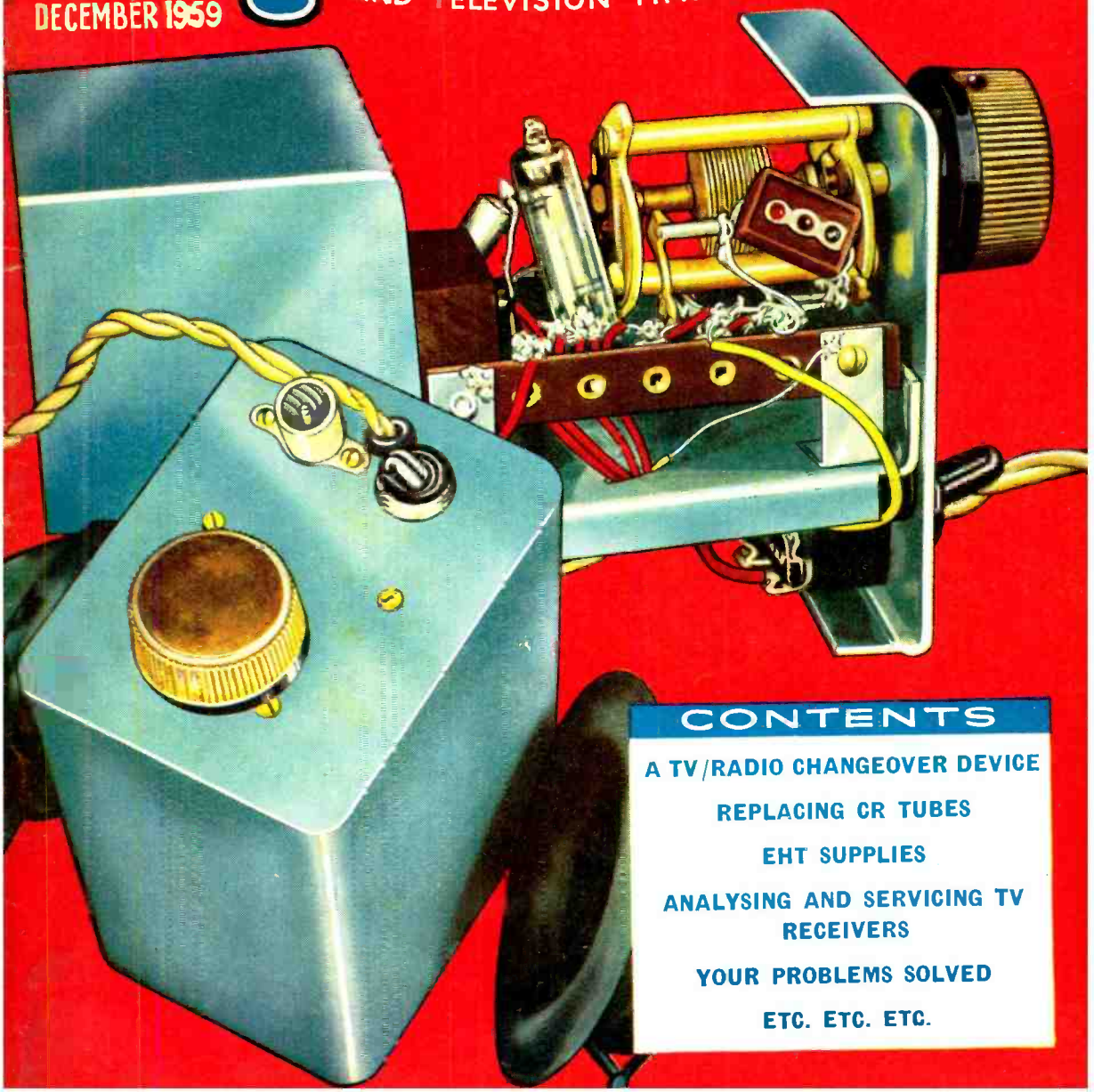
A FIELD-STRENGTH COMPARATOR

Practical Television

1'6

AND TELEVISION TIMES

DECEMBER 1959

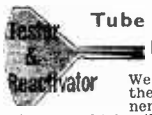


CONTENTS

Radio Stethoscope

This can be slipped into the pocket rather like a fountain pen. With it in most districts a receiver can be checked from the grid of the first valve right through to the output without a signal generator. The stethoscope is a complete fault-finder.
All the necessary parts to make this tracer 9/6, post 1/-.

Tube Tester and Reactivator



We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will reactivate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

T.V. Service Sheets

200 sheets covering most popular post-war televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., £2, post free. PREVIOUS PURCHASERS OF THESE SHEETS PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, £1, or 150-200, 10/-.

T.V. Masks

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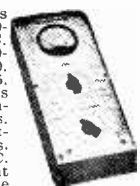
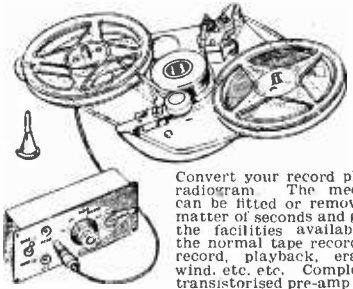


Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000, with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 19/6, plus 2/6 post and insurance.

Avo Prodclips

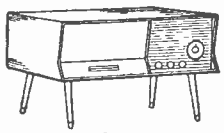
The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price 15/- pair.

Your Radiogram into Tape Recorder



Convert your record player or radiogram. The mechanism can be fitted or removed in a matter of seconds and gives all the facilities available with the normal tape recorder, i.e., record, playback, erase, rewind, etc. etc. Complete with transistorised pre-amp as illustrated. Only £13.12.0 or with Acos pick-up, £15.12.0. H.P. terms available.

This Month's Snip

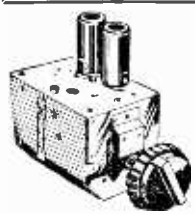


5-valve F.M. receiver kit. Note: This is not just a tuner but a complete receiver with power supplies—made by the famous Cossor Company. Until very recently this cost £15.15.0, but due to a large purchase we are able to offer this at the remarkably low price of £8.19.6, plus 3/6 post and insurance. Complete with full constructional details. The circuit uses five B9A valves and special features are the cascode R.F. stage and the Foster Seeley discriminator. All valves and components, printed circuit, printed dial, 10in. x 6in. elliptical speaker—in fact, everything except the cabinet is supplied. Do not miss this wonderful bargain!

Five Useful Articles

Our 1960 catalogue now ready gives constructional hints and circuits for five useful articles such as moisture operated switch etc. Send for this catalogue to-day, price 2/6 refundable from purchases.

TURRET TUNER



Brand new stock, not surplus, with coils for Band I and III, complete with valves PCC84 and PCF80—I.F. Output 33/38 Mc/s with circuit diagram 7/6. Knobs 3/6 extra, post and ins. 2/6.

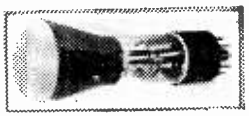
FOUR ITEMS FOR PRICE OF ONE

Set of modern T.V. parts, suitable for modernising old televisor or for a new one. For wide angle 14in. or 17in. tubes comprises: (1) Line output E.H.T. transformer. (2) 700 scanning coils on ferrite yokes. (3) Width control with ferrite core. (4) Frame output transformer. (5) Circuit diagram of a modern televisor. Offered at the price of the Line output transformer only, namely, 57/6, plus 2/6 post and insurance.

Band III Converters

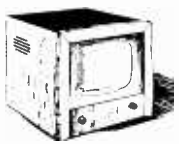
Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including two EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately, 1/6.
Please send two more kits, the one you sent last week is performing magnificently. We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

Building a Scope?



3in. oscilloscope tube. American-made type No. 3FP7, octal base 6.3 v. .6 amp. heater, electrostatic deflection, brand new and guaranteed, 15/- each, plus 1/6 post and ins.

14in. T.V. Cabinet



14in. T.V. cabinet of the latest styling—beautifully veneered and polished—limited quantity, sale price 15/- each. Carriage and packing 3/6 extra. Masks 10/- extra.

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This is a record player which operates from torch batteries. It is amazingly small and can, in fact, be carried in the pocket—it weighs only about 2lb. Despite its small size it will play all modern records, 7in., 10in. and 12in. at 33 r.p.m. or 45 r.p.m. Completely transistorised, it gives 100 milliwatt undistorted output. Price £15.15.0. H.P. terms available.

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Electronics (Ruislip) Ltd.
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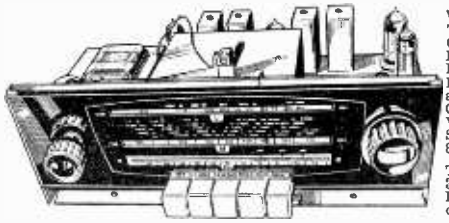
Phone: RUISLIP 5780.
Half day Wednesday.

Electronics (Croydon) Ltd.
266, London Road, Croydon.
Phone: CRO 6558.
Half day Wednesday.

Electronics (Finsbury Park) Ltd.
29, Stroud Green Rd., Finsbury Park, N.4.
Phone: ARChway 1049.
Half day Thursday.

BRAND NEW A.M.-F.M. (V.H.F.) CHASSIS AT £13.6.8. (P. & P. 10/-)



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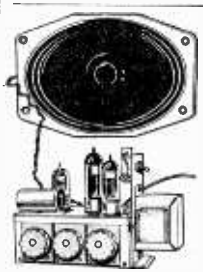
Tapped input 200-225 v. and 226-250 v. A.C. ONLY.
Chassis size 15" x 6¾" x 5¼" high. New manufacture.
Dial 14¼" x 4" in gold, red and deep brown.
Pick-up. Extension speaker. Ae., E. and Dipole sockets.
Five " piano " push buttons—OFF, L.W., M.W., F.M. and Gram. Aligned and tested. With valves. Tone control.
Cover 1,000-1,900 M. ; 200-500 M. ; 88-99 Mc/s.
Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
Speaker & Cabinet to fit, polished with back, 67/6.
8" x 5" ELLIPTICAL SPEAKER, 20/-.

TERMS :—(Chassis) £4.16.8 dep. + 10/- carr. and 6 Mthly. Payments of 30/-, or with Cabinet and Speaker, £5.9.2. dep + 10/- carr. and 7 Mthly. Payments of 35/-. Interior or outside F.M. dipole, 12/6 (2/- post). Co-axial cable pr. flat twin (300 ohm), 8d. yd.

We are specialists in I.T.A. Converters. Our converters give direct switching I.T.A. to B.B.C., metal rectifier, co-axial plug, can be fitted in 5-10 mins., and need no alteration to your set. ALL AREAS. ALL SETS. ALL CHANNELS. 12 months' guarantee (3 months on valves).

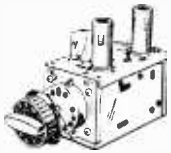
" READY TO USE " I.T.A. CONVERTER

Separate gain controls. Valves PCF80 and PCC84. Switch positions I.T.A. (1)—I.T.A. (2)—B.B.C. Bakelite moulded cabinet 8¼" x 4" x 6". £5.5.0. P. & P. 3/-.



3-VALVE AMPLIFIER (INCL. RECT.). Capable of giving 6 watts. 8" x 5" Speaker wired-in. Mains and output transformers. Valves ECC81, EL84 and Rect. 3 Controls, volume, bass and treble. On/Off switch. Fully guaranteed. Chassis size, 6¼" x 3" x 2¼".

Only 67/- (P. 3/- & P.)



INCREMENTAL TURRET TUNER by famous manufacturer for 35 to 38 Mc/s ; with knobs. Valves PCC84 and PCF80. ONLY 77/6, post free, or valves UCC84 and UCF80.

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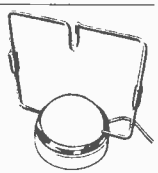

An I.T.A. table top aerial with amazing performance. The Wolsey Hi-Q at 19/6 (2/6 post). Gives good reception up to 20 miles, and has cross-over unit in base with socket for B.B.C. aerial.
Same model but very slightly tarnished for ONLY 12/6 (2/6 post).

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AUTOMATIC RECORD CHANGERS. COLLARO CONQUEST with manual play also. Turnover crystal pick-up. 4-speed. A.C. mains 200-250 v., see illus.

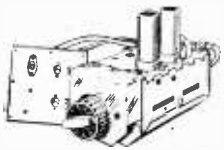
B.S.R. 4-SPEED AUTO-CHANGER UA8 only £6.12.6 (5/- carr.).

£7.10.0 (5/- P. & P.)

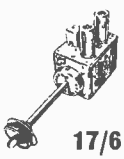
For the last 200 I.T.A. Converters of this type (Brand New and Fully Guaranteed) we will accept the " Below Cost" figure of ONLY 60/- (3/- P. & P.). Reduced from £4.7.6.
Two valves ECC81—grey hammer finish—Switch positions OFF, I.T.A., B.B.C. Own Power supply. BUY IT NOW.

60/- (3/- P. & P.)

THE BRAYHEAD TURRET TUNER, £7.7.0 post free. Complete with booklet and fitting instructions. State set and model no. when ordering.
Converts your 5-channel B.B.C. only set to receive 13 channels.



I.T.A. AERIALS clipping to existing mast 1-2" dia. 3-element, 27/-; 5-el., 35/- ; 9-el., 55/-; Loft mounting. 3-el., 20/-; 5-el., 27/6 ; Combined single B.B.C. and 5-el. I.T.A., 75/- with chimney lashings ; Co-axial cable semi air-spaced, 8d. yd. or 20 yds., 12/6 ; aerial and cable prices carr. paid.



17/6

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50 SILVERED MICA AND CERAMIC CONDENSERS, 10/-. 50 RESISTORS, 5/-.

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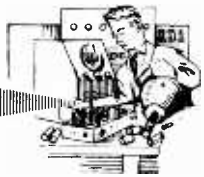
Practical Television



& TELEVISION TIMES

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CONTENTS :

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to : The Editor, "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of radio and television apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

TELEVIEWS

THE FUTURE OF TV

THE charter of the BBC comes to an end in July, 1962, and the initial ten-year period of the ITA is scheduled to finish in July, 1964. Both of these dates occur within the lifetime of the new Parliament and therefore the Postmaster General will have the task in the near future of considering the development of the whole of Britain's television and radio services. However, it is apparent that a large-scale review is needed rather than an attack on the problem in a piecemeal manner. It seems likely, therefore, that the Government will appoint another "Beveridge" committee. Therefore drastic changes in the present state of TV and radio seem unlikely for at least two years. The Broadcasting Committee of 1949, presided over by Lord Beveridge, was the fourth such committee (1923, 1925, 1935 and then 1949) formed to keep official policy co-ordinated with technical developments. The 1949 committee was formed " . . . to consider the constitution, control, finance and other general aspects of the sound and TV broadcasting services of the U.K. and to advise on the conditions under which those services and wire broadcasting should be conducted after December, 1951."

In January, 1951, the 327-page report (plus 583 pages of memoranda submitted) supported continuance broadly of the BBC's monopoly position. There was a majority decision against sponsored broadcasting. However, at that time, many expressed the view that TV and sound broadcasting in this country should not continue its development under the control of a single large corporation. Now the ITA has established itself as a powerful force in television and, in fact, in the life of the country. It is self-supporting and needs no subsidy. It yields to its promoters a gross income from advertising of some £50 million per year.

A new inquiry would face many problems for investigation. Among them would be the question of picture definition. At present the standard used in this country is a 405-line picture, but there is no doubt that a change to the more modern and more widely used standard of 625 lines would be a worthwhile step. However, a change such as this could not be made overnight without rendering millions of sets obsolete. Also if a change is necessary then a method of carrying it out must be found.

Any new inquiry would also have to survey the question of increasing the number of hours of "air time" for television. Both the commercial television companies and the BBC do not see why television broadcasting should be limited to some 60 hours in each week. Unlike the commercial companies, however, the BBC would be unable to proceed with increases in broadcasting time without receiving a larger income. Presumably the Treasury would have to release some of the licence revenue which it at present retains.

Our next issue, dated January, will be published on December 22nd

A Simple Diplexer

COMBINE THE OUTPUTS FROM SEPARATE BBC AND ITV AERIALS

NEARLY all modern commercial two-band television sets feature a single aerial socket which is common to both bands. Such an arrangement is ideally suited when a composite two-band aerial system is employed with a common feeder. Systems of this kind are in use mainly in districts within the service area of both stations where the local field strength due to both transmitters is relatively high. The actual aerials in these cases are coupled in such a way

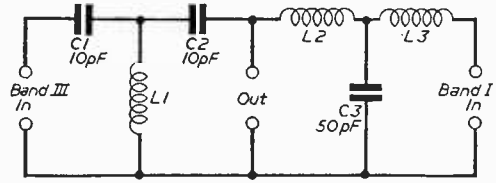


Fig. 1.—A complete high-pass/low-pass filter network for Band III and Band I frequencies.

that an impedance match is maintained at the point of connection to the feeder, and a reasonable isolation ratio between the two frequencies involved is achieved.

The Problem of Feeding Two Signals to a Common Input

In districts within the secondary service area and in fringe areas it is nearly always necessary to erect separate Band I and Band III aerials in order to obtain pick-up on Band III equal to that on Band I. Excluding brand new installations, the addition of Band III means the erection of a Band III aerial independent of the existing Band I array.

Since the losses involved in carrying the higher frequency Band III signals along the feeder from the aerial to the receiver are approximately double the losses at Band I frequencies, it is always desirable to use extra low-loss feeder on the Band III system, even though standard feeder may be employed on the Band I installation. For this reason it is not good policy to make do with the existing Band I feeder to carry the signals in both bands (although this is possible as we shall see later). The most desirable method calls for the use of a separate run of feeder from the Band III aerial to the receiver.

Two feeders, one for each band, are all very well if the set is fitted with separate aerial sockets, but this is rarely the case these days. A solution, of course, lies in fitting an aerial changeover switch or in changing over the feeders when the band-switch on the set is changed. Both of these methods are inconvenient, and the latter one soon results in deterioration of the set's aerial socket.

It is not possible to join together the feeders of two aerials working at different frequencies and still obtain optimum results.

Double Filter Network

Avoidance of signal shunting can be achieved by combining the signals in both feeders in a double filter network. One section of the filter has a high-pass characteristic and the other section a low-pass characteristic. Now, if the Band III signals are taken to the high-pass section and the Band I signals to the low-pass section, very little attenuation will occur on the signals passing from the aerials into the filters, but considerable attenuation will be offered across the outputs of the filters to the frequencies of the signals involved. For instance, the high-pass filter should be designed to pass the Band III signals and attenuate the Band I signals, and the low-pass filter should be designed to pass the Band I signals and attenuate the Band III signals.

Fig. 1 shows a complete high-pass/low-pass filter network and the values of the capacitors. Successful networks of this nature have been made up by the author on eight-way tag strips, using one of the tags as an earthing and fixing point. The method of construction is illustrated

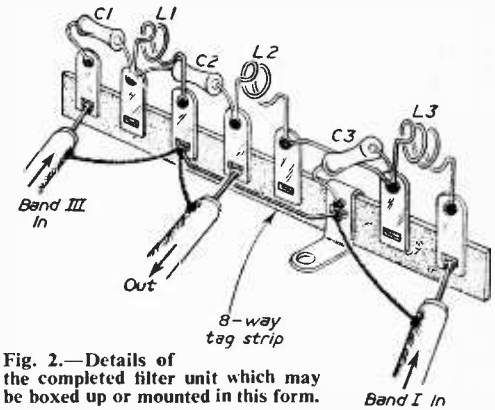


Fig. 2.—Details of the completed filter unit which may be boxed up or mounted in this form.

in Fig. 2. Here it will be seen that the coils are made self supporting. Tinned copper wire of 18 s.w.g. is ideal and the coils are best formed on a rod of ¼in. diameter. Coils L1 and L2 have two turns, and coil L3 three turns; the turns should be separated approximately the diameter of the wire.

The Problem of Extracting Two Signals from a Common Feeder

In areas of high signal strength where a combined Band I/Band III aerial might well be in use it may be required to extract the two signals from the common feeder either to feed to a receiver having two input sockets or in cases where a Band III converter is used.

The filter described is quite suitable for this purpose; it is, in fact, simply used the other way round, that is, the common feeder taken to the output terminals and the Band I and Band III outputs taken to the appropriate sockets on the receiver or converter.

EHT Supplies

No. 2.—EHT FROM THE LINE OUTPUT CIRCUITS OF THE TV RECEIVER

By W. Cleland

THE circuit of an R.F. EHT supply for an oscilloscope was given last month in Fig. 5. To avoid having to bring the primary and secondary close together, critical coupling must be obtained at a low value of coupling, i.e., the loaded Q's must be high.

Stray Capacitance

Although of minor significance, reversing the leads of the EHT secondary may also make a difference to the performance due to the altered disposition of stray capacitance, so it is necessary to adhere to the wiring plan intended for a particular coil.

