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MARCH 1958

AND TELEVISION TIMES

EDITOR: F. J. CAMM

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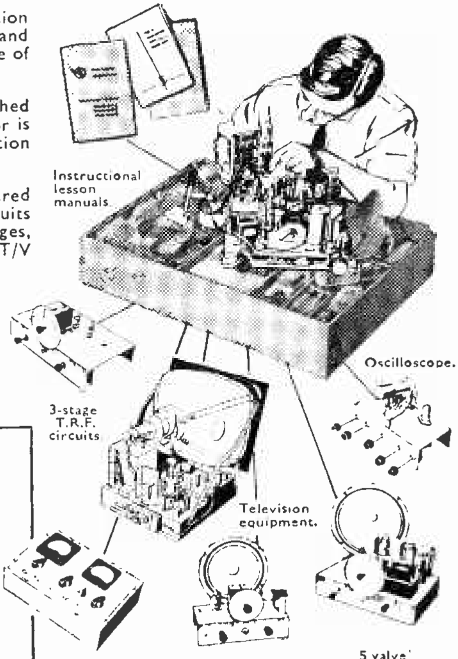

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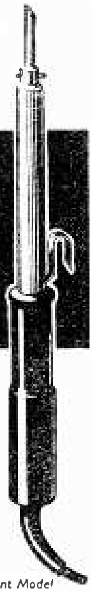

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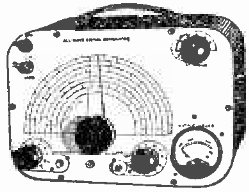

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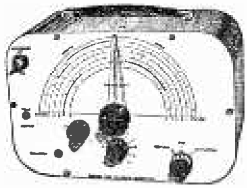

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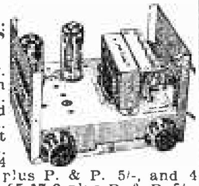

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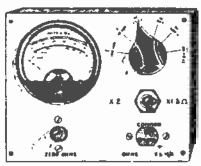

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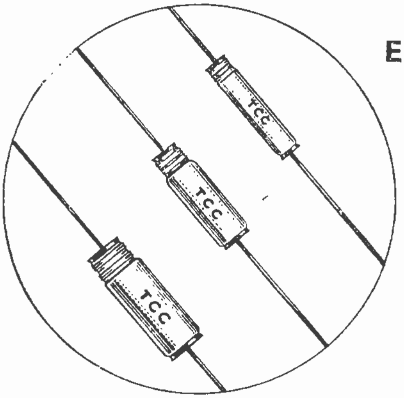

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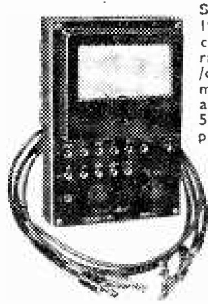

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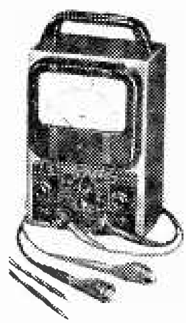

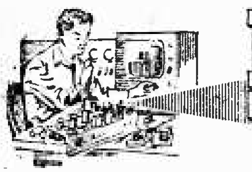

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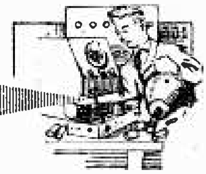

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TELEVIEWS

TV TRAFFIC CONTROLS

THE uses of television are not confined to entertainment only. Underwater TV has already been successfully used in the location of wrecks and now Durham has achieved the distinction of being the first city in Britain, possibly in the world, to be equipped with a permanent television traffic control system. This system was first tested in August, 1956. It has since been perfected and the permanent system was officially switched on recently by the Parliamentary Secretary to the Ministry of Transport and Civil Aviation. It is designed to speed the flow of traffic through the narrow and tortuous streets leading to the centre of the town. This television installation, which is of the industrial type closed circuit system, gives the policeman on point duty in Durham's market place an unobstructed view of vehicles approaching over two bridges which were previously out of the line of vision of the traffic controller. The miniature television cameras transmit pictures of 100 yard stretches of road over lead-covered coaxial cable to two 9in. monitors in the policeman's control box. The cables are laid underground and the whole equipment, including the cable, is of British design and manufacture. The cameras are fitted with windscreen wipers, demisters and defrosters and are operated from 25-core P.V.C. cables and specially designed multicore television camera cables. The three sets of remotely operated traffic signals used are actuated from the police box by means of 4-core P.V.C. insulated and sheathed armoured cables, and special police signal lights are operated by cables of similar construction. Electronics is indeed coming to the aid of the police and if this system is generally adopted in busy places, such as London, the speed of traffic through those places will be considerably accelerated, and make many traffic signals, probably the greatest cause of obstruction, unnecessary.

THE "PRACTICAL HOUSEHOLDER" EXHIBITION

A REMINDER to readers that the PRACTICAL HOUSEHOLDER EXHIBITION organised by our companion journal opened on February 19th and remains open until Saturday, March 1st. The Exhibition is open daily from 11 a.m. until 9.30 p.m., and from 10 a.m. to 10 p.m. on Saturdays. The entrance fee is 2s. 6d.

"THE BEGINNER'S GUIDE TO TELEVISION"

WE would inform all readers who have inquired as to the possibility of a reprint in book form of our recently completed series of articles entitled "The Beginner's Guide to Television" that a limited edition of this article in book form will be published later this year and an announcement will be made here when it is ready.—F. J. C.

Our next issue, dated April, will be published on March 21st.

Scanning & Synchronisation

7.—LINE SCANNING CIRCUITS (3)

By G. K. Fairfield

WITH the circuit and values given last month, sufficient scan will be obtained to deflect a 14in. or 17in. rectangular tube with an EHT of 12 to 14kV. The width control should give a ± 10 per cent. variation over nominal picture width and the linearity circuit should ensure that no departure from linearity will exceed ± 5 per cent. of that at the screen centre. Total power consumption will be about 100 mA from a 200 volt H.T. line. The boosted H.T. will be about 450 volts, allowing a drain of a few milliamps to be taken for the frame oscillator desribed in a preceding article. One word of warning, before connecting supplies to V2 and V3 it is advisable to check that the sawtooth oscillator V1 is functioning, as the absence of sufficient drive to V2 will result in small bias developed across Rg and over-dissipation of this valve.

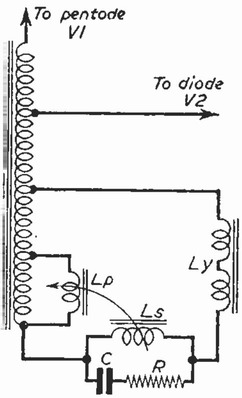


Fig. 47.—Scan width control.

Direct-drive Circuits

All the deflection circuits so far described made use of a transformer to supply scanning current to the coils and to match diode and pentode impedances. If the deflection coils used can be made to withstand higher pulse potentials a "transformerless" circuit becomes possible. This is known as the "direct-drive" system and a simplified circuit is shown in Fig. 48. Briefly the circuit functions on energy transfer considerations.

The sawtooth driving potential at the grid of V1 causes this valve to draw current via V2 (the diode acting as an anode load for V1. During the flyback V1 is cut off and energy stored in La is diverted to charge C2 and C3 and in the second part of the flyback these capacitors begin to discharge through La and Ly. As soon as the potential across Ly has reached a large enough value V2 is rendered conductive and the boost capacitor C1 is charged. With C1 fully charged V1 is made to conduct once more and the cycle repeats. Thus the conduction of V2 during the entire scan period keeps point X at a constant potential (approximately that of the H.T. line), and the difference between this and the boost potential across C1 enables a linear rise of current to take place in Ly.

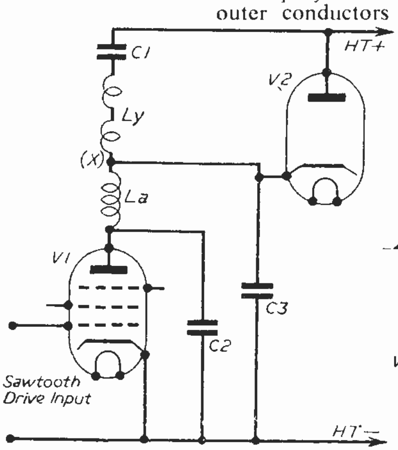
Referring to Fig. 49, energy transfer takes place during the flyback when that stored in La during the first part of the scan is transferred to Ly and later this energy is conveyed to C1 during the second scan period.

The major disadvantage of this circuit is that for reasonable efficiency the deflection coils Ly must have an inductance of some 34 mH and this, of course, leads to very high potentials being developed across them during the flyback.

Practical Circuit

A circuit designed to scan a 14in. or 17in. rectangular tube at 12-13 kV is shown in Fig. 50. An extra winding (2) has been added to La in order to boost the pulse voltage developed across this during the retrace period. Rectification by V4 will then provide EHT for the tube. The linearity circuit is a tuned transformer identical to that described in a preceding article, and is placed in series with the boosting diode cathode V3. Width control is very simply obtained by means of a high-wattage control R which varies the boost potential and hence current rise in Ly. This will be found to have very little effect on EHT as the picture width is varied. As in the previous circuit a small drain of a few milliamps is permissible from the boosted H.T. (about 400 volts) for the frame oscillator.

The capacitors C1 and C2 must be capable of withstanding a high pulse potential and are constructed of 70 Ω coaxial cable. This should have polythene insulation between inner and outer conductors and will be found to have a



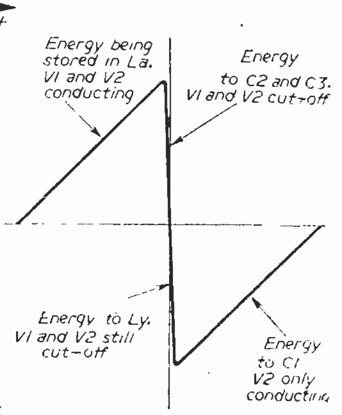


Fig. 48 (Left).—Simplified "direct-drive" circuit. Fig. 49 (Right).—Energy transfer in the circuit of Fig. 48.

capacity of some 25 pF/ft. The coil T2 shown in Fig. 51 consists of two windings "a" and "b" wound on ¼ in. diameter ferroxcube rod. If a wave-winding machine is available both windings can be wound in this way and suitable gears are quoted in the drawing. Winding "a" can also be layer wound with 0.001 in. paper interleaving between successive layers. An alternative way of winding the EHT overwind "b" was described in the previous issue and this method can be used if wave winding cannot be employed. The heater winding for V4 can also be wound on the ferroxcube core and consists of nine turns

WINDING DETAILS FOR FIG. 51.

Wdg. 'a'.—750 turns .0092 en. & single-silk ⅛in. wide wavewound using gears : A 48 ; B 42 ; C 39 ; D 44 ; E 30 ; F 90.

Wdg. 'b'.—1,300 turns .0040 en. & s.s.c. 1/8in. wide wavewound using gears : A 36; B 28 ; C 38 ; D 48 ; E 80 ; F 40.

Wdg. 'c'.—9 turns polythene insulated wire.

of polythene-covered wire (the "inner" of coaxial cable).

In setting up this circuit care must be taken to ensure that V3 is conductive during the entire scan period. As its cathode potential is rising towards the end of V2 conduction period it is possible for it to be cut off when the C.R. beam is approaching the right-hand side of the screen. This will cause severe "ringing" at this side of the picture and if this is found to occur the value of C2 and C3 will require adjustment.

This question of ringing is a very important one and it is likely to be experienced in various forms when any line scanning circuit is set up for the first time.

"Ringing" of the Line Scan

Normally this occurs at the left-hand side of the picture when the diode is just commencing to conduct. The ringing at the right-hand side mentioned above is unusual and peculiar to the direct-drive circuit. The major source of ringing will be resonances of the EHT overwind with

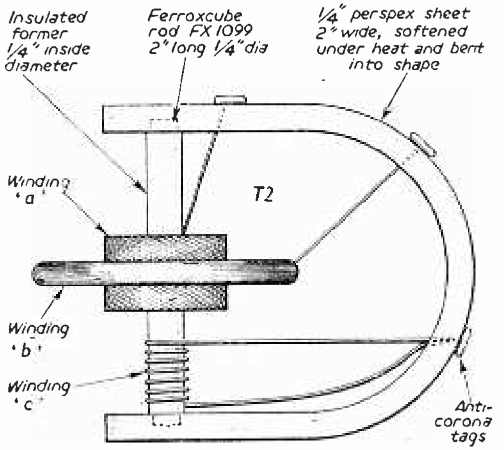


Fig. 51.—"Direct-drive" circuit—anode and EHT coil details.

itself and stray capacitance (Fig. 52). The tuned circuit so formed will oscillate at a frequency of between 2 and 600 Kc/s when shock-excited by the sudden change of current during the fly-back. To some extent these ripples are damped by the conduction of the boosting diode but at the beginning of the picture trace (extreme left-hand side) their amplitude is large and some modulation of the scanning waveform may be

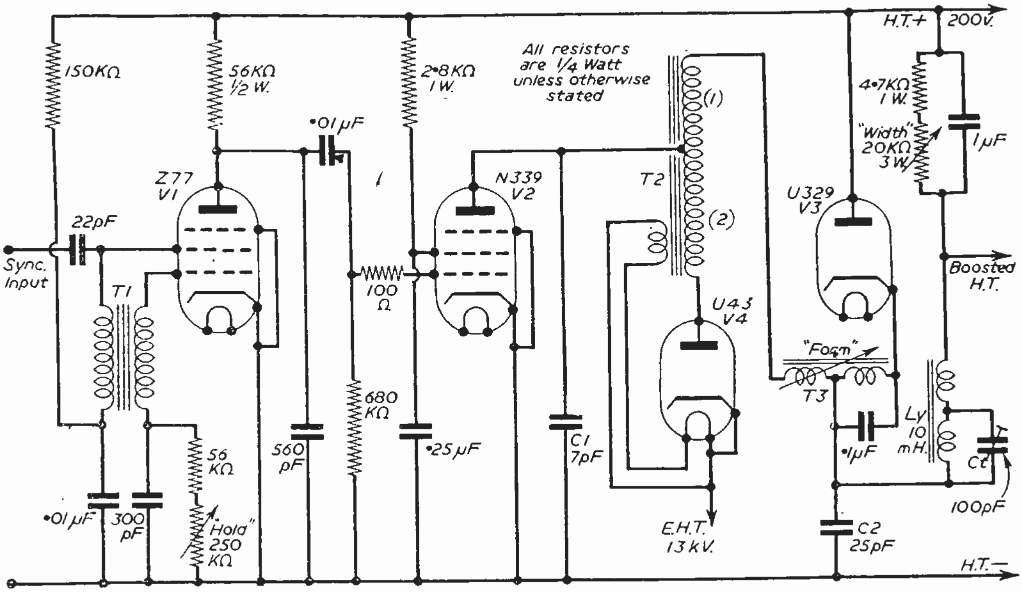


Fig. 50.—Practical circuit—"direct-drive" line timebase.

observed. If the magnification factor (Q) of this circuit could be reduced then the oscillations would not build up to such a large amplitude and the diode would exert a more noticeable damping effect.

One way of doing this, without at the same time reducing the EHT built up across the coil at the lower flyback rate (about 50 Kc/s), is to

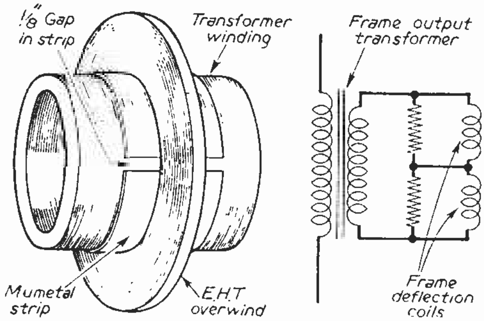


Fig. 53 (Left).—Method of reducing transformer "ringing." Fig. 55 (Right).—Method of avoiding frame coil resonances.

place a strip of μ-metal or radiometal foil between transformer windings and EHT overwind (Fig. 53). This should not form a complete turn but a ⅛ in. gap left between the two ends. In operation it serves to lower the effective Q of the EHT winding at the higher frequencies and reduces the amplitude of ringing.

Another source of ringing lies in the dissimilar resonances between each half of the line deflection coils. This is removed by tuning the half

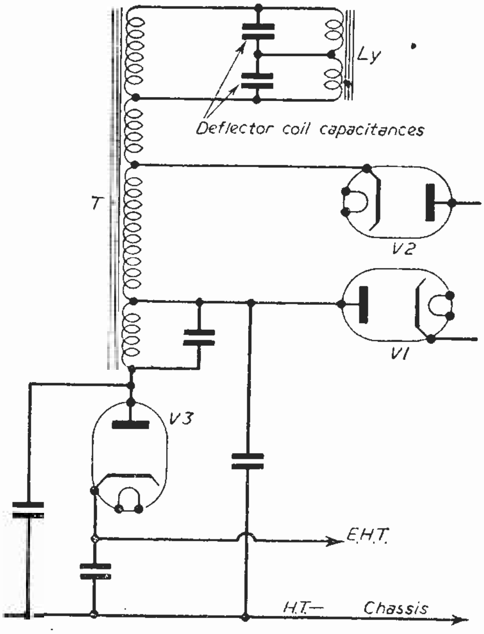


Fig. 52.—Line scanning output stage showing circuit stray capacitances

having the least stray capacitance (i.e., that end remote from earth) with a high-working voltage trimmer (Ct of Fig. 50) so that the two resonances can be made equal and their combined effect nullified.

Finally there is the resonance of the tuned circuit formed by the frame coils and stray capacitance C. This will cause the type of modulation to the line shown in Fig. 54, and as the coupling between line and frame coils cannot

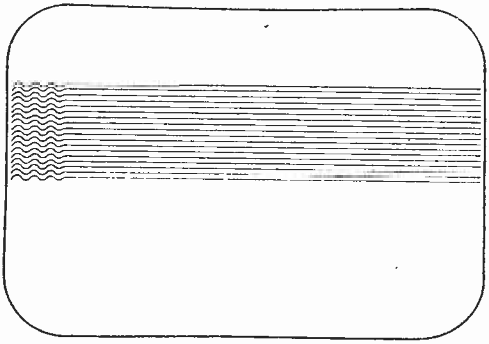


Fig. 54.—Ripple on line due to frame resonance.

easily be controlled, it is better to damp each half of the frame coils with a small resistance as shown in Fig. 55.

(To be continued)

New BBC Stations

NEW BBC television stations are to be built, with the approval of the Postmaster General, near Peterborough and in Orkney. The Orkney station will in addition carry sound broadcasts on VHF.

The Peterborough station will serve about 110,000 people who are at present outside the service areas of the existing BBC stations at Sutton Coldfield, Norwich, Holme Moss and the Crystal Palace. Tests are starting forthwith on a possible site and the construction of the station will start as soon as all the necessary consents have been obtained, but no date can yet be given for its completion. According to the BBC's present plans, the station will work on Channel 5 (vision frequency 66.75 Mc/s., sound frequency 63.25 Mc/s.) with an effective radiated power between 1 and 2 kW., and with horizontal polarisation, which means that receiving aerials should be mounted horizontally.

The Orkney station, which will carry both television and sound broadcasts on VHF, will serve some 30,000 people in the Orkney Islands and along the north coast of Caithness. According to present plans, the station will be on a site at Netherbutton, previously used by the Air Ministry, where an existing 350ft. tower will be used. The television transmissions will, it is proposed, be on Channel 5 (vision frequency 66.75 Mc/s., sound frequency 63.25 Mc/s.) and will be vertically polarised, which means that receiving aerials should be mounted vertically.

Multi-channel Tuner Installation

HINTS ON MODERNISING OLD RECEIVERS FOR MULTI-BAND RECEPTION

By Gordon J. King, M.I.P.R.E.

AS judged from letters received, it would appear that a large number of readers are still not too clear on the best method of adapting their receivers for multi-channel operation. Of recent months much has been written with regard to Band III converters of the simple add-on type. The merits and disadvantages of this mode of conversion have been discussed in some detail, and most of our readers are now clear on the fact that, while the add-on method serves admirably in the outer service areas of a Band I transmitter where the Band III aerial signal is large in comparison with the stray Band I signal picked up on the receiver/converter wiring, considerable trouble is often experienced in areas of high Band I signal owing to breakthrough of the BBC when the combination is switched to the I.T.A. channel.

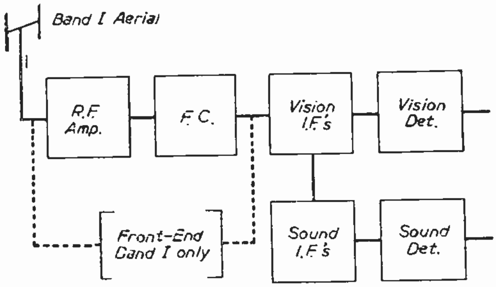


Fig. 1.—A block diagram of the sound and vision stages of a conventional superhet receiver.

Re-radiation of the converted Band III signals at the frequencies corresponding to the local Band I channel represents another difficult problem closely associated with this type of conversion. However, unless one is prepared to redesign and realign the sound and vision channels, there is little left for the experimenter to do but to use an add-on converter where the receiver is of the T.R.F. mode.

Multi-channel Operation

Since most single-band receivers now in use feature the superhet principle, however, it is not unduly difficult to add a multi-channel tuner and bring the receiver in line with current development. Tuners highly suitable for this purpose are readily available from most dealers at this time, and once the general idea of circuit connection is realised, the experimenter should have no difficulty at all in the installation of such a tuner to any type of receiver.

