SERVICING TV RECEIVERS

PRACTICAL TELEVISION

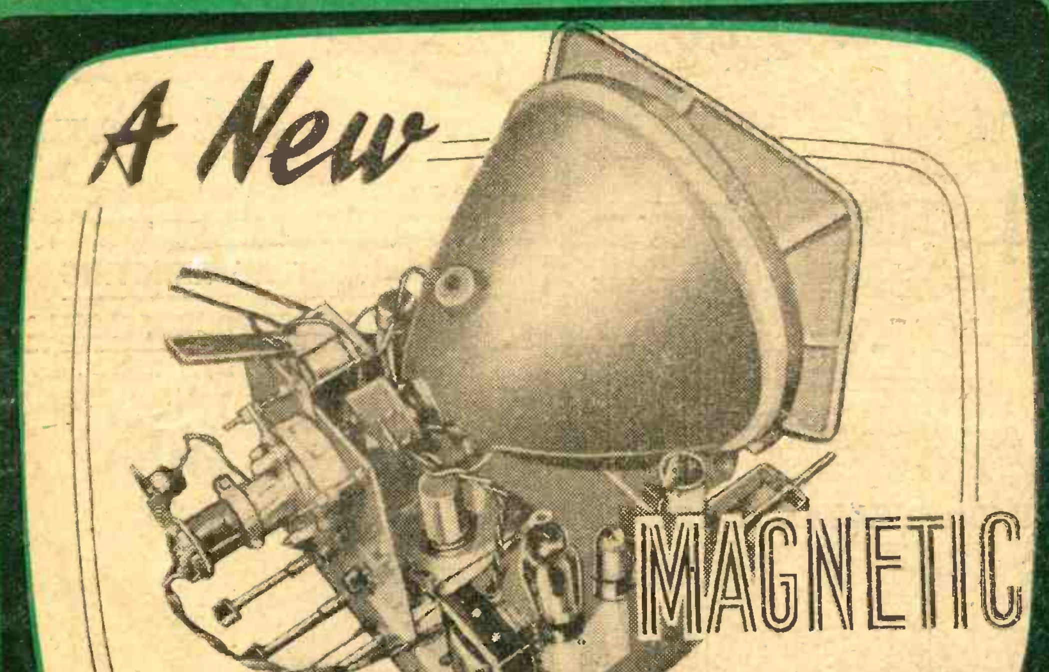
AND TELEVISION TIMES

1/-

EDITOR
F. J. CAMM

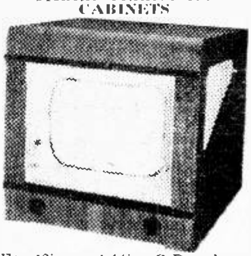
A NEWNES PUBLICATION

Vol. 5 No. 49 JUNE, 1954



FEATURED IN THIS ISSUE

TABLE TELEVISION CABINETS



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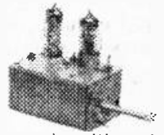

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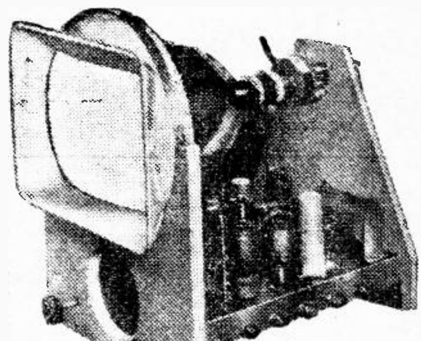

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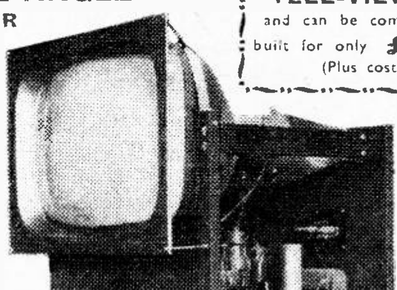
(Plus cost of C.R.T.)



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Televiews

COLOUR TV ON TAPE

THE Radio Corporation of America recently disclosed that it has developed its own system of recording colour television on magnetic tape. The system records and reproduces pictures in black and white and in colour with no intermediate operations such as film processing. In fact, it eliminates all chemical processing. An official of the company said that the magnetic tape recording of TV signals should make possible a simple means by which TV set owners can make recordings of TV pictures in their own homes. Such recordings can, of course, be played over and over again like a gramophone disc. A demonstration of the system showed the colours in true as distinct from the usually exaggerated reds, blues and greens of the cinema.

The same company has also announced that colour TV sets will be on the market about six months after the Federal Communication Commission approves the new colour system. The method of recording TV on tape corresponds in general principle to that employed for recording sound on tape or wire.

Colour TV can now be received in 35 big cities in the U.S.A. and by the end of this year the range will have increased to take in about 125 TV stations, which will bring colour TV to 75 per cent. of the American population.

Other American experts have been considering the problem from another angle—the tube or screen. Experts at the National Convention of the Institute of Radio Engineers in New York dealt with this in detail. The General Electric Company of America made the suggestion that the TV industry should adopt a single standard electron gun to replace the three types at present being used in America.

AN ATOMIC BATTERY

FROM America also comes the announcement that it is now possible to convert atomic energy, directly and simply, into small but usable quantities of electrical energy sufficient to operate a transistor, by means of an atomic battery. This direct conversion of nuclear energy may prove to be as significant as Edison's conversion of electricity to light. The battery recently demonstrated to the Press is powered by a minute quantity of long life strontium-90 radio-active isotope, obtained as a by-product of atomic reactor operation. This big stride has been achieved by coupling the battery's radio-active source to a transitor-like wafer which instantaneously releases about 200,000 electrons for each electron it receives.

This may prove to be the beginning of a new chapter in man's effort to utilise some of the enormous untapped energies within the nucleus of the atom for peaceful purposes rather than for the destruction of life. The atomic battery is likely to be applied first to portable and pocket-size radio receivers, hearing aids, signal control and similar devices.

Almost at the same time as the above announcements came the news that the Bell Laboratories have produced a "solar" battery. Made from strips of silicon, it is claimed that this battery is powered from energy radiated by the sun, and that it can deliver power at the rate of 50 watts a square yard of surface. This is approximately 50 million times the power of the atomic battery.

THE RADIO SHOW

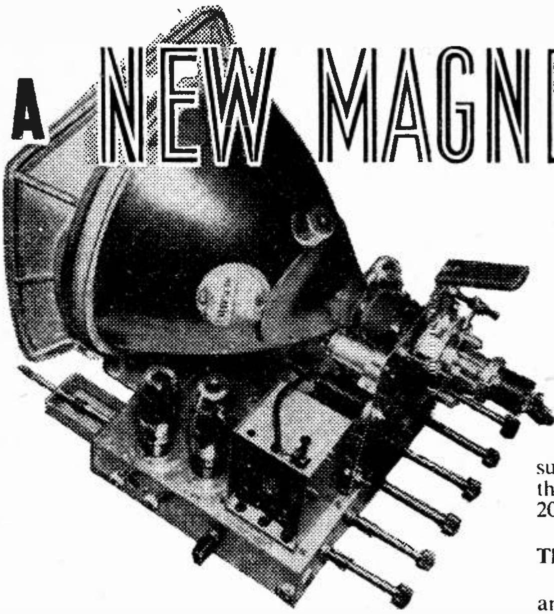
SPACE for this year's national Radio Show, to be held at Earls Court from August 25th to September 4th, is already overbooked. The demand has been greater than at any time since the war and this suggests that competition in the radio and TV market is likely to be even more competitive. All of the large firms in radio and TV are among the exhibitors, and all three services are taking space. The BBC are to be allocated more space than ever before.

PRACTICAL TELEVISION and our sister journal *Practical Wireless* will of course, occupy a stand.

INDEXES FOR VOLUME 4

INDEXES for Volume 4 are still available at 1s. 1d. each from our publishing department, address as above. Readers are advised, whether they have their copies bound or not, to obtain indexes so that they can rapidly trace articles and information published herein.—F. J. C.

A NEW MAGNETIC RECEIVER



CONSTRUCTIONAL DETAILS OF AN ECONOMICAL RECEIVER UTILISING SURPLUS COMMERCIAL RECEIVER COMPONENTS

By J. Cook

THERE are at present being advertised in these pages 9in., 12in. and 15in. narrow angle tubes and a number of key components at very reasonable prices, and it is a set of these which has been incorporated into the following design. This is not primarily a constructional article, with precise wiring and dimensional instructions, but rather is it intended to take the design section by section and dissect each in turn to show how it functions. Apart from prospective constructors, it may be that some readers will find this description interesting as a design study because some of the features, e.g., the method of D.C. shift controls, may be incorporated into existing equipments—always provided, of course, that underlying principles are appreciated. The warning remarks which appeared in the Editorial of this magazine some months ago concerning the many pitfalls of mixing circuits are most heartily endorsed by the writer.

Balancing cost against desired performance usually means accepting sub-standard results, but whilst the endeavour of this design has been to simplicity and economy of components the receiver maintains a full frequency response, excellent interlace, linearity, etc. Modern circuit techniques are employed, but the older and more cheaply obtained B9G and octal based valves are used. Any C.R.T. with a scanning angle not much greater than 50 deg. may be used and will be fully scanned, with an inch or two to spare, with the E.H.T. of 7 to 8 kV. derived from the line output auto-transformer. Since this is accomplished without an efficiency diode, which is the normal practice, it will be appreciated that the line transformer is quite an efficient component. A further economy in this stage is effected by operating the line output valve as a self oscillator, thus saving at least one valve and several components. The C.R.T. illustrated is the ion-trap type Mullard MW31/16; the more current type being the MW31/74. This is a similar tube but with a grey filter face plate. The equipment uses eight valves for video, timebases and power supply. Sound and vision strip valves account for the remainder and the receiver is designed for use on 200-250 volts A.C. only.

The Circuit

Apart from the question of T.R.F.-versus-superhet and, if the latter, the design of the mixer/oscillator combination, designs vary but little. Since many suitable vision and sound strips have been described in these pages, the circuitry of the author's receiver is included for interest only because the modified "Pye" strip used on the vision side is suitable for the 45 Mc/s London transmissions only, it being a T.R.F. line-up. In fact, unhappily, the T.R.F. seems to be dying a natural death due to the difficulty of retuning a vast number of tuned circuits when alternative channels are desired. However, if the 45 Mc/s channel is required, the "Pye" strip can hardly be bettered for performance and for ease of adaptation from its service rôle. With five R.F. stages and no less than 10 tuned and one broad-band inductance, the alignment of this strip to get the very best out of the BBC transmissions is a relatively simple matter since the strip is aligned to give at least 4 Mc/s bandwidth as it stands. The input coil has no variable core and is broadly tuned at 45 Mc/s; all the anode coils are peaked at 46.75 Mc/s with the exception of the final (diode) coil, which is peaked at 45 Mc/s; and the grid coils are all at 43.25 Mc/s as aligned at factory. Thus a little judicious stagger tuning, taking care not to overdo it on the sound channel side because of breakthrough, enables a bandwidth of 6 Mc/s for double sideband reception to be obtained without any great difficulty. Principal modifications are associated with the cathode biasing arrangements where a potentiometer controls the gain of the first two R.F. stages and controls picture contrast. Partially unby-passed cathode resistors develop negative feedback to counteract the changes of input capacitance and impedance which would otherwise introduce serious changes of tuning. The contrast control is located on the separate time-base chassis via cabling for the convenience of having all variable controls together. Sound input is extracted from the anode circuit of the second vision R.F. stage and fed thence into the two R.F. sound receiver; the sound output stage with associated gain control is located on the main time-base chassis.

Detector

The diode detector (EA50) is connected in such a manner that a positive-going signal is presented to the following video valve, i.e., the output is taken from the cathode. If the " Pye " strip is used the connections must be reversed to meet this requirement. The R.F. choke (Ch. 1) forms a low-pass filter with

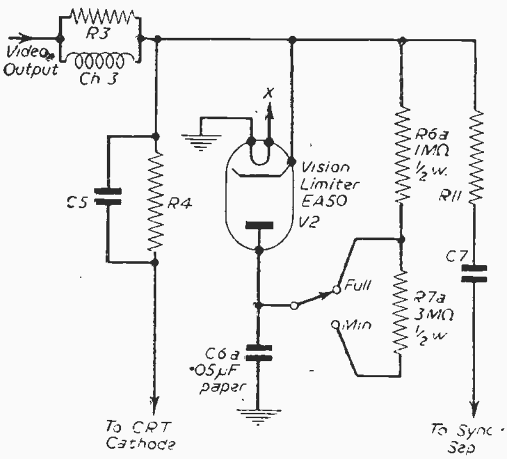


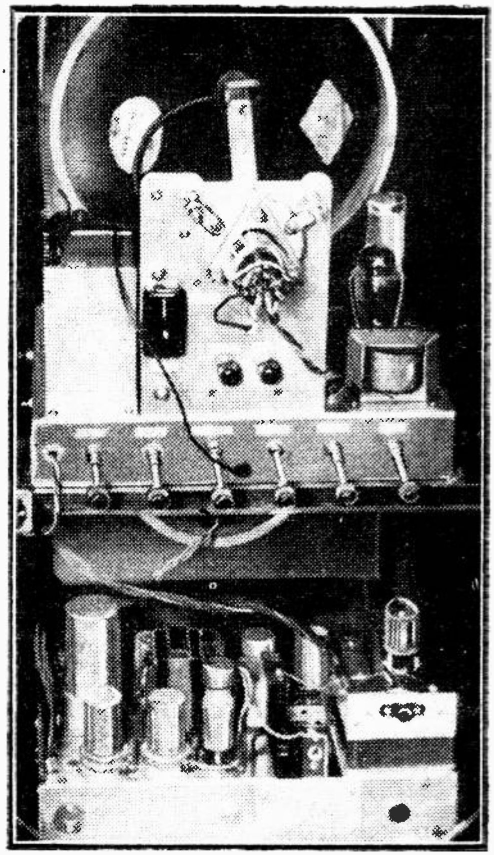
Fig. 2.—An alternative vision interference limiter circuit.

its associated components designed to reject the carrier (T.R.F.) or I.F. and harmonics (superhet). The two chokes used for this purpose in the " Pye " strip add up to about 5 mH., but rather more, some 200-300 mH., will be required in a superhet depending on the intermediate frequency. The load resistor (R1) must be as low as possible to maintain high-frequency response, but high enough to ensure reasonable detector efficiency. A value of 5.6 KΩ has been found a reasonable compromise although lower values may be tried and possibly preferred by some.

Video

The special EF55 valve has been tried in this position (V1), but it was found the " Old Faithful " EF50 when used with a high anode load resistor was capable of fully modulating any normal tube requiring something like 30 volts swing—and with greater economy having regard to the higher current requirements of the former valve. Inductance compensation is used in the anode load to offset the inevitable H.F. loss incurred by the high anode load. Provided that none of the coils in the preceding vision strip is peaked exactly to the resonant frequency of the chokes Ch. 2 and Ch. 3, very little " ringing " should be discernible. It should, perhaps, be explained that " ringing " is visibly apparent by the outlining of all details on the screen by a secondary image. A damping resistor (R3) is to prevent the over-resonance which would cause this effect. Additional H.F. compensation is provided by the by-pass condenser (C3) across the cathode bias resistor (R5). The value of this condenser has a profound effect on picture quality, being quite critical and varying from one set to another due to the different stray capacities associated with the video output lead and components going to the modulation electrode of the C.R.T. In fact, one TV set manufacturer has recently made the capacity variable and labelled it " Quality Control." What happens is that negative feedback is developed across R5 at low frequencies, when the condenser then has negligible effect. But as the frequency rises, the condenser becomes effective as a by-pass and the gain of the valve increases due to the reduction of negative feedback which provides a degree of correction dependent on the value of C3. Some experiment to determine the best value of this component is well worth while, for upon it depends the quality of the picture.

A 0.001 μF condenser is a good value to start with and, by increasing the value in steps of, say, 500 pF in parallel, the effect can be observed on the screen until a value is reached when L.F. response suffers and outlining haloes appear at the right-hand edges of images. A value slightly less than this is the correct value. In the author's receiver it was 0.0035 μF, but this value was probably rather higher than normal due to a long video lead to the tube. This long cable, though not good practice because of the extra capacity introduced affecting H.F. response, is, nevertheless, in order if it is possible by compensation to resolve the full bandwidth adequately. This is fortunate in large screen receivers because, as the tube diameter increases, the distance between tube



The finished receiver in a console cabinet.

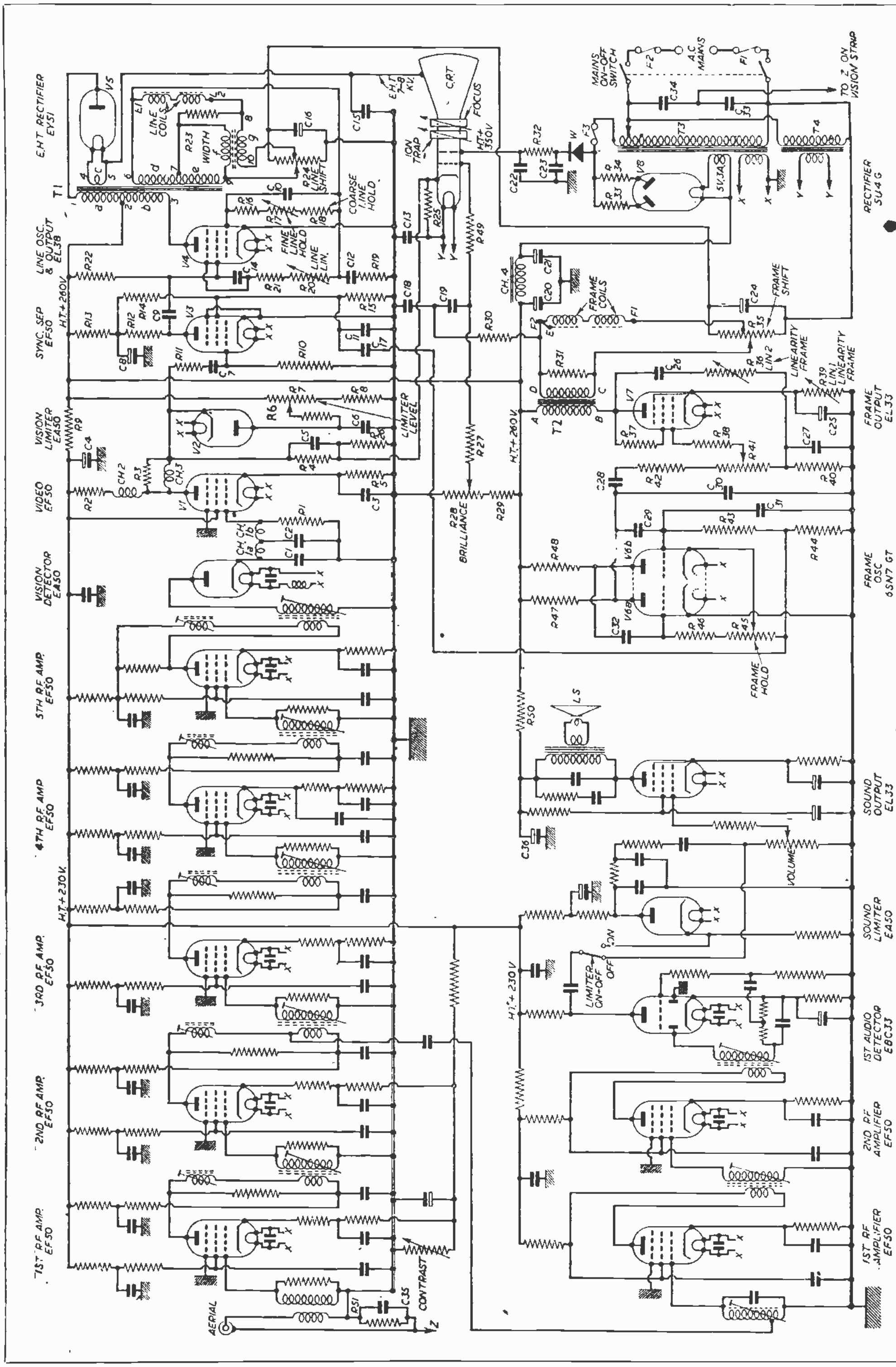
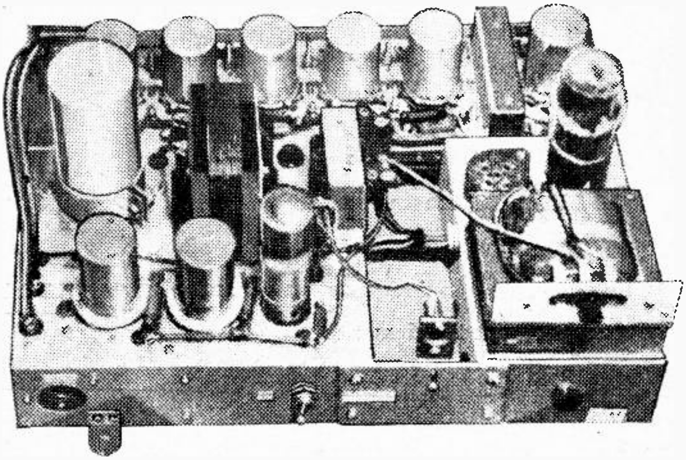


Fig. 1.—Complete theoretical circuit of the receiver.

socket and chassis and hence the length of the video lead unavoidably increases also. At all events, the resolution of the 3 Mc/s bars in the test pattern is the final acid test.