Very close coupling between the windings can be obtained without such high Q values if the primary is a single-layer coil inside the secondary and co-extensive with it in length. Another method of reducing leakage inductance is to use a ferrite core, although the losses thereby introduced indicate the use of a low frequency such as 25kc/s. A high-Q ferrite, i.e., a ferroceramic, is necessary. This is the hard material used for ferrite aerials and in line output transformers. The ferrite used in many tuning coils (which crumbles easily) is unsuitable and will not give a high output.

Losses

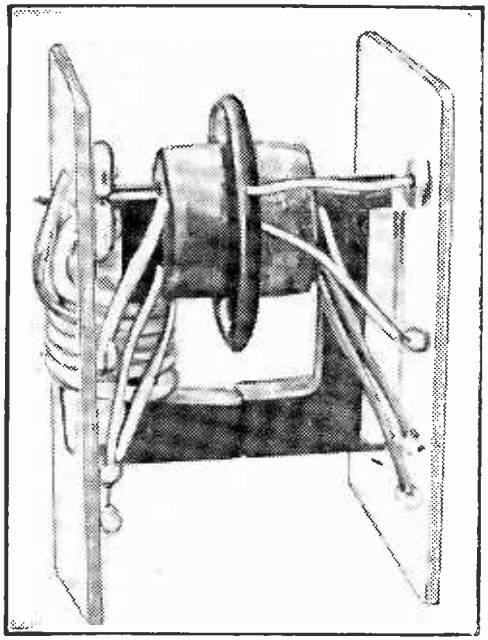
At high frequencies a ferrite core becomes warm, showing that appreciable losses can occur in it. There are many grades of ferrites, some almost insulators, and others of lower resistivity.

It is not necessary to use a core of the closed type as in line output transformers. Satisfactory results can be obtained with a rod core, since the main purpose is to increase the tightness of coupling. With tight coupling the value of tuning capacitance for maximum output becomes much less critical, because of the reduced importance of leakage inductance.

Efficiency can be increased by employing Litz wire. Dielectric losses can be heavy and have to be minimised by using a coil former of low-loss material such as polystyrene. Low-capacitance windings are necessary. A single-layer primary may be possible, but a sectionalised multi-layer winding will be required for the secondary. Normally it will be wave-wound for minimum capacitance and for an even distribution of the voltage stresses.

Grid Drive

The grid input is not in the least critical, as the oscillator works in Class C fashion, and a larger grid drive only means the increased accumulation of bias. However, an excessive grid drive might harm the valve. The amount required will depend upon the gm of the valve.



A home-constructed line-output transformer.

The grid winding should be coupled to the EHT secondary rather than directly to the anode winding, and sometimes the grid circuit also is tuned. This may cause simultaneous oscillation at two frequencies, with one predominating. It is also possible to dispense with a grid winding and to obtain the grid input by means of a very small capacitive coupling to the anode of the EHT rectifier, secured merely by bringing an insulated wire from the grid into the vicinity of the rectifier. However, a grid winding of a few turns is probably to be preferred.

Regulation

When carefully designed so that the effect of changes of loading on the secondary is minimised, an R.F. EHT supply can be arranged to have an effective internal resistance of less than 10MΩ when providing outputs of 10kV or more, for loads up to 100μA. Smaller EHT voltages can easily be generated with source resistances as low as 2MΩ.

Control Potential

If a regulator circuit is to be added to an R.F. type of EHT supply, there is little use in applying a control voltage to the grid, for reasons that have already been given. If, however, the oscillator valve is a pentode, the anode current can be controlled by means of the suppressor grid, through diverting more current to the screen grid. A negative control voltage for the purpose can be derived from a potential divider across the EHT supply, via a stage of amplification, with phase

inversion in the case of a positive EHT supply, a negative reference voltage also being necessary.

Unless an R.F. EHT unit is a carefully designed and tested product, it may prove to have an inconstant output. The output may alter considerably when different valves of a given type are each in turn plugged in, or it may increase or decrease for a lengthy period after switching on. There may even be difficulty in making oscillation begin. The variations are in part due to the reduction of Q with rise of temperature and to frequency shift. Ventilation is necessary to enable a stable temperature to be reached in a short time.

plates would be consecutive; not forming a single deflection assembly as with coils, because of the fundamentally different nature of electric and magnetic fields.

In magnetic deflection, even higher voltages are produced, but occur during fly-back. These high-voltage pulses are unavoidable with the techniques so far developed for large screen receivers, and it is customary to utilise them as a by-product for EHT generation, because the circuit is economical and compact. In this way some benefit is derived from what would otherwise be entirely a nuisance, since a severe stress is imposed upon the insulation of the line output

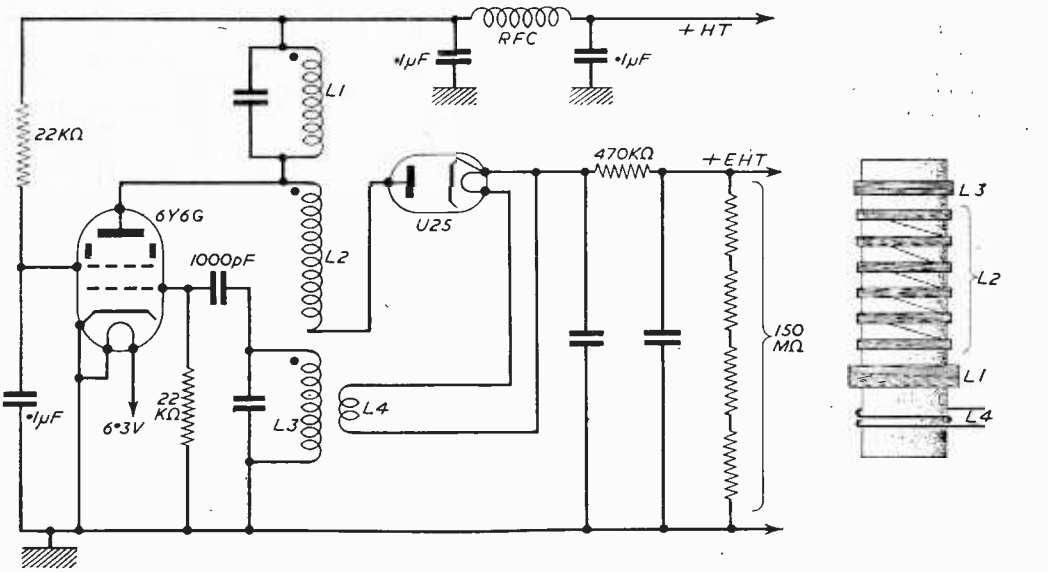


Fig. 6.—Positive R.F. EHT supply for a picture tube.

A high-frequency supply is much less dangerous, because there is usually only a small amount of energy available. In addition, much smaller smoothing capacitors will suffice, thus avoiding dangerous storage of charge. Owing to the high frequency, an electric shock is not experienced if the rectifier anode connection is accidentally touched, but singes are received on the skin, due to dielectric heating.

The efficiency of an R.F. EHT supply, i.e., the proportion of H.T. power transformed into EHT, can be as high as 30 per cent. at low EHT voltages, but at higher voltages, half this figure would be more typical. However, with an output of only about 1W, the H.T. drain would still be less than 30mA at 250V.

Line Output EHT

The achievement of uniform focus over a wide screen with minimum length of cathode ray tube has been made possible by adopting magnetic deflection instead of electric. In the latter, high saw-tooth voltages produced with the aid of step-up transformers would be required, and applied to well-insulated plates inside the tube neck. The transformer. Most television EHT supplies are of this type.

Surges

These high voltage surges arise because the voltage across an inductance of L henrys is always L times the rate (in amperes per second) at which the current happens to be changing at that particular instant. Thus a rapid change of current produces a correspondingly large voltage across the inductance, but this cannot exceed the voltage of the supply producing it, until the supply is switched off, as, for example, when the line-output valve is plunged into non-conduction, so isolating the line-output circuit. When this happens, the current, which during the scan period has risen at an even rate to a high value, continues to flow, but falls rapidly, now flowing entirely into the stray capacitance of the circuit, and charging it up to a high voltage.

This peak is reached half-way through fly-back, when the scanning spot would be at about the middle of the screen on its return, although it is actually blacked out by the synchronizing pulse on the grid of the picture tube.

Peak Voltage

If all the energy in the inductance were transferred to the stray capacitance without loss, the peak voltage reached would be

$$V_p : I_p \sqrt{\left(\frac{L}{C}\right)}$$

units being amperes, henrys, and farads.

Due to losses the voltage will be slightly less, but the Q-value would have to be very low to diminish the voltage very much. With Q=5, the voltage is about 85 per cent. When values are put in the formula, it is found that a peak of several kilovolts can occur at the anode of the line-output valve, apart from a subsequent step-up.

The current in the coils reverses as the pulse reaches its peak, the stray capacitance beginning to discharge back into the inductance to complete the first half-cycle of natural oscillation at the resonant frequency of the inductance with the stray capacitance.

Duration

This to-and-fro interchange of energy in the L/C circuit cannot, however, be allowed to continue beyond the first half-cycle. A continuance of the gradually subsiding wave of free oscillation would correspond to a rapid series of traversals of the screen by the scanning spot. Instead, the longer period of the scan has to succeed fly-back, the booster diode coming into action at its commencement to conduct the current at a uniform rate of decrease from the coils into a reservoir capacitance, so recovering energy to boost the H.T. voltage for the line output valve, diode conduction varying with the voltage developed across the linearity circuit to produce a uniformly changing current in the deflection coils.

Suppression

As a result of this action, the ensuing half-cycle of natural oscillation (a negative voltage pulse) is suppressed, and only positive voltage pulses are produced when the circuit is functioning normally, and these can be used to obtain the steady accelerating voltage for the cathode ray tube. An EHT rectifier is still required, although the negative side of the wave is of low amplitude, because, of course, the difference of amplitude is counterbalanced by the much shorter duration of the positive pulses, so it would not be realistic to regard the EHT diode merely as a blocking rectifier, preventing back-leakage between pulses.

Since, as regards amplitude, the voltage wave is virtually one-sided, consisting of a series of widely-spaced pulses, at a repetition rate of 10,125c/s, the peak inverse voltage that the rectifier has to withstand when its input reverses polarity, is only a little more than the pulse amplitude itself, whereas with a normal sinusoidal input, the peak inverse voltage would be nearly twice the input peak, i.e., the peak of the reverse half-cycle added to the direct voltage on the condenser.

Advantage

This suppression of negative half-cycles, gives the line output transformer plus EHT system in common use a distinct advantage over other systems, since the EHT rectifier can be used for output voltages nearly twice as high as the maximum permissible by other methods, which would in the other systems require either a voltage doubler or an EHT diode of a higher rating.

In frame fly-back, the voltages appearing at the anode of the output valve are less than a quarter of those in the line circuit despite the higher inductance of the frame circuit, because the current change in vertical fly-back is much less rapid, and there is heavier damping since the frame output valve conducts throughout the sawtooth cycle.

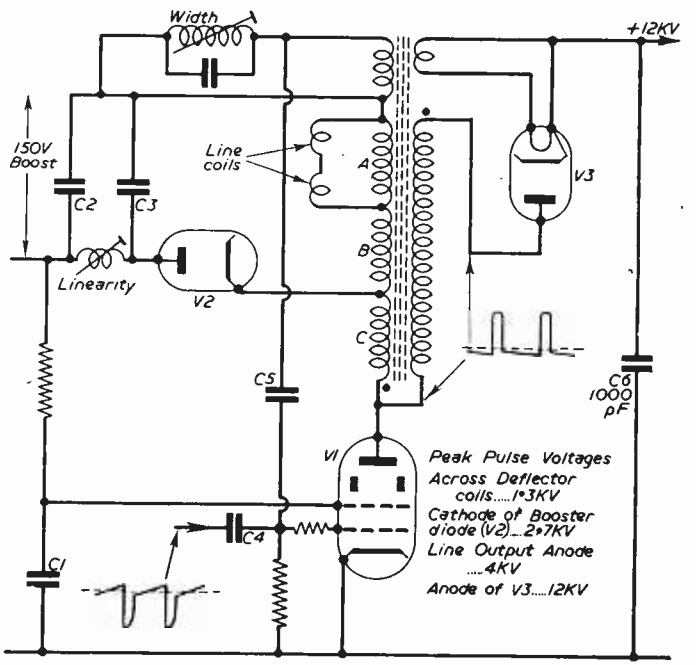


Fig. 7.—Line output stage for 17in. tube.

Power

The power required for horizontal deflection may be over a hundred times that for vertical deflection because of the higher frequency, which requires the deflecting energy to be supplied about 200 times as often. Some of this energy is recovered by means of the economy diode. These

energy surges are many times larger than the energy drawn per cycle by the EHT circuit, and the EHT rectifier only "skims off the tops" of the pulses. The smaller the fraction of scanning power that has to be taken for EHT at full load, the better the voltage regulations, because the EHT circuit functions more nearly as a peak voltmeter with constant output.

Although the fly-back pulses repeat at line frequency (10.125c/s), each is actually the first half-cycle of a burst of free oscillation at the resonant frequency of the anode circuit. This will be 30kc/s, or more, since it sets the fly-back period.

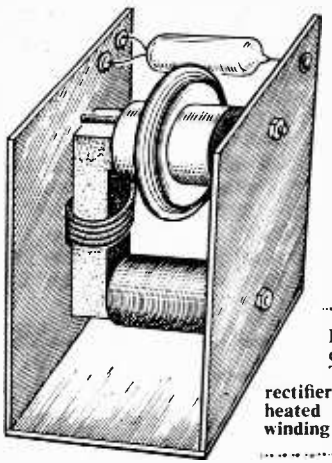


Fig. 8.—Typical line output transformer. The high voltage rectifier slung at the top is heated by the four-turn winding on the side limb.

The relatively long interval between pulses tends to make the regulation of this form of EHT supply poorer than that of other types. A regulation of 15 per cent. for a current increase from zero to 50μA is typical.

Line Output Transformer

The familiar construction of a line output transformer is shown in Fig. 8. The winding supplying the deflector coils is on the lower limb, and has a step-down ratio of 3:1 from the anode. It uses an auto-transformer arrangement to reduce leakage inductance to less than 1 per cent., and is wave-wound for uniform distribution of the voltage stresses with interleaving at about every 100 turns.

The high-voltage winding is a narrow wave-wound coil in order to minimize its self-capacitance. Its inductance may be as much as 1 Henry five or more times that of the primary, and as much as 20 per cent. of this will be leakage inductance, but this is unlikely to have much effect, since the EHT rectifier introduces very little capacitance.

The peak pulse voltages are tabulated in Fig. 7, and there is a peak of about 8 volts per turn during fly-back. This presents difficulties of insulation, in view of the high frequency, and of the need to minimize the leakage inductance of sections A, B, C which makes thick insulation impracticable. Thus wave-winding is desirable, especially in transformers for wide-angle deflection.

Valve Cut-off

The small capacitor C5 feeds back a negative pulse to the grid, ensuring that the line output valve does not conduct during fly-back, when the positive voltage on the anode rises to 4kV, which is within the maximum pulse rating (5.5kV) of the output valve, a type 6CD6G.

There are other methods of driving the grid negative during fly-back, but this one allows the output circuit to take control during fly-back, while other methods may have a tendency to extend the fly-back period, and to make the damping less effective, as shown by the appearance of bars on the left of the picture.

The capacitance C6 may be provided by the inner and outer graphite coatings of the cathode-ray tube, and may be about 1,000pF. It is inadvisable to switch on with the EHT capacitor disconnected, as the filament of the EHT diode is liable to disintegrate.

Heater Insulation

A disadvantage of the auto-transformer arrangement is that a pulse of nearly 3kV appears between the cathode and the heater of the booster diode, since its rather large heater current is obtained from the ordinary 6.3 volt line. Although some efficiency diodes have cathodes insulated to withstand voltages in excess of this, a cathode short-circuit to the chassis is likely if a breakdown should occur elsewhere, and this, of course, means an excessive H.T. current before the television set is switched off.

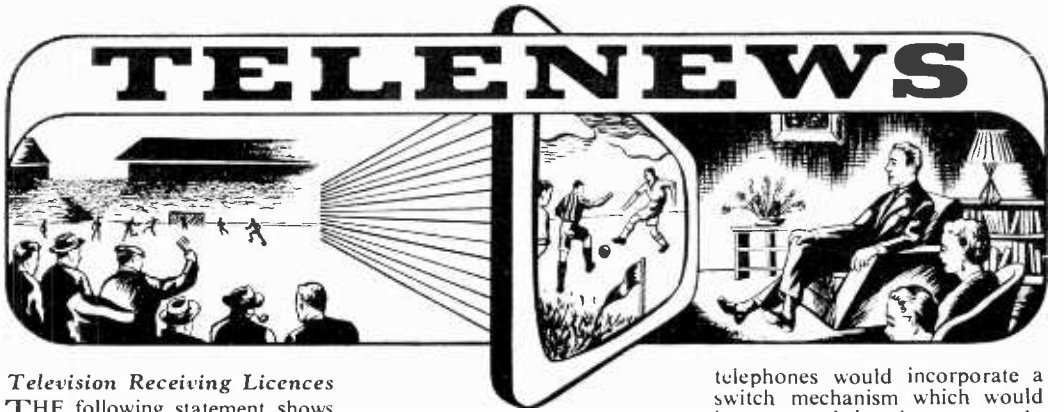
A four-turn winding heats the small wired-in EHT rectifier, and the diode filament should be at the right temperature when the picture is of the correct width and brightness. When the diode is not enclosed, the glow can be observed and compared with that obtained when a similar rectifier is heated from the 6.3 volt line supplying the other valves. With a small beam current, some latitude in the heater voltage is permissible (as much as ± 15 per cent.), but if grossly underheated, the cathode could soon lose its emission.

Metal Rectifiers

When delivering heavy currents at low voltages, metal rectifiers can give a better performance than valves, but their reverse resistance is much lower, and thermionic rectifiers are therefore more suitable for low currents at high voltages. There are, however, special 0.4mA pencil rectifiers (the 36 EHT type) which can be used in some circuits as substitutes for valve rectifiers, although their length is much greater. Pencil rectifiers of the 1mA type are less suitable for picture tube supplies. For example, one rectifier of this type has a back leakage of 1.5μA under a reverse potential of 800V, rising to 15μA at 1.6kV, so the back leakage must be considerable when it is used (as it can be) to rectify 3kV pulses. Metal rectifiers also have a larger capacitance, and are unsuited to radio frequencies.

There are difficulties in adding a regulator to a fly-back type of EHT supply without affecting the width of the picture. One method has been devised using an extra value in a variable loss circuit. Special Metrosil EHT resistors are also manufactured for stabilising EHT voltages. These are rated to pass 60μA at the working voltage ± 2½ per cent. and are obtainable for voltages between 7 and 16kV.

(To be continued)



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of September, 1959, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,738,816
Home Counties	1,271,422
Midland	1,497,050
North Eastern	1,590,012
North Western	1,320,231
South Western	798,916
Wales and Border Counties ...	578,890
Total England and Wales ...	8,795,337
Scotland	803,321
Northern Ireland	119,814
Grand Total	9,718,472

Developments in Electronics

IN his lecture at the 1959 Convention of the Brit.I.R.E. on "Television Engineering in Science, Industry and Broadcasting" earlier this year, Dr. Vladimir K. Zworykin looked ahead to ways in which electronics would play a part in three important, widely separated fields—Medicine, Transport and Public Affairs.

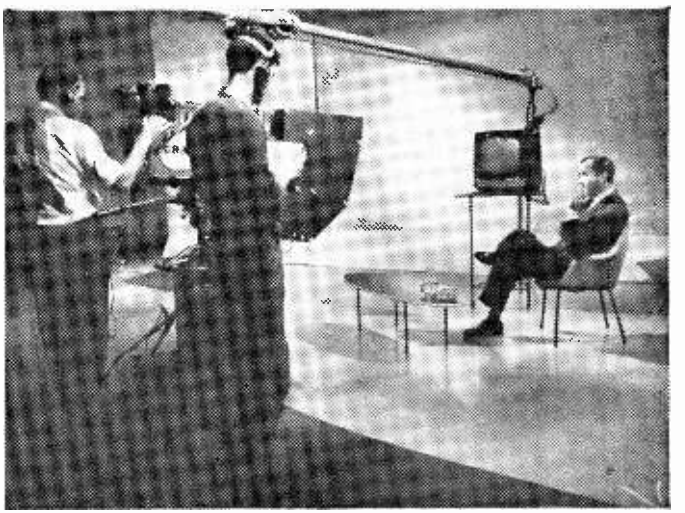
Electronics in Medicine.—The developments in electronics for medical research include the so-called radio pill for transmitting pressure variations from within the gastro-intestinal tract of a patient to an external radio receiver, and the use of "pace-maker pulses" to stimulate the muscles of the heart. The ultra-violet colour translating television microscope will find increasing use in the examination of tissue in biological research.