In Fig. 1 is shown a block diagram of the various stages in a single-band receiver concerned essentially with the sound and vision signals. As is usual practice, the signals from the aerial are amplified by the R. F. stage to a level which ensures adequate operation of the frequency changer section. Here the term "frequency changer" indicates the section of the circuit which deals with the production of the oscillator signal and the mixing of the oscillator signal with the incoming signals to produce the I.F. signals. In some receivers a single valve (pentode or double-triode) performs these functions, while in other receivers, notably Kolster-Brandes models, separate mixer and oscillator valves are employed. The I.F. signals so created are further amplified, sometimes first both together in a common I.F. stage, and then in their appropriate channels.

Redundant R.F.

Illustrated in Fig. 2 is the arrangement with the inclusion of a multi-channel tuner. The tuner itself contains the R.F. and frequency changer sections, along with the necessary coils and switching to provide the given I.F. signals on any channel. It is seen, therefore, that the incorporation of a tuner renders redundant the original R.F. and frequency changer stages relating to the receiver proper. The I.F. signals produced in the multi-channel tuner are coupled direct to a suitable point in an I.F. stage which is common to both sound and vision, and in this way the signals are amplified at I.F. in the separated channels in the usual manner.

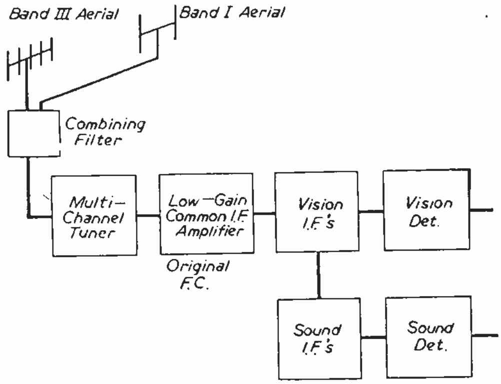


Fig. 2.—A block diagram showing how the tuner replaces the original R.F. amplifier and frequency changer stages, and how the original frequency changer is sometimes altered to form a low-gain common I.F. stage.

Coupling the Tuner Signal to the Receiver

Whilst the original Band I R.F. stage is always removed from the circuit, it is sometimes desirable to retain the original frequency changer or mixer valve and rearrange its circuit so that it functions as a low-gain common I.F. amplifier, into which the tuner signals can be injected without loss of efficiency as the result of the coupling.

The scheme is given in Figs. 3 and 4. Shown in Fig. 3 is the frequency changer stage of a representative single-band receiver (of the Ekco T141 series), in which an R.F. pentode (Mazda 6F1) serves as mixer and oscillator. The circuit is wholly conventional and requires no further comment.

A popular and extremely efficient method of coupling the tuner signal to the receiver is revealed in the modified circuit at Fig. 4. As may be seen, the oscillator and R.F. coupling components are removed completely from the control and screen grid circuits of the valve, and the screen grid is energised by connection to the decoupled H.T. point between the H.T. side of T1 primary and the 4.7k resistor, the 0.003 μF capacitor serving as the decoupling component for both screen and anode circuit.

Loading the control grid is a 100-ohm resistor, across which the tuner signal is connected by way of the tuner's coaxial signal feed lead, the inner conductor going to the grid side of the resistor and the outer conductor to the chassis connection—this is most important. Bias is applied to the valve by introducing a resistor of some 180 ohms in the cathode circuit and decoupling with a capacitor in the region of 0.001 μF. It is interesting to note that the valve was biased automatically by the oscillator signal when working originally as a frequency changer.

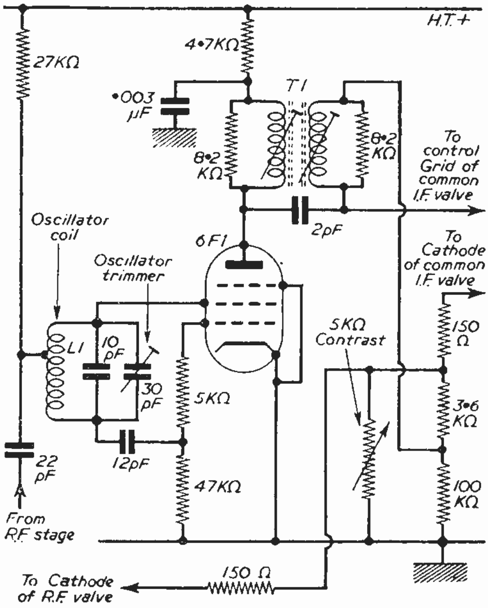


Fig. 3.—A representative frequency changer stage before modification.

Although removal of the connection from the contrast control to the cathode of the R.F. valve means that the overall gain of the I.F. channel is now controlled by varying the bias on the common I.F. valve only, it is usually found in practice that sufficient range of contrast control is possible, and that tendency to overloading can be avoided by adjusting the appropriate sensi-

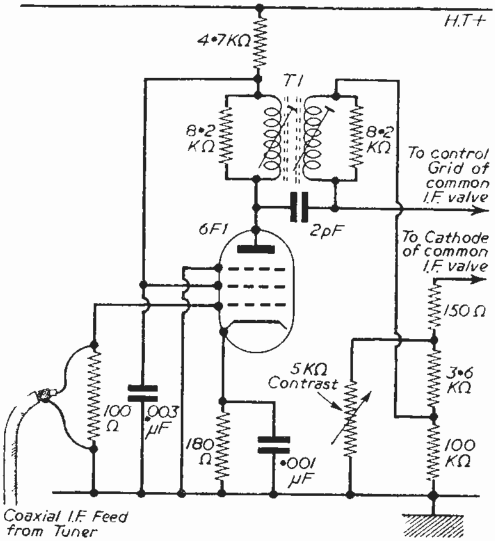


Fig. 4.—The stage at Fig. 3 altered to form a low-gain common I.F. amplifier to facilitate connection of the tuner signal.

tivity control on the tuner. In this respect, most commercial tuners feature either one or two sensitivity controls for varying the gain of the R.F. stage either simultaneously on both bands or individually on each band. Individual adjustment enables a balance to be made initially between the signals on Bands I and III, thereby avoiding the necessity of contrast adjustment when changing from one band to the other. The switching of the sensitivity controls is performed automatically as the turret is rotated.

Extra Gain

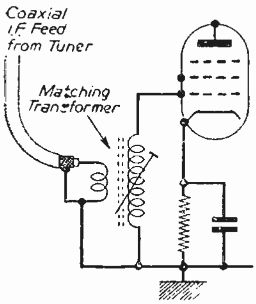
The arrangement shown in Fig. 4 suits the majority of cases, whether in the fringe or in the service area. If extra overall gain is required owing to the receiver working in an outer fringe area or on a relatively low aerial signal, the effective sensitivity of the modified frequency changer common I.F. amplifier stage can be enhanced by feeding the tuner signal to the control grid by way of a matching transformer, instead of direct to the grid across a low value resistor.

The circuit section at Fig. 5 illustrates the idea. The grid winding of the transformer should be designed to tune over the I.F. spectrum of the tuner/receiver, final adjustment being made by a dust-iron tuning slug in the coil former, while the tuner coupling winding should consist of two turns of p.v.c covered wire wound round the earthy end of the grid coil.

If a standard $\frac{1}{4}$in. former is used, a coil of 15 turns of 36 s.w.g. enamel-covered wire will tune over the standard I.F. range, between 34 and 40 Mc/s, 40 turns will cover a range of between 15 and 20 Mc/s, and approximately 50 turns will tune between 9 and 15 Mc/s. The coil slug is adjusted to give the best compromise between sound and vision.

Other Methods of Signal Injection

Another method of signal injection which is sometimes adopted, especially where a double-



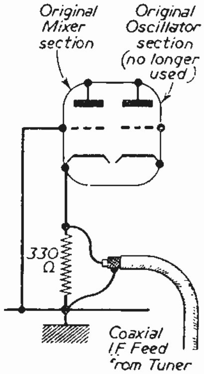


Fig. 5 (Left).—Extra overall gain can be secured by coupling the tuner signal by way of a matching transformer. Fig. 6 (Right).—When a double triode frequency changer valve is featured, tuner connection can be made at the cathode circuit of the original mixer section.

triode frequency changer valve is used, is shown in Fig. 6. Here the tuner signal is applied across the cathode resistor of the triode of the original mixer section, after first removing the decoupling capacitor, of course, and the grid is connected to chassis (earthed). The other triode section, relating to the original oscillator, is no longer required and is disconnected.

Although the methods given above demand slight circuit alterations to the parent receiver, they are to be recommended where the receiver is to be used on the edge of a service area or in fringe areas, where that little extra gain can be used to advantage.

In districts close to the transmitters there is often no necessity to alter the receiver at all, for manufacturers of tuner units terminate the tuner connecting leads with plugs for direct insertion into the vacated valve holders of the parent receiver. Plug-adaptors are also available in this connection to match the tuner plugs to the receiver valve holders. When this method is adopted, however, the tuner signal is injected into the common I.F. amplifier, and both the R.F. and frequency changer valves are removed from the receiver. Full details of this mode of connection are usually supplied with this type of plug-in tuner.

Tuner Heater Supply

When the plug-in method is used, both heater and H.T. power is conveyed to the tuner valves from the receiver circuits by way of the plug/valve holder connections. Where the receiver incorporates a series-connected heater circuit, a tuner also featuring series-connected valve heaters is used, and the tuner heaters are introduced in series with the receiver heaters. The valves used in this case are PCC84 (R.F. amplifier) and PCF80 (frequency changer), having 0.3 amp heaters, which, of course, should match the heater current of the receiver valves. Where the valves in a series-connected heater chain have 0.1 amp or 0.2 amp heaters, it is often necessary to use a separate heater transformer for the tuner valves, bearing in mind that the inclusion of a mains transformer destroys the D.C. feature of an A.C./D.C. receiver.

If the receiver has parallel-connected heaters, however, then a tuner also featuring parallel-connected valves is used, and the tuned heaters are connected in parallel with the receiver heaters. The valves used in this case are ECC84 (R.F. amplifier) and ECF80 (frequency changer), having 6.3 volt heaters, which, of course, should match the heater voltage of the receiver valves.

To give the experimenter a better idea of the connections necessary, the circuit of the Brayhead Type BT. 13A tuner is shown in Fig. 7. The tuner's I.F. output, heater and H.T. leads are carried in a multiway cable and terminated in a B9A plug to facilitate the plug-in installation method, aided by the plug-adaptor, as already described. However, when the tuner is to be wired into the receiver to give enhanced gain, the B9A plug is cut off the multiway cable and the covering pulled back to expose the colour-coded connecting wires.

If the receiver which is to be converted has a series-connected 0.3 amp heater, the heater chain will be broken by the removal of the R.F. valve, but the circuit is completed through the tuner

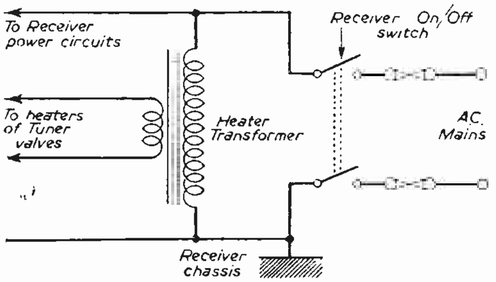


Fig. 8.—Showing how a separate heater transformer is connected for energising the tuner valves when they cannot be included in the heater chain.

valve heaters by connecting the brown and grey heater wires across the heater tags of the R.F. valve holder. This will result in a slight drop in current throughout the chain, since two valves are introduced and only one removed, but this can be compensated by resetting the mains voltage selector of the receiver 10 volts down, for example, from 230 volts to 220 volts.

If the receiver has a series-connected heater circuit different from 0.3 amp, a suitable resistor, equal in value to the heater voltage of the removed R.F. valve divided by the heater current, will need to be connected across the heater tags of the R.F. valve holder to maintain continuity of the heater chain. A wire-wound 3-watt resistor serves in most cases. A tuner incorporating 6.3 volt valves should then be used, and the heaters energised from a separate 6.3 volt heater transformer, having a primary to match the applied mains voltage. This should be connected across the receiver side of the on/off switch, as shown in Fig. 8.

If the receiver has parallel-connected 6.3 volt heaters, then it is a simple matter to connect the appropriate tuner heater wires accross the heater circuit of the receiver at any convenient point, ensuring first, of course, that the heater circuit is 6.3 volt and that a tuner with 6.3 volt valves is used.

Tuner H.T. Supply

H.T. for the tuner is picked up from the parent receiver, the required 30 mA usually being available without trouble owing to removal of the R.F. valve from the H.T. supply. The black H.T. negative lead from the tuner is connected to the chassis of the receiver. It should be clearly observed that when such a connection is made to a receiver of the A.C./D.C. type, the chassis of the converter, as well as the receiver chassis, is in connection with one side of the mains supply, and this may well be the live side. Care must be taken, therefore, to ensure (a) that the neutral side of the mains is connected to chassis and (b) that the tuner is installed within the receiver cabinet so that it cannot be touched during normal operation. The aerial circuit of the tuner is isolated from the chassis by way of C21 and C22, thereby complying with BSS 415 Safety Regulations in this respect.

The red H.T. positive lead can be connected more or less anywhere on the H.T. line of the receiver. A good point is the screen grid or anode tag of the vacated R.F. valve holder, that is, of course, provided the components directly concerned with the H.T. feed to this valve were not removed when the R.F. coupling and

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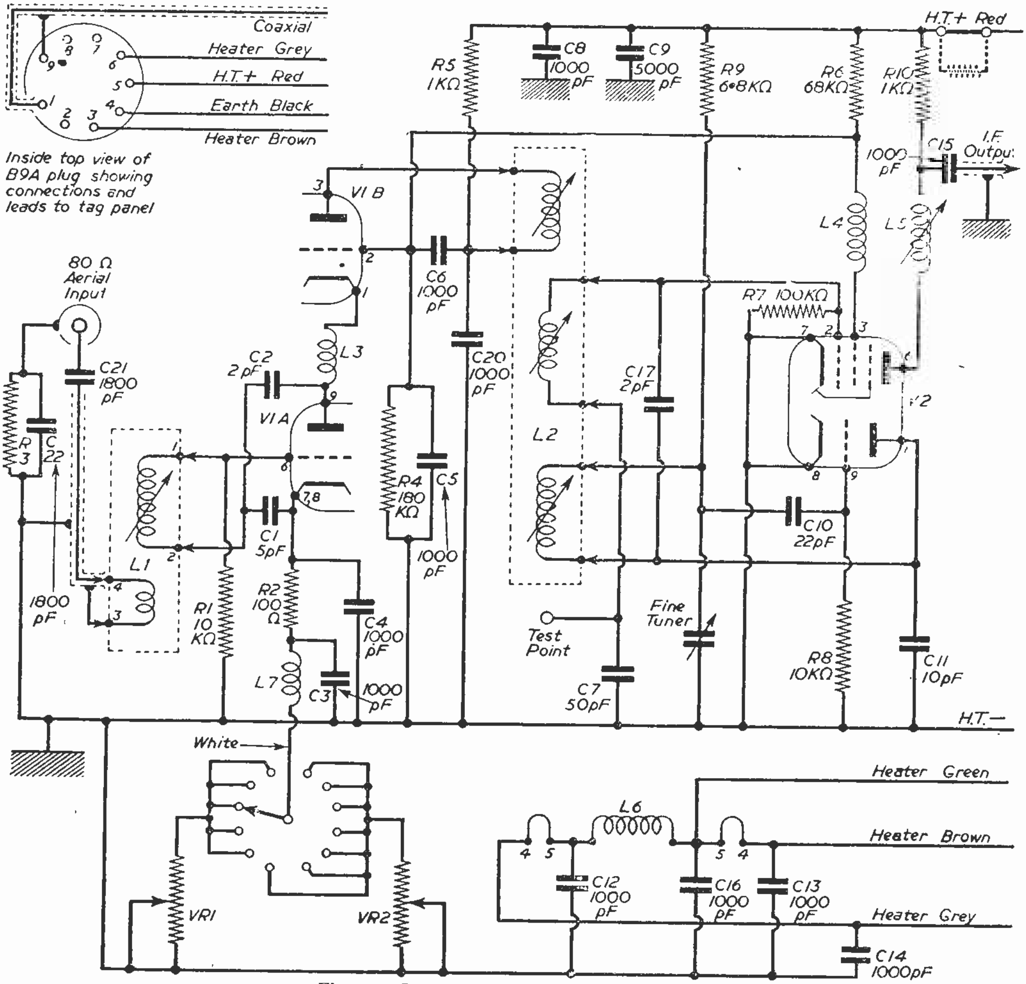
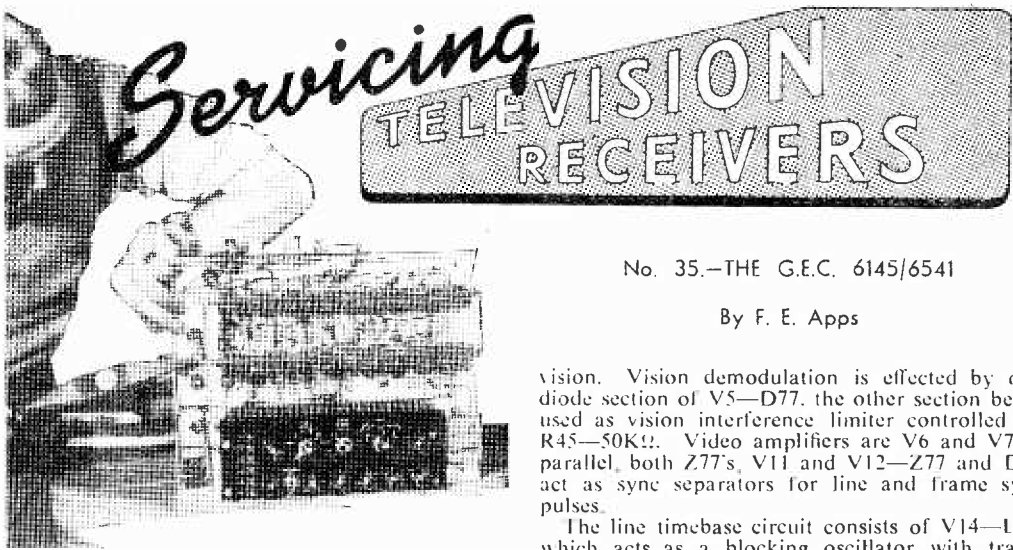


Fig. 7.—Circuit diagram of the BT. 13A.



No. 35.—THE G.E.C. 6145/6541

By F. E. Apps

THIS receiver, which is a 19 valve plus cathode-ray tube, is a superhet designed to work on any channel on Band I, and can be used with a converter for Band III. The intermediate frequencies are, Sound 37.625 Mc/s and Vision 34.125 Mc/s. The tube is a G.E.C. Type 6901A—16in. round tube, with a heater voltage of 6 volts, and requires 12kV—EHT. The deflection coils are 75 degree angle for full scan.

Description of Circuit

The valve and C.R.T. heater circuits are fed from a mains transformer with various tappings on the secondaries for the valves. The H.T. supply is as with an A.C./D.C. receiver, and therefore the chassis is connected to one side of the mains.

The first 3 valves, Z77's, are common to the vision and sound circuits and function as R.F. amplifier, frequency changer and I.F. amplifier. A variable 5,000 ohm. resistor in the cathode circuit of V1 and V3 acts as a contrast control, and determines the gain of both sound and vision sections. The frequency changer V2 is of the self-oscillating type, with a Colpitts circuit between screen grid and control grid. Interference from sound transmission of the adjacent television channel can be tuned out by adjusting L7 which, with C7 and C11, constitutes a series tuned circuit across the output of V2. Sound is tapped off the secondary of the 2nd I.F. transformer L13. Sound rejection from the vision circuit is provided for by T1—T2, which should be adjusted to minimum vision. Vision demodulation is effected by one diode section of V5—D77, the other section being used as vision interference limiter controlled by R45—50KΩ. Video amplifiers are V6 and V7 in parallel, both Z77's, V11 and V12—Z77 and D77 act as sync separators for line and frame sync pulses.

The line timebase circuit consists of V14—L63, which acts as a blocking oscillator with transformer TR2. The sawtooth voltages are fed to the grid of V15—KT36, on the anode circuit of which is the line output transformer and the horizontal form control. The efficiency diode is a U329 and the EHT rectifier a U37. The width control is across one part of a secondary winding of the line output transformer. R32 is horizontal hold. The frame circuit consists of V18—B65 and V19, N78. The B65 acts as a multi-vibrator

FRAME TB (Fig. 1c)	
R51—2.2 KΩ.	R67—100Ω.
R52—100 KΩ.	R68—330Ω.
R54—1.2 MΩ.	R69—2 KΩ.
R55—1 KΩ.	
R58—150 KΩ.	C50—.04 μF.
R59—500 KΩ.	C52—.04 μF.
R63—1 MΩ.	C54—.1 μF.
R64—1 MΩ.	C56—.25 μF.
R66—1.8 KΩ.	C59—500 μF.