Cathode modulation of the C.R.T. is effected through a resistance (R4) and associated by-pass condenser (C5). If a C.R.T. with a tetrode gun is used, the D.C. voltage applied to the cathode is nearly halved by R26 so that the voltage of the first anode may be reasonably low to maintain the required difference of about 250 volts. If a triode gun C.R.T. is used R26 is not necessary and need not be fitted. The feed circuit R4/C5 possesses a long time-constant. This is an arrangement which is finding increasing favour among manufacturers now because moderate changes in D.C. level of the picture, such as those sometimes experienced when going from one camera to another or picture "flutter" due to aircraft, are greatly reduced by this simple arrangement. When a change of D.C. level occurs causing the beam current to rise, the voltage across R4 increases proportionately. This increase of voltage across R4 biases the tube back.

(To be continued.)



Vision sound strips and power pack. Front left : Sound receiver with main H.T. smoothing components. Front right : Power pack. Rear : Pye vision strip.

LIST OF COMPONENTS

CONDENSERS

(All condensers have a working voltage rating of 350 volts unless otherwise stated.)

C1, C2—5 pF mica
C3—See text
C4—32 μF electrolytic
C5, 6, 7, 13, 22, 23, 28—0.1 μF
C8—16 μF electrolytic
C9—200 pF mica
C10—0.5 μF
C11, 26—0.005 μF mica
C12, 18, 31, 35 0.002 μF mica
C14—300 pF mica
C15—0.001 μF 12.5 kV (see text)
C16, 24—1000 μF electrolytics, 6v (can insulated)**
C17, 30, 32—0.05 μF
C19—0.01 μF
C20—100 μF electrolytic, surge limiting TV type
C21—64 μF electrolytic, surge limiting TV type
C25—100 μF electrolytic, 50 v.
C27—0.015 μF (0.01 plus 0.005 μF)
C29—500 pF mica
C33, 34—0.01 μF, 500 v.
C36—16 μF electrolytic

RESISTORS

(All resistors ½ watt rating unless otherwise stated.)

R1, 38—5.6 kΩ
R2—8.2 kΩ 2W
R3, 30, 49—22 kΩ
R4—220 kΩ
R5—270 Ω
R6, 40, 42—470 kΩ
R7—100 kΩ variable
R8—27 kΩ
R9—500 Ω 2W
R10, 32, 51—1 MΩ
R11—10 kΩ
R12—15 kΩ
R13, 21, 46—47 kΩ
R14, 15, 25, 27, 43, 44—100 kΩ
R16—220 Ω 2W
R17—100 Ω variable 3W
R18—1 kΩ variable 3W
R19—5 kΩ 10W
R20, 28—50 kΩ variable
R22—6.8 kΩ 10W
R23, 2.2 k—2.2 kΩ
R24—10 Ω variable pot. 1½W centre tapped**
R26—270 kΩ*
R31—470 Ω
R33, 34—45 Ω 5W
R35—6Ω variable pot. centre tapped**
R36, 41, 45—1 MΩ variable potentiometers
R37—33 Ω
R39—5 kΩ variable
R47—1 MΩ 1W
R48—100 kΩ 1W
R50—200 Ω 1 W

TRANSFORMERS AND CHOKES

T1—Plessey line output transformer Type SL7, Part No. CP.72036/2 or CP.72036 complete with width inductance.
L1/L2 and F1 F2—Deflector coils, low impedance line and frame to match above.
(Both the above manufacturers' surplus items available as a set together with focus coil from Radio Clearance, Ltd., Tottenham Court Road, W.1.)
T2—Multi-ratio frame output transformer (manufacturers' surplus available from Laskys Radio, Harrow Road, W.9)
T3—TV type auto-transformer, input 200 to 250 volts A.C. overwound to 300 volts at 250 mA. Heater windings 6.3 volts 8 amps, 5 volts 3 amps. (Obtainable from Premier Radio, Ltd., Edgware Road, W.2)
T4—Small heater transformer to suit C.R.T. (e.g., 6.3 volts at minimum of 0.3 amp. for MW 31/16)
Ch.1a, Ch.1b—See text
Ch.2, Ch.3—Universal video peaking chokes. Made by Denco
Ch.4—3 to 5 henry 250 mA smoothing choke, 50 ohms D.C. resistance

MISCELLANEOUS

F1, F2—2 amp. fuse
F3—750 mA fuse
V1, 3—EF50
V2—EA50
V4—EL38
V5—EY51 or SU61
V6 6SN7GT
V7—EL33
V8—5U4G
W—S.T.C. rectifier K3 25 or similar

*See text. **May be omitted if desired.

Modifying the R3118 and the ZC8931

CONVERSION DETAILS FOR A POWERFUL SOUND AND VISION RECEIVER

By B. L. Morley

(*Concluded from page 554, May issue*)

MODIFICATIONS to the vision stages are very simple. They are as follows :

*V*5.—Take two brown wires from pin 7 and connect together, clear of the valve. Remove the 0.1 μF from pin 7 to earth and short circuit pin 7 to earth.

*V*6 and 7.—No modifications required.

Contrast Control

This should be fitted on the front panel as given previously ; the brown wire previously wired to the centre of the "Gain" socket should be connected to the centre tag of the control and the other tag should be connected to earth. Make certain to reconnect the 50 μF condenser.

Detector V8

This valve was originally used for pulse input controlling the suppressor grid of V9.

To modify it disconnect the wire from L8 to the grid of V9 and connect it to the cathode of V8. Disconnect the cathode of V8 from earth. The connection of L8 to the cathode of the diode is most easily arranged by disconnecting the grid V9 wire from the top right-hand tag by the coil, and running a wire from this point through a spare hole in the base of the screening can to the cathode of V8.

Wind the filter coil as per the data.

Remove the 470Ω and 470 KΩ resistances from pin 7 of V9 and drill a hole in the chassis by the side of pin 7. Fit a small grommet in the hole and run a short piece of flex from the pin to grid of the valve. Fit a 4.7 KΩ from pin 7 to earth and connect the filter coil from pin 7 to the anode of the detector, and at this point connect a 15 pF condenser to earth.

Video Valve

Earth the suppressor grid (pin 5) of the valve ; remove the 100Ω cathode resistor and fit 47Ω in lieu. (A value between 47Ω and 68Ω is suitable.)

Connect an 8 μF condenser from the screened grid of V9 to earth. The condenser can be mounted on a clip on the side of the chassis. (A condenser of the Drilytic type is most suitable.)

Remove the small resistor panel from L9 can and mount it at the end of the resistor panel containing the 4.7 KΩ resistors underneath the chassis. The little panel should be fitted at right angles to the existing panel.

Wire up the panel by taking the red wire previously running through the bottom of L9 can to the junction of the 1 KΩ resistor and the 0.002 μF condenser, and the yellow wire to the screened grid of V9 and the other side of the 1 KΩ resistor. Wire from the 10 KΩ resistor to the anode of the video valve and connect the other side of the 0.002 μF to earth.

Wire the existing screened cable previously going to the "Pulse Input" socket so that one end is connected directly to the anode of the video valve and the other end to the video output socket.

If a magnetic tube is being used, then it is worth while to replace the screened wire with a short section of coaxial cable.

This completes the vision section. (Fig. 6.)

Cathode Modulation

The circuit arrangements just described are quite suitable for the VCR97 or for a magnetic tube which is connected to a timebase via a cathode follower and uses grid modulation. Where cathode modulation is desired, then the video valve output must be altered in accordance with Fig. 5b, while if direct connection to the grid of the picture tube is desired, then Fig. 5a circuit can be used.

Note that the detector is connected for grid modulation ; if cathode modulation is to be used the detector valve must have its anode and cathode reversed, and the bias resistor of V9 must be increased to 220Ω.

The Sound Section

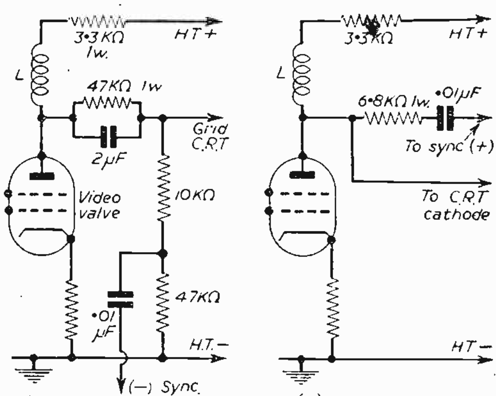
This section requires a little more work than the vision stages.

*V*10. This becomes the first sound I.F. As the frequency is 9.5 Mc/s the tuning of the coils must be altered. This is carried out simply by connecting an 0-30 pF postage stamp trimmer across each I.F. coil.

The hole which is spare in L9 can is enlarged to take ¼in. diameter coaxial. A similar hole in can L5 is also enlarged. A short section of coaxial cable is now run between the two cans.

Put 2 turns of approximately 22 swg enamelled wire on top of the coil in L5 and earth one end. Take the other end to the centre conductor of the coaxial cable and earth the outer of the cable. Do exactly the same thing in can L9.

The trimmer can be mounted on the upright metal strip which holds the can itself and it should be so



(a) Grid modulation Magnetic C.R.T. (b) Cathode modulation Magnetic C.R.T.

Note: L can be 3Mc/s boost choke as used in "Viewmaster".

Fig. 5.—Alternative methods of feeding the tube.

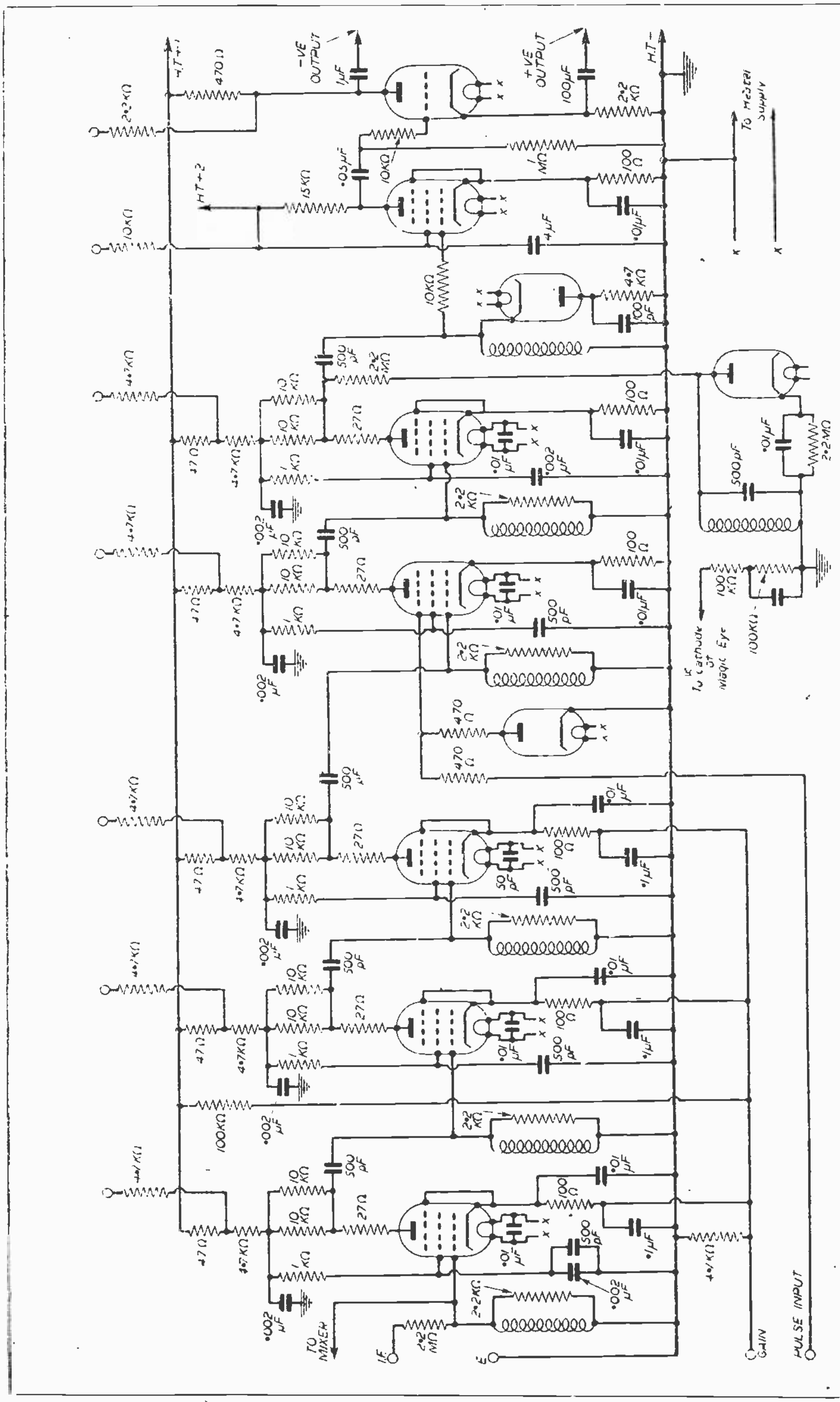


Fig. 4.—Circuit of the I.F. section of the R3118. As mentioned in last month's issue, the point marked " Pulse Input " should be replaced by a standard Pye aerial socket and then becomes the video output point. The valves are referenced from the left, starting at V5, thus continuing the sequence from Fig. 1 of last month's article.

arranged that the trimmer can be adjusted when the can is on.

The 2.2 KΩ resistor should be removed from across the coil.

2nd Sound I.F.

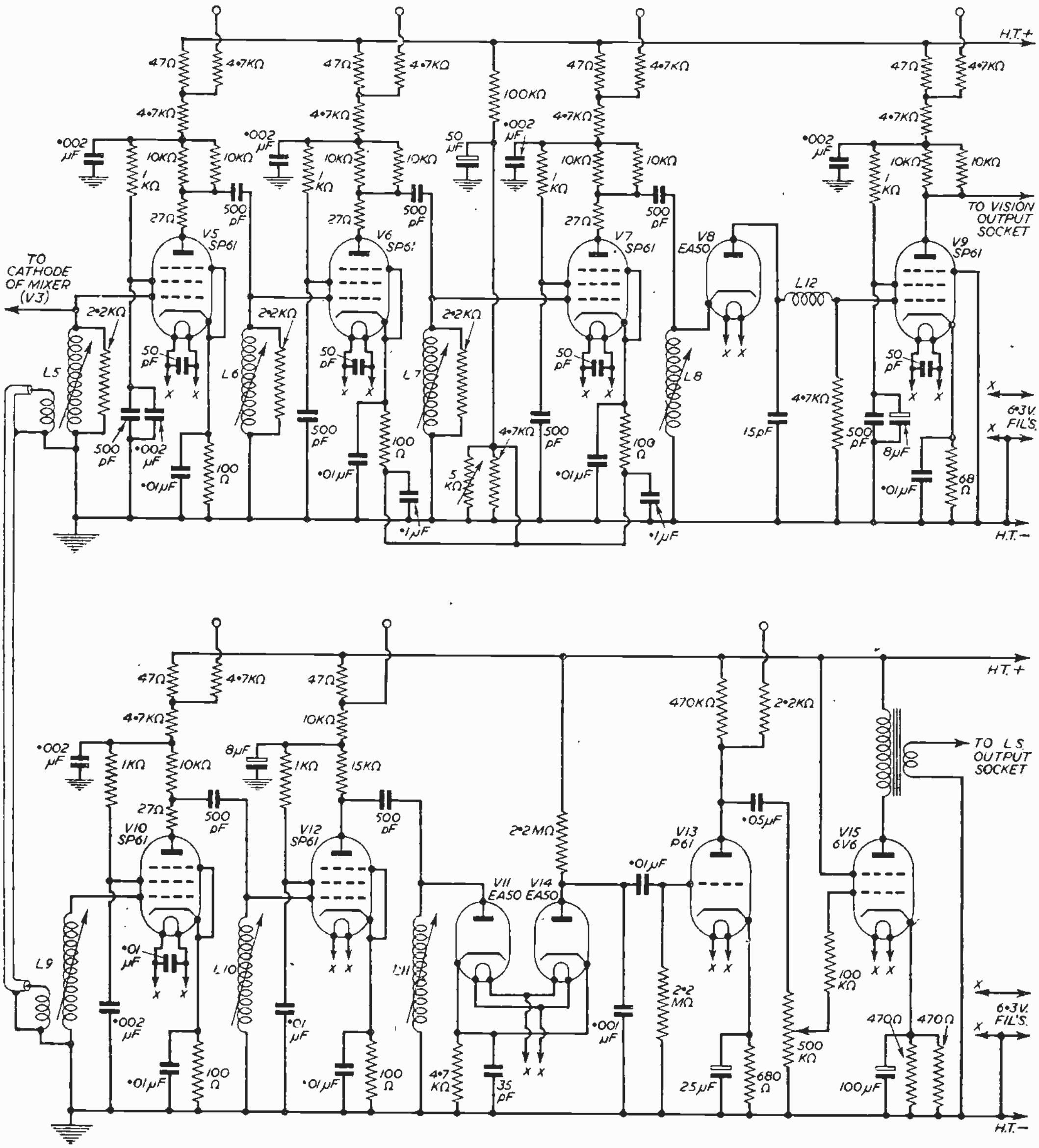
Take out the bottom 10 KΩ resistor on the panel in can L10 and fit the trimmer. Disconnect the white wire: remove the 10 KΩ resistor from the cap of V12 and short circuit the tags on the cap. Change the cap lead to the top tag of coil L10.

Now take two yellow wires from tag 4 and insert a 10 KΩ resistor between the yellow wire and tag 4. The cathode of the valve should now be decoupled with a 0.01 μF condenser.

Detector and Noise Limiter

Remove the 100 pF from the cathode of V14; strap the cathode of V14 to that of V11, and connect a 35 pF condenser between the cathodes and earth. Disconnect the 2.2 MΩ from the top of L11 can and fit 500 pF in lieu. This 500 pF is one removed from lower down the small tag strip. It is mounted as in the previous can.

Remove the 10 pF from inside L11 can and recover the 100 pF and 4.7 KΩ from the strip by V11. Run



Figs. 6 and 7.—The vision and sound sections.

a wire from can L11 to the anode of V11 and fit the 4.7 KΩ between the cathode of V11 and earth.

Reference to Fig. 7 should make the matter clear.

Remove the 100 KΩ resistor and connect the anode of V14 to the 2.2 MΩ resistor in L11 can and

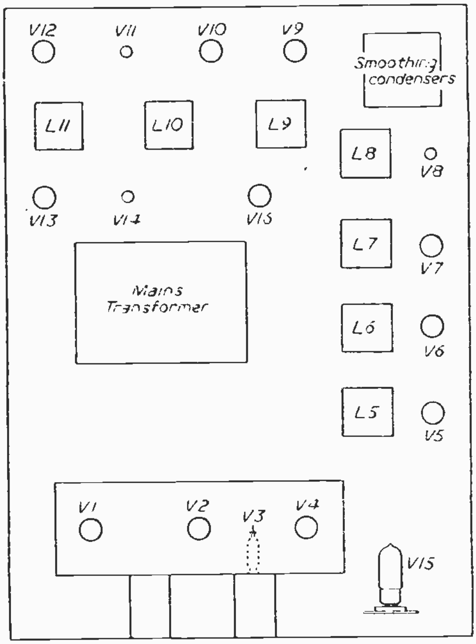


Fig. 8.—Chassis layout.

take the other side of the resistor to H.T. positive line.

Disconnect the red wire running between cans L11 and L10 and divert it to the anode of V12.

First Audio

Remove the 2.2 KΩ cathode resistor from V13 and replace it with one of 680 ohms. Fit a 25 μF 25 volt wkg between the cathode and earth and disconnect the lead going to the 100 μF condenser. Insert a 470 KΩ resistor in the anode circuit of the valve and disconnect the 1 μF paper type condenser; in its place insert an 0.05 μF mounted on the side of the chassis.

Wire the volume control as shown in Fig. 7.

Sound Output

The magic eye should have been removed and the holder is now wired for a 6V6. The red wire is the heater common and the black wire is the earth. The yellow wire goes via the switch operated by opening the tuning panel and the switch should either be removed or the contacts short circuited. This wire now becomes the H.T. positive feed for the 6V6 and should be connected to pin 4.

VOLTAGE READINGS AT TEST PANEL

V1 ...	1.5	V6 ...	1.5	V10 ...	1.5
V2 ...	1.5	V7 ...	1.2	V12 ...	3.0
V3 ...	1.1	V9 ...	1.25	V13 ...	4.0
V5 ...	1.8			V15 ...	20.0

Connect a 100 KΩ resistor on the component strip by the magic eye and remove the other resistors. This resistor now becomes the grid stopper for the 6V6. The other side of the grid stopper goes to the slider of the volume control.