Electronics in Transport.—Road accidents are becoming increasingly serious in many countries and a system is being developed for the elimination of the human element in the control of traffic. A series of wire loops would be embedded in the highway, so that the movement of a vehicle over the loops produces electric signals. The signals can be used to actuate warning lights at the side of the road if there is traffic dangerously near in the same lane.

Electronics in Public Affairs.—Finally the use of the existing telephone system in conjunction with data handling equipment to record the opinion of all voters on issues of national importance. Individual telephones would incorporate a switch mechanism which would be operated by the voter. At the end of the specified voting period interrogating pulses from the local telephone exchange would record his decision and the results of the counts of all exchanges would then be similarly transmitted to a central station.

Sweden's Radar Defence System

SWEDEN is to have an air defence system embodying new and secret automatic electronic techniques which, it is claimed, will make it far more effective than any other in existence today. It provides for



The American TV and radio commentator Edward R. Murrow gave the second of the Granada Lectures series on ITV recently. Murrow's subject was "Television and Politics." He said: "The eye of the camera should pursue the politician to the very limits of privacy and decency. When the politicians complain, as they have in several countries, that television turns their proceedings into a circus, it should be made clear that the circus was already there. "Television has merely demonstrated that not all the performers are well trained."

instantaneous action against enemy attack.

Although security forbids a detailed description, it can be said that the heart of the system is a very high speed computer which solves a large number of interception problems simultaneously and enables the defence weapons — fighters, guided missiles, and other anti-aircraft devices to be brought into action at precisely the right instant. Black-and-white and colour television and automatic information-dissemination techniques also play an important part in the system.

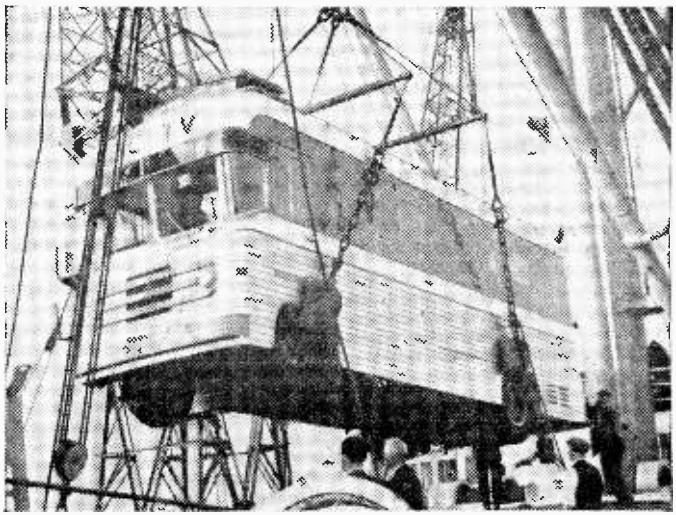
The Swedish Air Defence System has been evolved by scientists and engineers of Marconi's Wireless Telegraph Co. of England and their opposite numbers in the Swedish Air Force, working in the closest collaboration. The initial contracts for the design and supply of the electronic equipment, which are to the approximate value of £1,500,000, have been awarded to Marconi's via their Swedish associates Svenska Radioaktiebolaget.

BBC's New Peterborough TV Station

WHEN the BBC's new television station near Peterborough was brought into service on Monday October 5th, viewers in the Peterborough area found that, as a result of the very much stronger signal which the new station was providing. Channel 5 as compared with the signal from Sutton Coldfield on Channel 4, receivers in some cases would not continue to function satisfactorily on Channel 4. This was not the fault of the receiver or of the transmission, but is due entirely to the strong local signal from the new station. The BBC recommend, therefore, that viewers should take advantage of the greatly improved reception from the new station by having receivers and aerials suitably adjusted by their radio dealer for reception on Channel 5.

Television in Nigeria

THE Western Nigerian House of Assembly has passed a bill establishing television and broadcasting services in the Western Region. Western Nigerian television will not only be the first television network in Nigeria, but the first and only television network in Africa originating entire programme schedules. The first commercial radio network in Nigeria which will cover the entire Western Region will be inaugurated in a few months.



A Marconi three-camera television outside broadcast vehicle being loaded aboard M.V. " Port Montreal " at King George V Dock, London, en route for Hobart. The vehicle is for use at the Australian National Broadcasting station there, for which Marconi's have also supplied the transmitters and much of the studio equipment.

Presenting the bill, the Minister of Home and Mid-west Affairs, Chief Anthony Enahoro, told the House that although the television and broadcasting services were primarily intended to develop and expand the educational system of the Region, commercial advertising will be welcomed and the services will be run impartially. He also stated that the 1,000 television sets purchased by the Government were being installed in schools and hospitals throughout the two television areas centred on Ibadan and Abafon.

I.T.A. in South West England

THE I.T.A. has invited applications from groups wishing to become the programme contractor for the South West of England. The company appointed will be responsible for providing the programmes transmitted from the two new stations one of which will be near Axminster in Devon and the other at the edge of Bodmin Moor, near Liskeard in Cornwall. These stations are expected to cover the whole of Somerset, Devon and Cornwall west of a line from Weymouth to Bridgwater with the exception of a narrow belt some ten miles in width along the north coast from Barnstaple to Bridgwater. The number of people who will be within the service areas of the two stations is estimated to exceed a million.

TAM Surveys Ulster

FOR every 100 households receiving television in the Ulster ITV area, there are 83 with Band III (potential BBC and ITV) sets, reveals Television Audience Measurements Limited. During a recent survey TAM field workers visited 1,532 households chosen by random sample from the electorial register. Television sets in these homes were examined to determine their type and to assess the quality of reception on both channels. According to TAM there are 308,000 homes in the provisional reception area, and 109,000 of these are equipped for reception from the Black Mountain I.T.A. transmitter. An analysis of the size of households shows that whereas 65 per cent. of all households had three or more people living in them, no fewer than 79 per cent. of households with Band III are of this size.

Replacing C.R. Tubes—9

COSSOR RECEIVERS

By H. Peters

Model 916. Covering 917, 918, 919, 920, 921, 923, 924, 926, 928, in conjunction with notes below.

Unboxing

RUN the set for about 20 minutes to soften the scancoils (which are usually stuck). Switch off, unplug, and remove the back and the control knobs. These are retained by two grub screws each and the holes are sealed by wax which should be replaced on reassembly. Remove the two or four loudspeaker wires at the loudspeaker end after having noted their connections. Take out the two 2 B.A. screws at the top rear corners of the chassis and the two more beneath the chassis at the back edge. The chassis will then withdraw.

Changing the Tube

Remove the anode and base connections on the C.R.T. and the ion trap magnet, having noted its position. Mark the scancoils for polarity and direction. Remove the mask and safety glass, four 4 B.A. screws holding it to the clamping band. Loosen the long 4 B.A. nut and bolt at the top of the tube clamping band and withdraw the tube forward, supporting the scancoils so that the wiring is not broken.

Model 926

This differs from the foregoing since the C.R.T. assembly is fixed to the cabinet roof and not to the chassis. The chassis withdraws in the same manner as the 916 after all interconnecting leads to the tube cradle have been unplugged. The set is then inverted and the tube cradle withdrawn. This is done by removing the loudspeaker, and the two 2 B.A. bolts clamping the cradle above the control spindle holes. Remove the two woodscrews (on the same side as the speaker) which hold the chassis fixing bracket, take out the two 2 B.A. screws from the feet of the C.R.T. mounting bracket and withdraw the tube cradle, tilting it so that the tube neck is at the right-hand side in order to avoid the speaker fixing screws, and to prevent tearing the metal foil cabinet lining.

Models with Radio (918, 924, 928)

In general, the main chassis may be removed without disturbing the inter-connecting leads provided that the cable cleats are slackened. To do this, tilt the chassis forward as it is withdrawn and arrange to have a box or suitable support at the back of the set to rest it on during the tube change.

If you require to take the radio chassis out of the case, this may be done by removing the knobs and the screw at the top of the sliding part of the lid friction bar. Hinge the lid right back so that the underside is accessible and remove the four 4B.A. fixing screws at the extreme ends of the chassis, thus releasing the radio unit from the cabinet.

Reassembly

Reassemble in the reverse order to the above. It is important to refit the rubber dust excluding ring by refitting the mask and glass to the tube clamping band. If the band has broken it may be stitched or stapled together, but if it is too perished it is well worth replacing, a suitable substitute being a strip of plastic foam. Refit the ion trap, base connections and anode cap.

Setting Up

Adjust the ion trap magnet for the brightest possible picture. Check that the picture will focus somewhere near the mid-position of the focus knob. If it does not the focus magnet has probably become over-magnetised with age and needs a few soft iron shunts placed equidistant around its periphery. A tilted picture may be corrected by rotating the scancoils and a suitable tool for doing this may be made from an odd piece of wood and a small strip of rubber or plastic foam. It is not advisable to turn the coils by hand whilst the set is running.

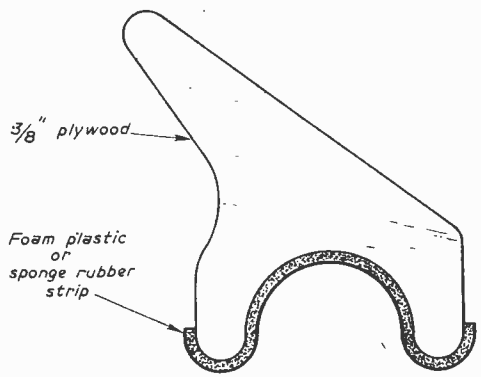


Fig. 1.—An improvised scancoil turner.

To position the picture loosen the three knurled locknuts at the back of the focus assembly and rotate the two large eccentric washers so that the rear focus plate moves at right angles to the tube neck.

Should it be stiff it may be eased with a few drops of oil between it and the focus magnet pot, and by working it round by hand with the set switched off until it is free. When all adjustments have been made re check the ion trap and re-box the set.

Boosting

To boost the tube use a 6.3 volt transformer and connect it in place of the two previous heater wires. These should be taped back, but not shorted together. Mains for the boost transformer may be taken from between chassis and the centre pin of the voltage selector panel.

Boosting Models with Radio

Some switching arrangement needs to be made to enable the tube heater to be disconnected whilst the radio is being used. The simplest way is to use a "Nuray" or similar transformer with a 6.3 volt primary which may be energised from the existing switched winding which feeds the tube heater.

Model 927. Covering 929, 930, 930T, 931, 932, 933, 934

Unboxing

Unsolder the loudspeaker leads, disconnect C.R.T. base, EHT connector, and scancoil plug.

Disconnect the braiding between chassis and cradle at the chassis end, refitting the bracket which supports one end of the mains dropper. Should a "hook-up" be desired whilst both chassis and cradle are out of the set this braid should be reconnected to prevent EHT voltages developing between the two. Release the control panel by twisting the side clip and remove the four screws securing the underside of the chassis to the cabinet. The chassis will then withdraw. The cabinet should next be laid face down on a soft cloth, the position of the scancoils and ion trap noted and the ion trap removed. On 12in. models remove the two 2B.A. bolts holding the focus gantry and slacken off the two 2B.A. bolts and bushes at the bottom of the tube mask and turn the clamping clips at right angles. The tube cradle will then withdraw.

On the 14in. and 17in. models the focus gantry bracket is fixed to the side of the cabinet by two 4B.A. bolts, which should be removed and the clamping ring is secured to the front of the cabinet by four 2B.A. screws which should be removed. The C.R.T. cradle may then be lifted out.

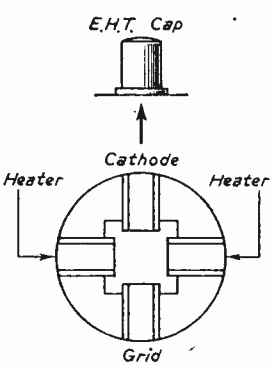


Fig. 3.—Base connections of the 10in. Cossor 108K ion trap triode.

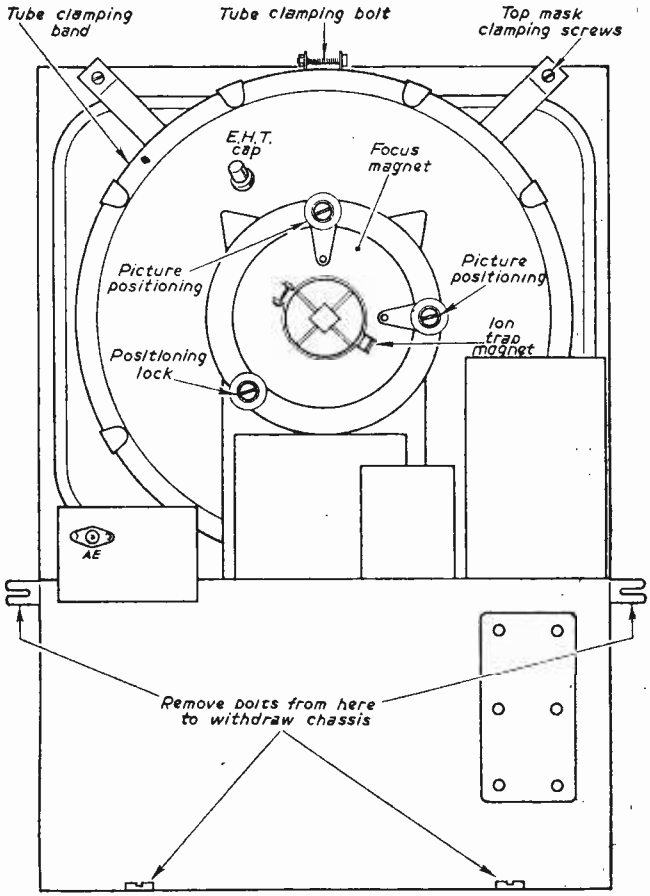


Fig. 2.—Cossor 916 : rear view of chassis.

Replacing the C.R.T.

Remove the four 4B.A. bolts holding the mask to the tube clamp and then slacken the clamp. The tube will then withdraw. Thoroughly clean before replacing in the reverse order, re-box and switch on.

Setting Up

Adjust the ion-trap magnet for the brightest possible picture and correct tilt by rotating the deflector coils, which should incidentally be mounted hard up against the tube bowl. With the focus lever upright, the three thumbscrews on the focus magnet are rotated (a) in the same direction until focus is obtained (b) in different directions until the picture is positioned centrally on the screen. The ion-trap magnet, focus and positioning adjustments are dependent upon each other so the sequence should be repeated several times until no further improvement results.

The 14in. and 17in. models have a later type of focusing system which uses a rotating metal disc for picture positioning. To shift the picture in one direction the disc is rotated, to shift it at right angles the disc is tilted by means of the

thumbscrew and spring. This unfortunately generally ends up in a position from which it cannot be adjusted without placing the knuckles squarely across the 21A6 anode.

It is noted in passing that the tube on these receivers can hold its EHT charge for a surprisingly long time and it pays to discharge the EHT connector *more than once* before handling the tube.

Boosting

To boost the tube, use a 6.3 volt transformer and mount it on the woodwork. Connect its boosted secondary to pins 1 and 12 of the tube after having removed the existing heater wires and shorted them together. Mains for the transformer may be obtained from between chassis and the large pin of voltage selector "A".

Model 937. Covering 939, 939F, 942

Dismantling

Remove the cardboard back and bottom, the four control knobs, and unclip the side panel of four preset controls. Unsolder the loudspeaker and remove the inter-connecting leads from C.R.T. cradle to set. These comprise the C.R.T. base connector, scancoil plug, and EHT lead and copper braid (the two latter being more accessible once the chassis has been loosened and withdrawn a few inches). Remove the four chassis retaining screws and withdraw the chassis.

Lay the set face down and unscrew the four large 2B.A. bolts at the front of the C.R.T. cradle and the two 4B.A. bolts at the rear which attach the back end of the cradle to the cabinet. Withdraw the cradle carefully to preserve the metal foil around the cabinet. Remove the ion trap and then the focus gantry. This is done by unscrewing the scancoil "tilt" screw, slackening the four 4B.A. nuts on the focus magnet bracket and removing the two 4B.A. nuts which secure each side of the gantry to the side plates. Turn and remove the focus assembly, then the rubber wedge and then the scancoils. The tube can then be removed after the 4B.A. nuts at each side of the clamping ring have been removed.

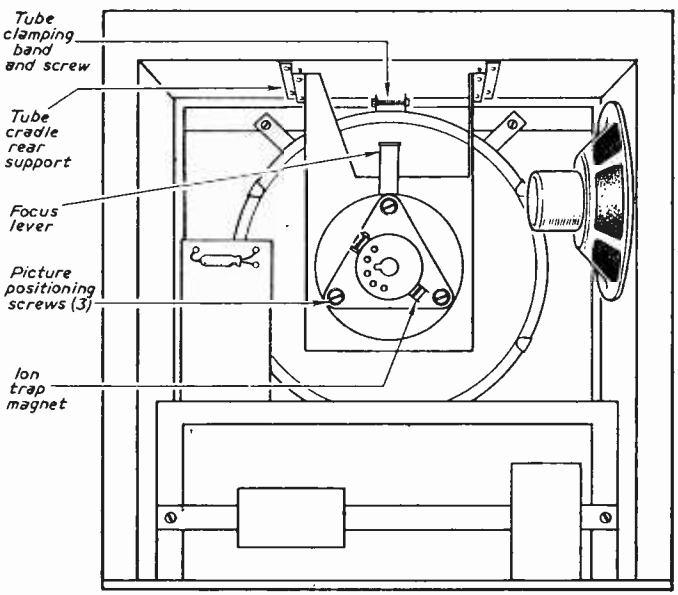


Fig. 4.—Cossor 927 ; rear view of cabinet and chassis.

Reassembly

Thoroughly clean all parts, including inside the cabinet before replacing in the reverse order. Reconnect all the inter-connecting leads to the chassis, including the loudspeaker, apply signal and switch on. Adjust the ion trap for maximum illumination of the screen, then focus the picture, straighten it with the "tilt" knob and correct the positioning by means of the rotating collar and the front of the focus magnet. This assembly is similar to that on the 930 series, which is dealt with in the preceding paragraph.

Boosting

To boost the tube heater a 6.3 volt transformer is required, its boosted secondary being taken to pins 1 and 12 of the tube after the previous wires have been removed and shorted together and taped off. Mains for the booster is available on the set side of the on/off switch, or more conveniently between chassis and the thick pin of voltage adjustment plug "A".

Model 938 and 938F

These are the 14in. versions of the 937 series and follow closely upon that receiver's construction. There is no preset panel to remove from the side when unboxing and the C.R.T. cradle differs constructionally from the 937. The clamping band around the front of the tube is attached to a wooden bar across the bottom of the tube, which is adjustable to an extent sufficient to position the tube correctly in the mask. The two 2B.A. bolts securing this wooden bar to the cabinet should be removed, as well as the two 4B.A. bolts at the back of the cabinet which hold the cradle to the cabinet sides. The tube cradle will then withdraw, and the tube can be removed therefrom after the clamping band is slackened.

Reassembly

As for the 937 (except that the rubber dust seal may be tricky to fit as it has a tendency to roll forward at an awkward stage of reassembly).

It may be held back temporarily with sticky tape until the tube in is position when it may

be released to roll forward and seal the gap between tube and mask.

Boosting and Setting Up

The information given for the 937 applies.

Screen Cleaning

On all the preceding models this involves dismantling the set. In the 916 series the safety glass removes with the chassis but from the 927 onwards it remains loose in the cabinet. It is for this reason that the set must be kept face downwards whilst the tube cradle is removed.

Model 934 and 944

These sets are similar in many respects to the 938, but have a detachable front, through which

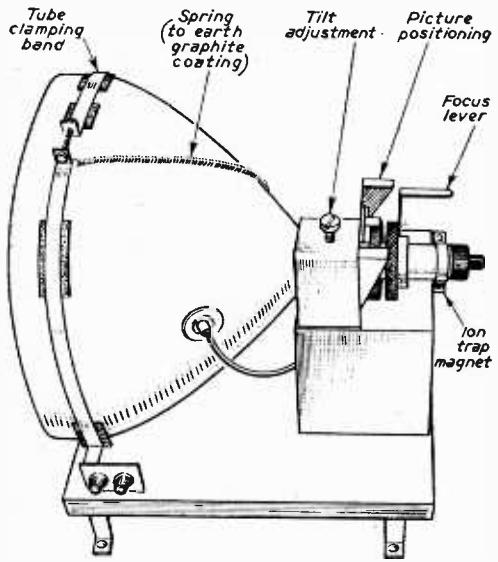


Fig. 5.—Cossor 945 ; chassis with cabinet removed.

the chassis withdraws after being loosened. Screen cleaning is as for the 946 below, and once the chassis is withdrawn the tube may be changed by removing its EHT connector, ion-trap magnet and base connector and withdrawing it forward from the chassis.

