from the diode recovery circuit.

Thus variation of the drive control will necessitate a new setting of the line-hold, and the frame, similarly, will require readjustment.

Reference to the circuit will explain this at once.

One reader has requested some guidance on the approximate position of the drive-control (VR5). This may be established from the picture itself. Over-drive will be seen as two white perpendicular bars in the centre of the screen and VR5 should then be turned down until any compression in the centre is removed. On no account should the line-output transformer fixing arrangements be interfered with, and it is quite important that the base of this component be securely held to chassis. Excessive " squeal " may be traced to causes through neglect or mishandling of this component.

Advantage should be taken of the improved design used for the deflection-coils. These are quite different in exterior finish to the early prototypes made available for the " Magna-View." Reference should be made to the sketch Fig. 3 and to the Feb/March issue. The deflection-coils now pass through the rear supporting focus-board and in consequence the focus-coil may be brought right up to them with some considerable saving of tube-neck space. Please note the insulating separating washer.

This new plan is particularly helpful in the setting up of the English Electric T901 which has a short neck and requires a single-field ion-trap magnet.

It cannot be over-emphasised that to obtain the maximum brilliance and resolution obtainable, if correctly set-up, from the T901, the ion-trap should be accurately located. The additional space provided by this modification renders that task exceedingly simple.

The dust-proof design which has been a feature of these series is maintained effectively by the sorbo-rubber which is glued with suitable adhesive to the focus board and pulled fairly tight around the deflection coils.

Note—do not stick sorbo to coils. These must be free to rotate, in order that the picture may be set vertically and horizontally.

Readers who visited Earl's Court radio show will no doubt have noticed this improved design on the English Electric stand. The fixing-bolt on top of the coils may be used if required for permanent fixture or to suit the individual design adopted. It is realized, of course, that many of our readers will apply their own ingenuity to the Magna-View. Denco (Clacton) Ltd., have informed us that insulators specially made for the English Electric tube installation are now available.

The improved design given above will not affect the constructor in any way, and is highly recommended.

TRADE NEWS

Denco (Clacton) Ltd., Old Road, Clacton-on-Sea, Essex.

The following wide-angle scanning components have been submitted to us for test:—

Deflection Coil Assembly WA/DCA1
Focus Coil WA/FCA1
Line Linearity Coil WA/LC1
Width Control Coil WA/WC1
Frame Output Transformer WA/FMA1
Line Output Transformer WA/LOT1
Frame Blocking Transformer WA/FBT1

This equipment was installed and tested in the " Magna-View." Complete scanning was obtained, free of shadowing effects. No deflection defocusing was observed. The picture was accurately disposed around the vertical and horizontal planes. The linearity and width controls functioned over a wide range, and some advantage is expected from this where timebase components are outside the specified tolerance ratings.

A slightly different setting for Frame Hold was noted, but this was well within the swing of the potentiometer. Frame linearity was good.

The focus coil has rather a strong influence on picture polarity, but merely rotating the deflection coil unit re-establishes the correct setting.

The line output transformer matches the deflection coils, with no apparent distortion. This transformer will be supplied with a 6.3V winding. Thus, the EY51 or R12 is recommended as EHT rectifier. The peak inverse working conditions are much improved. The EHT supply had excellent regulation.

Conclusions. Eminently suitable for the " Magna-View."

Westinghouse Brake and Signal Co., Ltd.

A re-examination by the above company of their rectifier ratings has shown that either the 14A/100 or 14A/86 is perfectly satisfactory for the " Magna-View " (250V 180 mA).

The 14A/342 previously specified is at least 50 per cent. more efficient than is necessary, and the use of the 14A/100 or 14A/86 will effect considerable financial saving.

Readers intending to use a composite TV, i.e., different vision and sound strips, should note the current requirements of these and select whichever rectifier is suitable. The ratings are given below.

14A/342	14A/100	14A/86
Max Input, 260V AC	260V AC	240V AC
Max. output, 300 mA	200 mA	200 mA
Price, £1.17.2.	£1.5.10.	£1.3.4.

The output DC voltage is dependent upon the value of reservoir condenser used. For the " Magna-View," the average value is 32 μF.

QUERY CORNER

A "Radio Constructor" Service for Readers

Video Stage Compensation

I have noticed that two types of frequency compensation are used in the video stages of television receivers. The first is the so-called cathode compensation, and the second the anode compensated circuit using one or more inductors. Which of these two arrangements is considered to be the better ?

