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AND TELEVISION TIMES

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EDITOR
F. J. CAMM

A NEWNES PUBLICATION

Vol. 3 No. 30 NOVEMBER, 1952

FEATURED IN THIS ISSUE

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- From VCR97 to ACR2X
- Low-noise Pre-amplifiers
- Servicing Without Instruments
- Pre-detector Stages
- Converting to a New Channel

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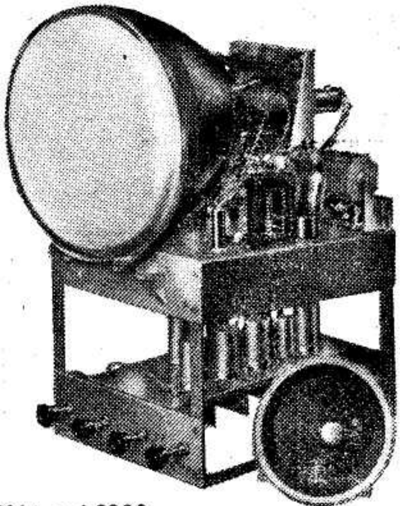

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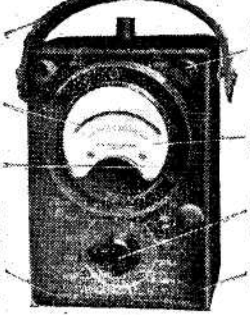

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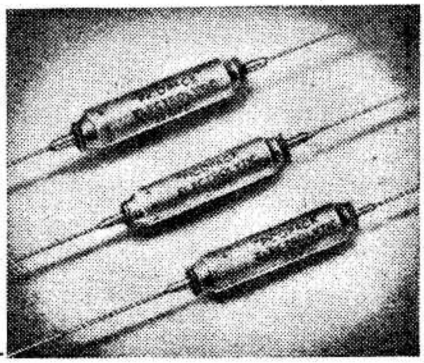

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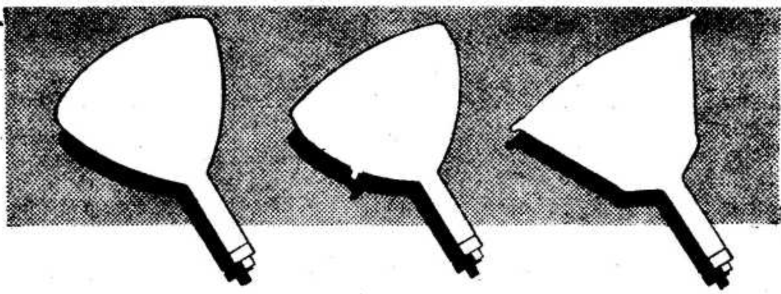

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PRACTICAL TELEVISION

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Editor: F. J. CAMM

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Vol. 3 No. 30 EVERY MONTH NOVEMBER, 1952

Televiews

Progress Analysis

DISCUSSIONS continue in the Press and in trade circles as to whether television is changing the pattern of family life. Even conjurers have realised that illusions suitable for stage presentation are unsuitable for the screen, the visual part of the most marvellous magic box of all time. They have decided that they must evolve a new technique.

In the first six months of 1951 every radio shop in this country on an average sold 79 radio receivers and 59 television receivers. In the same period for 1952 the sales of radio receivers per shop had dropped to 38, while television receivers averaged 40 per shop. The percentage drop is seen to be greater with radio than with television. The falling of sales is undoubtedly due to the new hire-purchase regulations which caused the cash sales of television receivers to fall by 61 per cent. and hire-purchase sales by 78 per cent. It is estimated that the total number of television receivers in use is now 1,900,000. Of these 63 per cent. employ 12in. tubes, 30 per cent. 9in. and 10in. tubes, 4 per cent. 15in. and 16in. tubes, 1 per cent. 14 in. tubes, and projection systems 2 per cent. Most sets are sold in the £60 to £75 price groups, which chiefly embrace 12in. table models. The proportion of 15in. table models is on the increase.

The 14in., 15in. and 16in. models have risen from less than 1 per cent. of monthly sales immediately before the 1951 Radio Show, to 24 per cent. of monthly sales at the present time, while models with 12in. tubes have dropped from 78 per cent. to 68 per cent. of monthly sales. Production figures are illuminating. In 1946 total annual production of TV receivers was 6,500. This had increased to 28,200 in 1947, 90,800 in 1948, 210,800 in 1949, 537,300 in 1950, 712,900 in 1951, bringing the total of television receivers produced up to the end of 1951 to 1,586,500. Of these, 1,524,900 were sold in this country. At that time there were 1,162,359 licences in force. To date that has jumped to 1,538,550. From January to June of this year over 388,000 TV receivers have been produced, of which 323,000 have been sold in the home market.

It would seem that the days of the 9in. and 10in. tubes are numbered. It is true that some firms still produce 9in. models, and while taxation and the present hire-purchase arrangements continue the smaller tubes will be employed to keep the price down. In due course it is very possible that projection television providing indirect viewing will oust the large tubes altogether. Unfortunately, projection TV receivers are necessarily expensive, the optical unit alone costing far more than the largest CR tube. The cost of this, however, is offset to some extent by the very small tube necessary.

Although there appears to be a growing demand for larger tubes, it is significant that the P.T. Argus employing a 6in. tube and the P.T. Receiver, employing a 9in. tube, are being built in large numbers. Home-constructed television receivers are on the increase and it is estimated that 400,000 of them are being operated at present. Well over 3,000 Argus TV receivers are already working.

The forecasts which were made some years ago that TV would be outside the skill of the amateur have proved to be very wide of the mark. Indeed, the amateurs have performed a great service to the industry in acting as unpaid ambassadors to the trade. Considerable sales must have followed the demonstrations given by amateurs.

QUERIES—DON'T FORGET THE COUPON!

ONCE again we must remind readers that we do not undertake to answer questions concerning receivers sponsored by other publishers. Those queries should be sent direct to the particular journal or publisher concerned. All querists must enclose with their letters the *query coupon cut from the current issue.* The coupon this month appears on page 288 and it should be sent with a stamped, addressed envelope. It has been necessary to introduce the query coupon because we were receiving so many letters from non-readers who have presumed that our free advisory service is free to all. It is only available to our regular readers.

INDEX FOR VOLUME II NOW READY

INDEX to Volume II, comprising issues dated June, 1951 to May, 1952, may be obtained for 1s. 1d., by post from the Publisher, George Newnes, Tower House, Southampton Street, Strand, W.C.2. Whether you have your copies bound or not you should obtain the index, which saves a lot of searching when you wish to consult a particular article.—F. J. C.

Using 12in. Electrostatic Tubes

HOW TO INCORPORATE CERTAIN EX-RADAR TUBES IN PLACE OF VCR97 AND SIMILAR TUBES

By J. H. Willis

THERE must be many experimenters using the VCR97, or other 6in. C.R. tubes, for television, who have considered the possibility of using the larger radar tubes which are available from some Government surplus stores at reasonable prices.

A study of ex-Service C.R. tube characteristics shows that 12in. (300mm.) screen diameter tubes are available which should be suitable for use, and the most suitable of these seem to be the following types :—NC20, VCR131 and VCR511A. The first two have short persistence green screens, and the latter a long-persistence screen, but the suffix A indicates that the screen is of the same type as the VCR517A which has a low intensity afterglow, and which has been found suitable for television purposes.

The deflection sensitivities of the NC20 and VCR131 are 900 mm./v./v., and the VCR511A 1,000 mm./v/.v. for both the X and Y plates. This means that for a final anode voltage of 5,000 volts—minimum for reasonable picture brightness—the peak-to-peak saw-tooth deflection voltages required for a rectangular picture 9¼in. × 7in. (235 × 177 mm.), are as follows :—

NC20, VCR131.

$$\text{Line deflection voltage} = \frac{235}{900} \times 5{,}000 = 1{,}300 \text{ volts.}$$

$$\text{Frame deflection voltage} = \frac{177}{900} \times 5{,}000 = 985 \text{ volts.}$$

VCR511A requires 0.9 times the above voltages for the same size picture, i.e.—

Line : 1,170 volts. Frame : 887 volts.

It was obvious that a linear 10,125 c/s saw-tooth of the order of 1,200 volts peak-to-peak with a sufficiently short flyback time would be a severe problem to overcome, especially as easily available valves had to be used. The writer, however, decided to try and overcome the above difficulties, so a VCR511A was bought and, after much experiment, the following circuits were evolved for the Line and Frame deflection voltage amplifiers.

Frame Timebase

The Frame voltage amplifier (Fig. 1) is comparatively straightforward, although it is to be noted that the antiphase feed to the second valve is obtained from a small resistance in series with the screen grid of the first valve. This method of providing an antiphase voltage to give push-pull output from an unbalanced input is unusual, but when used with negative feedback has proved highly satisfactory in enabling the maximum undistorted push-pull voltage output to be obtained. Another advantage is that the valve screens can be operated from the normal 300-350 volt H.T. line, and so small 350 volt working condensers can be used—the anodes require a much higher voltage as shown later.

Linearity control is achieved by arranging a large amount of negative voltage feedback from V1 anode to grid through a selected capacitance (C2). The amount of the feedback is made adjustable, so that precise adjustment of linearity can be obtained. The value of C2 can be selected to correct for non-linearity of the Frame oscillator as well as the amplifier, and when a blocking oscillator is used (as in the writer's case), the uncorrected picture is considerably pulled out at the top and compressed at the bottom. A smaller value of C2 gives more correction, and values between .001 μF and .005 μF should cover all cases. The grid to earth condensers C3 and C8 have negligible effect on the Frame saw-tooth waveform, but are necessary to eliminate interference from the Line amplifier.

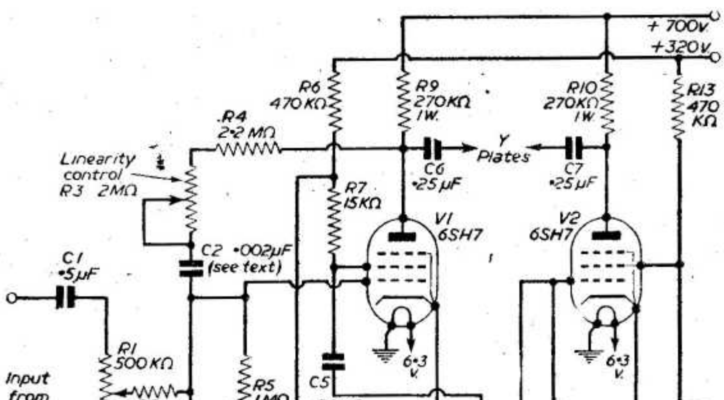


Fig. 1.—Circuit of frame deflection amplifier.

Line Timebase

The Line voltage amplifier is shown in Fig. 2. The conditions to be satisfied by this amplifier are much more severe and conflicting, e.g., the values of the anode load resistors are limited because of frequency response considerations (flyback time), and a larger voltage output than the frame voltage amplifier is required. A study of the circuit shows that the same type of antiphase feed to the second valve is used, but each valve has frequency response correcting negative current feedback which has the effect of eliminating the "fold-over" which occurs at the left-hand side of the picture when the flyback time is too long. The linearity control is C3, which applies frequency selective negative voltage feedback from the screen to the grid of V1.

The valves used for this and the frame amplifier by the writer are 6SH7 pentodes (ex-Service metal type), which are not showing any signs of failure after very many hours use with 700 volts D.C. anode supply voltage, and, in the case of the line amplifier valves providing a 600 volt " swing " at the anode. It is to be noted here that the line oscillator should be a Miller integrator—transitron type, which has an anode load resistance not greater than 20,000 ohms, also that the circuit with component values shown was the only one of the very many tried which gave satisfactory performance, i.e., maximum picture width *and* perfect linearity.

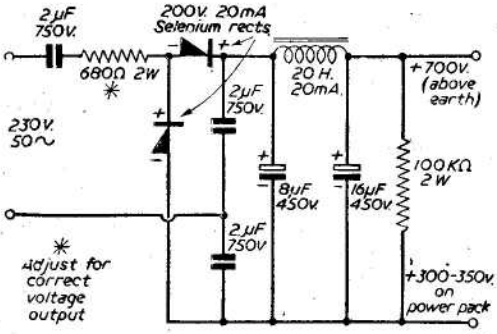


Fig. 3.—Mains unit for connecting in series with existing unit to provide 700 volts D.C.

In both amplifiers the linearity and V2 grid input controls are pre-set (it was found necessary to provide precise adjustment of voltage input to V2 grid) and the main grid input controls are fitted on the front panel and designated " Height " and " Width " respectively. Once the circuits are set up it will be found that the size of the picture can be varied in a linear manner by the adjustment of the height and width controls only. However, provided not less than 5 kV E.H.T. is available, the size of the picture will be fixed by the maximum output of the line amplifier, i.e., when limiting just occurs at both sides of the picture ; which with the VCR511A tube is at a picture width of 9¼in. with a measured E.H.T. of 5.5 kV. This is a pleasing light green picture which can be viewed in a lighted room provided that direct light is shaded from the tube face.

C.R.T. Supplies

The 700-volt anode supply requirement was simply overcome by building a small mains unit to provide 350-400 volts D.C. at approximately 15 mA and connecting the D.C. output in series with the existing power supply—of course, there must be no D.C. path between the output of the unit and the mains. A suitable circuit is shown in Fig. 3, but any other mains rectifier circuit can be used depending on the components available by the reader, provided a double-wound mains transformer or D.C. blocking condensers are used as indicated.

The cathode-ray tube supply network used was developed for use with a high impedance E.H.T. source capable of supplying up to 0.5 mA without excessive voltage drop—this is, in fact, an R.F. oscillator E.H.T. unit arranged to give a negative output with respect to earth of approximately 6 kV 0.5 mA maximum ; this output being continuously adjustable down to approximately 2 kV.

Fig. 4 shows the C.R.T. supply network and video output arranged for cathode modulation, together with the D.C. restoring diode. Cathode modulation was chosen because, in the writer's opinion, the video output valve is more efficiently used, and good response up to 3 Mc/s is obtained with the circuit shown.

Base Connections

The C.R.T. base connections differ from the VCR97 connections only in the case of the grid and cathode which are reversed, i.e., the large tubes mentioned have contact numbers 1 and 2, cathode and grid respectively.

The Y (frame) deflector plates should be nearest the screen, so that when correctly connected the visible deflector plates will be horizontal. Other points to note are that the brightness and focus potentiometers must be mounted on an insulated panel set back from the main panel with well-insulated couplings for the controls, also that the diode should be mounted close to the tube socket, and well insulated from earth.

Isolating Transformer

The use of negative E.H.T. means that ordinary 500 volt condensers can be used for coupling the deflector plates to the deflection amplifiers, and the provision of shift voltages is considerably simplified. However, this arrangement necessitates feeding the C.R.T. and diode filament from a separate well-insulated 4-volt winding on a mains transformer. If no such winding is available it is a fairly simple matter to wind a 6.3 to 4 volt isolating transformer, using a stack of laminations with a centre limb of approximately 0.5 sq. in. cross-sectional area as found in medium-sized L.S. output transformers.

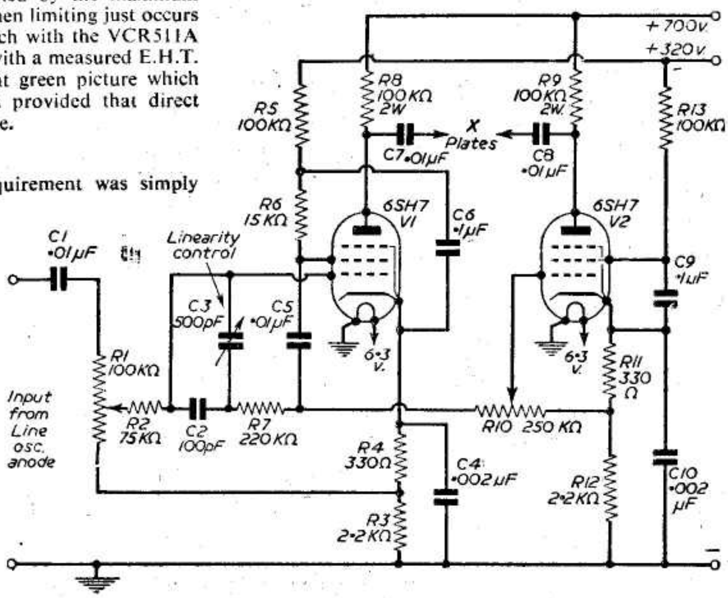


Fig. 2.—Circuit of the line deflection amplifier

The winding bobbin should have end cheeks made of two or three layers of good quality paxolin; the 6.3-volt winding is put on first and, for the usual size of core, can consist of 65 turns of 20 S.W.G. double-cotton-covered wire with the ends brought out through holes in the paxolin cheeks. This winding should be evenly covered with about five layers of empire cloth, over which is wound the 4-volt secondary which will consist of 45 turns of 20 S.W.G. wire. The wire ends are also brought out through holes in the paxolin, spaced well clear of the primary leads and of the core. This secondary winding is then wrapped with empire cloth, and when the core is assembled there should be a clear space between the outer limbs and the 4-volt winding. A transformer constructed on the lines described has proved entirely satisfactory with an E.H.T. voltage up to 6 kV.

With regard to the E.H.T. supply, as stated before, the writer used an R.F. oscillator unit—this consists of a home-wound coil working with a 6V6 valve and voltage doubling rectifiers—space does not permit a detailed description, but Fig. 5 shows a modification of the writer's circuit for use with a 50 c/s mains transformer having a 2,500 volt secondary.

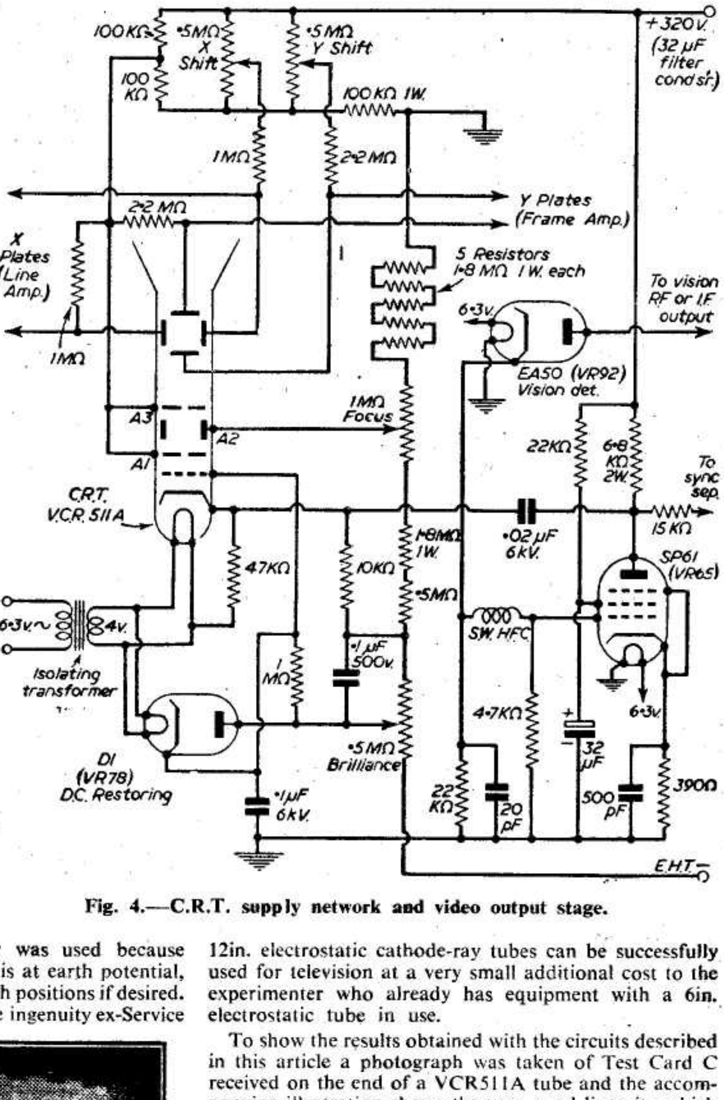


Fig. 4.—C.R.T. supply network and video output stage.

As can be seen, the circuit is very simple. A valve rectifier was used because one was available, and the filament is at earth potential, but metal rectifiers can be used in both positions if desired.

This article shows that with a little ingenuity ex-Service 12in. electrostatic cathode-ray tubes can be successfully used for television at a very small additional cost to the experimenter who already has equipment with a 6in. electrostatic tube in use.

To show the results obtained with the circuits described in this article a photograph was taken of Test Card C received on the end of a VCR511A tube and the accompanying illustration shows the very good linearity which is obtained on both frame and line scans.

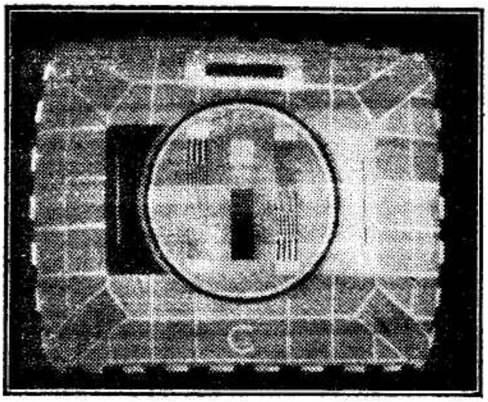


Fig. 6.—Actual photograph on tube face of VCR511A showing fine linearity obtained with the circuits described.

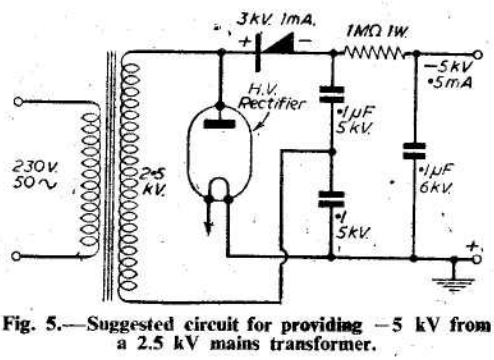


Fig. 5.—Suggested circuit for providing –5 kV from a 2.5 kV mains transformer.

Low-noise Pre-amplifiers

CIRCUIT AIDS FOR INCREASING THE RANGE OF EXISTING RECEIVERS

By A. Thomson

THE full enjoyment of television at extreme ranges from a transmitter is dependent upon a number of factors. One of the most important is the signal-to-noise ratio of the received signal. This can be improved by using a multi-beam aerial properly matched to feeder and receiver, and by locating the aerial in a position as free from interference, etc., as possible. When the signal is very weak, any further gain is usually obtained from a pre-amplifier.