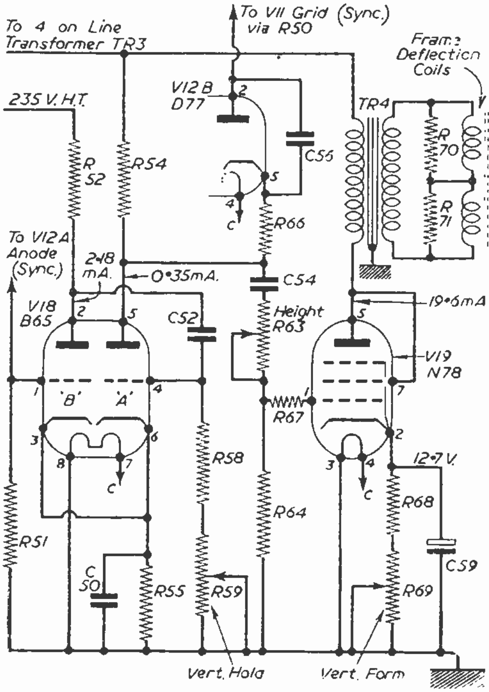


Fig. 1(c).—The frame timebase section.

with vertical hold control R59—500K between the grid of the triode and chassis. The output is fed to the grid of V19, via C54 and R63 (1 meg.), the height control.

The vertical form control is in the cathode line of the frame output valve.

The sound circuit consists of V8—Z77, V9—D77, V10—DH77 and V13—N78. V8 is the sound I.F. valve. V9 acts as a sound noise suppressor. V10 is the sound demodulator and A.F. amplifier. V13 is the sound output valve. Sound volume is controlled by R28 (.5 megs.) in grid circuit of V13.

The Cathode Ray Tube

This is a triode with a B12A base. It is modulated on the cathode (pin 11) from V6, V7. The brightness control, R47—100K, is in the grid circuit. As difficulty was experienced, owing to wide-angle deflection, with neck cut off, i.e., a shading in top left-hand corner of picture, a small magnet similar to an ion trap is fitted on the neck of tube near to the base. Rotating this magnet clears this shading. To prevent distortion of the scan, due to the stray magnetic field of the focus magnet, which affects the top left-hand and bottom right-hand corners, strips of stalloy lamination are fixed on a bracket on the chassis near to the deflector coils. These strips, which can be rotated on the bracket, are moved until optimum scan shape is obtained.

Focus

This is restricted in this model and it may be found that when the deflector coils or the cathode-ray tube are changed, optimum focus cannot be obtained without shifting the focus magnet. This may mean fixing spacing washers between magnet and focus magnet plate, or removing them if already fitted.

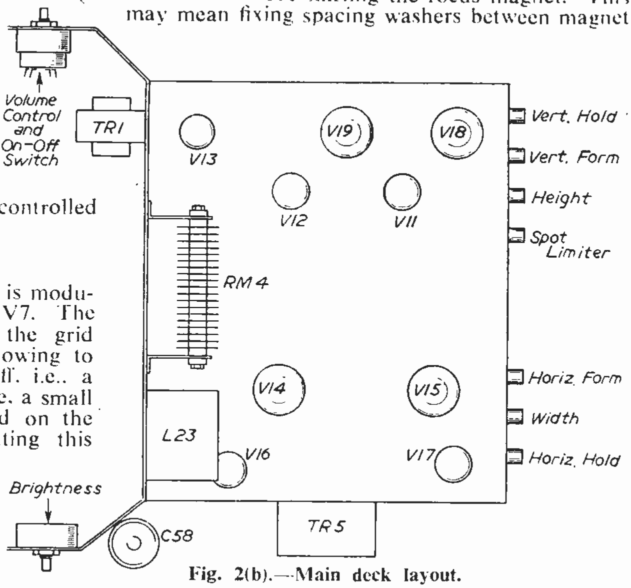


Fig. 2(b).—Main deck layout.

Dismantling of Set

The chassis is in two parts, one the main chassis which comprises power supply, timebases, controls, and sound output stage, the other the subdeck consists of R.F., F.C., I.F.'s, video demodulator, video amplifier stages. After removal of back, R.F. subdeck is first removed. This is held to main chassis by two 6B.A. screws. Before moving subdeck, disconnect the chassis lead going to main chassis, the lead from tube base to subdeck, and the octal connecting plug which supplies heater and H.T. voltages to subdeck.

To remove main chassis remove the four 2B.A. fixing bolts at bottom of cabinet, pull off knobs from volume control and brightness control. Chassis can then be withdrawn.

SYNC (Fig. 1a)	
R49—2.2 KΩ.	R65—10 KΩ.
R50—2.2. MΩ.	C49—.1 μF.
R53—47 KΩ.	C51—.01 μF.
R56—68 KΩ.	C53—.01 μF.
R57—33 KΩ.	C55—25 μF.
R60—68 KΩ.	C57—200 μF.
R61—5.1 KΩ.	C58—100 μF.
R62—1 KΩ.	C60—.02 μF.

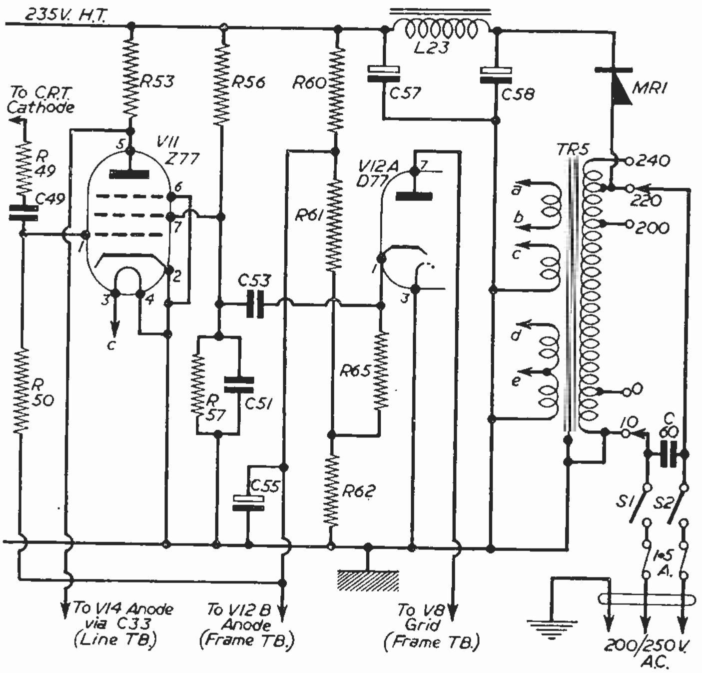


Fig. 1(a).—The sync circuit.

Servicing and Typical Faults

When servicing this receiver care should be taken to ensure that the chassis is at earth potential. For practically all faults it is first of all advisable to check the smoothed volts and also the current taken by the receiver. This should be taken at a point where the main H.T. line leaves the smoothing choke L23. The volts are 235 and the current 220 mA. Observing the fact that there are several Z77's in the layout, advantage should be taken to change valves over in suspected positions. For instance, should the fault be affecting vision and sound then V1, V2, V3 could be changed by either, V4, V6, V7, V8 or V11. The metal rectifier MR1 will be a likely cause of low H.T. and should be changed. Replacement will be an RM4.

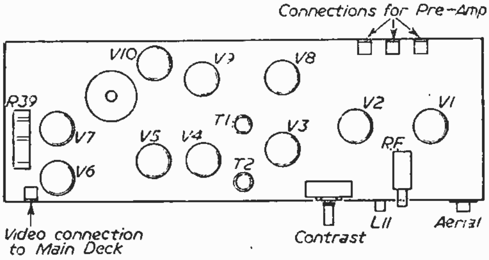


Fig. 2(a).—Subdeck showing position of valves and controls.

Frame Circuit

Likely faults here are: (1) foldover at bottom of picture. Here R68 and R69 should be checked as well as C59. The cathode volts on V19 should be 12.7 volts. (2) Lack of height. Check R64 and R63. (3) Intermittent hold. Generally due to V18, although C52, C54, R58 and R59 should be checked.

Line Circuit

(1) Poor hold. May be due due to V14 or following components C33, TR2, R32, R33, R34. (2) Insufficient width. Check the following, C36, R37, R38, C37, V15, L22. (3) Poor horizontal form. In adjusting this control for good linearity, adjust it for maximum picture brightness. The two results coincide quite closely. (4) EHT low or nil. Check V15, TR3 (readings at end of article), C45, V17, C43.

LINE TB (Fig. 1b)

R32—100 KΩ.	C33—200 pF.
R33—100 KΩ.	C35—.01 μF.
R34—3.3 KΩ.	C36—.01 μF.
R37—5.6 KΩ.	C37—4 μF.
R38—68 KΩ.	C41—22 pF.
R41—100Ω.	C42—1.0 μF.
R42—10 KΩ.	C43—32 μF.
R72—5.5Ω.	C44—.1 μF.
C31—.001 μF.	C45—500 pF.

Sound on Vision

If adjustment of oscillator L11 does not clear this, careful adjustment of T1 and T2 on a transmission should clear. A method that can be used is to adjust the horizontal hold to slip picture so that edge can be seen. If there is any sound on vision it will appear as a wavy or ragged edge. A re-setting of L11 after this may be necessary.

Vision on Sound

This may be due to cross-modulation. In this case try interchanging V1 or V2 with any other Z77 except V2 the frequency changer. On the other hand it may be due to too strong an input signal. Fitting an attenuator will allow the receiver to operate at a different gain control setting for the same picture contrast.

COIL AND TRANSFORMER DATA

L19	Video grid coil	4.5 ohms
L8, L18, L20	R.F. chokes	2.5 ohms each
L21	Hor Form	3.3 ..
L22	Width control	8.2 ,,
TR1	Primary	560 ,,
TR2	,,	18 ,,
TR2	Secondary	10 ,,
TR3	Tags 1—2	19,000 ,,

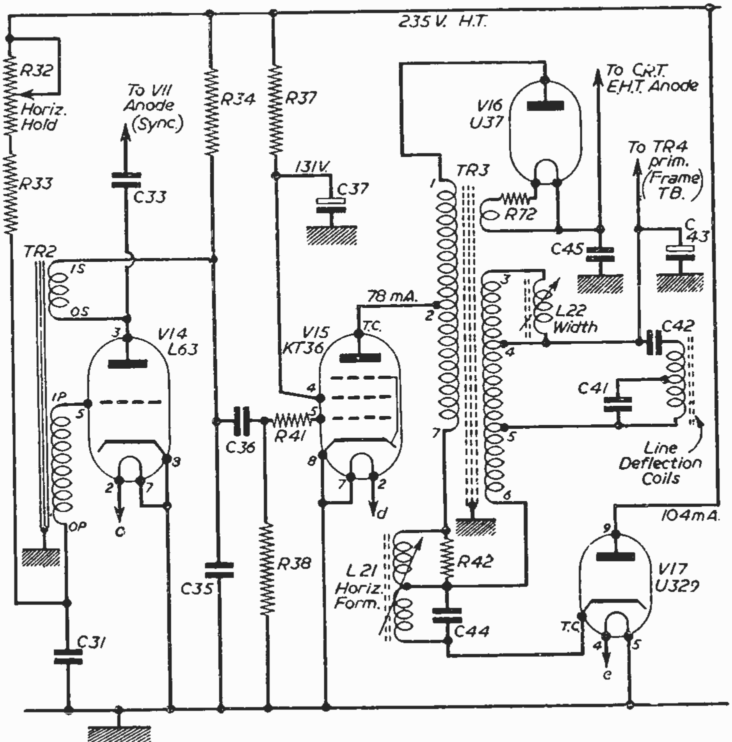


Fig. 1(b).—Circuit of the line timebase.

TR3	Tags 2—7	7 ohms each
TR3	Tags 3—4	0.5 ,,
TR3	Tags 4—5	3.1 ,,
TR3	Tags 5—6	4.0 ,,
TR4	Primary	1,450 ,,
TR4	Secondary	9 ,,
Mains XFMR	Brown/black	1.0 ,,
	Black/white	19.5 ,,
	White/grey	1.5 ,,
	Grey/blue	1.6 ,,
	Yellow/yellow	0.61 ,,
	Yellow/black	0.1 ,,
	Red/black	2.2 ,,
	Green/black	2.1 ,,
Deflector coils	Line	13.8 ,,
	Frame	36.0 ,,
Choke	L23	74.0 ,,

Other Points

Should the C.R.T. develop a heater/cathode short it will in all probability burn out R38. This is on top on subdeck near V6: V7. In replacing this see that no shorting to chassis can take place.

Replacing Tube

When replacing a tube, care should be taken to see that mask is square and sides vertical. Front edge should be 3 1/16in. from front plate of chassis. The bracket supporting focus coil should be positioned so that rear face of focus unit is 9/16in. forward of the second of the four triangular support plates. The bracket is movable by loosening bolts connecting it to chassis.

America Buys British Colour

FOR some years past the medical profession, and teaching hospitals in particular, have been keenly interested in the possibilities of closed circuit television as a medium for demonstrating surgical and clinical techniques. The television system has the unique advantage of giving a magnified close-up view of the proceedings to a large body of people simultaneously. It has always been realised, however, that whilst many actual techniques can be successfully demonstrated with black-and-white television, the absence of colour imposes a severe limitation upon the overall usefulness of the medium for this application.

Marconi's have been actively concerned with the development of colour television for many years, and, among other things, engineered the first compatible colour TV system to be seen in Britain, and supplied the cameras and transmitters which the BBC are using in their experimental colour broadcasts. Now, as a result of this considerable experience, a practical medical colour TV system has been evolved.

To further this important development, the well-known American pharmaceutical firm, Smith Kline and French Laboratories, have placed an order with Marconi's for the supply and operation of a fully-equipped mobile colour television unit, which will be placed at the free disposal of Medical Authorities for use at professional meetings of all types throughout Britain. It will be recalled that earlier this year Smith Kline and French Laboratories shipped to England their American mobile colour equipment and provided demonstrations in London and elsewhere.

The unit will embody the latest types of Marconi colour equipment including a 3-tube Image Orthicon colour camera channel, colourplexer, pulse and waveform generating equipment, vision mixing equipment, vision distribution equipment and sound equipment. Black-and-white camera channels will also be incorporated for televising the panel of doctors who normally comment on proceedings from a separate studio at intervals during the telecast. (For this part of the programme, of course, colour is not essential.) A 405-line system to Anglicised NTSC standards will be used.

Wall Installation of TV Sets

GENERAL ELECTRIC television engineers have voiced a word of caution in the U.S.A. for those planning to use a television set in a wall installation. In view of the importance of the points raised they are repeated below.

Prompted by the increasing popularity of "built-in" furniture and appliances, G.E. prefaced the cautionary note by urging those contemplating such an installation to seek professional advice before undertaking the task. In so doing they said the possibility of a heat or fire hazard due to lack of essential air circulation may be avoided.

All American General Electric TV receivers, as well as those made by most U.S. manufacturers, are approved by the Underwriters Laboratory. This approval, however, is given on the basis of the complete receiver with the chassis enclosed in its own cabinet.

The TV cabinet is designed by the manufacturer so as to permit adequate air circulation throughout the interior of the set when operating in an open area. This provides the necessary cooling action and is absolutely vital for safe operation and long life.

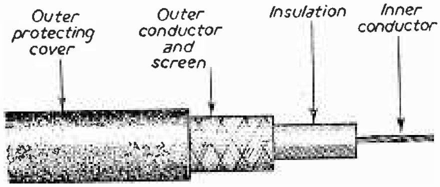
G.E. engineers point out that some people may assume that the cabinet provided with the set can be built directly into a partition with no additional safety measures. This, they say, is not true. Even if the TV set were to be placed flush against a wall, sufficient air circulation might be cut off and so impair operation of the set or create a heat menace.

Actually, a built-in television receiver, when properly installed, should be enclosed in a separate enclosure with a minimum of two inches of air space between the TV cabinet and the enclosure at bottom and rear and three inches between the enclosure and the top of the set. Adequate grill openings should be provided in front and at top and bottom of the receiver. This enclosure should be constructed of an approved galvanised material similar to the standard terminal or junction box or other approved fireproof material. The TV within the box should be supported by metal braces and the mains power supply, installed by an electrician, should be within the enclosure.

COAXIAL CABLE HINTS

HOW TO MAKE USE OF ODD PIECES OF CABLE WHICH CAN OFTEN PROVE VERY USEFUL. By "Scan"

MOST TV experimenters accumulate odd pieces of coaxial cable, but do not realise that it can be turned to good account. Short lengths of coaxial make excellent tuned circuits. Considerations of bulk on the one hand and falling efficiency on the other, fix their most useful working range at 50-500 Mc/s, which covers a wide group of amateur constructors' interests. Within this range they will not only do all that the conventional tuned circuit can do, but they will often do it better. They offer an extremely high "Q," freedom from direct radiation, compactness and great versatility in application to physical layout.



An Example

How are we to achieve these results as required, without the use of higher mathematics? Let us start with a piece of cable one quarter-wavelength long (for the exact meaning of one quarter-wavelength see below). Let us short-circuit one end. This is shown in Fig. 1. Now apply a voltage of the appropriate frequency at the open end, and let its value be E volts. The distribution of voltage and current along the line is then as in the top graph. This is really common sense—we would expect the voltage to drop to zero at the short, and the current to rise to a maximum at the same point; it may be complicated to prove, but it is not difficult to see! Now let us derive the effective impedance at every point in the line. This is done, as in Ohm's Law, by dividing the voltage by the current. This gives us the lower graph, which is derived from the upper one by taking points on the E curve, and dividing these voltage values by the corresponding current figures from the I curve. Once again, as common sense would dictate, we find that the impedance at the short-circuit is zero. (I have actually seen this deduced as the result of a page and a half of calculations!) But look at the input end—that curve is going up and up, and, in theory, with a perfect line, would reach infinity. And that is really the whole secret. With certain values of L and C, a parallel-tuned circuit offers a (theoretically) infinite impedance to certain signals—those having a frequency $\frac{1}{2\pi\sqrt{L.C.}}$ With a given length a short-circuited piece of coaxial offers (theoretically) infinite impedance to certain signals—those having a frequency which makes the line effectively one quarter-wave long. The two things are equivalent, except for considerations of efficiency and convenience.

To practical cases then. I will not presume to offer the instruction on the preparation of open and short-circuited ends on a length of coaxial; however, before discussing circuits, a practicable means of making tappings may not come amiss. It is shown in Fig. 4. To prepare, for example, an 8in. length, tapped at 3in. from the short, cut 5in. and 3in. lengths, and join as illustrated. Incidentally, when cutting lengths it is not usually necessary to make allowance for end stripping, except at the highest frequencies; and even then such allowance is largely a matter for trial and

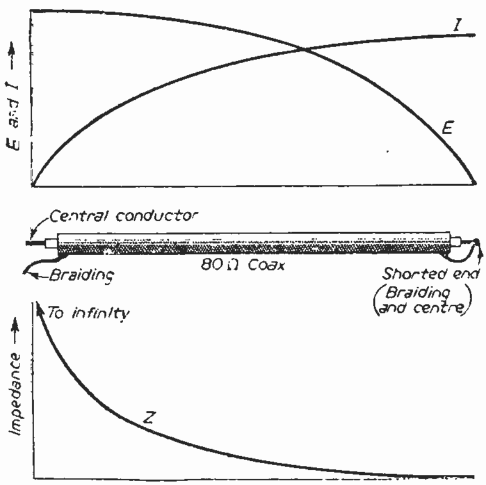


Fig. 1.—Short length of coaxial cable and the impedance, voltage and current curves.

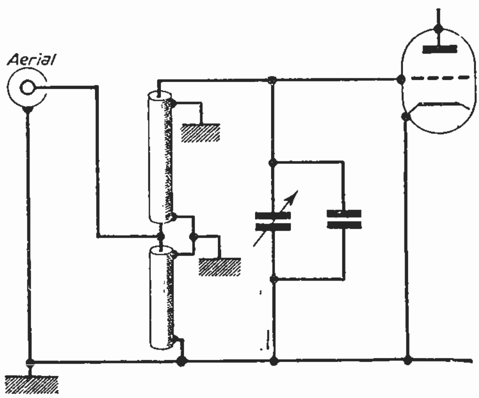
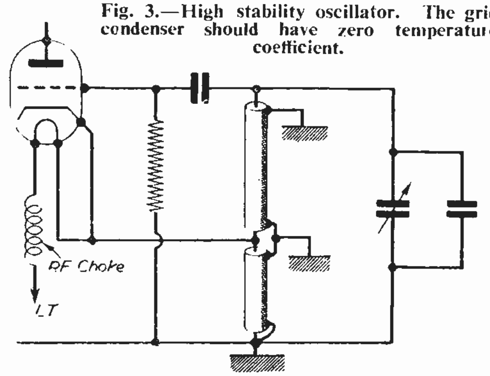


Fig. 2.—Aerial coupling and R.F. tuning (tapped line, braiding earthed at three points).

error. These things are not nearly so critical as some appear to think.

Fig. 2 shows aerial coupling and R.F. tuning, Fig. 3 is an oscillator and Fig. 5 an R.F. coupling. It will be noticed that in each case the line is tuned by means of a variable condenser in parallel with a fixed one. The connection of capacity across a line has the effect of increasing its length, and the variable, therefore, is a convenient means of tuning. The presence of the fixed condenser has two purposes; first, it enables us to use shorter lines than would otherwise be needed, thereby indicating compactness;

Fig. 3.—High stability oscillator. The grid condenser should have zero temperature coefficient.



and secondly, it will be found when using lines that normal values of capacity swing in the variable component tend to give rather wider frequency coverage. Since this is not desirable in, say, the oscillator of a superhet (as it may affect the het volts), and since stages to be ganged together must be constructed similarly, the fixed condenser is included in all the diagrams.