The green wire on the magic eye is used for the cathode of the 6V6 and underneath the chassis it is diverted to the positive side of the 100 μF condenser. Two 470Ω resistors are connected across the tags of this condenser.

The output transformer is fixed underneath the long metal strip, towards the front end of the chassis, upside-down. It is wired as shown in Fig. 7 and one side of the output is earthed, while the other side is taken to the Pye output socket. (One side of the Pye socket must also be earthed, of course.)

This completes the modifications. Fig. 8 shows the layout at the top of the chassis.

The wiring should now be checked before checking the alignment.

Alignment

Connect phones or a loudspeaker with its output transformer to the video output socket, via a condenser of about 0.1 μF.

Connect an aerial to the aerial socket and insert the mains plug: switch on and allow the set to warm up. Set the contrast to maximum.

The vision signal should now be tuned in. If the tests given previously have been made there should be no difficulty in getting the signal. The vision signal sounds like a mixture of rough hum and motor-boating.

Note the position of the trimmers and now tune in the sound signal and again note the position of the trimmers.

The loudspeaker (without transformer) should now be connected to the loudspeaker output socket and the oscillator should be swung until the sound signal is heard. Adjust the trimmers to maximum volume, and note the position of the oscillator.

Now reset the oscillator for the vision signal and retrim the sound I.F.s.

Gradually work the oscillator from sound position to the position obtained for vision and when the two readings approach each other go back to the vision stages.

Once again adjust all tuners to maximum vision

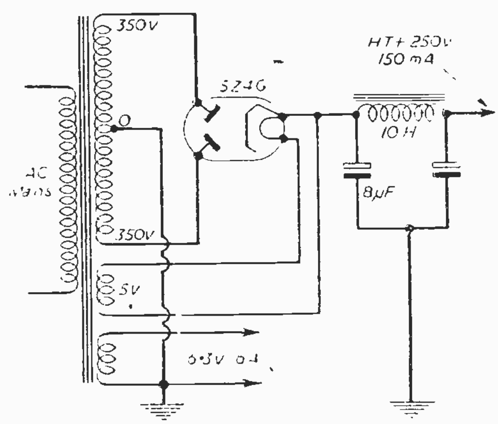


Fig. 9.—Circuit of a suitable mains unit.

signal and then adjust the oscillator until the "volume" of the vision signal is reduced by half. Note the position of the oscillator. Now go back to the sound channel and adjust the oscillator for maximum sound and finally adjust the sound I.F.s for maximum sound.

The position should now be reached where the vision signal is correctly positioned and has plenty of "volume" and the sound has plenty of volume.

Final adjustments to vision and sound are best done when Test Card C is being radiated.

Power Pack

In the case of the ZC unit a power pack will be necessary; this need not be elaborate and a suggested scheme is given in Fig. 9.

Instability

If difficulty with regeneration is experienced then further decoupling can be added by connecting a 500 pF condenser across each 50 pF decoupling condenser.

Increasing the Gain

An increase in gain can be obtained by disconnecting the 2.2 KΩ damping resistors from the vision I.F. coils.

Increasing the quality

The band-width of the vision I.F. stages should be ample to provide a signal of good quality. If quality is poor, then the vision I.F. coils can be retuned. It should not be normally necessary to do this, but if it is attempted, then the work should be done on Test Card C so that the result of the operations can be observed.

Test Voltages

One useful feature of the unit is that a small test panel is provided so that valve voltage readings can be checked. A list of those obtained with the prototype is appended.

Pre-Amps

In the remote areas a pre-amplifier can be used and circuits for such pre-amps have been given from time to time in the pages of this journal.

Note that any pre-amp used must be equipped with its own power supply. The existing power supply of the unit is already worked to the limit by using the 6V6 valve.

BBC Station and Studio News

North Hessary Tor

FOLLOWING the Public Enquiry at Exeter in September, 1953, the Minister of Housing and Local Government on January 25, 1954, gave his formal planning permission for the erection of a BBC television station on North Hessary Tor, subject to agreement between the BBC and the Devon County Council as to the exact position of the building and mast. Agreement has been reached on this point. It is, however, alleged that there are commoners' rights affecting North Hessary Tor, of which the present owners of the land have no records. The legal processes involved in disproving the existence of these commoners' rights or alternatively of extinguishing any commoners' rights which may exist on the very small amount of land which the BBC would need to enclose may take several months and may still further delay the television service for Devon and Cornwall. In the meanwhile the BBC is taking all possible steps towards the provision of the transmitters so that any delay may be minimised.

The Meldrum Station

A contract for building work at the new medium-power television transmitting station for North-East Scotland, at Meldrum, Aberdeenshire, has been placed with Alexander Hall & Son (Builders) Ltd., of Aberdeen.

The contract covers the provision of the main station building, the drainage system, service roads, and fencing.

Crystal Palace Station

A contract has been placed with British Insulated Callender's Construction Co., Ltd., for the design, supply and erection of a self-supporting tower to carry the aerials for the new London Television Transmitting Station at Crystal Palace.

This new tower, which will be designed and built to comply with the BBC's specification of structural requirements, will have a height of 640ft. It will be of lattice steel construction, tapering from 120ft. square at the base to 9ft. 6in. square at the 440ft. level. Between 440ft. and 600ft. the tower will have parallel faces 9ft. 6in. across; on this portion will be mounted eight stacks of four dipoles forming the Band I transmitting aerial. Above this there will be a topmast 40ft. high and 2ft. 6in. square.

Provision is made at the 440ft. level for the installation of dish-type receiving aerials for picking up outside broadcast transmissions. There will be a hoist between this level and the ground.

The tower will be equipped with aircraft warning lights to comply with the requirements of the Ministry of Transport and Civil Aviation.

It is expected that the main structure of the tower will be completed by the autumn of 1955.

New Studio Equipment

Contracts have been placed with Marconi's Wireless Telegraph Co., Ltd., Electric and Musical Industries Ltd., and Pye Ltd., for new television cameras, picture monitors and other equipment for studio use.

The Marconi contract covers the provision of 16 cameras using the 4½in. Image Orthicon pick-up tube developed for studio use, the associated camera channel apparatus, six vision mixing and pre-view switching equipments, distribution amplifiers and waveform generators.

The Marconi Image Orthicon Cameras are of the same type which will be used with the four BBC Television Outside Broadcast Vehicles now under construction at Marconi's Chelmsford Works.

The Pye contract covers the provision of 62 picture monitors.

This equipment will be used to re-equip some of the existing television studios and to extend studio facilities in the London area.

A Simple WOBBULATOR

CONSTRUCTIONAL DETAILS OF AN EASILY BUILT INSTRUMENT SUITABLE FOR ALIGNING TELEVISION RECEIVERS

By S. C. Murison

(Concluded from page 546, May issue.)

THE potentiometer now has a 360 degree travel. During 170 degrees of this the resistance between the wiper and one of the track ends varies linearly. During the remaining 190 degrees the wiper to track end resistance is constant except for a momentary open-circuit at the point where the wiper leaves the end of the foil.

Construction

The form which the instrument takes need not be the same as that shown in the photographs. Changes must not be made to the layout of the oscillator, however, unless the constructor has facilities to ensure that the performance is not impaired by the changes. The layout of the parts in the oscillator can be seen from the photographs. A single earthing point is used at the side of the valve-holder away from C3. The earthing wire from the rotor of C3 should not be forgotten in wiring up.

Fig. 4 gives details of the brackets used on the original. No tools beyond a hack-saw, a hammer, a vice and a drill need be used in making the brackets. Aluminium sheet of 16 s.w.g. was used for the originals. The side flanges on each bracket are present to improve their rigidity and should not be omitted. It is recommended that two flexible couplers in tandem be used to couple the shaft of C3 to that of RV2. This makes their alignment very little trouble.

The only connection to the wavemeter is made by a 3in. length of coaxial cable, which is soldered to the wavemeter before it is fastened in place, because it is not accessible afterwards. The screw used to secure the wavemeter coil to the front panel should be no longer than is necessary to hold the coil firmly. Too great a length of screw projecting into the coil can damp it and by so doing will broaden the appearance of the frequency marker. An ideal solution is to stick the former to the panel with a *really good* adhesive.

If the same oscilloscope is to be used all the time with the wobbulator, it may not be necessary to build a power pack into the wobbulator. It may be possible to arrange a plug and socket arrangement for the power supply to the internal timebase, so that when the wobbulator is used it uses the power which is normally fed to the timebase. If this course is adopted, it is safer to leave L3, C8 and C9 on the wobbulator. This improves the decoupling and minimises any tendency for feedback from the oscilloscope to the wobbulator. The requirements of the wobbulator are 6.3 volts at 0.75 amps and 300 volts at 12 mA.

If a great deal of alignment is to be undertaken and the user does not wish to tie up an oscilloscope exclusively for this work, a simple unit on the lines of Fig. 5 makes a convenient solution without undue expense. The simple Y-axis amplifier can receive its heater and H.T. supplies from the wobbulator via a plug and socket. The same plug and socket can carry the X-axis sweep voltage. It is not recommended that the same cable be used for the mains supply to the monitor unit. A multi-core cable for this purpose can be seen on some of the illustrations.

It should be noted that the Y-axis amplifier used to display the output of the receiver need not have a good high-frequency response. Providing that enough gain at 20 to 30 c/s is available to allow a reasonable vertical deflection to be obtained, there are no complicated requirements for this amplifier.

Setting-up

When the instrument is fully wired, a check to make sure that it is oscillating should be made. At this stage its output frequency will probably be unknown: and consequently the easiest way is to short-circuit C3, while watching the glow in V2. With RV1 fully clockwise, short-circuiting C3 results in the glow in V2 dimming.

The first step in the setting-up process is to make the left-hand end of the trace correspond to the low-frequency end of the wobble. Disconnect one side of the mains going to the motor and tape it or otherwise render it harmless. Slacken off the grub screws

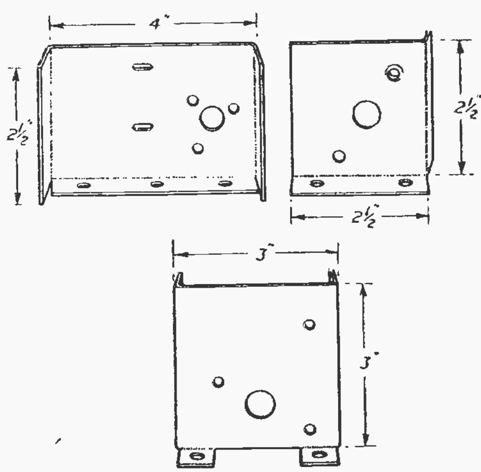


Fig. 4.—Details of the mounting brackets.

in the couplers between C3 and RV2. Connect the wobbulator to the oscilloscope and connect both to mains. By hand, turn the shaft of RV2 until the spot is fully to the left of the screen. Now turn C3 to its maximum capacitance position, and then turn it five degrees towards minimum capacitance in the same direction as the motor will turn it. Tighten up the grub screws on the couplers without disturbing the relative positions of C3 and RV2 shafts. The motor lead should now be connected. *It should be noted that the method given above will only work when there is a direct connection from the wiper of RV2 to the X1 plate.* Even if it is not intended to use the wobbulator with such a connection, it should be employed for setting-up purposes.

The next step is to calibrate the wavemeter. Although easier methods may suggest themselves, the method which follows is recommended because of the accuracy which is possible with it. A detector of some kind is necessary. The simple circuit given in Fig. 6(a) is very suitable. A signal generator covering 40 to 70 Mc/s is necessary. The only important thing required of this generator is good frequency calibration. If a constructor does not have one of his own, he should be able to borrow one by virtue of the happy relationship which always seems to exist between service mechanics and constructors.

Using the arrangement of Fig. 5, tune the signal generator to 70 Mc/s. Set C1 to maximum capacitance. Reduce the value of C2 and unscrew the core of L2 until a pattern like that of Fig. 6(b) appears on the screen. This pattern is produced by a beat between the wobbulator and the signal generator. Now tune C1 until the frequency marker coincides with crest of the beat pattern. If the wavemeter cannot be tuned high enough in frequency, gently increase the spacing between the turns of L1 until it can tune to 70 Mc/s. When this has been done, paint the turns of L1 with coil dope. Mark the pointer position corresponding to 70 Mc/s.

Tune the signal generator to 65 Mc/s, adjusting the core of L2 and the setting of C2, if necessary, to keep the beat pattern on the screen. Tune the wavemeter to coincide with the new position of the beat pattern. Mark the pointer position for 65 Mc/s. This process is continued down to and including 40 Mc/s.

It is a matter of personal preference how many points on the calibration of the wavemeter should be permanently marked. Probably the best method is to calibrate every 5 Mc/s point in one colour and to mark the extremities of each television channel in another colour. It is worth taking pains in the calibration of the wavemeter, for it will be used throughout the life of the wobbulator as a reference to frequency, not only in making measurements on receivers but also in changing the wobbulator from one channel to another.

When the wavemeter has been calibrated, it only remains to adjust C2 and L2 for the desired channel. To do this a detector is still necessary, but the signal generator is not. As a detector either the arrangement of Fig. 6(a) may be used, or the wobbulator output cable may be fed into the aerial socket of a receiver tuned to the desired channel. If the latter method is used, the Y-axis of the oscilloscope should be fed from the anode of the video amplifier valve. The actual procedure is the same whether C2 and L2 are being set-up for the first time or whether a change of channel is being made.

Set C2 to minimum capacitance. With the wavemeter set to the highest frequency required for the desired channel, adjust the core of L2 until the frequency marker appears on the right-hand side of the trace. Now tune the wavemeter to the lowest required frequency and adjust C2 to bring the frequency marker to the left-hand side of the trace. Re-tune the wavemeter to the highest frequency and readjust the core of L2, if necessary, to bring the frequency marker to the right-hand side of the trace. Return to the lowest frequency of the channel and check the setting of C2. Repeat this process until the ends of the

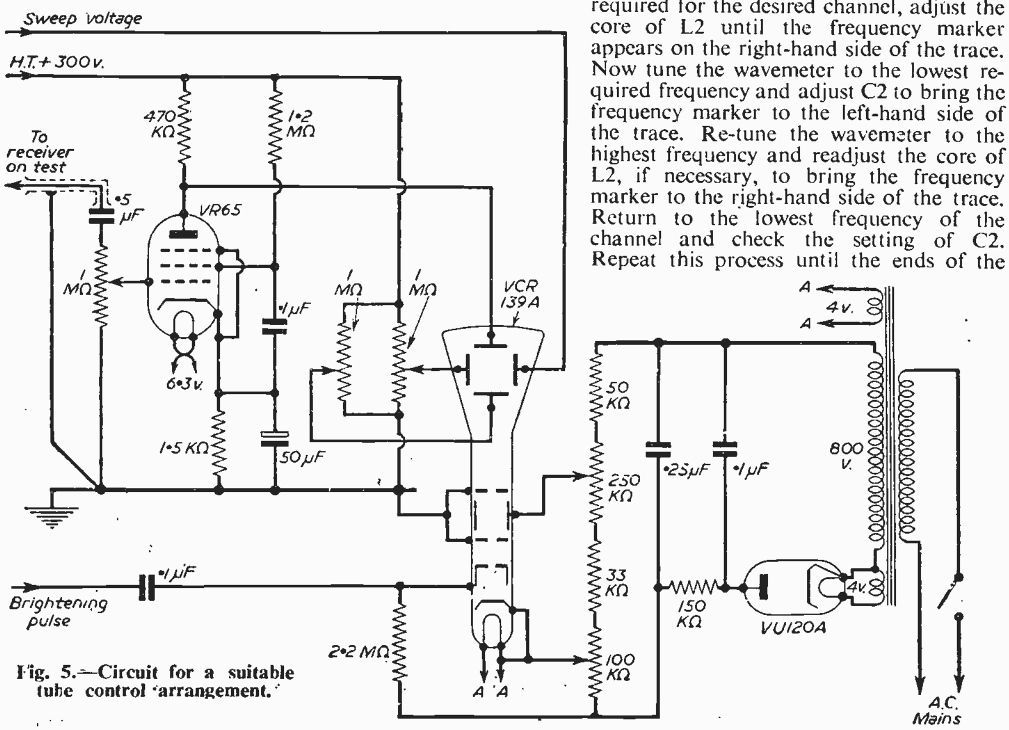


Fig. 5.—Circuit for a suitable tube control arrangement.

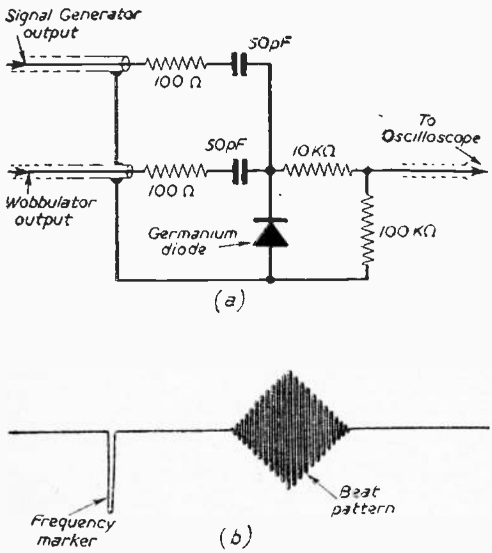


Fig. 6.—A suitable simple circuit for a detector.

horizontal trace correspond to the desired frequency limits required.

Usually it is only necessary to adjust L2 twice and C3 three times, if one starts from scratch without any idea of where they should be set. After a little experience it is possible to set them up practically without reference to the wavemeter—although they should always be checked by it, of course.

If the wobbulator is to be moved about in cars and vans, it is worthwhile to slip a thin strip of rubber between the core of L2 and the threads in the bore of the former. This prevents the core being moved by vibration, yet leaves it free enough for changing the channel.

Modifications

The instrument as described is well suited to rapid alignment on a chosen channel. Any proposed modification should be well considered. It is not wise to make any change to the circuit of V1 unless the constructor is prepared to embark on a long series of measurements to check the constancy of output voltage over the band. It may be felt that the unused half of V1 is a waste; but any proposed alternative should be carefully checked to ensure its freedom from microphonic effects.

The more ambitious constructor may care to devise a method of panel control for C2 and the core of L2. Providing that no pieces of metal which may be resonant in the band 40 to 70 Mc/s are involved, this would be a slight advantage.

Mobile TV Laboratory on the Continent

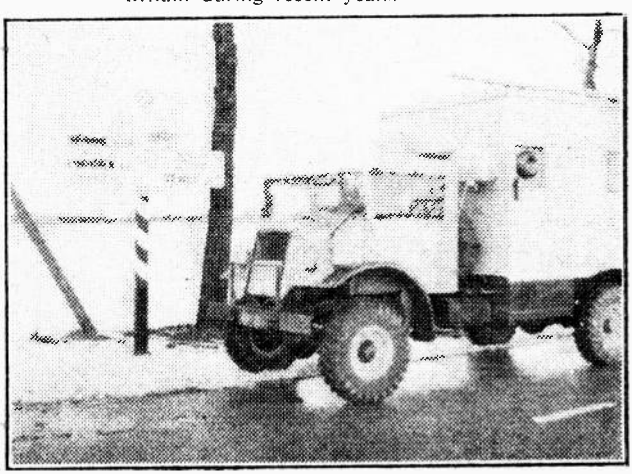
IN order to extend its information regarding television reception abroad, The General Electric Co. Ltd. has carried out a series of field tests on the Continent. A mobile laboratory, manned by a team drawn jointly from the G.E.C. Research Laboratories at Wembley and the G.E.C. Radio Works Development Laboratory at Coventry, has spent several weeks on the Continent testing receiver chassis developed for use on European transmitting systems. Valuable information has been gained on TV. reception generally, which will be particularly useful in the design of G.E.C. export receivers.

Since the European transmitting stations use negative modulation and 625 lines, while their sound is frequency-modulated instead of amplitude modulated, their system is basically different from that used in this country: reception conditions are accordingly quite different, and the information required could only be obtained by field tests on the spot. For example, the use of negative modulation renders Continental synchronising systems much more susceptible to interference, and to obtain the same quality of reception as is achieved on the British system a much more complicated receiver is needed. Again, since the sound on Continental TV is frequency-modulated, inter-carrier systems can be used, and information on these was also obtained.

In addition, the results obtained enabled the performance of the closed line transmitter at the Research Laboratories, Wembley, to be checked. Photographs of Dutch and Wembley waveforms were compared.

Measurements were made of the signal/noise ratio in various towns, an important factor in designing receivers for general use in a given area. In the course of the expedition, the van was also taken into a part of Holland in which Dutch and German transmissions overlapped; this enabled the team to study the degree of protection obtained with the tuning stages of the G.E.C. test receivers, which proved to be extremely high. Furthermore, additional information was obtained on the reception conditions prevailing on the 200 Mc/s band used in Germany.

The expedition followed naturally on a series of field tests which have been made throughout Great Britain during recent years.



The G.E.C. mobile laboratory out on field tests near Eindhoven.