The author is situated approximately 100 miles from the Wenvoe transmitter and the location is 240ft. above sea level. The receiver consists of a converted R3170A employing R.F. stage, F.C. and 3 I.F. stages followed by an EA50 detector and an EF50 video amplifier, this feeding into a 12in. Cossor cathode ray tube, type 121K. At this distance and with Wenvoe working on only 5 kW, a picture of poor quality was obtained. At times, when the signal strength reached about 15 to 25 microvolts per metre, an excellent picture was received. As a 4-element multi-beam aerial at a height of 30ft. was being employed, it was decided that further gain could be best obtained by the use of a pre-amplifier. This pre-amplifier was to be built on a separate chassis and have a self-contained power supply, making it independent of the main receiver.

The Circuit

The next question was "What type of pre-amplifier will be most suitable?" It had to have a high gain and a low noise level and so 4 pre-amplifiers were constructed and tested, the findings being detailed in this article.

The first pre-amplifier constructed was a single pentode stage, employing a Mazda type 6F1 valve and the circuit similar to that given in the August issue, which described an efficient small pre-amplifier for use with the "Argus" receiver. This pre-amplifier performed well, but did not give sufficient gain at this extreme range and so attention was directed to the use of triode valves.

A 6J6 double triode was next tried in a push-pull stage, and the circuit is given in Fig. 1. The construction of this pre-amplifier is quite simple, but the setting-up procedure not so easy. The centre tap on the coil has to be carefully fixed, as the mechanical centre is not always the electrical centre, and it was found that this was best carried out with the pre-amplifier connected to the receiver and adjusted on a signal injected from a signal generator. The small condensers C2 and C3 are the neutralising condensers and consist of lengths of plastic-covered wire twisted together to form a small capacitor. With the pre-amplifier connected to the receiver and power supplies on, the wires are twisted a little, keeping C2 and C3 in step until oscillation ceases, the correct position being the centre of the range over which oscillation does not occur. The tuning condensers C1 and C4 consist of a 20 + 20 pF split stator condenser, the rotor being at earth potential. A double stage of push-pull can be added by employing another 6J6 and using a similar circuit added to Fig. 1. The results obtained from the pre-amplifier were very good.

PRINCIPAL COMPONENTS

Mains transformer, 250-0-250, 60 mA, 6.3 volts, 3 amps., 5 volts, 2 amps. Radio Supply Co., Leeds.

Polystyrene coil formers. G. W. Smith (Radio), Ltd., London.

Ceramic B9G valveholders and silver mica condensers. Alpha Radio.

An Alternative

The next pre-amplifier constructed employed the grounded-grid technique so familiar to radar receivers. As previously stated, the author's receiver is a converted R3170A and uses two CV66 (RL37) triodes in a grounded-grid circuit. The circuit as used in the R3170A is typical of the circuitry used for this type of valve. The circuit operated in the region of 200 Mc/s and, by using the grounded-grid triode, an appreciable decrease in noise level resulted. The circuit gives a very broad bandwidth and is perfectly stable. The old adage that a triode was unsuitable for V.H.F. amplification has been superseded by earthing the grid. This effectively puts a screen between input and output circuits. Of course, other factors and improvements in manufacture have made triode valves suitable for V.H.F. work.

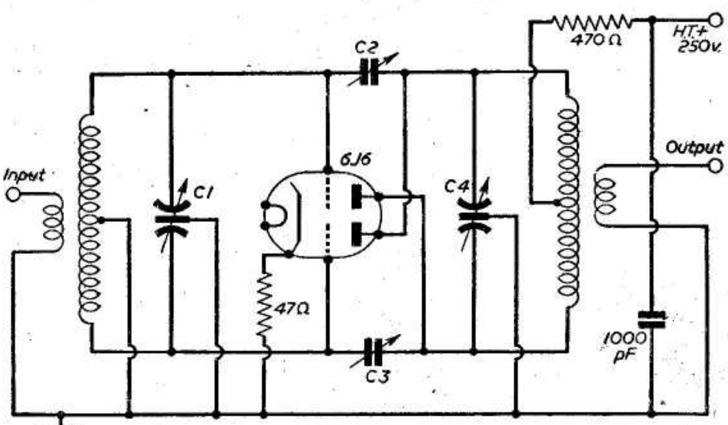


Fig. 1.—A push-pull input amplifier stage as used experimentally.

As the CV66 was in the R3170A, it was decided to use these in a Wallman Cascode circuit and a suitable circuit was found. This was the "low noise pre-amplifier" described by T. M. Rodwell in the July, 1950, and the September, 1951, issues of this paper. The pre-amplifier was constructed to the specification given, using the CV66 instead of the EC91, and performed remarkably well. When the writer was asked to supply a pre-amplifier for test purposes, the above pre-amplifier was given.

A new version of the model was planned and a tinned steel chassis made up measuring 11in. by 3½in. by 1¾in. The power supply was also built on this chassis. The circuit is shown in Fig. 2, whilst the layout of components is given in Fig. 3. This is a neutralised triode followed

Coil Winding Data

	L1	L2	L3	L4
Wenvoe	6	6	7	18
Birmingham	6	6	7	18
Kirk o' Shotts ...	8	8	9	18
Holme Moss	9	9	10	18
London	10	10	11	18

Aerial and output windings consist of three turns interwound at earthy ends of coils. All coils have iron-dust cores.

by a grounded-grid triode. It will be seen from the circuit that the arrangement is slightly different from that described by Mr. Rodwell, the neutralising coil being positioned between the cathode of the CV66 and the grid of the EF50. The 100-ohm resistor supplies the necessary bias for the CV66 and the cathode circuit is completed via the neutralising coil L4 and the grid coil L1 in the EF50 grid circuit. This pre-amplifier, when used in conjunction with the R3170A, produced an excellent picture from the Wenvoe transmitter; no grain effect was seen and the picture was of good contrast. It was tested in conjunction with a commercial receiver which only just received a picture occasionally and the addition of this pre-amplifier brought forth a good picture of entertainment value.

The coils are wound on 1in. by ½in. diameter polystyrene coil formers which have a single 6 B.A. holding screw. The wire used for the coils is 22 S.W.G. tinned copper. The aerial input and the output windings consist of three turns of plastic-covered 22 S.W.G. wire. The neutralising coil is also wound on a polystyrene former with 28 S.W.G. enamelled wire. The coils and components are arranged to keep all leads short and by using tinned

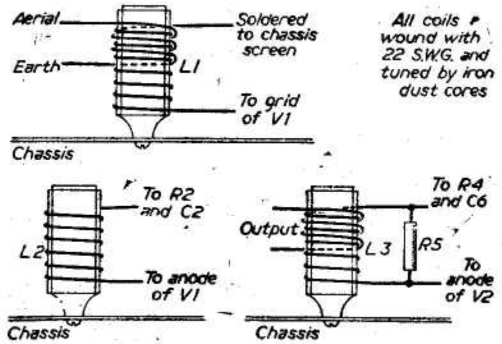


Fig. 4.—Details of the coil windings.

steel for the chassis and screens, all earth connections are made direct to the metal-work. Fig. 4 shows the coil construction of L1, L2 and L3. A Belling and Lee coaxial plug and socket was used for the aerial input. Valveholders are of the B9G ceramic type and all condensers are silvered mica. Resistors are of the ½-watt type with the exception of R6 which is of 3 watt rating. Coil winding details for Wenvoe are given above; for other transmitters the number of turns have to be increased and an approximate figure is given in the table. However, as this has not been checked by actual construction, the reader may have to vary the number of turns slightly to obtain optimum results.

The CV66 (RL37) valve is equivalent to the Mullard

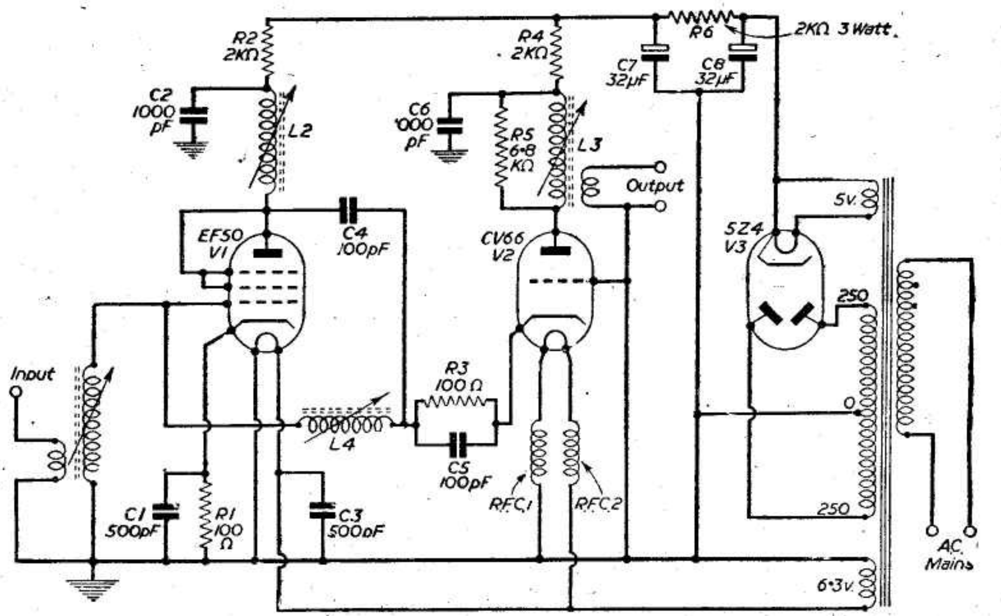


Fig. 2.—Final circuit recommended by Mr. Thomson.

EC54 and the data and valve base connections are given to assist constructors who cannot find details of this valve in a current issue of a valve manual. It will be seen that the grid has four terminations at pins 2, 3 and 6, 7. All four of these valveholder lugs are soldered direct to chassis. The anode has two connections, 4 and 5, and these should be strapped together. The modern version of the EC54 is the B7G type valve EC91 and may be used as can such valves as the 9002, etc. Of course, the valveholders will have to be B7G instead of B9G. The first valve is an EF50 strapped as a triode, but was used because it was to hand. A 6AK5 would be better in this position or its equivalent the Mullard type EF95. If the constructor does not have a CV66 or an EC91, an EF50, strapped as a triode, could be used also for the grounded-grid stage. The R.F. chokes RFC1 and RFC2 consist of 50 turns of 34 S.W.G. silk-covered wire wound on a high value 1-watt resistor. All coils are tuned by iron-dust cores.

The circuit is very easily set up and is stable in operation. The resistor R5 which is shunted across L3 primary broadens the bandwidth. If the signal is very weak then R5 can be omitted, an all-round value was found to be 6.8 thousand ohms.

Valve Data

CV66 (RL37, EC54) Grounded Grid Triode

		B9G Base	
Anode voltage	250	Pin 1	Heater
Anode current	10 milliamps	2	Grid
Grid voltage	-1.5	3	Grid
Heater voltage	6.3	4	Anode
Heater current	.43 amps	5	Anode
Internal anode imp.	10.9 K	6	Grid
Amplification factor	98	7	Grid
Mutual conductance	9.0 ma/V	8	Cathode
		9	Heater

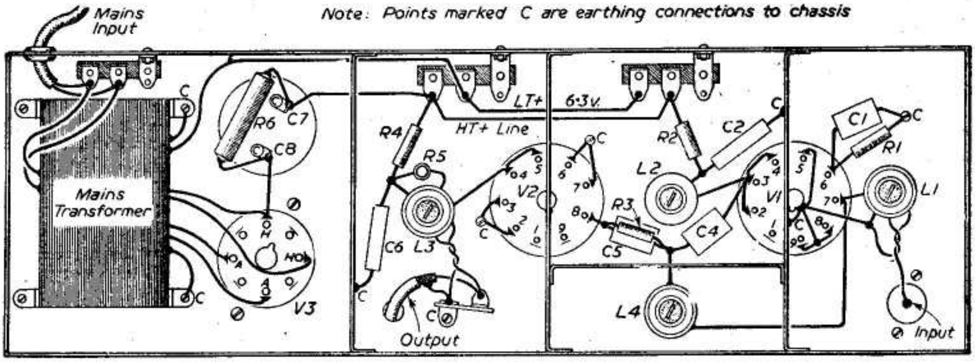


Fig. 3—Practical layout and wiring of the circuit shown in Fig. 2.

"ARGUS" COMPONENTS

IN order to assist constructors who may find certain resistors for the "Argus" in short supply the near equivalents in the following list can be used :

R1—270Ω	R18—68Ω	R29—270 KΩ	R32—470Ω	R66—470 KΩ	R69—470 KΩ
R10—270Ω	VR1—5 KΩ	+470 KΩ	VR2—5 KΩ	R67—220 KΩ	R70—470 KΩ
R13—270Ω	R27—27 KΩ	R30—47 KΩ	R34—3.3 KΩ	R68—470 KΩ	R71—470 KΩ
R17—4.7 KΩ	R28—270 KΩ	R31—470Ω	R39—47 KΩ		

Colour TV in Berlin

AT the request of the Board of Trade, Pye Limited, of Cambridge, took their system of colour television to the German Industries Fair, which opened in Berlin in September. Thousands of Berliners were able to see several short programmes televised in colour and the excellence of the pictures with true colour rendering was a great tribute to British equipment and British engineering skill.

Pye colour television is not new to Great Britain, and it has already been used for demonstration purposes at two leading London hospitals. It has also been shown at several trade exhibitions.

Although colour television will not reach the home for some years yet, a fully practicable system is already in production in the research laboratories of Pye Limited. This is a result of some twenty years' research and represents one of the greatest technical advances in the history of TV.

New London Installation

ONE of the two medium-power television installations ordered by the BBC from Marconi's Wireless Telegraph Co., Ltd., in May will be installed as a reserve at Alexandra Palace in time for the Coronation next year.

Transmitter equipment consists of a five-kilowatt vision transmitter, two-kilowatt sound transmitter, and associated equipment.

It has already been announced that the other installation will be used as a standby at Sutton Coldfield.

The existing Alexandra Palace transmitter—which was installed in 1936 and began regular daily transmissions in November of that year—was the first public television service in the world. This was a combined Marconi-E.M.I. project. With a break for the war years between 1939 and 1946 this transmitter has given continuous service ever since.

PRE-DETECTOR STAGES

BASIC FEATURES AND PRACTICAL DESIGN CONSIDERATIONS FOR THE EXPERIMENTER

The Signal Frequency Section

THE aim of this series of articles is to convey to the experimenter the basic features and practical design considerations associated with the pre-detector stages of a modern television receiver. The plural in this case meaning the signal frequency, intermediate frequency, and frequency changer sections where the receiver under discussion is of the superhet type, as opposed to a straight receiver (T.R.F.) in which the signal frequency stages alone comprise in overall form the entire pre-detector circuits.

Although such circuits can be treated exhaustively by complex mathematical analysis and weird abstract artifices—as they usually are—which are understood only by the initiated minority, they can be comprehended successfully from the lower plane practical aspect, and it is in this vein that the writer intends to treat the subject in these articles—nevertheless, a little formula and abstract reasoning will still be necessary!

A Question of Bandwidth

Whether we are considering a T.R.F. or superhet style of circuit the first stage will invariably be the same in both instances. What we are after is an arrangement whereby the signal voltage existing across a properly terminated low-impedance feeder can be transferred with optimum efficiency to the control grid of the first valve. Further, the bandwidth of the stage will have to be such that it will embrace both the sound and wide-band picture signals. Usually, the first stage also embodies some form of gain or picture-contrast control, with perhaps the exception of a signal stage unit pre-amplifier.

A typical circuit in this form is depicted by Fig. 1. Now our first consideration is that of bandwidth; the reason for this is clearly shown in a recent article (see "Picture Definition," PRACTICAL TELEVISION, September, 1952), and it can be shown that the circuit capacitance and resistance is closely linked with this. The grid coil L2 is, of course, tuned to a frequency between the sound and vision signals, and this frequency let us denote f_o. Now the bandwidth of the circuit is the frequency spectrum between where the response would fall 1db at a frequency higher than f_o, say f_h, and where the response would fall 1db at a frequency lower than f_o, say f_l, this is made clear by Fig. 2, showing the bandwidth equal to $(f_h - f_l)$. If we denote the ratio of response at f_o to that of f_h or f_l by r, then, we can use a formula connecting the overall bandwidth to the circuit capacitance (C) and resistance (R), or :—

Bandwidth equals $159\sqrt{(r^2-1)}/CR$ ... ... (1)

where the units C, R and f are in picofarads, kilohms, and megacycles/sec., respectively.

Distributed Capacitances

So far as the tuned circuit L2 is concerned, as indeed any tuned circuit, it possesses not only inductance, but also self-capacitance. This capacitance virtually comprises a number of very small capacitances formed between adjacent and non-adjacent turns, and also between the coil terminal leads. These diminutive capacitances, however, can be represented, from our point of view, by assuming them replaced by a single capacitance of appropriate size shunted across the coil terminals. Also present across the coil are stray wiring capacitances together with the input capacitance of the valve; the combined effect of these capacitances tune the coil to the desired resonant frequency according to the equation :—

Resonant frequency equals $10^6/2\pi\sqrt{LC}$ ... ... (2)

where the resonant frequency is in kilocycles/sec., L is in microhenries, and C is in picofarads. It is easy to see, therefore, how far removed from that calculated the actual resonant frequency might be should the shunt capacitance be ignored or wrongly assessed. Usually, the coil capacitance can be reckoned at about five pF, with a similar value for stray wiring capacitances, this forms a total of 10 pF to which will need to be added the input capacitance of the valve.

The Input Capacitance

The value of input capacitance of a valve alters appreciably with a variation of control grid bias potential, and unless special precautions are taken the control of contrast or gain will modify severely the resonant frequency of the first tuned circuit. Such effects have been dealt with fully in a recent article (see "Contrast Adjustment," PRACTICAL TELEVISION, October, 1952), but for the sake of continuity they will again be briefly mentioned at this point.

In order to facilitate the control of picture contrast or video channel gain, some form of control must be embodied in the video channel circuits. The first two or sometimes three stages are usually arranged so that the bias potential on the valves may be varied by the use of a single control. Altering only the control grid potential, however, creates a marked effect on the valve's input capacitance and resistance (impedance). Two ways are available by which these undesirable effects may be reduced to negligible proportions; one is to arrange the contrast control so that both the control and suppressor grids are biased at the same time and in the same ratio. Thus, an increase of negative bias will reduce the stage gain without any undue modification of input capacitance.

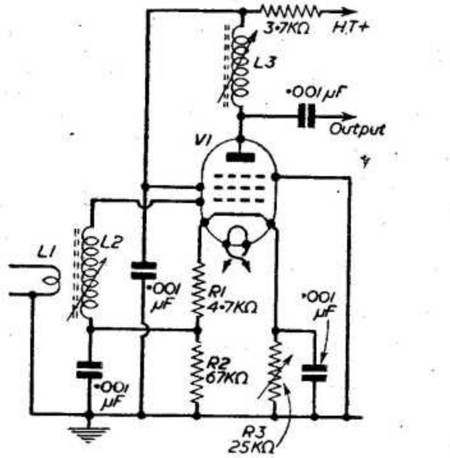


Fig. 1.—A typical first stage signal frequency amplifier showing the method of contrast control.

In practice the suppressor grid needs more bias than the control grid in a ratio of about 12 : 1. This is easily provided by the inclusion of a potential divider across the cathode circuit, the tapping of which is taken to the "cold" end of the grid coil, while the suppressor grid is returned direct to the earth line (see Fig. 1). In this way the control grid is less negative than the suppressor grid, where the negative potential applied to the control grid is :—

$R_2/(R_3+R_1)$ of the cathode bias ... ... (3)

The other way of obtaining a constant input impedance is by the inclusion of an unbypassed resistance in series with the cathode circuit of the controlled valves. An appreciable degree of degeneration (negative feedback) unfortunately occurs, but if sufficient overall gain is available this method offers a simple solution.

Because television valves are not variable-mu they do not permit a very wide range of contrast control to be effected, and this is the reason why it is often necessary to control more than a single stage.

Input Resistance

As previously intimated, not only have we the input capacitance of the valve to contend with, but we have also its input resistance. This is a value, depending on the type of valve, which is inversely proportional to the square of the input frequency, which simply means that at higher signal frequencies the value of input resistance will decline. Such phenomena is brought about mainly by the fact that at the higher frequencies the valve's cathode circuit swings predominately inductive and in effect creates a degree of feedback ; an added factor is also the electron transit time within the valve which will, of course, determine the magnitude of resistance expected from a valve of certain design. This can be clearly illustrated by comparing a modern high slope television pentode—designed for a high input resistance at television frequencies—with, say, a valve of ordinary design ; a Brimar 8D3, for instance, has an input resistance in the region of 8 kΩ at 45 Mc/s, whereas the input resistance of a valve in the 6J7 class hardly reaches the 1 k Ω figure working at the same input frequency.

Damping Contributories

The foregoing brings to light how it is that the circuit bandwidth is tied up with the values of C and R, and also, as we have seen, they are really inherent to the circuit as a whole. Now, since we are still considering the aerial input circuit, we must not forget to take into consideration the characteristic impedance of the aerial feeder which, due to the transformer action of L1, L2, is reflected across the grid circuit. The magnitude of this effective impedance is governed by the voltage transfer ratio (n) of the transformer, so that R equals Rtn^2, where R is the effective resistance shown across the secondary, and Rt is the feeder's characteristic impedance.

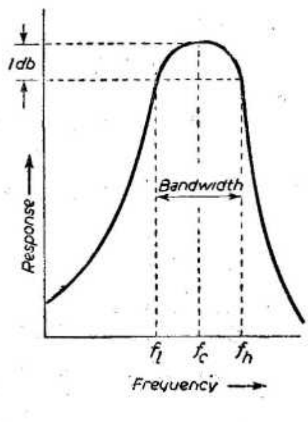
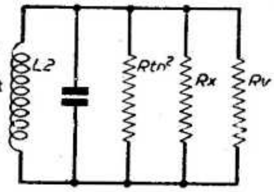


Fig. 2.—Illustrating the effective bandwidth, fl—fh, of a tuned circuit.

