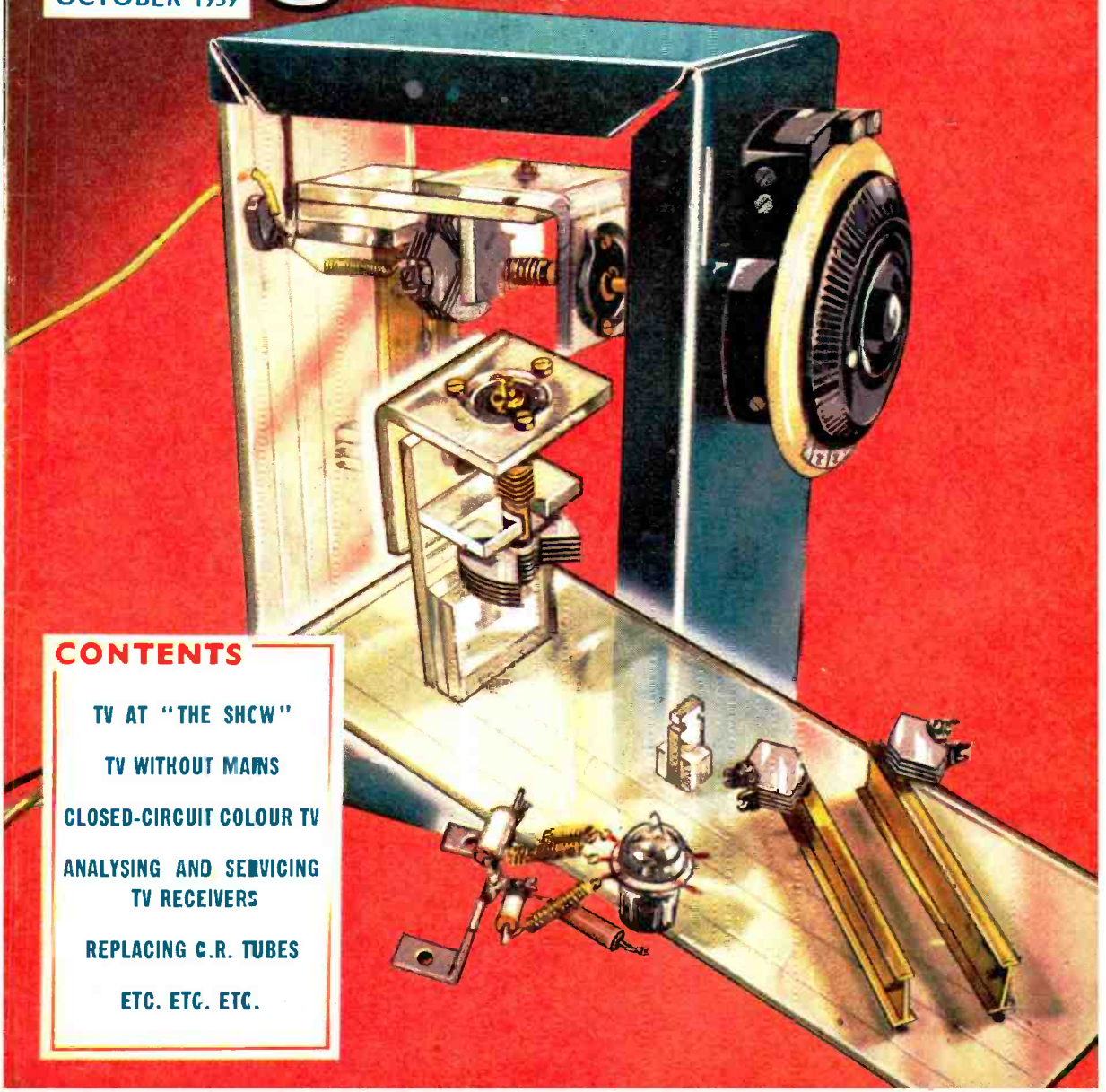
A BAND V SIGNAL GENERATOR

Practical Television

1/3

AND TELEVISION TIMES

OCTOBER 1959



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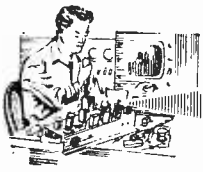
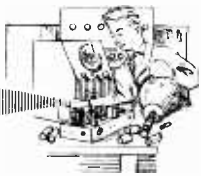