Model 946

To replace the tube proceed as for model 937. To clean the screen, remove the four decorative screws at the side of the cabinet front frame. The front frame will lift off enabling the safety glass to be picked out for cleaning.

Setting Up and Boosting (943, 944, 946)

The instructions for setting up and boosting the tube are as given in the 937 paragraphs.

Models 945, 945F and 947

These are the two "Quick Service" models in which the cabinet lifts off the chassis.

Dismantling

Remove cabinet back, turret and volume knobs. Remove the escutcheon screws and unplug the loudspeaker. Remove the two 2B.A. bolts at the rear of the chassis and lift the cabinet up and forward clear of the chassis.

Replacing the C.R.T.

Remove EHT connector and tube base connector, mark and remove ion-trap magnet. Slacken the four 4B.A. screws holding the focus assembly and loosen the tube clamping band. Withdraw the tube forward. When reassembling ensure that the front of the tube face is forward of the chassis edge by 1¼in. on 17in. sets and 2 3/16in. on 21in. sets.

Setting Up

Adjust the ion trap for maximum brightness. "Tilt" is corrected by the thumbscrew on top of the scancoils and picture positioning by the shuffle plate immediately in front of the focus magnet.

Boosting

Boosting follows the lines of previous A.C./D.C. models. The 6.3 volt winding of the boost transformer being taken to pins 1 and 12 of the tube after the previous wires have been shorted and taped together. Mains for the transformer primary can be picked up between chassis and the thick pin of voltage plug "A."

Printed Circuit Model 948
Unboxing

Remove the back (four screws) and the four control knobs. These are grubscrewed on to the spindle and the heads of the grubscrews are covered with wax, which must be replaced on reassembling. Remove two screws from underneath the cabinet and two inside the top of the cabinet. The cabinet will slide off forward when the loudspeaker, and later on the neon lamp, have been disconnected.

Changing the Tube

Remove the base, EHT connector, ion trap and picture centring magnet. Lay the two latter well away from steel objects and each other. Slacken off the strap around the tube bowl, check that the tilt adjustment is tight, and withdraw the tube forward.

Reassembling

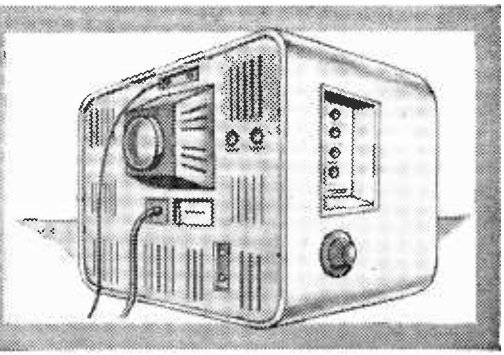
The tube is easier to replace if it is twisted gently as it is eased into the supporting grommet, and the EHT connector is fitted better when the tube is about an inch from home.

Setting Up

Replace the picture centring magnet, and ion-trap, and tube base. Switch on and apply a signal. Adjust the ion trap for maximum brightness and then adjust the picture positioning magnet to centralise the picture on the screen.

(*Continued on page* 138)

Servicing Television Receivers



No. 51.—THE PHILCO A1497, A1800 AND A1810

By L. Lawry-Johns

THE A1497 is a 14in. table model, the 1800 a 17in. table model and the 1810 is a 17in. console with doors.

Circuit

These are dual band receivers with A.G.C. derived from the sync separator circuit and a separate sensitivity control which can be shorted for Band III operation where the difference between the signals is excessive. A contact-cooled metal rectifier is used for H.T. and this, together with the surge resistors, R74-75A, form the "weak links" which provide the usual trouble spots. More will be said of this later. The circuit design is simple and straightforward, making fault tracing and general servicing comparatively easy. The turret tuner is of the original Cyldon type with provision for shorting the sensitivity control on Band III by linking connections C and D on the Band III aerial coil biscuit.

Points to Note

The H.T. feed to the vision and sound I.F. stages and the turret tuner is decoupled by a 16μF capacitor and a 470Ω resistor (C23 and R22). Any interaction between sound and vision (hum-on-sound and sound-on-vision too severe to be due to improper tuning) should direct attention to this capacitor. Also a short in the early stages will result in R22 becoming either O.C. or severely overheated and presenting a charred appearance. It is also of interest to point out that R22 is shown as such in the volumes of "Radio and Television Servicing," although other references differ. All valve and component references in this article are taken from the maker's sheet and the above servicing volumes.

Heater Chain

A pilot lamp is incorporated, rated at 3V, 115mA, and is shunted by a 15Ω resistor (R72). This completes the heater chain to chassis instead of the tube heater and this is a point worth bearing in mind.

Both line and frame timebases employ triode blocking oscillators. Scanning coil connections

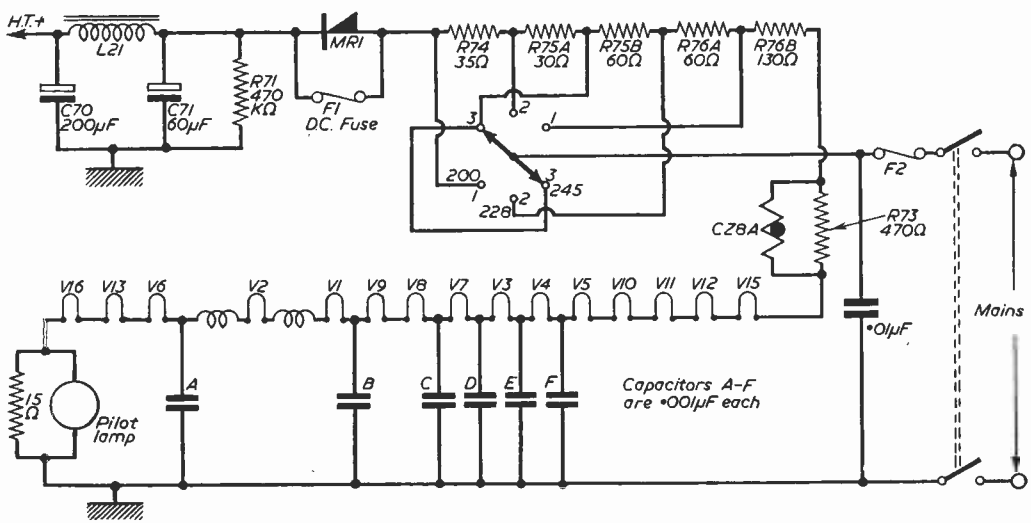


Fig. 1.—H.T. and heater circuits (V16 is the C.R. tube).

plug into sockets on top of the central frame output transformer. Viewed from the rear the two right-hand side sockets are for the line coils, the left-hand side socket is a chassis connection, whilst the two remaining are the frame coil sockets. There are two fuse sockets or holders but only one fuse is normally fitted (F2), the other (F1) being for use on D.C. mains only, the socket being wired across the H.T. metal rectifier. F1 is the right-hand holder as viewed from the rear. When a fuse is fitted in this socket it should be rated at 500mA, with the D.C. mains polarity ascertained and a three-pin mains plug used to prevent reversal. F2 is rated at 1A and is the normal mains fuse in series with the live side of the input.

The C.R.T. is a Brimar C17FM (17in.) or C14FM (14in.). The heater is rated at 12.6V, 0.3A.

Common Faults

The most common symptom is

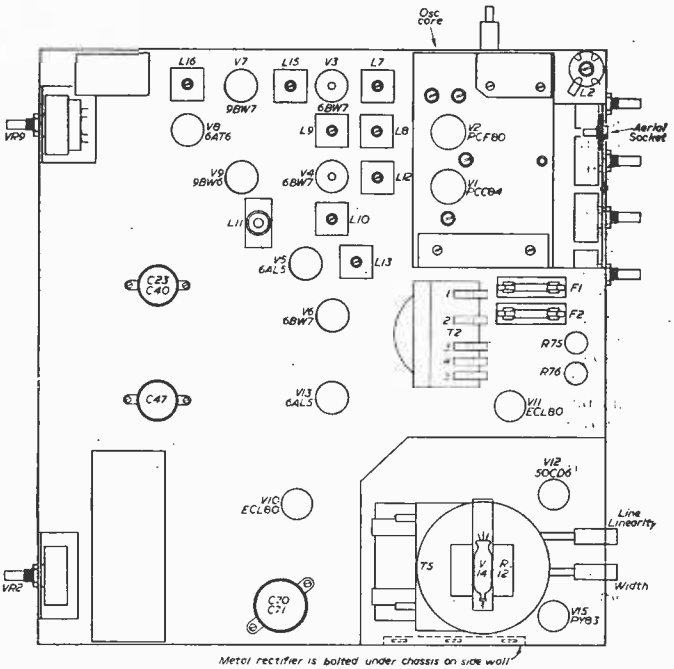


Fig. 2.—Plan view of chassis.

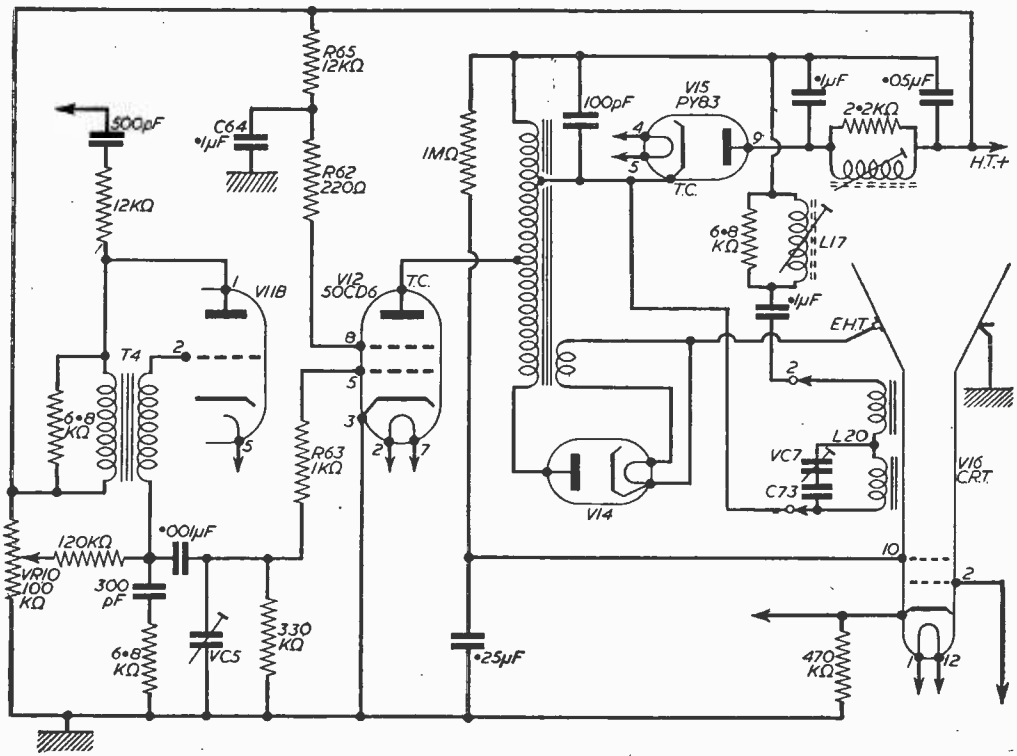


Fig. 3.—Line timebase circuit.

no sound, no vision, all heaters glowing normally. This is the normal indication of an open-circuited metal rectifier and this is often the correct diagnosis, but it is also important to check the A.C. input to the rectifier. If the full mains is being applied to the negative (—) end of the rectifier it can be changed with confidence, but if no voltage is present, R75A will almost certainly be found open-circuited. If in doubt, set mains plug to 228V which should restore the missing voltages if R75A is at fault. If this action does not restore working conditions, suspect R74 which is a wire-wound resistor under R75. Once the defective resistor has been located, return the voltage selector to its proper position. Failure to do this will result in more rapid wear of the valves and tube. If R75A is defective wire a 30Ω, 5W resistor across contacts 2 and 3 on the mains selector panel. If R74 is defective, replace it in the position it now occupies. If the metal rectifier is defective, replace with a type FC101 (direct replacement); alternatively, drill fresh holes and fit the larger FC31 or leave the rectifier where it is and fit an RM4B in the space just behind the contrast control.

It will also be necessary to fit a new or additional metal rectifier if the H.T. line voltage falls below 200V as evidenced by lack of width, i.e., the sides of the picture close in although the *width* control is at maximum.

Other Causes of Lack of Width

Although the metal rectifier can be suspected when the width fails, if the H.T. voltage is 200V or over, the cause must be looked for elsewhere. Normally the 50CD6G (V12) will be found low. If the valve is in order, however, check the ECL80 (V11) and the setting of VC5 (*line drive*). Less likely causes are R65, 12kΩ (changing in value) or V15 (PY83) losing emission.

No Picture. Sound O.K.

Advance *brilliance* control (second from right at rear). If there is no raster resolved, remove rear cover to ensure that (a) the tube heater is glowing (b) that the line whistle is audible and (c) that the R12 (EY51) on top of the (left-hand side) line output transformer is working. The heater glow should be visible. In practically every case the tube heater will be glowing and the line whistle will be audible. This leaves trouble with the R12. If its heater is out, check for a spark at the left-hand side or single-wire end. A healthy spark should leap to the offered blade of a screwdriver.

(To be continued)

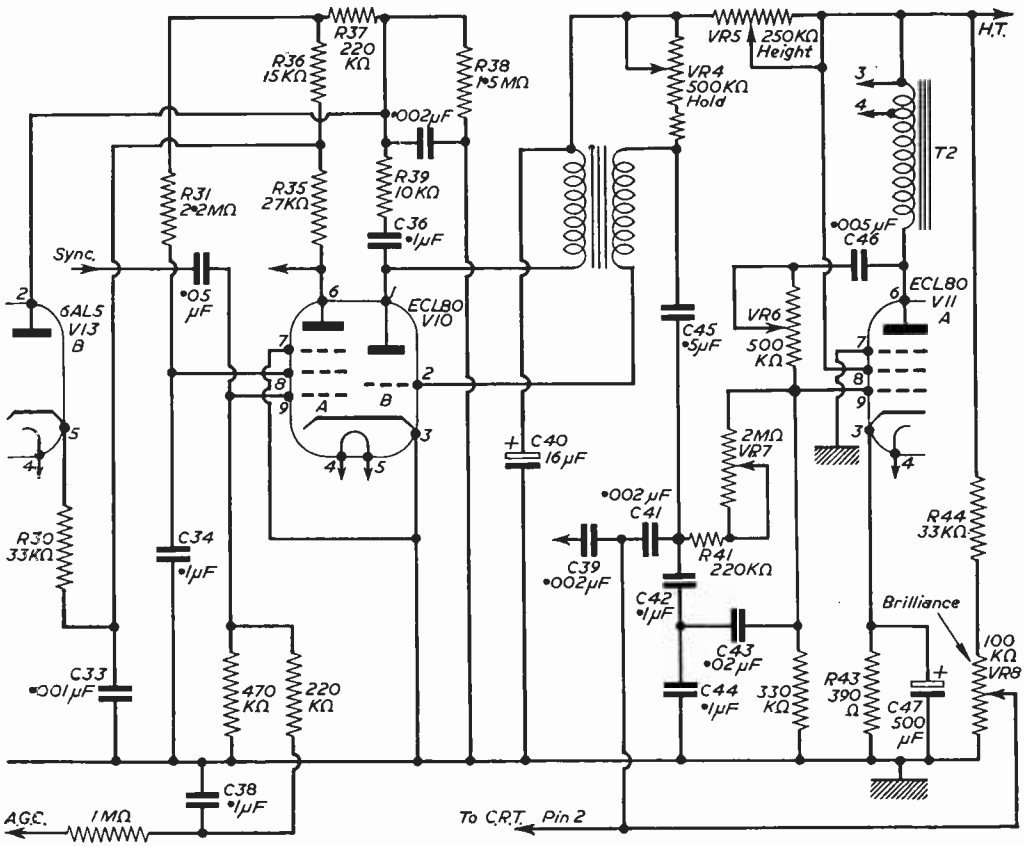


Fig. 4.—Frame timebase circuit.

A TV/Radio Changeover Device

USE THE SAME OUTPUT TRANSFORMER FOR TV AND RADIO

By J. B. Willmott, A.I.P.R.E.

IN a great many homes today, the TV receiver provides the main part of domestic entertainment, and the radio receiver is placed in some unobtrusive corner of the living-room, or possibly suffers the indignity of banishment to the kitchen. Frequently the receiver is of archaic pattern and both from the aesthetic viewpoint and that of standard of reproduction, leaves much to be desired. There are, however, many occasions when the ready availability of the alternative sound programme is desirable, and particularly when the first novelty of TV has faded, the home constructor may well contemplate the installation of a new radio receiver of modern appearance and performance. Undoubtedly, a primary consideration must be choice of suitable cabinet housing, and while first thoughts may lie in the direction of miniaturisation, there are drawbacks to small receivers, not the least of which is the restricted frequency response normally associated with the small diameter loudspeakers necessarily incorporated.

Two Purposes

If, however, the TV receiver contains an adequate speaker unit, there immediately arises the possibility of making this speaker serve both TV

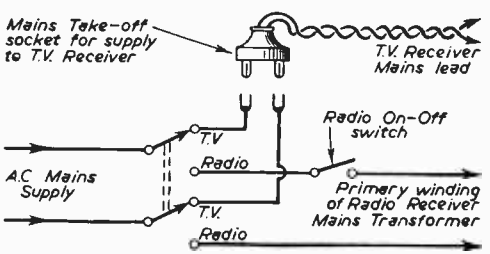


Fig. 2.—Changeover switching for mains supply to TV or radio.

and radio requirements. The advantages to be gained from this arrangement are considerable.

The cabinet housing the radio receiver no longer needs to be large enough to house its own speaker, frequently the largest single component; thus the cabinet can be small in size and of simple design.

There is a worth-while saving in cost, as in addition to the simplified cabinet requirements,

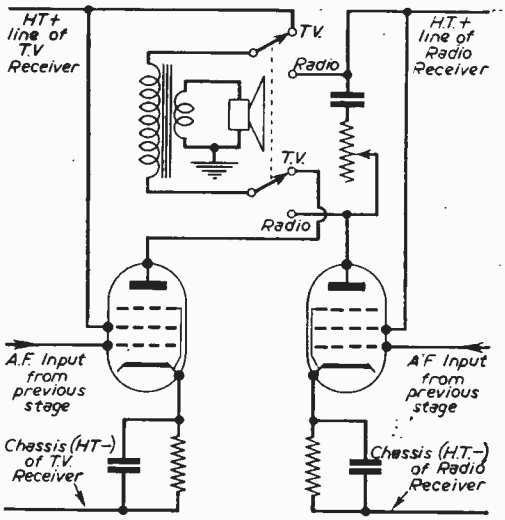


Fig. 1.—Changeover switching for feeding output transformer from TV or radio.

the radio receiver unit requires neither output transformer nor loudspeaker; while the only additions over and above normal circuit requirements are a 4-pole, 2-way "Yaxley" type switch, a small 4-pin plug and socket connector, and about 1 yard of 4-way flex.

Requirements

Looking at the scheme from the theoretical angle, the requirements are that with the changeover switch set to "radio", the mains power supply must be fed to the input of the mains transformer (preferably via the normal on/off switch, frequently combined with volume or tone control) of the radio receiver unit, and at the same time, the "common" output transformer primary winding (situated on the TV receiver chassis) connected between the H.T. positive line and output valve anode of the radio receiver. When the switch position is changed to "TV", the requirements are that the mains supply be fed into the mains lead of the TV receiver (again via the on/off switch provided on the latter), and simultaneously that the output transformer primary is connected between the H.T. positive line and sound output valve anode of the TV receiver.

Radio Unit

It is not proposed within the scope of this present article to describe in detail the construction of the radio receiver unit, since this may take practically any form which the home constructor favours; numerous designs have been published in PRACTICAL WIRELESS. The only departures from standard practice are that, first, the output transformer and speaker unit normally featured are omitted (and their places taken by the existing similar components in the TV receiver), and secondly, space must be provided on the radio chassis for the additional control

(*Continued on page* 133)

RECORD PLAYER CABINET

RP4 **79/6**

Stylish cabinet by famous manufacturer. Cloth covered in contrasting colours (red and grey). Grilled front controls panel. Size 15 x 19 x 8¾in deep. Beautifully made. A cabinet you can be really proud of. Takes 4-speed B.S.R. Autochanger. 6½in. round or 7 x 4in. elliptical speaker. Room for any amplifier of your own choice. Carr. & Ins. 4/6

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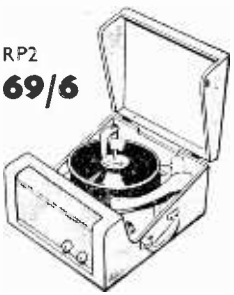

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take B.S.R. Monarch 4-speed Autochanger and 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. and Ins. 4/6.