FAULT SYMPTOMS

THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

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

(*Continued from page 549, May issue*)

THIS in itself, however, represents a form of interlace checking aid, particularly when such a condition is compared with a non-interlaced picture clearly revealing the total inertness of the line structure and the comparatively wide and empty spaces between. To provide a comparison it is easy to achieve a non-interlace by adjusting the framehold control just off lock so that the picture slips very slowly downwards.

Incidentally it should be noted that the illustration given last month and marked Fig. 45 actually consists of three illustrations, the centre one being 46 and the lower one 47.

Another method is by following the apparent line movement with the eyes, and, after a little practice, as the eyes scan the screen vertically it is possible momentarily to resolve just a single frame of a picture to obtain a comparative mental impression of non-interlace. Should it seem impossible to obtain a fleeting glimpse of a separate frame by this method, however, the indication may be that interlace is not occurring, or it may mean that the requisite art of moving the eyes at the correct speed in a fixed plane has not yet been acquired; practice on a number of receivers is generally desirable before making a definite statement in this respect! To assist, however, the use of a pencil or finger can be employed to trace the line movement mechanically—the eyes, of course, then following the movement of the pencil, while at the same time scanning the screen. Practice is necessary to determine the optimum speed of pencil movement.

Examining the frame flyback lines is another method frequently adopted. Fig. 48(a) reveals how the flyback lines are generally formed when the brightness control is advanced beyond its desirable setting (this, of course, is assuming that no flyback suppression device is embodied in the receiver; this will be considered later). The two vertical columns of short horizontal lines (the two horizontally adjacent short lines tend to resolve into a complete line if the brightness control is advanced too far) are those in which we are mainly interested for this test. The actual number of lines is of no consequence, since the number is a function of the speed of the frame flyback and will vary from receiver to receiver.

We are interested in the spacing between the short lines of one of the columns; it does not matter which column is considered. When the spacing is even—taking into consideration, of course, the fact that the space tends to diminish towards the top of the screen, anyway—it indicates 99 times out of a 100 that interlace is taking place. The 1 per cent. possibility that interlace is not occurring under these conditions embraces the remote chance that, although the frame timebase is being "fired" at the precise moment each frame to create evenly spaced flyback lines, something unusual may be happening to impair raster interlace.

As compared with a good interlace condition at Fig. 48(a), the diagram at (b) illustrates how the flyback lines generally resolve when the interlace is not so good or when it is not occurring at all.

Faults in a Receiver Which May Affect Interlace

When it is realised that a successful interlace can occur only when the start of a frame scan coincides with the start of a line scan every other frame only, we can clearly understand why a slight disturbance in the frame generator or synchronising circuits is liable severely to impair the interlace performance. If, for instance, the scans start together at every scan they follow the same path and no interlace exists; and it is interesting to note that to do this the frame generator has to be "pulled" only half a line every other frame. As a ratio this works out to something like 50 microseconds in 20 milliseconds, or one part in 400. It has been proved, however, that a minute disturbance in the frame circuits of one part in 2,000 will impair the interlace to a noticeable degree, probably resulting in something like a 40-60 interlace.

About the largest normal disturbance generated in a television receiver is during the line flyback when, as we have already seen, a high potential pulse is developed across the line output transformer and associated inductors. In a large number of cases a poor interlace is the result of this pulse gaining admittance, by some means or other, to the frame timebase sections to "fire" the generator either slightly before or after the "firing" time necessary for a perfect interlace.

In this respect the cause can generally be traced to an undesirable coupling existing between the line timebase and frame generator. This may be due to a defective component in the sync separator, interlace filter (if such a device is incorporated), or in the frame generator circuit itself—sometimes poor insulation in the frame blocking oscillator transformer provokes the symptom, although the frame timebase may be functioning quite normally otherwise.

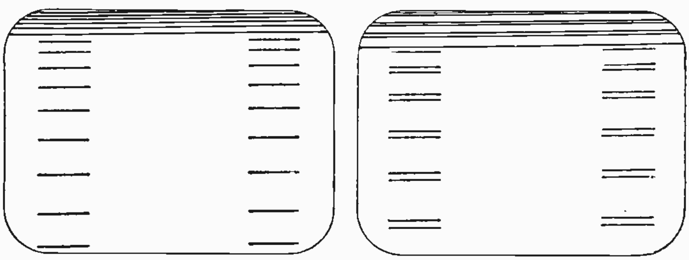


Fig. 48.—The formation of flyback lines, showing possible and non-interlace.

It is also most important to ensure that no screening has been removed from the line timebase and that no associated interconnecting wire has inadvertently been moved near the vision detector, video amplifier, synchronising circuits or frame generator.

Sometimes it happens that the line pulses are not sufficiently isolated from the frame generator by the sync separator, and due to this possible leakage path arrive at the frame generator in a roundabout way. Modern receivers, unless a fault is modifying their performance, are less prone to this kind of trouble, since, generally, an efficient interlace filter acts, apart from its normal function, as a satisfactory " buffer " between the line timebase and the frame generator.

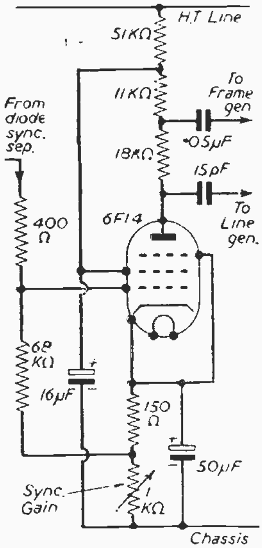


Fig. 49.—The sync amplifier stage of the Decca Projection Model 121.

It has been known for line pulses—due to the flyback—to get mixed up in the H.T. circuits, often as the result of poor decoupling, and following a most unorthodox route find their way to the critical frame circuits. If poor interlacing is suspected to be due to this cause a lot of time is saved by working the frame generator from a separate power source as a test. If then interlacing is not restored the fault must obviously lie elsewhere. A pair of high resistance headphones can prove most useful as an indicator for tracing line pulse leakage. They should be used connected in series with suitably rated isolating capacitors, and one terminal can be connected to the receiver chassis and the other employed as a wander-lead, allowing quick connection to parts of the frame circuit. Line pulses in the frame generator will, of course, be heard in the phones as a high-pitched whistle.

To make this test successfully it is first desirable to stop the frame generator. In certain receivers this can be done simply by removing the appropriate valve. In other circuits, however, care must be taken owing to the possibility of the valve heaters being wired in series, or that two sections—one section only working as frame generator — may be embodied in a single valve unit. The ECL80—triode pentode—and the B36—double triode—are typical valves in this category often employed in frame timebase circuits. Killing the H.T. supply by disconnecting a resistor in the anode lead is about the easiest way of tackling the problem in these cases.

Before leaving the symptoms of poor interlacing, it may be instructive to consider two such problems presented to the writer in recent months. One of the receivers was a Decca Projection Model 121. This set employs an amplifier stage solely for the sync pulses, the actual separation being performed by a diode circuit. The sync pulses from the diode are, therefore, directly applied to the control grid of the sync amplifier valve, and the amplified pulses in correct phase appear in the anode circuit. The circuit at Fig. 49 shows the relevant details, in which it will also be seen that a variable resistor is included in the cathode circuit to control the gain of the stage.

The complaint was poor interlacing, coupled with a critical line hold. Usually on this model an optimum interlacing point can be found on the sync gain control. In this case, however, the control had very little effect, and being a projection receiver the fault condition of non-interlace was clearly revealed on the large screen. General circuit analysis soon established that the 50 μF cathode by-pass electrolytic capacitor had lost most of its value. Incidentally, it is always a good point to make an immediate test on any electrolytic capacitor that may form a part of the circuit under suspicion—they have a bad habit of drying up and changing from a capacitor to a resistor.

There are cases when an associated valve develops some obscure fault that, although the general function of the circuit remains unaffected, tends to disturb the interlace performance. This makes it desirable, therefore, particularly if a receiver suddenly develops the symptom of poor interlacing without any unusual accompanying symptom, to try substituting the frame generator and sync separator valves with others known to be well up to standard before anything more serious is contemplated.

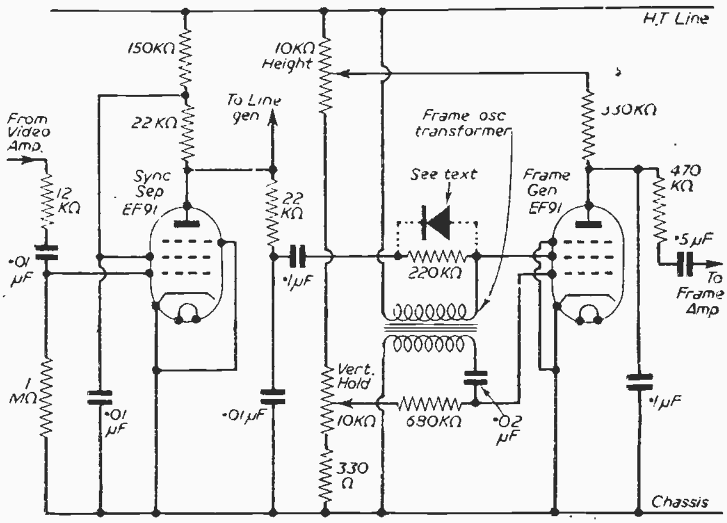


Fig. 50.—The frame synchronising section and frame blocking oscillator of the Ferguson 941T.

The circuit in Ferguson Model 941T tends to suffer in such a way, and in an instance investigated by the writer care was demanded in selecting a *new* replacement valve that gave a good interlace. Fig. 50 illustrates the sync separator and the blocking oscillator section of this receiver. It was discovered that by including a Type W6 Westector rectifier across the frame sync feed resistor, as shown in dotted lines on the diagram, a much improved interlace performance was achieved, and replacing associated valves was then not such a critical process; apart from this, frame lock was made much more solid and was less affected by sudden bursts of interference.

No Raster (E.H.T. O.K.)

We have already considered ways and means of checking E.H.T. and the line timebase circuits with respect to a blank screen being caused by lack of picture-tube final anode potential. Having established that the missing raster is not due to this cause, however, it is still a comparatively simple matter to locate the precise cause and, generally speaking, such a symptom represents one of the less complex faults to diagnose—so far as a direct viewing receiver is concerned.

In the first place it is fairly obvious that, after having established the presence of E.H.T., we will observe the picture-tube in the vicinity of its neck to ensure that the heater is emitting light and, we hope, electrons. Although we can see the heater glowing we can only assume, for the time being, that it is producing the desired quantity of electrons. It is interesting to note, however, that from data gained from observations made by the writer the chance that the glowing heater is not emitting electrons in the correct way for screen illumination is very small indeed.

So far as the picture-tube itself is concerned, something may have happened to the fluorescent quality of the screen to cause our lack of raster. In practice a fault of this nature very rarely—if ever—occurs. Though it should be remembered that as a tube wears the phosphors comprising the screen undergo a chemical change which tends to reduce their light emitting efficiency this effect may be hastened if direct sunlight is allowed to fall on the tube face for any length of time. This must be taken into account when examining a set for a blank screen, but essentially, provided the raster died suddenly, whether during a period when the set was actually operating or whether the symptom was brought to notice when the receiver was switched on, it is safe to be definite that the fluorescent screen is not responsible.

Check the Tube Heater Circuit

Sometimes, mainly for mechanical reasons, the tube "goes down to air." When this occurs, however, the tube heater rapidly burns out—it being very rarely observed alight under these conditions. Furthermore, a white deposit is often seen clinging to the inside of the neck of the tube.

With this reasoning in mind, therefore, we can clearly see that there is little need to express concern over the health of the picture-tube, even though no trace of illumination is displayed on the screen and yet E.H.T. is around in normal quantity; this is, of course, provided the tube heater is glowing.

In certain cases there is still a degree of hope, even with the tube heater cold! Where the valves and tube heaters are connected in series, for instance; the tube may be O.K.— a valve heater, series resistor or even a fuse may have "blown" to open the tube heater circuit.

Where the tube heater is energised from a winding on the mains transformer the possibility of a dry joint or poor soldering tag connection should always be borne in mind, particularly where a soldering tag carrying heater current is secured in connection with the receiver chassis by means of a rivet or nut and bolt. A bad electrical contact has been known to exist between the tube base heater pin and the heater lead-out wire. A two minute job with a soldering iron focused on the appropriate pin on the tube base saved the day, and a considerable expense. Remember, then, even though an open circuit may be shown across the heater pins on the tube base, do not discard the tube before checking the soldered connections.

Check the Setting of the Ion-trap Magnet

Assuming, then, that the tube still possesses useful life, the missing raster may be caused by the ion-trap magnet, on the neck of the tube, incorrectly positioned. This cause should be suspected if, for instance, the raster disappeared during the time a receiver was being examined for another reason. Some ion-trap magnets are not securely locked to the neck of the tube, and tend to shift easily if touched or inadvertently knocked while, perhaps, some other adjustment is being performed within the set. This possibility is well worth bearing in mind if the receiver embodies a tube with an ion-trap. An ion-trap magnet very rarely moves out of adjustment on its own accord, however, so the sudden disappearance of a raster should not always be associated with this cause.

At this point it may be instructive to consider the correct way of adjusting the ion-trap magnet. We will assume that the magnet is already on the neck of the tube with the arrow pointing towards the screen. The magnet should be carefully rotated until the arrow is immediately over the line marked on the tube neck. On Mullard tubes this line is nearly always in line with the position corresponding to pin number three on the base.

As an initial adjustment the magnet should be moved along the neck of the tube until it is slightly in advance of the tube base, and the following adjustments must be performed while the receiver is switched on, preferably during the transmission of the Test Card. With the brightness control set for screen illumination of *only just* workable intensity the magnet should be moved gradually towards the screen until the focused raster is at maximum brightness. During this operation care must be taken to keep the arrow marked on the magnet over the line on the neck of the tube. Without altering the position of the magnet readjust the brightness and contrast controls to give a picture of correct contrast ratio.

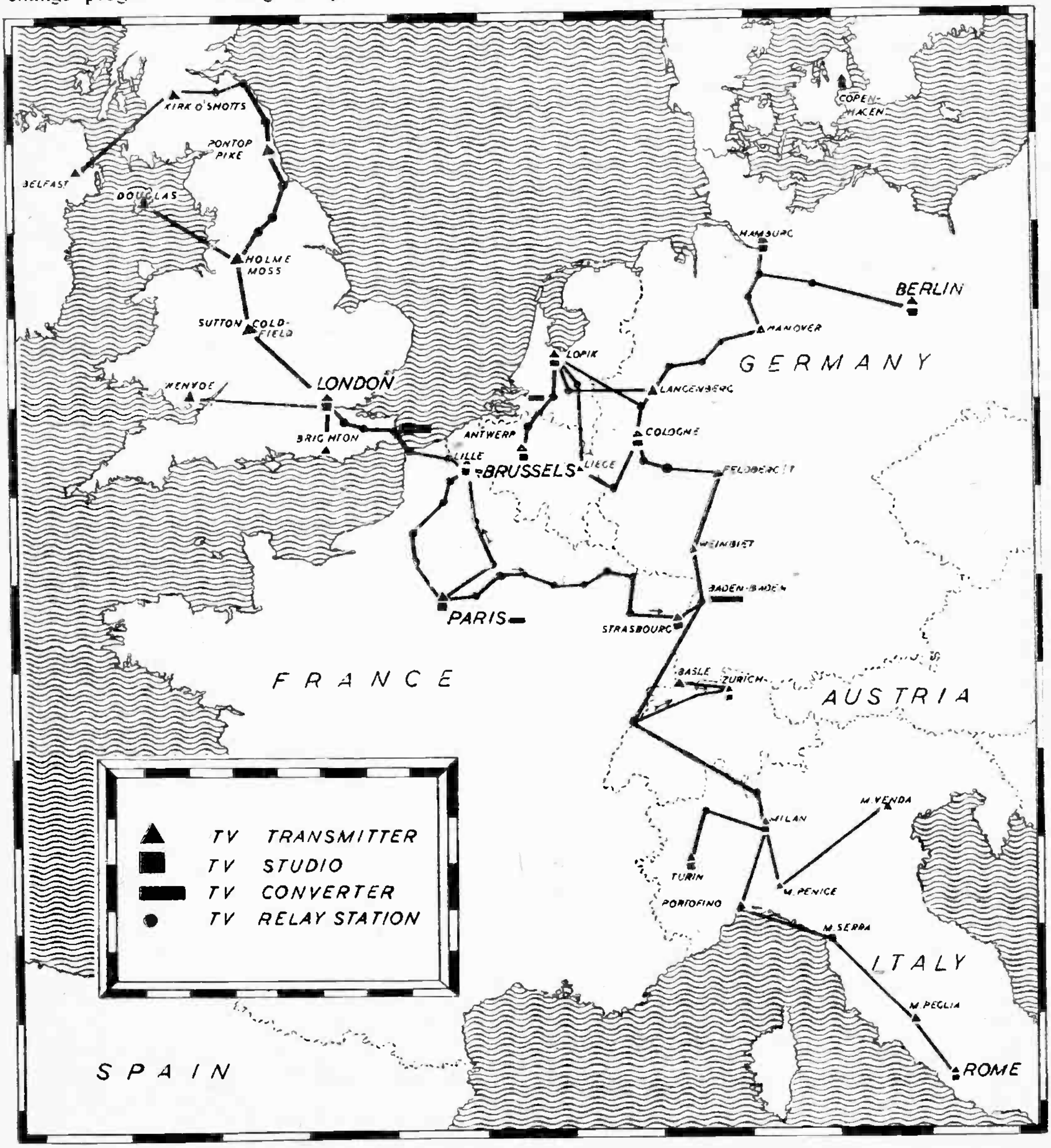
Finally, readjust the magnet along the tube axis for optimum picture brightness, and by means of the picture centring adjustments on the focusing unit ensure that the picture resolves in correct position on the screen. If it is found that the picture cannot be centred correctly by this means it is in order to rotate the magnet slightly to assist in this respect. It is extremely important to ensure, however, that no loss in illumination results by this adjustment; if it is noticed that the illumination is impaired the magnet MUST NOT be rotated.

(To be continued.)

"Eurovision"—An 8-way Hook-up

SOME INTERESTING DETAILS OF THE INTER-CONTINENTAL RELAYS

DURING the Coronation celebrations last year the BBC made arrangements to provide pictures of the ceremony to viewers on the Continent. As an extension of the idea, and profiting by the experience gained during last year's relays, a more elaborate hook-up has been arranged and the map below shows the vast linkage which has been provided in order that eight countries may interchange programmes during the period from June 6th to July 4th. It will be seen that in addition to those countries which participated in last year's relays there are now Switzerland, Italy and Denmark. The network will cover about 4,000 miles and will incorporate 44 transmitters and 80 relay stations as indicated on the map. Hamburg is now linked to Copenhagen via four relay stations situated on the intervening islands.



The major problem in arranging this interchange of stations is the different systems which are used in the various countries, an arrangement which it was at one time thought would prevent a satisfactory link-up. However, as with many major problems a simple way out was eventually found—consisting, in effect, of merely placing a receiver in front of a transmitting camera and photographing the received picture. Every one of the countries participating in this hook-up will be using some British equipment, and it is stated that the total value of such equipment will approach £2,000,000. This will include transmitters, cameras, studio apparatus, outside broadcast units and vehicles, various radio links, one of which will include a relay station 10,000ft. up on the Jungfrau, forming the link between Italy and Switzerland. In addition to the many items of equipment a large number of British radio engineers will also be employed to instruct foreign technicians in the use of the British equipment and in some cases will be retained to carry out the actual relay work.

M. Jean d'Arcy, the Director of Television Programmes, R.T.F., said : "This is an experiment with all kinds of technical and other difficulties to overcome, but it is the most ambitious undertaking yet in the history of television involving problems not met in the U.S.A. It points the way to a permanent exchange of television programmes in which Great Britain, through the BBC, and France, through the R.T.F., have been joint pioneers.

"In spite of the problems of the commentaries in different languages, television may be more likely than sound radio to make international broadcasting a reality and to enable 'Nation to speak unto Nation'—in the words of the BBC motto. Our unique conference of eight nations has brought this a little nearer."

TV in Italy

There are centres for the production of programmes in Turin, Milan and Rome and transmitters in Torino-Eremo, Milan—Torre del Parco, Monte Penice, Portofino, Monte Serra, Monte Peglia, Rome—Monte Mario, Florence and Monte Venda. The important dates for Italian TV are September of 1949 when the first transmitter went up in Turin and at the same time a studio and transmitter went up in Milan. In March of 1950 a plan was presented to the Minister of Communications (Post Master General in England) for the organic distribution of the various transmitters and for a national network. In February of 1951 the national council of research asked that Italy should adopt the European standard of 625 lines. In May of 1951 the TV and Radio services were combined. In June of 1951 in Turin the first experimental TV shows were given, and in October of 1951 the first direct transmissions were made on outside sites. In April of 1952 the first real studio was set up in Milan in the Radio Palace, with a complete transmitter, and a micro-wave link between Turin and Milan came into being. In August the direct connection of metric-waves between Milan and Turin took place. In September of 1953 the connection between Milan and Rome was finished and Milan became the centre of Italian TV. On October 3rd, 1953, the large TV studio in Rome was finished.