Practical Television



& TELEVISION TIMES

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CONTENTS :

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

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

TELEVIEWS

TV RECEIVER DESIGN

AS many readers will have seen for themselves, at this year's National Radio and Television Exhibition, the emphasis in the field of TV receiver design was laid upon the 110 deg. C.R. tube with its associated shorter cabinet. However, it was noticeable that very few manufacturers had made the greatest possible use of this development. True, many of the cabinets were shorter, but in many instances, the cardboard back of the receiver had been extended so that the total depth of the cabinet was very little less than formerly.

Full use of the new tube was made in a receiver which could be suspended in the corner of a room giving a very striking effect. As audio enthusiasts will know, the corner position is held to be the best for a loudspeaker and also means that the sound output is greater. Thus, good sound reproduction is achieved. However, television sound transmissions are of a high quality and often deserve to be heard through a good amplifier and loudspeaker system, and now that so many sets incorporate the V.H.F./F.M. waveband, surely an output for a high quality amplifier should be a standard feature.

THE "P.T." AND "P.W." FILM SHOW

WE are pleased to announce that another film show, sponsored by this journal and our companion journal PRACTICAL WIRELESS, is to be held at Caxton Hall, Westminster, on Friday, January 22nd, 1960, at 7.30 p.m. when the Editor will take the chair. Admission will be by ticket only. The event, which has proved so popular in previous years, is being arranged in conjunction with Mullard Limited.

The films are entitled "Photo Emission", "From Us to View" and "Mirror in the Sky". The latter film deals with events leading up to the experiments by Sir Edward Appleton to confirm the existence of the Heaviside layer, and continues with the discovery of the Appleton layer and the development of the pulse techniques which became the basis of radar. The film concludes with one of the latest scientific achievements—the radio telescope.

Applications for tickets should be made now. Please mark your envelopes "Caxton Hall" in the top left-hand corner. All applications will be dealt with in strict rotation.

THE printing dispute which has prevented normal publication of this journal since the issue dated July, 1959, has been settled and we shall now be able to publish normally.

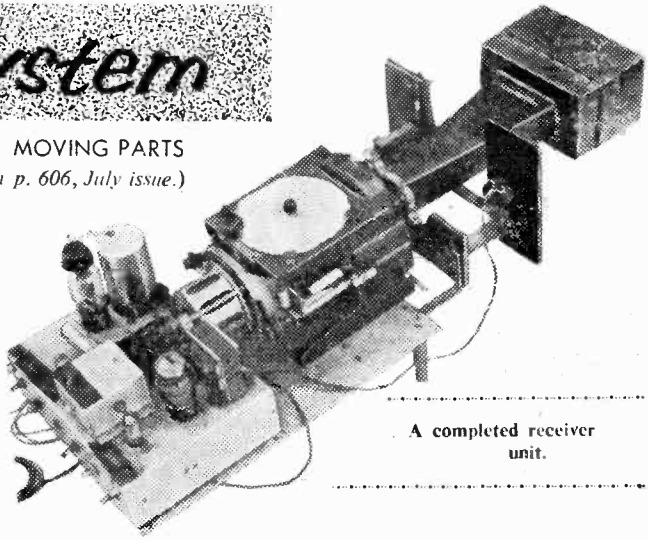
We greatly regret the inconvenience which this dispute has caused to readers, but we are certain they will appreciate that this break in publication has been due to circumstances beyond our control.