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Elegant cabinet, cloth covered in grey or red with sunken control panel and speaker fret. Size 13 x 17 x 8in. deep. Takes a B.S.R. Monarch 4-speed Autochanger ; 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. and Ins. 4/6.

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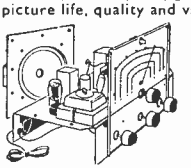

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79/6 5 valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning w/change switch). Four w/bands with position for gram. p.u. and extension speaker. A.C. Ins. Carr. 5 6.

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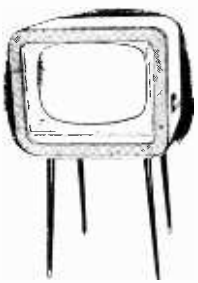

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spindle operating the changeover switch, also the 4-pin plug and socket connection to the TV receiver. Both these requirements are normally easy to meet, the switch being fitted to either the front or side chassis runner, and the plug and socket connections arranged on the rear runner.

Switch

The switching is carried out by the use of a 4-pole, 2-way "Yaxley" type switch; 2 poles are used to provide switching of the mains supply, and the remaining 2 take care of the output transformer switching. Fig. 1 clearly shows the theoretical circuit.

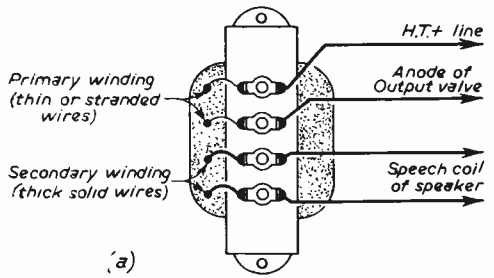


Fig. 3a.—Connections to output transformer before modification.

There remains now the problem of wiring in this device with the minimum possible disturbance to the existing TV receiver circuitry. While the incorporation of this device does, in fact, require very little actual modification, a few words of warning are, perhaps, not inappropriate at this stage.

Live Chassis

A great many TV receivers are of A.C./D.C. pattern, and a number of A.C. only models, using a mains transformer for valve heater supplies, obtain their H.T. supply by direct rectification of the mains supply, and this means that the chassis is in direct connection with one side of the mains supply. It is, therefore, of great importance to ensure that no contact is made with metalwork by any of the wiring changes carried out. Also, before commencing to work on the TV receiver, remove its plug from the mains socket.

One further point; many firms who supply receivers on rental terms will not permit access to the interior of their sets, and the same applies in the case of many "maintenance agreements". Make sure of your position in this respect before undertaking any modifications.

It will be apparent from the foregoing remarks that this switching arrangement can be incorporated in practically any TV of modern design, as these utilise permanent magnet speakers of normal pattern; a few of the older pattern receivers which use mains energised speakers are, of course, unsuitable for modification, as in these, energisation of the field coil is dependent upon the receiver being in operation. Normally the whole, or a part, of the H.T. supply flows through the field coil for this purpose.

TV Wiring

Turning now to the practical aspect, the work to be done on the TV receiver will be first described; this will be as detailed as possible in order to give maximum possible guidance to the less experienced readers. First action is to locate the sound output transformer, and identify the primary winding tags (or fly-lead connections where no tags are present). Examination will show that 4 leads issue from the windings of the transformer; two of these will be of relatively thick solid wire (and will be connected to the speech coil of the loudspeaker), the remaining two will be of finer wire, connected to a tagstrip mounted on the transformer, or may comprise multi-stranded flexible type of wire. It is these latter which represent the primary winding (see Figs. 3(a) and 3(b)) and are to be marked "A" and "B." Now establish which of these two primary connections goes to the H.T. positive line of the TV receiver, and which to the anode of the output valve. It is a good plan to "label" these temporarily "A" and "B" respectively with small slips of paper, to avoid possible errors. Disconnect the wires from the tags or cut the fly leads if no tags are used, taking care not to exert any undue strain on them (this might cause disruption of the internal connection with the output transformer windings), and using approximately 1 yard of red and black twisted flex, neatly solder one end of the red wire to the wire removed from point "A." Carefully insulate the joint with good quality insulating tape. Now join the end

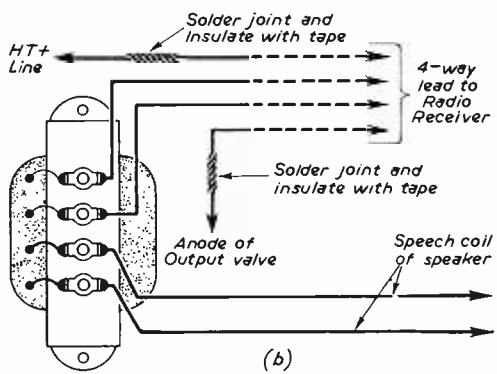


Fig. 3b.—Connections after modification. Note that in some output transformers, the position of the various tags may differ from the above (see text for identification).

of the black wire to the recently vacated tag "A" (or the end of the corresponding flying lead if no tag is provided).

Four-way Cable

Next, using the wire removed from tag "B" (i.e., the connection to anode of output valve), take approximately one yard of green and yellow (or any other twin-coloured flex dissimilar to red and black flex), and in a similar manner connect one end of the green to this; and likewise connect one end of the yellow to the tag "B."

The two lengths of twin-coloured flex may be bound together to make a neat four-way cable, and taken out through the most convenient hole in the rear cover of the TV receiver. This completes the work to be done on the TV receiver. But one final word of warning. On no account must the TV receiver be operated with these leads in their present disconnected state, as the anode of the output valve is "open circuit," and the presence of full H.T. on the screen alone would quickly ruin this valve.

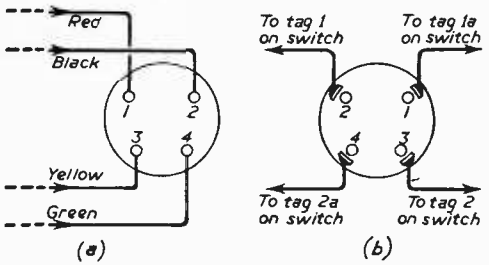


Fig. 4a (Left).—Connections to 4-pin plug (rear view). Fig. 4b (Right).—Connections to 4-way socket (rear view).

Proceeding now to the actual switching circuits, mounted on the radio receiver chassis, reference should be made to Figs. 2, 4 and 5. In the prototype, use was made of plug and socket connections to all external leads and this is strongly recommended.

Plug and Socket

Using a small 4-pin plug and socket of the type shown in Figs. 4(a) and 4(b) proceed as follows: Mount the socket at any suitable position on the radio chassis; normally the rear runner will prove ideal. Looking at the 4-pin plug from the rear, wire exactly as shown in Fig. 4(a), making absolutely certain that the colour coded connections are correct. Now proceed to wire up the 4-pin socket to the changeover switch, referring to Figs. 4(b) and 5. These show both components as seen from the rear. The sequence of wiring is as follows:

1. Connect Tag No. 1 on 4-pin socket to Tag No. 1a on switch.
2. Connect Tag No. 2 on 4-pin socket to Tag No. 1 on switch.
3. Connect Tag No. 3 on 4-pin socket to Tag No. 2 on switch.
4. Connect Tag No. 4 on 4-pin socket to Tag No. 2a on switch.

To complete the radio-television switching to the common output transformer, the following connection should now be made:

Connect Tag 1b on the switch, to the H.T. positive line of the radio receiver, for example, at the junction of smoothing choke and electrolytic smoothing condenser, i.e., the "second" section of the combined reservoir/smoothing capacitor normally employed in this position.

Connect tag 2b on the switch to the anode tag of the output valveholder of the radio receiver.

Mains Wiring

This completes the switching arrangements for changeover between radio and TV sound output stages, and it now only remains to arrange the changeover of mains supplies to correspond. Here again it is convenient to provide a socket outlet on the radio chassis, into which the mains plug of the TV receiver can be inserted. A simple solution is to use a small 2-pin plug and socket connector, the socket section forming the outlet from the radio chassis (see Fig. 6).

Take a suitable length of twin mains flex, and connect one end to tags 3a and 4a of the changeover switch, pass the flex out through a suitably grommeted hole in the rear chassis runner, and add the socket to the free end of the flex.

Now connect tags 3b and 4b of the changeover switch to the primary input tappings (suited to the local mains supply) of the radio receiver mains transformer, one of these leads being taken via the receiver on/off switch (or both, if a double-pole type switch is provided) which in most designs is combined with either the volume or tone control.

Finally, through a further grommeted hole in the rear of the radio chassis, feed in a suitable length of twin mains flex (this is to form the mains supply from wall socket to receiver) and connect to tags 3 and 4 on changeover switch. As all the leads concerned in mains supplies are carrying A.C., there is no question of polarity, and any of the connections to tags 3a, 4a, 3b, 4b, 3 and 4, can be made "either way round" without detriment.

Testing

The wiring is now completed; if a test meter with an ohms range is available, or even any simple type of continuity checker, it is a simple matter to carry out the following tests before connecting to mains and switching on. In the absence of any test gear, it is suggested that all wiring be carefully re-checked from text and diagrams. Actually, the circuitry is extremely straightforward and there should be no errors.

The changeover switching will give the following settings, when control-knob operated from front of chassis:

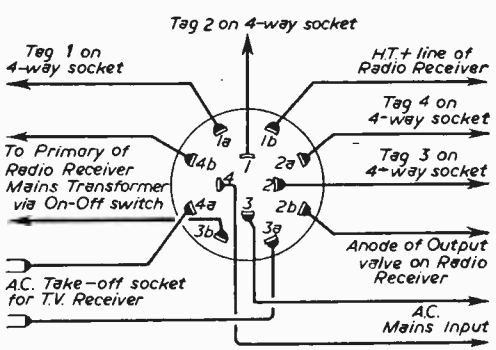


Fig. 5.—Connections to 4-pole, two-way switch.

Anti-clockwise—Radio.
Clockwise—Television.

Ensure that on/off switch on both radio and TV is "off," and connect the ohmmeter across

the mains supply lead (*not* connected to supply of course!). There should be no reading. Now switch the radio receiver "on" when with the changeover switch in the anti-clockwise position, a reading of a few ohms (say, 5 to 20) representing the D.C. resistance of the mains transformer should be registered. Switch the radio "off," and turn the changeover switch to the clockwise position; the ohmmeter should show no reading. Now switch the TV receiver "on," when the meter should immediately indicate the input resistance of the TV receiver, usually between 400 and 1,000 ohms for A.C./D.C. receivers, or 5 to 20 ohms for those employing a heater transformer. If on any of the foregoing tests the meter reads "full scale" (i.e., zero ohms), there is a wiring fault present, and this must be located before proceeding further.

Checks

Now connect the ohmmeter to tags 1 and 2 of the changeover switch. When in either the "radio"

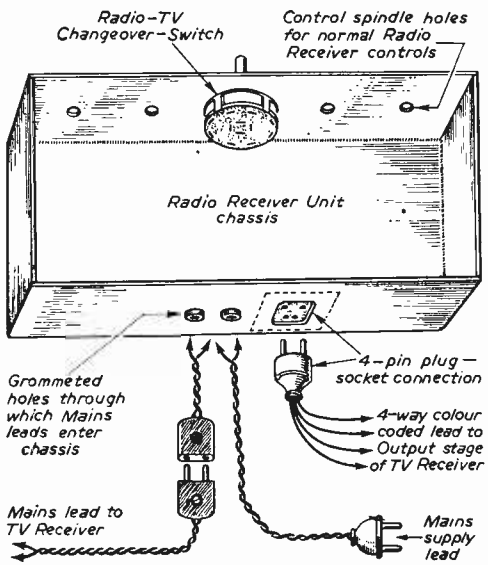


Fig. 6.—Suggested layout and interconnections between radio chassis and TV receiver.

or "television" position of the switch, the resistance of the primary winding of the output transformer will be indicated, normally between 200 and 500 ohms. To make doubly certain that all is well, connect the ohmmeter between the H.T. positive line of the radio receiver and the anode pin of the output valve. With the changeover switch in the "radio" position, once again the output transformer primary resistance should be indicated, no reading being shown when the switch is in the TV position. Similarly, the ohmmeter may be connected between H.T. positive line of the TV receiver and its output valve anode pin. Now, there should be no reading with the switch in the "radio" position, and once again the output transformer primary resistance should be indicated with the switch in the "TV" position.

Operation

Having satisfied oneself that all the above tests are in order, insert the mains plug in the wall socket, the TV receiver mains plug into the outlet at the rear of the radio unit, and turn the changeover switch to the desired position. Operation of the on/off switch on the radio or TV should then bring the desired receiver into operation. When changing over from one service to the other, it is best to follow the undermentioned sequence:

Switch off the receiver in use (i.e., radio or TV).

Operate the changeover switch.

Switch on the other receiver.

The temptation to leave both radio and TV receiver switches permanently "on," using the wall socket switch for on-off purposes, should be resisted, as this then means that the changeover switch has to cope with full mains and H.T. positive voltages, which may lead to arcing at the contacts, with ultimate erratic operation; and, of even greater importance, less technically minded members of the family might be tempted to switch rapidly from one position to the other, and then perhaps quickly back again if the alternative were not to their liking. This rapid switching on and off of a TV receiver, especially those of A.C./D.C. pattern, can be extremely harmful, and should be avoided. Adherence to the prescribed routine will prevent this from occurring.

Tone Controls

A few final words of comment: in the circuit diagram, a capacitor and variable resistor are shown "dotted in" in the anode circuit of the radio receiver, these represent the normal type of top-cut tone control used with pentode output valves, and this control will be operative in the "radio" position of the changeover switch. It may be found that a capacitor, or resistance and capacitor, are already wired across the primary tags of the output transformer in the TV receiver to provide a fixed amount of top-cut. These components must be left in position, and will remain in circuit when switched to radio. If this results in too much "top cut," even at the minimum setting of the radio tone control, reduce the value of the tone control capacitor on the radio unit, for example from 0.02μF to 0.01μF, or from 0.01μF to 0.005μF.

When the complete scheme is set up, it is advisable to ensure that the TV receiver is so connected that its chassis is wired to the "neutral" side of the mains supply (one of the popular "neon test" screwdrivers will give an instant indication of this), reverse the 2-pin plug and socket connection between radio outlet and TV receiver mains lead if necessary.

No doubt many readers will feel that this somewhat simple device has been described at great length, but for the benefit of beginners, step-by-step instructions have been given; and if these are followed implicitly, even the novice should have little difficulty in carrying out the work.

A Field-strengt

ALIGN YOUR BBC AERIAL ACCURATELY

Using the comparator.

WHEN erecting an aerial for television reception it seems to be common practice to rely on the picture received when making adjustments to the alignment of the array. Often this proves somewhat unsatisfactory especially if a lady member of the household is called upon to judge the quality of the picture. A far better alternative would, of course, be to send the lady on to the roof to swing the aerial around for best results, while inspecting the picture oneself. However, this may not always be desirable: and there are locations in which verbal communication between the viewing point and the adjusting point is not practicable without the use of a telephone. The apparatus here described was designed for such an occasion. It consists of a miniature battery-operated receiver which can be carried easily in the pocket, and used on the roof to indicate the best setting-up of the aerial. At other times, it also does duty as a "personal" television sound receiver.

Circuit

The circuit diagram is shown in Fig. 1 and is not self-explanatory in that the operating conditions are different from what might be expected at first sight. In fact, the first valve is a simple but efficient super-regenerative detector. This is followed by a transformer coupled A.F. amplifier feeding into a pair of headphones.

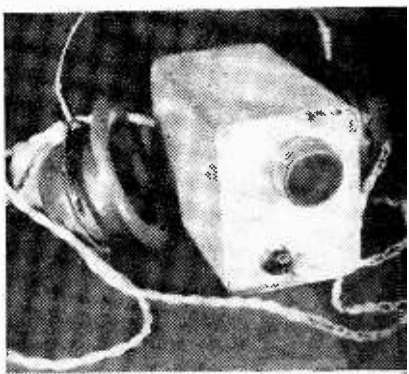
The tuned circuit L2, C1 can be tuned over the range of BBC frequencies by the variable capacitor C1. L1 provides a loose but correctly matched coupling to the aerial, and L3, part of the anode circuit of V1, gives feedback to maintain oscillations. The coupling between L3 and L2 is tight, and feedback is strong. Hence V1 oscillates fiercely.

Valves

To ensure the super-regenerative action, the grid leak and condenser are so chosen that the valve "squegs" at a frequency of about 20kc/s. This is, of course, above the normal audible range and in any case cannot be heard through headphones of the usual type. The "detected" signal develops small A.C. voltages across the primary of the A.F. transformer T1 and stepped-up voltages are applied between grid and filament of V2, a straightforward A.F. amplifier.

The anode circuit of V2 includes a midget output transformer, as in the circuit diagram, for matching to

Front view of the comparator.



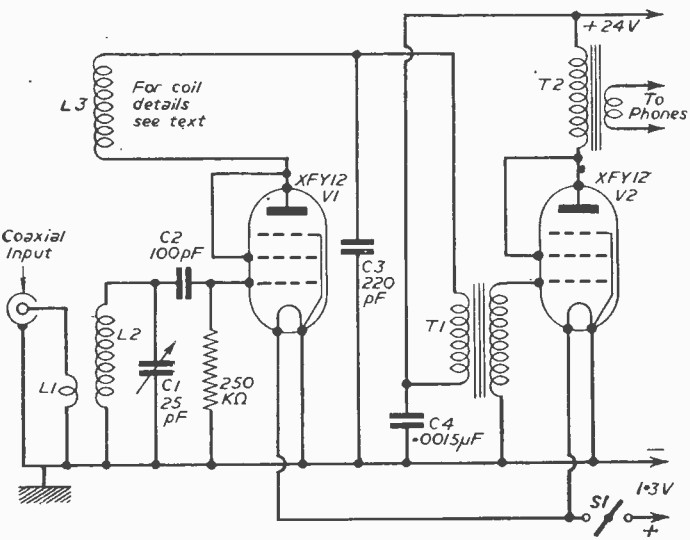
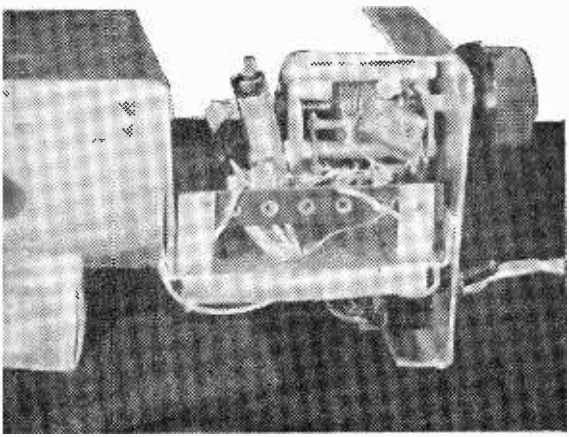


Fig. 1.—The circuit diagram.

Comparator

By D. R. Bowman



The unit removed from its case.

LIST OF COMPONENTS

L1, L2, L3—See text.
C1—25pF variable midget type.
C2—100pF silver mica.
C3—220pF mica or silver mica or ceramic.
C4—0.0015μF or 0.001μF ceramic.
S1—Toggle type on-off switch.
R1—250k.
V1, V2—Hivac type XFY12.
T1—Midget A.F. transformer.
T2—Midget output transformer (if used).
Batteries - L.T.—1.5V cell.
H.T.—15 midget 16.5V cells.

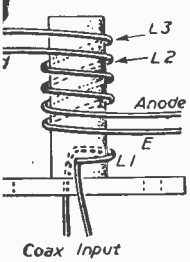
a pair of low-resistance headphones. Alternatively this transformer can be eliminated if high-resistance phones are connected direct into the anode circuit; in this case a condenser of capacity 500pF should be connected directly across the jack (if used) or between V2 anode and chassis.

Coils

Coils L2 and L3 comprise a bifilar (interleaved) winding of three turns each on air-cored former 0.4in. in diameter—Aladdin or similar. The wire is close-wound and may be 24-gauge or similar enamelled copper. L1 is a half-turn of the same wire, spaced 0.1in. from the earth end of the winding L2, L3. Fig. 2 shows the connections.

Components

Good-quality components, introducing few losses, must be used—this is definitely not a "junk box" receiver. The hearing-aid type valves used are working near their limit at these frequencies, and for this reason it is not practicable to extend the coverage to Band III signals. However, the extremely low consumption of both L.T. and H.T. circuits enables very small batteries to be used, and makes it possible to carry the receiver complete with power supplies, in the pocket.