Ghost Images

ELIMINATING REFLECTED SIGNALS

By S. Edmunds, A.M.T.S.

THE causes and effects of "Ghosts," as the multiple images due to reflected signals are so aptly termed, are well known, but the practical steps necessary to provide a remedy are not such common knowledge, and the purpose of this article is to explain the most effective methods of dealing with this trouble.

Many elaborate anti-ghost arrays have been evolved, and quite fantastic claims made for some of them, but in the writer's experience the most consistently effective is a three- or four-element fringe type consisting of the usual dipole, reflector and one or two directors. One advantage of this type over the double "H" or "X" arrays is that it offers less resistance to the wind and is considerably lighter. An attenuator is often necessary owing to the higher gain.

It is essential to have an assistant watching the receiver screen to notify the effect of movements of the aerial, and if the two are far apart it is well worth while to hook up an "intercom." This is easily improvised from a pair of earphones and a spare loudspeaker used as a microphone, amplified if necessary through the domestic radio receiver. Agreement upon a system of signals before going up to the aerial saves time and unnecessary repetitions of operations.

It helps a lot if the cause of the reflections can be determined first, and to this end a climb to the highest part of the roof will enable an aerial view to be obtained. Note the direction and distance of any likely cause of reflections and rotate the aerial so that it "points" well away from it. Do not worry about the direction of the transmitter at this stage.

In addition to orientating the aerial about its vertical axis, tilting upwards sometimes helps, and in difficult cases even leaning it over to one side or the other may do the trick. In one particular case near the Truleigh Hill booster, a cure was eventually found by mounting a standard "H" horizontally.

Movement to another chimney stack should not be resorted to until other methods have been tried, as it often means lengthening the feeder as well as re-making the lashings, possibly requiring extra lashing wire or different lashings. Small increases in height are not usually of much avail, but may be helpful in "noisy" areas for reducing interference when, as is sometimes the case, the direction of least reflection is that of strongest interference.

A mismatched feeder can cause a ghost, but it must be very long before the ghost is displaced far enough from the true image to be visible as such. More often it is evident only as a slight blurring of the picture.

The foregoing remarks apply principally to those areas where outdoor aerials are normally used. In districts where an indoor aerial provides sufficient signal strength it should be tried in various positions about the house before a more elaborate outdoor array is resorted to. One of the indoor types with flexible elements is particularly useful for this purpose, or a simple substitute for testing is easily made from flex. The latter is not recommended for permanent use owing to its narrow bandwidth.

Line Circuit

Line oscillations are obtained in a very efficient single-valve transitron circuit. A single transformer is used which is overwound to provide E.H.T. (rectified by V9), and which incorporates its own inductive width control.

The valve used (an EL38) is caused to oscillate by positive feedback from the transformer winding feeding the deflector coils. The feedback is applied to the grid via C28.

The periodicity of the oscillations is controlled by the time constant of the grid circuit via R35, R36, C30 and R40.

Power Supply

The H.T. is obtained directly from the mains using the D.C. principle, the rectifier being connected to the top end of the auto-transformer. Secondaries of the auto-transformer feed the C.R.T. heater and the heaters of the remaining valves in the circuit.

Controls

Two variable controls are set into the front panel. They are the contrast control and the volume on/off control.

There is a sensitivity control fitted at the back of the receiver and which is pre-set. It is R3 and it controls both the sound and the picture. When setting up the televisor the following procedure is suggested. With the aerial disconnected, adjust the brilliance control on the back of the receiver until the line-scan appears. Reduce it until the lines are just about visible. Now set contrast to zero and sensitivity to zero and plug in the aerial. Now advance the contrast to about one-third and then advance the sensitivity control until the picture is strong enough. Now adjust contrast and brilliance until the correct value of tones is obtained. Advance the volume control.

COMPONENT VALUES

RESISTANCES	
R1—39 Ω	R35—220 Ω
R2—120 Ω	R36—1 K Ω
R3—10 K Ω	R37—6.8 K Ω
R4—1.5 K Ω	R38—47 K Ω
R5—6.8 K Ω	R39—50 K Ω
R6—22 K Ω	R40—5 K Ω
R7—100 K Ω	R41—100 K Ω
R8—1.5 K Ω	R42—2.2 K Ω
R9—2.2 K Ω	R43—68 K Ω
R10—39 Ω	R44—150 Ω
R11—120 Ω	R45—1.5 K Ω
R12—10 K Ω	R46—68 K Ω
R13—1.5 K Ω	R47—68 K Ω
R14—5.6 K Ω	R48—1 M Ω
R15—5.6 K Ω	R49—1.5 M Ω
R16—150 Ω	R50—47 K Ω
R17—1.5 K Ω	R51—2 M Ω
R18—5.03 K Ω	R52—2.2 K Ω
R19—47 K Ω	R53—470 K Ω
R20—6.8 K Ω	R54—10 K Ω
R21—330 Ω	R55—180 Ω
R22—470 K Ω	R56—47 K Ω
R23—1 M Ω	R57—1 M Ω
R24—3.3 M Ω	R58—1.5 M Ω
R25—330 K Ω	R59—100 K Ω
R26—10 K Ω	R60—100 K Ω
R27—1 M Ω	R61—100 K Ω
R28—47 K Ω	R62—1 M Ω
R29—15 K Ω	R63—1 M Ω
R30—100 K Ω	R64—470 K Ω
R31—100 K Ω	R65—2.2 M Ω
R32—15 K Ω	R66—5 K Ω
R33—50 K Ω	R67—470 K Ω
R34—15 K Ω	R68—10 Ω
	R69—10 Ω

If it is found that insufficient volume is obtained, then L1 can be retrimmed towards the sound channel, provided it does not spoil the quality of the picture. The sensitivity control can then be adjusted to make up for the loss in picture contrast.

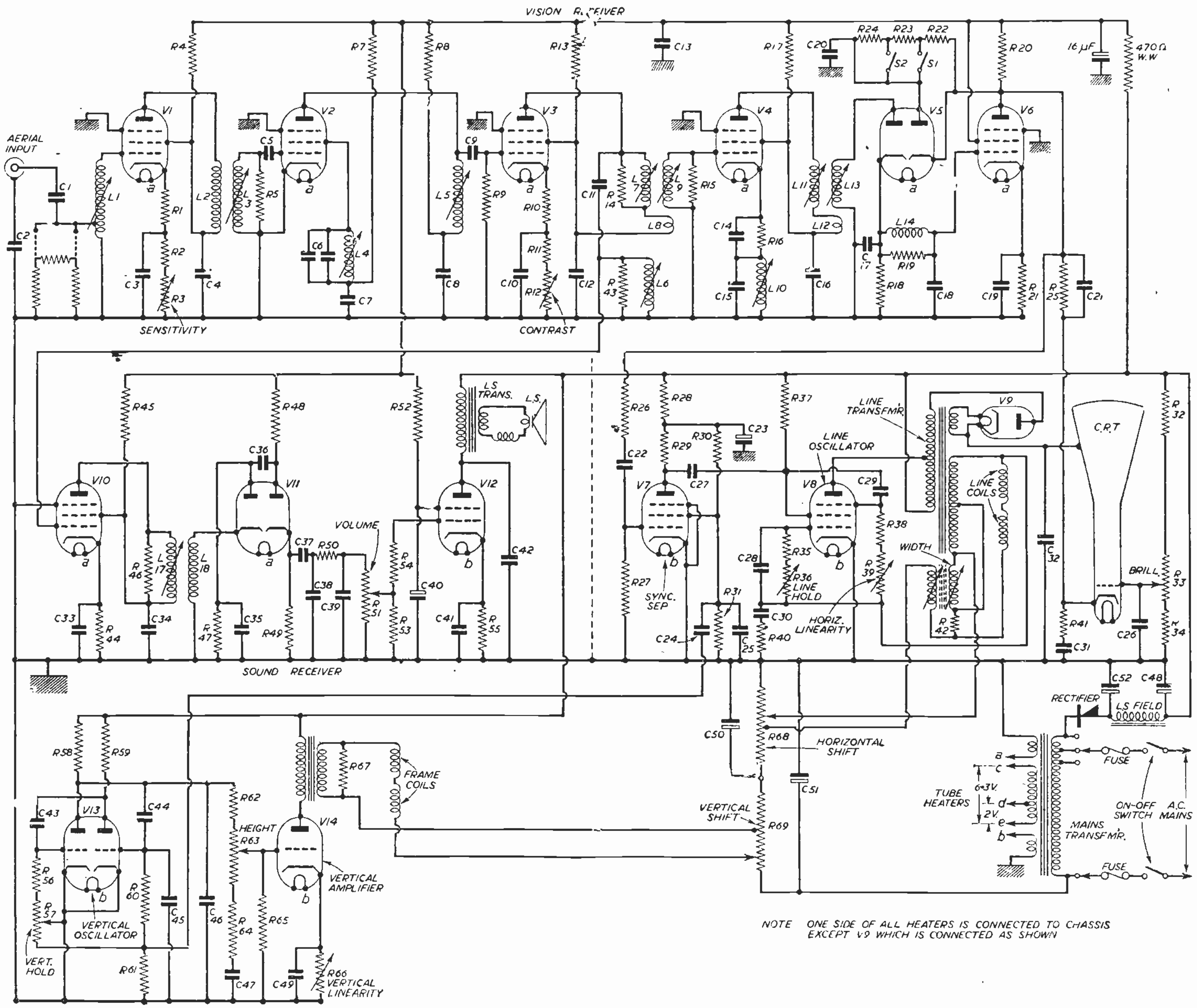
At the rear of the chassis are various controls, as shown in Fig. 2. The line linearity is used for correcting horizontal distortion; the line-hold locks the picture horizontally and it will be found that these two controls interact to a certain extent. Interaction is also liable to take place with the width control, which is a plunger fitted on the left rear side of the line transformer.

The sensitivity and brightness controls have been mentioned previously.

The vertical (frame) linearity controls the linearity of the vertical scan and should be adjusted in conjunction with the height control to prevent the top becoming elongated.

The vision interference limiter is in the form of a rotary switch. Unless interference is experienced the switch should be left in the minimum position. Where interference is experienced, the switch can be rotated to the second position and, where it is very severe, then it can be switched to the third position. The latter position should not be used if it can be avoided, as it is inclined to cut the peak whites and thereby introduces a certain amount of greyness into the highlights.

Vertical holding is accomplished by the frame (or vertical) hold control. This control also affects the interlace, and its correct positioning is critical. The control should be set while the lines of the picture are closely observed. The optimum position is where the horizontal lines are equidistant, and it will be found that this is on the threshold of picture slip. The lines should not appear in pairs but should



Circuit of the Plessey Mark II Chassis.

COMPONENT VALUES

CONDENSERS	
C1—100 pF	C35—50 pF
C2—.005 μF	C36—.01 μF
C3—.001 μF	C37—.01 μF
C4—.001 μF	C38—500 pF
C5—100 pF	C39—500 pF
C6—30 pF	C40—16 μF
C7—.005 μF	C41—25 μF
C8—.005 μF	C42—.002 μF
C9—100 pF	C43—.05 μF
C10—.005 μF	C44—500 pF
C11—2 pF	C45—.002 μF
C12—.005 μF	C46—.05 μF
C13—.05 μF	C47—.02 μF
C14—.005 μF	C48—100 μF
C15—650 pF	C49—100 μF
C16—.005 μF	C50—1,000 μF
C17—5 pF	C51—1,000 μF
C18—5 pF	C52—64 μF
C19—750 pF	C53—.01 μF
C20—.05 μF	
C21—.1 μF	**VALVES**
C22—.1 μF	V1—6F1
C23—16 μF	V2—6F1
C24—.05 μF	V3—6F1
C25—.005 μF	V4—6F1
C26—.05 μF	V5—6D2
C27—200 pF	V6—6F1
C28—.25 μF	V7—6F1
C29—300 pF	V8—EL38
C30—.002 μF	V9—EY51
C31—.1 μF	V10—6F1
C32—.001 μF	V11—6D2
C33—.005 μF	V12—6P25
C34—.005 μF	V13—6SN7
	V14—6L18

be definitely at equal distances from each other.

The voltage adjustment should be set at the voltage of the local supply and requires no further treatment. It is dangerous to set this control at a voltage tap lower than that of the local supply as the valve and C.R.T. heaters may be overrun.

Alignment

The I.F. stages should not be touched by the amateur; it is extremely easy to mis-align and extremely difficult to re-align correctly without the aid of a wobbulator.

The R.F. stages can be aligned by setting L1 at 1 Mc/s and L3 at 2 Mc/s below the carrier frequency. The oscillator coil can then be adjusted for maximum sound and any further re-adjustment carried out when Test Card "C" is being radiated.

The sound I.F. peak frequencies are all 10.5 Mc/s for L6, 17 and 18, while L10 (the rejector coils) should be set at minimum response on the vision circuit at 10.5 Mc/s.

In the vision section L9 and L13 are set for maximum response at 11 Mc/s while L7 and L11 are set for maximum response at 13.5 Mc/s. L5 is nominally adjusted for 12.5 Mc/s but can be varied to give an overall flat response between 11.5 and 13.5 Mc/s.

Modifications

It is not possible to give a comprehensive list of all the modifications which may crop up from time to time. It should be remembered that manufacturers are continuously endeavouring to improve their products and weaknesses which reveal themselves in the field are corrected in newly-produced models. This principle applies to most manufactures.

One of the modifications which is most noticeable is that in some of the models the H.T. feed to vision and sound receivers has been separated from the main supply, a decoupling resistor and condenser (values 470 ohms and 16 μF respectively) being inserted in the supply.

In some of the later models R36 has been increased to 2 KΩ and R35 omitted.

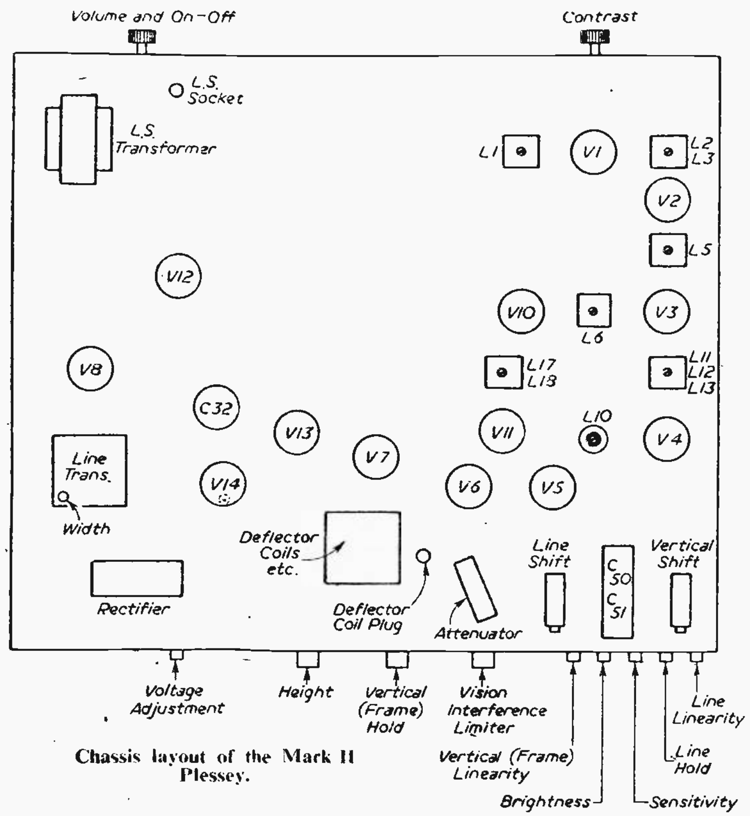
Another important feature is that in some models the capacitor across the oscillator coil has been split into two parallel condensers (C6) one of which has a negative temperature coefficient. This counteracts any tendency for the oscillator frequency to drift as the set warms up.

V13, which is normally a 6SN7, is replaced with a miniature version, the 12AU7, in some models.

The Picture Tube

A Mazda CRM121A is normally fitted. The heater is fed from a separate winding on the mains transformer and any cathode-heater short circuit which may develop will show itself as a deterioration in picture quality. The supply of CRM121A's is becoming erratic and the tube can be replaced with a later version, the CRM123B. This tube normally takes a higher E.H.T. but functions quite well as a direct replacement.

Those who would like to take advantage of the possible increase in brilliance with the later tube can increase the E.H.T. by the addition of a Cockcroft Walton multiplier.



Chassis layout of the Mark II Plessey.

SERVICING TV RECEIVERS

Plessey Mark II Chassis

SOME USEFUL DATA FOR THE SERVICEMAN

MUCH interest was aroused when we published, in the November, 1953, issue, details of the Plessey chassis Mark I which has been used in several television receivers such as the Regentone, the Marconiphone, the Argosy, the Defiant and others, and in response to requests we are now giving some details of the later version, the Mark II.

The theoretical circuit is shown in Fig. 1 and it will be observed that while the basic form of the Mark I version has been retained, several important modifications have been made. Further, it will be found that there are slight modifications of this basic circuit in various receivers, and it is not possible to give a complete outline of all the modifications. However, it will be found that the basic circuit given in the illustration will enable servicing to be carried out quite easily.

Perhaps the most striking modification is the introduction of a shift network for the line and frame scan which enables the picture to be centralised on the screen without tilting the focus magnet; this enables centreing to be carried out quickly and easily and avoids risk of fracturing the neck of the C.R.T.

The centreing is obtained from R68 for the horizontal (line) scan and from R69 for the vertical (frame) scan.

R68 and 69 are connected in series with the negative line from the power pack and there will be a voltage drop across the resistors. In the case of the vertical shift the centre tap is taken to one side of the deflector coil and the other side of the coil is taken to the slider. It will be seen that a small current will flow through the coils which is just sufficient to shift the picture, the current being made to flow in either direction as the slider crosses the centre tap and thus alters the polarity of the D.C. flowing through the coil.

A similar principle applies in the case of the horizontal scan, the functions being performed by R68.

Circuit Description

The aerial input is isolated from the chassis by C1 and C2 so as to avoid any danger of the aerial becoming alive.

An attenuator position is provided so that in areas of high signal strength the televisor is not overloaded. The fitting of the attenuator pad is optional and is usually wired in by the dealer. Pi attenuators giving 10, 20, 30 and 100 db, attenuation are available.

The signals from the aerial are fed into the first R.F. coil L1, and thence to the R.F. amplifier V1. The output of this valve is fed into the coupling coil L2, and L3, its companion, feeds the amplified signal into the mixer valve V2.

A straightforward pentode mixer is employed, the local oscillations being generated in the screened grid circuit through L4, the oscillator coil. Sound and vision signals are fed to the first I.F. amplifying valve V3.

From the anode of V3 the vision signal is taken at an I.F. of 14 Mc/s through L7, 8 and 9 to the vision I.F. valve V4, while the sound signal at an I.F. of 10.5 Mc/s is taken from L6 to the sound I.F. valve V10.

In the cathode of V4 is a small coil L10 which is a sound rejector.

The output of the vision I.F. stages is taken to the vision detector V5 via the coupling circuit L11, 12 and 13.

For demodulation a 6D2 is used, the first half being employed directly as a detector and the second half as a vision noise limiter.

The demodulated signal is fed via the correcting network to the grid of the video valve V6. The output of this valve is taken via a direct coupling to the cathode of the C.R.T.

Clipping of peak white pulses due to ignition interference is accomplished by the second half of V5, the amount of clipping being made variable by the switch S1, S2.

The Sound Section

The sound signal is fed from L6 to the sound I.F. valve V10; the output of the valve is fed to the sound detector V11 via the coupling coils L17, L18.

The sound detector is another 6D2 valve and performs functions similar to the vision detector as it not only demodulates but also acts as an ignition interference limiter.

The output from the detector is fed into the audio output valve V12.

Note that in some models the anode of the output valve is fed from a different H.T. supply than the previous part of the circuit. This is accomplished by the dropping resistor of 470 ohms decoupled by the 16 μF condenser shown in the vision H.T. supply line.

Sync Separation

The composite signal from the vision stage is fed to the sync separator valve V7 via the coupling condenser C22. The cathode of the valve is taken directly to earth and the valve performs its own D.C. restoration. Frame sync pulses are taken from the screening grid and line sync pulses from the anode. By this method the two sets of pulses are better separated and interaction between them reduced.

Frame Circuit

V13 is the frame oscillator working in a multivibrator circuit, the output being fed into V14, a triode valve. This part of the circuit departs from more orthodox methods, as manufacturers generally favour the blocking oscillator. However, the circuit shown gives excellent results and the interlace is quite good.

There is plenty of output, which is more than sufficient to scan the tube fully in the vertical direction.

Pages from a TELEVISION ENGINEERS Notebook

17—FREQUENCY CHANGERS

ALTHOUGH the double-triode type of television mixer stage was discussed previously in this series and finds use in many home constructed televisors, there are several other forms of mixer suitable for television superheterodyne receivers which merit attention.