Having now got a little more to work on we can re-draw the input circuit of Fig. 1 to its basic form as shown by Fig. 3. Here C represents the capacitance across L2 as previously defined, while Rv is the input resistance of the valve. The resistor Rx is an element which may be found necessary to include across the tuned circuit so that it will embrace a bandwidth as determined by equation (1), and is usually termed the damping resistor. In certain instances, however, especially in a circuit where the shunt capacitance is large, the parallel value of Rtn^2 and Rv may be sufficient to produce the desired pass-band without the addition of the damping resistor.

Fig. 3.—The basic input circuit of Fig. 1.



Signal Voltage Step-up

The voltage transfer from the feeder to the grid of the valve is maximum when

n equals $\sqrt{Rx\ Rv/Rt\ (RX+Rv)}$ ....(4)

From first principles the value n may be taken to be equal to the actual turns ratio of the transformer ; for instance, 1 : n equals L1 : L2, although this is not strictly accurate it is sufficient for the purpose of this discussion, and in any case provided the coupling is reasonably tight, which is usually so in practice, the degree of error is negligible. We can now form some idea of the voltage step-up the input transformer will produce. Let us take an example : suppose Rx equals 6,000 ohms, Rv equals 8,000 ohms, and Rt equals 75 ohms, then n will equal 6.76. Or, in other words, the control grid will receive a voltage greater than that appearing across the feeder by 6.76 times—quite a desirable step-up.

Stage Gain

Next we must consider the tuned anode circuit L3 of Fig. 1. The coupling between this and the grid circuit of the following stage might be, in its simplest form, after the style of Fig. 4(a) or (b) (to be given next month). In either case, C1 constitutes a capacitive coupling, and provided C1 is fairly large (0.001 mfds.) both circuits are equivalent in function. This becomes obvious when it is realised that so long as C1 offers negligible impedance at the operating frequency, the elements L1 and R1 can be considered as being in parallel from the R.F. point of view, in both instances, by virtue of the decoupling capacitor C2.

Bearing this in mind we are able to simplify the circuit to its equivalent form as depicted by Fig. 4(c). As before, C represents the self-capacitance of the inductor L1 plus the stray circuit capacitances, plus the sum of the output and input capacitances of V1 and V2 respectively. R1 is the coupling resistor, while ra is the anode impedance of the valve V1. In series with the ra we have the grid signal voltage eg times the amplification factor (μ) of V1.

(To be continued)

PICTURE FOCUSING

THE IMPORTANCE OF CORRECT FOCUS, AND SOME INTERESTING CIRCUITS

By Gordon J. King

REGULAR readers of PRACTICAL TELEVISION will, no doubt, recall an article by the author entitled "More About the Cathode-ray Tube" (see P.T., October, 1951). This article explains how the electron beam is influenced by electrostatic and electromagnetic forces, and how such forces can be arranged to bring the beam to a sharp point of focus at the fluorescent screen of a cathode-ray tube.

The following article deals more with the actual control of focus, and the various modes used to perform this function in conjunction with a modern style magnetic picture-tube.

Scanning Spot Size

Firstly, then, it should be borne in mind that the focusing efficiency of any receiver is in one way directly responsible for the amount of detail which will be exhibited on a reproduced picture, for as we have already seen (" Picture Definition," P.T., September, 1952,) it is pointless to extend the band-pass of the video frequency circuits unless the scanning spot is small enough to permit the reproduction of fine detail. A large spot size, for instance, will tend to cause overlapping of the horizontal scanning lines with a resulting reduction in apparent picture definition; although, on the other hand, an extremely small spot size will have the effect of making the scanning lines unduly prominent.

This, of course, is a good point from the definition aspect—which is then limited only by the high-frequency response of the video chain—but unless spot wobble is employed the spaces between the scanning lines tend to make lengthy viewing rather an uncomfortable process. A compromise between picture and spot size is, therefore, aimed at by tube manufacturers; for instance, the optimum spot size for a small diameter projection type picture-tube is in the region of 0.0028in., while for an average 12in. tube the spot size should be approximately 0.038in.

These spot sizes are an inherent characteristic of the tube when applied with the stipulated operating potentials and magnetic focusing field, although it is important to note that an alteration in any one of these will have a marked effect on the size of the spot. Furthermore, as we already know, an increase in final anode potential necessitates an increase in focusing field strength to maintain an optimum point of focus.

With tetrode tubes the first anode potential is also a very important consideration so far as focusing is concerned, for as this potential is enlarged so the spot size reduces. The effect is usually greater between about 100 to 300 volts, while upwards from 300 volts very little reduction in spot size is obtained. This factor is well worth bearing in mind for it could possibly be the correct solution where a satisfactory focus cannot be achieved even though the focusing system appears to be without fault.

Practical Focusing Arrangements

The required focusing field may be provided either by an electromagnet, a permanent magnet, or by a combination of both. Whichever method is used, however, a facility must be provided to enable easy adjustment of field strength, thereby enabling the optimum focus point to be readily obtained.

Until just recently the electromagnetic arrangement was favoured by designers; such a method takes the form of a solenoid mounted concentrically on the neck of the tube and designed so that it will provide a magnetic field parallel with the tube axis (see Fig. 1). Variation of field strength is readily achieved by altering the current through the focusing coil.

The permanent magnet arrangement consists of a circular ring, with flat sides, magnetised along its axis so that the poles are actually the flat sides. This is clamped between two soft-iron plates to form a gap as with the electromagnetic system. Usually the magnet is designed to give approximately the correct focusing field necessary for the tube it is to be used with, although

Fig. 1.—An electromagnetic focusing arrangement.

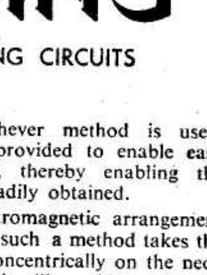


Fig. 2.—A combined focusing arrangement.

a fine degree of adjustment is possible by sliding the magnet along the neck of the tube. A larger degree of adjustment is frequently provided by a soft-iron sleeve which, by means of a lever projecting through the back of the cabinet, can be made to traverse the tube neck in such a way that it gradually by-passes the focusing field as it enters the magnet assembly.

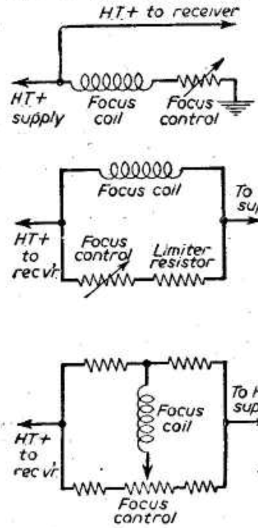
The most expensive and satisfactory system comprises a combination of both the foregoing methods. A permanent magnet contributes the main focus field, while the electromagnet facilitates focus adjustment (see Fig. 2).

Field Strength and Position

The magnitude of focusing field for optimum beam focus depends primarily on the picture-tube characteristics and, as we know, on the electrode potentials, especially the final anode potential (E.H.T.). As a general illustration tube focusing requirements are usually given in manufacturers' data sheets, in the form of amp./turns necessary to focus the tube at a stipulated E.H.T. potential. A 12in. tube, for instance, may require about 650 amp./turns to embrace the focus point, while a figure in the region of 950 might well be needed for a projection type tube operating with an E.H.T. of 25 kilovolts. We can see from this, then, that a large number of turns is necessary for the focus coil, and more so when the focus current is limited by virtue of circuit design.

Usually the focus coil is included in series with the receiver H.T. circuits and a variable resistor arranged so that the current through the focus coil may be easily adjusted—but as we shall see later another method is sometimes adopted. Two disadvantages are manifested with this arrangement : one is that considerable power is absorbed from the H.T. circuits, for it is obvious that a large number of turns of wire will give rise to a fair amount of resistance. A voltage drop will thus be developed across the focus coil, and the power dissipated in heat is the product of this drop and the current flowing through the focus coil—a typical example might be 100 mA. at 30 volts, or 3 watts !

The second is that because the resistance of the focus coil increases with temperature the focus setting tends to drift slightly with operating time. Nevertheless, both of these disadvantages may be eliminated by the



Figs. 3, 4 and 5.—A high-resistance focusing circuit ; a circuit suitable for a low-resistance coil, and a bridge circuit suitable for the combined focusing arrangement.

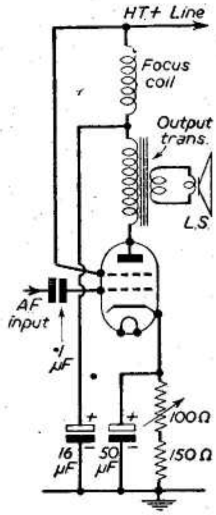


Fig. 6.—Utilising the output valve current for energising the focus coil (see text).

employment of a permanent-magnet focusing system, which nowadays is being generally adopted in receiver design. With the composite method a small controlling current only is necessary so that the problem of focus drift is minimised.

The importance of focus coil position should also be observed, which again is often included in manufacturers' literature, but if this is not readily available the rear end of the focus coil should be initially set an inch beyond the front of the final anode. If the coil is mounted adjacent to this electrode the focus at the centre of the screen will be very sharp, but it will deteriorate towards the sides and corners.

Energising the Focus Coil

The current required to energise the focus coil can be obtained from the H.T. supply by a variety of methods. The simplest arrangement is where the focus coil is of high resistance, for then it is only necessary to connect the focus coil directly across the H.T. circuit with the focus control in series so that the current through the focus coil may be altered at will (see Fig. 3).

A low resistance focus coil is usually connected in series with the H.T. supply as shown by Fig. 4. In this case the focusing current is altered by shunting the coil with the focus control resistor—a current limiter resistor must be included in series with the control in order to create a linear focus adjustment, and also to prevent the coil from being short-circuited when the focus control is set at minimum resistance.

Where the combined focus system is employed it is necessary for the focus coil field to assist or oppose the permanent magnet field, thereby enabling the overall field to be adjustable over the optimum focus point. The form of bridge circuit, as shown by Fig. 5, offers a satisfactory solution here.

A Good Idea

The direct current component flowing through the sound output valve is sometimes utilised to energise the focus coil—such a circuit is wired after the style of Fig. 6. On first sight this method may appear pointless, but really it is a good idea, for it tends to counteract that change in focus field as the coil warms up.

Now, provided the sound output valve is working under pure class " A " conditions the signal will not have any effect on the mean D.C. flowing through the valve and focus coil. Furthermore, if we examine the characteristics of a pentode or tetrode valve we shall observe that the mean current is independent, within limits, of the applied anode potential ; thus, any slight deviation of focus coil resistance will have negligible effect on the focus of the picture. Therefore, by arranging a variable bias control to function in conjunction with this valve a means is made available by which the focus current can be easily adjusted—this control is, of course, the variable resistor in the cathode circuit.

E.H.T. Potential and Focusing

As previously intimated, the larger the E.H.T. potential applied to the final anode the greater must be the focus field to obtain a satisfactory beam focus. We have already seen in the previous article that this is due to the fact that the beam electrons are accelerated to a greater velocity by a larger final anode potential, and under these conditions are less easily influenced by a magnetic field.

It follows, then, that by computing the approximate focusing field needed to focus a picture-tube with a known E.H.T. potential, it is practicable to employ a permanent magnet to give an approximate focus, and alter, within limits, the E.H.T. potential to give a desired range of focus control.

Some Marconi receivers employ such an artifice, the circuit of which is depicted by Fig. 7. As will be seen E.H.T. is derived from the line flyback, a method which lends itself admirably to E.H.T. control. The focus control simply renders adjustable the sawtooth drive applied to the line output valve and thus the magnitude of rectified E.H.T. potential, resulting in a very neat, but effective, focusing arrangement. It should be noted, however, that the alteration of sawtooth drive to provide a usable focus range has negligible effect on the width of the picture, which may seem at first hardly feasible !

A diminutive change in E.H.T. potential will thus have a marked effect on picture-focus, and for this reason it is desirable for the E.H.T. supply to possess good regulation characteristics. A bright section of picture, for instance, will give rise to a heavy beam current, and unless the regulation is satisfactory the picture highlights will appear out of focus, while the remainder of the picture possessing just mediocre illumination will focus sharply.

What actually happens, of course, is that during the periods of heavy beam current the E.H.T. potential drops slightly, thereby pulling certain sections of the picture out of focus. Not only may this effect occur, but it is also likely that during a shot consisting of brilliant overall illumination the entire picture may enlarge noticeably, due to the scanning field having a greater deflection influence on the lower velocity beam electrons —aircraft fading creates a perfect illustration of this, when, on certain receivers, the picture not only rhythmically reduces in brightness, but also in size.

No. E.H.T. circuit has a perfect regulation, of course,

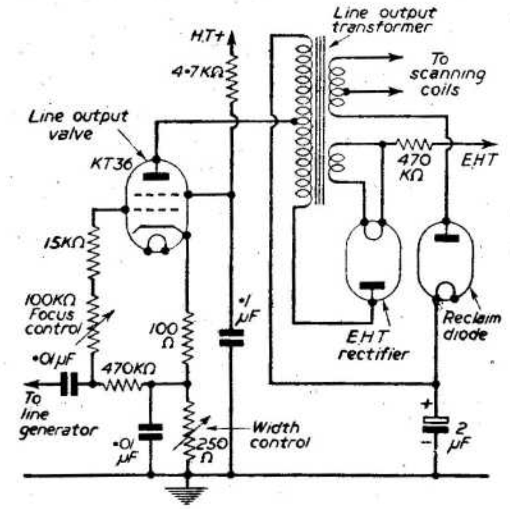


Fig. 7.—A circuit where a variation of line sawtooth drive is employed to alter the E.H.T. and thus the picture focus.

although the nearest approach is the old style of mains derived E.H.T. systems. Flyback, ringing choke, and R.F. systems tend to suffer more from bad regulation, but in some cases it is often possible to counteract the effect by the embodiment of an automatic E.H.T. regulator. This is somewhat analogous to an A.V.C. system. A diode valve is used to rectify a sample of the E.H.T. pulse content ; the resulting potential is fed to the control grid of the E.H.T. generator valve in such a way as to reduce its negative bias when the E.H.T. potential drops. This, as will be appreciated, has the effect of increasing the valve's gain and thus producing more E.H.T. In more elaborate systems the grid/cathode potential of the picture-tube is also controlled, so that a fall in E.H.T., due to excessive beam current, makes the grid more negative, with a resulting reduction in beam current !

Focusing Faults

One of the most frequent causes of an unsatisfactory focus, where the electromagnetic principal is adopted, is a reduction of current through the focus coil—sometimes the focus control needs to be positioned hard anti-clockwise (minimum shunt resistance) before the picture shows any sign of focusing. This effect can usually be traced to a falling-off in the emission of the rectifier, or one of the valves which contribute a large percentage of current through the focus coil—it should be remembered, of course, that the H.T. supply to a certain section of the receiver only may be passed through the focus coil, in which case the fault is easier to localise. A reduction in the value of the reservoir, or the H.T. smoothing electrolytics may cause a drop in H.T. voltage and thus a drop in current through the focus coil.

On the other hand, the focus coil may be passing too much current, a partial short-circuit in the stages involved, for instance, perhaps a leaking capacitor somewhere. An incorrect setting on the receiver input voltage selection panel may be responsible, for many commercial receivers are very critical in this respect.

A reduction of E.H.T., to the extent that the focus is outside the limits of mechanical (in the case of permanent-magnet focusing), or electrical control, causes, in most instances, an enlargment in picture size, which is not satisfactorily adjustable by reducing the picture height and width controls.

Poor E.H.T. regulation is most likely caused by a falling-off in emission of the E.H.T. rectifier valve, or perhaps leaky, or open circuit smoothing capacitors—due attention should, therefore, be given to the aquadag coating on certain types of picture-tubes which forms one plate of the E.H.T. smoothing capacitor—ensure that it makes a good connection to chassis.

Since a good focus has such a large bearing on picture definition, it is, in the writer's opinion, one of the most important functions which a television receiver has to perform. It is, therefore, in the interest of constructors and experimenters to ascertain that the receiver is performing this function at an efficiency which is more than just mediocre.

Sixth Annual Amateur Radio Exhibition

THE Sixth Annual Amateur Radio Exhibition, organised by the Incorporated Radio Society of Great Britain, will be held at the Royal Hotel, Woburn Place, London, W.C.1, from Wednesday, November 26th to Saturday, November 29th, 1952. The Exhibition will be opened at 12 noon on the 26th by Col. Sir Ian Fraser, C.B.E., M.P., a Past President of the Society.

As in past years the exhibition will be supported by a number of companies who specialise in the provision of valves, apparatus, equipment and publications, for the radio amateur. In addition the War Office, Air Ministry and Post Office will be represented.

The sponsoring organisation will exhibit apparatus and equipment constructed by members including a "live" amateur transmitting station. The British Amateur Television Club will demonstrate amateur television equipment.

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Air Ministry, Automatic Coil Winder and Electrical Equipment Co., Ltd., Cosmocord, Ltd., E.M.I. Sales and Service, Ltd., Easibind, Ltd., English Electric Co., Ltd., General Electric Co., Ltd., General Post Office, George Newnes & Co., Ltd., Goodmans Industries, Ltd., Iliffe & Sons, Ltd., Panda Radio Co., Philpotts Metal works, Ltd., Salford Electrical Instruments, Ltd., Siemens Electric Lamps and Supplies, Ltd., Taylor Electrical Instrument Co., Ltd., War Office, Westinghouse Brake & Signal Co., Ltd.

Transmission Lines—2

PRINCIPLES AND PRACTICE

By B. L. Morley

As the current ratio is determined by the impedance ratio we can calculate the SWR on this basis:

$$SWR = \frac{Zr}{Zo} \text{ or } \frac{Zo}{Zr}$$

where SWR = Standing Wave Ratio.
Zo = Characteristic impedance of the line.
Zr = Terminating Impedance.

The usual practice is to put the larger figure (either Zo or Zr) on top so that the result is always greater then 1.

Table I given below shows the db losses to be expected for various SWRs using ¼in. overall diameter coaxial cables. The figures are approximate and will, therefore, vary slightly with the manufacture of the cable.

TABLE I

SWR	db loss
2	0.35
3	0.9
4	1.5
5	2.0
6	2.4
7	2.75
8	2.95
9	3.2
10	3.5
15	5.0
20	6.0

As an example, supposing that the centre impedance of a dipole due to length and position of reflector and director is 40 ohms, and that 80 ohm coaxial cable is used to connect it to the televisor, then

$$SWR = \frac{Zo}{Zr} = \frac{80}{40} = 2$$

From Table I the db loss for an SWR of 2 is 0.35 db—an amount which would be unnoticeable in the picture.

Now, supposing the centre impedance was 10 ohms, then the SWR would be $\frac{80}{10} = 8$ and from Table I we see that this represents a loss of 3db—a considerable loss for the fringe area viewer and offsetting to a marked degree the gain obtained by the additional reflector and directors.

Matching Stubs

There is another peculiarity of transmission lines which is of practical importance. Let us take the case of an open-ended line first.

At the end of the line (Fig. 14) we have zero current and maximum voltage. This end can therefore be represented as a very high impedance.

(a) At ⅛ wavelength the reflected waves show a rising voltage and falling current (looking at it from the

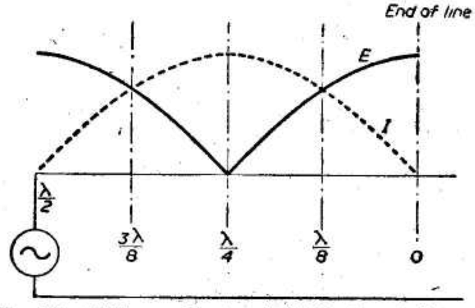

Fig. 14.—Voltage and current distribution at the end of an open-ended line.

generator's point of view). This is the condition in a charging capacitor. If the line was therefore cut at this point it would exhibit *capacitative reactance* whose reactance Xc = Zo.

In other words a transmission line which is $\frac{\lambda}{8}$ long could be used in place of a capacitative reactance.

(b) At $\frac{\lambda}{4}$ we have exactly the reverse conditions to that at the end of the line. Here the current is at maximum and the voltage at minimum. The line at this point, therefore, exhibits a very low impedance.

(c) At $\frac{3\lambda}{8}$ we have a rising current and a falling voltage, which is a condition similar to that in an inductance. The line at this point would therefore exhibit inductive reactance whose value X_L = Zo.

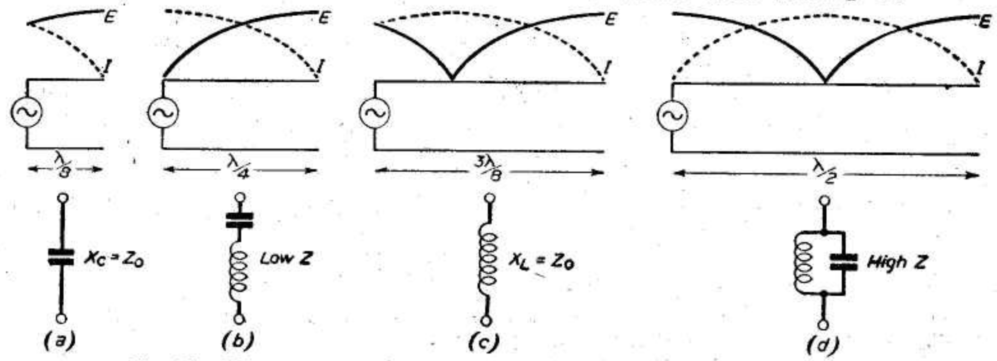

Fig. 15.—Voltage and current distribution at the end of lines of various lengths.

(d) At $\frac{\lambda}{2}$ we have the same conditions as at the end of the line; the current is zero and the voltage at maximum. The impedance is therefore high and can be represented as a series resonance.

The various conditions are shown in Fig. 15.

Short-circuited Line

A short-circuited line behaves in a similar manner, though the conditions are reversed, as at the short-circuit the current is maximum and the voltage zero. Fig. 16 shows the conditions.

All the conditions enumerated above are repeated from $\frac{\lambda}{2}$ to λ. It will be seen that an open-circuited or short-circuited line up to $\frac{\lambda}{4}$ long can be made to simulate any kind of reactance required.

This useful feature can be employed to "tune out" inaccuracies in matching. A simple practical method is to attach a length of coaxial cable, about 6 ft. long, in parallel with the existing aerial socket on the televisor. The televisor should be previously adjusted for maximum results; at first the picture contrast will deteriorate. Now, cut off an inch at a time from the end of the 6 ft. length of cable without leaving the ends short-circuited; cutting is finished as soon as the best picture is obtained. Employment of this method will enable the fringe viewer to obtain the last possible ounce from his installation.