K. Knowles, (*Uxbridge*).

First let us take a look at a video amplifier circuit and consider what is meant by the term " compensation," and the reason for its use. Figure 1 shows a typical video amplifier which at first glance appears to be any ordinary R-C coupled audio stage. The difference, however, is that the video amplifier must handle a range of frequencies from zero up to about 3 Mc/s, and it is very important that it should have a reasonably flat frequency response between these limits. This latter requirement is the one which is most difficult to achieve in practice.

If the video amplifier had no compensatory arrangement the stray capacitances across the input and output circuits of the valve would cause a falling off in the amplification as the signal frequency is increased. The reason for this will be obvious if we consider the effect of the unwanted or stray capacitance which exists across the anode load. The value of this capacitance may well be 30 pF. Now, taking a signal frequency of 2 Mc/s, the reactance of a 30 pF capacitor at this frequency is 2700 ohms, which is in all probability less than the anode load resistor. Thus without compensation the response of the amplifier will fall off very seriously at the higher frequencies, in spite of the fact that the anode load resistor may be only a few thousand ohms in value. To correct this condition a system of frequency compensation is employed. There are several systems, but those in general use may easily be divided into two types, the cathode compensated arrangement and the anode or choke compensated circuit.

Taking the cathode compensated circuit first and referring to Fig. 1, typical circuit constants are as follows: R_1=330 Ω; R_2=6.8 kΩ; R_3=5.6 kΩ; C_1=680 pF. To understand the principle of the circuit, consider its operation when the cathode capacitor is removed and an AC potential is applied to the grid of the valve. When the input signal is positive going the anode current of the valve is increasing, causing the cathode potential to increase. This increase effectively reduces the signal voltage which appears between the grid and cathode of the valve, and thus the output is reduced. If now a large value capacitor were used for C1, the cathode voltage would be held constant and the total AC signal voltage would appear between grid and cathode of the valve. Under such conditions the maximum output would be obtained from the stage. However, and this is the whole point of the circuit, if the value of the cathode capacitor is carefully

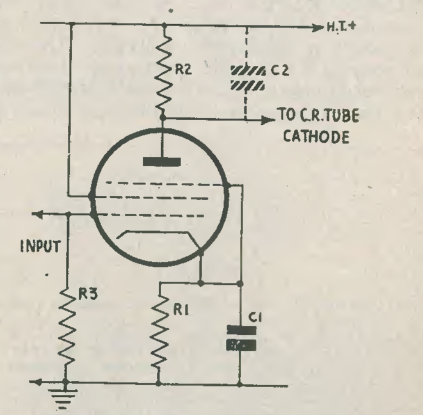


FIG. 1. THE CATHODE COMPENSATED VIDEO AMPLIFIER C804

chosen it is possible to reduce the output at low frequencies and increase it as the frequency rises. This state of affairs is brought about because the reactance of the capacitor decreases and hence less signal voltage appears at the cathode as the frequency increases.

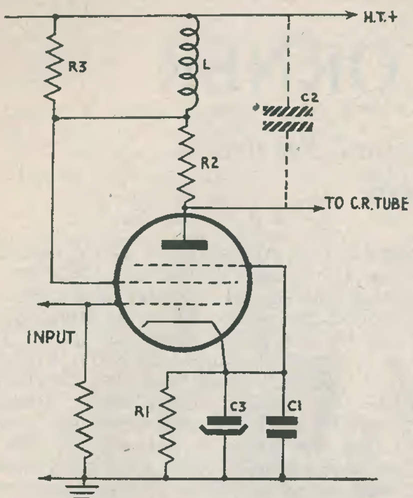


FIG.2. THE ANODE COMPENSATED VIDEO STAGE.
C805

Optimum compensation occurs when $R1 \times C1 = R2 \times C2$. C2 is the stray capacitance in the anode circuit of the valve and is usually in the region of 30 pF. The effect of varying C1 is quite marked on a received test card pattern, and it is a good plan to make it a preset capacitor for adjustment whilst the main vision channel is being aligned. Cathode compensation is not practicable in a video amplifier which drives the grid of a CR tube, because under these conditions the valve operates with a very low value of bias resistor and thus insufficient feed back is obtained at the low frequencies.