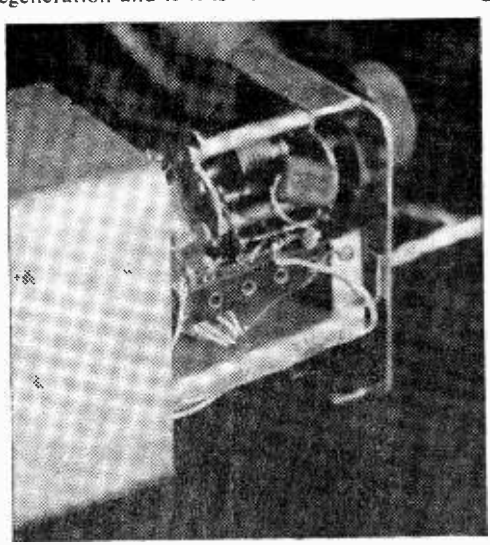
2.—Winding L1, L2 and L3.

Layout is by no means critical, so long as short connections are made in the H.F. circuits of V1. The wire leads to the valve are connected by soldering to a tag strip mounted on the metal chassis; this enables the valve to be supported in the wiring without any valveholder. The complete set may be fully contained in a metal can measuring 5in. × 3½in. × 2¾in. The receiver chassis measures 2¾in. × 2½in. and the battery compartment 2¼in. × 2in.; and there is plenty of room. For the reader who wishes to use this size of chassis, a diagram is shown (Fig. 3), which includes bending allowances. The bend radius of 1/32in. is obtained by bending 18-gauge half-hard aluminium sheet in a vice without bending-bar, hammering down with a sheet of cardboard between hammer and sheet.

Using the Comparator

With super-regenerative receivers there is a certain automatic A.V.C. effect, but in practice little difficulty is experienced in setting a Yagi array to the maximum-signal position by the volume of sound in the phones. It is not usually possible to set to the minimum-signal position and turn turn through 180deg., unless the coaxial lead is very well-matched to the aerial and unless a balance-to-unbalance device is fitted.

On rotating the tuning condenser, if the cricuit is operating correctly, a loud hiss is heard which dies away completely as the signal is tuned in. The hissing sound is characteristic of super-regeneration and if it is not heard when switching



Another view of the construction.

on, something is wrong in the wiring. The video signal gives a sound of continuous strength for a given signal input, but experimenters may prefer to line-up on the sound signal. The video signal is associated with a heterodyne whistle, which is due to beats between the line-frequency pulses and the frequency of squegging of V1. The line frequency pulses are not heard as the 'phones give very low response at 10kc/s. No such heterodyne whistle is heard on "sound", and the sound reception alone is of definite entertainment value.

Battery Consumption

The consumption is about 0.5mA H.T. and about 30mA L.T. The batteries will last a very long time, and though the valve filaments are a little overrun with new L.T. batteries the writer has not found any failure in a total of about 30 hours' use. The L.T. battery after 30 hours shows a voltage on load of 1.3, which is very reasonable for the filaments.

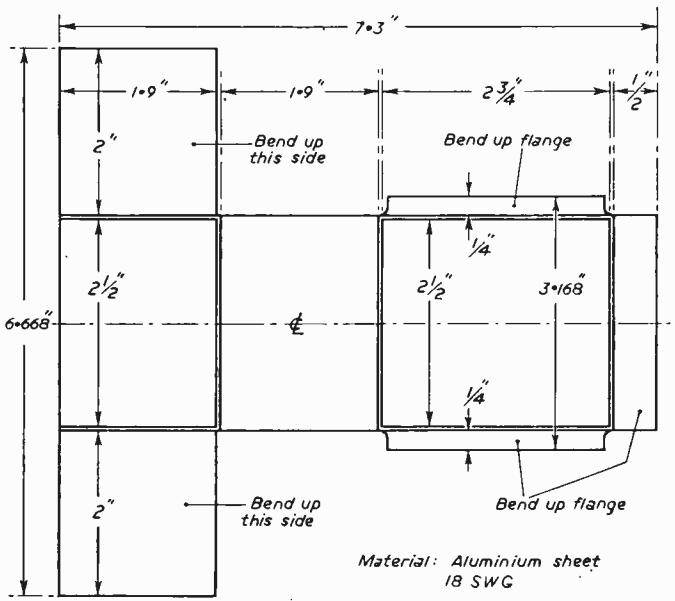


Fig. 3.—Making the chassis.

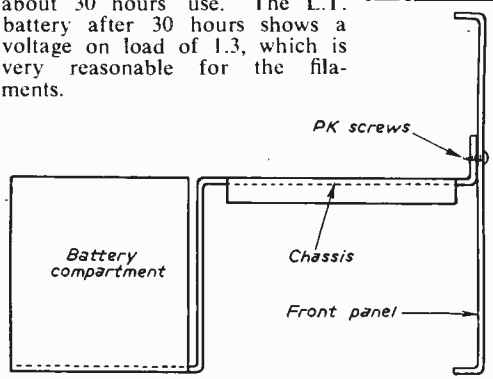


Fig. 4.—Assembly of the chassis and battery compartment.

Radiation

Since super-regenerative receivers have a name for radiation, it should be said that with the low power used in this device no interference has been found with neighbouring sets whose aerials are more than 20 yards away. However, when a neighbour's aerial shares a common chimney stack, some caution may be needed.

As a "personal" receiver it works well on a 5ft. length of wire "thrown out" from the coaxial centre-pin, and interference is then negligible.

Uses

Although, as mentioned earlier, the coverage of this field-strength comparator does not extend to frequencies in Band III, it will nevertheless prove very useful, particularly in fringe areas. Accurate alignment of the BBC aerial will be possible without reliance having to be placed on a compass bearing.

REPLACING C.R. TUBES

(*Continued from page 126*)

This device provides two angles of movement, (a) by moving the whole device round the tube neck like the ion trap magnet, and (b) by turning the magnet in its cup. Adjust picture tilt and lock the tilt knob and check that the preset focus control, on the side of the tube support bracket at the back, is giving best focus. Repeat the above adjustments until no further improvement results.

Boosting

Use a 6.3V boost transformer with mains primary. Connect the 6.3 volt winding to pins 1 and 12 of the tube, having previously removed the existing heater wires, shorting them together and taping them back.

Mains for the boost transformer may be picked up from across the neon lamp.

Screen Cleaning

This may be done without unboxing by removing the two mirror screws on the strip along the bottom of the safety glass. It is then possible to pick out the safety glass and clean the screen.

Winding Booster Transformers

IMPROVING RESULTS FROM OLD C.R. TUBES

By F. G. Rayer

THE emission of an aged tube can be increased by raising the cathode temperature, and this is normally done by slightly increasing the heater voltage by means of a booster transformer. Such a modification is usually very easily arranged, and can give a new period of life to a

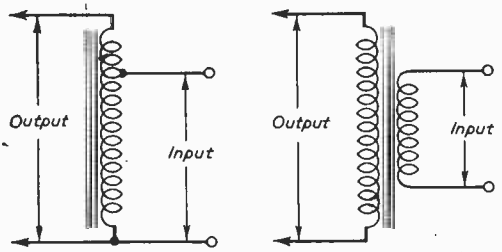


Fig. 1.—Auto and two-winding transformers.

receiver or oscillograph tube. It is not, of course, a complete substitute for a new tube, but it does allow the working life of an old tube to be extended, at very small cost, and this is often useful.

Auto-transformer

The necessary transformer will be for low voltage only, and has few turns, so that it is easily wound. It may have a single tapped winding, or separate windings, as shown in Fig. 1. The single winding type, known as an auto-transformer, is simplest to wind. The type with separate windings has the advantage of allowing isolation of the heater circuit, and for this reason is occasionally necessary when a tube has developed leakage between heater and cathode.

An unnecessarily great increase in heater voltage is likely to cause early failure of the tube, and a tapped winding is useful, so that a small increase in voltage can be provided at first, and be added to later after a period of running. An increase in voltage of between about 20 per cent. and 50 per cent. is usual, the high voltages only being used if essential. A boost of less than 20 per cent. will be particularly useful when a tube has been a trifle under run, perhaps due to a somewhat low mains voltage. For a 2V tube, voltages of 2¼, 2½, 2¾ and 3V could be provided. With a 4V tube, tapings could supply 4½, 5, 5½ and 6V. A similar percentage increase can be provided for 6.3V, 10.8V, 13.3V or other tubes.

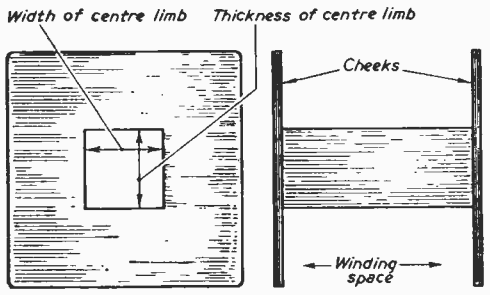


Fig. 2.—Bobbin and core size.

Transformer Windings

Though the transformer can be very small, winding is simplified if the core is reasonably large. The core of a damaged speaker or mains transformer, or smoothing choke, or similar component, will usually do well. Such cores can be wound at the rate of eight turns per volt, for

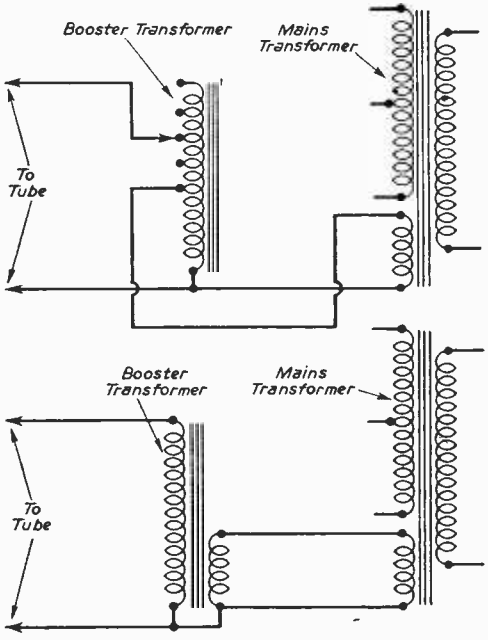


Fig. 3.—Transformer circuits.

each 1 sq. in. cross-sectional area of core. The area required for this calculation is that of the centre limb only, and is thus virtually the same as the area of the bobbin opening. This can be found by multiplying the two dimensions, as shown in Fig. 2. Quite often the area will be less than 1 sq. in. The number of turns can then be found by:

$$\frac{\text{Voltage required} \times 8}{\text{Cross-sectional area in sq. in.}}$$

A bobbin can be made from stout card, if necessary. For up to 3 amperes 16s.w.g. wire can be used. This will do for 2V 2.5A and similar tubes. For up to 2A, 17s.w.g. is satisfactory, with 18s.w.g. for up to 1.5A. For the 0.6A type of tube, 20s.w.g. will be suitable, and 22s.w.g. is sufficient for .3 amp tubes. The bobbin will usually be only partly filled, so there is no need

to select the smallest possible gauge, to economise in space.

Winding

Holes are pierced in the bobbin cheeks for leads, taking care these are not so located that the stampings will bear on the wire where it comes from the bobbin. Turns should be wound neatly, side by side. A strip of brown paper between layers will make winding easier, and cushion against expansion stresses, with enamelled wires. The small number of turns makes hand winding perfectly straightforward.

As example, a transformer for 2, 2¼, 2½, 2¾ and 3V would consist of 24 turns in all, on a 1 sq. in. cross-sectional area core, the winding being tapped at 16 turns for 2V, 18 turns for 2¼V, 20 turns for 2½V and 22 turns for 2¾V.

Circuit Details

Fig. 3 shows how the auto-transformer or double-wound transformer is connected. Only the one heater lead has to be cut in such cases. If the transformer has been wound for various outputs, start with the lowest boost, to find if this is sufficient.

It will be observed that such a transformer cannot easily be added if valve and tube heaters are in series. In such cases the booster transformer may either be wound with a separate mains voltage primary, or receive current from a 6.3V or other small heater transformer, added for this purpose. The booster transformer is then wound to give the desired outputs, with a 6.3V input. It will also be necessary to modify the mains dropper tapping, or mains voltage selector panel connection, or add a ballast resistor to replace the tube heater, which will, of course, be run from the transformer, instead of the valve heaters series circuit. It must also be noted that such series circuits are used in A.C./D.C. receivers, and that a transformer can never be used with D.C mains.

Specification for an Outside Engineer

By L. E. Higgs

MANY hard things have been said by the newspapers and others about the radio/TV serviceman in the past—some of them perhaps justified—but when the requirements of an efficient TV domestic service engineer are considered it presents a formidable, broad-fronted mass of knowledge, skill, physical dexterity and experience.

As a brief specification consider: technical knowledge of the circuits, layouts, probable defects and common symptoms, not of one maker, but usually a dozen or more, including TV, radio, tape recorders and electro-mechanical record players of considerable complexity covering the latest thing to 10 years back and the quickest way to access to each.

Strength of Body and Mind

Physically he must be of slight build in order to negotiate flights of stairs carrying a 17in. TV, tools and aerial, with long arms to embrace the 21in. table model, with the strength of Atlas for the lifting of the earlier models and delivering the odd fridge, plus the dexterity of a cat when in lofts, beam walking. The importance of acute hearing and discerning eyes goes without saying; his nose is often useful.

His nerves, however, must be even better than this to cope with the variety of customers and home working conditions and intermittent faults occurring in wide-flung geographical locations, all within the specified times on his job list, the daily grind of town traffic and a thousand things to remember—spares, bills, promises, addresses—failure of any one can bring trouble and much extra work.

Danger

The hazards of the job also are surprisingly large in number—death from electric shock, implosion, impact with the ground (roof aerial checks), van accident and possible injury by rupture, soft X-rays and, probably the most dangerous of all, the insidious collection of dusts from a cross-section of the whole community—some healthy, some otherwise.

As a driver the job list would appear to need a Stirling Moss on some days despite the "carrier licence" limit of 30 m.p.h., but speeding and endorsements never pay in a job where a man's living depends on being able to drive, and one scrape wastes too much time in courts and insurance form filling to justify the time he was trying to save.

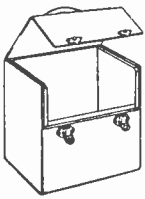
Character

Temperament is another facet of his character, probably the most important, the ability to fit in with all kinds of people in their varying homes, patience with old or awkward folk, firmness where payments, collections and estimates are concerned, doggedness with the obscure technical defects and being able to take on the extra urgent job when returning at the end of the day.

Add to these the clerical bookwork, Saturday all day working and attempting to keep up in the evening with modern trends and developments, and it is not surprising that the good engineer is supposed to be a rare bird and to his employers "worth his weight in gold"—a point conspicuous by its absence in some firms.

However, the compensations of an active outside life in interesting technical spheres with no monotonous regularity—every job is different, the equipment everchanging (even the endless cups of tea are of varying flavour)—and the satisfaction of meeting the challenge of the daily crop of faults lone-handed brings a special kind of reward unknown in other work.

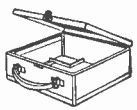
RECORD CASE
A GIFT FOR ALL AGES



Beautifully made in various colours, covered in washable leatherette. Strong modern case and carry handle, hinged top, plated clip fasteners. P. & P. 2 6.

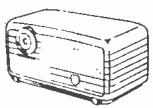
To hold 30 E.P. 7in. records	21/9
To hold 40 E.P. 7in. records	23/9
To hold 20 10in. or 12in. records ...	22/6
To hold 50 10in. records	24/6
To hold 50 12in. records	27/6

TWO OUTSTANDING BARGAINS



STURDY CASE 12/6

(Ideal record case.) Covered in burgundy and grey washable rexine. Size 8½in. x 7½in. x 3½in. deep. Strong clasp, hinges and carry handle. Ideal for portable radio or transistor set. Can be adapted as a record carrying case to hold 18 E.P. 7in. records. P. & P. 2 6.



BAKELITE CABINET

5/9 Brand new. Attractive design. Size 12in. x 7in. x 5½in. Colour brown. Ideal for small receivers, etc. P. & P. 3 3.

★ **BATTERY PLAYER UNIT 99/6**
Takes any size record, has latest turn-over crystal pick-up. Base 9½in. x 11in., weight 3½lb. Colour ivory. Current cons. 60 to 90 ohms. 6 or 9 volt. 4-speed. P. & P. 4 6.

★ **VALVE BATTERY AMPLIFIER 39/6**
Ideal for use with player above. 1½ volt L.T., 60 or 90 volt H.T. O.P. imp. 3 ohms. P. & P. 3 6.

★ **3 TRANSISTOR AMPLIFIER 79/6**
9 volt. O.P. imp. 3 ohms. OC71 driving 20C72. P. & P. 3'6.

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FOCUS MAGNETS. 9/9. Brand new 38 mm. Incorp. picture shift control. P. & P. 1/3.

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RP6

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Dept. X11.

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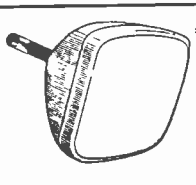

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15" — 17" - - - -	£7. 0.0
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Electro Statics 10/- extra.

Carriage and Ins., 10/-. (Goods) Terms: C.W.O. 15/- (Pass)

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6AL5	5/-	6K7	4/6	12AT7	6/-	EF36	5/-	VR150/30	
6AM5	5/-	6L6	6/6	12AU7	7/-	EF37	9/-		5/-
6AM6	6/-	6SA7	6/-	12AX7	7/-	EF39	5/6		
6AQ5	6 -	6SC7	4/6	12BH7	10/-	EF50	3/6	UL84	9/-
6AY6	7 -	6SJ7	5/-	12SH7	5/-	EF50	5/-	VCR97	
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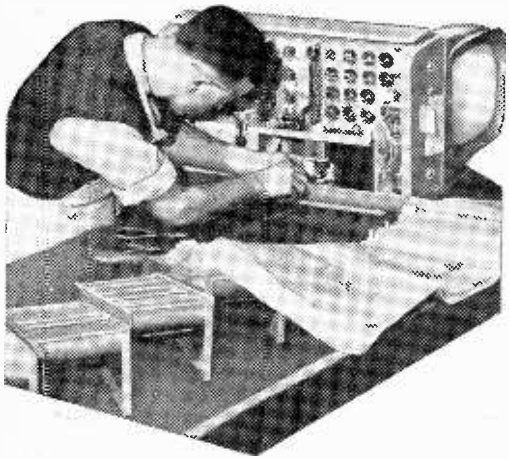


Analysing and Servicing TV Receivers

No. 11.—PROJECTION RECEIVERS

By "Diadem"

PROJECTION receivers are often thought of as being completely different from conventional receivers. There are differences and these mainly lie in the EHT circuits and in the timebase and other circuits associated with the C.R. tube. A typical circuit for the EHT generator in a projection receiver is shown in Fig. 47. V1 is a double diode triode, the triode section acting as the blocking oscillator with T1. The sawtooth waveform generated is about 1kc/s, this is applied to the control grid of the EHT generator valve V2. This valve is biased below cut off, but during the latter part of the positive-going. sawtooth input cycle, the anode current flows and is then rapidly cut off. When the anode current ceases at the end of each input cycle, the stored up energy is released in the form of a short chain of damped oscillations of about 25kc/s. The peaks of these oscillations, giving about 8.5kV, are then rectified in a tripling circuit to give a final output of.25kV.

Regulation

An EHT potential as constant as possible is essential. This is partly achieved by the biasing arrangement and the high stability components. Resistors R1, R2 and R3 are ± 2 per cent. high stability types. C1 is ± 5 per cent. and should be in perfect condition. Automatic regulation of the bias voltage applied to the control grid of V2 is provided by an AGC arrangement. An alternating potential is induced into winding L1 and is rectified by the diodes of V1. This voltage is then fed to the filter network R2. R3, C2, and is then passed on to V2 control grid as bias. This method prevents the picture content varying the EHT potential at the time when a heavy beam

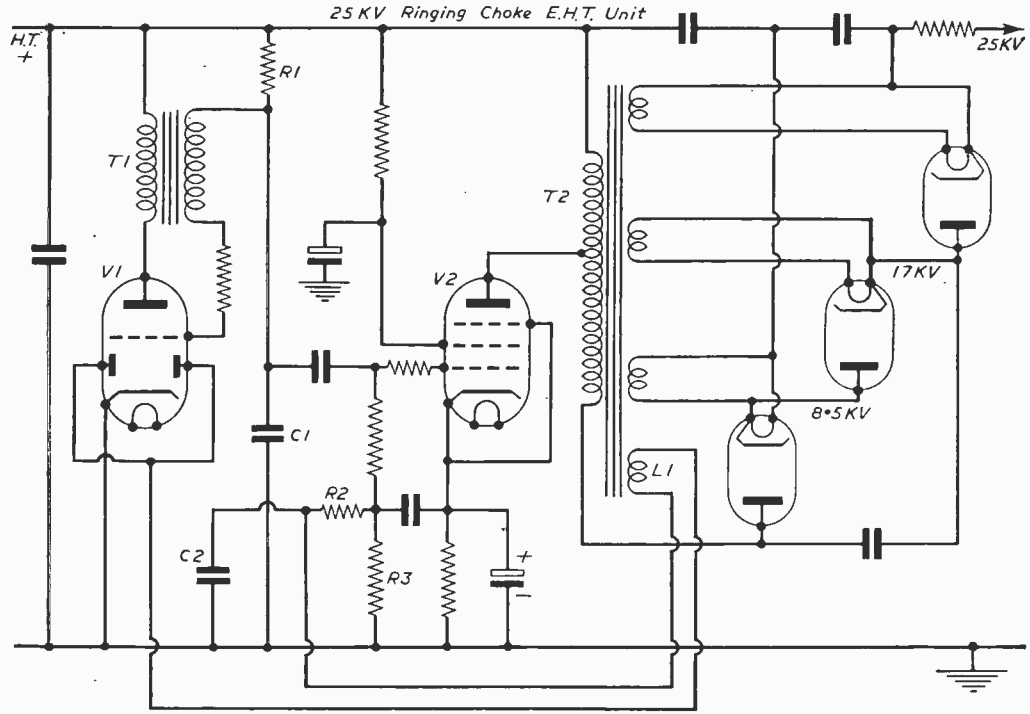


Fig. 47.—25kV ringing choke EHT unit.