Simplified Diagrams

The diagrams have been kept as simple as possible, in order to preserve the emphasis on the methods of using the lines. Thus, the valve is shown as a triode; it may well be, but you can also use pentodes or tetrodes, while the circuit of Fig. 3 may be used for the triode section of a frequency changer. All that is necessary is to see that the valve selected is suitable for the frequencies to be covered. In Fig. 3, A.V.C. can be supplied in the normal way. In Fig. 5, the line is not shorted, but is shunted at one end by a condenser C1. This is because the central conductor is used to carry H.T. to the anode of the valve. The value of C1 should be large enough to appear substantially a short-circuit to the

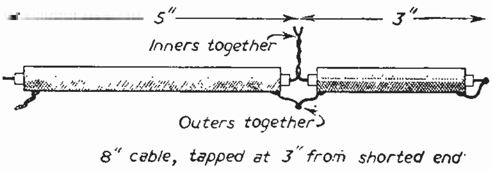


Fig. 4.—A short length of coaxial cable and method of connection.

frequencies concerned—say, 5,000 pF at 50 Mc/s, down to 500 pF at 500 Mc/s. In all the diagrams the outer screening is shown earthed at several points. This has been found in general to be the best procedure, though it is not usually necessary to observe "single point earthing" for the earth connections.

What lengths to cut? Fundamentally, we start from a quarter-wavelength of the highest frequency to be covered, i.e., if we wish to tune from 80-100 Mc/s, we take 100 Mc/s, which is 3 metres, and divide by 4, giving 75 centimetres, or about 30in., which which would not be very compact. However, this figure applies only to

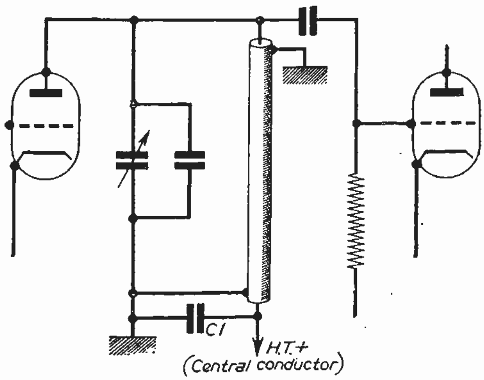
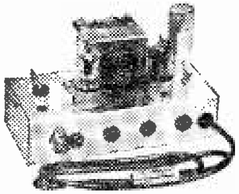


Fig. 5.—R.F. coupling.

air-cored cable. For cables having polythene or similar cores, wavelengths within the cable are all shortened to approximately two-thirds, which at once brings the length down to 20in. This is still rather long, and so we fall back on the fixed condenser already mentioned in this connection. In the end we find that, with a 20 pF fixed condenser and a 5-25 pF variable, we can cover the range quite nicely with about 6in. to 8in. of cable, much depending, of course, on the input capacity of the valve concerned, and the strays in the circuit.



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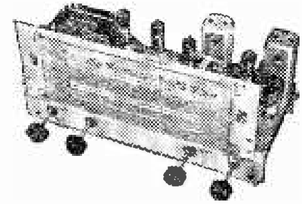

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SIMPLIFIED TV SERVICING

6.—THE CATHODE-RAY TUBE

(Continued from page 314, February issue)

AS the C.R.T. is the most expensive component of a television set, it is as well to know when and how it becomes faulty. In my experience many tubes have been declared faulty, when actually the fault has not been the tube but some component in the set. This, therefore, can be a very expensive business if someone with little experience says that the fault is the tube when it is really something else. Let us then consider what a cathode-ray tube is and its functions in a television receiver.

The cathode-ray tube is essentially a valve. It has its electrodes, each of which perform a certain function. It is a hard vacuum type, and in the case of an electro-magnetic version (the usual type used) has external components closely coupled to it that affect its operation. The voltages applied to its internal electrodes are much higher than those applied to a valve, but its action as regards the electronic stream is very similar. Cathode-ray tubes as used at present are either triodes, tetrodes or pentodes. Heater volts vary from 2 to 10 volts, and EHT from 5 kV up to 25 kV.

Faults on C.R.T.s

Heaters may be open—or short-circuited. Here check that the base connections are O.K. and that the base is making proper contact. There may also be shorts between electrodes such as between cathode and heater, cathode and grid, and grid and anode 1. These faults may be shown by uncontrollable brilliance. The tube may also be "soft": this will be indicated by either a blank or very dim screen and may also be seen as a blue glow around the electrodes inside gun of tube. Another fault that can occur is no, or insufficient EHT supplied to the tube. This may be due to low emission, EHT rectifier or open-circuit EHT condenser. In present-day sets the EHT condenser consists of the inner and outer coatings of the tube. The outer coating is connected to chassis by a spring contact. Should this not be in contact with tube then the condenser is not in circuit and EHT will be low. Tubes losing emission can have their useful life prolonged by fitting a booster transformer. This steps up the tube heater volts by approximately 25 per cent., and gives the tube a further period of useful life. Fig. 1 gives a circuit for fitting a booster transformer to an A.C./D.C. receiver.

Changing Tubes

As some of the older triode tubes wear out, and no replacements are available, it often becomes necessary to fit a tetrode tube in its place. Now a tetrode requires an extra voltage supplied to it on anode 1, and it becomes necessary to find a suitable point in the circuit from which this voltage can be supplied. This voltage is generally about 350 volts.

In changing from old-type circular round-faced tubes (now obsolete) to the circular flat-faced type, it will in most cases be necessary to fit a new mask, otherwise the tube will not fit in correctly.

With some sets it is quite satisfactory to fit a larger size tube, for instance, many 9in. and 10in. sets will take a 12in. tube, although the maximum width may not always be obtainable. Before deciding to fit a larger tube, make sure that there is plenty of room for it without the envelope of the tube shorting on to any component. Also check the amount of EHT the new tube requires and see if it is available from your receiver. Check the angle of scan of old tube compared with new. New scan coils may be required.

It should be pointed out that if fitting a tetrode in place of a triode, great care should be taken to see that the first anode voltage is as laid down for the tube. Low voltage will result in no brilliance on the tube.

Ion Trap

Many readers write and state that they have altered position of ion trap to correct focusing and have not succeeded in doing so, but have, in fact, spoilt their brilliance. May I therefore state again that the ion trap does not control focus at all. Its job is clearly stated by its name, to trap the ions and thus prevent burn on the screen, or perhaps destruction of the cathode by bombardment of heavy ions. Should the ion trap be moved, either accidentally or for some other reason, it should be reset as follows. With the set switched off, the ion trap magnet should be pushed over the base of the tube with the arrow marked on it pointed towards the screen. The set should then be switched on, the brightness control set to a position where the raster is just visible. The arrow should be on top side of gun. The trap should then be slowly moved

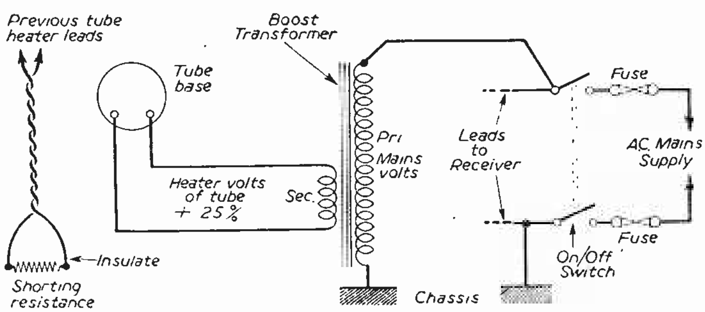


Fig. 1.—Circuit showing application of a booster transformer.

towards the screen until focused raster is at its brightest. Now reduce brightness control until peak white is at its correct level, and then further move trap slightly to obtain maximum brilliance. Should the raster be slightly out of centre, and the position of focus coil will not centre it, the ion trap may have to be rotated slightly to do this. This, however, should not be done at the expense of brilliance. The ion trap should now be locked in position with the screw fitting. See that the position does not change whilst tightening screw. Do not subject an ion trap to strong magnetic fields or to mechanical shocks. Either of these may cause it to lose strength and a new one will be necessary.

Removal and Cleaning of Tubes, etc.

All sets after about 12 to 18 months collect a certain amount of dust inside, which settles on to face of tube and on to inside of front glass of cabinet. This is due to the static charge on these parts which attracts the dust. Many a poor picture can be made quite good if this dust is removed. It would be impossible here to give all the different methods employed by manufacturers in boxing their sets, but they generally come under two headings. One type is where the tube is separately mounted, and the other which the tube is chassis mounted. In both cases the sets have to be removed from the cabinet to get at the tube front and the plate glass. *Warning.* Before attempting to remove either chassis or tube, see that the EHT lead is shorted to ground, together with the coating of the tube. In the case of the tube being separately mounted, carefully disconnect all C.R.T. connections and mark where they came from. When the chassis bolts and knobs are removed, carefully withdraw the chassis. The tube supports can be removed and tube withdrawn. Handle the tube very carefully and not by the thin end. To prevent risk in the case of accidents, wear goggles: They will save your eyes if implosion should occur.

Cleaning Front of Tube and Glass

If dust is loose, brush off with a very soft brush to prevent scratches. The writer always uses Perspex polish No. 3 for cleaning the front of tube and also the glass. Follow the instructions on jar. Be careful not to damage or rub off the coating of the tube. Only use soft cotton wool for wiping off and polishing front of tube and glass.

Disposing of an Old Tube

Do *not* take it out into back garden and hit with a hammer. This is dangerous. Place the old tube in a cardboard box, completely covered, with a small hole at one end to take an iron bar or poker. In this way the tube can be broken up without the danger of flying glass.

Focusing Faults Due to C.R.T.

In some cases poor focusing may be due to the cathode-ray tube itself, although in general it is not so. In the cases referred to a slight rotation of the tube may find a position of optimum focusing. It should be noticed that the focus magnet or coil should be at right angles to to the tube.

U.H.F. Television Transmitter

THE BBC has installed at the Crystal Palace the first high-power U.H.F. television transmitter in Europe for the purpose of carrying out a series of tests in Band V (610-960 Mc/s) to obtain information on the possible use of this band for television broadcasting.

The U.H.F. transmitter and aerial equipment is being hired by the BBC from E.M.I. Electronics Ltd., who designed and manufactured it at Hayes, Middlesex, in the same laboratories that gave birth in the 1930's to the first high-definition television system. It is an interesting piece of history that the 200 ft. mast at Hayes which E.M.I. have been using for the past year to carry out tests of the new U.H.F. aerial was the prototype of the mast erected at Alexandra Palace in 1936 to radiate the world's first public television service.

Technical Details of the Equipment

The transmitter now at the Crystal Palace comprises a 10 kW vision transmitter and a 2½ kW sound transmitter. The vision frequency is 654.25 Mc/s, but the transmitter is available for operation anywhere within the frequency range 470-960 Mc/s (Bands IV and V).

The equipment is low-power modulated on both sound and vision channels and employs klystron tubes in both audio and video final stages.

These klystrons use three external cavity resonators and operate as linear amplifiers with a power gain of approximately 100. They are driven by a modulated amplier stage operating with a cathode modulated circuit.

The Waveguide

The output of the transmitters is combined in a circuit of the filter bridge type constructed in rectangular section waveguide. The combined output is then conveyed to the aerial by an elliptical waveguide having dimensions of 12in. × 6in. The elliptical waveguide is made of 99.5 per cent. aluminium in 12ft. lengths.

At the top of the television mast the waveguide is transformed into a 5in. concentric feeder to take power to the four driving points of the helical aerial, the pole supporting the aerial being arranged to form the outer of the concentric feeder.

The Aerial

The helical aerial, made of ½in. diameter copper rod, comprises four bays mounted one above the other on the same vertical axis, each having a linear height of five wavelengths.

Operation on 405 and 625 Lines

The BBC is at present carrying out tests on the British 405 line standards and it is expected that these will continue until about March, 1958. However, the transmitter has been designed with a view to operation on either the British 405 or the Continental 625 line standards.

Making Scanning Coils

CONSTRUCTIONAL DATA FOR THE EXPERIMENTER

By "Serviceman"

A PRELIMINARY description of the scanning process has been given in various articles in these pages and it has recently been shown that an L/R ratio of about unity (L in mH and R in ohms) is convenient for both line and frame coils. The most important features of the scanning coil assembly are: (1) good focus uniformity, (2) correct raster shape and (3) high sensitivity.

The first two requirements are incompatible in that uniform focusing over the entire screen of the flat-faced tubes now in common use will result in a pincushion-shaped raster (Fig. 1a). so that a compromise solution will have to be reached. In 90 deg. scanning coils extreme pincushion distortion is experienced and four small permanent magnets are disposed about the tube neck to correct for this effect. The adjustment of the raster shape is brought about by grading of the deflector-coil wire density as the angle θ. subtended by different portions of the coil is varied. This will be made clear by Fig. 2. which shows the end view of two sets of coils. one ungraded (a) and the other graded (b). This grading should follow a "cosine-squared" law, in relation to the angle θ. but in practice is not extremely critical. Raster shape can also be controlled by the shape of the core used and this is especially true in the case of the castellated design to be described later.

The sensitivity af the scanning coils will be found to be directly proportional to the length of the coils used (l in Fig. 3). and also the distance of the centre of the coils from the screen. and inversely proportional to the square root of the E.H.T. potential. It is obviously advisable to use as long a coil as possible. but a limit will be reached when "neck-shadowing" becomes apparent. This is illustrated in Fig. 3. for two alternative lengths of coil l1 and l2. If the beam is not to be obstructed by the cathode-ray tube neck then coil l2 is the longest that can be used in the example. The sensitivity is also proportional to the magnetic field produced across the tube neck and in order to improve this. especially at line frequency, a magnetic core is placed around the set of scanning coils. This can take several forms, and iron-wire. semi-circular laminations and layers of nickel-iron tape have all been used for this purpose. More recently. however. ferroxcube has been used for this purpose. and with its low hysteresis and eddy-current losses it is an extremely valuable material for wide-angle scanning.

Considering now methods of scanning coil construction, numerous arrangements have been tried and a few are illustrated in Fig. 4. Of these the saddle type is usually the more sensitive and lends itself better to amateur construction. Two practical examples will now be given suitable for scanning 53 deg. and 70 deg. scanning-angle tubes respectively.

Narrow-angle Deflector Coils

A mandrel is needed to form the coils and a suitable design is shown in Fig. 5. The internal dimensions of the coil are adjusted by the position of the stops shown, placed in the appropriate holes.

The frame and line coils are first wound flat between the mandrel plates to the shape illustrated

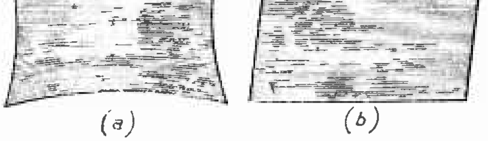


Fig. 1(a).—Pincushion distortion; (b) trapezium distortion.

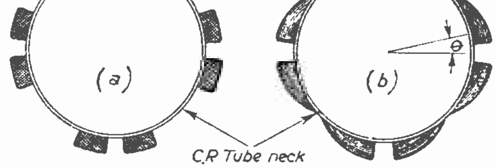


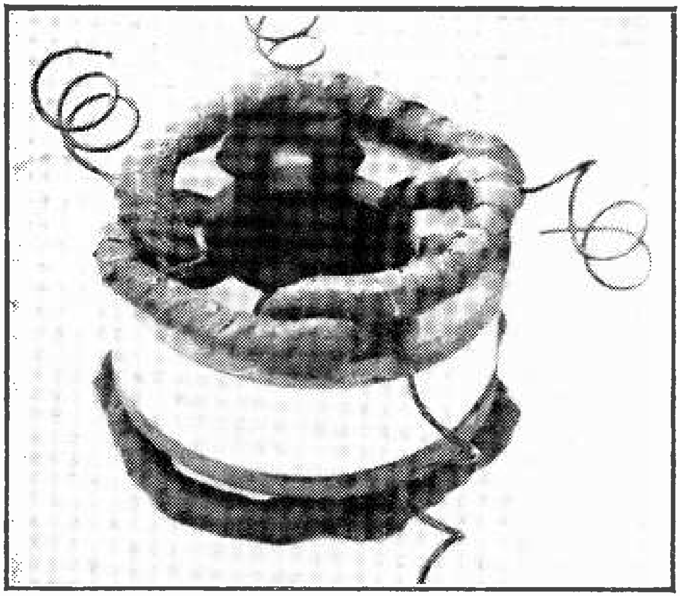
Fig. 2.—End view of ungraded (a) and graded (b) deflection coil wire densities.

in Fig. 6. Adhesive tape is applied to the winding as shown so that the coils may safely be removed from the forming jog without disturbing the wound shape.

Next it is necessary to form the coils to the shape shown in Fig. 7. This can be done by first bending up the ends of the coil at right-angles, along the dotted lines shown in Fig. 6, and then bending to shape over a cylindrical piece of wood of the diameter of the tube neck.

It should be unnecessary to mention here that the utmost care should be taken in "forming" this particular winding. Apart from the risk of cracking the enamelling, with the risk of a short-circuit between turns, there is also the possibility that the windings may be so distorted that what might be termed "outside" turns might become pushed down near to "inside" turns. This will affect the efficiency of the coils. In order, therefore, to avoid these risks the keen constructor will cut out a rough wooden shape, and upon removing the winding from the mandrel will carefully tap the coil into shape with another light piece of wood. Needless to say this work requires very great care to preserve the shape and relationship between windings. Care and time spent over this part of the work will be repaid in the reliability and efficiency of the finished article.

Finally, the four coils are assembled together with the shorter frame coils inside those of the line, tape being wound between the coils as shown to maintain them in position. Care must be taken to see that the pairs of coils are exactly at right-angles or trapezium distortion will result (see Fig. 1b).

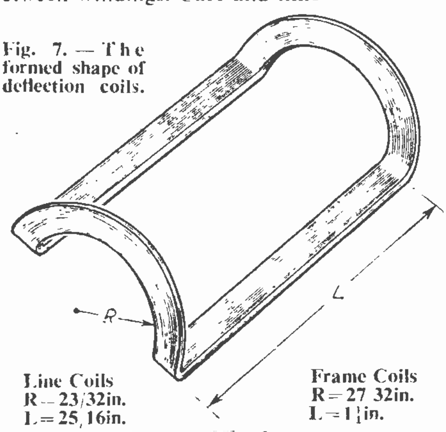


A wide-angle coil made up to the instructions given here.

The core material used is 20 s.w.g. iron-wire and six layers are wound in the space between the coils. The coils are protected from damage whilst this is being put on by two card cheeks, at each end of the coils.

The completed deflector coil will be found suitable for use with the frame circuit described in the November, 1957, issue for scanning a 12in. tube. The line coils have an inductance of about 6 mH and the frame coil resistance of 26 Ω.

Fig. 7. — The formed shape of deflection coils.



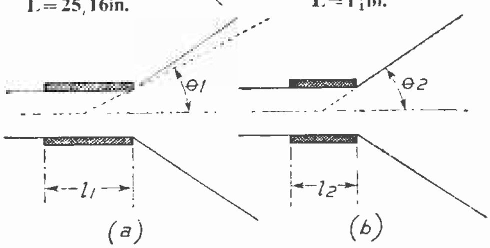


Fig. 3.—Maximum scanning-angle θ for two lengths of scanning coil l1 and l2.

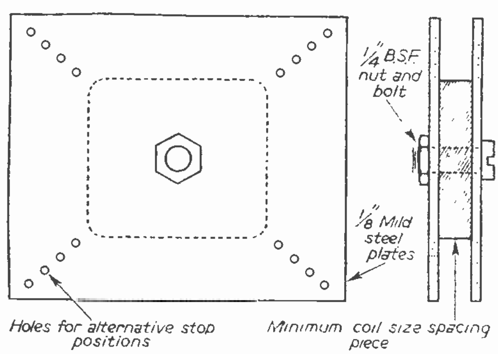


Fig. 5.—Deflection coil-winding mandrel.

Wide-angle Deflector Coils

A simpler constructional method is made possible with this coil assembly by the use of Mullard ferroxcube cores FX 1154. These have a series of eight slots cut around the internal periphery into which the coils are fitted. Two cores are used spaced ¾in. apart, with an insulating spacing ring (see Fig. 9)—a suitable adhesive for bonding these cores to the ring is "Evo-stik," an impact adhesive obtainable from most hardware stores. The great advantage of this arrangement is that raster shape is determined almost entirely by the machined shape of the ferrite cores, and far less care need be taken with the distribution of the coil windings.

The four coils are wound to the dimensions given in Fig. 10, using the mandrel previously described. After winding they are completely wrapped toroidially in P.V.C. tape or oiled silk and inserted in the appropriate slots as shown on the left. The end turns must be pushed flat and preferably tied in position. This is necessary if "shadowing" is to be avoided, and the coil centre must be placed as far up the neck of the tube as possible. A little care should be taken here to shape the windings at the front so that the assembly will go as far as possible forward on the neck of the tube. If you are replacing an existing set of coils you should inspect them and notice how they are formed. If you do not have access to any, remember that the tube widens out rapidly where the neck ends, and if the coils are not shaped they will only go forward until the end of the coil assembly comes up against the tube. If the turns are now bent outwards and carefully shaped, they will go over the widened tube and the complete assembly will thus go further forward. This widening out should not be overdone, but in the case of the castellated coil unit, the Ferroxcube ring should be as close as possible to the end of the neck of the tube. The completed coil assembly should have an inductance of about 10 mH for the line pair and a resistance of 24 Ω for the frame coils. This is suitable for the designs previously described in sections 3 and 6 of the series on "Scanning and Synchronisation."

Suitable Transformers

It is, of course, necessary to use these coils with suitable transformers. It must be remembered that transformer and coil must be matched and as a general rule one make of transformer will not go with another make of scanning coil.