Turning now to the anode compensation video stage, a typical circuit is shown in Fig. 2. With this arrangement the cathode bias resistor is fully bypassed by means of an electrolytic and a small mica capacitor, the latter being included to ensure adequate bypassing at the higher frequencies. The choke is included in series with the anode load, and because its reactance increases with frequency so also does the effective load presented to the valve. This increase in load offsets the decrease which, as has already been explained, occurs because of the stray shunt capacitance. The optimum value of the inductor is fairly critical because if it is too low adequate compensation will not be obtained, whilst if it is too high the HF response of the stage will rise and severe 'overshoots' will be visible on the picture. It is, however, a good plan to make the inductance slightly higher than required, and then damp it by means of a shunt resistance as indicated in the circuit diagram. This arrangement provides a good degree of control over the compensation as it is a simple matter to experimentally adjust the shunt resistor until the optimum response with no overshoot is obtained. The approximate value for the inductor may be calculated with the aid of the formula $L=0.4\,C2(R2)^2$ where C2 represents the stray capacitance across the load circuit. Assuming an anode load of 4.7 kΩ and taking the stray capacitance as 30 pF gives us an inductance value of 265 μH. The circuit constants for Fig. 2 are therefore as follows:—R1=330Ω; R2=4.7 kΩ; R3=10 to 22 kΩ; C1=0.001 μF; C2=stray capacitance; C3=25 μF 25V electrolytic.

For both the video stages discussed above, a high slope short grid base pentode such as is used in the vision RF or IF stages should be employed. In both examples the bias has been arranged so that the video valve is suitable for driving the cathode of the CR tube. The circuit in Fig. 2 is, however, suitable for grid driving the tube, but in this case the bias resistor must be reduced to about 100 Ω. In some circuits an additional choke is included in the signal lead to the CR tube, whilst there are certain receivers which employ a combination of these methods of improving the frequency response of the video stage. Whichever case is encountered, the foregoing explanation should assist the constructor in understanding its fundamental principles.

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.

In conclusion, a few constructional details of a typical anode compensation inductor may be of some value. The coil consists of 150 turns of 40 swg enamelled copper wire wound in three sections on a ¼-watt resistor. The resistor should have a value in excess of 0.5 MΩ and makes an ideal coil former. The three sections of the winding are formed by means of paxolin cheeks as shown in Fig. 3.

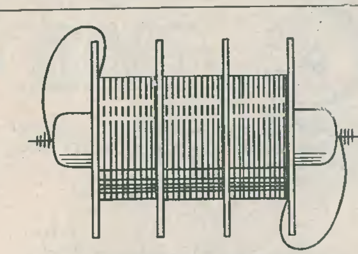


FIG.3 A COMPENSATING INDUCTOR WOUND ON A ½ M. OHM RESISTOR
C806

Earthing Filaments

Valve catalogues usually specify which side of the filament of battery valves should be connected to LT– but on certain valves this information is omitted. In these latter cases does it matter which side of the filament is earthed? K. Barratt

It is important on valves which have a suppressor grid internally connected to one side of the filament to specify this side as LT–. Also, on mutiple valves which include a diode located at one end of the filament it is imperative that the polarity is specified. Valves incorporating a single diode, such as the 1S5, have the diode at the negative end of the filament. If the reverse was the case the diode would, of course, have a fixed bias equal to the filament voltage. In examples such as those listed above the polarity of the filament is always specified. Where unspecified, it may safely be assumed that the polarity of the filament is immaterial to the operation of the valve.

Mainly for the Beginner . . .

R.F. CHOKES

by H. E. SMITH, G6UH

RF Chokes

The RF Choke, that all important item in radio receiver construction, especially in SW and VHF receivers, is often treated as just another component to be fitted and, provided it is a choke of "some kind," is connected into the circuit regardless of its suitability for the job. The RF choke is used in receiver circuits to prevent RF voltage from flowing back into the mains supply, or entering the audio circuits, or being short-circuited by other components such as capacitors. A good RF choke must have as high an inductance as possible, relative to the frequency bands being dealt with, and as low self-capacity as possible. It should therefore have a high length-to-width ratio. Fig. 1 shows this in detail, and it will be seen how the construction affects the performance.

In general, chokes used in "all-wave" receivers should be specially constructed so that their performance is equally effective on all frequencies from, say, 500 kc/s to the highest frequency covered by the receiver. For operation on the broadcast band, the choke must have a higher inductance *and* a higher impedance than the circuit to which it is connected, *i.e.*, it must self resonate at a lower frequency than the lowest frequency to which the receiver will tune. An effective and simple choke for broadcast frequencies covering approximately 550 kc/s to 1.5 Mc/s is shown in Fig. 2. The number of turns is not critical, but should not be *less* than that quoted. Use only coil dope or Durofix for securing the turns and *never* use wax, pitch, or ordinary varnish. The use of such fixatives increases the self-capacitance. When used in receivers covering all bands up to 30 Mc/s or so, the choke must be effective over the whole range.

The self capacity of a choke used for the broadcast bands is too high to allow satisfactory operation on the higher frequencies, so the method shown in Fig. 3 is often adopted.