Balance to unbalance converters, as described in a previous issue of this journal, use the principles expounded in this section, the low impedance existing at the end of the converter being reflected as a high impedance at the centre of the dipole.

Matching Transformers

When reflectors and directors are added to a dipole the centre impedance of the dipole falls from its nominal 72 ohms to a figure dependent upon the number and spacing of the parasitic elements. It can fall as low as 3 ohms in certain cases.

Such an aerial can be matched to an 80-ohm line at the aerial by employing a "T" match, or double and triple folded dipoles, or some other method ("Aerials, Principles and Practice," PRACTICAL TELEVISION, August, 1951.) A $\frac{\lambda}{4}$ length of transmission line can, however, be employed as a matching or impedance transformer. If a $\frac{\lambda}{4}$ length of line is terminated at the far end by an impedance Za, then the input Zb impedance to the line will be

$$Zb = \frac{(Zo)^2}{Za}$$

$$\text{therefore} \quad Zo = \sqrt{Za \times Zb}$$

In other words a $\frac{\lambda}{4}$ length of line will couple two impedances together (Za and Zb) so that the two will match, the $\frac{\lambda}{4}$ section acting as an impedance transformer.

Example

Suppose we wish to match a 70-ohm cable to a 40 ohm dipole, then

$$Zo = \sqrt{Za \times Zb} = \sqrt{70 \times 40} = \sqrt{2800} = 50\,\Omega \text{ (approx.)}$$

therefore a $\frac{\lambda}{4}$ section of 50 Ω cab'e will effect a practically perfect match.

In all the foregoing it should be remembered that throughout we have been dealing with *Electrical Wavelengths* and not the physical wavelength. To find the electrical wave'ength of a cable its physical wavelength should be multiplied by the velocity factor "V" of the cable.

For those who would like to experiment, the V factors of various types of transmission lines is given in Table II.

TABLE II

Type of Transmission Line	V Factor
Open wire lines 400-600 Ω	0.975
Coaxial cable air insulated	0.95
Coaxial cable 50 Ω	0.66
Coaxial cable 75 Ω	0.66
Twin lead 300 Ω (balanced)..	0.82
Twin lead 150 Ω (balanced)..	0.77
Twin lead 75 Ω	0.68
Rubber insulated	0.56
Twisted pair (lamp flex)	0.65

Choosing Transmission Cables

There are two types of transmission line in common use in television practice. They are balanced twin and coaxial cable. The actual type will be determined by the design of the input to the televisor. If the input is balanced then a balanced twin feeder will have to be used, and if the input is unbalanced coaxial cable must be used.

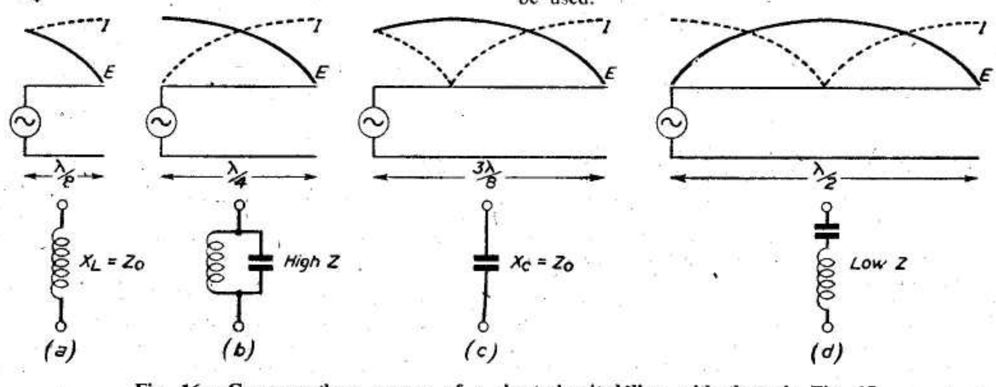

Fig. 16.—Compare these curves, of a short-circuited line, with those in Fig. 15.

It is possible to feed either cable into either type of input by using a matching transformer as described in a previous issue of PRACTICAL TELEVISION ("Aerial Matching," by W. J. Delaney, PRACTICAL TELEVISION, February, 1952).

Cables for television are supplied with various characteristic impedances and it is wise to choose one whose impedance matches the input impedance of the televisor. Any slight mismatch at the aerial end will have no noticeable effect; as we have seen in previous paragraphs, a mismatch giving an SWR of 2 will only cause a loss of 0.25db.

Cables are also subdivided into two classes—local and fringe. Fringe cables have a much lower attenuation factor than local types, and are therefore more expensive. The principle used in the construction of low-loss cables is to make the dielectric between the conductors to consist mainly of air. As attenuation increases with increasing frequency, it is usual to give the db loss at varying frequencies.

Fig. 17 shows three types of cables manufactured by Telcon Radio for television reception: left is a 50Ω coaxial for local reception. The centre conductor is seven-strand copper and it is surrounded by the polythene insulator. The second conductor consists of a copper braid which is in close contact with the polythene. PVC is extruded over the whole cable for protection and insulation. The overall diameter of this cable is less than ¼in. and the attenuation per 100ft. is 4.8db at 45 Mc/s and 7.1db at 100 Mc/s.

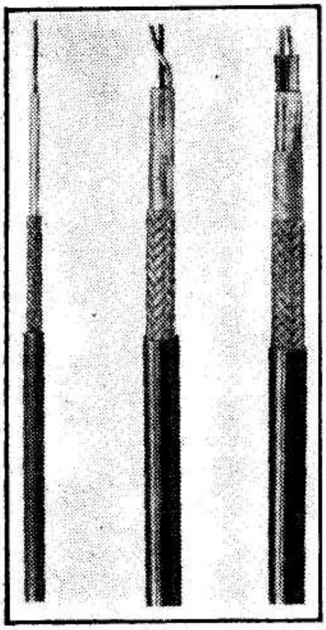

Fig. 17.—A group of commercial coaxial cables. This illustration and that given on p. 197 of last month's issue were given by courtesy of the Telegraph Construction and Maintenance Company.

The 75Ω cable for local reception is constructed similarly, the overall diameter being slightly larger. Attenuation per 100ft. is 3.7db at 45 Mc/s and 5.7db at 100 Mc/s.

In the centre is a 75Ω coaxial cable for fringe area reception. It will be noticed that the centre conductor is lapped with polythene string, helically wound, and the whole enclosed in a polythene tube. The second conductor again consists of braided copper wrapped round the tube, and a PVC covering encloses the whole cable. Due to the method of winding the polythene string round the centre conductor the main portion of the dielectric is air. The cable has an attenuation constant of 1.5db at 45 Mc/s (per 100ft.) and of 2.4db at 100 M/cs.

Compared with the previous cable at 45 Mc/s there is a saving of 2db per 100ft.—worthwhile for the fringe viewer.

On the right is an 80Ω twin cable designed for fringe area reception. The two wires are twisted together and are enclosed in a polythene tube. Air again forms part of the dielectric. The braided wire forms a shield to screen the feeder on its path to the televisor, and it should be earthed at the televisor end. The attenuation per 100ft. is 2.5db at 45 Mc/s and 3.6db at 100 Mc/s.

A similar type designed for local reception has a loss of 5.9db at 45 Mc/s and 7.5db at 100 Mc/s.

Table III gives the characteristics of television cables manufactured by Henley's.

TABLE III

Impedance Ω	Type	Area	Att. per 100ft. db at 45Mc/s	100 Mc/s	Code
55	Coaxial	Local	4.8	7.2	TV1
75	Coaxial	Local	2.7	4.4	TV3
75	Bal. Twin (screened)	Local	5.2	7.5	TV5
80	Bal. Twin (unscreened)	Fringe	2.8	4.3	TV6
55	Coaxial	Fringe	1.9	2.9	TV7
75	Coaxial (semi-air spaced)	Fringe	1.5	2.4	TV9
75	Bal. Twin (screened)	Fringe	2.5	3.6	TV10

For local areas TV3 (coax.) or TV5 (bal. twin) are suitable while the manufacturers recommend TV9 or TV10 for fringe area reception.

Table IV gives the characteristics of cables manufactured by Telcon Cables (Telegraph Construction and Maintenance Co.).

TABLE IV

Imped. Ω	Type	Area	Att. per 100ft. db at 45Mc/s	100Mc/s	Code
50	Coaxial	Local	4.8	7.1	K16M
50	Coaxial	Fringe	1.7	2.6	AS93M
75	Coaxial	Local	2.6	4.2	PT1M
80	Bal. Twin	Local	2.1	3.2	K20
80	Bal. Twin (screened)	Local	5.9	7.5	K12SM
80	Bal. Twin (screened)	Fringe	2.5	3.6	BA24PSM

The two tables are not intended to be fully comprehensive, but are given so as to give the reader an idea of the performance to be expected from different types. Consultation of manufacturers' lists of characteristics will enable the constructor to choose the type most suitable for his installation.

When installing cables, two points should be borne in mind; they are: (a) to avoid sharp bends in the cable as these are liable to cause reflections; (b) connections at both ends should make good electrical contact—especially at the dipole end which is not readily available for inspection.

Converting to a New Channel

MODIFICATION AND RE-ALIGNMENT DETAILS WHEN CHANGING FROM ONE STATION TO ANOTHER

By B. L. Morley

IT is quite an easy matter to convert a televisor from one channel to another, provided a few elementary rules are observed. The methods outlined here show how this can be done and how construction data for one station can be used for any other.

Television receivers fall into two main classes—superhets and straight receivers; the latter type is the more difficult, as more work is involved.

Before discussing the actual details, it should be remembered that televisors tuned to Alexandra Palace are a separate case and require special treatment. They will be dealt with separately.

We shall commence by making the following assumptions:

1. That the circuit diagram of the televisor is not known.
2. That the coil winding data is not known.
3. That no special test instruments are available.

As the superhets are the easier to convert we shall deal with them first and, to make the method clear, shall assume that it is desired to make a conversion from Holme Moss to Sutton Coldfield.

Fig. 1 illustrates the make-up of a modern superhet. There may be an additional vision I.F. stage and even an additional sound I.F. stage, to that shown, but the general principle remains the same. The key to the whole position lies in the oscillator, and the normal procedure is to adjust this circuit first, then the R.F. stages. Reference to the diagram shows that this would mean adjusting L5 first, than L4, L3, L2 and L1.

Rejectors in the vision circuit of the sound and adjacent channels are not always present, so they have been shown by dotted lines.

In the simple case where the desired conversion is between adjacent channels, the existing latitude in the tuning arrangements will be probably sufficient to enable the conversion to be done simply by retuning the stages mentioned above. Except for the alteration of the coils, however, the procedure outlined in the following paragraphs should be used so that the stages can be correctly aligned.

The Oscillator

Before we go any further, let us brief-up on the oscillator.

When tackling an unfamiliar televisor, the I.F. of the vision and sound may not be known, and without these we cannot calculate the oscillator frequency. Under these circumstances, the only thing to do is assume the value of these frequencies and, by approximation, the number of turns in the oscillator coil can be calculated. Any discrepancy can be taken up in the latitude of the tuning arrangements.

Assume that in this case the vision I.F. is 13 Mc/s, we need not bother about the sound frequency because it will be adjusted automatically. The Holme Moss vision frequency is 51.75 Mc/s, but for ease of working we shall call it 52 Mc/s. Sutton Coldfield is 61.75 Mc/s and again, for ease of working, we shall call it 62 Mc/s.

If we wish to produce an I.F. of 13 Mc/s from 52 Mc/s, we have a choice of two values for our beat frequency; they are

$52+13=65$ Mc/s,

and

$52-13=39$ Mc/s.

We do not know which frequency has been chosen by the manufacturer, but probably the latitude allowed by the tuning range will cover a mistake made in our choice. In this case, we will choose the lower frequency.

The next step is to find the oscillator coil and if the circuit is carefully traced through, it will probably be found quite close to the second valve from the aerial. In most cases it is rather obvious as it will take the form of a large coil about 1in. in diameter and of heavy gauge wire, being the only unshielded coil in the televisor, or the coil in the largest can (often tuned by a Philips air-spaced concentric trimmer), or even be remarkable as the only coil on a ⅜in. diameter former wound with bare wire. There should be no difficulty in locating it.

The number of turns should be counted and then we can work a little sum. Supposing that in our case we find four turns; to make the sum an easy one, we shall call our 39 Mc/s oscillator frequency 40 Mc/s.

(*Continued on page* 261)

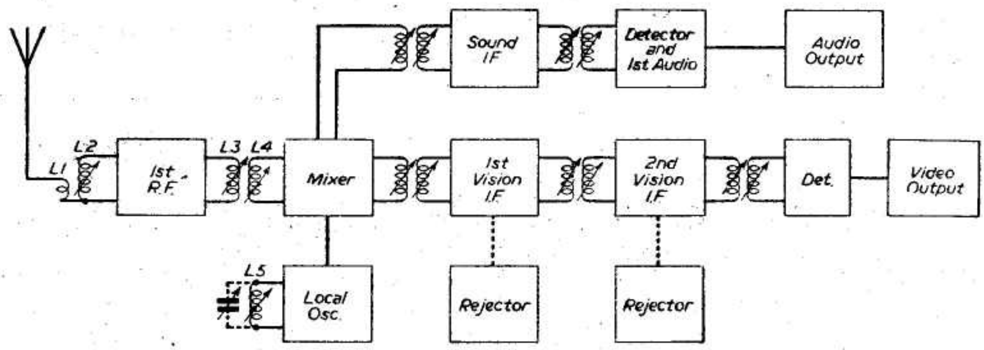

Fig. 1.—Block diagram of a typical superhet television receiver:

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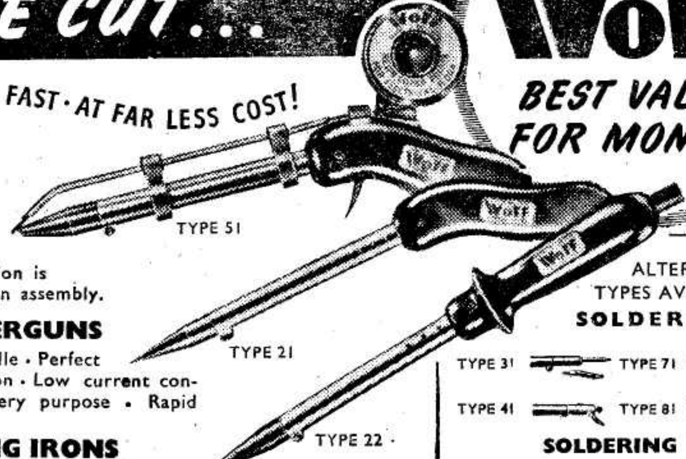

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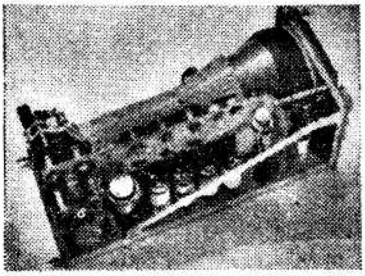

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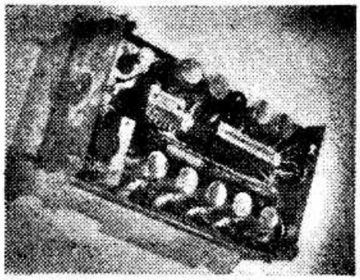

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(*Continued from page* 258.)

This will mean that each turn of the coil represents 10 Mc/s. Of course this is not strictly true, as we have not taken into account stray capacitances, etc., but again there is sufficient latitude to take this figure.

Referring again to our vision I.F. of 13 Mc/s, we shall require a new oscillator frequency for the new channel. Calling the new channel 62 Mc/s, then our oscillator frequency will have to be

$62-13=49$ Mc/s.

This is near enough 50 Mc/s and the difference between this and the old oscillator frequency is

$50-40=10$ Mc/s.

We have seen that as our coil has four turns of wire, each turn represents 10 Mc/s and for our new channel, which is 10 Mc/s away from the old one, we shall require one turn *less* on the oscillator. It is one turn *less* because our new channel is at a higher frequency.

The modification, then, is to take off one turn from the coil and restore the circuit.

Having dealt with the oscillator there is a choice of two methods of dealing with the R.F. coil and the aerial coil.

The first, which we will call (a), is the easier of the two. It is to do nothing at this stage except find brass cores of the same diameter as the existing iron cores and with the same thread.

The second method, (b), is to take some turns off the coils. In all probability, the coils will be in screening cans and will have to be dismantled. It is a wise precaution to take a note of the wires on the tags of the coils before they are unsoldered preparatory to dismantling.

We then repeat the process with these coils by counting the number of turns of wire. Calling Holme Moss 52 Mc/s, and assuming we have found eight turns of wire on the coil, we can see that each turn represents $6\frac{1}{2}$ Mc/s. Again, this figure is not accurate, but it is near enough for our purpose. Sutton Coldfield is 62 Mc/s, a difference of 10 Mc/s from Holme Moss.

If one coil turn represents $6\frac{1}{2}$ Mc/s, a half turn will represent $3\frac{1}{4}$ Mc/s and therefore one-and-a-half turns will represent $6\frac{1}{2}+3\frac{1}{4}=9\frac{3}{4}$ Mc/s. This is near enough 10 Mc/s, so if we *take off* one-and-a-half turns our coil will tune to Sutton Coldfield. Each coil is treated in the same manner and then replaced into the circuit.

We are then ready to begin retuning and alignment.

Alignment

It is of the first importance to use an aerial cut to the new channel and of the type normally used in the locality of the conversion. This aerial should be mounted as high as possible.

Set the contrast and volume controls to maximum and start rotating the oscillator trimmer, or tuning slug, until the sound channel is heard. The oscillator should be left in the maximum volume position and the next move will depend upon whether method (a) or (b) has been used with the R.F. and aerial coils. If (a), the cores should be adjusted for maximum sound, but if a peak cannot be reached with the cores right out, then they should be replaced with the brass ones.

If method (b) has been used, the cores will be found to reach a peak position quite easily.

Having done this the vision should be checked and the oscillator trimmer turned a little way each side of the sound position. If no picture can be seen (make sure that the contrast control is at maximum), it means that a new position of the sound signal must be found. The oscillator should therefore be further adjusted until a second position is found where the sound is heard. It is quite possible that in doing this the vision signal will be heard on the loudspeaker at some point ; it sounds like a mixture of rough hum and motor-boating. It should be ignored and the search for the second sound position continued. When it is found it will be possible to tune in the vision signal with the oscillator trimmer at a position quite close to, or even on top of, the sound channel.

Once the picture has been obtained, the volume control should be reduced to zero so that the next step can be taken without the action of the sound channel interfering with one's judgment of the picture.

Both the R.F. and aerial coils should be adjusted for maximum vision signal and the oscillator trimmer adjusted in the same manner. The quality of the picture will probably be horrible, but it will be rapidly cleared up in the next step.

If at all possible the vision alignment should be made with Test Card " C " rather than on the picture itself. The televisor should be well warmed up for at least half an hour before the alignment is made. With the oscillator trimmer first adjusted for maximum signal, it should be moved slowly towards the sound channel. To verify the direction of the sound channel, move the trimmer quickly in either direction and the sound channel will come through on the vision at one point showing itself as varying black bars. The trimmer should be turned towards the sound channel until the picture goes slightly dim and the contrast control advanced to counteract the loss of signal. It will be noted that the picture quality begins to improve and it should be possible to resolve the $2\frac{1}{2}$ Mc/s bars on the test card. It will be more difficult to resolve the 3 Mc/s bars and will require some time and patience. Of course, if the receiver did not previously resolve these lines then it will not be possible to do it after the modification without altering the cores of the I.F. coils.

Do not alter any of the cores of the I.F. cores or the whole of the I.F. alignment will be upset and the picture may never be the same again. The $2\frac{1}{2}$ Mc/s bars provide a good picture. If the televisor will resolve the 3 Mc/s lines, so much the better, but not at the risk of I.F. adjustment.

A check should be kept on the L.F. response. This can be easily checked by watching the black squares. They have a clean-cut edge, but should it be at all smeary, adjustment of the R.F. coil will cure it.

Having obtained a picture of good quality, a drop of wax or similar substance should be dropped on to the trimmer and cores to prevent any detuning.

Here, the volume control may be turned up and it is possible that no sound will be heard. If so, or if the sound is weak, retrim the sound I.F.s until the sound is obtained at maximum volume.

This completes the alignment.

In spite of the warning concerning the vision I.F. stages, there are some occasions where it is legitimate to re-adjust them. This is where the manufacturer has deliberately reduced the bandwidth of the televisor to increase the gain for fringe-area reception. Some commercial televisors have had the bandwidth reduced to just below 2 Mc/s for this purpose, the idea being that it is better to receive a stronger picture with slightly less detail than to receive one which is marred by valve noise and thus covered with " snow."

If it is desired to realign such a receiver, then the risk can be undertaken. It should be noted whether the I.F.s are transformer coupled stages, and if this is so, a 470-ohm resistor should be connected across one coil of a pair while the companion coil is being trimmed.

It is wise to proceed with caution. The adjustments given previously should be made and the I.F. coils trimmed one at a time. The number of half turns made to the core should be counted, the effect being watched on the picture quality. A maximum of 10 half turns should be made and if no improvement of quality results the core should be restored to its original position and the effect of the next one tried.

It is essential to use Test Card " C " for this operation.

London Receivers

The difficulty with London receivers is that, owing to the fact that the Alexandra Palace transmissions are on the double sideband system, a choice of three methods is open to the manufacturer in the alignment of his receiver. He can employ single sideband conditions using the upper sideband, employ single sideband conditions using the lower sideband, or employ wideband reception using both upper and lower sidebands. The net result of all this is that the sound I.F. may be far removed from the vision I.F. when the circuit is retuned for any of the other channels.

An effective method of dealing with the situation is as follows :

Modify the oscillator coil in accordance with the procedure given and use brass cores, if obtainable, for the aerial and R.F. coils. If brass slugs are not used, the coils will have to be modified on the lines already given.

When aligning the televisor, the sound channel should be ignored and the vision signal only used in the first instance. As the oscillator is adjusted, the vision may be heard on the loudspeaker before it is seen on the screen. In this case, the R.F. and aerial coils should be adjusted for maximum volume of the signal. Continue to look for the vision signal on the tube face ignoring anything which may be heard on the sound.

When the vision signal is found, the R.F. and aerial coils should be adjusted for maximum signal (if not done previously) and the sound volume control turned up to maximum position. If the sound is not heard, move the oscillator about half a turn in each direction. If no sound is heard then, continue turning the oscillator trimmer. The picture will disappear from the screen but it may be possible to find a second position on the trimmer where it is again present.