A suitable frame transformer was described in our issue dated November last, whilst a transformer for the line time base was described in the last issue (February, 1958). Both of these transformers will be found under the articles entitled "Scanning and Synchronisation," whilst suitable circuits for use with these transformers have also been described under the same titles. This series commenced in the September, 1957, issue.

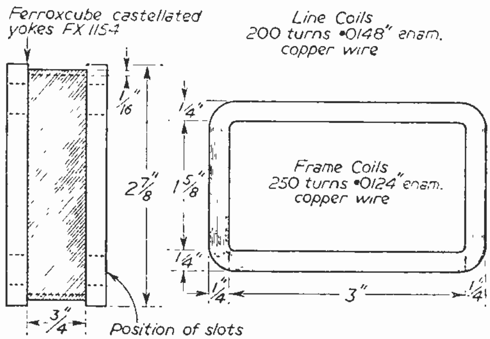


Fig. 9 (left).—Details of Core assembly for wide angle deflection coil. Fig. 10 (right).—Details of the wide-angle deflection coils.

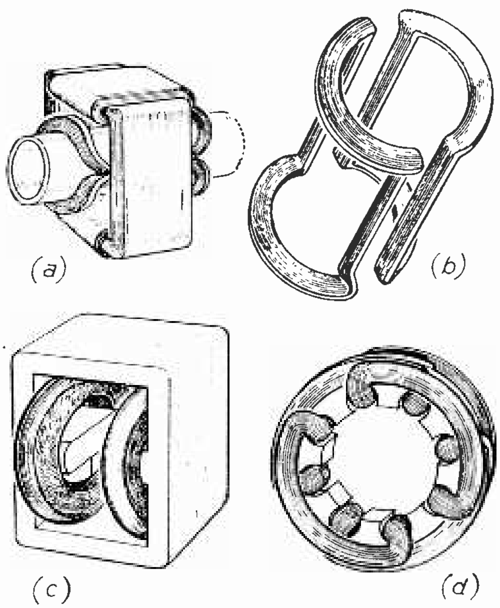


Fig. 4.—Various forms of deflection coil. (a) Toroidal frame and saddle-wound line coils ; (b) saddle-wound ; (c) yoke-type, and (d) castellated yoke with saddle-wound coils.

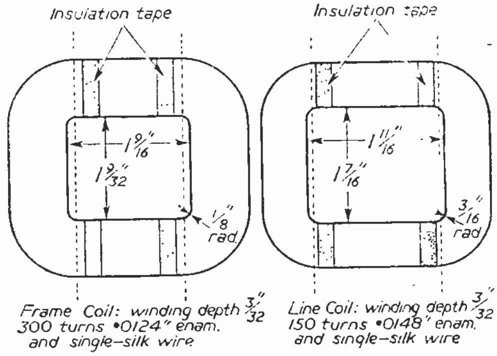


Fig. 6.—Details of narrow-angle deflection coils.

A Remote Control Unit

FIT ARMCHAIR CONTROLS TO YOUR RECEIVER AS SHOWN HERE

By A. E. Simons

THE unit about to be described gives remote control of brightness, volume and switching from the armchair, bed, etc., and can be used with the majority of TV receivers.

VR1 and S1 are combined (brightness and on/off switch), VR2 is the volume control (a 50 ohm wire wound pot. being suitable). R1, R2 and C1 are in the brightness control network.

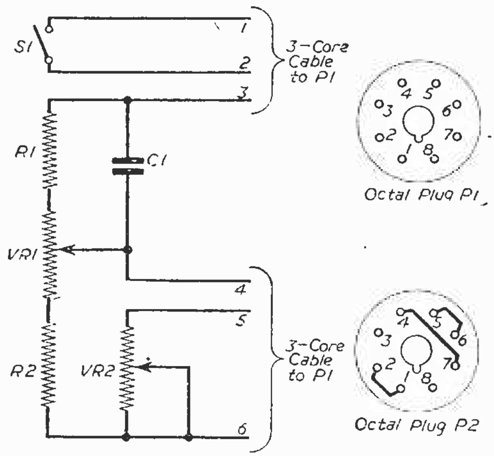
These components are fitted into a small wooden box with two lengths of three-core circular flex of the required length, with Octal plug P1 connected as in Fig. 1.

The value of C1, R1, VR1 and R2 depend upon the type of set being used—they must be duplicates of the brightness control network C2, R3, R4 and VR3, in the receiver (Fig. 3), in some cases R3, R4, or C2 may not be included.

Fig. 3 shows the receiver modified to take the control unit. An Octal socket was fitted to the chassis with an aluminium bracket and was made accessible to Octal plug P1 by a hole cut in the back panel.

Points marked W, X, Y and Z show where the alterations to the wiring were made in the writer's receiver (Ekco T.164) and dotted lines show the original connections. The volume control in the speaker transformer secondary eliminated the need for screened cable and is quite effective—the volume being pre-set by the main volume control in the receiver.

The Octal plug P2 has its pins linked (Fig. 2), and must be inserted into the Octal socket when the remote control unit is not required—this reconnects the original brightness control, etc.



Figs. 1 and 2.—The remote unit circuit and plug wiring.

Notes.—No metal parts must be exposed to the operator of the unit and double check your connections to the Octal plugs and socket—it is easy to make a mistake with these.

The receiver must be switched on first with the normal switch S2 when using the control unit.

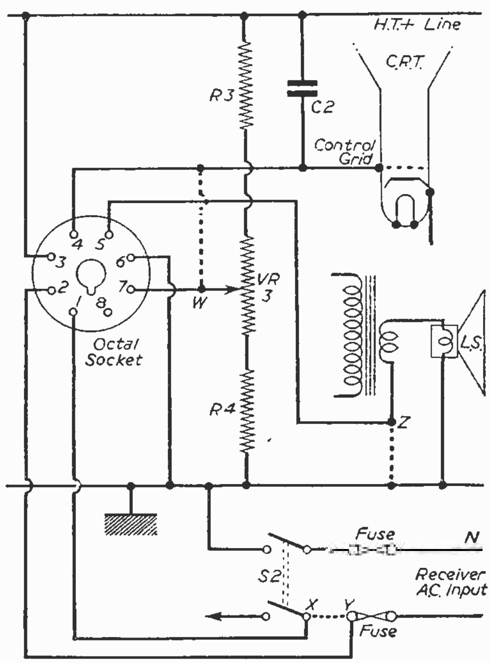


Fig. 3.—Modifications to the receiver circuit.

Subliminal TV

IT is reported that tests have shown that when a message lasting for one 3,000th of a second is flashed on a screen at five-second intervals the viewer is not aware of having seen it, but absorbs it unconsciously.

Subliminal perception, as this is called, has been rejected as a form of advertising by the national association of the American broadcasting industry as being unfair.

Television stations have been urged to have nothing to do with it, at least until the whole idea has been studied more carefully.

Nevertheless, the Subliminal Projection Co., Inc., which has applied for patents on projection machines that could be used to flash "secret" messages on cinema and television screens, insists that a number of advertisers are keenly interested in the idea.

LINEARITY FAULTS

THE CAUSES AND CURES FOR SOME FORMS OF DISTORTED PICTURE

THE linear sawtooth wave in a deflector inductor is affected by its inherent inductance. In a line timebase, during the forward stroke, the inductance affects the way in which the current wave builds up, and the great rate at which the current must be reduced to complete the flyback causes the setting up of a large back EMF. In a line timebase the deflector inductor has enough resistance to be regarded as an inductance and a resistance in series. Owing to the higher frequency of the line the inductive component is more important than the resistance. In a frame circuit the inductive is largely resistive.

Principles of Linearity

The output stage of both line and frame circuits introduces distortion because the wave shapes of input voltage and output current differ. It will be seen that it is easier to modify the shape of the driving voltage than the output current. Thus it is usual to limit the output stage non-linearity and finally correct to the grid voltage wave shape. It will be appreciated that perfect linearity cannot be obtained, but by careful design it can be made so that it is good enough for first-class viewing.

Negative Feedback Method

To reduce distortion of the waveform of the output stage negative feedback is generally adopted. The output valve is controlled at its grid by a voltage wave in generating the sawtooth currents, so therefore we must derive a voltage for feedback purposes which is proportional to the output current. Thus, should there be any difference between this voltage and the sawtooth generated, the negative feedback tends to cancel it. Now with negative feedback applied thus, losses will occur which will cut down the available scanning power. Many methods have been devised to overcome these losses. Fig. 1 shows one method. Here the feedback voltage is obtained from the capacitor in the series C.R. circuit across the scanning inductor. It will be noticed that the feedback voltage is fed back into the grid/cathode circuit of the output valve. Fig. 2 shows another method. Here the H.T. supply to the output stage of the timebase is tapped into the primary of the output transformer. Then the potential at the free end of the primary will consist of negative-going peaks separated by nearly linear changes having a positive slope. By feeding the sawtooth generator charging circuit from this point instead of from the steady H.T. voltage, the non-linearity of the sawtooth output wave is counteracted. Adjustment for linearity is made by adjustment of the tapping. Fig. 3 shows another method of achieving linearity.

Here the drop in potential on the screened grid which occurs at the flyback is passed to C1 and during the flyback is also driven negative from the negative potential existing at the control grid via R1 and the linearity control. The scan therefore commences with the suppressor grid at a negative potential and the rate at which this electrode rises towards cathode potential is controlled by the linearity control. The condenser C2 is connected across R2 and the hold control to avoid a voltage step across these resistors due to the sudden change in grid current during the flyback time. Fig. 4 shows a method of correcting distortion introduced by the output valve and transformer in a frame circuit. Fig. 5 shows a line output circuit where a tapped inductor in conjunction with C1 secures control of horizontal linearity.

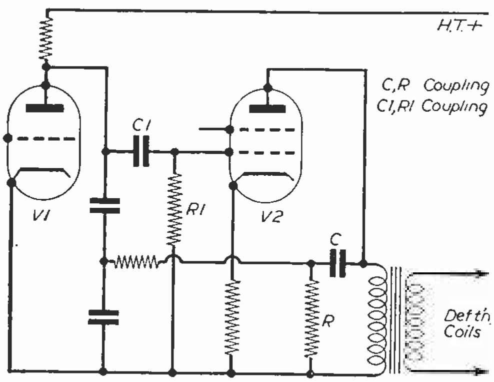


Fig. 1.—One form of feedback for linearising the output.

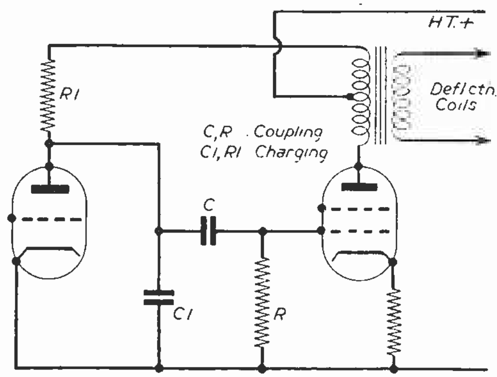


Fig. 2.—An alternative feedback arrangement.

Faults and Their Cure

Practically all sets when new have reasonably good linearity, but as they age linearity decreases. In most cases this is due to valves ageing and changing their characteristics. Therefore, when experiencing deterioration of linearity always try new valves. This will mean the output stage of whichever waveform, horizontal or vertical, is

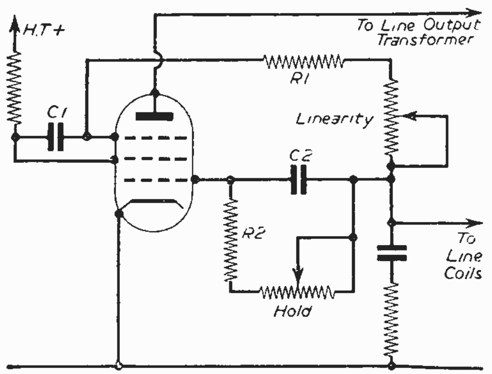


Fig. 3.—Another method of linearity control.

affected. Should this not effect a cure then components must be carefully checked. Resistors, values should be compared with the service diagram and it is a good idea to change them if doubtful. Keep to the values given in service sheet. Capacitors are very important in linearity circuits. Should any of them have the slightest leak, linearity will suffer. Therefore, I suggest changing them straight away. It may save you a lot of time and worry. Again keep to the capacity laid down in service sheet.

In line circuits linearity controls are often of the variable inductor type, and in some of the latest models a permanent bar magnet is moved with relation to the linearity coil. As not many engineers or amateurs possess an inductance bridge, it is suggested that if these coils are suspect they should be changed. They may possibly have shorted turns and thus be low in inductance. In most cases, except for sets more than four or five years old, they should be able to be obtained from the manufacturers' service department.

There is another point to remember, that is that linearity is often tied up with the correct

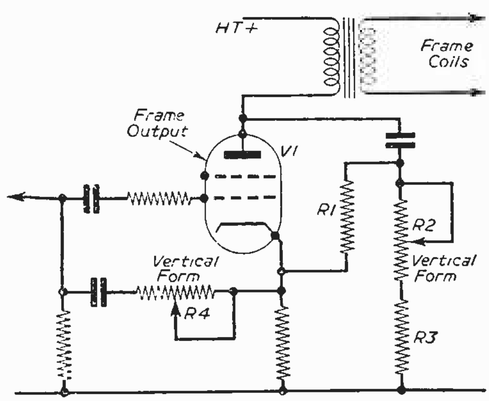


Fig. 4.—A frame output stage.

potentials being applied to the valves in question. Therefore, do not forget to check this.

Poor linearity can also be due to faulty deflector coils and also line and frame transformers.

In both of these cases changing the faulty component is the only cure. It will be realised that should the sawtooth generated be faulty, no amount of linearity controls in the output circuits will cure it. Therefore, in the case of sets where either the line or frame generator is not also the output valve, check these very carefully.

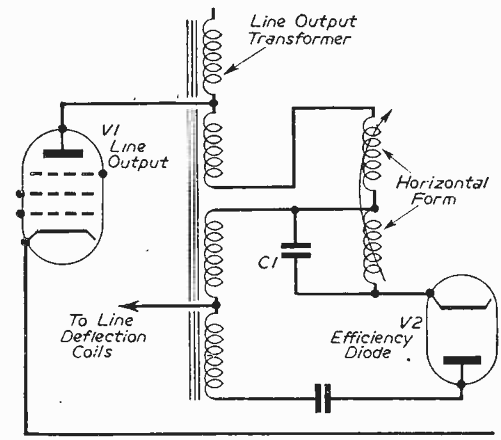


Fig. 5.—A line output stage.

Changing the valve is the best way, and in a set where there may be two of the same kind, changing them over may give you a clue.

PREMIER RADIO CO.

(Regd.) B. H. MORRIS & CO. (RADIO) LTD.

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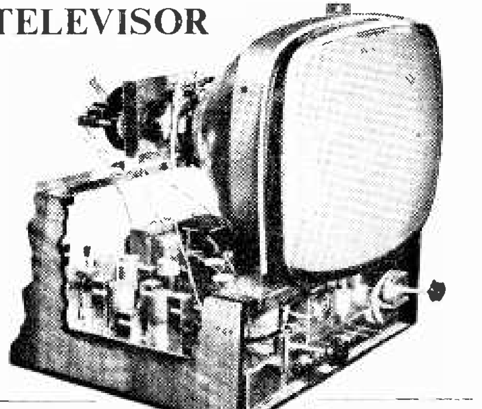

These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls.

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Build in 5 easy stages. Full Construction details available.
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Console Cabinets with full length doors for 14in., 16in., and 17in. tubes. Price £14.14.0.
H.P. Terms : Deposit £7.7.6 and 9 monthly payments of 18/6.
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On above cabinets add 21/- for pkg. and carr.

The "Petite" PORTABLE

MAY BE BUILT FOR

£7·7·0

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★ Size only 8in. x 8in. x 4½in.

Batteries extra.

HT 10/- (Type B126) or equivalent.

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Battery eliminator now available for 37/6.

SAVE POUNDS and put it together yourself !!

TOTAL COST ONLY

£9.19.6

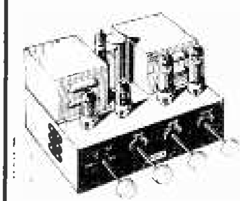
plus 5/- post & pack

Each Unit may be purchased separately as follows :—

Amplifier Cabinet in maroon and fawn (size 13¾ x 11 x 6½in.)	£2/10/-
1 Valve Amplifier	£2/19/6
7 x 4in. Elliptical Speaker	£1/1/6
B.S.R. TU8 Turntable and Pickup	£3/19/6

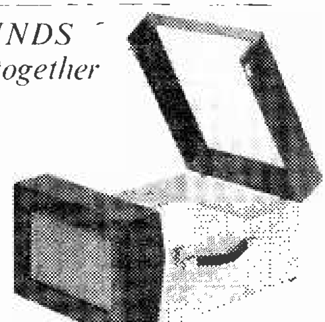
This can also be supplied complete with the **Latest Collaro 4-speed Junior Turntable and Pickup** for only **£10/12/6** plus 5/- packing and postage.
If any of the individual items are purchased, kindly add the postage as follows : Cabinet 3/-, Amplifier and Speaker 3/-, Turntable 2/6.

8-WATT AMPLIFIER



This design includes 5 miniature Valves of the latest types, an Ultralinear Output Transformer suitable for Speakers of 3 and 15 ohms and a very attractive Perspex front panel with gold lettering, complete set of parts, £8.8.0.
Postage & Packing, 5/- extra.

SAVE POUNDS and put it together yourself !!



Cabinet, £2/19/6
plus 5/- pkg. & post
Premier 1-valve Gram. Amplifier, £2/19/6
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Premier 2-valve Printed Circuit Amplifier, £3/5/6
plus 2/6 pkg. & post.
8in. x 5in. Speaker, 27/6
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Collaro 4-speed Changer, £8/19/6 plus 5/- pkg. & post.
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If a set of parts are purchased together, pkg. & post will be 10/-

RECORD CHANGERS

Collaro RC456—£9.15.0. Dep. £1.5.0 & 8 monthly payments of £1.5.9.

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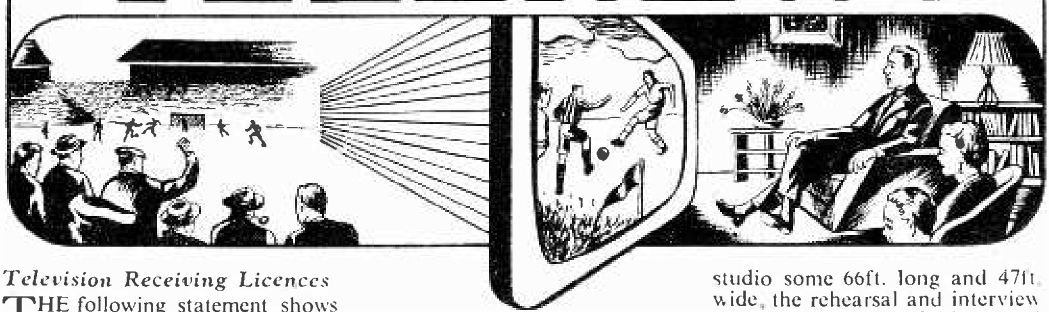
WHY buy surplus or reconditioned tubes when these Fully Guaranteed Wide Angle Tubes are available ? The latest type 17in. Rectangular Tube MW43/64 by Telefunken at £17 (inc. tax), post and packing 21/- extra.

PLEASE ADDRESS ALL MAIL ORDER ENQUIRIES TO (Dept. PT3), 207 EDGWARE RD., LONDON, W.2

TELENEWS



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of December, 1957, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,551,581
Home Counties	943,362
Midland	1,259,017
North Eastern	1,242,505
North Western	1,091,342
South Western	589,720
Wales and Border Counties ...	438,367
Total England and Wales ...	7,115,894
Scotland	568,329
Northern Ireland	76,571
Grand Total	7,760,794

Pye Transmitters for St. Hilary

WITH the opening of the Independent Television Authority's sixth transmitting station at St. Hilary, near Cardiff, still further Pye transmitters have been brought into use.

The installation and testing of these transmitters, together with the many other items of equipment used in this station, was achieved by Pye in the remarkably short period of three months.

The main vision transmitter gives a peak power output of 20 kW, producing an effective radiated power of 200 kW, and operates in conjunction with a 5 kW sound transmitter. A 5 kW vision transmitter, together wih a 1¼ kW sound transmitter, is provided for standby purposes.

The transmitters installed at St. Hilary are part of a series of television transmitters which have been designed, manufactured and installed by Pye during the past three years, and which are now operating in various parts of the world.

In addition to the transmitters at St. Hilary, a large quantity of Pye television studio equipment has been installed at the Pontcanna studios of TWW Ltd., the programme contractors for South Wales and the West of England.

Cardiff Studio

THE BBC's new "drive-in" television studio in Cardiff is located in the former Wesleyan Methodist Chapel lying between Broadway and Sapphire Street.

The building originally comprised the chapel, a hall, domestic accommodation and ancillary areas. The old hall at the Sapphire Street end of the building has been in use for some time as a single camera interview studio, the facilities of which were on many occasions augmented by cameras and equipment from the Welsh outside broadcast unit.

Alterations now completed, however, have considerably extended the space, facilities and equipment available for the production of television programmes in Cardiff.

The Broadway premises now contain the main studio some 66ft. long and 47ft. wide, the rehearsal and interview studio measuring 57ft. long and 28ft. wide, a telecine suite, vision switching centre, property and scene dock, dressing rooms, make-up and wardrobe rooms, together with office and general accommodation.

BBC Man Joins I.T.V.