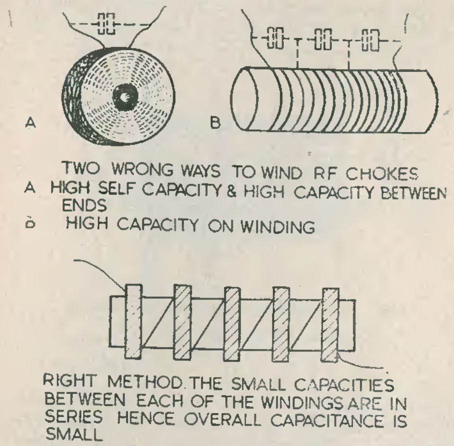


FIG. 1
RF CHOKES—WRONG & RIGHT METHODS OF CONSTRUCTION

C768

As will be seen, this is merely two chokes in series, both being wound in the same direction with the first section effective on the higher frequencies, and the whole effective on the lower frequencies. As the frequency is increased the efficiency of the choke becomes a matter of increasing importance, and on some VHF and UHF bands it is sometimes necessary to actually tune the choke before it is 100 per cent. effective.

For operation on the amateur bands between 7 and 30 Mc/s, a choke consisting of 100 turns of 26 or 28 swg enamelled wire, close wound on a ⅜" former, is quite effective provided it is wound in one layer. For TV bands, use the same wire as above and wind 25 turns on a ¼" former. If space permits, the turns may be spaced from each other by the wire diameter. Always wire the choke into the circuit at right angles to any inductance which may be near it, especially in oscillator circuits. At television frequencies and higher, it is always good practice to by-pass all chokes with a small capacitor to earth at the " cold " end (the end nearest HT or earth). This capacitor may be 2000 pF or so for frequencies between 30 and 100 Mc/s, but need only be about 200 pF for 144 and 420 Mc/s.

For VHF work, RF chokes require to be particularly efficient, and in circuits containing several chokes great care must be taken to ensure that there is no mutual coupling between them. One megohm ceramic type resistors make extremely useful formers for VHF chokes, and the fact that it is being wound on a resistor does not have the slightest detrimental effect on its efficiency. For 144 Mc/s, measure off 19 inches of 30 swg enamelled wire, clean and tin the ends, solder the start to the wire end of the resistor and wind the whole length on to the resistor, soldering the finish to the other wire end. Apply a smear of Durofix to each end of the winding and leave to dry. For 420 Mc/s, proceed as above but use only 7 inches of wire. In the latter case it is sometimes better to use a smaller diameter former, ⅛" Paxolin rod, or a broken knitting needle of the same size comes in quite useful for the purpose.

RF Chokes in mains filters

When making up mains filters, do not forget that the inclusion of an RF choke will often cure the most stubborn forms of interference. In fact, an RF choke *alone* will sometimes do the trick.

As with the receiver, the size of the choke to be used depends on the frequency in use, and the question of adequate insulation must not be overlooked. The choke is carrying full mains voltage and should therefore be treated in the same way as any other piece of mains apparatus.

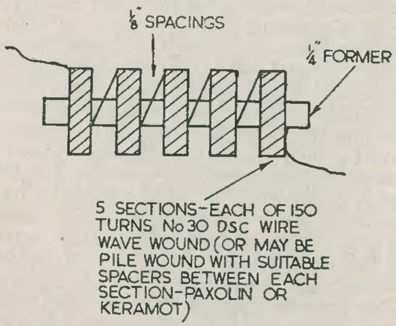


FIG. 2
AN RF CHOKE SUITABLE FOR ALL FREQUENCES FROM 550kc/s TO 1·5Mc/s

C769

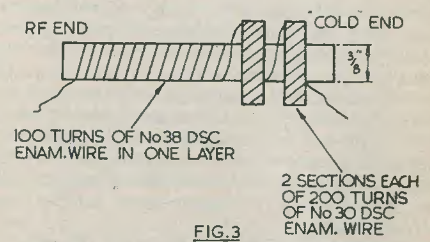


FIG. 3
AN RF CHOKE WHICH WILL BE EFFECTIVE ON ALL BANDS UP TO 30Mc/s OR SO.

C770

For the listener, the best place for the RF choke in the filter is at the mains input end, but the transmitter, who naturally wants to keep radiated RF out of the mains, would fit it at the output end, or in some cases at both ends. The great failing in some commercial mains filters is that they are only effective over certain ranges. If such a filter has been purchased and it is found that it is only effective up to 30 Mc/s or so, additional chokes may be fitted externally to suit the particular frequencies required. These should be fitted as close to the filter as possible, preferably in a screened box with the casing earthed. Fig. 4 shows how this may be done, using a commercial mains filter designed for a maximum frequency of 30 Mc/s.