Our next issue, dated November, will be published on October 22nd

A Closed-Circuit Colour TV System

A SEQUENTIAL SYSTEM WITHOUT MOVING PARTS

By R. W. Wells (*Continued from p. 606, July issue.*)



A completed receiver unit.

IN the experiments described in the previous article, coloured light was produced from polarised white light, using Cellophane filters. Change in colour was brought about by manually rotating the plane of polarisation of the light through a few degrees. The Faraday cell described below performs the same function without any moving parts.

The Faraday Cell

Faraday discovered in 1845 that the plane of polarisation of a beam of light was rotated on being passed through lead glass in the presence of a magnetic field. The Faraday cell consists, therefore, of an electro-magnet with a glass core. Figs. 5 and 6 give details of the coil former, which, it will be seen, consists of two winding sections. Each section should be filled up with 30 s.w.g. enamelled copper wire and should have an individual inductance of about 10H after the magnetic shroud has been added. The coils should be connected in parallel, to give a combined inductance of about 5 or 6H.

The core ought to be extra dense flint glass (Chance 030181 or 927210) and the ends should be flat and polished.

The polaroids and Cellophane layers have to be fitted with considerable ingenuity in order to obtain the correct orientation for each layer. To cut down loss of light, the layers may be interspersed with oil and compressed against the glass. It is suggested that the experimenter should try to aim at an orientation angle of about 6 deg., as this value has been found to set a

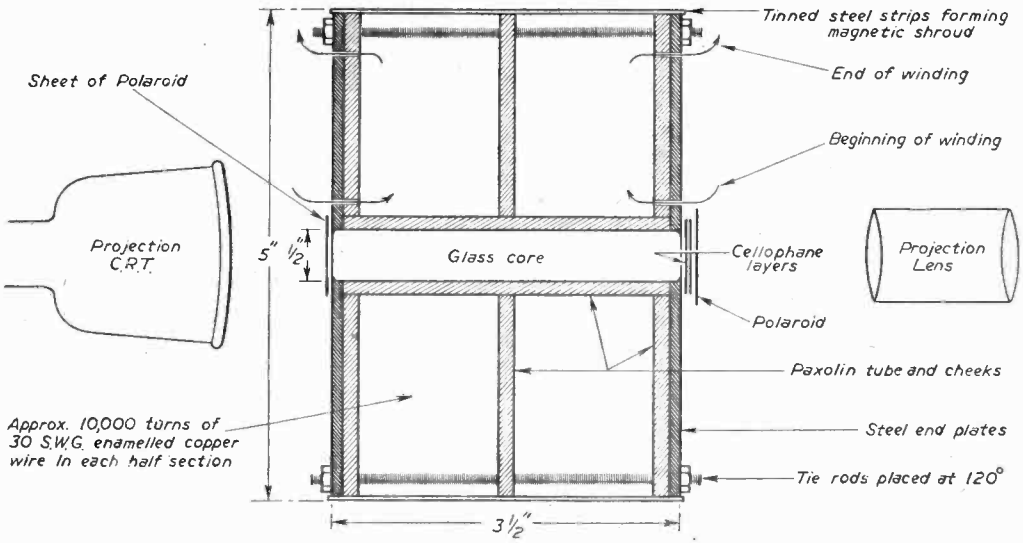


Fig. 5.—The Faraday cell as a colour switching device.

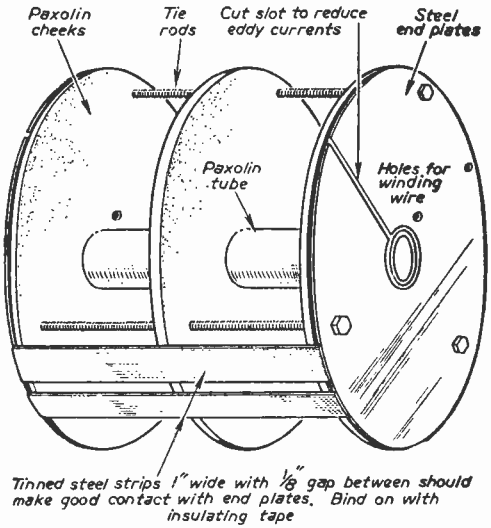


Fig. 6.—Coil former and shroud for Faraday cell.