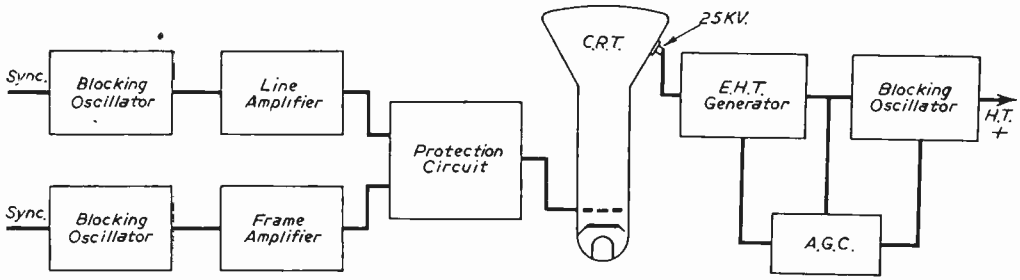


Fig. 48.—Block diagram of time bases and EHT generator in projection receivers.

current would reduce the EHT. When the EHT potential drops, the bias voltage of V2 is reduced; the gain of the valve is therefore increased, and this in turn increases the EHT.

Fig. 49: The working of this circuit is explained in the "faults" section.

Faults in Projection Receivers

No Raster.

For those readers who are unfamiliar with the working of a projection receiver, a fault of no raster can be baffling. It is no use poking about here and there to find it. It must be done systematically. The fault may be in the line or frame timebase or the projection circuit (see Fig. 48). It may also be in the tube or its voltages or the ringing choke EHT unit. These then are the main items. A brief explanation of the protection circuits may help here. The tube voltage is 25kV and if failure of the line timebase occurs, a vertical line will be traced on the screen, and if the frame timebase fails a horizontal line will be seen. If both timebases fail, a spot will remain stationary in the centre of the tube face. In each of the three faults, destruction of the tube fluorescence in the areas covered will be instantaneous. Therefore, in all projection receivers a protective circuit is incorporated to cut off the beam automatically in case of failure of either or both timebases. In the protective circuit (see Fig. 49) two signals are taken, one from the line output stage and the other from the frame output stage, and these signals are then rectified by two diodes. The rectified outputs are applied to the grid-cathode circuit of the tube, so that failure of either timebase reduces the grid voltage and cuts off the beam. First check the EHT by switching off the set and watch for a bright decaying spot in the centre of the screen. If this does not occur, the pulse generator and the EHT generator valves and components should be checked. It is not possible to check the three EHT rectifiers as these are immersed in oil in the choke transformer can.

If the spot is seen on switching off, check the grid voltage on the tube; if the protection circuit is functioning properly, this should be low or

(Continued on page 147)

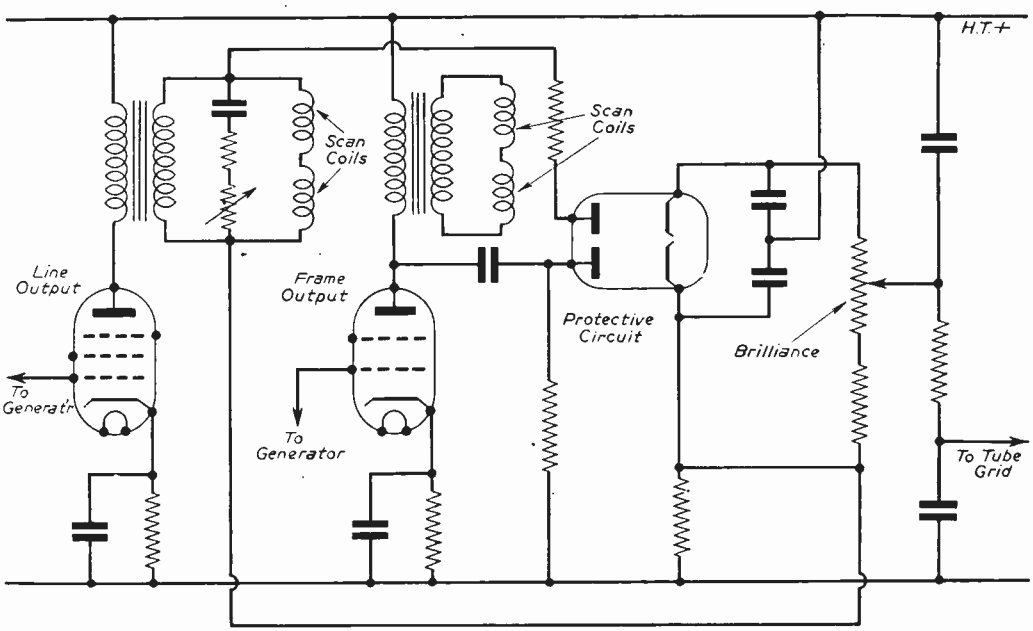
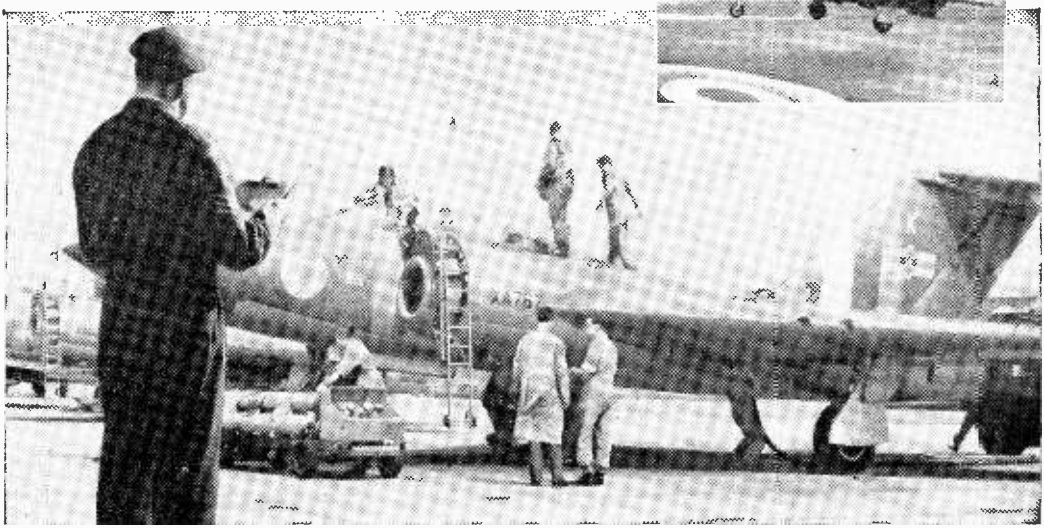


Fig. 49.—Projection tube protection circuit.

Touch-down!



7 minutes to go!

Their sortie completed—two Javelins return—only two aircraft—only four men—but it takes a large team of technicians to get them back into the air without delay.

A Javelin's ground crew works at top speed. They can rearm and refuel the aircraft and have it back on the runway fully serviced in seven minutes. Here, the Master Radar Station takes over. Once again a technical team . . . air operations staff, teleprinter operators, radar specialists. In the R.A.F., *every* man counts.

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AS PART OF THEIR SERVICING, recharged batteries are hoisted into the Javelin's fuselage. These provide a reserve source of electric power.

IN SEVEN MINUTES, two more Javelins are ready on the runway. From the Control Tower, it's . . . 'All clear for take-off'.

zero. The cathode voltage should also be checked. The protection valve, usually a double diode, could be changed to remove any doubt, and make sure that both heaters are alight. However, the fault will usually lie in the timebases. Check the line output valve for spark on its anode cap and the voltage on its screen. Also examine the booster diode and its voltages. The cathode voltage will be the higher, of course. Check all high value resistors. Before suspecting the line transformer, check all the frame circuit and its valves. Check the main H.T. rectifiers.

X-ray Danger

As all the tubes operating with potentials over about 16kV emit soft X-rays care should be taken against radiation when working the tube outside the optical box. *Keep the brilliance low* and be at least 3ft. away from the tube face. A lead glass screen should be used, but if you turn the tube face away from yourself and view the screen through a mirror this should be all right for quick servicing.

Line across the tube, either horizontal or vertical.

The protection circuit is not operating. Check the secondaries of the frame and line output transformers and examine the scan coils for open circuit. If these are all right check the tube protection circuit and the resistors to the tube grid.

Picture size varies with signal.

This also affects the brightness and the picture jumps in and out of focus. The fault nearly always lies in the EHT unit. The cause is poor EHT regulation. It is a very common fault and not always easy to trace. A typical procedure is as follows: first change the pulse generator valve, and check carefully the blocking oscillator transformer in the anode and grid circuits of this valve, and the resistor between the H.T. line and the transformer secondary. This resistor is very critical and is a high stability component. Two more high stability resistors are in the control grid circuit of the EHT generator valve and these two resistors also control the regulation. The three resistors should be checked very carefully, and if in doubt replace them. The H.T. rectifiers should also be suspect. The EHT rectifiers could also cause this trouble. but that means returning the transformer to the manufacturers.

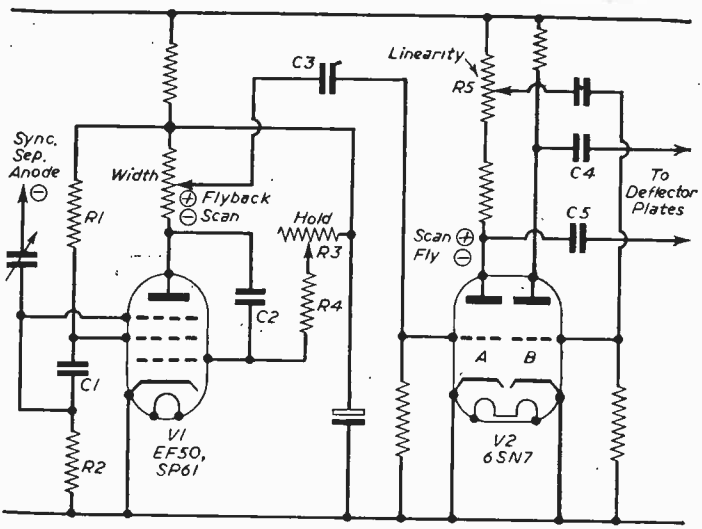

Fig. 50.—Time base and output circuit.

Electrostatic Receivers

Many home-built receivers employ electrostatic deflection. There are also some commercial receivers which employ electrostatically deflected cathode ray tubes and accordingly details of some of the common circuits and faults employed in such receivers will be of assistance to many.

The Miller Transitron Timebase (Fig. 50)

This timebase is used to a considerable extent and the mode of operation is as follows: The charged capacitor C2 is partially discharged through R3 and R4 and is then recharged by the action of the valve. The time taken for this function is called the scanning period. The flyback and linearity is controlled by C1 in conjunction with R1 and R2. The output from V1 anode is of sawtooth waveform and is fed through coupling condenser C3 to the amplifier V2A. Part of the output of V2A is passed to the linearity control R5 before being fed to V2B. The output from V2B is then in the opposite phase to V2A, and this is correct for feeding to the deflector plates. C4 and C5 are the deflector plate coupling condensers.

(To be continued)

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).

PORTABLE TUBE

SIR,—Hardly anyone today would think of using a radio set without an extension speaker socket—or as an alternative, a portable set. Radio in each room of the house was, at one time, a trade slogan. Why cannot this be applied to TV? As I see it, a TV set is the same as a radio set from the viewpoint that it tunes in the signal, and the C.R. tube takes the place of the loudspeaker, making visible the intelligence received by the set instead of making it audible. Why then cannot the tube and the scanning coils be separated from the set, and taken to a distant viewing point? I admit I do not know a lot of the techniques of TV but it does not seem that this is an insurmountable problem, but I should think one of your popular contributors could be induced to produce a "plug-in tube" unit which could be carried from room to room, or made as a separate unit to use with an existing TV set. Would it not be popular?—G. F. RANSOME (Winchester).

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.

PROJECTION TELEVISION

SIR,—In your October issue a reader was enquiring when the above will come about, and what inventors are doing about this. I wish to draw your and his attention to my Patent (No. 821583). It is entitled "Colour Television Systems." This I believe will be of great interest to you and your readers of all walks of life. If any of them require a copy they should apply to the Sales Branch, Patent Office, and not me. The invention describes many novel features for a Colour Television Camera and Colour Television Receiver, and I hope in due course to get the invention developed for public interest by one or more manufacturers, if I can get, what all private inventors require, "fair play" as I know that manufacturers like to get results from within their own ranks.—R. B. POOLE (W.C.1).

TRENDS IN TV DESIGN

SIR,—In his article "Trends in TV Design" in the November issue, "Engineer" had apparently forgotten that another important point in design appeared to be the removal of the many "pre-set" controls. It is true that valves and some components age in use and adjustments may therefore become necessary to compensate for the resulting change in performance. Whilst it is important that a customer should be given the facility of making such adjustment without calling in a serviceman, it is found that many viewers do not appreciate that such adjustments should be made carefully. So many viewers turn the control as though they are winding up a clock and, passing the correct setting, turn it back with the same undue force and cannot arrive at the intermediate fine setting. As a result, they try one of the other controls, and soon have the receiver completely out of adjustment, calling for an engineer to reset all controls.

In some modern receivers these pre-set controls have now either been dispensed with or placed right out of reach, improved valves and circuit techniques having now made it possible to obtain reliable working over a long period without the need for these adjustments.—G. A. WOLSEY (Borehamwood).

MK. 1 ULTRASCOPE

SIR.—I would be pleased to receive any information on the above TV receiver. I am a disabled ex-serviceman and spend quite a lot of time "messing about" with electricity. The Mark I Ultrascope is no doubt war surplus so I am unable to obtain circuit diagrams. The unit in my possession is complete except for some wires off the C.R.T. I have had some indication on the tube but I cannot follow the wires.—P. GODDEN (22, Victoria Road, St. Annes on Sea, Lancs).

COLOUR TELEVISION

SIR,—Replying to my suggestion in the May issue of PRACTICAL TELEVISION that we should make much more progress in the development of Colour Television if we dropped the idea of "compatibility," your correspondent E. H. Price suggested (July issue) that it would be much too costly to proceed along these lines. Having been associated with the development of electronic equipment for the last 25 years, I can assure Mr. Price that his comment regarding cost are not valid in 1959. For many years past our factories have been producing high-quality, high-frequency, wide-band transmitters and receivers for the three Services. Most of these operate at frequencies far above our present-day TV requirements. Production techniques have so improved in this country, as well as the United States that it is fair to say we have the knowledge to begin production of a reasonably priced colour TV receiver, as well as camera-channels and transmitters, etc., as soon as the drag-lines of "compatibility" are severed.

Once permanent peace is established we can use a large part of the redundant high-frequency service equipment as the basis for both receiving and transmitting gear for a high-quality colour TV service. Only the cost of modification need be passed on to the civilian buyer.

Thus, by using modern techniques and converting service equipment as it becomes available, we have the basis for a really cheap colour TV service for years to come.—R. D. COYLE (Albury).

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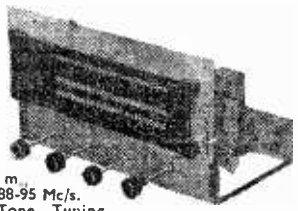
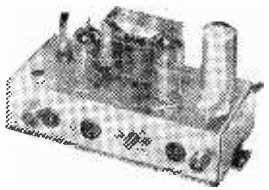


3 waveband and switched gram positions. Med. 200 m.-500 m. Long 1,000 m.-2,000 m., VHF/FM 88-95 Mc/s. 4 Controls. Vol., On-off, Tone, Tuning, Wavechange. P.U., Ae. and E., and speaker sockets. Magic eye tuning. Philips continental tuning insert with permeability tuning on FM, and combined AM/FM IF transformers, 460 Kc/s and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry, including AVC and Neg. Feedback. 3 watt output. Sensitivity and reproduction of a very high standard. Chassis size 13¼in. x 6¼in. Height 7¼in. Edge illuminated glass dial 11¼in. x 3¼in. Vertical pointer, Horizontal station names, gold on brown background. A.C. 200/250 v. operation.

£13.10.0 *Carr. and Ins. 5/-. Complete with 4 knobs walnut or ivory to choice.*



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B1-B3 changeover Sw. and BBC Aerial Socket fitted and wired, 8/- extra.

Band 3 Aerials. Single Dipole with 4 yds. cable, 13/9, 3 Element Beam, 25/-, 5 Element, 32/6, etc. B1-B3 Crossover Units, 7/6.

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Garrard—Latest RC121/D/Mk 2—fitted with GC8 Xtal cartridge, plug-in monaural head. Auto manual selector, etc. The connoisseur's choice for audio perfection. Bargain 10 gns.

Plug-in stereo head GCS/10 £2 extra.

All above are *brand new, fully guaranteed* models. Carr. and Ins. 4/6.

Comprehensive bargain range of Collaro, BSR and Garrard Units in stock. Send for comprehensive bargain lists.

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12in.	£6	17in.	£8.10.0
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All tubes Rebuilt with new Heater Cathode and Gun Assembly—reconditioned virtually as new! Full 6 months' unconditional Guarantee. As used by our own Service Dept. Comprehensive stocks—quick delivery. 10/- part exchange allowance on your old tube.

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Contemporary styled, rexine covered cabinet in two-tone fawn and brown, or mottled red with white polka dot. Size 18¼ x 13¼ x ht. 8¼in., fitted with all accessories, including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Cabinet Price **£3.3.0.** Carr. and Ins. 3/6.

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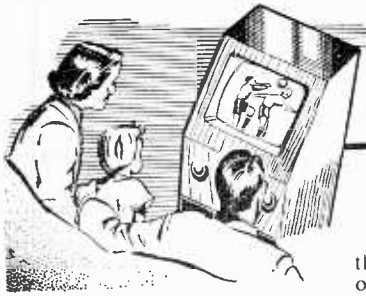


UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

COMMERCIAL TELEVISION was the title of a recent lecture symposium organised by the British Kinematograph Society. Such a broad all-embracing title could cover a very wide field, technically and creatively. Though the sub-title "British versus Transatlantic methods of presentation" might indicate a comparison of styles, techniques or organisations, it still left one guessing. The speakers were to be important executives from Associated Rediffusion, Anglia TV, the Canadian Broadcasting Corporation and the N.B.C. of America, with a BBC television engineer as Chairman, which gave promise of a thoroughly controversial evening. This is what it turned out to be.

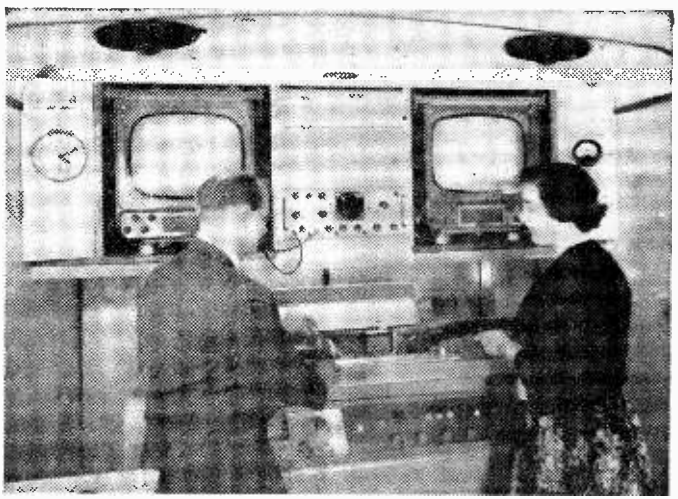
U.S.A. versus U.K.

THE audience of film studio and television production and television men was not disappointed. First, a "sponsored" Perry Como film, especially made for American TV, was shown by 16mm film projection, in which the advertising was almost wholly integrated into the action of the scenes. Various reasonably smooth excuses were worked into the continuity of the dialogue, songs and sketches to soften the blow of occasional references to "National Cheese Week" and to the virtues of various consumable products. This, explained Mr. Joseph Harsch of the N.B.C. was perfectly normal and acceptable to U.S.A. television audiences, much more so than would be a succession of advertising spots, one after another.