The mixer stage of any superheterodyne is made up of two basic parts: the mixer proper, or modulator which produces the intermediate-frequency output, and the local oscillator. In television techniques particularly, the oscillator must be quite stable in frequency, and must be unaffected by reasonable changes in temperature likely to be experienced in the actual receiver cabinet. A separate oscillator tends to be best from this point of view, and combined valves, such as the triode-hexode, are not so common now as they were before the war. The double-triode is, of course, a combined valve in one sense, but the oscillator is strictly separate and the single glass envelope simply encloses the distinct systems. This article will therefore be mainly concerned with the mixer stage proper, the oscillator being ignored for the time being.

General Principles

Frequency changing is basically the low percentage modulation of the local oscillator frequency by the aerial or signal frequency; the signal frequency may or may not be amplified before reaching the mixer stage, although in television, a single R.F. amplifier is almost invariably employed. One of the resulting sidebands of the modulating process is used as the intermediate frequency, the two sidebands produced, of course, being the signal frequency plus and minus the oscillator frequency. Mixing is carried out in one of three ways: in the type of valve known as the hexode or pentagrid, the signal is placed on one grid and the oscillator output on another; the signal grid may be nearest the cathode, as shown in Fig. 1(a) or it may be a later electrode as shown at (b). In the third form, signal and oscillator frequency are applied to the same electrode such as is shown in Fig. 1 (c), and mixing results from the characteristic curvature of the valve. For a fuller explanation of this process, you should refer to Part 3 of the present series. The conversion operation of all three mixer types can be readily analysed from the signal grid to plate transconductance g_m plotted against the oscillator grid voltage curve, and this is true even when combined valves such as triode-hexodes are used.

Such analysis shows that the conversion conductance of a triode with signal and oscillator voltages applied to the grid is equalled only by the hexode connection of Fig. 1 (a), although the triode is usually the quieter in operation. If a pentode is used as a mixer with both inputs applied to the control grid, the conversion conductance is about four-fifths of that obtainable from the triode, but the noise is greater, fluctuations in the current distribution between the screen and anode being part of this. The only serious disadvantage of the triode over the pentode is that feedback occurs in the former and must be taken into account. The I.F. tuned circuit in the anode is capacitive at the signal frequency, the input resistance is low at this frequency, and the feedback will tend to step up noise. The input damping will be small, however, if the anode-grid capacity is negligible in comparison with the I.F. tuning capacity, but this is not always the case. If the receiver uses no R.F. stage, the pentode form is probably to be preferred.

The mixer circuit of Fig. 1 (b) has a conversion conductance about half that of either the above, but it is difficult to compare this form of circuit with those because there is no direct dependence of the signal-grid characteristics on the cathode and oscillator-grid configuration. Noise is inclined to be greater, but if a suppressor is added (hexode

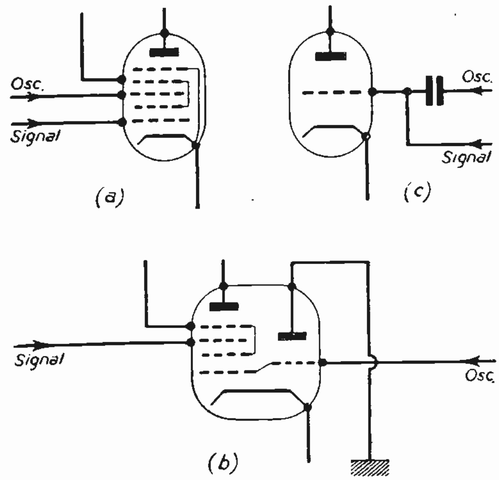


Fig. 1.—Mixer circuits suitable for television receivers.

construction) to eliminate secondary emission, the remaining noise is primarily that of current distribution and is not much worse than that of the pentode form. Loading of the input circuit is negligible with this mixer.

The remaining difficulty with the triode and pentode forms of mixer is that of interaction of the signal and oscillator circuits. This interaction can lead to radiation from the stage, thereby becoming a nuisance to nearby apparatus, and alignment troubles, pulling as this is more generally called.

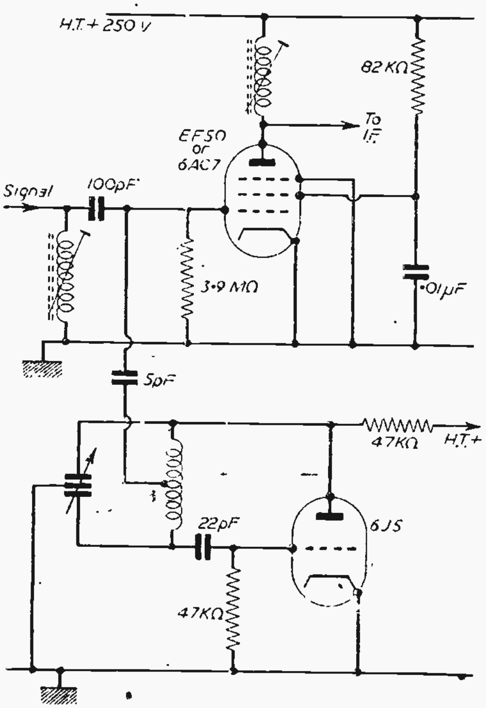


Fig. 2.—A practical mixer circuit using a pentode as a mixer with separate triode oscillator.

Interaction is, of course, greatest when the voltages are applied to the same electrode in the valve; to overcome this difficulty, very loose oscillator coupling has to be employed, but this is no disadvantage in its way, since the oscillator voltage required is generally quite small.

Although, then, none of the forms of mixer discussed meet all the requirements of television practice, the triode or pentode with the signal and oscillator frequencies applied to one electrode will produce the greatest gain and lowest noise figure, and are to be particularly preferred where there is no previous R.F. amplification.

A Practical Design

A practical circuit suitable for the home constructor is shown in Fig. 2, this using a pentode as mixer with a separate triode oscillator. Surplus valve types are employed, as these are most readily available at low cost. A few notes will be given on the design considerations of this circuit.

We note first of all the method of obtaining bias for the pentode, which is by means of a high time-constant grid C.R. circuit, a 100 pF condenser and a 3.9 MΩ resistance. The point of this form of bias is to make the mixer stage as little dependent as possible upon the amplitude of the oscillator voltage. This applies particularly in receivers having a switched oscillator stage (five-channel models, for example), as variations in oscillator output at the various frequencies is then unavoidable. Further, it is desirable never to let the oscillator voltage swings carry the mixer valve into grid current.

Automatic bias of the type illustrated in Fig. 2 is derived from rectification of the oscillator voltage, the grid being driven negative by an amount depending upon the oscillator amplitude. This steady bias will be removed if the oscillator stops working, however, and so the screen must be fed from a high resistance. This resistance assists even further in the independence of gain with oscillator amplitude, although its presence will increase the noise very slightly.

The actual oscillator is of little importance provided that it is stable with temperature changes, etc., and in the figure the common Hartley is shown. The output is tapped down this coil and fed through a small condenser, thus reducing the possibility of interaction between the circuits. The tapping point can well be about a quarter-way up from the grid end of the coil.

HONOUR FOR POINEER

ON April 29th the high award of the Faraday Medal of the Institution of Electrical Engineers was presented to Mr. Isaac Shoenberg.

This award has been made to Mr. Shoenberg for his outstanding contributions to the development of television in this country.

The great success of the television Coronation programme last year was to a considerable extent the result of his pioneering work and it was with this in mind that the Council of the Institution decided that it would be appropriate while thoughts of the Coronation were still fresh to award him the Faraday Medal of the Institution.

Mr. Shoenberg led the team of scientists at E.M.I., Hayes, who developed the television system and ancillary equipment adopted by the BBC in 1936.

The Emitron

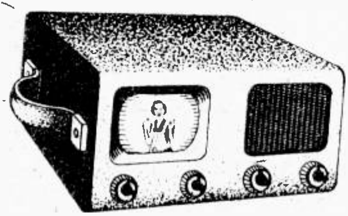
His development of the electronic picture tube known as the Emitron contributed perhaps more than any other single item to the success of the new system.

Later, in 1937, Mr. Shoenberg was able to offer the Post Office and the BBC transmission equipment including special cables and repeaters which enabled the Coronation Procession of King George VI to be televised.

Since then E.M.I. have supplied the British Broadcasting Corporation with considerable additional television equipment including many Emitron cameras of advanced types, film scanners and other studio equipment, outdoor television apparatus, high power vision transmitters and microwave television links which are facilitating the reception of television broadcasts from various parts of Europe.

The occasion of this award to Mr. Shoenberg is a reminder, too, of the foresight and imaginative investment of considerable capital in these early days by the E.M.I. Company under the late Mr. Alfred Clark.

MINIATURE PORTABLE T.V.



You can probably think of many other reasons when you may need a midget televisor, but it will certainly be useful when—
(a) Someone is ill, or confined to another room.
(b) Your big T.V. fails.
(c) You want to alter or adjust your big T.V.
(d) The commercial programmes start.
(e) Servicing an aerial installation.

The Elpreq Miniature Televisor uses standard conventional circuitry, employing a total of 13 valves and 2 crystal diodes. The cathode-ray tube used is a 2½in. Service type VCR139A, which has a standard equivalent and will therefore always be obtainable. The layout is extremely clean, straightforward and professional. The wiring, whilst naturally being a little more intricate due to miniaturisation, is nevertheless completely accessible, and very good results have been obtained. The total cost, if you have to buy every part, would come to **£16-£17**, but you may have many of the components already in stock, as only standard conventional components are used. A carrying case, similar to the artist's illustration above, will be available shortly. Its size will be approximately 9½in. x 8in. x 6in. (internally). Full construction data, layouts, diagrams, templates, etc., running into some 50 sheets, is available, price 5/-, post free.

THE STROLLER

A new booklet for Constructors, shows how to make a sensitive and powerful superhet battery portable, which will be just the thing to take on a day out or on your holidays. The booklet also shows how to make the Picnic Player, a useful battery-driven record player. The price of the booklet is 2/6, which is returnable if component parts are purchased.

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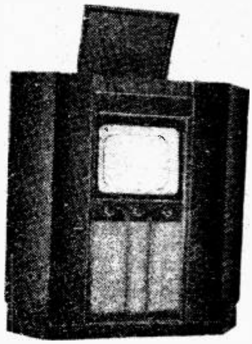

A circuit for a suitable radio unit to fit into our Coronation Console Cabinet has now been completed and thoroughly tested. All the parts are available. The total cost is **£5.19.6.** Data is included free with orders for parts, or can be supplied separately. Price **2/6.** **Note:** This radio unit incorporates T.V. control and is also highly suitable for fitting into other televisors. The addition of a radio unit to a televisor is not only worthwhile but is essential where the televisor is kept in a room away from the main radio. The Superior 15 Corner Cabinet (illustrated) is also available now in light oak, or medium oak to suit your furnishings, and it really does look impressive. The price is **£18.** plus carriage. H.P. terms **£6** deposit, balance over 12 months.

About the Superior 15 itself, if you have not already ordered your set of parts for this, be advised and do so immediately. We are definitely getting down to the last batch of the 15in. tubes and once these are gone the Super 15 T.V. cannot be repeated. At **£37.10.0** for all the parts (including 15in. Cossor Tube) this represents the finest value ever offered to the home constructor. If you doubt your ability to make it, then send **7/6** for the data and study this first. Don't forget, we guarantee to help you to get perfect results and, if necessary, for nominal charge, will take in your televisor, completely check over your work, and return it to you in perfect order.

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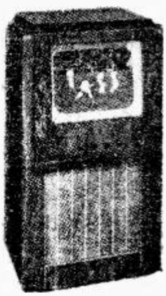

This cabinet is offered below cost. It is suitable for a televisor using tube sizes varying from 12in. to 17in. Its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive televisor and really good quality. Unrepeatable. Offered at **£7.5.0.** carriage, packing, etc., 12/6. **Note:** These are cut for 12in. tubes, but the holes for the controls are not drilled.

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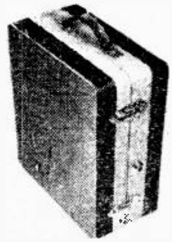

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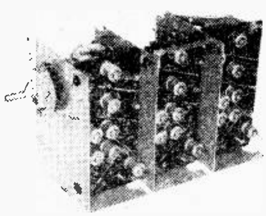

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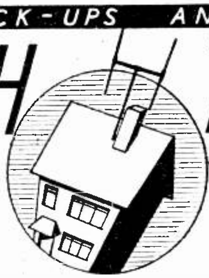
TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

MOST of us have rather got out of the habit of going to the theatre and seeing real actors (" in person ! ") appearing in plays. We have all become so used to gazing at their shadows on TV and cinema screens that the flesh-and-blood originals seem to be somewhat smaller than life : sharp-focused coloured characters moving about in permanent long-shots and mumbling incoherently. That, at any rate, is the opinion of the younger generation, brought up in this electronic age of perpetual magnification in entertainment. Poor voice production on the stage could not be tolerated in the days before public address amplification, when singers sang instead of crooning and actors had to pitch their voices so that even the back rows of the gallery could hear every whisper.

" SUCH MEN ARE DANGEROUS "

CHANGING styles of theatrical interpretation are well illustrated when one is able to see old stage plays re-presented on television. The TV version of Ashley Duke's *Such Men are Dangerous* recalled for me a youthful visit to the theatre in the early twenties when I was enthralled by the magnificent portrayal of Count Pahlen by the late Mathieson Lang. This fine actor obtained many of his most dramatic effects by gestures and dialogue delivery which might now be considered by many to be too broad. How wonderful were those theatrical gestures, so typical of a time when actor-managers were the most important men in the London theatres. Then I saw a silent film of the same story, in which Lewis Stone played Pahlen in a rather restrained but most effective manner and, later on, a French talking film in which the dialogue was translated with sub-titles. I therefore awaited the TV version with considerable interest—and I was not disappointed. Stephen Murray's interpretation of Pahlen was in keeping with the new medium—restrained, quiet but strong. Theatrical gestures were avoided and close-ups demonstrated the many shades of meaning which can be conveyed by the eyes alone. Under Rudolph Cartier's polished direction, Mr. Murray's performance was ideally suited to the intimacy of television. Time marches on ! Thirty years ago older playgoers sighed over the restrained acting of Mathieson Lang, recalling the robust declamatory manner of Irving and Tree.

LENGTHY PLAYS

Such Men Are Dangerous was a very long play—two hours, including a short interval. If it had faults, the principal one was its great length—though I was myself gripped by it almost all the time. Another costume play, *Beau Brummell*, by Anatole de Grunwald, was half an hour shorter, but, lacking the story value of the Pahlen play, seemed to drag a little in parts. Here again, Peter Cushing's interpretation of the arrogant dandy of Regency days was restrained and intellectual in style, far removed from the romanticism of John Barrymore's portrayal many years ago. I cannot remember the detail of the Barrymore film but it seemed to me that Mr. de Grunwald introduced entirely new characters, especially that of the unfashionable country girl, Georgina Seymour, beautifully played by Daphne Slater. Campbell Logan's production was smooth and the technical values were first class. These costume pieces come over very well indeed and by comparison the more modern TV plays seem to creak with age. *Ambrose Applejohn's Adventure*, for instance, had little shape, form or wit and seemed more suitable as a vehicle for the clowning of a slapstick comedian than the well-known and loved " Housemaster " style of Jack Hulbert. It was difficult to believe that this play ran successfully for many months in a West End theatre, when Charles Hawtrey played the leading part. I suppose the light comedies of Seymour Hicks, enormously popular in their heyday, would suffer the same fate on TV.

MUSIC ON TV

MOST viewers concede that music, as such, belongs to sound radio, and only on rare occasions do they become enthusiastic about straight presentations on TV of bands and orchestras. The sight of rows of musicians playing *en masse* does not usually excite, even when the blurry long-shots are relieved by odd close-ups of individual instrumentalists or the conductor. There are exceptions, of course, and Vic Oliver's shows and " Music For You," for instance, are admirably handled by the producers. My pet aversions are the jazz-band gentlemen who introduce alleged " funny " gags in between or during their musical numbers. Generally speaking, the less they say, the better. If their bands are really good, they should cut down the patter. *The Glenn Miller Story*, a film in which 22 full musical numbers are admirably put over, was excellent both in its cinema form and in its sound radio excerpts. Here, the chief factor for success was in the varied methods of musical presentation used in one film with introductory dialogue readily adaptable for cueing in musical numbers on sound radio. I realise the difficulty of varying the clothes, settings and even the constitution of a band during a live TV transmission. This difficulty might be overcome by generous use of film for alternate sequences with live transmissions.

OLD CROCKS ?

SOUND radio has given a clear exposition of the subtle differences of the adjectives " Veteran," " Vintage " and " Edwardian " as applied by enthusiasts to the extraordinary and rather special automobiles seen on the Brighton runs and other club gatherings. It has occurred to me that these adjectives could be appropriately applied to many of the TV plays we have seen lately, though in some cases one could substitute the disrespectful description of "old crock." T. W. Robertson's play *Caste* seemed to come into this last category, with its contrived plot, its asides and its exaggerated characterisation. And yet there lingered a great deal of charm in this old play. Unfortunately, museum pieces cannot stay the pace and a running time of one hour 25 minutes was a little too long, despite the good performances of Sarah Lawson and Jill Bennett as the Eccles sisters and Mervyn Johns as their father. It was a play designed for a theatrical age of exaggerated gestures, declamatory speeches and that insinuating device for conveying plot points to the audience—the stage "aside." Too good for burlesquing and too naïve for underplaying in the modern style, *Caste* was played just a little too straight to make the grade. Nevertheless, the bright and vigorous hoydenish performance of Jill Bennett will linger in the memory for a long time.

"JEANNIE"

AIMEE STUART'S play *Jeannie* is not old enough to be a museum piece and yet it seemed to belong to a far-off theatrical era. In the title rôle, Barbara Mullen played the part of a woman from a Scottish village who decides to spend the whole of a small legacy on one grand holiday in Vienna to give her memories to store up for her old age. Her adventures in that gay city with an impecunious count and a Yorkshire business man provide an enchanting series of episodes leading up to an entirely satisfactory and happy ending. Naturally, Eric Portman played the part of Stanley Smith, the blunt but kindly Yorkshireman. It would have been difficult to think of anyone else playing the part after his success as the Yorkshire politician in *His Excellency*. It might well have been difficult to follow the dialogue with Scottish and Yorkshire dialects mingled with the broken English of the continental characters, but David Macdonald and Dennis Vance, director and producer respectively, kept the accents at a reasonable level that could be understood by all. This TV play ran for one hour 30 minutes; still on the long side, but the interest was held by the very fine performances of Barbara Mullen and Eric Portman. Back-projection and other technical devices were used in the train sequences and elsewhere to great advantage, and the whole production had a smoothness and polish which put it in the top class. *Jeannie* was a vintage play, worthy of a repeat in a year or two.

FAMILY FARE

MUCH more in the modern "Mrs Dale" or "Archers" family saga style was *It Never Rains*, by Lynne Reid Banks. Once again were we given a regional play set in Yorkshire, with Olga Lindo and Carl Bernard playing the parts of parents of three children having widely differing temperaments, and their personal problems, ambitions and troubles provided an entertainment that lasted for one hour 55 minutes. Again the play was a little too long, in my opinion—especially as the action was restricted to the kitchen of the Boltons' house. Producer Douglas Allen kept the camera on the move with expert handling, emphasising points without too much dependence on cutting from camera to camera. Incidentally, I am puzzled by the fact that this play was handled by a producer only, whereas others seem to call for a director as well as a producer. In film production the director is the man on the studio stage who instructs the actors while the producer sits in an office (or a private theatre) exercising his judgment on the artistic and commercial angles of the script, the selection of artistes, design of settings and editing of the film. In the theatre the producer directs the artistes in their performances and supervises all the technical presentation. Just what is the difference between a TV producer and a TV director? Then, of course, there is that other mysterious executive whose function is signified by the fact that he "presents" this or that TV play or feature. I must say that it conjures up for me a vision of a dominating gentleman behind a large desk mumbling wise and hypnotic words behind a large cigar.

TV PLAY ARCHIVES

I HOPE that photographic records are being made of some of these plays, even if they are only kept in the BBC archives for reference. Both 35 mm. and 16 mm. film recordings are available, of course, but are expensive if the resultant film record is not used for a public repeat performance. Meanwhile, great progress is being made with magnetic recording of pictures.

MAGNETIC RECORDING OF TV

IT still seems hard to believe it possible that good television pictures can be recorded on magnetic tape. And yet it has been done, and done very well, according to a friend who has seen what has been achieved at the Princeton Laboratories of the R.C.A. Compared with the problems of recording sound on magnetic tape, the demands of picture recording are enormous. For instance, the recording of a 4 megacycle-per-second signal on tape travelling at 30ft. per second results in a wavelength on tape of less than 1/10,000 of an inch. On the other hand a 100-cycle note recorded on the picture magnetic recorder has a wavelength of 4in., whereas on an ordinary 15in. per second sound magnetic recorder the same frequency would have a wavelength of less than 1/10in. This imposes immense problems in the design of recording and reproducing heads, particularly when a recording is intended to be reproduced on an entirely different reproducing machine. Azimuth settings require very fine adjustment to avoid losses in reproducing performance on account of excessive ground noise levels; on low-frequency sounds recorded at this very high speed it has been found desirable to use a high-frequency carrier, modulated in amplitude by the audio-frequency signals. For colour television recording the present R.C.A. standards are a ½in. tape travelling at 30ft. per second carrying five tracks in the following order: blue information; red information; sound; green information; synchronising signals. For black-and-white ¼in. tape is used, with one track for picture and one for sound, the latter being recorded with a modulated carrier. Results of pictures from magnetic recordings were practically as good as the direct pictures, both in colour and black-and-white. The cost of recording pictures on tape is claimed to be less than 10 per cent. of the cost of recording on film.