At the second appearance of the vision signal, the sound should again be tried, varying the trimmer half a turn each way. If still no success is obtained, the next step is to peak up the vision once again and adjust the sound I.F. coils, starting with the one nearest the mixer, until the sound signal is heard.

Having obtained both sound and vision at the same setting of the oscillator trimmer then the sound volume control should be reduced to zero and the picture quality dealt with as in the previous case.

Changing to a Lower Channel

Everything which has been said applies equally for when it is desired to change to a station on a lower frequency, but in this case instead of taking off coil turns to attain the desired frequency, coil turns are *added on* in accordance with the data obtained from the simple calculations. This is the only difference to the procedure.

Straight Receivers

When a straight receiver is converted, each R.F. coil has to be treated which involves quite an amount of work. The number of turns required is calculated in the same way described for the R.F. and aerial coils in the superhet. It should be noted that each coil in the vision receiver will have a different number of turns. This is brought about by the necessity for stagger-tuning ; it was not noticed in the superhet as the staggering is accomplished in the I.F. stages.

It should not be forgotten that the rejector coils will require modification, the same method of calculating the number of turns being employed.

Alignment should be done on Test Card " C " the most satisfactory method where signal generators are not available.

Straight Receivers—London

As the only modification to a London receiver is to convert it to a lower channel, by far the most satisfactory method is to replace the iron slugs with brass ones, but if these are not available the coil windings will have to be altered on the lines given in the preceding paragraphs.

In addition to the vision and receiver coil modifications, rejector coils must be added to the vision receiver. The best method of doing this is to make two coils on two formers of the same size, same wire and same number of turns as those in the sound receiver (after the latter have been modified), together with parallel condensers of the same value as those already in use, if any.

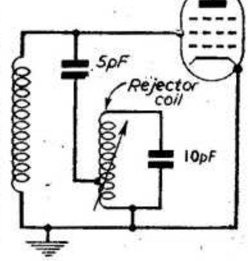


Fig. 2.—Details of a wave-trap or rejector circuit.

The coils should be mounted in the second and third R.F. stages of the vision receiver, but if the first two stages are common to sound and vision then the third and fourth R.F. stages must be employed. The bottom end of the coil's winding should be connected to earth and a 5 pF mica condenser connected between the grid of the R.F. valve in the stage, and a tap on the rejector coil one quarter of the way up from the earthy end of the coil (Fig. 2).

It is best to adjust the rejector coils at the end of the evening's programme when the news is being read and there is nothing on the vision channel. A pair of earphones should be inserted in the video output stage and the rejectors adjusted for minimum sound.

Modifying Construction Data

When construction data for one particular channel is received and it is desired to use the data on another channel, then an approximation of the number of turns required in each coil can be made by applying the simple arithmetic given previously.

Supposing, for example, it is desired to use coil data given for Holme Moss for a televisor built to receive Sutton Coldfield. Divide the number of turns given for each coil into the frequency of the Holme Moss transmitter. This will give the frequency per coil turn.

Now find the difference in frequency between Holme Moss and Sutton Coldfield. If the frequency per turn is divided into this figure the answer will give the number of turns difference in the coil windings. As Sutton Coldfield has a higher frequency than Holme Moss, this figure is the number of turns less which are required for that particular coil.

A "PERSONAL" TELEVISOR

BUILDING A PORTABLE RECEIVER WITH 3IN. TUBE FOR TESTING OR PERSONAL USE

By E. N. Bradley

THE "Personal" Televisor, a miniature unit displaying a picture on a 3-in. tube (and, of course, complete with a sound section capable of operating a small loudspeaker) commenced life as a small pre-amplifier built to test the possibilities of a new American technique, that of series-connected R.F. stages. Results were so promising that it was decided to build a complete midget television receiver utilising B7G based valves throughout (apart from an EA50 vision detector) and the circuit of this receiver is shown in Fig. 1.

It must be emphasised at the outset that this is solely a "good reception area" set, requiring an input of better than one millivolt for satisfactory operation in the London area, and a rather greater input in those areas served by the higher frequency stations. Nevertheless this limitation permits the receiver to be used in a surprising number of locations.

On a first consideration there would appear to be little value, apart from novelty value, in a receiver giving no more than a 3in. picture, but this is not really the case. The receiver is readily transportable and so suitable for sickroom and nursery use, whilst it might also be employed by the service engineer engaged in the installation of aerials as an indicator for alignment, ghosting, etc., beside the aerial itself. The receiver can also be used in much the same way as a portable radio during holidays, where a good reception area is being visited providing that an A.C. outlet is available. Provided that an adequate signal exists a simple wire aerial can be rolled up and transported within the receiver case.

Points of Design

In the vision receiver V1 and V2 are the series-connected R.F. amplifiers and it should be noted that this type of circuit must not be confused with direct coupling. The valves are actually completely in series with the H.T. supply, requiring only one point of connection with the H.T. line. The benefits obtained from this type of operation are numerous.

In the first place the number of decoupling components required undergoes a drastic reduction, compared with a normal T.R.F. vision amplifier circuit. V1 has neither decoupling resistors nor chokes, but only C4 between the "cold" end of its anode load coil and earth ("earth" throughout refers to the chassis) whilst V2 has only R4 and C7 as decouplers. Again, coupling between stages is greatly simplified for the grid of V2 is connected directly with the anode of V1, L2 therefore serving both as anode load and grid load, with no losses introduced in inductive or capacitive couplings. At the same time no chokes, load resistors or grid leaks are required, nor are there extra coils to tune. The close coupling between stages gives a naturally broad response, ideal for television purposes (in more comprehensive receivers the response is broadened still further by resistive loading of the coils) and the deliberate loss of H.T. voltage often required in more normal R.F. circuits to avoid too high anode and screen voltages is obviated since only half the H.T. potential appears across each valve.

One disadvantage of the circuit is that the cathode of V2 rises to approximately 100 volts above earth, thus setting up a potential across the heater-cathode insulation, but since the specified valves have this insulation rated to withstand a potential of 150 volts the point is of no importance in the present circuit. It is, of course, a bar to including a greater number of valves in the series-connected chain unless the H.T. voltage is so chosen that no valve has too great a potential set up between its heater and cathode. In American service equipment employing this type of circuit, for example, four-stage I.F. amplifiers are now common, midget valves and a suitable H.T. voltage being used.

A further point to remember is that in such a circuit, no matter how many valves are employed, all the valves instead of a single valve will be controlled by any normal type of gain control. It is, therefore, best to incorporate the gain control—the "contrast" control in a vision circuit—in a separate stage either before or after the series-connected strip, and in this circuit the control follows the detector.

Whilst practically any high-slope television pentode with suitable heater-cathode insulation may be employed in a series-connected strip (Z77s and EF91s were tested successfully in the present receiver) it is obviously wise to employ a valve which works well with a low H.T. supply, and for that reason Mullard EF95s (6AK5s) were chosen for the final construction. EF91s have a higher slope but a greater H.T. voltage is necessary to operate them at their most efficient point; since it was desired to employ a simple half-wave power pack this was not convenient and the EF95s, though having a slope of only 5 mA/V as against the EF91s 7.6 mA/V probably work slightly better in the circuit as it stands. Since the valves are in series it is necessary to pass the full rated working current through both valves if the mutual conductance is to be maintained at a high level, and if this cannot be done it is better to employ valves with a slightly lower slope of which full advantage can be taken with a restricted H.T. supply.

Sound rejection methods in the series-connected strip can be similar to those employed in more usual amplifiers, and in Fig. 1 a cathode sound trap in the cathode circuit of V2 is shown. In the normal manner, this trap is tuned to the frequency of the adjacent sound carrier so presenting an impedance to that frequency and setting up degeneration within the stage operative on any sound carrier present. Whilst cathode sound rejection is by no means the perfect method it is satisfactory in the present receiver, where more elaborate means cannot be employed, and by maintaining a high Q in L3 the rejection notch is reasonably deep and narrow.

In the present circuit broad response has been treated as secondary to a high gain, and so the highest picture frequencies were sacrificed in the prototype, the small picture size making their retention scarcely worth while. As a result the possibilities of "spreading" in the cathode rejector—the formation of too wide a rejection notch—are not as important as in a more ambitious receiver, and under normal circumstances the rejector can be fitted, tuned and forgotten. In the London reception area the sound trap will not be needed at all, except in areas of the highest signal strength. The trap should be fitted, however, in areas served by the single sideband transmitters.

Before passing to the R.F.-detector coupling, it may be as well to make some mention of the network R1, C1, C2 inserted between the earthy side of the input feeder socket and the chassis. This network is required since the chassis of the televisor is directly connected to the mains supply, regulations requiring that in such a case the aerial shall be isolated from the mains. The network permits the connection of a direct physical earth to one side of the feeder (the shield of co-axial cable, preferred as a feeder for this receiver) and to the receiver, such an earth connection sometimes being beneficial in the prevention of hum effects, etc., and in improving signal strength. The chief point to remember, when employing a normal co-axial input socket, is that the body of the socket must be isolated from the chassis by insulating washers.

The Detector

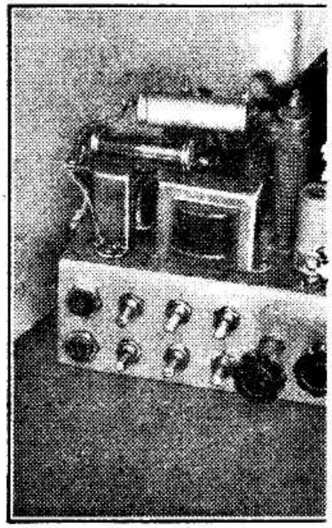
In Fig. 1 is shown a normal coupling between the R.F. amplifier and the detector, V2 being loaded by an R.F. choke with a capacitive coupling between the anode of V2 and the detector tuned circuit. In early trials with this circuit, however, a different coupling was used, and details of the possible alternative may be of interest to experimenters intending to test out the series-connected R.F. amplifier. The alternative circuit, only possible with series-connection techniques, is shown in Fig. 2.

In this case the series-connected amplifier is fed at the cathode of V1 with a negative H.T. supply, easily provided by a small addition to any normal power pack. If inductive coupling is used between the feeder and the first R.F. stage the highly negative first tuned circuit has no effect on the aerial and input arrangements, though from the point of view of safety the aerial coupling loop should be wound with well-insulated wire. Since the first valve is fed from a negative source the second (or last) valve in the series-connected chain must be earthed—the screen of V2 in Fig. 2 is thus shown directly connected to the chassis, with the anode also returned to chassis through the final tuning coil. The detector, in this case, can be connected directly to the anode of the final R.F. valve and so also share in the advantages of direct coupling.

A simple modification to a typical full-wave power pack to provide a negative H.T. supply is shown in Fig. 3. As a series-connected R.F. strip requires only about 10-15 mA, the unbalance caused in the mains transformer by the addition of a rectifier on one side only is merely nominal and generally not detrimental.

In the first version of the present circuit a negative supply was obtained by making C40 an 8 μF. electrolytic capacitor (considerable care must be observed to maintain the correct polarity) when relatively heavy currents could be drawn from the junction of rect. 2 with rect. 3. The chief drawback to the circuit under those conditions was the number of reservoirs and smoothing capacitors required, and negative H.T. feed to the R.F. amplifier, with consequent direct coupling into the detector, was abandoned only for lack of space for the extra smoothing components.

The detector in its present arrangement feeds through the usual choke into the contrast control, R9, from which the rectified vision signal is taken to the grid of the video amplifier. For the sake of simplicity it was decided to use grid modulation of the C.R. tube, for which a positive going output from the video amplifier is required, this in turn requiring a negative going input into V4. The detector must therefore be connected up to give a negative signal, which means that the input for the sync separator can also be drawn from this stage—if the detector supplies a negative going vision signal, the sync pulses of that signal can be said to be positive going. Such an input is, of course, needed by the simple limiter type of sync separator provided by V5.



The main parts of the Televisor

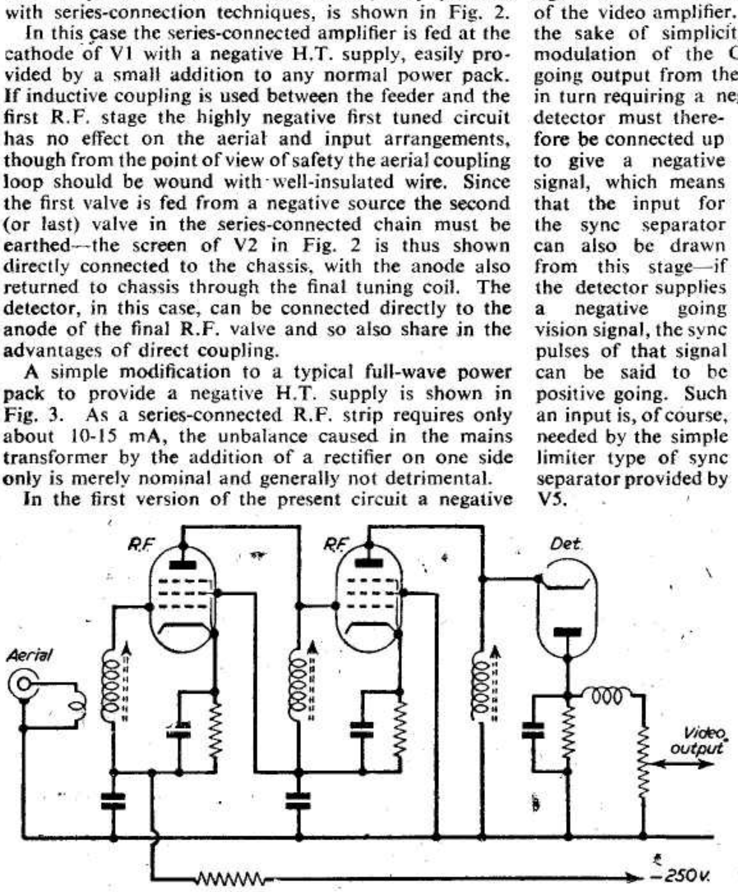
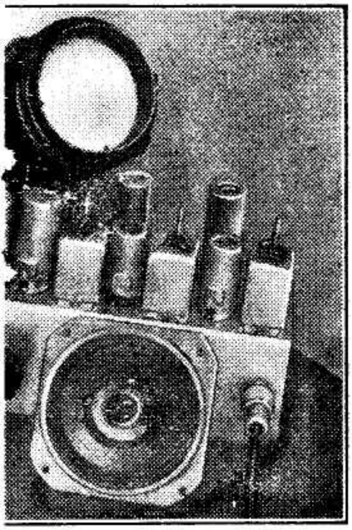


Fig. 2.—Series-connected R.F. amplifier with negative feed and directly-coupled detector.

LISTS

L1-L5—See coil data.
C1—0.01 μF tubular, 1,000 v.w.
C2—0.001 μF mica, 1,000 v.w.
C3, C6, C20, C24, C28, C30, C33-
mica, 350 v.w.
C4, C7, C12, C14, C21, C26—0.01 μ
mica (preferred), 350 v.w.
C5—70 pF trimmer, postage stamp t
C8, C13, C18, C29—100 pF mica, 3
C9—10 pF mica, 350 v.w.
C10—5 pF mica, 350 v.w.
C11, C39, C40—0.1 μF tubular, 1,000
C15—500 pF mica, 350 v.w.
C16, C17—3-30 pF Philips concentr
C19, C25—0.005 μF tubular or mica,
C22—Optional, 0.002-0.01 μF. See t
C23, C34, C37, C38—8 μF Electrolyt
C27, C31, C32, C36—0.1 μF tubula
C35—8 μF Electrolytic, 450 v.w.
R1, R26, R40—470,000Ω, ½ watt.
R2, R6—See text.
R3, R5, R23—200Ω, ½ watt.
R4, R35—2,700 Ω, ½ watt.
R7, R8, R10, R19, R24, R27—10,00
R9—10,000 Ω pot. contrast control.
R11—100 Ω, ½ watt.
R12, R15, R28, R29—220,000 Ω, ½
R13, R37—33,000 Ω, ½ watt.
R14, R52—100,000 Ω, ½ watt.
R16—150 Ω, ½ watt.
R17, R38—22,000 Ω, ½ watt.
R18, R20, R22, R44, R47—1 MΩ, ½
R21—0.5 MΩ pot. volume control.
R25—10,000 Ω, 1 watt.
R30, R36—15,000 Ω, ½ watt.
R31—3.3 MΩ, ½ watt.
R32—0.5 MΩ pot. frame hold.
R33—47,000Ω, ½ watt.
R34, 150,000 Ω, ½ watt.
R39—82,000 Ω, ½ watt.
R41—0.5 MΩ pot, line hold.



ready for insertion in the cabinet.

Protective biasing is given to the video amplifier despite the fact that the grid is supplied with a negative going signal, the cathode-bias resistor being unbypassed in the original circuit, though if desired the effect of by-passing with 0.001 μF. can be tried to give some levelling of response over the frequency band. In areas where the signal strength is found to be a little low for the receiver it would probably be advantageous to reduce the present (relatively) high value of R11 to about 50 ohms, by-passing this resistor with 0.1 μF. to increase video amplifier gain.

The value of R11 as given in the components list is higher than is usual for a video amplifier with a negative going input, but this means of valve protection was adopted rather than the more common and more desirable method of decreasing the screen potential to about 150 volts. The reduction of screen potential, in a video amplifier, calls for very heavy decoupling, and again space was at a premium. Against the various disadvantages of this type of video amplifier may be set the fact that it automatically provides a very fair degree of interference limitation, not unimportant in a small receiver of this type.

The Sync Separator

Before dealing with the sync separator proper, it is necessary to consider that section of the detector circuit which passes the rectified vision signal to V5. It is essential that the value of C10 should be kept low, 5 pF being a common value, and in a larger receiver this capacitance might well be provided by making the lead from the end of R8 to C12 from a short length of co-axial cable, the screen being connected to earth to provide the required capacitance to the inner conductor. In the present receiver, with only small distances between components, it is better to employ an actual 5 pF silver-mica capacitor for C10.

The working conditions of V5 are so chosen that the negative going signal containing the video information merely drives the valve further into the cut-off state so that there is practically no variation of screen and anode currents during the picture content of each line. The positive sync pulses, however, cut the valve on to produce negative going pulses for feeding to the timebases, the line sync pulses being differentiated through C13 and the frame sync pulses integrated across C14. The output levels of the pulses are standardised since although the valve is fed through a capacitance, C12, it provides its own D.C. restoration.

By using a fairly low value of coupling capacitor between V5 and the frame timebase an attempt was made to provide a spiky sync pulse for frame synchronisation by differentiation of the front edge of each small step in the integrated waveform. Oscillographic inspection of the sync separator output in the original televisor appeared to show a measure of success but once again a poor signal strength may adversely affect the circuit and in some locations it may be desirable to increase the value of C15 by trial.

Isolating Timebases

Isolation between the timebases is considerably assisted by drawing the line and frame sync pulses from separate electrodes of V5.

OF COMPONENTS

-0.001 μF

tubular or

pe.

50 v.w.

v.w.

ic timmers.

350 v.w.

ext.

ic, 350 v.w.

r, 350 v.w.

Ω, ½ watt.

att.

watt.

R42, R43, R50, R51—2.2 MΩ, ½ watt.
R45, R46—0.5 MΩ pots shift controls.
R48—0.5 MΩ pot focus control.
R49—0.5 MΩ pot. brilliance control.
R.F.C. 1, 2, 3—60 turns 40 S.W.G. enamelled wire on ¼in. diameter former (47 K. Erie type 8 resistor makes a suitable former). Turns close-wound, and anchored to wire leads at ends of former.
L.F.C.—10 henrys 60 mA.
T1—Universal midget output transformer.
Sp—2½in. or 3in. speaker.
T2—230-250 volts primary, 6.3 volts 2.5 amps. secondary.
T3—230-250 volts primary, 6.3 volts 1 amp. secondary.
Rec.1—230 volts 60 mA. SenTerCel rectifier.
Recs. 2, 3—230 volts 30 mA. SenTerCel rectifiers.
Rec. 4—Germanium diode.
S1, S2—S.P. on-off main switches.
V1, V2—Mullard EF95 (6AK5).
V3—Mullard EA50.
V4, V5, V7, V8, V10—Mullard EF91 (6AM6, Z77).
V6—Mullard ECC91 (6J6).
V9—American 6C4.
Six B7G valveholders, ceramic, with base and top shields.
Three B7G valveholders, ceramic, unshielded.
One diode cradle holder.
One co-axial plug and socket.
Chassis, cut and bent from sheet aluminium, 12in. × 3½in. × 2½in.
Five tagboards, 5-way.
One tagboard, 3-way.
One tagboard, 1-way.
One cathode ray tube, with screen and base, etc., 3BP1.
Eight control knobs.
Three screening cans for tuning coils.
Wire, sleeving, flex, nuts, bolts, solder, etc. etc.