MR. BERKELEY SMITH, assistant BBC Head of Outside Television Broadcasts, is to become Head of Outside Broadcasts for Southern Television, the Independent Television Company which expects to begin its programmes next August. The station will be at Chillerton Down, Isle of Wight, where the building is already up to roof level.

Mr. Smith, who is one of the BBC's most experienced and successful producer-commentators, will appear in Southern Television programmes and

Mr. E. K. Cole, chairman and managing director of E. K. Cole, Ltd., presented his firm's 1,000,000th television receiver to Nurse E. M. Howling, who accepted it on behalf of a local children's home.

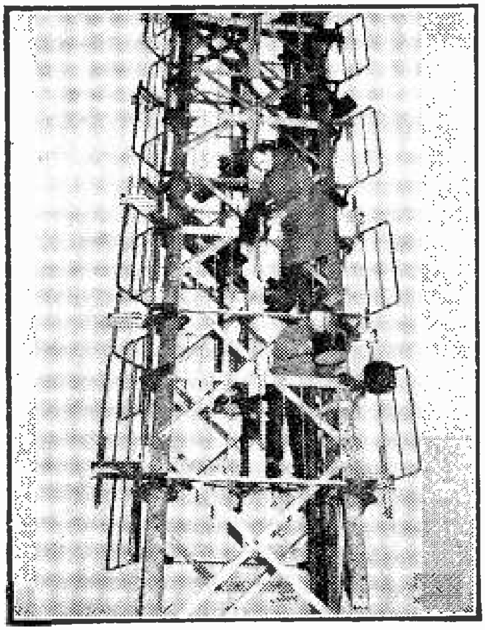
direct behind the scenes. He has been with the BBC for 12 years, having transferred to television in 1949.

TV Factory to be Enlarged

THE television department at the Orion Radio Works, Budapest, is to be enlarged so that 50,000 sets a year can be produced. The factory is the biggest of its kind in Hungary.

A new AT501 set made at the factory has a 17in. screen and can be used on two channels. It is said to be "easily adaptable" to a 12-channel set.

Poland has ordered 300 sets and if these prove satisfactory an order for 10,000 is expected next year.



The picture shows Marconi engineers working on the sixteen stack high gain aerial at St. Hilary.

St. Hilary Main Aerial

MARCONI'S WIRELESS TELEGRAPH COMPANY LTD. announce that the mast, aerial and feeder system of the Independent Television Authority's transmitting station at St. Hilary, Glamorgan, has now been officially handed over to the Authority.

It may be recalled that on October 30th the Authority issued a statement regretting a postponement in the opening of its South Wales and West of England service due to "unforeseen technical defects in the aerial system." This was indeed the case; an entirely new and highly promising type of aerial which had been ordered off the drawing-board and designed, developed, manufactured and tested in the incredibly short time of eight months proved in the final adjustments to require more development work before it was entirely satisfactory.

Accordingly this aerial never left the company's research laboratories and a more conventional type of aerial was put in hand at the Marconi works. By an all-out, round-the-clock effort this new array has been manufactured, tested, erected on site and matched, all within seven weeks. This is, without doubt, a world record and a tremendous engineering achievement.

Trans-Atlantic TV Cable

"BY far the best thing a British government could do to promote exports to Canada would be to put in hand a trans-Atlantic television cable at the earliest possible date."

Mr. C. O. Stanley, chairman and managing director of the Pye group of companies, made this suggestion recently when he announced contracts which Pye Telecommunications Limited had received recently from Canada.

The occasion was a private electronics exhibition which was held in London for members of the Canadian Trade Delegation.

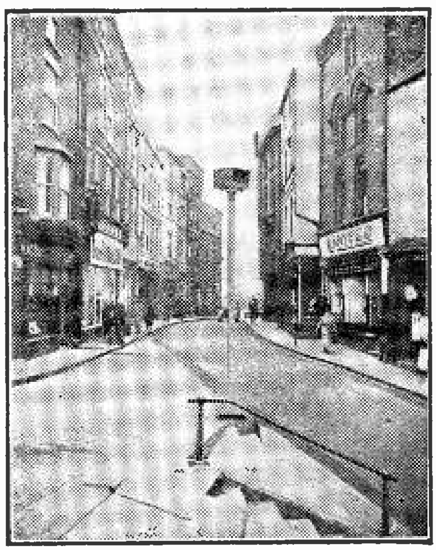
The Smellie

AN invention just registered in the U.S.A., can be clipped to a television set to release various smells, such as coffee, roses, or peaches, to coincide with a "commercial." It is called a synchronised odour emitter and consists of a battery with several odours in its cells.

Traffic Control TV

WITH the aid of a third eye, provided by television cameras, a police constable in the Market Square of Durham can now see the traffic he is controlling before it reaches the Square, instead of relying on good judgment as in the past. This television installation, the first of its kind in Britain, was brought into operation by Mr. G. R. H. Nugent, Parliamentary Secretary to the Ministry of Transport and Civil Aviation, when he switched on the cameras which work on a closed circuit.

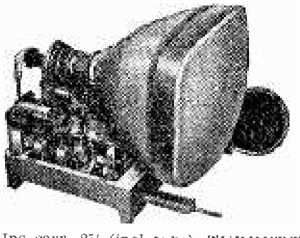
The cameras are installed at the Framwellgate and Elvet Bridges and give the constable in his box in the Market Square a picture of the volume of traffic waiting at or approaching either bridge.



The television eye at Durham (see paragraph above).

CASH OR TERMS

17in. T.V. CHASSIS, £19.19.6

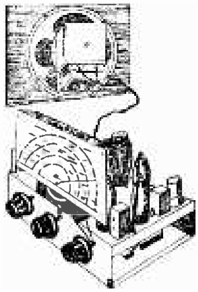


Latest improved circuits. Higher E.H.T. (brilliant picture). Improved sensitivity (for greater range). Chassis easily adapted to any cabinet. 17in. rectangular tube on adapted reconditioned chassis. Channels 1-5. Less valves. With 5 valves, £21.19.6. With all valves, £25.19.6. Valve line-up (5 valves): 2-6D2s, 6SN7G, 6P25, EL38. Others: 7-6F1s, EL38, 6L18. 12 months' guarantee on tube, 3 months' guarantee on valves and chassis. Ins. carr., 25/- (incl. tube). **TURRET TUNER, 50/-** extra. State B.B.C. channel and I.T.A. if turret tuner required.

14in. T.V. CHASSIS, TUBE & SPEAKER, £13.19.6

As above with 14in. round tube. Less valves. Guaranteed 3 months. With 5 valves, £15.19.6. With all valves, £19.19.6. Turret tuner, 50/- extra. Ins. carr. 25/- (incl. tube).

DENCO RADIOGRAM CHASSIS, 97/6

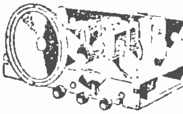


Three and 4 waveband turret tuned. Superhet. A.C. chassis, with 6in. or 8in. speaker. Size 8¼in. x 10in. x 12in. Valve line-up: CCH35, EF39, EBC33, CL33 and CY31. (C1C or dropper.) Ins. carr. 7/6.

SUPER CHASSIS 99/6

Five-valve superhet chassis, including an 8in. speaker. 4 control knobs (Tone, Volume, Tuning, W.C. switch): 4 waveband with position for gram. P.U. and for extension speaker. A.C. P. & P. 5/6.

POPULAR RADIO OR R/GRAM. CHASSIS, 39/6



Three waveband and gram. Superhet. 5-valve International Octal. Ideal table gram, but still giving high quality output. 4 knob control. 8in. P.M. Speaker, 7/9 extra. Set of knobs, 2/-. Size 12in. x 6in. x 9in. Less valves. Ins. carr. 4/6.

CONSTRUCTOR T.V. CHASSIS

SOUND & VISION STRIP, 19/6. Superhet. 10 valveholders (EF91, etc.). Less valves. P. & P. 2/6.

TIME BASE, 7/9. Containing scanning coil, focus unit, line trans., etc. Less valves. Ins. carr. 2/6.

POWER PACK AMPLIFIER, 19/6. O.P. stage 6V6 with O.P. trans. Smoothed H.T. 350 v. 250 mA., 6.3 v. 5 a., 22 v. 3 a., 6.3 v. 4 a., 4 v. centre tapped. Less valves. Free drawing. Ins. carr. 5/6.

Boxed VALVES — 3 MONTHS' GUARANTEE

6L19	8/9	6H6M	1/9	12AU7	5/9	EB91	6/9	EF33	5/9
1S5	4/9	SP41	3/6	12BE6	6/9	ECC81	8/9	PEN46	6/9
EZ40	8/9	T41	8/9	EAF42	8/9	ECH42	8/9	EL32	6/9
4D1	2/9	6SG7	3/9	12SJ7	1/9	EF39	6/9	EL91	3/9
								PEN45	6/9
6B8	3/9	77	3/9	SP61	3/9	EF41	8/9	TT11	6/9
6F12	7/9	8D2	3/9	DF66	5/9	EF91	7/9	X66	3/9
6D2	6/9	8D3	7/9	EB34	1/9	EF37	4/9	Z77	7/9

American Types. U.X. All at 1/9 each.

18	75	1D6	80
42	38	6D3	6A7
			6C8

Barrettors 301 also at 1/9 each.

CHASSIS, 1/- each. 6 or 8 valve. Latest type midget valve design for A.M. and F.M. New cadmium plated on s.w.g. steel. 2¼in. x 7¼in. x 2¼in. P. & P. 1/6. Post on 4, 3/-; 12 for 10/- Carr. 5/-

CAR AERIALS, 6/9. Whip antennae, 50in. long collapsing to 11in., one-hole fixing. Post 1/-.

T.V. AERIALS, 25/6. For all I.T.A. channels. For outdoor or loft; 3 elements. Famous manufacturer at half the normal price. Post 2/6.

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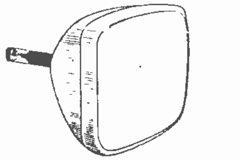


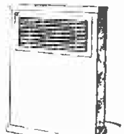
12 MONTHS' GUARANTEE

17in. £7.10.0

14in. £5.10.0

Six months' full replacement. 6 months' progressive [illegible] possible by the high quality of our tubes. Ins. carr. 15/6. **SPECIAL OFFER** of 14in., 15in., 16in. round T.V. TUBES at £5. **CONVERT** your 9in., 10in., 12in. to these sizes. Information on how to "Do-it-Yourself" in our FREE catalogue. 12in. T.V. TUBES, £6. 3 months' guarantee on all round tubes. 15/6 ins. carr. Also T.V. TUBES WITH BURNS, £1, including carr. [illegible] State type and size required.

ELECTRIC CONVECTOR HEATER, 99/6



Cleaner, cheaper, safer than paraffin. A.C./D.C. Switched for 1 or 2 k watts. Illuminated grille. Ins., carr., 10/6.

INSULATING TAPE, 1/6 (75ft. x ½in. wide), finest quality adhesive, in sealed container. Post 9d.

T.V. MASKS, 7/9. 17in. Grey plastic. Brand new. Post 2/-.

T.V. MASKS, 14/9. 17in. Halo lighting. New. Post 2/-.

T.V. MASKS, 10/9. 17in. White plastic. New. Post 2/-.

TORCH LANTERNS, 6d. each. Ex.W.D. Includes 2 bulbs, less 800 battery. P. & P. 1/-. Crate of 48 with 22 bulbs extra 22/- (118 bulbs in all). Ins., carr., 10/-.

BEAUTIFUL EXTENSION SPEAKER, 29/9

Complete fitted with 8in. P.M. Speakers "W.B." or "Goodmans" of the highest quality. Standard matching to any receiver (2-5 ohms). Flex and switch included. Unrepeatable at this price. Money refunded if not completely satisfied. Ins., carr., 3/6.

8in. P.M. SPEAKERS, 8/9. Let the lady of the house listen to that radio or T.V. programme. Complete with O.P. trans., 10/-. P. & P. 2/8.

P.M. SPEAKERS, 12/9. ELAC or Goodmans. High quality. 2-5 ohms. Complete with O.P. trans., 14/-. P. & P. 2/9.

HEADPHONES, 1/9

Single earphone and band. C-LR. Ideal for crystal sets, extension on radio, etc. P. & P. 1/3.

SIMULATOR UNITS, 19/6. Complete with valves. Telescopic aerial. Instruction booklet FREE with each order. Ideal for Walkie-Talkie conversion. Test set 172A. Ex-W.D. P. & P. 4/6.

SELF FEED SOLDERING TOOL, 19/6. 6-12 volt, 110-125 volt. Made for the American market. Car battery or mains, export quality. Complete in light carrying case. Reel of solder and spare parts. P. & P. 2/9. A few of the above in 6-12 volt, 200-240 volt, 35/6.

5-VALVE MIDGET RADIO, 79/6. Superhet Octal valves: 12K8, 12K7, 12Q7, 35L6 and 35Z4. 5in. speaker included. 2 wavebands. 3 control knobs. 100-240 volts. Universal supply. Wooden cabinet, size 17in. x 8¼in. x 6in. Ins., carr., 3/6.

T.V. CHASSIS, 49/6. Complete chassis by famous manufacturer. R.F. E.H.T. unit included. Drawing 2/6 or FREE with order. Chassis in 3 separate units (power, s/vision, timebase interconnected). These chassis can easily be fitted into existing console cabinets. Less valves and tube. Channels, 1-2, 3-5. Easily converted to I.T.A. Ins., carr., 10/6.

HEATER TRANSFORMERS, 12/9. 0-200-250 v. Primary [illegible] Heater ½ amp. P. & P. 1/9.

HEATER TRANSFORMERS, 3/9. 2-1 Ratio auto trans. for heater winding up to 6 v. P. & P. 1/9.

HOME RADIO, 79/6. 5 valve (octal) superhet. 3 waveband receiver. A.C./D.C. Universal mains can be adapted to gram. P.U. In wooden cabinet. 18¼in. x 11¼in. x 8½in. Ins., carr., 7/6.

RADIOGRAM CHASSIS, 29/9. 5 valve s/het., 3 waveband and gram., including an 8in. P.M. speaker. A.C. mains. Complete, less valves. Front drive. Size: 12in. x 10in. x 8in. Printed dial. Ins., carr., 5/6.

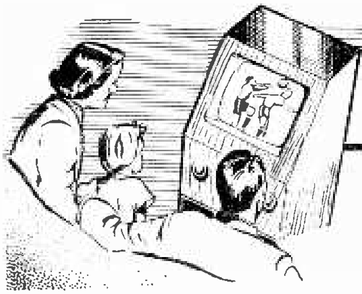
R.F. E.H.T. COIL, 30/-. 6-10 kv. Drawing and data FREE with each order. Post free.

MIDGET RADIO SUPERHET, 79/6. 5 valve A.C. [illegible] Wooden cabinet measures 14in. x 7¼in. x 9in. Octal valves: 6K8, 6Q7, 6K7, 6F6G and a metal rectifier or Universal equivalents. Ins., carr., 3/6.

IDEAL CHASSIS, 39/9. Radio or radiogram chassis. 5 valves superhet. A.C. 3 waveband and gram. switched. Less valves. 8in. P.M. Speaker, 7/9 extra. Set of knobs 2/- extra. Ins., carr. [illegible]

Liverpool St.—Manor Park Stn.—10 mins. *Send for cur FREE 1958 Catalogue.* *Open cll day Saturday.*

DUKE & CO. (Dept. 2), 621/3, Romford Road, Manor Park, E.12. *Tel.: ILF 6001-3.*



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

Decentralisation

SOONER or later, both ABC-TV and the Granada Network will have to consider branch studios, which were vaguely mentioned in the early days. Liverpool, Leeds, Blackpool and Scarborough all deserve local studios, or at the least, local offices from which could be organised regular local O.B. programmes. These could be training grounds of producers and personnel for the main centres. There are, I know, sound arguments against the establishment of such branch studios. Decentralisation is wasteful of manpower and plant. But it is not wasteful of the development of ideas which might be stifled in the close atmosphere of huge central establishments. There are dangers in too much centralisation.

I hope that the full operation of the BBC's television centre in Shepherd's Bush will not result in any curtailment of BBC activities at Lime Grove Studios, at the Television Theatre at Shepherd's Bush, at the TV film studio at Ealing, or at the little Viking studio at Kensington. Each place has it own individuality. The success of the Granada Theatre at Chelsea is a good example of the possibilities of a branch studio. This theatre can indeed be regarded as a branch of the Granada Network in Manchester, not of the Granada Theatres organisation, whose head office is in London.

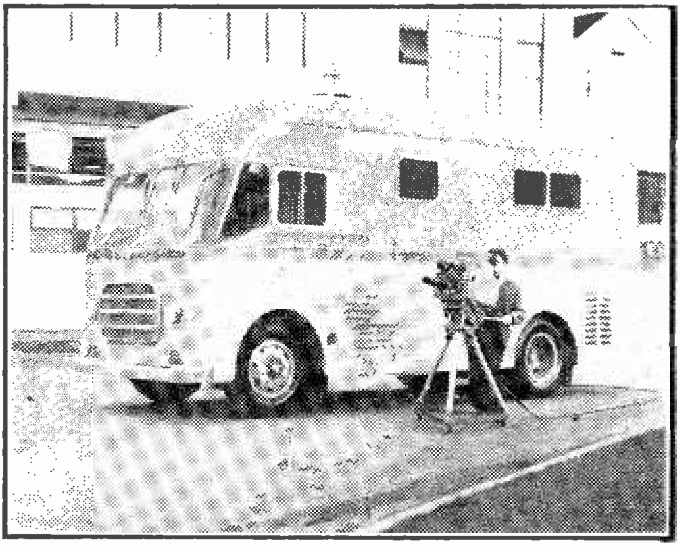
Documentary Features

DOCUMENTARY films, whose principal characteristics were montages of machinery, smoky chimneys and grim-faced men in cloth caps, have almost gone for good. They were largely the products of similarly grim-faced angry boys who tried to make a living for themselves in films. Many of them are now working on television documentaries, live and filmed, and they are no longer grim-faced. Plump and cheerful, success has mellowed their outlook on life. Their changed circumstances may have contributed to the more cheerful trends that the modern television documentary is taking. Even controversial subjects can be handled in an interesting--even entertaining manner. Early efforts, such as Granada's "Under Fire," frequently caused offence, and I suppose that the BBC's "Panorama" still does, especially to the mysterious men who control the Electrical Trades Union. Woodrow Wyatt's exposure attracted world-wide attention, with head-lined reports in all the national newspapers. However, "Panorama" earned a Gallup Poll award as being the best British documentary feature. It has punch, and one of its biggest assets is the presence of Richard Dimbleby, whose technique as announcer, compere and general philosopher and friend of the viewer is unsurpassed.

Another outsize personality whose impact is big in more ways than one is James Robertson Justice. In the BBC feature "One Man's Meat," he often talks a lot of nonsense, but he does it with such engaging charm and good humour that he captures the attention and sympathy of the viewer.

Creaks

"NOISES OFF" during the tense moments of television plays have always annoyed viewers. In the last few weeks there seems to have been a recurrence of this trouble at one or two television studios.



The above equipped mobile television unit for outside broadcasts has been purchased by A.B.C. Television from Marconi's Wireless Telegraph Co., Ltd., for use in the Manchester area.

particularly on I.T.A. stations. For instance. *The Shining Hour* and *The Pier*, both ABC-TV plays, had many inappropriate sound effects superimposed by the production personnel and technicians. The former play was notable for a large amount of camera movement, tracking and panoraming which was not too easy on the eyes of the viewer—and it was obvious that these movements also added to the "noises off." Some television play producers seem to be determined to be arty-crafty with their camera angles, forgetting that the complications they introduce may not be worth the trouble. In any case, off-stage creaks give the viewer a sense of creaking mechanics behind the scenes. If the actors mumble and speak lines softly, the unwanted stage noises become even louder. Conditions of various studios vary, so far as noises are concerned, but some technical crews seem to do their work most efficiently and smoothly, without undue "hob nail boots" effects. It would be interesting to viewers if the I.T.A. companies mentioned the name of the originating studio in the titles, such as "from Granada Television Centre, Manchester," "from ABC Capitol Theatre, Didsbury," or "from I.T.A.'s Wood Green Empire." This would encourage the crews at these and other I.T.A studios to make a good name for themselves with the viewers. There would be nothing to lose by having some sort of competition between the various studios, rather than continue with the present anonymity.

Usherettes distribute sticks of peppermint rock to the "live" audience of "Chelsea at Nine" as they leave the Granada TV Theatre, Chelsea, after the show.

Skiffle

SKIFFLE seems to be infiltrating into all kinds of programmes lately, with varying success. Teenagers tell me that the best performances of this exuberant music is on the BBC's "Six Five Special" programme. Many of the solo performances are mimed to playback, which is used most effectively, and owing to lack of space for dancing, the peculiar and somewhat ritualist gestures of "hand jiving" by seated members of the audience is carried out in its place. Shots of three or four teenage girls doing this hand-jiving simultaneously are rather fascinating. I have quite enjoyed the slick and professional performances of the guest bands that sometimes appear, particularly the lively Charles MacDevitt group, a team of youngsters who have suddenly shot into the top of the bill position at music halls in London and the provinces. Pete Murray is a most expert compère on this somewhat noisy programme. I particularly liked the way he mentioned that Sister Rosetta Thorpe, a jive singer, would be appearing in Granada's "Chelsea at Nine" show at a later date. It was the first time I had heard the opposition programmes of I.T.A. mentioned by a BBC announcer in this manner. I hope the I.T.A. companies will return the courtesy to the BBC on future occasions!

Exports to U.S.A.