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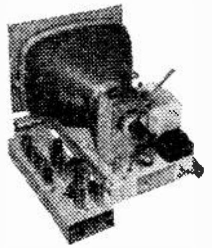

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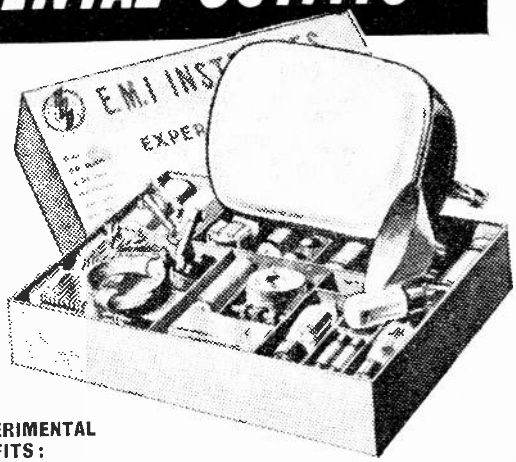

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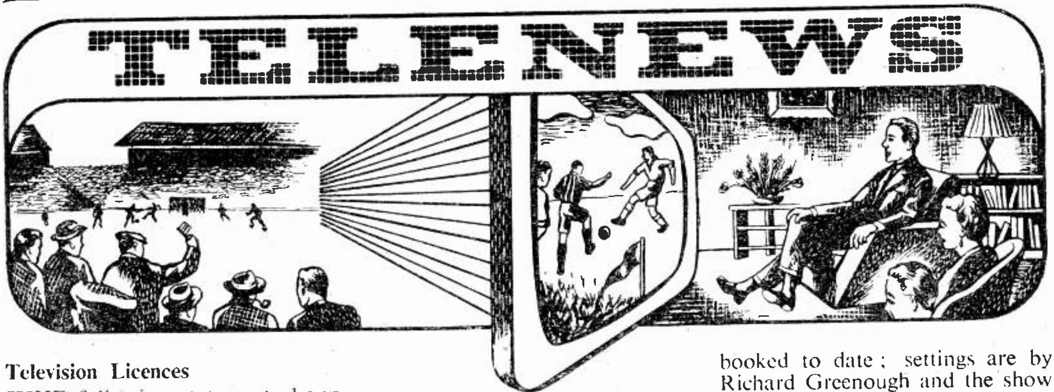

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended March, 1945. The grand total of sound and television licences was 13,436,793.

Region		Number
London Postal	...	936,019
Home Counties	...	351,920
Midland ...	...	632,117
North Eastern	...	427,072
North Western	...	450,745
South Western	...	138,163
Wales and Border	...	158,230
Total England and Wales		3,094,266
Scotland ...	...	144,273
Northern Ireland	...	10,353
Grand Total ...	...	3,248,892

World's Tallest Structure

ENGINEERS have commenced work on what will be the highest man-made structure in the world—a 1,572ft. television aerial.

The station site is situated in Oklahoma City, U.S.A., and the aerial will exceed the mast on the Empire State Building, New York, by 100ft. Completion is expected by the autumn of this year.

Relay TV for Eastbourne

IN the course of the installation of a television relay network at Eastbourne, recently, Link Relay Vision, Ltd., required a direct cable link between two of their principal stations. Every precaution had to be taken to ensure the least possible distortion of signal and part of the link between the two stations now consists of a special underground precision multicore cable designed by British Insulated Callender's Cables, Ltd., and manufactured in one length of 1,500 yards at their Helsby Works. It runs across a part of the Eastbourne Corporation territory where overhead wiring would have been unsuitable.

"In the News"

THE panel for "In the News" on May 28, will consist of Sir Robert Boothby, M.P., W. J. Brown, Anthony Greenwood, M.P., and Michael Foot, M.P.

The chairman for the programme will be Frank Byers.

Aberdeen Contract

A CONTRACT for the building work on the new medium-power television transmitting station, at Meldrum, Aberdeenshire, has been placed by the BBC with Alexander Hall and Son (Builders) of Aberdeen.

The contract includes the erection of the main building and the provision of a draining system, service roads and fencing.

His First Series

ON May 12 Bob Monkhouse, the well-known BBC script-writer, began his first series of monthly television programmes, in which he is supported by his partner, Denis Goodwin.

Produced by Kenneth Carter, the new series will be a mixture of sketches and music in an intimate style, following no set form or pattern. The Tanner Sisters and Eric Robinson and the Orchestra are among the musical residents booked to date; settings are by Richard Greenough and the show will come each month from the Television Theatre.

No Plans Yet for Schools

REPLYING on the subject of a television service for schools, Mr. Kenneth Pickthorn, Parliamentary Secretary to the Ministry of Education, said in the House of Commons recently that the BBC were unable to say when such a service would begin.

He added that it would be too costly for educational programmes to start on an experimental basis as

The new Orient liner, "Orsova," is the first ship to have the new Marconi Marine 15in. "Radiolocator" radar. One of the "Orsova's" navigating officers is seen watching the screen of the new radar in the liner's chartroom.

lengthy preparations and heavy demands on studio space and equipment would be involved.

Direct from the States

NEARLY 450 scientific and engineering experts met at the Milan International Samples Fair recently to discuss developments in the field of electronics and television and most were optimistic that television broadcasts could be received soon in Europe direct from America. This would be by means of the trans-Atlantic telephone cable, upon which work has already been started.

British Transmitters for Denmark

SIX television transmitters (three vision and three sound), with associated aerial systems, transmission lines and combining units, are to be manufactured by Marconi's Wireless Telegraph Co., Ltd., for installation in Denmark.

This important export order has been received from Sophus Berendsen, Ltd., the Marconi agents in Denmark, for supply to the Danish P. and T. It was secured for Britain despite severe competition from foreign countries, rival tenders being submitted from America, Germany and Holland.

Television Society Awards

THE Council of the Television Society has announced that the "Electronic Engineering" Premium has been awarded to D. D. Jones for his paper on "Transistors and Other Crystal Valves," and that the "Mervyn" Premium has been awarded to G. J. Hunt and E. W. Elliot, for their paper "An Introduction to the Sine Squared Pulse."

All three authors are employed in the Research Laboratories of The General Electric Co., Ltd.

Fewer Sets Sold

REPORTS from the trade show that the sale of television receivers is on the decline, commercial television being blamed for the gradual decrease. Potential viewers feel that by waiting they may avoid the expense of converting a normal receiver for commercial programmes.

New sales reports also indicate an increase in the buying of radio sets; figures for February of this year were the highest for that month—a bad one for the trade—since 1951.

Hotel Licences

NEW regulations under the Wireless Telegraphy Act, 1949, which come into force on June 1, will enable the G.P.O. to issue special licences for the reception of television in hotels.

The basic cost of this licence will be £3 plus an additional £3 for every single room to which television is relayed. There is as yet no licence which legalises the charging of an admission fee for the viewing of TV programmes.

"Biggest Gamble"

MR. CECIL McGIVERN, BBC Television Controller, recently described the plans for the international exchange of television programmes in July as "the biggest gamble that television has ever undertaken."

Top TV Town

ACCORDING to figures just released by the BBC, Walsall would be the chief contender for the position of "Top TV Town" if such a title existed. Walsall, a small Midlands town just north of Birmingham, can boast the total of 27,000 television licences whereas Wolverhampton, with a much larger population, possesses only a thousand more than little Walsall.

After Hours

THERE are not many workers who, having finished their evening meal, prepare to return to the scene of their day's work for the evening.

This is the case in Ilkeston, Derbyshire, however, where a hosiery firm have provided their employees with TV viewing facilities as part of their welfare scheme.

Aerials on Guernsey

THE States of Guernsey recently granted permission to the BBC to erect three temporary television masts and a hut at Pleinmont Point.

This is still subject to confirmation by the island's natural beauties committee and satisfactory tests will have to be made.

A popular artiste with viewers these days is Joan Regan, resident singer in "Quite Contrary," whose pleasant voice and easy style led to a request appearance in "Well, You've Asked For It."

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 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.

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SP250B, 250-0-250, 60 mA. 4 v. @ 0-2 a. 4 v. @ 3-5 a. **25/-**
SP300A, 300-0-300, 60 mA., 6.3 v. @ 2.3 a. 5 v. @ 2 a. **25/-**
SP300B, 300-0-300, 60 mA., 4 v. @ 2-3 a. 4 v. @ 3-5 a., 4 v. @ 1-2 a. ... **25/-**
SP350A, 350-0-350, 100 mA., 5 v. @ 2-3 a. 6.3 v. @ 2-3 a. **29/-**
SP351, 350-0-350, 150 mA., 4 v. @ 1-2 a. 4 v. @ 2-3 a., 4 v. @ 3-6 a. ... **36/-**
SP375A, 375-0-375, 250 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-5 a. 5 v. @ 2-3 a. ... **55/-**
SP501, 500-0-500, 150 mA., 4 v. @ 2-3 a. 4 v. @ 2-3 a. 4 v. @ 2-2 a. 4 v. @ 3-5 a. **47/-**
SP425A, 425-0-425. 200 mA., 6.3 v. @ 2-3 a. 6 v. @ 3-5 a. 5 v. @ 2-5 a. ... **67/6**
EHT Upright for VCR97 tube. 1750 RMS v., 5 mA., 2-0-2 v., 1a., 2-0-2 v., 2a. **37/6**

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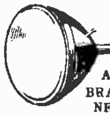

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,, K3/45	3.6 kV.	1 mA.	...	8/2
,, K3/50	4 kV.	1 mA.	...	8/8
,, K3/160	12kV.	1 mA.	...	21/6

H.T. Type S.T.C.

Type RM1	125 v.	60 mA.	...	4/-
,, RM2	125 v.	100 mA.	...	4/6
,, RM3	125 v.	125 mA.	...	5/6
,, RM4	250 v.	250 mA	...	18/-

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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).

"H" VERSUS THE MULTI-ELEMENT ARRAY

SIR,—Reference Mr. A. Hale's notes in the March issue on the subject "'H' Versus the Multi-element Array," he infers that aerials can be compared to within 1 db by observation of pictures. The only way to compare two aerials by this method is by observing the difference in signal-to-noise ratio. Ability to detect 1 db change in modulation depth does not imply ability to detect 1 db difference in signal-to-noise ratio; in fact, there is no connection between the two parameters.

Mr. Hale, by including the cost of a 12ft. mast and chimney lashings, managed to obtain a very low ratio between the prices of the two types of aerials, but I must admit that even with the exclusion of these items my ratio of 5/1 is still slightly high, at least so far as Belling and Lee's prices are concerned.

By the way, whilst I was searching through my Belling and Lee catalogue in order to check the prices I came across the following statement in praise of the "H" aerial:

"Research proves that the improvement in signal obtained by the addition of one element is not worth the cost, even though many people feel they must be better."

Perhaps the most serious mis-statement of facts is made by Mr. West when he refers to galactic noise.

In *Nature*, 158 (1946), curves are given showing the magnitude of galactic noise and at normal television frequencies up to about 70 mc/s, this type of noise is seen to be much greater than valve noise.

In a well-designed receiver at 45 mc/s, the valve equivalent noise temperature is only a few hundred degrees Kelvin, but the aerial noise temperature is several thousand degrees Kelvin. This means that the noise power in the aerial is many times greater than the valve noise, and it is this noise which causes the "snow" one sees on the screen. The fact that the aerial noise is predominant accounts for the disappointing results obtained when low noise pre-amps are tried.

At Band III frequencies galactic noise is much less than valve noise as seen from the curves and a low noise pre-amp will give a definite improvement. Also at these frequencies the broad band matching difficulties of multi-arrays will disappear, because the band width of the aerial will require to be much less compared with the centre frequency. The required bandwidth at normal television frequencies is about one tenth of the centre frequency, but at Band III frequencies the ratio is reduced to one fortieth. For these two reasons, multi-arrays (or Yagis as they are called), will be superior at the much higher frequencies.

The same reasoning applies to the use of Yagis at radar frequencies, which are much higher than normal television frequencies.

In answer to Mr. Wilson, I would like to say that my figures were obtained from a report on a survey of the service area of Sutton Coldfield, which appeared in Proc. I.E.E. Pt. III, 1951. The disagreement with his figures may be due to the use of different reference levels.—M. R. HARKNETT (author of "'H' versus the Multi-element Array") (E. Southsea).

FOCUSING — 85K TUBE

SIR,—I have read with sympathetic interest W. Herring's query in your feature "Your Problems solved" in the March PRACTICAL TELEVISION concerning the focusing of the Cossor 85K tube. I might well have written an identical letter, but have now just managed to obtain a good focus with this type of tube myself, and the following information might, therefore, be of assistance.

It would seem to me that Mr. Herring has purchased the 85K V.M. Kit as displayed by an advertiser. If so, then the mask supplied in this kit offers the maximum 4 : 3 ratio picture dimensions that this size tube can give: in consequence, the corners of the picture are made up in part of the corner radius of the tube bulb. This corner radius is obviously much sharper than the radius of the tube face and the effect of this difference, to me, is that in assuming the centre and major part of the tube face to be flat in one plane "A," then the corners of the picture verge into a plane "B," which gradually assume an angle of nearly 90 degrees from plane "A." In these circumstances it can hardly be expected that the electron beam will remain in focus when having to turn corners. However, since very little picture detail is usually contained in the corners, the small amount of defocusing that occurs in these areas does not detract from the general quality obtainable, for otherwise I have found the 85K will positively focus over a very high proportion of the screen.

The suppliers of this surplus tube recommend the WB 109/1 or the Elac 17/4 Focus Magnet, but these recommendations only hold good when using 6-7 kV E.H.T. In applying the full permitted 9 kV resulting in an increased beam velocity the low flux density of the above two magnets might not allow a satisfactory focus to be obtained.

I am using an Elac R20 Focus Ring, but as I am operating the 85K on the original View Master 6 kV E.H.T., this magnet tends to be rather too strong, as the gap has to be nearly fully closed before any focus is obtained.

My main trouble was not so much in the overall focusing, but in the correct centring of the picture within the mask. Repeated efforts failed to get the raster to extend fully to the right-hand side. It was found that the ion trap would give a false centring of the picture, but only with a dangerous reduction in the overall brilliance of the raster.

After much trial and error it was found that the very critical positioning of the focus magnet along the neck of the tube solved the trouble. The picture now centres easily, and whereas previously picture shift could be obtained only in a general leftward direction shift can be made now in all directions. Focusing is good all over, except for the corners, as mentioned above. Incidentally, the ion trap remains in its Optimum Brilliance position and has not been moved in any way to obtain focusing or centring.

The manufacturers of the tube recommend that the focus magnet should be fitted approximately 3in. from the end of the glass of the tube neck. I have found this to be rather confusing, as in my case the gap in the magnet is 4in. from the end of the glass.

The measurement I find most concrete is this: the distance between the extreme rear edge of the scanning coils to the leading edge of the vernier adjustment plate or front plate of the focus magnet is 2¼in. I would also point out that this measurement checks with that on the 15in. TV Kit marketed by the same firm (verified by measurement on one model at one of their branches). Nevertheless, it has been my experience that up to a ¼in. either way of this 2¼in. can make or mar the correct focusing and positioning.

Another final point Mr. Herring might consider is in checking the position of the focus magnet in relation to the axis of the tube neck. Given the focus unit is uniform in flux density, tilting too far up or down or sideways could possibly cause defocusing in parts of the picture. On the other hand, if the magnet is faulty to some degree, then tilting might well assist in obtaining focus. Finally, he might try swinging the focus magnet through 120 degrees either way around the neck to see whether this helps.

As a matter of interest, it is my opinion that there does not appear any necessity in raising the E.H.T. to 9 kV with this tube. I obtain quite good pictures using only 6 kV and can even, on occasion, use a tinted filter in front of the screen and still get sufficient brightness whilst retaining focus.—L. H. MILLER (London, N.17).

COST OF COMPONENTS

SIR,—Whilst I heartily agree with H. Telford, with regard to the exorbitant price of large-size cathode ray tubes, I find it difficult to imagine how they can be serviced except by their respective manufacturers. However, a prominent manufacturer does, in effect, repair your tube for you, if of their manufacture, by supplying you with a new tube at half price, and repairing your tube equal to new.

But in my view a more serious shortcoming of TV is the low quality of reproduction presented by the majority of receivers. We who are interested in TV do occasionally note, with appreciation, a solitary model which can resolve a picture up to 3 Mc/s, with good linearity, contrast, interlace, etc., but for one set which can do this there must be thousands that will not.

This suggests to me immense possibilities, for some manufacturer who will dare to claim in advertising his wares: that "every set which leaves his works will resolve Test Card C with no visible imperfection." Providing no second-rate sets were ever allowed to leave his works that manufacturer would be firmly set on the road followed by the famous motor-car manufacturers. A position which, at the present time, cannot fairly be filled by any of the better-known TV manufacturers.

But unlike H. Telford, regarding what he calls unitisation, I feel my manufacturer as outlined above could with advantage, exchange, complete electrical elements as distinct from cabinets, of their TV sets at a fixed fee to keep them always up to standard, and so maintain his reputation.—G. METCALFE (Skipton).

BRIGHTENING VCR97

SIR,—Although my experiments are now over, using VCR97, I have been tempted many times to write of a tip I used for brightening the tube considerably, in fact in my case when the tube got a little old made the difference of a picture or no picture at all.

I do not feel it possible that I am original in this idea as to me it seems obvious what happens.

Here is the tip in a few words but first you will need a permanent magnet from an old loudspeaker.

There are two positions for it, under the tube at the front or in a reversed position at the back. I used to keep mine on the table in front as my heap of equipment never got to the stage of being fitted to a cabinet. It seems pretty obvious to me what happens, the beam is pulled or pushed to the tube face, according to the position of the magnet.

I should be very interested to know how other readers fare as I only tried it with one tube and feel certain that my experience was not unique.

Of course, the position of the magnet is fairly critical and needs to be found by experiment.—P. R. MOUNTER (Langport).

TUBE REPLACEMENTS

SIR,—With reference to the May, 1954, issue, page 580, "Your Problems Solved," we would offer the following information regarding the answer given to the query from G. O. Ware, Enfield.

The MW22-16 is a tetrode tube incorporating an ion trap and before recommending this tube as a replacement for earlier non-ion trap tubes, it is necessary to ensure that it is possible to do this, for the following reasons:

1. Insufficient room for the adjustment of the ion trap magnet (a space of approximately 30 mm. of the glass neck next to the base is usually required).
2. Ferrous rear tubes supports which will cause a deterioration in the field strength of the ion trap magnet.

In the case of the Invicta T101, we do not recommend the MW22-16 as a replacement as there is insufficient room on the neck of the tube to adjust the ion trap magnet. We normally recommend our type MW22-18, which is a non-ion trap tube. When substituting it is necessary to change the base to a B12A type and earth the external conductive coating.—I. A. REID (Mullard, Ltd.).

YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 47 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

LACK OF WIDTH

Could you help me with a fault on my "View Master"? My width control only opens out full to a 9in. tube and not a bit over; after that just one side opens out and that is on the linearity side, and the other side remains stationary. I have always had the picture wider on that side and I cannot overcome it. Would you kindly help me?—F. J. Morley (S. E.14).

Insufficient line width may be due to the voltages in the V10 stage being on the low side and we suggest that this should be measured and, if necessary, corrected; also ensure that the correct boost volts are obtained across C42, if necessary replacing MR2 and V10.

REPLACING BRIMISTOR

Could you inform me as to the correct value for a 1 watt resistor, in series with the heaters and heater voltage dropper resistor, in the Ferguson Model 998T, 12in.?

The resistance in question must have suffered from a dry joint, as the increase in resistance caused severe thermal agitation, resulting in the colour code being burned off.—R. G. Stevens (Nr. Loughborough).

A 1-watt resistor is not used in the heater circuit of the Ferguson type 998T. We feel that you may be referring to the Brimistor type CZ1A; this is connected between the heater of the H.T. rectifier (PY82) and the mains dropper. In certain sets a thermistance is used instead of a Brimistor. When a Brimistor is employed, however, a 350Ω 5-watt wire-wound resistor is connected in parallel. It should be mentioned that it is quite normal for these components to work at a very high temperature.

CHANGING A TUBE

The Emiscope tube of my H.M.V. 1949 No. 1804 10in. tube, type 3/4 has just blown. As I have always wanted a larger picture, can you give me any details as to the possibility of putting in a 12in. tube without too much modification?—D. G. Lewis (Romford).

Your model set is not readily adaptable to cater for a current type 12in. picture-tube. There is an older style 14in. tube, however—Emiscope type 3/5—that could be used in the receiver without any electrical modification of any kind. This tube is now generally available for replacement purposes only.