Finally, the points to remember when constructing RF chokes:—

Never use cotton covered wire. This absorbs moisture and by so doing will render the choke ineffective.

When fitting chokes to anode or grid sockets of valveholders, make the end as short as possible and solder the choke right on to the socket.

Never fit an RF choke parallel to, or lying against, the chassis.

Mount vertically wherever possible.

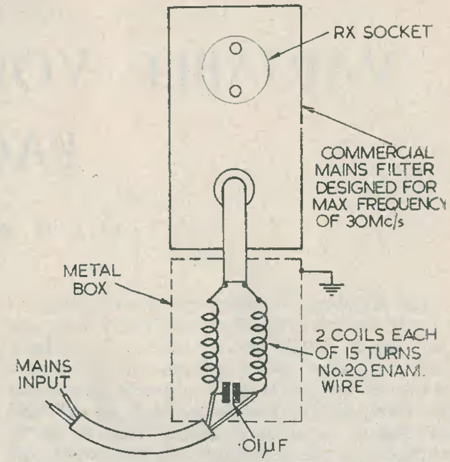


FIG. 4
ADAPTING A STANDARD MAINS FILTER FOR VHF OR TV FREQUENCIES

C771

Keep each end of the choke at least as far apart as the total length and never bring one end down across the winding.

Where two chokes are mounted close together, keep them at right angles to each other or screen one from the other.

Do not allow other components such as resistors and capacitors to lie against the RF choke, and keep *all* wiring as far as possible from the " hot " end.

Do not use thin wire for heater chokes in VHF receivers, as this will cause a voltage drop. (Nothing less than 20 swg for *any* heater chokes).

The Editor Invites

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

" THE RADIO AMATEUR "

The contents of the October issue, on sale this month at 1s. 6d., include:—A Tape Recorder for the Radio Amateur. A Frequency Meter for the Amateur Station. An Effortless Key System. The Design of Mains Transformers. Superhet Design. VHF FM Equipment as well as the regular news features, Amateur Bands Commentary, SW Broadcast Bands Review and On The Higher Frequencies.

VARIABLE VOLTAGE POWER PACKS

by A. W. WOOD, B.Sc.

The building of power packs nowadays is a fairly expensive business, and many amateurs rely on a single power pack, or perhaps two, to serve many pieces of apparatus. Many of the pieces of equipment previously described in this magazine, such as AF and RF Signal Generators, Signal Tracers, Oscilloscopes, Radio Receivers, Gramophone and TV Pre-Amplifiers, Main Amplifiers and many others require power supplies from 200–400 volts at 10 to 100 mA.

It is a simple matter to privide several outlets from a power pack to work several units, either separately or all at the same time (providing, of course, that the total demand is within the capabilities of the power pack) but a big snag arises, which is shown by the accompanying graph.

Using a 350–0–350 transformer feeding into a conventional condenser-choke-condenser filter as in Fig. 2, the volts available vary according to the current drawn, from 450 or more volts on light load, dropping to 300 volts or less on full load.

These results were obtained with a choke of fairly low resistance, and the variation would be greater with one of higher resistance. The variation of volts with current taken is a measure of the "regulation," and the rather poor regulation is due to the resistance of the rectifier, choke and HT secondary windings of the transformer.

There are two main occasions when the regulation of a power pack is of particular importance. These are:—

(1) Class B Amplifier or modulators.

(2) When the power pack supplies several units.

In both these cases the HT current is variable in that in (1) it is constantly variable, according to the audio input, and in (2) it is intermittently variable according to how many units are in use. The scheme adopted by the writer is not suitable for (1), but it has proved itself very suitable for (2).

The only ways of dealing with (1) are (*a*) mercury vapour rectifiers (because of their low resistance) and choke input filters (which