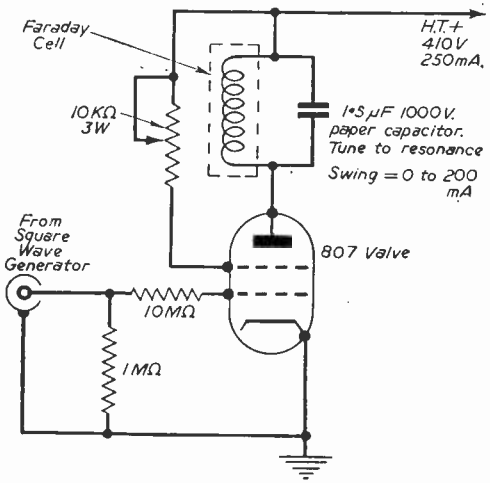


Fig. 7.—Circuit of the Faraday cell driver unit.

compromise between loss of light and power to be supplied to the Faraday cell.

Colour Switching at the Receiver

The black and white image measuring about 1½in. × 1in. on the screen of the MW 6/2 tube. after passing through the Faraday cell and filter combination and the lens as shown in Fig. 5, may be projected on to a ground glass or specially prepared Perspex sheet fitted with a hood. The colour frame switching signals are taken from one output of the 25c/s double square wave generator, a circuit diagram of which is shown in Fig. 8. This output is then amplified

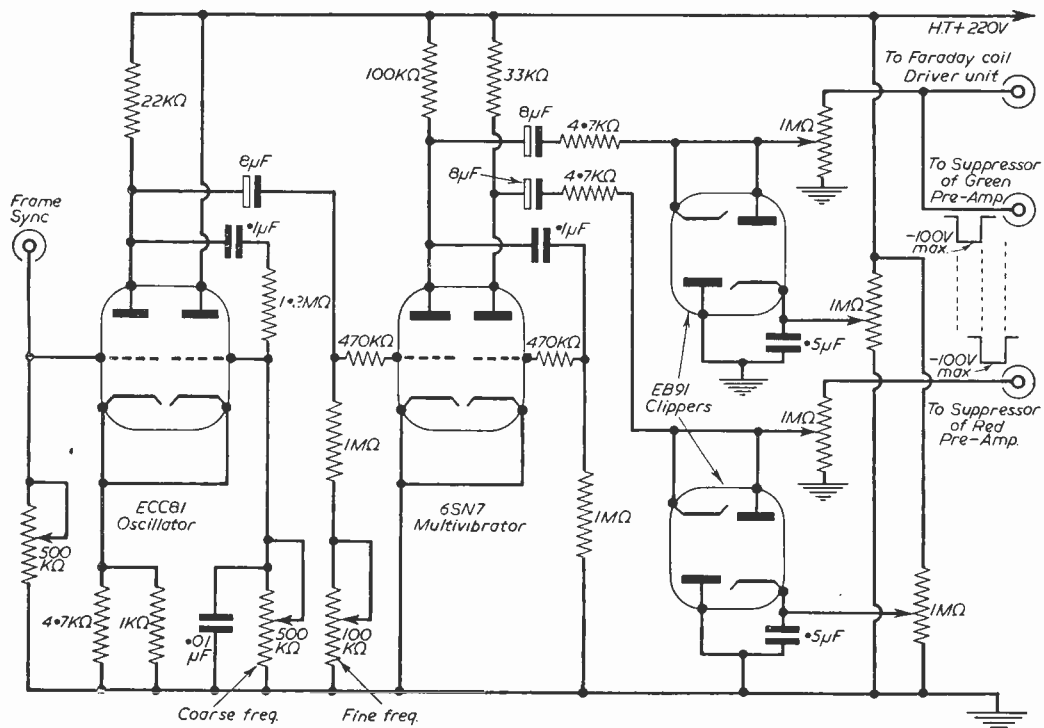


Fig. 8.—Circuit of the 25c/s double square-wave generator.