WE see lots of American television films on both BBC and I.T.A. It is pleasing to hear that quite a number of British-made television films are now scoring quite heavily on American television. These include Mark Saber, Sir Lancelot, Inspector Fabian's series, Dick and the Duchess (not yet seen in England), Edgar Lustgarten's Scotland Yard films, Robin Hood and the Douglas Fairbanks series. There are also individual programmes, both filmed and telerecorded, which are exported in a steady stream. The English voice, not always acceptable in many States, particularly in the Middle West, is beginning to make headway. Producers have to take care with accents, however. Some actors appear to be talking "la-di-dah" to the American viewers and are not liked. Donald Gray, who plays Mark Saber, however, seems to be very popular. I must say that though he and his leading lady, Diana Decker, give good performances, the stories seem silly and infantile.

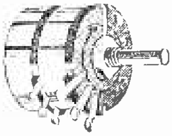
Disc Favourites

THE tremendous boom in gramophone discs, of which popular numbers are bought in millions by the teenagers, calls attention to the vast difference in sound quality of the gramophone recordings from the live television performances of the same artistes. Naturally, when a gramophone disc is made, several "takes" are recorded with all the modern resources of a recording studio—including special acoustics, separate solo studio, artificial echo and so forth. Selection is made of the best result out of several different takes, and parts of takes are sometimes combined by re-recording. On the other hand, live performances in a television theatre have to be straight off the cuff, with the artiste thinking also how he looks as well as how he sings. The result sometimes suffers from the theatre's acoustics, which frequently have a long reverberation time, and all from the use of public address loudspeakers in the auditorium. It seems to me that the wholesale use of playback is the only answer to this problem.

FREE GIFT

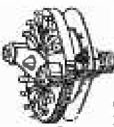
All purchasers of the Multiminor this month, will receive our M.M. Range Extender which adds: capacity 0.1 m.f. in two ranges—inductance 0-100 henrys and decibel —20 to +36. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows:—D.C. volts 0-1,000 (seven ranges). A.C. volts 0-1,000 (five ranges). D.C. Current 0-1 amp. (5 ranges). resistance 0-2 megs. (2 ranges). (complete with test leads). Immediate delivery. **Cash price £9.10.0** or **10/-** deposit and **19** weekly payments of **10/-**.

MORGANITE POTENTIOMETERS



Single and 2 gang types available, standard size with good length spindle, all new and boxed. Gang type **3/-** each—values available: 5K 5K, 100K 100K, ½ meg, ½ meg. Single types **1/-** each, values available: 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg.

CERAMIC SWITCHES

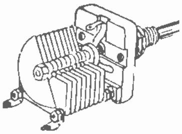


By one of our best makers, 3 pole, 3 way, **2/6** each, also standard type switches 12 pole, 2 way, **1/6** each, 6 pole, 3 way, **1/6** each, 3 pole, 6 way, **2/6** each, 6 pole, 4 way, **2/6**.

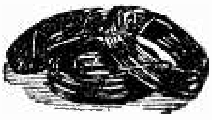
50 assorted resistors. Well mixed and useful values, ¼ and ½ watts. **Price 5/- per 50.**

50 assorted resistors. Well mixed and useful values, 1 watt. **Price 6/6 per 50.**

FINE TUNERS

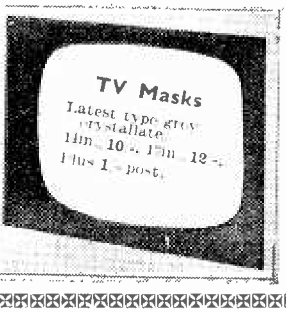


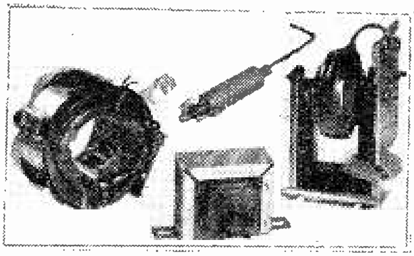
Ceramic trimmers all with ¼in. spindle of fair length, 5, 10, 15, 30, P.F. at **2/3** each or **24/-** per dozen.



CONNECTING WIRE

P.V.C. covered in 100ft. coils—**2/9** a coil or four coils different colours, **10/-** post free.





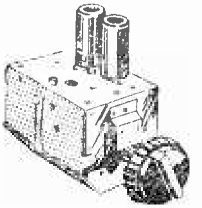
FOUR ITEMS FOR THE PRICE OF ONE

This set of modern T.V. parts is equally suitable for modernising an old televisor or for building into a new one. Suitable for wide angle 14in. or 17in. tubes using EHT or 12-14 kV. The four items comprise: (1) Line output EHT transformer (2) 70° scanning coils on ferrite yokes (3) Width control with ferrite core (4) Frame output transformer. With these parts we also give free, complete circuit diagram of a modern televisor which uses them. We offer the whole lot at the price of the Line output transformer only, namely **57/6** plus **2/6** post and insurance.

SEND NO MONEY

—just a large stamped addressed envelope and we will send you details of how you can build a 14in. or 17in. televisor in one evening without technical knowledge. If you decide not to build our televisor we request you to return the data or remit **3/6**. **Note:** Second hand parts or units are not used in our televisors or sold by us.

NOW 2 MODELS
Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete, with valves. Model 1 I.F. output 33/33 Mc/s. Series heaters. Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With circuit diagram, **79/6**. With knobs 3/6 extra, post and insurance **2/6**.

THIS MONTH'S SNIP

is a fine walnut veneered table receiver cabinet complete with metal chassis, three colour glass scale, back plate and scale mounts, as illustrated but less knobs. Offered at less than the price of the cabinet, namely **39/6** plus **5/-** carriage and insurance.

INDICATOR No. 96

Contains many hundreds of very valuable spares including no less than 12 potentiometers. This indicator unit will take the VCR97 or the VCR517 and with relatively simple modifications can be turned into an Oscilloscope. Limited quantity offered at the extremely low price of **10/-** each, carriage and packing 4/6 up to 250 miles, beyond this distance at cost.

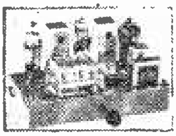
CONDENSER TESTER AND REACTIVATOR

This unit tests condensers under correct working conditions at proper voltages, it can also be used for "reforming" electrolytics. All basic parts and full instructions **50/-**, plus **2/6** post and insurance.

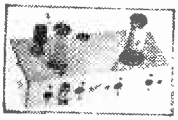
TRANSISTOR TIMER

All the parts for making transistorised Enlarging or Process Timer with constructional details. **£2.10.0.** plus **2/6** post and packing.

BEGINNER'S SUPERHET



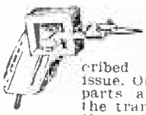
All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., etc. required to build the "Beginner's Superhet" as described in the January issue, Practical Wireless are available as a parcel. Price **£3**, plus **3/-** post and insurance.



BAND III CONVERTER

Suitable Wales, London Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra). Price only **19/6**, plus **2/6** post and insurance. Data free with parts or available separately **1/6**.

MAKING A SOLDER GUN



A 7-second solder gun of the type costing £3-£4 was described in a previous issue. Only two essential parts are required—(a) the transformer and (b) the push switch. These we can supply at **13/6**, plus **2/-** post. The rest of the parts you will have in your own "junk" box. Copy of the article concerned given free with the kit.

We can supply all the main components for making this unit, which will not only test cathode-ray tubes, but will also reactivate them. Supplied complete with full instructions. Price **£3**, plus 2/6 postage and insurance.

ELECTRONIC PRECISION EQUIPMENT, LTD.

For prompt attention post orders should be sent to our Eastbourne address marked Dept. 5.

42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780 Half day, Wednesday.	**66, Grove Rd., Eastbourne, Sussex.** Half day, Saturday.	**29, Stroud Green Rd., Finsbury Park, N.4.** PHONE: ARChway 1049 Half day, Thursday.	**266, London Road, Croydon.** Phone: CRO 6558 Half day, Wed.

CORRESPONDENCE

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

FERGUSON 306T

SIR.—In the December issue of PRACTICAL TELEVISION on page 241, a Mr. J. Ford of Willenhall states that he has a Ferguson 306T and in six months has had to replace EY86 four times.

I have the same model and had the same trouble and the following may help Mr. Ford. The 2.2 mΩ resistor, No. 137, on the line output valve should be changed to 1 mΩ, and resistor No. 157 which is in series with the EY86 heater should be changed from 4.7Ω to 20Ω. I have done this and have had no trouble. Perhaps I should mention that I could not get a 20Ω resistor so fitted one of 18Ω.—A. V. ADAMS (Cardiff).

INTERLACING AND LINE WHISTLE

SIR.—I should like to thank the many readers who wrote to me with assistance on the problem of ascertaining whether interlacing was effective or not, and it is obvious from the replies received, that there is no really reliable method. I would say that it is really hit or miss, and where fly-back suppressors are fitted and effecive, one is never really sure. Whilst on this subject I wonder if any of the really knowing ones have "cured" the line whistle. Is it in fact true, as I have been told, that the makers do not attempt to remove this whistle as it forms part of the set which is of value to the G.P.O. in tracing unlicensed sets?—H. REDMAYNE (Barking).

HORIZONTAL OR VERTICAL

SIR.—Seeing your notes in the December issue concerning aerials in Scotland, I have been informed by a friend that in certain parts of the country, where the signal is horizontally polarised, one often finds that results are better when the aerial is placed vertically. On the other hand, a vertically polarised aerial does not seem to offer the same facilities, in other words placing the aerial horizontal gives poorer results. Is this due to the fact that the horizontal signal follows the line of country, and is therefore more affected by houses, hills, etc.? If so, why do the Americans use horizontal polarisation? Is it bound up with the problem of aerials? Is a horizontal aerial safer than a vertical?—H. BOOTH (N.W.).

STEREOPHONIC SOUND

SIR.—During recent tests by the BBC of stereophonic sound, the TV set had to be used with an ordinary radio set. I wonder how many experimenters who co-operated in this test found, as I did, that the sound on the TV channel was immeasurably superior to that on the ordinary waves. I could not, however, get a stereo effect no matter how I moved the radio receiver about. It seemed to me that the set nearest to me drowned out the other. I tried increasing the volume from the furthest set to make them level at my ear, but could not really say that there was any sense of "depth" in the sound until I took the radio set into the next room. Then with both doors open I did get a very realistic effect, but it was noticeable that in one room the effect was more marked than the other presumably due to the channel being used, i.e., right or left. I hope further experiments will be carried out in this new development. F. RITCHIE (Cricklewood).

> **SPECIAL NOTE**
>
> **Will readers please note that we are unable to supply Service Sheets or Circuits of ex-government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.**

AERIAL DESIGN

SIR.—In the January issue Mr. Brown covers a very important point regarding aerial design. As a Serviceman I find that many people want to buy the most elaborate aerial possible, with the mistaken belief that it will give them a better picture. It should be remembered that the more elements, as a rule, the more complicated the polar diagram, and the narrower the forward lobe. This can be a great drawback under some conditions, and as a well-known maker of aerials has pointed out at a lecture given in various parts of the country to dealers, a good aerial badly installed may give worse results than a bad aerial properly installed. It is all very well "doing it yourself," but it must be done properly and with a sound knowledge of conditions in the actual street in which it is being installed. B. R. BRETHERTON (Sidcup).

[The above reader raises an interesting point, and we do not think we can do better than reproduce the following statement recently issued by Messrs. Belling Lee in this connection.

"Some people think that the greater the number of elements the greater the gain. There are many four-cylinder cars more powerful than many with six cylinders. It is all a question of design. We have an 'H'-type aerial with higher gain than at least one well-known four-element array. We designed the first four-element array, and, although it was a winner, we stopped production a few years back because we made a three-element array with a still higher gain, and we couldn't justify the fourth element. The theoretical and practical gains from the fourth element were just not worth while."—EDITOR].

CHECKING INTERLACE

SIR,—I believe a short time ago a reader asked for a hint as to the best method of checking whether a set was interlacing properly. Normally this can be done by turning up the brightness control and examining the flyback lines which are then revealed. An adjustment of the frame hold control will result in these jumping from narrow to wide spacing and you will quickly identify how they should be. If, however, there is an efficient flyback suppressor circuit in the set you will not be able to produce the lines. In this case proceed as follows. Adjust the scanning coil clamp or other adjustment at the back of the set to make the picture come low in the mask aperture so that the top few lines in the blanking area are visible. This will mean turning up the brightness control slightly. You will then see, if interlacing is taking place, that the first line starts dead in the centre, and the second line at the left-hand edge. By adjusting the hold control as previously you will see that the half line will jump about and start at various places. Set the control so that it stays perfectly stationary (if possible) beginning at the middle of the area. You may find that you cannot get it to stay dead still, but if the circuits are good and all working properly it will be practically stationary.—G. R. JOHNSON (Edgware).

THE C.R.T. TESTER

SIR,—There is a letter by G. Aungiers in the February issue regarding my article on C.R.T. tester which I feel I should answer. The circuit as shown by me needs no ammendment for cathode to grid leakage, for this test is the same as the emission test. This means that the leakage will be shown up as extra current when the emission is tested. In the case of a C.R.T. with a good emission no doubt will be felt in deciding whether the tube has a cathode/grid leak, for the high reading obtained will be much higher than a new tube. When, however, the C.R.T. emission is low, then some doubt may exist as to whether the emission is all right or whether the tube has a grid/cathode leak. If, when the tube is tried out in a TV set, the picture is flat and too bright then it can safely be assumed to have a leak.—J. HILLMAN (N. Ireland).

A PROBLEM SOLVED

SIR,—Although I have long since passed the experimenter and "do it yourself" brigade, I still take your magazine to read the bits of news and keep in touch in a sentimental sort of way. I do not consider I am young enough to do the modern constructional work and just get along with a commercial set, etc. Recently, however, my bought set developed a fault and I was almost on the point of going to a dealer to get the set seen to, when I thought of the Problems Solved columns of your pages, and turned up the few back numbers I had and looked to see if there were any notes on my set. By a strange coincidence, I found one and it was exactly the same trouble as I was experiencing. Apparently all that was involved was an adjustment of the position of the ion trap and I did this and removed the shadowing.—G. BOON (Reading).

MULTI-CHANNEL TUNER INSTALLATION

(*Continued from page* 364)

oscillator components were taken from the circuit to aid with the connection of the tuner signal.

The H.T. supply to the tuner can usually range from 175 to 210 volts, 185 volts being a nominal value. It is not desirable to exceed 210 volts, however, and on the Brayhead unit a link in the H.T. positive circuit can be removed to allow the connection of a series resistor for balancing the H.T. voltage.

Points to Watch

The average dimensions of a turret type tuner are overall height from the base of the unit to the top of the valve screens 5½in., length 6½in., and width 3¼in. It should first be ensured, therefore, that there is sufficient room in the receiver cabinet to house the tuner with reasonable clearance from receiver components.

Make sure that there is a tuner available with an I.F. output to match the receiver it is proposed to convert. Units are available covering the three major I.F. bands, viz., 10 Mc/s, 16 Mc/s and 38 Mc/s. The Brayhead people make three basic units with I.F.'s as follows: Type 10P/10S, vision 14 Mc/s and sound 10.5 Mc/s; Type 16P/16S, vision 16 Mc/s and sound 19.5 Mc/s; Type 35P/35S, vision 34.65 Mc/s and sound 38.15 Mc/s; the prefix letter "P" or "S" indicates parallel- or series-connected heaters, using 6.3 volt or 0.3 amp valves, as already mentioned.

It will be seen from this list that a set, such as the Ultra VA72, V600 and V710 series, with a sound I.F. of 16 Mc/s and a vision I.F. of 19.5 Mc/s is not catered for. Here it will be realised that the vision I.F. is above the sound I.F., meaning that the oscillator frequency is below the signal frequency.

In the large range of Cyldon turret tuners, a model (E/16/L) is available to suit this case. In this range there are also units available for direct inclusion into a heater circuit comprising 0.1 amp valves. The tuner valves then employed are UCC84 (R.F. amplifier) and UCF80 (frequency changer).

On most tuners there is a reasonable range of I.F. and oscillator adjustment to cater essentially for receivers whose I.F.'s are slightly removed from those mentioned above.

Adjustment

It is important to note that the only tuned circuits which can successfully be adjusted by the experimenter are the I.F. coil or transformer, L5 in Fig. 7, and the oscillator coils associated with the various channels for which coil sets are included in the turret. The remaining circuits are adjusted accurately at the factory for the best overall performance and must not be altered.

With the channel selector set as required and the fine tuning control adjusted to the centre of its travel, the oscillator coil should first be adjusted with a non-metallic trimming tool, such as a screwdriver-shaped knitting needle, for maximum sound consistent with minimum sound on vision. The oscillator core associated with the channel in use is accessible through a hole in the front face of the tuner.

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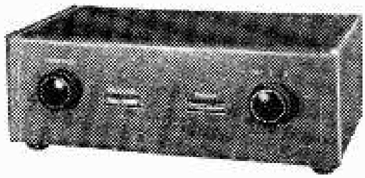

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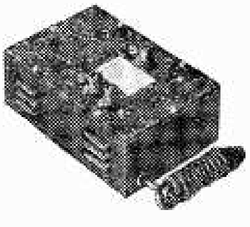

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Your PROBLEMS Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 399 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

ULTRA V8-14

My problem is lack of width. The picture usually has ½in. gap at either side and will not increase by movement of width control.

Regularly the picture expands of its own accord until the picture more than fills the mask with a change of focus, which requires constant adjustment of the focus magnet. After a brief period the picture returns to its usual limited size and at times to a more reduced size, again with a change of focus. The supply voltage is regular. I have the service sheet available.—M. Muir (Glasgow).

We would advise you to have the V13-U801, V9-20P4 and V10-U329 valves tested. One will almost certainly be at fault.

BEETHOVEN B80

The trouble is in the frame circuit; very poor lock, top portion of picture appears at bottom of the screen and two bright horizontal lines containing a small portion of picture matter appear on the screen. Both ECL80 and ECH42 have been renewed in frame circuit, making no difference to this fault.—J. F. Birks (Liverpool).

We suggest that you check the high value resistors associated with the frame ECH42 and ECL80 valves. R54, R55, R59 are the components to suspect in the first instance.

G.E.C. BT5146

A very dim but otherwise normal picture. Advancing either brilliance or contrast control causes highlights to go muddy, and still further, picture disappears, leaving a blank raster. At this point the line timebase loses sync. The following valves have been replaced, having been found faulty on test: KT36, U37 and D77. The D77 was lighting up very brightly. Valves and crystal diode in the vision receiver have been replaced with known good ones. Vision limiter has been tried out of action by o/c the cathode connection. A replacement tube—not new, but guaranteed—MW31-74, has been tried, but with similar results.—G. R. Dance (Wolverhampton).

You may have low H.T. volts. At C58—120 μF it should be 225 volts. If low change metal rectifier, replacement RM4. Have you fitted ion trap to C.R.T.31-74. It is necessary for this tube. 300 volts is low for A1 but should work.

DEFIANT T141

I am able to get a fair picture on I.T.V. The eight element aerial is fixed on a 20ft. mast in the middle of the garden and I would like to know if I could get better reception by adding four elements to the aerial to make it a twelve element, or raising the height of the aerial. I have noticed that the mains tapping is on 245 volt, the mains supply is supposed to be 240v. though it seldom goes over 230v.; would it be safe to lower the tapping to 235v.?—F. Thomas (Bethesda).

It is quite in order to lower the voltage tapping to provide a more accurate match of actual mains voltage. We would not advise you to add another four elements to the aerial as the results would not give you the gain required. Rather we would suggest you change the type of aerial to, say, a double array or add another eight element array a little below (3ft. 4in.) the first, coupling the two feeders together ensuring that both cables are of identical length to the junction point. Alternatively the present array could be hoisted higher, if possible, to provide the extra signal.

G.E.C. BT1746

On switching on, the frame collapses to about 4in. in height, and as this occurs the sound goes completely off. It is possible to use this set for hours without mishap, but the above fault suddenly develops and sound comes and goes every two seconds accompanied by frame collapse, as already stated.—H. Purves (Wallsend-on-Tyne).

This double fault is probably due to intermittent breakdown of C62-C63 (16 + 32 μF). It will be necessary to check R48 (470 ohms) leading to sound output transformer. Check all components on sound-frame H.T. line.

PLESSEY CHASSIS

All I can get on screen is a very dim illumination. When drawing spark from EHT at tube anode sparking is observed between focusing magnet and deflector coils. A ¾in. spark can be drawn from EHT. Grid voltage readings 40-210, with cathode lead removed, these readings appear at free pin. Cathode voltage 100, with grid lead removed, this voltage does not appear at free pin. (P.T. September, 1957, page 60, grid cathode shorts.) First anode volts 300. The tube is a Mazda tetrode 17in. The heater volts 12.6, supplied through a separate transformer. The smoothed H.T. is 290 volts; is this correct?—John Laird (Glasgow).

Unless the coupling arrangements from the video amplifier to the C.R.T. cathode have been altered, 180 volts should be recorded at the latter tag. Check also the video amplifier anode and if this voltage is low inspect the anode load resistor 6.8 KΩ) and the cathode components as the 750 pF shunt capacitor may be shorted. Quite apart from this, however, it is likely that the C.R.T. emission is low or the ion trap magnet improperly adjusted.