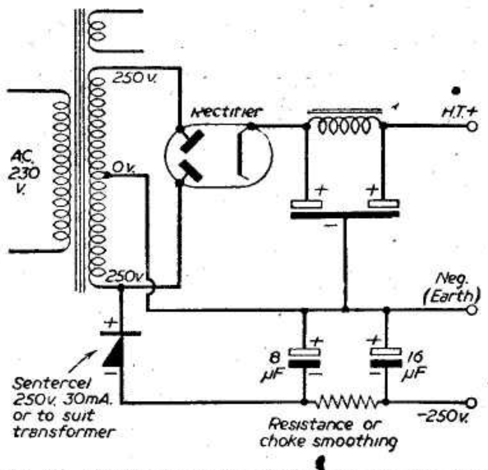
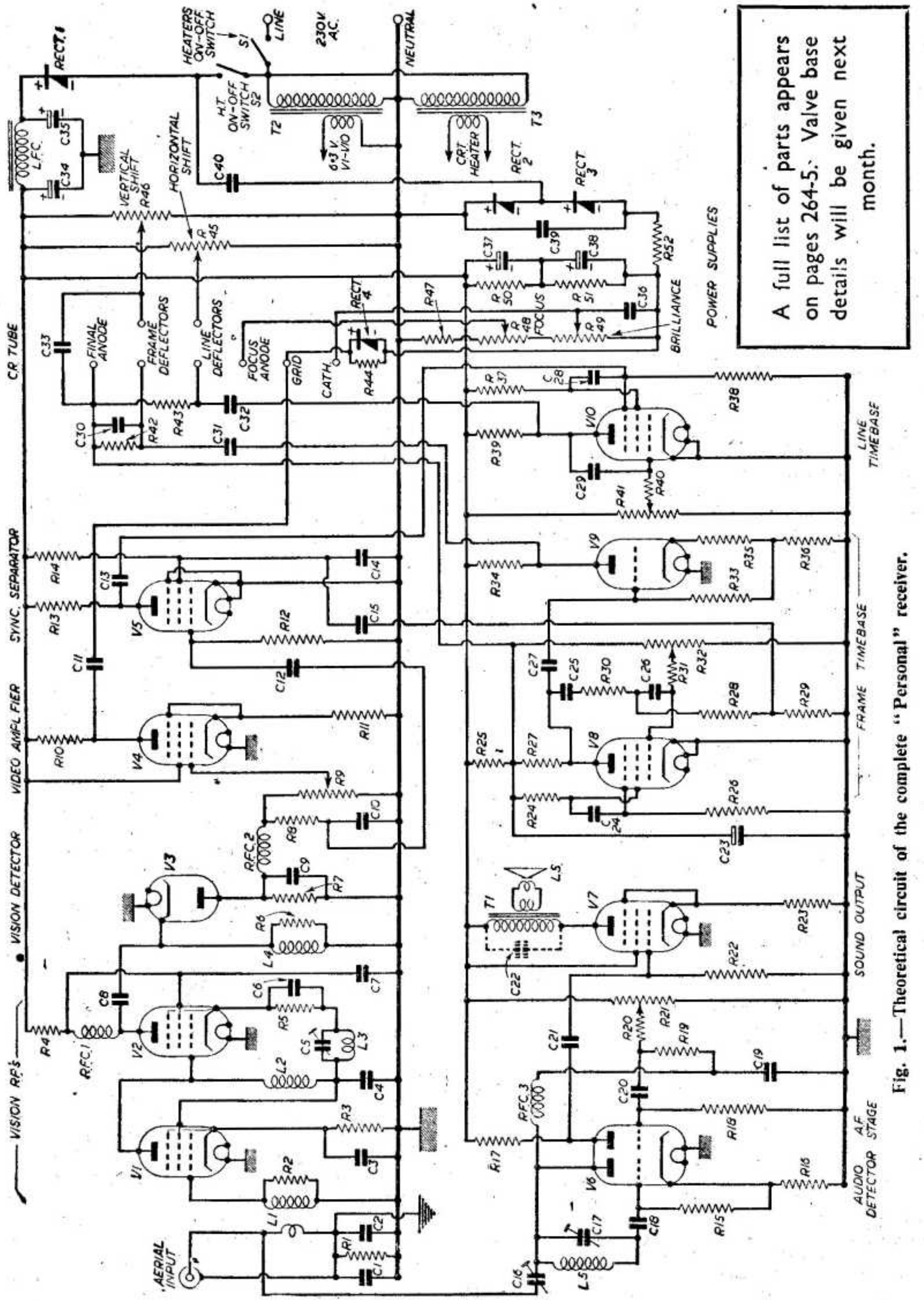


Fig. 3.—Providing negative H.T. from normal power pack.



A full list of parts appears on pages 264-5. Valve base details will be given next month.

Fig. 1.—Theoretical circuit of the complete "Personal" receiver.

The Timebases

The timebases employed in the televisor are of the Miller type, built round EF91's. The majority of B7G based valves are unsuitable for this application since their suppressors are often internally connected with their cathodes. In the line timebase, V10, ordinary circuitry is employed save for the fact that a fixed anode load is used rather than a potentiometer to avoid over-crowding of the chassis walls with controls. The timebases as shown are designed to suit a 3BP1 tube and if coupled to any other tube their circuits may require alteration. The scan width is adjusted by choosing R39 by trial; the value given in the components list gave a picture slightly wider than the tube screen, thus cutting off the corners, but with different valve batches a variation of R39 may be necessary. The component is mounted in a readily accessible position to facilitate adjustment.

A good deal of time was spent on the frame timebase which in its first form was found to be extremely non-linear. Timebase circuits other than the Miller were tested as alternatives, but with no greater success, and eventually a variation of the Miller timebase, with an amplifier, was evolved and found to be completely linear by oscillographic inspection. This timebase was coupled to the 3BP1 tube and checked on a bar generator when it was found that the raster was still completely non-linear with curvature in the direction opposite to that previously obtained.

Further extensive tests were carried out, using several 3BP1 tubes which all gave equivalent results, and it was finally discovered that at low frequencies the tube suffers from what may only be termed a form of trapezium distortion which appears to clear at higher frequencies. The frame deflection input waveform required for a linear raster needs some curvature; the curvature of an uncompensated Miller timebase using the EF91 is too great whilst a linear scanning stroke introduces reverse distortion in the raster. Once this fact was recognised it was a fairly simple matter to adapt the Miller circuit for "variable distortion" by splitting the normal single grid-anode capacitance into two capacitances in series, separated by a resistor, C25, R30, C26 in Fig. 1. Control over this combination is obtained by introducing resistance to earth, formed by R28 and R29, variation of this resistance introducing the necessary non-linearity in the scanning stroke to give an excellently linear raster on the tube screen.

Ideally R28 and R29 would be a rheostat but again it was decided to employ fixed values chosen by trial at the outset. This conferred the further advantage of a convenient tapping point for the frame sync input, which when taken to the suppressor grid of the circuit tended to damp down the transitron action of the suppressor and screen. If, on the first trials, non-linearity of the picture is found in the vertical direction, R29 should be varied experimentally to clear the distortion. In the original circuit it was found that the change in value of R29 was fairly critical, and tolerance variations of resistors with the same value markings is sometimes sufficient to give control.

It should be noted that whilst the non-linearity effect just described has been likened to trapezium distortion there is actually no trapezoidal shaping of the raster which, in the original televisor, was found to be excellently rectangular. It would seem probable that the effect would be eliminated by push-pull deflection, where both frame deflector plates could share the work, but in this small unit the extra complication of push-pull deflection seemed hardly worth while.

The Miller timebase is followed by a triode amplifier, the timebase alone giving insufficient scan. The amplifier is given negative feedback by returning the grid leak to a point well up a reasonably high cathode load and, as in the case of the line timebase, the output amplitude is controlled by the anode's load being chosen to suit the circuit conditions. The value for R34 given in the components list provided a raster equal to the screen height in the prototype; some variation of R34 may be found necessary to take up differences in component tolerances and valve batch characteristics.

It may be found that one or other of the timebases does not fire immediately, but requires "starting" by swinging the frequency control. This can be overcome by testing other EF91's in that timebase circuit until a ready starter is found. Since five valves of the required type are used in the receiver, there should be no trouble at all in replacing a slow starter which in any case will be found in only a few sets. The replaced valve may, of course, be employed in any other circuit with no bad effects.

It will be appreciated that the present Miller circuit and amplifier shown in Fig. 1, have been developed to suit the 3BP1 tube, and that they will not necessarily give linear rasters and correct amplitudes with other tubes. If it is desired to employ some other type of C.R. tube, it will probably be best to commence with a normal Miller timebase; as an alternative a cathode-coupled multivibrator frame timebase, with amplifier, might be tried.

The Sound Section

As with other parts of the circuit, tests of several different sound strips were made in an endeavour to obtain the best possible results and finally, as is so often the case, the simplest solution was found to be outstandingly the best. In early trials the sound was tapped from the cathode rejector between V1 and V2, but this was found to introduce a likelihood of feedback. The desirability of building the complete sound section round two valve positions, limited the combinations of R.F. amplifier-detector-output circuits, which could be tested, and the final circuit, as shown in Fig. 1, was found to give greatest range and gain. This sound receiver is a small detector—A.F.—output strip, an ECC91 (6J6) double triode providing both the detector and audio amplifier sections in a single valve, followed by an EF91, which operates a 2½in. speaker very adequately.

The receiver relies for its high gain on a detector of the super-regenerative type, which is normally brought by the gain control R21 to the verge of oscillation, and so to a sensitive point, without interference to the vision channel. Direct capacitive coupling between the detector anode and the core of the co-axial feeder is provided by C16, any degree of unbalance caused by this type of coupling being apparently unimportant, to judge by results. The value of C16 is set by trial to give best results, the capacitance value being kept as low as possible.

The only component in the sound section which may require variation from the value given in the components list is the detector anode load R20. This should be of such a value that the detector comes into oscillation when R21 is practically all in. Valve and component variations may make it desirable to vary the original value of R20 over a slight range if absolutely maximum gain is required from the detector stage. The audio amplifier and output stages are conventional, save for the fact that no by-pass capacitor is used across the bias resistor in the cathode line of V7.

(*To be continued.*)

From VCR97 to ACR2X

DETAILS OF MODIFICATIONS NECESSARY IN THIS POPULAR CONVERSION

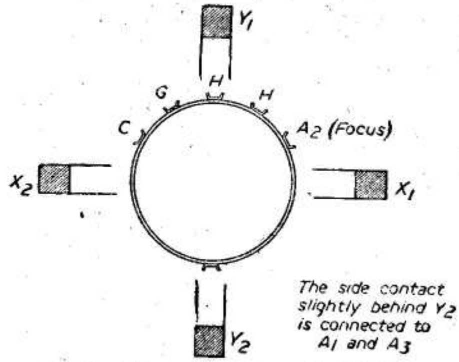
By J. Muir Smith

IN reply to a number of requests here are the complete conversion details for changing from the VCR97 to the ACR2X.

Firstly, the mechanical differences:

The ACR2X, unfortunately, has a base which at the moment seems to be quite unobtainable. I overcame this difficulty by inserting the original base inside that from a broken VCR97, and then wiring the base and side contacts of the ACR2X to the corresponding contacts on the VCR97 base. The tube may then be quickly substituted in circuits which were previously used with the VCR97.

The base connections of the ACR2X are as follows:



Details of base connections of ACR2X.

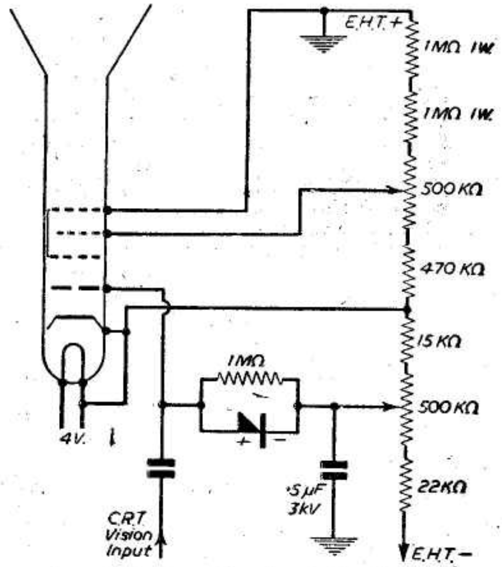
Characteristics

Secondly, the electrical differences:

VCR97
Heater voltage, 4 volts.
Heater current, 1 amp.
A3 max. voltage, 2,500 volts.
Y plate sensitivity, 600 mm/v/v.
X plate sensitivity, 1,140 mm/v/v.

ACR2X
Heater voltage, 4 volts.
Heater current, 0.9 amp.
A3 max. voltage, 4,000 volts.
Y plate sensitivity, 675 mm/v/v
X plate sensitivity, 600 mm/v/v.

From the data given it can be seen that by using the ACR2X with a final anode voltage of about 2,000 volts the only electrical difference is that the Y plate sensitivity of the ACR2X is double that of the VCR97, i.e., if a timebase designed for the VCR97 were connected up to an ACR2X the line amplitude would be correct but the frame amplitude would be twice the tube width.



Voltage supply network details.

Timebases such as those used in the P.T. Argus and others employ a Miller Transitron oscillator driving a similar valve with 100 per cent. negative feedback. These are the simplest to convert, and require only the removal of the frame amplifier valve.

Timebases which employ an oscillator driving a double triode (e.g., 6SN7) should have the load resistances of the two frame amplifier triodes halved.

Any E.H.T. network designed for the VCR97 may be employed without any alteration. The network in use at the moment is shown above.

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By F. J. CAMM

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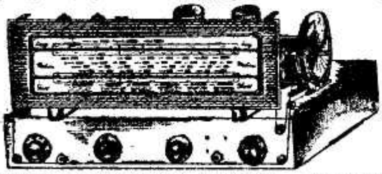

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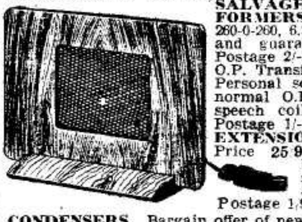

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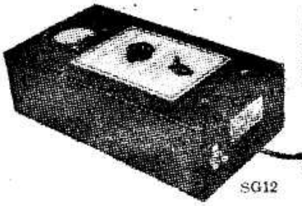

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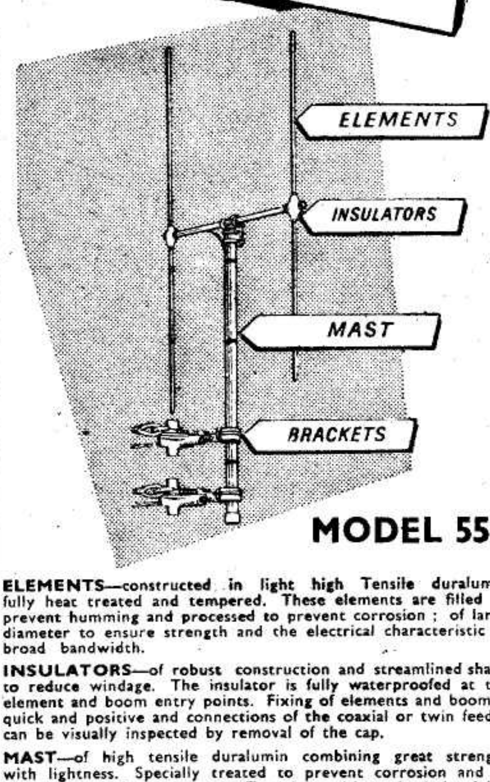

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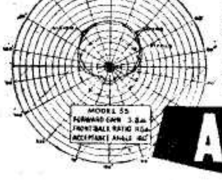

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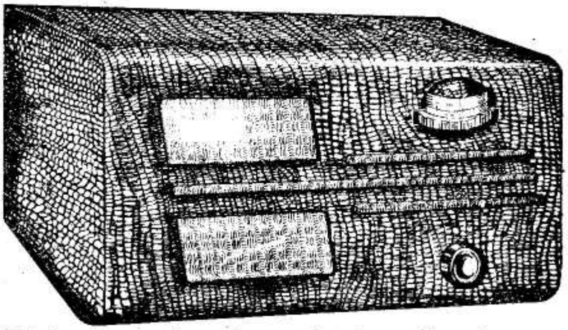

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Servicing Without Instruments

SIMPLE IDEAS FOR TESTING AND FAULT FINDING FOR THE BEGINNER

By W. J. Delaney (G2FMY)

A RATHER surprising fact brought out by visitors to our stand at the Radio Show was that many would-be constructors hesitate to build a television receiver as they have no test equipment, and feel that it is risky to undertake the task. The problem is that test equipment would cost as much as a television set using an ex-Service tube, and that in any case, many constructors would not know how to use the equipment. Although it must be admitted that for proper servicing a range of good test instruments is essential, it is by no means necessary for the amateur who wishes to build himself just one receiver for domestic use to own any test apparatus. Most amateurs who are interested in radio or television will no doubt possess a test instrument, usually of the multi-purpose type, but some may have only a dual-range voltmeter. The latter will probably not read above 200 volts, but even this may be used for fault finding, and the following details will give an idea of the lines of attack in locating a fault in a home-made receiver. It will be assumed that the constructor has just completed his first receiver—be it a standard with large tube, or one of the converted ex-Service units or tube assemblies.

Precautionary Tests

Theoretically, before risking damage to an expensive C.R. tube, voltage tests and checks should be made at different parts of a circuit, but here it is important to stress a point which is often overlooked. In an attempt to avoid damaging valuable parts we find that many constructors try and test separate sections of a complete television receiver, and as a result obtain false indications or damage expensive parts. As an indication of the sort of wrong test which is made, let us assume that the vision and sound sections are fed from exactly the same H.T. rail as the timebases. Now the anode current from the vision section will perhaps be of the order of 50 mA., the sound 20 mA. and the timebases 100 mA. or so. Obviously, therefore, if only the sound section were to be operated—either by removing all the remaining valves, or by disconnecting the H.T. feed to the other sections, the voltage dropped through any series resistor will be very much less, and even if there is no series resistor in the H.T. feed the voltage applied to the section will be quite different from that given when all the other sections are operating. The first rule therefore is, that in most receivers it is not practicable to try and test each section individually—the entire apparatus must be switched on as a complete unit. Obviously, therefore, in order to safeguard valves, etc., the first step before switching on is to make certain that no serious mistakes have been made in the wiring. If you have an all-purpose test meter, even of the cheapest kind, before inserting any valves or the C.R. tube, check for a short-circuit across the H.T. positive and negative lines. A short-circuit here will damage the rectifier, and can be caused not only by a mistake in the wiring but also by a faulty smoothing condenser. If you do not possess even a voltmeter, a rough check may be made by connecting a pocket-lamp bulb in series with a suitable torch battery and connecting them from H.T.— to H.T.+. There should be no light, but if there is a slight glow, check the circuit and make certain that there is no low-resistance potentiometer across the supply, which may be found in some circuits for obtaining low voltages for certain points.

Having checked the H.T. supply the next check should be for the heaters, and again the test meter is the most satisfactory item, connecting it across any valveholder (in an A.C. model where the valves are in parallel) and checking that 6.3 volts, or whatever the voltage rating is supposed to be, is present when the set is switched on. It should be switched on and off fairly quickly, as the transformer may be damaged if left switched on for any length of time without a load.

Again, for those with no instruments, a 6.3 or 8-volt torch bulb or dial lamp may be connected across the heater sockets of one valveholder, with short lengths of wire pushed into the sockets and the bulb held across them. The bulb will show whether the appropriate voltage is present, indicate an open circuit, and will blow if there is an H.T.-to-heater short-circuit. In an A.C./D.C. or similar circuit where the valves are in series, the same check will prove continuity only if all valveholders are provided with the correct valve load, and therefore each valveholder should be checked as already described for a short-circuit to the H.T. positive rail, and then when all the valves are inserted, if it is thought that a further precautionary measure is justified, the heater line should be disconnected from the chassis and a low-voltage torch bulb used to complete this connection. If it glows faintly and steadily it may be assumed that the heater circuit is more or less satisfactory.

Testing Sections

The receiver may now be switched on, and the necessary trimming or adjusting carried out. Fortunately, a television receiver has, in effect, its own test instrument incorporated in the picture tube, and this gives an indication of the majority of actual faults. Thus, if a complete raster is received but no picture, although sound can be tuned, obviously the vision receiver is faulty; if a horizontal line only is obtained, the frame timebase is faulty, and so on. No instruments are therefore necessary for locating the *section* in which a fault is obtained, but its actual *source* can be more quickly located with instruments. Thus, a faulty vision receiver may be checked stage-by-stage, and an open-circuited anode load easily found with a good current meter. But again, the amateur with no test equipment need not be put off, provided he has a pair of headphones. These may be inserted into each anode circuit in turn, and the noise heard will give a good indication as to whether there is a successive build-up from stage to stage and a complete break will easily be noticed, whilst a badly-off-tune stage will also give a good indication in the 'phones. If there are no headphones available, the loudspeaker may be used in a similar manner, replacing the speaker transformer by an equivalent high-wattage resistance in order to maintain the sound output stage working correctly. This idea may also be adopted for lining up the vision stages, tuning for maximum response, and afterwards adjusting each individual stage for correct bandwidth.

Timebases

The timebases may be fairly easily checked by using the indication given on the tube. For instance, if it is seen that the frame section is not functioning, the valves should be checked first, changing them round with others of a similar type in the other timebase or some other part of the receiver, but where this is not possible, get them tested by a local dealer. Where the constructor possesses a voltmeter, even if this does not read higher than 200 volts and even if of the moving iron type, it may be used to measure the voltage drop across certain items, such as cathode resistors, where only a rough indication is necessary to check that a stage is actually functioning. *In this connection it must again be stressed that no attempt should be made to measure the voltage applied to the anode of a line output valve, in view of the high peak fly-back voltages which are developed here.*

Complete failures are not too difficult to cure as the cause of the trouble is usually fairly obvious upon analysis, but faults such as distorted waveforms are more difficult to trace without elaborate test equipment, and all that the amateur can do in these cases is to replace or substitute components one at a time. The various articles published in these pages from time to time on the function of different circuits will enable an appreciation of the working to be obtained, and will assist in tracking down faults, and it is hoped that the above details will assist those who are interested in construction but hesitate to build a receiver without test apparatus.

The Television Society

THE following is a programme of meetings for the 1952-53 session. All meetings, unless otherwise stated, are held at the Cinematograph Exhibitors' Association, 164, Shaftesbury Avenue, W.C.2, and commence at 7 p.m.

1952

Wednesday, October 1st: "The Viewing of Motion Pictures: Films and Television." Prof. W. D. Wright (Imperial College). (Joint meeting with the B.K.S.). Held at Film House, Wardour Street, at 6.30 p.m.

Friday, October 24th: "The Birth of a High Definition TV System." S. J. Preston, M.A. (E.M.I., Ltd.).

Thursday, November 13th: "Component Reliability in TV Receivers." Dr. G. D. Reynolds (Murphy Radio, Ltd.).

Friday, November 28th: "High Quality Front Projection TV Receivers." P. D. Saw (Aren Radio, Ltd.).

Thursday, December 11th: "The Television Society's Transmitter—Part 1. H. Banting, H. Fairhurst, and C. Banthorpe.

Wednesday, December 17th: "The Television Society's Transmitter—Part 2. C. Banthorpe, D. N. Corfield and E. A. Dedman.

1953

Thursday, January 8th: "An Introduction to the Sine-squared Pulse." C. J. Hunt and E. W. Elliot (G.E.C. Research Labs.).

Friday-Saturday, January 23rd-24th: The Society's Annual Exhibition (Friday, members only; Saturday, open to visitors by ticket). At the Edison Swan Co.'s offices, 155, Charing Cross Road, W.C.2.

Thursday, February 12th: "The Importance of the D.C. Component." D. C. Birkinshaw, M.B.E. (B.B.C. Television).

Friday, February 27th: "The Scanning Electron Microscope." D. McMullan, M.A. (Cambridge University).