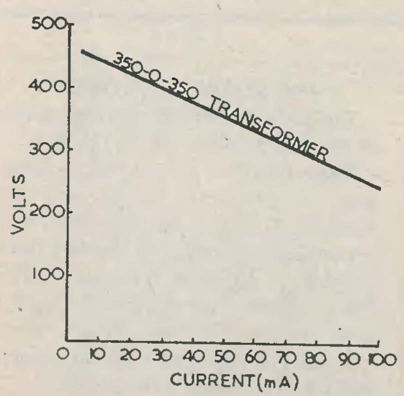


FIG.1

C782

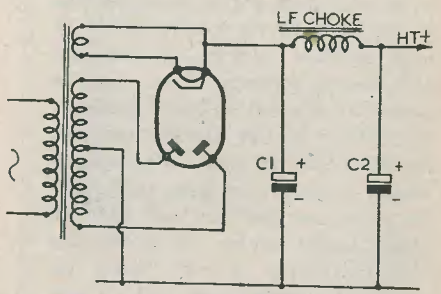


FIG.2

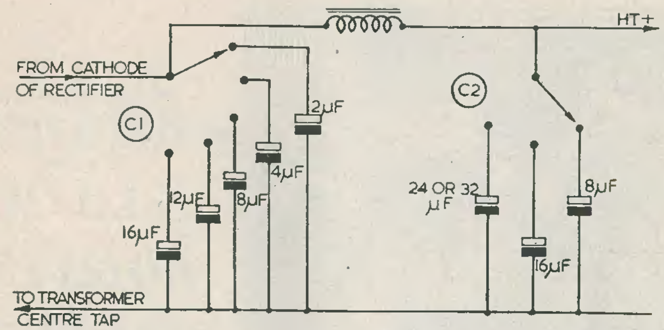
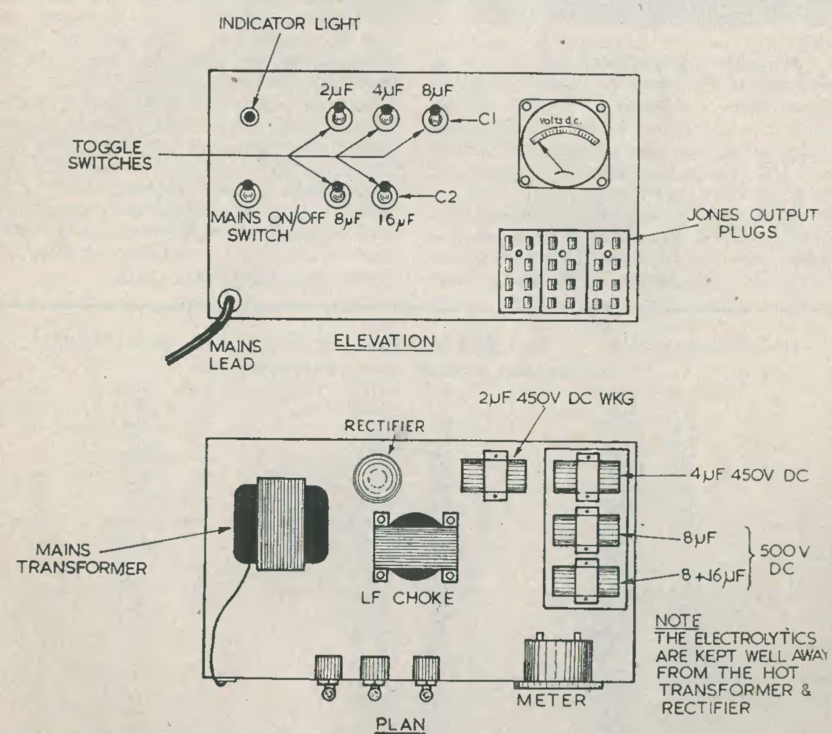


FIG.3 C783

have an inherently better regulation than condenser input filters) or (*b*) Voltage stabilisers (as described in a previous issue). These are all very well in their way, but the transformer used has to give a much higher voltage than the desired output volts due to the fact that the striking voltage is much higher than their working voltage.



C784

FIG.4

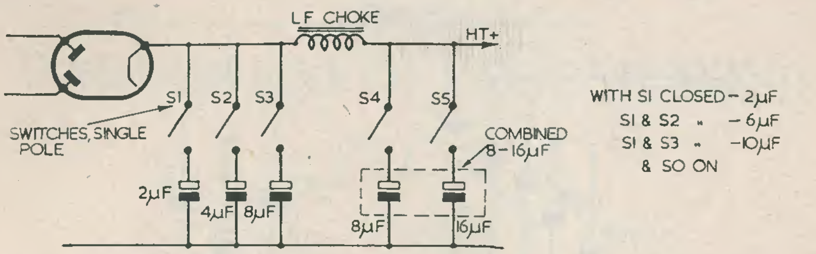


FIG.5

C785

The scheme to be described enables the output voltage to be varied *for experimental purposes or to keep the output volts constant* while the number of units is changed.

The basic principle is that of varying the size of input condenser, thus varying the output voltage.

At first glance it might seem that this is rather expensive in electrolytics, but this is not so, as by using a 2µF, a 4µF and an 8µF for C1, and a combined 8–16µF for C2, the switching can be arranged to combine these. Probably the simplest way is to use toggle switches as found on many pieces of ex-government equipment, but the reader will no doubt wish to make use of equipment available, and there is scope here for individuality. The diagram herewith shows the layout adopted by the writer.