AMBASSADOR TV2 MK1

I have replaced dark screen with clear plastic which has improved viewing under electric light but brightness control is almost fully clockwise, should this be so? There is a ¼in. shadow across and slightly down right-hand top corner of screen which I cannot eradicate. Have tried adjusting focus magnet scanning coils hard up to tube base and width control at maximum. Incidentally, increasing width improves picture, particularly brightness. Circuit diagram for MKII which I have gives 350 pF for width control whereas in my set this is 500 pF. Focus needs adjustment each time set is switched on and needs occasional alteration during viewing. Horizontal hold (top left control on panel) needs fairly frequent adjustment—picture pulls to right or breaks up into line right to left.—F. W. Viggars (Liverpool).

Have the U801 valve tested. If this is in order check its anode resistors (four 47Ω). Also check the electrolytic capacitors associated with the width control, etc., and the resistor of 220 KΩ associated with the V5B cathode (and the C.R.T. cathode therefore). Also check V5, 6D2 for emission and the brilliance network resistors, if brilliance is still low. Allow for tube deterioration.

PYE D18T

I cannot get the brightness down to get rid of the flyback lines. I have a circuit diagram for same. Can you please advise me about this? The set is fitted with Mullard MW22-8 with metal coating. I have a MW22-7 without coating. Is it O.K. to use this tube in place of MW22-8, and is any rewiring necessary?—W. J. Treadwell (Coventry).

We would advise you to change the 2 μF capacitor mounted on the right side of the tube neck on a paxolin panel. This should restore normal control of brilliance. The MW22-17 may be used in place of the 22-18, although strictly speaking a .001 μF 6 kV capacitor should be added to the EHT, to replace the smoothing action of the outer conductive coating of the 22-18. This, however, is sometimes not necessary in practice due to the capacity already existing between the inner anode coating and chassis.

PHILCO BT1840

The fault started with fading sound on both radio and TV, also the tone control was useless except when fully clockwise; any other position just made it blurred. I had the radio valves tested and 14S7 had heater cathode short, which I replaced, now sound stays on, but there is a fairly loud hum on both radio and TV, and sometimes when it is on radio on the medium wave it changes frequency as if it was on short-wave. I have had the radio chassis at a dealers, he tested all valves and smoothing condensers but the fault still remains but it has no effect on picture, which is quite good.—R. Butterworth (Bury).

The sound output of the TV and the radio is common (50L6GT) and we are inclined to suspect that this valve is introducing hum. Also you may find that the new 14S7 is defective. If it isn't, check the gang condenser to insure that it is not capable of independent movement and then check the medium-wave padding capacitor.

MURPHY V150

The service sheet gives instructions on alignment with signal generator and output meter. The vision output meter is connected to the video amplifying valve cathode resistor via a 500 pF capacitor and a 300μH R.F. choke. My problem is obtaining the choke. Dealers inform me that without further details of the choke, i.e., type, make or number, etc., they are unable to help me. Could you please tell me if there is another component that I could use that is more easily obtained?—G. R. Jordan (Willenhall).

The 300 microhenry choke mentioned in the alignment instructions is not critical and is merely inserted in series with the meter lead to prevent I.F. radiation, and its consequent instability. If you have a small medium-wave coil a grid winding of this will do just as well, or you can make a suitable substitute by fitting two cardboard cheeks ⅛in. apart on to an insulated resistor of over ½ meg. value and winding very thin wire between them until a layer about ½in. in diameter has been built up. The ends can be soldered to the resistor wires as the latter is too high a value effectively to damp the choke.

REGENTONE 173T

Recently the picture has lost its width. With the width control fully extended there is a 1in. margin each side of the picture. It also rolls every hour or so. I have checked PL81, PY81, EB91, PL83, ECL80. All are O.K. except ECL80 sync separator which I have replaced—L. Bird (Aston).

Replace the metal rectifier (14RA1283), which appears to be deteriorating. This is mounted flat on the front (almost centre) of the chassis.

EKCO T221

Very poor line hold until I advance the horizontal hold, when the bottom half of the picture becomes quite clear whilst the top half is slipping. This fault, after an evening or two, may clear itself without making any adjustment whatever. Also could you please enlighten me on how to remove the turret tuner, for on tuning in to Channel 9 the picture disappears completely without touching the set; on touching the switch the picture returns.—L. V. Entwistle (Manchester).

The trouble you are experiencing is either frame or mains hum getting into the line time-base, and by reversing the mains you will be able to ascertain which one it is. If it is mains the

(Continued on page 399)

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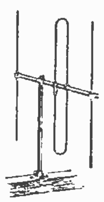

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position of the distortion will change from top to bottom. if it is frame it will stay where it is. Mains hum can be introduced by heater-cathode leakage of the video amplifier. sync separator or line timebase valves. and also by faulty smoothing. Frame can be breaking through due to faulty smoothing, in particular the 2 μF screen decoupler to the sync separator. To remove your turret, withdraw chassis and unscrew outer bolt on which the turret hinges. Remove bonding strip and unplug five-way connector. Unfasten aerial panel from main chassis and disengage turret sideways and forward.

VIEWMASTER

I used a G.E.C. 12in. tube 6705A with flyback EHT boost and modifications for increase of width and height. The tube was broken during a removal and I have been able to replace it with a CRM121 (12in. 6 kV max.) whose only fault is an ion burn. As the tube has a max. volts of 6 kV I had to take off the EHT boost and so my trace was too big and I had to reduce the scan. When I switched on I got a trace 6in. high but wide and I have only been able to resolve a picture by playing about with values of components and have replaced every component in the line oscillator and timebase except the line output transformer and coils.—J. Galvin (Welwyn).

We cannot advise you to experiment in the way that you have been doing since the performance of the Viewmaster will undoubtedly be affected. The original Viewmaster circuit without the EHT boost gave 6 kV and if that is all that is required then we suggest you adhere to the specified circuit. Another alternative is to leave the circuit as it was with EHT boost but connect a 200 pF condenser to the line scanning coils tags L1 and L2.

FERGUSON 968T

Fault, sound on vision during loud passages of music. Also the picture height control at rear of set is at maximum, but the picture does not completely fill the tube in that direction.—R. Stannard (E.17).

If the sound-on-vision is present even with the volume turned right down it is probably caused either by overloading of the first stages due to a too strong aerial signal or misalignment of the vision channel tuned circuits, particularly the sound rejectors. Insufficient height on this model is often caused by value increase of the 470k resistor which is connected to the slider of the height control.

EKCO T164

I cannot get a complete picture. No matter what adjustments I make to the controls the best I have had yet is an approximate 2in. strip of the centre of the picture, but the most strange effect is that remaining strips of the picture are behind the centre strip and the effect can only be compared to a film negative cut into strips, placed one behind the other and held up to the light. I purchased this set minus U25 and line (EHT) transformer. I fitted these both, being new, and have tried four different 10P13's in the frame output but with no effect. I changed all the valves with a set of known good valves but result was a reduced picture in which no details could be made out.—L. E. Miller (Doncaster).

The frame timebase on the T164 is centred around half of the 20L1 frame oscillator and the 10P13 frame output valve which are just alongside the line output stage shield. Apart from the valves, which we suggest you check again, the common causes of scan reduction are: Faulty 500 μF cathode bias decoupler to the 10P13; change of value of 1 meg resistor in series with wiper of hold control, faulty blocking oscillator transformer and a faulty interlace metal rectifier (Type Q3/4). The "negative" effect may be due to a low C.R.T. If so, it will still be present when your scan is corrected and may need a booster transformer for the heater.

FERGUSON 988T

I purchased this set second-hand eighteen months ago and it has given excellent service until recently. The line EHT transformer T1 on service sheet has broken down and I have obtained a new one, but the physical dimensions are totally different from the old one. The dealer who supplied it to me contacted the makers and they assured him that this is the correct one for the model as there was conversion after this model was issued. What I would like to know is, has any other component to be altered in the conversion? I have the service sheet for this set, published in 1952, and there is no mention of the transformer conversion. I can draw a moderate spark from the top cap of V8 (PL81), but nothing from EY51, which does not appear to be lit. I fitted a new EY51 with the same result. Also, the first anode of the C.R.T. should show 454 volts, but on testing with an "Avo" Model 7 I could get no reading. Sound is O.K. but no raster on screen.—R. S. Evans (Onchan).

We have no knowledge of this transformer being severely modified as you mention. A universal transformer, having a tapping on the primary so as to cater for the 988T and the 988T "Twelve Plus," was eventually produced. but this is mechanically the same as the former model. We would suggest. therefore, that you contact your supplier for a conversion sheet relating to the component with which he supplied you.

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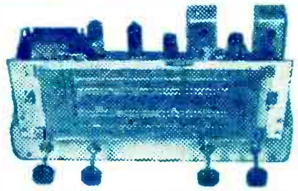
L.F. CHOKES 15-10 H. 60/65 mA., **5/-**; 10 H. 80 mA., **8/6**; 10 H. 150 mA., **12/6.**
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped, 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, **22/6.** Bargain 300-0-300 65 mA., 6 v. 4 a., 4 v. 2 a., **15/-.**
HEATER TRANS. Tapped prim., 200/250 v. 6.3 v; 1½ amp., **7/6**; tapped sec. 2, 4, 6.3 v., 1½ amp., **8/6**; prim. 230 v. Sec. 6.3 v. 3 amp., **10/6.**
ALADDIN FORMERS and core. ¼in., **8d.**; ⅜in., **10d.** 0.3in. **FORMERS 5937/8** and **Cans TV1/2.** ½in. sq. x 2in. and ⅜in. sq. x 1 in., **2/-** ea., with cores.
TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., **16/9.** **Solon Instrument Iron, 24/-.**
MAINS DROPPERS. 3in. x 1½in. Adj. Sliders, 0.3 amp. 750 ohms, **4/3.** 0.2 amp., 1,000 ohms, **4/3.**
LINE CORD. .3 amp., 60 ohms per foot. .2 amp., 100 ohms per foot. 2-way, **6d.** per foot. 3-way, **7d.** per foot.
LOUDSPEAKER P.M. 3 OHM. 2½in. square, **17/6.** 5in. Goodmans, **17/6.** 7in. x 4in. Goodmans, **21/-.** 3½in. square, Elac., **21/-.** 8in. Plessey, **19/6.** 6½in. Goodmans, **18/6.** 10in. R. & A., **30/-.** TSL Tweeter, LSH75, **8/6.** 12in. Plessey, **30/-.** 8in. M.E. 2.5k. field, tapped O.P. transf., **24/6.**
15 ohm Plessey 10 wt. 12in. with Tweeter, 97/6.
CRYSTAL DIODE G.E.C., **2/-.** **GEX34, 4/-.**
HIGH RESISTANCE PHONES. 4,000 ohms, **16/6** pr.
MIKE TRANSF. 50 : 1, **3/9** ea.; 100 : 1, Potted, **10/6.**
SWITCH CLEANER Fluid squirt spout, **4/3** tin.
TWIN GANG TUNING CONDENSERS. 365 pf. miniature 1in. x 1½in. x 1½in., **10/-.** .0005 Standard with trimmers, **9/-**; less trimmers, **8/-**; midget, **7/6**;
SINGLE. 50 pF., **2/6**; 100 pF., **7/-**; 150 pF., **8/6.** Solid dielectric 100, 300, 500 pF., **3/6.**
SPEAKER FRET. Expanded Metal Silver, 15¾in. x 9½in., **2/-** each.
GOLD CLOTH. 17in. x 25in., **5/-**; 25in. x 35in., **10/-.** Tygan 4ft. 6in. wide, **10/-** ft.; 2ft. 3in. wide, **5/-** ft.

All Boxed **VALVES** New & Guaranteed

1R5	8/6	6K8	8/6	EBC33	8/6	HABC80	12/6
1S4	8/6	6L6	10/6	EBC41	10/6		
1S5	8/6	6Q7	10/6	EBF80	8/6	NVR2A	7/6
1T4	8/6	6SA7	7/6	ECC84	12/6	MU14	10/6
2X2	3/6	6S67	8/6	ECF80	10/6	P61	6/6
3V4	8/6	6V6G	7/6	ECF82	10/6	PCC84	12/6
5U4	8/6	6V6GT	8/6	ECH42	10/6	PCC84	12/6
5Y3	8/6	6X4	7/6	ECL80	8/6	PCF80	10/6
5Z4	10/6	6X5	7/6	ECL82	12/6	PCF82	10/6
6AM6	8/6	12A6	7/6	EF39	7/6	PCL82	10/6
6B8	5/6	12AH8	10/6	EF41	10/6	PEN25	6/6
6BE6	7/6	12AT7	10/6	EF50	5/6	PL82	10/6
6BH6	10/6	12AU7	10/6	Equip.		PY80	10/6
6BW6	8/6	12AX7	10/6	EF50	5/6	PY81	10/6
6BW7	8/6	12BE6	10/6	Sylv.	8/6	PY82	10/6
6CH6	10/6	12BH7	10/6	EF80	10/6	SP61	5/6
6D6	7/6	12K7	8/6	EF92	5/6	UBC41	10/6
6F6	7/6	12Q7	8/6	EL32	5/6	UCH42	10/6
6H6	3/6	25Z4	10/6	EL84	10/6	UF41	10/6
6F5	6/6	80	8/6	EY51	11/6	UL41	10/6
6J6	7/6	954	1/6	EZ40	10/6	UY41	10/6
6J7	8/6	EA50	1/6	EZ81	11/6	U22	10/6
6K6	6/6	EABC80	8/6	E1148	1/6	X79	10/6
6K7	5/6	EB91	6/6				



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THREE WAVEBANDS. **FIVE VALVES**
S.W. 16 m.—50 m. LATEST MULLARD
M.W. 200 m.—550 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40
12-month guarantee.
A.C. 200/250 v. 4-way Switch; Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass dial 10 x 4½in., horizontal or vertical available. 2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains.

10 gns. Carr. & Ins. 4/6.

TERMS: Deposit £5.5.0 and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., 17/6; 10in., 25/-; 12in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS
★ COLLARO ★
HIGH-FIDELITY AUTOCHANGER
Model RC456
7in., 10in., 12in. Records
16, 33, 45, 78 r.p.m.
4-SPEEDS—10 RECORDS
With Studio "O" pick-up
BRAND NEW IN MAKER'S BOXES

OUR PRICE £9.15.0. post free
TERMS: Deposit £5.5.0 and six monthly payments of £1.
Space required 14in. x 12½in. 5in. above and 3in. below.
Suitable Player Cabinets, 49/6.
Amplifier Player Cabinets, 63/-.

GARRARD 4-SPEED SINGLE RECORD PLAYER 4SP
Brand new and fully guaranteed 12 months

AUDIO PERFECTION

Designed to play 16, 33, 45, 78 r.p.m. Records. 7in., 10in., 12in. Lightweight Xtal pick-up. GC2 turnover head, two separate sapphire styli, for Standard and L.P., each plays 2,000 records. Voltage 200/250 A.C.

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Terms: Deposit £5 and 4 monthly payments of £1. Space required 14in. x 12½in. 3in. above and 2½in. below.
Amplifier Player Cabinets, 45/-.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes. 2½in. sides, 7 x 4in., **4/6**; 9 x 6in., **5/9**; 11 x 7in., **6/9**; 13 x 9in., **8/6**; 14 x 11in., **10/6**; 15 x 14in., **12/6**; 18 x 16 x 3in., **16/6.**

TRANSISTORS. Audio, **10/-.** R.F. 2.6 Mc/s, **21/-.** Mullard OC71, **20/-.**

HANDY VOLT METERS. 2in. Twin Range. 0-25 v., 0-250 v., D.C. with leads and leather case **12/6** complete.

BUILD THIS REPRODUCER BARGAIN
Special Single Player Kits.
Famous maker's surplus stocks. 4-speed Collaro Gram. pick-up unit, **£4/12/6.**
Handsome portable case, 17½in. x 13½in. x 7in., **£2 5/0.**
Ready built 3-watt amplifier with valves and 7" elliptical loudspeaker, **£3/12/6.**
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CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1½in. x 3/16 in. Bargain Price **6/6.** No transformer required.

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SUPERHET MODEL 527 X FOR ALL-DRY BATTERY OPERATION
S.W.1 13.6 to 43 metres, S.W.2 42.8 to 136 metres, Medium 187 to 575 metres.
A fine All-wave receiver giving world-wide reception on three wavebands. 6in. speaker. The cabinet is maroon and beige with gold trimmings. Valves: DK92, DF96, DAF96, DL96.
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Volume Controls
Long spindles. Guaranteed 1 year. Midget 10,000 ohms to 2 Meg. No Sw. S.P.Sw. D.P.Sw.
3/- 4/- 4/9
Linear or Log Tracks.

80 ohm CABLE **COAX**
Semi-air spaced Polythene insulated. ¼in. dia. Stranded core. **9d.** yd.
Losses cut 50%.
Fringe Quality. Air Spaced. **1/6** yd.

COAX PLUGS ... **1/-** **DOUBLE SOCKET 1/3**
SOCKETS ... **1/-** **OUTLET BOXES** ... **4/6**
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/-. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. T.V. Type. All values 25 ohms to 30 K., **3/- ea.** 50 K., **4/-.** (Carbon 50 K. to 2 m., **3/-.**)
WIRE-WOUND 4 WATT. Pots 2¼in. Spindle Values, 100 ohms to 50 K., **5/6**; 100 K., **6/6.**
CONDENSERS. New Stock. .001 mfd. 7 kV. T.C.C., **5/6**; Ditto, 20 kV., **9/6**; 100 pf. to 500 pf. **Micas 6d.**; Tubular 500 v. .001 to .01 mfd., **9d**; .05, .1, **1/-**; .25, **1/6**; .5/350 v., **1/9**; .1/350 v., **9d.**; .01/2,000 v., **1/9**; .1 mfd., 2,000 volts, **3/6.**
CERAMIC CONDS. 500 v., .3 pf. to .01 mfd., **10d.**
SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., **1/-**; 600 pf. to 3,000 pf., **1/3.** Close tolerance (± 1 pF.) 1.5 pF to 47 pF., **1/6.** Ditto 1% 50 pF. to 815 pF., **1/9**; 1,000 pF. to 5,000 pF., **2/-.**

I.F. TRANSFORMERS 7/6 pair.
465 Kc/s Slug tuning Miniature Can. 2½ in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
Wearite M800 I.F. 465 Kc/s 12/6 per pair.
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NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	2/-	8+16/500 v.	5/6
2/450 v.	2/3	8+8/500 v.	4/6	16+16/500 v.	6/-
4/450 v.	2/-	16+16/500 v.		25+20/450 v.	5/6
8/450 v.	2/3		6/-	32+32/350 v.	4/6
8/500 v.	2/9	**CAN TYPES**		32+32/450 v.	6/6
16/450 v.	3/6	Clips	3d.	50+50/350 v.	7/-
16/500 v.	4/-	16/450 v.	3/6	60+100/350 v.	11/6
32/450 v.	5/6	32/350 v.	4/-	100+200/275 v.	
25/25 v.	1/9	64/350 v.	5/6		12/6
50/25 v.	1/9	500/12 v.	3/-	1,000+1,000/6 v.	
50/50 v.	2/-	8+16/450 v.	5/-		6/6

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGE. K3/25 2 kV., **5/-**; K3/40 3.2 kV., **7/-**; K3/45, 3.6 kV., **7/6**; K3/50 4 kV., **8/-**; K3/100 8 kV., **14/6.** 50 c.p.s. voltage, 30% of above.
MAINS TYPE CONTACT COOLED 250 v. 50 mA., **8/6**; 250 v. 85 mA., **9/6.** Selenium 300 v. 85 mA., **7/6.**
COILS Wearite "P" type, **3/-** each. Osmor Midget "Q" type adj. dust core, from **4/-.** All ranges.
TELETRON. L. & Med. T.R.F., with reaction, **3/6.**
FERRITE ROD AERIALS. M.W., **8/9**; M. & L., **12/6.**
T.R.F. COILS A/HF **7/-** pair. **H.F. CHOKES, 2/6.**
FERRITE ROD 8in. x 3/8in. dia., **2/6.**

JASON F.M. TUNER COIL SET. 26/-. H.F. coil, aerial coil, Oscillator coil, two I.F. transformers 10.7 Mc/s. Detector transformer and heater choke. Circuit book using four 6AM6, **2/-.** J.B. Chassis and Dial, **19/6.**
Complete Jason F.M. Kit, **£5.18.6.**
With Jason superior calibrated dial, **£6.15.0.**

FULL WAVE BRIDGE SELENIUM RECTIFIERS: 2, 6 or 12 v. 1½ amp., **8/9**; 2 a., **11/3**; 4 a., **17/6.**
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amp., **15/6.** 2 amp., **17/6**; 4 amp., **22/6.** Circuit included.
VALVE and **T.V. TUBE** equivalent books, **5/-.**
TOGGLE SWITCHES. S.P. **2/-.** D.P. **3/6.** D.P.D.T. **4/-.**
WAVECHANGE SWITCHES
5 p. 4-way 2 wafer long spindle **6/6**
2 p. 2-way 3 p. 2-way short spindle **2/6**
2 p. 6-way 4 p. 2-way 4 p. 3-way long spindle **3/6**
3 p. 4-way, 1 p. 12-way, long spindle ... **3/6**
VALVEHOLDERS. Pax. Int. Oct., **4d.** EF50, EA50, **6d.** B12A, CRT, **1/3.** Eng. and Amer. 4, 5, 6, 7 and 9 pin, **1/-.** **MOULDED MAZDA** and Int. Oct., **6d.** B7G, B8A, B8G, B9A, **9d.** B7G with can, **1/6.** VCR97, **2/6.** B9A with can, **2/6.** **CERAMIC** EF50, B7G, B9A, Int. Oct., **1/-.** B7G with can, **1/9.**
BLACK CRACKLE PAINT, air drying, **3/-** tin.

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