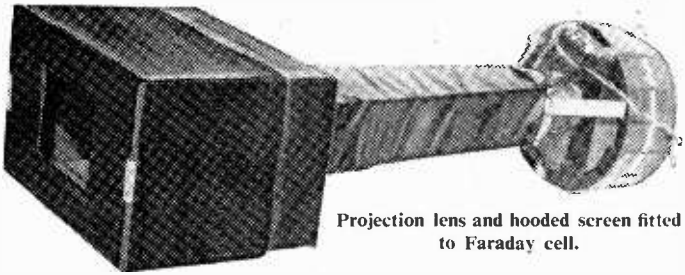
by the Faraday cell driver unit shown in Fig. 7.

Colour Switching at the Transmitter

For colour switching the transmitter in synchronisation with the receiver, either of the following methods should prove suitable.

(1) The colour transparency is scanned by the projection tube raster (Fig. 1) and the transmitted light allowed to fall in even distribution on the photo-cells, one being covered by a fixed red filter and the other by a green filter. Associated with each photo-cell are the preamplifiers, one of which is shown in Fig. 2. These are capable of being switched alternately by feeding the generator outputs (Fig. 8) to the suppressors of the second amplifier valve.

(2) The Faraday cell arrangement shown in Fig. 5 may also be used at the transmitter to operate a single photo-cell having a reasonably flat spectral response over the required region.



Projection lens and hooded screen fitted to Faraday cell.

Adjustments for Correct Colour Mixing

Each photo-cell preamplifier is fitted with a gain control. This has to be adjusted to give white in the case of a magenta/green system and yellowish white in the case of a red/green system. Wrong settings will give incorrect additive colours and will also lead to bad apportionment of brightness between each colour frame.

Forthcoming Conventions

THE IMPACT OF NUCLEAR DEVELOPMENT ON ELECTRICITY SUPPLY AND INSTRUMENT TECHNIQUES

THE Measurement and Control Section and the Supply Section of The Institution of Electrical Engineers announce that with the support of the council they are organising jointly a convention on the Impact of Nuclear Development on Electricity Supply and on Instrument Techniques, to be held in London in September, 1961.

Discussions

Among the subjects to be discussed will be present and future energy requirements in relation to energy resources available; economics; operating characteristics; the siting of nuclear power stations and its effect on system planning; health physics; radiation detectors; pulse circuits; nuclear measuring instruments for research, processing control, and for prospecting and mining applications; instruments for nuclear reactors and associated plants; and data processing for nuclear applications. It is proposed that visits of technical interest will be associated with this convention.

The organising committee will be pleased to receive offers of papers for consideration for inclusion in the convention.

Nuclear Generation

The council understand that the Federation of British Industries are considering holding a conference on the general problems of nuclear generation during 1961, and there will be an appropriate co-ordination of arrangements where possible.

THE THIRD INTERNATIONAL CONFERENCE ON MEDICAL ELECTRONICS

The Electronics and Communications Section of The Institution of Electrical Engineers announces that with the support of the council they are organising the Third International Conference on Medical Electronics in London in the second half of July, 1960, in association with the International Federation for Medical Electronics, which was inaugurated this year.