He explained the American system, in which the television organisations provided the studio network facilities for the advertising sponsors to produce their own shows. The difficulties of re-editing the same film for BBC presentation must have been great. Stephen McCormak, formerly with the BBC and now with Anglia, and Donald Bennett of Canadian Broadcasting gave examples of elaborate live production and specially filmed production, the former being a telerecording and the latter shot on 16mm film. Both speakers together with Lloyd Williams, of Associated Rediffusion, stressed that the make-up of British and Canadian programmes was completely divorced from the advertising side, and that the American style of integrated advertising would not be digested over here, even if it were allowed. Asked about the future of 16mm film shooting for television, now that magnetic video tape recording had made such headway, Mr. Williams said that there was room for both methods, with the right facilities. Major improvements in 16mm film techniques had ensured its continued use.

"Hancock's Half Hour"

TONY HANCOCK and Sydney James are a busy team, both on television and sound radio. *Hancock's Half Hour* has become a "must" in both fields putting quite a strain on the staying power of these two brilliant comedians. Fortunately, the modern techniques of video tape and sound recording recently enabled them to go ahead and get one or two "half hours" in hand. This backlog gave them a brief but much needed respite. I must say that the BBC video tape transmission was of very fine quality and that Tony Hancock's spell as foreman of jury at Old Bailey came over in fine style, situation-comedy at its very best. This particular episode was notable



Mr. Walter Kemp, Technical Controller of TWW, loads the two-inch wide magnetic tape on to the video and audio record heads for recording in the new specially-designed mobile Ampex videotape recording unit. This unit, which has just been delivered to TWW, will be used for recording studio programmes and outdoor events in Wales and the West Country. This picture gives a close-up of the Ampex console with the record and preview picture monitors on each side of the waveform monitor.

for the fine casting of quite small parts—all played by top-line actors. Austin Trevor played the judge with just the right amount of exasperation at Tony's preposterous foremanship of the jury, who were almost equally rattled by his leadership. Prominent amongst the jury were Leslie Perrins and Kenneth Kove, who are more often seen in cinema films. Sydney James is the perfect stooge, a fine actor, and a comedian with a wonderful sense of timing. Production values on this series continue to be first class, and Duncan Wood, producer, gets top marks. The writers, too, Ray Galton and Alan Simpson are to be congratulated upon the scripts of this series, which are tailored to fit the personalities and the situations, with plenty of scope for visual as well as verbal comedy.

The Vidicon

E.M.I.'s new vidicon TV camera seems to have made a big impression upon television engineers, giving quality comparable with the image orthicon camera though still lacking the complete flexibility of the image orthicon. All the British makers are going ahead with the vidicon type of camera, which is much lighter in weight, less expensive to buy and maintain, and for which the camera tube hire is about one-fifth of the hire of an image orthicon tube. It is the usual practice for the equipment manufacturers to supply camera tubes on hire on a "tube burning time" basis of so much per hour. With three or four cameras warming up for half an hour or so, and then being used several hours a day for rehearsals and live transmissions, these hire charges can mount up to many thousands of pounds a year, at 30s. or 35s. per hour each. No wonder the TV engineers are encouraging the development of simpler cameras, which can give first-class results on many features which do not call for rapid camera movements. The improved vidicon camera tube is also used for telecine, of which I hear that fine results are being obtained by Pye. The flying spot telecine scanners of Cintel and E.M.I. continue to give superb results, however, particularly as regards their range of tones and grey scale.

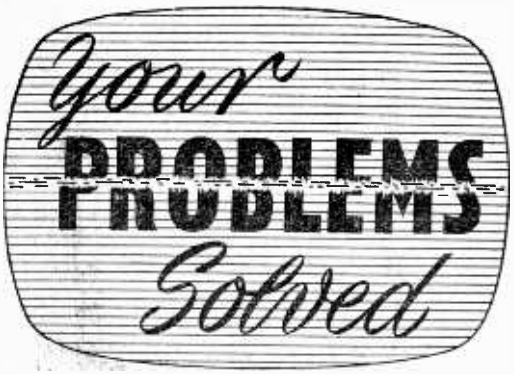
"The Third Man"

TIME flies! It must be six or seven years since The Third Man film took the cinemas by storm and packed in the audiences. Then, Orson Welles played the part of Harry Lime, an unpleasant racketeer in Vienna just after the war. The TV Harry Lime is a much pleasanter, if less dramatic, spiv who seems to work out his operations more along the lines of Robin Hood. Michael Rennie smiles his way through difficult and dangerous situations, which are smoothly and expensively produced on film by a combination of the BBC and the NTA of America. I suppose Iain MacCormick, who wrote the story and script of this television series, had his eye on the wider family audience of television, when he made Harry Lime less of a villain than the sinister Harry Lime of years ago. I am inclined to think that he has done the right thing. I have only one main point of criticism. The "Harry Lime" theme, played on a zither and which was such an important background in the original film is back again. But it is faded up with loud volume, quite missing the sinister effect it originally achieved as a reasonbly quiet musical background.

The Third Man was shot on 35mm film for use on BBC and major U.S.A. networks, but will undoubtedly be available optically reduced to 16mm prints for world distribution.

Peter Scott

ANIMAL, scenic and exploration items cater for a special audience—but the audience is vast. It is in this field that the 16mm film really comes into its own. The Granada television visits to the London Zoo were at one time mainly live, but now there are fairly large portions of filmed material included. Animals would not "perform" or show themselves off reliably for live television. Granada shoot their Zoo films on reversal negative film, the photographic emulsion of which has been much improved lately. This reversal film becomes a master positive from which further reversal prints or negatives are made, for editing. The original master is retained, unedited, for use on other items in the months or years to come. Granada are thus building up a most valuable library of animal shots. Peter Scott's nature study lectures on BBC have a charm of their own, admirably illustrated with animal shots filmed on his travels all over the world. Lately, we have seen unusual animals and birds in island haunts in the Pacific and in Panama, interesting in themselves, but doubly so with the delightful restrained commentaries of Peter Scott.



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. 159 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

McMICHAEL M17T

A few minutes after switching on and receiving normal sound and picture, the screen suddenly brightens up and has diagonal lines across it as if the aerial had been suddenly removed. There is still a faint background picture, and the sound is perfect. Altering brightness and contrast controls has no effect at all. The only way the picture can be regained is by switching off three or four times over a period of five minutes or so. Then a normal picture is obtained which will last all evening, provided the set is not switched off, when the above performance has to be repeated when reception is again required.—D. Jones (Dinas Powis, Glam).

The fault is due to a grid-cathode short in the tube. Try the following modification. Remove H.T. lead to pin 7 and insulate it. Remove A1 lead from pin 10 and solder to pin 7. Remove grid lead to pin 2 and solder to pin 10. Link pin 2 to pin 11.

PETO SCOTT 1416T

The fault is that when changing the channel switch the picture slips down about half-way and stops there. The frame lock is fully anticlockwise and advancement of this makes the picture slip rapidly downwards. I can clear the fault by turning the frame hold clockwise and then anticlockwise rapidly, when the picture slips down and then comes up and locks perfectly. It will remain like this until a change of camera when it will slip down half a frame again and lock there. In this position there are bright lines across the screen similar to flyback lines, but the picture is perfectly focused. This fault can also be made to come on by tapping the channel switch. This sometimes makes the picture go altogether with a distorted sound from the speaker.—L. Carter (Derby).

We suggest you check R88 and C94. Also remove tuner cover and clean switch springs and studs thoroughly, lightly smearing with MS4 silicone grease (or Vaseline).

REGENTONE

The fault appears on the raster between programmes when the picture is blank. It started as a vertical white band about ¾in. wide, situated 4in. from the left-hand side of the tube. This vertical band waves about from side to side slightly. Lately it has broadened, and is now about 2in. wide and continues to wave about So far, the fault is not very noticeable when the programme picture is on, but I fear it may spoil the picture eventually.—B. Brown (Newcastle-upon-Tyne).

The band could be due to oscillation in the EL38. Replace it or clamp an ion trap magnet to the glass envelope and adjust to eliminate the band.

ENGLISH ELECTRIC 1650

Please can you tell me how to rewire an aerial plug for the above set as the plug got badly damaged and I could not tell how it was wired up. I bought it from my friend as my own set had given up and my aerial has just the ordinary coax plug, but this set has four leads. I have taken the plug off my aerial and pushed the ends in the holes marked TV. I get sound but no picture although there are horizontal lines on the screen. Is it the fault of the plug not being wired up properly?—W. Allen (Leigh, Lancs).

The 1650 is designed for a twin feeder input. Thus if a coaxial downlead is used it is of little importance which way round the coaxial is connected provided it is to the TV pair in the plug. Twin feeder should be used for optimum results. but a picture should be displayed using coaxial if the aerial is efficient and the set is in working order.

FERRANTI 14T6

No sound at all. All the valves light up and I have changed them about.—C. Newson (Maidstone, Kent).

We would advise you to replace the PCL83 sound audio-output valve. This is mounted under the tube neck in the front centre of the R.F. chassis (not in the main deck).

EKCO T.221

I am having a lot of interference with the above set. The main trouble appears to be "sound-on-vision"—ITV being particularly affected especially when loud music is played or voices raised. In the main the BBC channel is quite steady, but even so a certain amount of interference has been experienced here, too, and a white line can sometimes be seen to be moving vertically from one side of the screen to the other. The aerial used is a dipole. I understand that this is reputably a bad area for reception and I should be pleased to receive your views on the subject.—D. Holland (Wigan, Lancs).

To correct the sound on vision, first check that the local oscillator core on each channel is set correctly with the fine tuner midway. This adjustment may be made through the hole in the cabinet side. If no improvement results adjust

the air-spaced condenser which is underneath the chassis near the inside corner of the turret tuner.

From our own experience of reception in the north we would say that there are very few places apart from the Vale of York where a single dipole is any good at all, owing to ghosting.

FERGUSON 454T

I have lost the picture (no EHT) on this set. I have checked PL81 and PY81 and associated resistors. I have also checked the two PCF80's. Could you please tell me what else I should check before condemning the line output transformer? Is there any way of checking this?—H. Tindley (London, N.3).

You could check the signal at the output of the line multivibrator (V5B and V14B) with the aid of a pair of headphones. The line whistle should be heard if this section is in order and, with the aerial disconnected, the pitch of the whistle should vary with adjustment of the line hold control. Ensure that isolating capacitors are employed to connect the phones to the circuit to avoid risk of electric shock. If the line whistle is present here and the PL81 voltages are correct, and if the valve appears to be working very hot, then the line output transformer is almost certainly to blame. Anyway, the next only conclusive test is transformer substitution.

ALBA T644

Recently the width has begun to fail about ½in. on the right-hand side looking at the screen. Also I cannot achieve optimum sound with optimum picture when tuning in with the fine tuner. If I used air spaced cable would the picture be improved? It is very poor at present. I am about 50-60 miles from the transmitter and I am using a combined aerial.—G. Cornick (Weymouth, Dorset).

Check the H.T. rectifier PY82 efficiency diode, PY81 and line output valve PL81. Replace whichever is low. Also check PCC84 valve on the tuner unit. The T644 is not a high gain model and any deterioration in the valves will cause an inferior performance. Low-loss cable is not likely to add much to the overall gain, but the use of a separate high-gain Band III aerial would be well worth while.

INVICTA 120T

When I switch on the picture revolves. I have changed the two ECL80's.—G. Green (Billesley, Birmingham 14).

If you remove the bottom cover, you will see that a 47KΩ (yellow-violet-orange) resistor connects from one end of the control to the line hold (chassis connection).

Directly wire another 47KΩ across this one to decrease the total resistance, i.e., two 47KΩ in parallel have an effective resistance of 23.5KΩ. This should return the hold control to the centre and allow a new ECL80 to be fitted on the front end of the inner row to the right of the tube. If the hold is unreliable, check the M3 and WX6 interlace diodes under the front end (centre) of the chassis.

K.B.35

I have two intermittent horizontal lines going on my screen. They remain perhaps for one minute to an hour then suddenly vanish, then come back for a few flicks across the screen then disappear again. I have replaced most valves in the set and looked for loose or dry joints. I wired in a Brayhead converter myself.—E. Johns (Hafod, Swansea).

It is very difficult to pin-point this sort of fault as the cause need not even be in the receiver. A defective electric light bulb, for example, could cause such symptoms.

Note the effect of the vertical, lin., height and hold adjustment. Tap each valve in turn with a hard object such as a pencil. Try a disturbance test on the components under the chassis. Replace original valves and use the receiver without the tuner.

TUBE CHANGE—HMV 3806

Would you kindly tell me what changing a TA15 C.R.T. in a model 3806 H.M.V., to a Mazda CRM151, or 152A, or B entails? I understand that the heater supplies are two volt which I can obtain from a 2 volt transformer, but what other alterations are needed? Will the EHT be suitable? Also will the conversion be quite satisfactory as regards focus and scan? I am forced to make this change as TA15's are difficult to obtain. —W. Prance (Devoran, Cornwall).

The Mazda CRM151 requires a 2 volt heater supply and has a Mazda octal base socket connected as follows: Heater 1 and 8. Cathode 3. Grid 5. (Triode tube.) The CRM152 again has a 2 volt heater but has a duodecal base wired as follows: Heater 1 and 12. Cathode 11, Grid 5. (Triode.) The CRM153 requires 12.6V for the heater and this is a tetrode tube with a ion-trap gun assembly. The connections are: Heater 1 and 12. Cathode 11. 1st anode 10. Grid 2. (Tetrode, ion-trap magnet IT6.) The Emiscope TR15 is a tetrode tube with no ion-trap and has the following base connections (B7B) heater 5 and 7. Cathode 6. Grid 3 1st anode 2. Thus if a CRM151 or 152 is used leave the lead to pin 2 (A1) disconnected.

PYE VT4

Occasionally, the frame collapses leaving a narrow band of light across the centre of the screen. I have replaced the frame oscillator valve (ECC82), and tested the H.T. rectifiers (PY82's). After switching the set off (following appearance of the fault) and allowing things to cool down the picture is quite O.K. again. The fault occurs only occasionally.

Secondly, I have been unable to get any vestige of a channel 10 signal though the channel 5 signal is perfectly satisfactory. As yet, my set has no channel 10 aerial, but I would have thought that a slight amount of signal would have come through. Is there any method of adjusting the turret tuner for the required signal, or must I return it to the manufacturers?—H. E. Newry (Calne, Wilts).

(Continued on page 159)

We suggest you check the PL82 frame output valve, which is next to your ECC82. As your fault is intermittent (and, presumably, you have no oscilloscope) a simple check of the PL82 stage is to apply a 6,3V A.C. signal (from the C.R.T. heater) via a .1μF capacitor to the control grid whilst the fault is on. If this latter stage is O.K., a distorted raster about 4 to 5in. high will result.

Channel 10 should appear on the VT4 on position 9 of the tuner. We doubt if you will receive a readable signal without an aerial and you may have to replace one or both of the turret valves. We do not advise you to tune up the turret unless you are experienced in these matters.

FERGUSON 992T

This set has a blank place in the top side of the cabinet for ITA conversion, but no tuner is fitted. Can you tell me the tuner required and its connections?—W. A. Goodnight (Chessington, Surrey).

A Schedule E receiver requires a Type A ITA tuner, while a Schedule A to D receiver requires a Type B1 tuner. However, it would seem that the former is required in the case mentioned. Fitting instructions are supplied with the tuner, which can be obtained from most Ferguson agents.

REGENTONE T176

After fifteen months of use this set has developed a picture fault, the trouble being that the picture is cramped about 2in. at the top. I have a service manual and circuit tester. The PCL83 was tested and found to be low in emission so I replaced it. The picture was all right for about an hour and then dropped or cramped to 1 to 2in. I am sure my trouble is cramping and not fold-over. I cannot adjust it with the height control or at the back with the frame linearity control which only stretches out the lines and the picture is out of proportion. I have interchanged valves of the same type in the set without success.—J. Deighton (High Wycombe).

Try another PCL83. If still at fault, check the components from pin 6 of the PCL83 base through a 270k resistor, .02μF and .01μF capacitors. 1.8M resistor (to chassis). Then check the .001μF and other components associated with the PCL83 circuit.

COSSOR 938F

The vertical and horizontal holds are very critical. After changing various valves and testing condensers, etc., I tried a 6.3V isolation transformer on the tube, this did improve the picture slightly, but there was no improvement on the vertical and horizontal hold.

There is also a discharge at the spring clip that is fitted to the clamping band at the front of the tube and resting on the top of the tube. When this discharge takes place, the picture becomes bright and very good, but it slowly darkens again. —E. Hillman (Stoke-on-Trent).

You may be able to make better contact with the aquadag if you take a long spring right across the top of the tube from the clamping band to the side support. If this fails to cure your sparking suspect the SU61 on the line output transformer. The poor sync is normally due to faulty 6AB8's, faulty 12AU7, or poor chassis contacts on the tagstrips beneath. The pull-in range of the line oscillator may be reduced by changing the .02μF from grid pin 7 of the 12AU7 and chassis to .01μF or .005μF. Weak frame may be caused by a faulty interlace diode in the grid circuit (pin 2) of the 6AB8 frame oscillator adjacent to the 12AU7.

FERRANTI T1205

This set has developed a loud hum, which varies according to the brightness of the picture. I have tried to adjust this by the tuning coils, but the hum disappears and I get sound on vision.

I have been given a new Cyldon TV12K/U10L tuner and wish to know how I can insert it into my set. It has separate Band 1 and 3 aerial inputs, and the leads to the set are fitted with valve pin inserts, one is marked "mixer" and the other is unmarked. The converter is wired to four of the pins on each insert.—E. T. Hammond (Edgware, Middlesex).

This trouble may be caused either by misalignment of the sound channel, resulting in the passage of the vision signal and causing the hum effect, or overloading of the first valve due to too strong an aerial signal. In the former case, realignment would solve the problem, and in the latter, an aerial attenuator would help. The turret tuner mentioned is not suitable for the set.

PHILCO 1800

Up to the present I have had one new tube, two valves and six metal rectifiers replaced. With the new rectifiers, the picture is perfect for about two months then it begins to darken and creep in top and bottom, steadily worsening until replaced by new metal rectifiers. The set then goes through the same procedure. All the maintenance has been carried out by the local TV engineer.—J. Ekkels (Kilbirnie, Ayrshire).

It would appear that the surge resistor to the metal rectifier has been shorted out, and that the voltage tapping is incorrect and the receiver is being overrun, or that the rectifier is not bolted flush to the chassis. The original type of rectifier should be replaced with an FC101 or the mounting modified to accept a larger type FC31.

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1T4	8/6	6N7M	7/6	EB91	6/6
2N2	3/6	6Q7G	10/6	EBC33	8/6
2S2	8/6	6SA7	7/6	EBC41	10/6
2V4	8/6	6SJ7M	10/6	EBF80	10/6
2X4	8/6	6SN7	8/6	ECC81	12/6
3A5	8/6	6V6G	7/6	ECF80	11/6
3Q4	10/6	6X4	7/6	ECH42	10/6
5AM8	8/6	6X5	7/6	ECL82	12/6
5B8	5/6	12AT7	9/6	EF39	7/6
5B50	7/6	12AU7	9/6	EF41	10/6
5B16	10/6	12AX7	9/6	EF50	5/6
5GW8	10/6	12BE6	10/6	EF80	10/6
5U4	7/6	12K7	8/6	EF91	8/6
5Y3	7/6	12Q7	8/6	EF92	5/6
6A8	8/6	12SA7	9/6	EL32	5/6
6B8	6/6	35Z4	9/6	EL84	10/6
6J5	6/6	35Z5	10/6	EM81	12/6
6J6	7/6	80	10/6	EM84	12/6
6J7G	8/6	807	6/6	EZ40	8/6
6K6GT	6/6	954	1/6	EZ80	8/6
6K7G	5/6	EA50	1/6	EY51	8/6
				EY86	10/6
				EZ81	8/6
				GZ32	10/6
				KT66	10/6
				PCC84	8/6
				PCF80	11/6
				PCL82	11/6
				PEN25	6/6
				PL82	10/6
				PY80	8/6
				PY81	8/6
				PY82	8/6
				U25	8/6
				U26	8/6
				U191	10/6
				UABC80	7/6
				UAF42	10/6
				UBC41	10/6
				UBF80	10/6
				UCC84	10/6
				UCH42	10/6
				UF41	10/6
				UF89	8/6
				UL41	10/6
				UY41	8/6
				UY85	8/6
				VP23	10/6
				VR105	8/6
				VR150	8/6

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Marconi : VT63DA.

Baird : 2014, 2017, 2114, 2117.

Cossor : 930 & T, 931, 933-4-5, 937, 938 & A. & F. 939 & A & F, 943T, 946.

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