Thursday, March 12th: "Television Aerial Equipment." N. M. Best (Antiference, Ltd.).

Friday, March 27th: The society's annual dinner. Details to be announced later.

Thursday, April 9th: "Aspects of Television Programme Planning." Cecil Madden, M.B.E. (B.B.C. Television).

Friday, April 24th: "The Fleming Memorial Lecture." Details to be announced later.

Thursday, May 7th: "A Delayed Trigger Oscillograph." R. Anderson and J. R. Smith (The Plessey Co.).

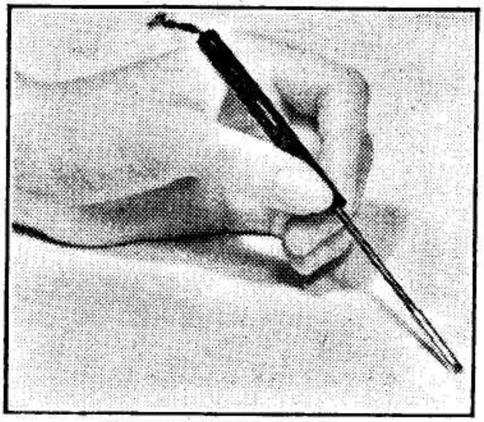
Friday, May 29th: "A Directly-driven Line-scan Circuit." Emlyn Jones and K. Martin (Mullard Labs.).

A summer meeting will be held in June.

Non-members of the society are admitted to meetings on the presentation of a signed ticket obtainable from any member, or from the hon. lecture secretary, Mr. G. T. Clack, 43, Mandeville House, Notre Dame Estate, S.W.4.

A New Soldering Iron

A NOVEL soldering iron has recently been produced by Oryx Electrical Laboratories, 3, Tower Hill, London, E.C.3, and is illustrated below. It weighs only ¼oz. and is intended for operation from a low voltage source. This may be 6-6½, 12-13 or 24-27½ volts according to the particular model. The working bit is a push-on fit and is replaceable, and the consumption is rated at less than 9 watts. The bit acquires working temperature in about half a minute, and a new type of element is fitted. This is of a type which will withstand shocks or jars and the only attention which the iron normally needs is the removal of the bit and the insertion of a small drop of oil. For instrument repair work, or even the making of coil connections in model miniature coils such as are used in television receivers, this type of iron will be found extremely useful and effective in action. The price is 16/9d.



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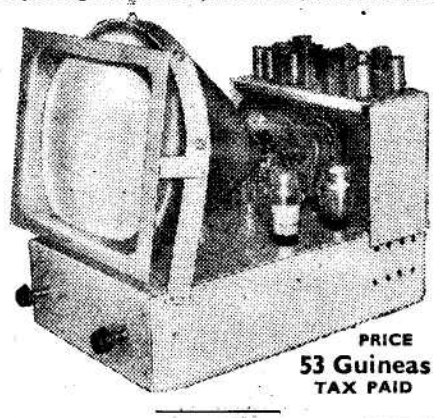

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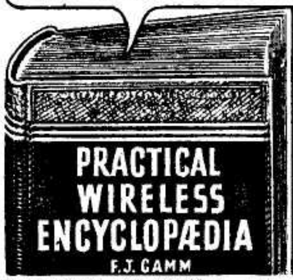

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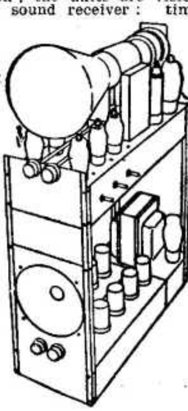

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Carriage and packing **10/-** extra.

A reprint of the data, in "Practical Television" by permission of the Editor of "Practical Television," together with some additional diagrams and notes produced by our Television engineers, are available as a constructor's envelope. Price **5/-** post free.

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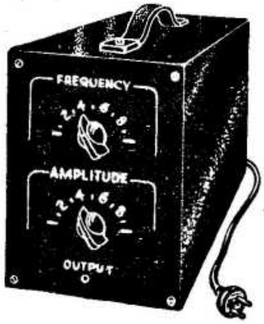

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Note. Cabinets as per the illustrated prototype will be available shortly.

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are designed to match the above Transformer and to give a 70 deg. Scan.

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Aberdeen Station

SHORTAGE of equipment, steel in particular, was blamed by Mr. D. Gammans, Assistant Postmaster-General, at Wick, Scotland, for the slow-up of completion of the BBC's low-power TV stations, of which Aberdeen is one.

Free Suppressors for Ipswich

A MOTORING organisation and several radio retailers have launched a scheme in the Ipswich area whereby motorists have their cars fitted with suppressors free of charge.

Ipswich is "on the fringe" of television reception and receivers are therefore extra sensitive to interference from electrical apparatus and motors.

Mr. P. J. C. West, chairman of of the Suffolk branch of the R.A.C., has reported that car owners have given the idea strong support.

New Transmitter

THE BBC has decided to install one of the two medium-power transmitters, ordered from Marconi's earlier this year, in reserve at Alexandra Palace ready for next year's Coronation.

The other is to be kept at Sutton Coldfield in case of emergency.

Few Scottish Licences

ALTHOUGH the Kirk o' Shotts transmitting station has been in operation for over six months, the viewing public north of the Tweed is much smaller than that anticipated.

Whereas dealers had expected to sell over 50,000 sets in the first half year, less than 23,000 have purchased receivers since March.

Colour Television in Berlin

AT the request of the Board of Trade, Pye, Ltd., took their system of colour television to the German Industries Fair which opened in Berlin recently. Thousands of Berliners were able to see several short programmes televised in colour and the excellence of the pictures with true colour rendering was a great tribute to British equipment and British engineering skill.

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.

Copyright in all drawings, photographs and articles published in "Practical Television" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

Pye colour television is not new to Britain and has already been used for demonstration purposes at two leading London hospitals and at several trade exhibitions.

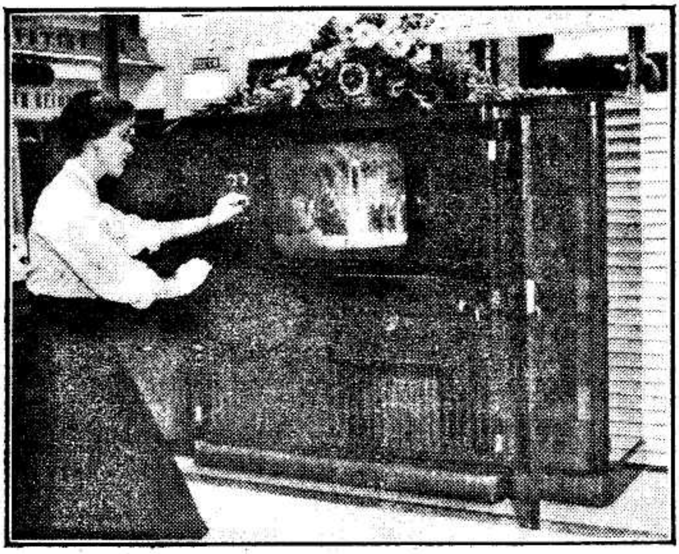
TELEVISION LICENCES

THE following statement shows the approximate number of television licences issued during the year ended August, 1952. The grand total of sound and television licences was 12,806,012.

Region	Number
London Postal	608,360
Home Counties ...	198,275
Midland	379,172
North Eastern	147,156
North Western	179,456
South Western	28,328
Welsh and Border ...	33,467
Total England & Wales...	1,574,214
Scotland	23,625
Northern Ireland ...	108
Grand Total	1,597,947

Flight to Cities Halted

MR. G. A. MARRIOTT, manager of the valves department of the General Electric Company, said in Dublin recently that one of the achievements of British television has been the provision of an evening's



The dearest set at this year's Radio Show was this combined television and radiogram exhibited by Decca. It was priced at £757.

entertainment for people in agricultural districts, thus halting the trend of country people moving to the cities.

From this example, he said, Ireland should exploit the possibilities of television in an attempt to prevent the flight from the land.

Archbishop's Criticism

BEFORE leaving America after a holiday with his wife in New England, the Archbishop of Canterbury described television as "a mass-produced form of education which is potentially one of the great dangers in the world to-day. The world would have been a happier place if television had never been discovered. It contributes to the uneasiness of life to-day."

Dr. Fisher's wife, however, is not entirely in agreement with him.

The inventor of the remote controlled television camera, exhibited at the Radio Show, is seen operating it from the control box. Above behind is the camera, and in the screen at bottom can be seen the televised picture of the photographer taking this picture.

Largest Viewing Audience

IT has been estimated that over 16 million people will watch the Coronation on television next year.

The large figure is expected to be reached through the generosity of set owners in sharing their receivers, and would be the largest viewing audience in the country so far.

Relay Plans Dropped

PORTSMOUTH and South Hampshire Television Society have decided that in place of a relay transmitter on Portsdown Hill, they will urge the erection of the proposed television station on the Isle of Wight.

A deputation from the committee of the Society is to meet local M.P.s for talks on the matter.

Gallery in City Guildhall

RESTORATION plans of the City of London Guildhall include the building of a gallery to mount cameras and equipment for the televising of important functions and events. Work has begun on the repairs and is hoped to be completed in about six months.

Mr. Rank Does Not Fear TV

MR. J. ARTHUR RANK, the Odeon film chief, is not perturbed by the growth of television, for, he says, Britain makes good films and need not fear it, although it has expanded in this country as fast as in America.

BBC Retirement

THE BBC announces that Mr. M. T. Tudsbery, C.B.E., M.I.C.E., the Civil Engineer, is retiring from the established staff of the Corporation on October 4th, 1952, under the age limit.

Mr. Tudsbery is being retained temporarily as Consulting Civil Engineer to advise the Corporation on civil engineering and building matters. In this capacity he will maintain his interests in major schemes and developments, and in particular his personal control of the development of the White City site for television.

Mr. Tudsbery joined the BBC in January, 1926, as the Corporation's first Civil Engineer.

Set for Each Room

AFTER a rich trader had seen a television demonstration given by British technicians in a Singapore sports stadium, he was so impressed that he decided to buy a receiver for every room in his house. He ordered thirty-five.

Aerial Ban

AS television aerials are banned from school buildings in the West Riding of Yorkshire, it appears unlikely that pupils of the junior boys' school at Bentley, near Doncaster, will see their new big screen projection receiver in operation.

The set, which can produce pictures four feet wide, was a present from the school's Parent-Teachers' Association, who bought it from proceeds of events specially organised to raise the money.

"TV Opthalmoscope"

SCIENTISTS at St. Thomas's Hospital, Westminster, London, have built a device which will enable opticians to see into a patient's eye at large magnifications.

The patient watches a small light spot, and a view of his eye appears on a television screen at enormous proportions. The device, which also eliminates the blinding glare of the normal optician's instrument, has been invented by 27-year-old Mr. P. Styles and Mr. H. Ridley, opthalmic surgeons.

Scottish Mining

A PROGRAMME on Scottish mining methods is to be televised direct from the bottom of a colliery at Tillicoultry at the end of this month.

Following discussions with Alloa coal board officials, BBC technicians and engineers are confident that they will not meet any technical snags which cannot be overcome. Four cameras will be used and a complete unit will be taken underground.

It is hoped to hire a local hall in Tillicoultry, in which television receivers can be installed for the benefit of miners' wives and families.

Master Aerials

PROVIDED that a Housing Committee recommendation is accepted, master aerials are to be erected on two large blocks of flats in Battersea, London.

No individual external aerials will be then allowed.

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350-0-350 v 80 ma, 6.3 v 2 a, 5 v 2 a ... **17/6**
350-0-350 v 90 ma, 6.3 v 3 a, 5 v 2 a ... **21/9**
250-0-250 v 100 ma, 6.3 v 4 a, 5 v 3 a ... **23/11**
350-0-350 v 100 ma, 6.3 v-4 v 4 a C.T. 0-4.5 v 3 a ... **23/11**
350-0-360 v 120 ma, 6.3 v 4 a, 5 v 3 a ... **28/11**
350-0-250 v 150 ma, 6.3 v 4 a, 5 v 3 a ... **29/11**
350-0-350 v 150 ma, 6.3 v 2 a, 6.3 v 2 a, 5 v 3 a... ... **29/11**

CLAMPED UPRIGHT MOUNTING
250-0-250 v 80 ma, 6.3 v 3 a, 5 v 2 a ... **18/9**
250-0-250 v 100 ma, 6.3 v 6 a, 5 v, 3 a, for 1355 conversion ... **26/9**
350-0-350 v 100 ma, 6.3 v 3 a, 5 v 3 a ... **23/9**

FULLY SHROUDED UPRIGHT
250-0-250 v 60 ma, 6.3 v 2 a, 5 v 2 a. Midget type 2½-3-3ins. ... **17/6**
250-0-250 v 100 ma, 0-4-6.3 v 4 a, 0-4-5 v 3 a ... **25/9**
300-0-300 v 100 ma, 0-4-6.3 v 3 a, 0-4-5 v 3 a ... **25/9**
350-0-350 v 70 ma, 6.3 v 2 a, 5 v 2 a ... **18/9**
350-0-350 v 100 ma, 0-4-6.3 v 4 a, 0-4-5 v 3 a ... **25/9**
350-0-350 v 150 ma, 6.3 v 4 a, 5 v 3a ... **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 Eng. Televisor ... **67/6**
425-0-425 v 200 ma, 6.3 v 4 a, C.T. 6.3 v 4 a, C.T., 5 v 3 a, suitable Argus Televisor, etc. ... **51/-**

FILAMENT TRANSFORMERS
All with 200-250 v 50 c/s Primaries: 6.3 v 2 a, **7/6**; 0-4-6.3 v 2 a, **7/9**; 12 v 1 a, **7/11**; 6.3 v 3 a, **10/11**; 6.3 v 6 a, **17/9**; 0-2-4-5-6.3 v 4 a, **17/9**; 12 v 3 a, or 24 v 1.5 a... ... **17/9**

CHARGER TRANSFORMERS
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**; 0-4-9-15-24 v 3 a, **22/9**.

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250 ma 8-10 h 50 ohms ... **16/9**
250 ma 3 h 50 ohms ... **8/9**
200 ma 5 h 50 ohms Potted ... **9/6**
150 ma 10 h 220 ohms Potted ... **10/9**
100 ma 10 h 200 ohms ... **7/6**
90 ma 10 h 100 ohms ... **5/9**
80 ma 10 h 350 ohms ... **5/6**
60 ma 10 h 400 ohms ... **4/9**
50 ma 50 h 1,250 ohms Potted ... **9/6**
40 ma 5 h 150 ohms ... **3/9**

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IR5	9/6	7D8	6/9	EF91	11/9
3S4	9/6	807	10/11	EB91	10/6
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		80	9/11	EL33	9/11
5U4G	10/6	9D2	2/11	KT44	5/3
5V4G	11/6	954	1/11	KT66	11/6
5Z4G	9/6	12K7GT	10/6	MU14	9/6
6J5GT	5/9	12K8GT	10/6	OZ4	6/11
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6K7G	6/11	12SC7	6/11	RK34	1/11
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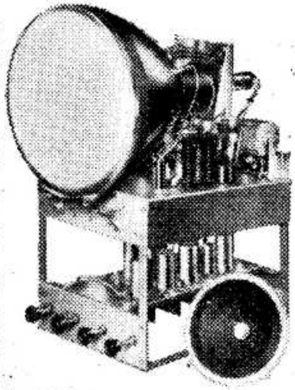

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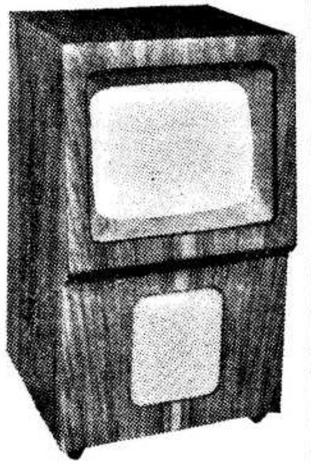

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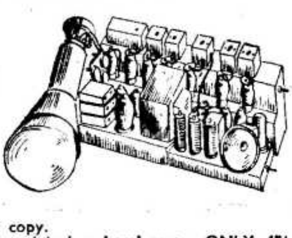

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TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE

By Iconos

FILMS FOR TV

THE initial " impact " of television in the U.S.A. is now over. All the main centres of population have a choice of several different programmes. It is an accepted part of American life—an essential piece of furniture in the home. The " honeymoon " period has ended, but the sales of bigger and better TV sets still soar upwards.

My " spies " tell me that Hollywood may have felt the draught in the early days of television—but not now. The really good films still fill the cinemas to capacity, but the less good films do not do at all well—which is not a new state of affairs. Hollywood studios are busier than ever making films for television as well as for the cinemas. At this moment there are no fewer than thirty-six three-reel films being made in Hollywood for television, and as it only takes two to three days (and sometimes less) to complete each subject, the annual output must be colossal. Already the consumption of negative film stock for TV is five times the amount used for cinema releases. Far from being swallowed up by television, it seems to me that Hollywood has made a good meal ticket of television !

HOLLYWOOD HUSTLES

THE speed of working on TV films in Hollywood is terrific. Fifty camera set-ups a day are secured (compared with about 15 to 20 for cinema filming) and the custom is to make at least three films at the same time, using the same actors and settings. For instance, a TV series might deal with incidents in the life of a District Attorney. First are shot all the court scenes in several or all of the stories. Then follow other settings which are common to more than one episode. Finally, the less important sets or exteriors are taken, many of which occur in single episodes only.

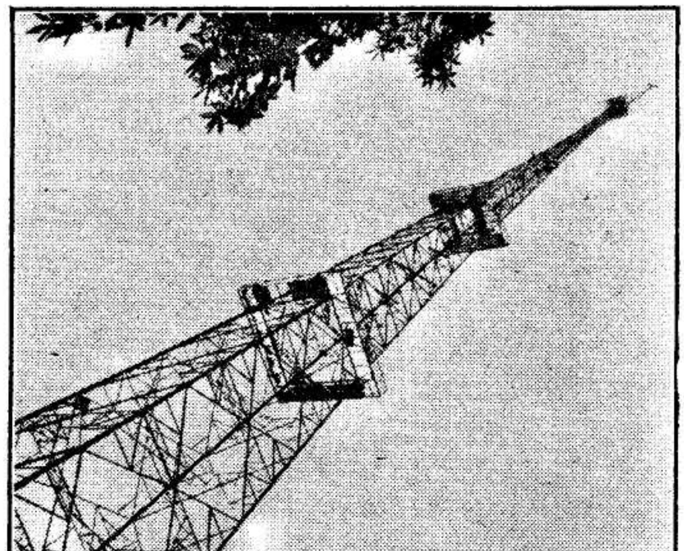
In this way, five or six 26-minute TV dramatic features can be photographed on film in the space of 12 shooting days. Add to this about 20 days of preparation, scripting, casting and rehearsals, plus 10 days to cover editing, sound and music effects, titling and special effects, and you get a breathless impression of high-pressure mass-produced canned entertainment. Strangely enough, my " spy " adds, the results are sometimes very good indeed.

BRITISH NATIONAL STUDIOS

WILL the American situation repeat itself here ? I think it will, but with typically British restraint. The BBC does not film its plays —yet—because of complications with unions on fees for repeat performances. But several companies are making documentary films for the BBC and others are making films for American TV organisations. The latest company to undertake such work here is Douglas Fairbanks, Limited. Douglas Fairbanks, Jnr. has taken a long lease of the British National Studios at Elstree for this specific purpose. British National Studios have been closed since April, 1948, but has retained all its plant, including lighting, cameras and sound equipment. There are four stages :

Stage B—36ft. x 61ft.	Total floor area, 33,556 sq. ft.
Stage C—80ft. x 112ft.	
Stage D—80ft. x 112ft.	
Stage E—80ft. x 168ft.	

together with the usual dressing-rooms, workshops, theatres, cutting rooms, scoring stage and a power plant which has an output from motor generator sets of 2,000 kW. The floor space at this studio is slightly greater than that available to the BBC at Lime Grove, where



Until recently Canadians had to rely on television programmes originating in the United States. Now they are able to receive from the recently completed studios of the Canadian Broadcasting Company in Toronto and Montreal. Here is the huge television tower in the heart of Toronto, which transmits within a 35-mile area.

five stages have a total floor area of about 31,000 sq. ft. The Douglas Fairbanks organisation, therefore, immediately steps into the front rank of television production in Europe, with a huge potential capacity and an initial output of one TV production per week. Until sponsored television becomes a practical proposition in England, however, the TV films produced here will be for export only, principally to the U.S.A.

FOR EXPORT ONLY

PRODUCTION of television films for America is not a new departure for English companies, but has not been particularly successful up to now. Odd films have been made here and there at smaller studios, such as Viking (Kensington), Marylebone, Carlton Hill and Paignton, but have failed to make any great impression. The ill-fated Paignton Studios, well equipped and apparently ideal for the purpose, made one or two TV films and then silently faded away. It was housed in the magnificent Oldway building, partly a Town Hall, at the invitation of the enterprising and optimistic Town Council However, the new Fairbanks venture at Elstree commences operations immediately with very substantial financial backing and long-term contracts with American TV networks. It has every indication of breaking the spell and starting a snowball which may well decide in a practical manner the political issue of sponsored television in this country. Good luck to D. Fairbanks Ltd.! A Gilbertian situation may arise in due course, with more studio stage space, equipment and personnel being occupied with sponsored television films (for export only!) than the equivalent facilities used either by the BBC or the film industry!

INLAY

IN the meantime, the get-together of television and film technicians in the British Kinematograph Society was inaugurated with four excellent papers of common interest. The trick process developed by the BBC, known as "Inlay," was publicly described and demonstrated for the first time. This process enables very small sections of sets, with actors in them, to be grafted on to still photographs of large and complete sets or buildings. An example was shown of a window frame behind which an actor sat at a table, together with some odd pieces of furniture dotted about the studio floor. This was "inlaid" into a photograph of the exterior of a building. The composite picture reveals the actor at the table in one of the rooms of the building. He gets up and walks away, disappearing from view. Presently he reappears in the doorway and is seen to walk around the odd furniture, which is now obviously in the hall. In a similar manner, the actor could be placed in, for instance, Trafalgar Square, in which case the background could be a motion picture with moving traffic instead of a still photograph. Great possibilities of set construction economies are opened up by "Inlay."