The meter can be excluded if desired and terminals can be provided for connection to another meter, but it does add a professional finish to the equipment. The writer used Jones plugs and sockets but the reader may use octal sockets, etc. It is, however, best to decide on one kind and keep to them, thereby standardizing the gear.

The wiring is done as in Fig. 5.

If desired, a further choke and condenser can be added to improve the smoothing with low values of C1, and so on.

It is not advisable to exceed 16 µF for the input condenser, otherwise the rectifier may be overrun by the peak charging currents into the condenser. Note that the lower the input condenser value, the lower the output volts, but the better the regulation.

In conclusion, it may be said that the unit proved especially useful when a signal generator was being run off the power pack at the same time as an AF oscillator and an oscilloscope. The frequency of a signal generator is susceptible to changes in HT, and by means of this switching the HT volts were kept fairly constant whether or not other units were being used.

A VISIT TO THE OSRAM - G.E.C. TELEVISION TUBE PLANT

by

A. TORRANCE

Test Table

Most of us have probably at different times felt like rebellion towards the high prices of cathode-ray tubes, but after a visit to the G.E.C. factory and seeing at first-hand the problems involved, it was possible to realise why prices are at their present level.

Your writer found himself attached to a most jovial party from the east coast, organized by Mr. L. C. W. Perry, secretary of the R.T.R.A. of Norwich.

It reflects considerable credit on these gentlemen that they should be studying the various aspects of television at this time. This particular field of entertainment is within reach of the areas in which these technicians reside only at odd times, and Mr. Perry informed me there is not the remotest hope of a B.B.C. service for some years.

After being fortified by a most excellent lunch, provided by our hosts, G.E.C., the tour of the factory commenced with the genial Mr. Donisthorpe of Magnet House as host.

We were fortunate to have as guide Mr. Davidson, who is in charge of cathode-ray tube production and knows intimately the requirements of every process. A stage-by-stage description follows:—

(1) BULB WASHING PLANT

(Designed and built by Osram Works)

Bulbs are unpacked and loaded in trays on to the machine, which washes them with water, acid, hot alkali, more water and finally rinses them with distilled water: finally, the bulbs are dried on a hot air dryer.

(2) SCREENING PLANT

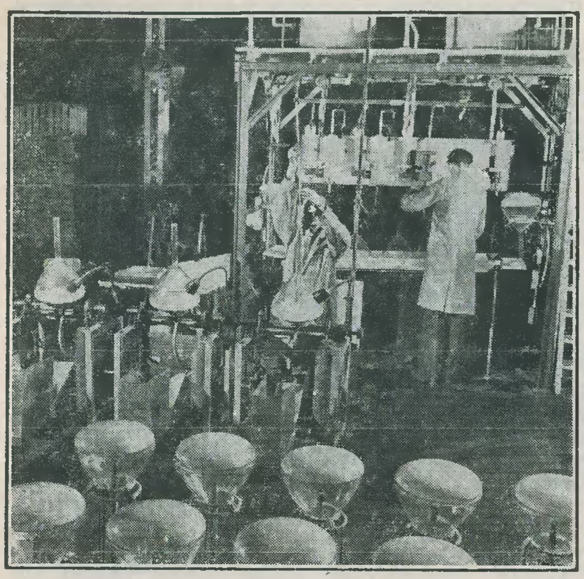
The inner screen surface of the dried bulb is coated with a solution of Phosphoric Acid, which is allowed to plasticise on a strictly controlled schedule and is then dusted with the Fluorescent Powder from a specially designed gun. The powder is swirled over the screen surface, to produce an even texture, and then the body of the bulb is cleaned off. Finally, the screen is baked on by raising the temperature to 350°C for 10 minutes. The total heat cycle takes 45 minutes to avoid cracking this thickness of glass.

(3) FILMING

The operations can best be appreciated by first understanding the aim, which is to cover the back of the Fluorescent Screen Powder with a very thin film of aluminium. In order that this shall only cover the back of the screen powder it is necessary first to put down a "Barrier Film," which in the G.E.C. process is of nitro-cellulose, and which is subsequently removed by heat treatment after the aluminium is deposited on to it.

The baked screen is first thoroughly washed in filtered temperature-controlled water to remove any loose particles, and then is flooded to a depth of ¼-inch with the same water and placed on a specially designed tipping head.

When all movement in the water has ceased,



Preparation for Evacuation

a quantity of nitro-cellulose solution in ether is injected on to the surface of the water. The ether evaporates, leaving a film of nitro-cullulose which is lowered on to the screen surface by decanting the water very slowly to avoid tearing and stretching.