I.F. COIL DATA

I have a Sobell Model T91 which has recently developed trouble which I have localised to the T4 sound transformer (9.5 Mc/s ?). Unfortunately, the fault destroyed the turns on this component and I would like to rewind it. The component is now obsolete with the makers. Could you please provide me with the turns, spacing, etc., required to perform this operation?—C. J. Hurley (Tylorstown).

This data is not available and is not issued by the manufacturers. You should be able to deduce the approximate number of turns required and the mode of winding by examining the adjacent transformer in the sound channel. It may be necessary to modify the number of turns slightly to obtain the optimum tuning point.

IMPERFECT FOCUSING

I have recently fitted an "Elac" Duomag focaliser, type No. FD14/9 medium flux to my "View Master," which uses a Mullard tube MW 31-16 (12in.), and find it totally unsuitable.

It was specified that a "tetrode" tube was being used, and my dealer, although I think in some doubt, recommended medium flux.

I find that the brightness of the spot is affected, and no matter how I move the focaliser, either towards or away from the deflection coils, I cannot get even a rough focus.

I should therefore appreciate it very much if you could let me have your remarks and recommendations at your earliest convenience.—Alan Lewis (Selby).

From your description it is quite evident that your focusing arrangement is unsuitable. It is probable that the focus flux is excessive for a tetrode tube, and, in addition, it is possible that it is too large physically, causing a variation in the magnetic field of the ion trap magnet. Hence there will be a variation in brightness when adjusting focusing. As this type of focus magnet is an unspecified type, we have no operating experience with it on this particular receiver.

FAULTY TUBE

I have an Ultra TV model W470, 9in. tube. I have had three service engineers overhaul it within one month but still cannot get a satisfactory performance for more than 1½ hours' continuous viewing. The I.F. chassis has been sent to the makers for check-up and was returned fitted with a new oscillator coil and two new valves. They diagnosed "frequency creep." These replacements have not made any difference to the performance.

These are the symptoms: After warming up for 10 minutes, the picture comes up quite good with contrast, focus and definition quite good. After about 90 minutes' viewing the picture slowly darkens with a falling of contrast and high-lights until the whole picture becomes milky. Any further adjustment of the contrast control makes the picture fade to almost a plain milky screen.

I shall be glad if you will diagnose the trouble and tell me what the fault or faults may be.—T. W. Bond (S.E.10).

On the face of it, this symptom would seem to be the result of a defective picture-tube. Many unusual effects are caused by a picture-tube that deteriorates in efficiency and alters in characteristics after it has been working for a while. Unfortunately, a fault of this nature can be proved only by substituting the suspected component.

RESISTOR VALUE CHANGE

On my television receiver Pye FC1 the line hold control has got gradually more critical.

Looking at the back of the receiver the control knob has to be turned fully anti-clockwise to prevent the picture tearing. I have tried different EF80 valves, but there is no improvement.—W. Paterson (Hambleton).

This symptom on the Pye series is nearly always caused by an alteration in value of a resistor directly associated with the line hold circuit. If you examine this section, two resistors will be observed connected to the line hold potentiometer: the one connected to the slider of the control should measure 150,000Ω and the one connected to the high potential side of the control should measure 39,000Ω. These resistors should be checked for value and replaced if necessary.

POOR INTERLACE

I would welcome your advice regarding my "View Master," constructed for double-deck working, using a 12in. Mullard 31-17 tube.

I have recently noticed that a fault has developed with the interlacing—it appears to be pairing on lines. I have checked wiring, changed valves, but cannot locate the fault. I will also mention that to obtain a reasonable line hold I can only do so by doubling the value of the resistor in series with the variable line hold.

I trust that you will be able to assist me with the mentioned faults.—G. A. Wright (Orpington).

To improve interlacing it is probably only necessary slightly to reduce the value of R57.

The increase in the value of R44 can have no connection with difficulty in interlacing, and in any case will cause no harm.

LOW E.H.T.

I have a Cossor television set, model No. 926.

For 18 months it has given perfect results, but now on switching on the picture height is extended considerably and the focus is very bad. The focus can be brought back by turning the control fully over (focus control R77).

After about 10 to 15 minutes the picture height has shrunk to normal and the focus control has to be readjusted, then picture is perfect until next switch-on.

Can you give me a lead to the fault ?—A. H. March (New Malden).

The main cause of this trouble is low E.H.T. voltage, which gradually increases nearly to normal after the set has been in operation for a while. This in a large number of cases is due to a defect in the E.H.T. rectifier valve, which results in low emission after the valve commences to conduct, but gradually returns to something like normal after the cathode has been emitting for a while. The valve concerned in your set is an SU61, and is positioned underneath the removable metal top of the line output transformer can.

FAULTY RECTIFIER VALVE

Could you help me rectify a fault which has developed in my "Ultra" TV model VA7216 ? On switching on screen fully lights up, then after about one minute it suddenly cuts right out, leaving the screen blank and leaving a spot in the centre of tube, which also dies out. If I switch on after a short period again it comes on with loud hum and remains O.K. for rest of programme. This trouble happens regularly.—A. Woodroffe (Birmingham, 18).

The effect you describe is often caused by an intermittent defect in a section of the U801 valve. This is positioned behind a metal shield at the right-hand side of the chassis when viewing from the rear of the cabinet.

MAINS TRANSFORMER FAULT

I shall be much obliged if you will assist me in locating some trouble I am experiencing with my "View Master" television on which I use a 12in. G.E.C. aluminised tube type 6705A and E.H.T. boost.

On most occasions on switching on the neon warning lamp glows and the valve heaters and C.R.T. remain dead, although the mains plug is properly connected. On the occasions when the neon lamp remains dead, the valve heaters function, but after the normal heating-up time the tube face becomes very bright with the flyback lines showing and the picture hardly noticeable behind the brightness. On reducing the gain, the usual point is reached where line slip occurs, but on increasing the gain no noticeable change takes place and the brightness control has no effect on the screen. The sound is as normal.—W. Cameron (Glasgow, S.4).

There appear to be two quite separate faults in your receiver. In the first place, if your neon lights but the heaters do not, it must merely indicate a disconnection to your mains transformer, possibly due to a faulty mains switch. When your receiver is operating and the brightness is excessive, it may be due to a fault in your C.R.T., a fault in the brightness control circuit, though this should be shown up by a voltage measurement and, possibly, by a failure in the operating conditions of V5, such as a short-circuit across R70, which may prevent sufficient bias being developed.

SOUND ON VISION

I have a Philco model T1412. It is two years old. When test card is on the centre ring appears to be moving round, and when raster is on the black vertical band seems to be flowing down. It is a good picture, but when anyone is singing loudly waves start to move up the screen.

I would be very grateful if you could determine the fault for me.—J. Derbyshire (Newton-le-Willows).

This is the symptom of sound interference on vision. Several factors could cause the effect, but in the main you should carefully check the following: general alignment of the tuned circuits; excessive aerial signal—this would be evidenced by little or no setting of contrast to resolve a picture: a microphonic valve associated with the frame timebase (in this case the effect would be displayed in more severe form as the volume control is turned up).

REPLACING A RESISTOR

On switching my Pye BV30 TV there was a crack ; the sound was on, but no picture. I took the set out and under the PZ30 and PL38 valves I found a wirewound resistor burnt out ; it is the only wire resistor in the set. Could you help me by telling me the value of it ? —Benison (Worksop).

The wirewound resistor to which you refer is probably the line-output valve screen feed. This has a value of 1,500 ohms, but before replacing check the insulation of the 0.1 microfarad capacitor which is connected between one side of the resistor and chassis. The capacitor generally short-circuits to cause the resistor to burn out.

RADIO UNLIMITED offer: Valves, new/boxed, 5/- each; 1L4, 3A4, EB91, 6K7, 6B8, 12J5, 6J5M, 6C5, D63, LP2, EF50, SP41, SP61, ARP12, AR8, 6K6, 6H6M; at 6/6 each, 6J7M, 6V6, 6F6, EL32, 6X5, 12SL7, VR101, 6SK7, EF91, EF92; at 8/6 each, 5Z4, U14, 6BE6, 6BA6, 6BW6, 12AT7, 6AT6; at 7/6 each, 1T4, 1S4, 1S5, 1R5, 3S4, 3V4; c/plete sets, 5Z4, 6V6, 6K7, 6Q7, 6K8, 35/-; Viewmaster set of 12, £6/2/6; Viewmaster Coils, 17/6 set, incl. choke; Iso. Trans., 2v, 4v or 6v, 6/6; V/master Fil. Trans., 35/-; Coilpacks, l., med., short, 24/6; Heater Trans., 200/240v, 6.3v at 1.5a, 5/6; Chokes, 10h-65ma, 5/-; Co-ax. Cable, 7/6 doz. yds.; Cored Solder, 16oz. ctn., 8/9. New lists available. RADIO UNLIMITED, Elm Road, London, E.17. (KEY 4183.)

VIEWMASTER (Sutton Coldfield) completed 12in. Console chassis, valves, tube with cathode heater short, speaker, pre-amp.; offer nearest £25. OWEN, "Northdown," Beech Street, Highley, nr. Kidderminster.

T.V. AND RADIO Service Sheets, 2/3. Sales/loan list, 1/-; s.a.e. RATEL, 171, Norris St., Preston.

TELEVISION.—All home-built TV Coil Sets; ⅜in. TV Canned Formers, 2/3; Commercial Converters, £15. BEL, Marlborough Yard, N.19. (ARC. 5078.)

SENSATIONAL AMPLIFIER, fully isolated A.C., 3 int. oct. valves, vol. and neg fedbk. controls, dual input, 2 ohm out; no ex-Govt. components; newly wired and tested; 79/6. E. K. ELPHEE, 47, Arksey Lane, Bentley, Doncaster.

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For T.V. only use our Midget Iron Dust Chokes and Button Condensers, specially designed for small spaces, 3/6 set of 4, p.p. 3d.; state 1 amp or 2 amp. SERVIO RADIO, 156-8, Merton Rd., Wimbledon, S.W.19. (LIBerty 6525.)

ELECTRONIC TESTER required for fault tracing and repairs on miniature audio equipment including work on transistor circuits. Please write with details of experience and wages required to PERSONNEL OFFICER, Fortiphone Ltd., 22-27, Addington Square, S.E.5.

STORAGE BATTERIES, 12v, 75AH heavy duty, 19 plates, separate cells in hardwood cases; finest possible specification, £5/17/6, 9/6 delivery; 12v, 22AH, almost similar specification, surprisingly powerful, £2/14/-, delivery 5/6; 6v, 90 AH, 15 plates, hard rubber Cells, also suitable for cars, tractors, lorries, etc., £3/7/6, delivery 7/6; 6v, 150 AH, extra heavy duty, 25 plates, separate cells in hardwood cases, £5/7/6, delivery 8/6. TEDDINGTON ENGINEERING CO., CO., LTD., Dept. "C," High St., Teddington, Middx. (KINgston 1193-4.)

MESSRS. JASSOY & HAYES, F.V.I., A.A.L.P.A., Agents to the Radio/Television Trades, can offer several businesses for sale as going concerns to those enthusiasts wishing to branch out on their own. Write and give particulars of requirements. JASSOY & HAYES (P.T. Dept.), 23, Leinster Terrace, London, W.2. (AMB. 9575.)

RATES

4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

"VIEWMASTER" Valves, exact to specification, guaranteed new and boxed, set of 12, £5/15/-, post free; "Tele-King" 17in. Receiver, complete set of 17 valves, exact to specification, £8/19/6, post free; 6AM6, EF91, 6F12, Z77, EB91, 6AL5, 6AM5, EL91, any 8 for 50/-, post 1/6; 1.4v miniatures, 1S5, 1R5, 1T4, 3V4, 3S4, 1S4, DK92, any 4 for 27/6, post 1/-. All guaranteed brand new and boxed. For individual prices and other types, see displayed advert., p. 48. READERS RADIO, 24, Colberg Place, Stamford Hill, London, N.16. (STA 4587.)

LOUDSPEAKERS repaired promptly. MODEL LOUDSPEAKER SERVICE, Bullingdon Rd., Oxford.

ELECTRONIC COMPONENTS. Send stamp for interesting comprehensive bargain list. A. J. S. McMILLAN, 5, Oakfield Rd., Bristol, 8.

VCR511A 12in. Electrostatic Tube, £5. Write: R. HALLETT, 30, Denholme Rd, W.9.

TRANSFORMERS: EMI. Input, 110/245v, outputs 350/0/350v, 120ma, 6v, 4a; 4v, 2a, Dropthru', 18/- (p. paid). Meters: 2in. sq., 5 or 100ma, 7/-; 2in. rd., 4a. AC, 8/6; 2½in. rd. fl., 100, 200 or 20ma, 8/-; 15v, a.c., 10/6; 130v. AC/DC (1ma FSD), 15/6. Pots, w/w, 20 k 10w, 3in. dia., 3/6. Condensers, .5 2.5kVw block, 4/6; 500 or 750pf. Ceramic, 15kVw, pair 5/6; 8mfd, 500vw block, 4/6; R.F. Units: 24, 25, 15/-; 26, 27, 35/-, with valves. Dynamotors, soiled cases, input 6 (or 12v), output 250v, 80ma approx., 8/6 (p.p. 2/-). LT/HT Filter for these, 2/6, c.w.o., post extra; immediate despatch. S.A.E. for List/enquiries. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

MANUFACTURER'S SURPLUS STOCK.—Telefridge Service, 193, Mare Street, Hackney, have pleasure in announcing the opening of a special department solely for the convenience of the home constructor and radio enthusiasts everywhere. Electronic spares and service sheets a speciality. Send 2½d. stamp for free list. Personal callers welcomed. (Amherst 4426.)

AMERICAN MAGAZINES.—One-year "Audio Engineering," 28/6, specimen copy, 3/-; "High Fidelity," 50/-, specimen copy, 4/6; "Popular Science," 28/6. Free booklet quoting others. WILLEN LTD. (Dept. 23), 101, Fleet Street, London, E.C.4.

HIGH GAIN 4W 230-250 AC Audio Amplifier, suitable mike or gram., with tone control; chassis 8in. x 6in. or 9in. x 4in., price £5/14/-, complete with valves and fully wired. Controls, less switch, ¼in. spindle, 1/8 each pre-set 25K (miniature); 2 Meg Spindle, 1in. long (min.), pre-set 20K (1¼in. dia.); 2K spindle, ½in. long (1¼in. dia.); Alum. alloy tube, ⅛in. dia., 18SWG, 9d. ft.; 1½in. dia. for cross arm, 2/- ft.; cast mast-head Bracket for 2in. pole, 8/6 (with 4 "U" bolts); 2in. dia. high tensile Poles, 10ft., 32/6, 12ft. 39/-, 20ft. 65/-; double Chimney Lashings, complete, 30/-, single 25/-; please add a little for carriage. GLADSTONE RADIO, Gladstone Place, Newton Abbot, Devon.

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ALL YOUR T/V COMPONENTS, Valves, Books and Transformer Rewinds can now be obtained from one source. Send 9d. stamps for new "Replacement and Rewind Manual." "DIRECT T/V REPLACEMENTS," 134-136, Lewisham Way, New Cross, S.E.14. (Tideway 3696, 2330.)

50 SECONDHAND Televisions always for sale; famous makes. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

BOOKLETS: "How to use ex-Gov. Lenses and Prisms." Nos. 1 and 2, price 2/6. Ex-Gov. Optical lists free for s.a.e. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

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News from the Trade

TWO NEW TELEVIDOR RECEIVERS HAVE CONVERTOR UNIT SOCKETS

TWO new television receivers have been added to the Vidor range. Both have a socket for a multi-channel convertor unit giving second and third programmes. Model CN 4220 has a 14in. flat, daylight viewing tube and retails at 65 guineas including purchase tax. The 17in. TeleVidor—CN 4221—is priced at 74 guineas including tax.

The convertor unit socket embodied in the new TeleVidors provides for an input at the intermediate frequency, thus eliminating the interference from Band I stations.

The socket also enables the heater and H.T. power to be fed to the convertor from the receiver chassis, thus dispensing with the need for a separate power supply. By adopting this system Vidor hope to provide in due course a suitable convertor at minimum cost.

All TeleVidor receivers are superheterodynes and have no special circuitry which would complicate their adaptation for use with any standard convertor.

Manufacture of the TeleVidor 12in. receiver—model CN 4216—will continue, and the price remain unchanged at 56 guineas with tax.—Vidor-Burndept, 18, Abbey House, Victoria Street, S.W.1.

WOLSEY ADDITIONS

A FURTHER addition to the range of Wolsey "Quick-Fix" aerials, the "Deltex," introduced for the first time at the 1954 R.E.C.M.F. Exhibition, is an X-shaped aerial with the added advantage of delta matching which, by ensuring correct matching of aerial to feeder, results in marked gain and performance over similar aerials that are not matched.

The "Deltex" is supplied completely pre-assembled for speedy erection, the ½in. dia. 18 s.w.g. elements being swivelled into position and firmly clamped by one bolt only, the clamp being of very robust construction in corrosion-resisting alloy. The matching stubs complete with junction box are attached at one end and when swung into position are clamped at the other by the insertion of one bolt and tightening of a wing nut. The diecast junction box is specially sealed to prevent entry of moisture and designed for ease of making connections. Available for all channels, suitable for wall mounting, mast mounting or chimney lashing.

Price of the DX/L kit comprising the "Deltex" aerial, 6ft. by 1⅛ in. duralumin stand-off arm and complete set of chimney lashings with aluminium diecast chimney bracket is 77s. 6d. retail.

With a view to assisting the engineer, and for providing the most efficient contact, Wolsey have introduced the new solderless co-axial plug. This can be quickly and easily assembled, and obviates the necessity for soldering. The dimensions of the cable of which it will accept are from .2in. to .312in., and by the action of the collet ensures a firm grip on the cable. The plug is manufactured of brass, nickel finish and is nylon insulated, price 1s. 2d. retail.

Wolsey Television, Ltd., 43-45, Knights Hill, West Norwood, S.E.27.

This is the "Nuray" heater booster unit which was described in this section in last month's issue. It is available from Direct TV Replacements, 134-136, Lewisham Way, S.E.14.

TRICOLOR PICTURE TUBE

RECENTLY made commercially available by the RCA tube department, the 15GP22 is a directly viewed picture tube of the glass-envelope type for use in colour television receivers. It is capable of producing either a full-colour or a black-and-white picture 11½in. by 8⅝in. with rounded sides (double-D).

The 15GP22 utilises three electrostatic-focus guns spaced 120 deg. apart with axes parallel to the tube axis; magnetic deflection; electrostatic convergence; and an assembly consisting of a shadow mask and a plane, tricolour, filterglass phosphor-dot (screen) plate located between the shadow mask and a clear-glass faceplate.

The tricolor phosphor-dot plate, which serves as the directly viewed screen, carries an orderly array of small, closely spaced phosphor-dots arranged in triangular groups (trios). Each trio consists of a green-emitting dot, a red-emitting dot, and a blue-emitting dot. The phosphor-dot plate has approximately 195,000 dot trios or 585,000 dots and is metalised after application of the phosphor-dots to give increased light output and contrast, as well as to prevent ion-spot blemish.

The metal shadow mask, interposed between the electron-gun structure and the phosphor-dot plate, contains round holes equal in number to and centred with respect to the dot trios.

A technical bulletin for the 15GP22 may be obtained from RCA Photophone, Ltd., 36, Woodstock Grove, Shepherds Bush, London, W.12.

QUERIES COUPON

This Coupon is available until June 21st, 1954, and must accompany all Queries.

PRACTICAL TELEVISION, June, 1954.

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250-0-250 v 100 ma. 6.3 v 4 a. 5 v 3 a	23 11
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250-0-250 v 100 ma. 6.3 v 6 a. 5 v 3 a. for R1335 Conversion	31 6
350-0-350 v 100 ma. 6.3 v 4 a. 5 v 3 a ...	25 9
350-0-350 v 150 ma. 6.3 v 4 a. 5 v 3 a ...	33 9
350-0-350 v 250 ma. 6.3 v 6 a. 4 v 8 a. 0-2-6 v 2 a. 4 v 3 a. for Electronic Engineering Televisor	67 6
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All with 200-230-250 v 50 c/s Primaries ; 0-9-15 v 1.5 a. 13 9 ; 0-9-15 v 3 a. 16/9 ; 0-9-15 v 6 a, 22/9 ; 0-9-15-30 v 3 a, 23 9.

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250 ma 7-10 h 200 ohms. Fully Shrouded	16/9
100 ma 10 h 150 ohms	7 9
80 ma 10 h 350 ohms	5 6
50 ma 40 h 1,000 ohms Potted... ...	8 11

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150 ma 10 h 150 ohms Tropicalised ...	9 6
250 ma 3 h 50 ohms Potted	7 11
250 ma 15 h 250 ohms	14 9
250 ma 10 h 100 ohms	16/9

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.02 mfd 8 Kv, 1 11 ; 0.1 mfd 2,000 v, 1 11 ; 0.25 mfd 5,000 v. 3 9 ; 0.5 mfd 3,500 v, 3 6.

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