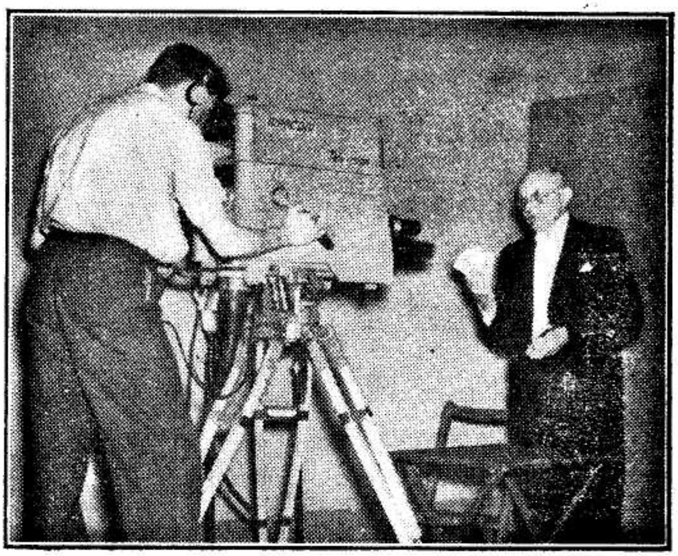
OVERLAY

ANOTHER method of achieving the same result is by "Overlay," in which the action part (necessarily in the foreground) is played in front of a black background, the blackness of which is used, in a clever piece of circuitry, for switching electronically the scanning from the still photograph to the foreground action, picked up on separate cameras. This works well, providing the background is blacker than the darkest part of the actor. Otherwise, the actor is liable to become a ghost, with the scenery visible through him. This method is used in America, in spite of occasional defects.

Other papers dealt with the operation of the new Vinten motorised miniature camera crane, which has been so successful on ballet and spectacular scenes at Lime Grove; the methods of speak-back and intercom. between the TV producer and his team (including an ingenious midget portable R/T transmitter); and a detailed survey of the range of TV cameras now available for all purposes besides television entertainment. The speakers in this remarkable session were Messrs. A. M. Spooner, Charles Vinten, G. C. Newton and R. Toombs, all front rank technicians in their particular fields.

TV AND OUR ELDERS

I HAVE noticed that elderly people of 80 years or more seem to get far greater pleasure out of television than almost any other form of entertainment. It is a strange fact that whilst they often drop quietly off to sleep listening to sound radio or reading a book, they watch TV with rapt attention for long periods. I wonder why this is? The newsreels fascinate them and they are gripped by the plays—even by TV plays which tend to lull younger people to sleep! My theory is that the slower tempo adopted by the TV producers, on account of the small TV reproducing screens, makes it much easier for them to follow the action. They also express much greater preference for television sound compared with radio sound, which may be accounted for by their naturally poor hearing on higher frequencies. The extra top on TV sound helps a lot.



The late Judge Ernest C. Weathered of Bristol performs a card trick before the camera at the recent International Brotherhood of Magicians' Annual Convention at Hastings, part of which was televised.

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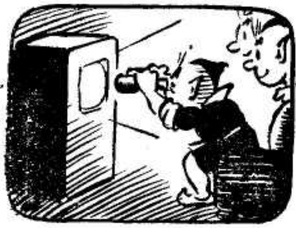

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CORRESPONDENCE

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).

RADIO SHOW DEMONSTRATIONS

SIR,—In reply to Mr. Harper's letter on the subject of apparently faulty demonstration at the Radio Show, I suspect he also must have a sense of humour. After discussing the damage done to his eyesight with the bad cameras, he goes on to mention a dark red line and I can therefore either assume that he is so ahead of the transmission that he has colour television or that his eyesight is affected permanently.

But seriously, my point was that most of these receivers produced patterns which were different from one another and therefore it is an understatement to say that it is very unlikely that the transmission was at fault, and lastly, I do not see how a camera fault emanating at Alexandra Palace could only be visible on Holme Moss, and at that only in the Bolton area.—G. T. LAYTON (Urmston).

"VIEW MASTER" LAYOUT

SIR,—I would like to pass on some information regarding the excessive hum on the "View Master," when the volume control is at minimum, which I noticed was in your problems solved recently. I had the same fault with mine when I first assembled it.

It seems that when the "View Master" is assembled as a double-deck arrangement, the sound detector, which is immediately beneath the frame timebase, picks up the hum from this source. At first I thought a screened grid-lead would suffice, but this made not the slightest difference. The hum, however, can be completely eliminated by constructing a screen from a sheet of aluminium approx. 6in. x 4in. on the sound-vision chassis. This screen is bent over the top of the sound detector valve, completely shielding this valve from above. The screen is easily fixed by the two screws which hold the tag strip underneath. —E. C. TWIGGE (Southport).

WENVOE RECEPTION

SIR,—I was most interested to read in "Under the Dipole" in the September issue that reception from Wenvoe was possible on an indoor aerial in Weston-super-Mare.

It may interest "Iconos" to learn I am enjoying perfect reception on a "Defiant" set, with a 9in. tube working off a home-made aerial hanging on the bedroom wall situated on the first floor.

When you consider Taunton is situated at least 30 miles from Wenvoe and handicapped by terrain difficulties, I think you'll agree this is not bad going. —JOHN BURTON (Taunton).

MINIATURE RECEIVERS

SIR,—I was interested to see in the August number a photograph with description of a miniature receiver.

I have also built a model—shown in the accompanying illustration. This is 9in. long and 6in. high and a description of it is as under.

On the left is a gramophone with pick-up. The record revolves at 30 revs. a minute and the motor of this runs off the mains.

The centre part : the tube lights up showing a positive film. The speaker below is 2¾in. in diameter, and is run from a small portable set.

The right-hand side contains a tape recorder. This plays "Three Blind Mice" when switched on (musical box inside). It also contains dial for radio, which lights up.

I should like to know if the model shown in the August issue has a working tube?

I have a bronze medal for a working model wireless cabin (Spark).—W. ROSE (Bottle Ship Specialist) (Plympton).

A.V.C. AND TELEVISION

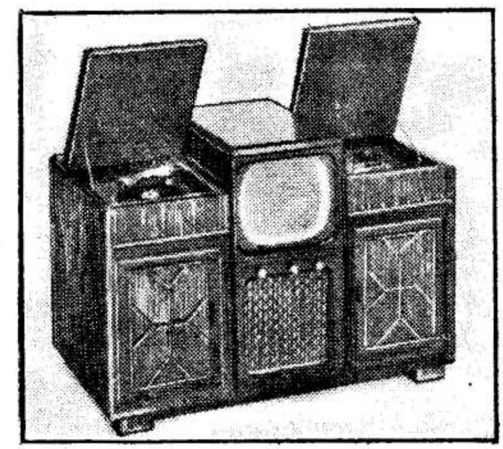
SIR,—In the October edition you print an article by E. W. Holt entitled "A.V.C. and Television." He starts his article reasonably and stresses that A.G.C. (he calls it A.G.S.) can only be derived from a point which does not vary with picture content, e.g., the sync pulse amplitude. He then shows four circuits, all of which *do* vary with the picture content, and states that they can provide A.G.C. The circuits only provide a voltage proportional to the average input to the sync separator, i.e., the picture signal + sync pulses. The sync separators merely D.C. restore them to chassis, but do not remove the picture signal except at the outputs. Even this voltage cannot be used for A.G.C., however, because it is not proportional to the entire sync pulse. In fact, it is highly desirable that the sync separator output pulses should *not* vary in amplitude, and for this reason only a small part of the sync pulse should operate the sync separator. Mr. Holt's circuits would perform properly on a steady signal only, such as the test card, and are almost exactly like deriving the A.G.C. voltage in a radio receiver from the audio output.

In a correct A.G.C. system for TV some way is found to establish black level, and from this the sync pulses can be measured and a voltage derived.

It is not a very simple matter, but it can be done.— C. H. BANTHORPE (Hayes).

"ARGUS" FAULT

SIR,—After completing the wiring of the "Argus" Televisor I came across a fault, a description of which might be of service to other constructors who have fallen into the same trap as I did.



A fine miniature receiver built by Mr. Rose.

In order to test for leaks in the H.T. circuit I connected a 60v. battery and a meter in H.T.-earth circuit with the valves removed and found that the circuit was passing about 8 mA. This was traced to the timebase, and on operating the height control to maximum the leak became a dead short. The trouble was found to be due to the fact that the bush for securing the volume control to the metal chassis was common with the centre (slider) terminal on this component. After taking the necessary steps to insulate the control from the chassis the fault disappeared.—C. EDMUNDSON (Langholm).

PECULIAR FAULT

SIR,—I recently experienced a peculiar fault which I think is worth passing on to others. The fault took the form of the collapse of the picture in a vertical direction, the bottom rising upwards and the top falling. This was quite rapid and was only detected when the picture opened out, which it did the moment the top and bottom lines met in the centre of the screen. The opening was just as rapid until the last ½in. or so when it slowed up and thus enabled one to see what was happening. This would occur for nights on end, several times during a transmission, sometimes at intervals of half an hour or so, and sometimes several times in fairly quick succession. I tried all sorts of things and finally cured it by fitting mains chokes to the power socket on the floor, and from this finally traced the trouble to the use of electric light switches in the house. Every time a light was switched *on* the picture would collapse and return to normal as mentioned. Switching off did not affect the picture. Can anyone explain the reason for this fault ?—G. BRAMLEY (N.W.9).

SERVICE SHEETS

SIR,—I feel that I cannot let this matter of the supply of service sheets go without comment. I am a teacher in Radio and TV at one of the City of Birmingham Education Department's Institutes of Further Education (formerly known as Evening Institute). My experience has been that all the radio and TV manufacturers are willing to supply service manuals and service sheets for educational use or trade use only. That is, they can be used for study purposes and not taken away from the class for servicing. The number held by my class at the moment is about 1,300. Often these manuals are used for practical demonstrations where a student brings his own faulty set (sets belonging to other people are not allowed), and repairs are executed in the class room.

The class is also well equipped with a very wide range of test gear which the students are taught to use. The classes are composed of both trainees for the radio and TV trade and the amateur. All get the same attention and training and yet this year there is, at the time of writing, little support for the class, and there is danger of the class being cut to one evening per week at this centre. —JAMES S. KENDALL (Instructor in Radio and TV at Four Dwellings School, Quinton, Birmingham).

FAULTY METER

SIR,—With reference to a recent query sent in by myself, rather brashly, I would like to say that the "fault" was not on the set, but on my meter. Apparently the fault is of an intermittent nature, so I need not enlarge upon the various garden paths faults of that nature can lead us.

I was using the meter to-day on another set on the 250 volt scale, D.C., to take the H.T.+ve reading at the choke. It was reading a steady 230 volts when suddenly it battered over, as previously explained. This also happened on the 1,000 volt scale and just as suddenly the fault went clear.

I would, therefore, hasten to apologise if the very much respected theorists on your staff have gone through a rough time.

Actually, I was hoping vaguely it was some strange hook-up which had great possibilities for E.H.T. supplies. However, I'm sorry to have caused any trouble; in future I'll watch my test gear.—G. HAMPTON (Glasgow).

STEREOSCOPIC TELEVISION

SIR,—I have been following, with great interest, the correspondence on stereoscopic TV and I find that Mr. J. H. Bixley's suggestion is the most practical so far, although he is not clear on the final presentation of the pictures.

However, I think it should be pointed out to all interested that by means of these image-splitting attachments for cameras (which are now available) the BBC could broadcast stereoscopic pictures of an experimental nature in a matter of a few weeks. A good time would be between 4 p.m. and 5 p.m. when the ordinary programme is off.

The result at the receiving end would be two half-size images side by side which could be viewed by a pair of lens as in the old-fashioned stereoscope.

Although far from being perfect, it would be a practical step towards stereoscopic TV. As far as I can make out, the more ambitious schemes involving colour filters, polarised light, parallax grids, etc., means a doubling of the video bandwidth, which in turn means a change in the design of transmitters and receivers.—R. HALL (Co. Durham).

"VIEW MASTER" LAYOUT

SIR,—Reading your September issue I came across a query presented by G. Roebuck (Ashton-under-Lyne) headed "View Master R22 Overheating."

I had the same trouble (I'm a beginner), and I found out the cause was the 3 M/cs boost choke was of a new type from the original specified.

The original was shown as bolted to the chassis, but the new type has its connections leading to the bolts. Thus, it means that if the new type is bolted to the chassis a short develops and overheats R22.

Therefore the choke must be put in upside down and affixed through the larger hole in the chassis by means of the detachable cap. This might be the trouble Mr. Roebuck is suffering from.—MAURICE DAVIES (Aintree).

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

H.T. FAILURE ?

I bought a new scan coil to replace one in my set. On fitting the new coil and switching on there was no picture and only a little sound with the volume control turned right up, also the set appeared to be "motor-boating." I wired up the new coil to the four-pin plug the same as the old coil : C1 black lead, F1 brown lead, L2 blue lead ; E and F2 joined together with a green lead from F2. On putting back the old coil the same symptoms occurred. I have tried changing the valves, as I have a new spare set, but the trouble is still there. The scan coil is the same type as used in the "View Master" and fitted over the neck of the C.R. tube. I have had the set two-and-a-half years and it was bought under a rental purchase agreement.—C. March (Croydon).

It is unlikely that the fault is associated with the scanning coils, and from your description it appears that the H.T. supply to the receiver has broken down. You should check on this with a voltmeter, and inspect the main rectifier and smoothing circuits for a possible failure. You do not state the reason for changing the scanning coils in the first place, but it is possible that a short through them to chassis damaged the main rectifier originally.

FAILING SYNC

Many thanks for your reply to my query of April last with regard to "Failing Synchronism in Premier UR97 Kit."

I replaced SP61 separator and oscillator valves as suggested. I tried some dozen SP61s and found very great difficulty in finding one suitable for the line oscillator position ; in fact several would not get a picture at all. Finally, I settled for the best and have been afraid to change it since. The results have since then been much improved, and while not being perfect in this respect, synchronisation remains fairly steady up to two hours or so, although will sometimes appear "touchy" on and off.

I cannot accept the fact that all these valves are so faulty, but rather that there is an associated fault, most possibly a condenser.

If you could again give me the benefit of your experience I would be more than obliged.—N. H. Baker (Thornton Heath).

You are possibly right in assuming that the fault does not lie in the valve but rather in an associated component. Check on the differentiating circuit and try smaller values ; also, try tapping up or down the input divider which feeds the line oscillator, keeping its total value constant. You could experiment freely with the components making up the whole of the oscillator stage, as one of these may be high or low in value, and substitution is possibly the only way of tackling a fault of this nature.

TUBE FAILURE

Referring to my model T.S.114 A.C. mains operated. The fault on set is that the picture, from quite good, goes dull and changes back to a good picture again. I have checked the set over and find with all the connections off the tube, feed the voltage to the heaters, put ohmmeter from cathode to one of the heater pins with the set switched on I get a fluctuating reading. Measure the same connections cold, and I do not get any reading at all. This appears to me to be an intermittent short. Could you tell me if this is the case, and is there anything that can be done about it ?—C. A. Hare (S.E.16).

Provided that all the other connections are off the tube, your test does indicate roughly that a heater-cathode breakdown is occurring when the heater is hot, but a reading of this sort can sometimes be the result of an ordinary thermionic current. If the reading is the same whichever way the meter is connected, it does seem that the tube is faulty, but if the reading is only obtained with the meter connected one particular way, you should re-check by some other method on the possibility of a breakdown. If a breakdown is occurring, use an isolating heater transformer for the tube and let the winding float.

VIEW MASTER AERIAL FEEDER

In your issue of February, 1952, you printed an article entitled "Aerial Matching." I have built a "View Master," but the dealer who erected my aerial for me fitted a co-axial cable and assured me that the balanced feeder was unnecessary. Since the reproduction on the tube (12in.) has the symptoms of weak signal strength I have decided to try out Mr. Delaney's little transformer.

My problem is that I do not understand where the connections D and E are to be made. Will you be kind enough to let me know. Perhaps you would find it simpler to indicate the right way on my own copy of the "View Master" circuit.—John G. Mackenzie (Glasgow).

In the first place we suggest you inform your dealer that it is important to use a twin feeder for the "View Master," as the aerial input circuit was designed specifically for this type of feeder and not co-axial.

As you are complaining of a weak signal it would be better to modify the aerial input circuit to match the co-axial feeder rather than use a separate matching transformer which will cause further losses.

E.H.T. FAULT

My trouble is in the line timebase (circuit submitted) and takes the form of low E.H.T., very poor linearity, and bright bars on the left of the picture. In addition to this I get no results (no E.H.T. or scan) for at least 10 minutes after switching on despite the fact that the 10 kc/s whistle is clearly audible. The E.H.T. rectifier is a VU111 driven by a 4v. winding on the mains transformer ; the line output transformer is not at fault as one borrowed from a friend (which is known to work) gives identical results. I have an EY51 but it is not lighted by the winding on the Line O.T.—a 6v. .04 amp. bulb just glimmers.

The power pack (Premier—more or less) gives about 450 volts H.T. as it is only used for the timebases. I have built a separate one for vision and sound receivers.

I have rebuilt the timebase using different (and tested) condensers, resistors, valves and valveholders. I have also tried a number of variations (Haynes TV circuits) on my circuit—all to no avail.

The original circuit (exact copy of Premier) worked well until the Premier line output transformer and one

4-volt winding on the mains transformer started internal sparking, although I still had to endure the initial 10-minute time lag. I realise that the Cohen replacement transformer does not properly match the scanning coils but feel that this should not cause all the trouble.

There are three other points which may be of importance : 1. The sync. is very strong (although results are the same when there is no transmission). 2. I have tried reversing the secondary of the L.O.T. without success. 3. Decreasing the 5K linearity control on 6SH7 improves linearity but decreases E.H.T. even more.

I have a home-made 'scope but have not been able to trace the root of the trouble—chiefly, I think, because the flyback time of the Miller timebase seems nearly to equal the sweep time !

The 6X5, which is a sort of efficiency diode, should, I feel, not really be required with 450v. H.T. and only a normal Mullard 9in. tube. Incidentally, there is a separate heater transformer for the C.R.T. and the "Black Spotter" valve, as a heater-cathode short was at one time suspected in the tube.—J. B. Leane (Gomshall).

You should try working the circuit without the 6X5, as this valve is simply a damper and is not used in an efficiency circuit in any way. Replace it with a condenser of about 0.01 to 0.05 μF, of at least 500 volts working, and remove the 0.5 μF which is now shunting the line linearity control and the fixed resistance.

After this, if further improvement is necessary, you should try other values of the 807 screen resistance (2 KΩ to 20 KΩ) ; decouple the screen to the cathode instead of to earth ; remove the cathode 0.5 μF bypass condenser ; remove the 1 MΩ resistor from the VU111 rectifier output. This seems rather high for a series feed, and 100 KΩ should be adequate.

It is assumed that the primary of the line transformer is correctly wired, i.e., H.T. and VU111 ends are not reversed, and that the 807 itself is in good order.

USING 955 VALVE

I am experimenting with the 1355 receiver and intend building an R.F. unit to use with this. I was wondering if an Acorn 955 triode would be suitable as a local oscillator, as one never sees these valves used for television circuits, even though they are designed for V.H.F.s. I would greatly appreciate it if you would let me know about this valve as I have a few on hand and don't want to buy any more if these will do.—R. Burns (Wigton).

The 955 acorn valve is quite suitable as oscillator in a television receiver, and a conventional circuit will give you excellent results.

"COMPACT TELEVISOR"

May I ask for one final piece of advice before I dismantle the set as completely hopeless.

Your reply of March 19th advised me to disconnect all the deflector plates from their present circuits and re-connect them to the final anode pin on the tube.

After reintroducing the extra resistor (in my case 470K) at the bottom of the bleeder chain, I do not get a spot but a rectangular block on the left. Adjustment of the brilliance or the focus both cause a shadow to raise up the block on the screen and fade it out so that it can hardly be seen. You will note that I cannot get a spot but a reasonably bright block off centre.

The cathode has approximately 240v. on it so I found by experiment that 470K added to the bottom of the bleeder chain gave me practically the same potential on the grid as I raised the brilliance. I am thus now able to get the bias as advised in the text.

I have checked and rechecked the set many times and pondered over it but cannot understand why I get a block instead of a spot.—J. Letford (Surbiton).

Your letter seems very revealing—no spot was obtained until the deflectors were connected to the anode and the spot is then completely unfocused and cannot be brought to a focus by variation of the appropriate control.

This indicates a complete breakdown at some point either in the bleeder chain or the C.R. tube itself. We have a tube in which we found it necessary to remove the base cover and repair the lead to the grid which had parted due to corrosion caused by poor soldering flux. It is just possible that in your tube something similar has happened—it is only the work of a moment to undo the two screws holding the cover over the tag end of the tube and to inspect the internal wiring, exercising very considerable care not to damage the leads, etc.

If the tube is correct there must be a break or short—probably a break—in the R70 to R74 network inclusive. We suspect R72 chiefly, then R73, the focus control—possibly one end of the track is not connected to its tag.

LONG-DISTANCE RECEPTION

Moving here about a year ago I gave up television as being unsuitable for the area. I now wish to rebuild with the help of your journal, and would be glad if you have any advice as to suitability of the Argus or A.C./D.C. television set described recently, with the addition of a pre-amp. if required. Failing these sets would the View Master or Practical Television set be a better proposition over a conversion of ex-surplus units already described. The signal would be received from A.P., or maybe Wenvoe when signal increases.—R. Parfrey (Portsmouth).

For really long-distance reception there is nothing to beat the R1355 used with an RF25 or 26 unit. a one-valve pre-amp. and an aerial consisting of two directors, dipole and reflector. The modifications are very easily carried out and the arrangement can be recommended for magnetic or electrostatic C.R.T.'s.

The other receivers mentioned will get a signal at long distances provided a two-valve pre-amp. is used in conjunction with a good aerial.

VIEW MASTER—DISTORTION OF SOUND

After operating satisfactorily for some months, the sound has recently become harsh or distorted. Valves have been replaced, but to no avail.

When volume is increased the trouble is much more evident.

Can you suggest what to look for ?—K. Barker (Derby).

The fault you describe is most likely due to a failure in the D.C. bias applied to MR1. We suggest checking the voltage at the positive side of C32, which should be about 185 volts. If necessary, replace R36, R43 and C32 and, if the fault still persists, it may be that MR1 is at fault.

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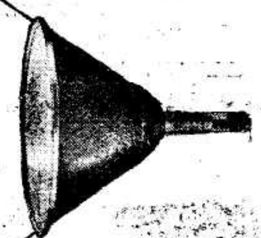

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