(4) ALUMINISING

A high degree of vacuum is rapidly attained by use of special mercury diffusion pumps.

An aluminium pellet is then evaporated by electrical heating. The aluminium coats the whole inner surface of the bulb. The thickness of the coating is automatically controlled by an electronic device which stops the process as soon as the required thickness is reached.

(5) ASSEMBLY

Components, which are specially cleaned before use, including heaters coated with insulating material and cathode sprayed with an emissive coating, are jigged and welded together on to a glass pinch. The whole assembly is finally washed in alcohol prior to being joined to the outer bulb.

(6) SEALING IN

The electrode assembly or "gun" in the bulb neck is melted on to the flange of the glass pinch.

(7) 24-HEAD HIGH VACUUM PUMP

Each tube travels with its own pump unit, consisting of a 2-stage mercury vapour pump backed by a rotary oil pump and using liquid oxygen trap. This ensures a very high degree of vacuum, and in order to remove the gases from the glass and the gun assembly the whole tube is baked at 380°C under vacuum, prior to activation of the cathode and the firing of the getter to clean up the last traces of gas. The whole process takes 2 hours.

(8) TEST TABLE

The performance of any television tube can be accurately assessed by this equipment.

(9) TECHNICAL CONTROL

Equipment for additional tests, including picture tests. Statistical control of quality by an independent department. Each tube is then given a period of two weeks' ageing. All are then unpacked and re-tested completely. This final process ascertains vacuum condition and emission standards.

(10) BULB RECOVERING PLANT

The outer bulb being an expensive item, steps are taken to re-use where possible.

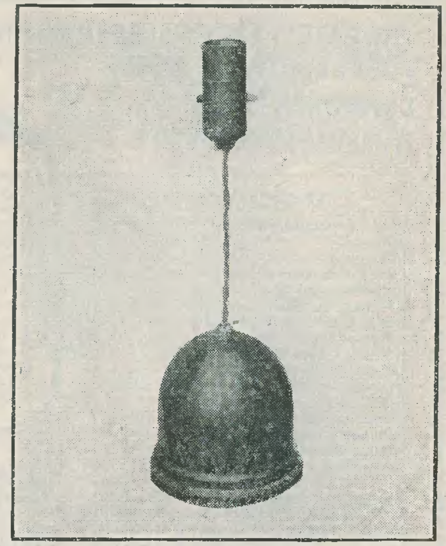
They are pre-heated and new contacts and stems melted in. Cooling is carefully controlled to relieve strain by annealing in a "Lehr." New necks are then joined to the body and the whole is finally pressure tested to two atmospheres before re-issue to the production line.

Just analyse this chain of operations, realize that any fault observed will send a tube right back to the first stage, and you would leave G.E.C. feeling as your writer did. Perhaps they are not so expensive after all !

TRADE REVIEW

Electric lighting offers many opportunities for the application of plastics, and in this connection interest attaches to the "Wayne" patent self-winding "Baby" reel, a production of Power House Components Ltd., King Street, Nottingham, carrying the registered trade mark "P.H.C."

This self-winding electric cable reel absorbs 9-10 ft. of ordinary twin lighting flex—but its appearance is as neat as a fixed light. The construction is of Bakelite mouldings and the metal parts of fine Brass stampings, the spring which rotates the drum being made from the best ribbon steel, and the contacts are evenly maintained by phosphor bronze springs. The whole is neatly finished in polished Bakelite. The "Baby" reel is obtained complete with 10 ft. of twin lighting flex ready for wiring. A Push Bar lampholder also in Bakelite, suitable for home and office use, can be obtained if required.



Wireless Fundamentals

By E. Armitage, M.A.(Cantab.), B.Sc.(Lond.). This important new textbook develops the theory of radio from the fundamentals to an explanation of the superheterodyne principle. The physical and experimental side is kept to the fore throughout the book, while purely mathematical treatment of the more theoretical parts of the subject is provided in the Appendixes. With 335 illustrations. 18/- net.

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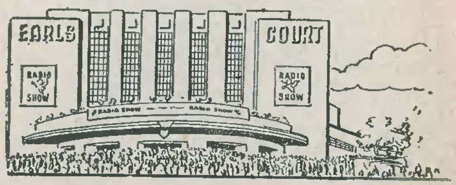

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(*Continued on page 159*)

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RECEIVER R1355. As specified for *Inexpensive Television*. Complete with 8 valves VR65 and 1 each 5U4G, VU120, VR92. Only **55/–d.** carriage 7/6d. Brand New in original Case.
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(*Continued from page 157*)

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(*Continued on page 160*)

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Small Advertisements—*cont.*

(*Continued from page 159*)

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