Scope

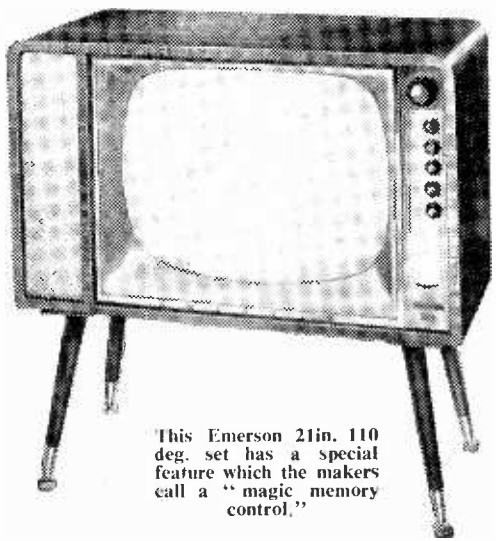
The keynote of the conference is the bringing together of members of the medical and electrical engineering professions in discussion to which both sides can contribute, so that each will gain a better understanding of the problems of the the other. For this purpose there will be general sessions to enable medical practitioners and electrical engineers who are not experts in medical electronics to increase their background knowledge of the field, and specialist sessions in which those engaged in medical electronic work can present papers on the latest developments and discuss particular problems in greater technical detail.

Present plans include the organisation of an international scientific exhibition on medical electronics in conjunction with the conference.

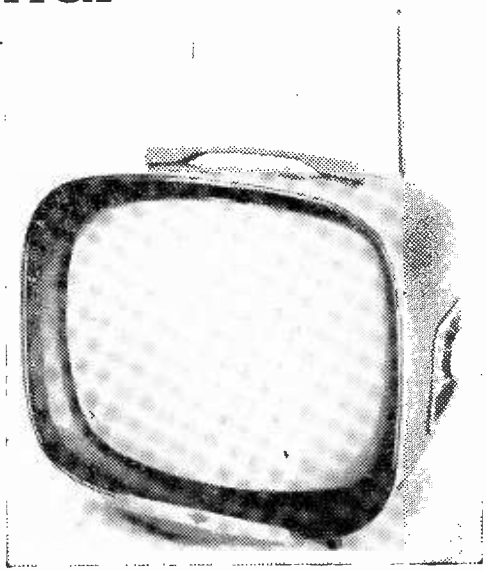
TV at the National Radio Show

A REPORT ON THE TRENDS OF DESIGN OF THE MODERN RECEIVER AS SEEN AT THIS YEAR'S EXHIBITION

IN previous years the keen experimenter has looked forward eagerly to the Radio Show in order to see what modifications have been made to the standard television receivers during the year. New circuits have appeared annually, with various features designed to surpass those given by the previous year's models, and manufacturers have vied with one another to introduce some exclusive feature. Thus we have seen A.V.C., flywheel sync, automatic picture control, and other ideas, and it would appear that at last the circuit has reached finality. Thus there was a very keen interest aroused at the opening of the Radio Show as to what might appear, but when the opening day came the prophecies of many were fulfilled—there was little new circuitry. As most readers are aware, the BBC have been experimenting in Bands IV and V, and in many quarters it was expected that some developments would be seen in tuning ideas in order to cover these bands with existing techniques. The question of higher definition has also arisen recently, and speculation centred round the possibility of new timebases which would readily lend themselves to quick modification should a high-definition system appear later in this country. However, nothing on these lines appeared, and the circuits which were employed were more or less as before.



This Emerson 21in. 110 deg. set has a special feature which the makers call a "magic memory control."



The K.B. 17in. Royal Star with 110 deg. tube and slender cabinet.

Smaller Cabinets

Most of the developments which were visible to the lay public in past years were concerned with the tube, which has gradually increased in size from 7in. up to the now commonplace 21in. This year, however, whilst size remained constant, the use of wider deflection angles resulted in the production of much shorter tubes with the result that cabinet sizes have been reduced considerably. This, then, was the only outward sign of development at this year's Show. Coupled with the modern designs used by many manufacturers, the result was a pleasing departure from many of the sets seen at previous Shows.

Although transistors were employed in certain stages of some receivers, it was not expected that there would be a marked development in this field, especially in view of the details given in our recent article on this subject. The all-transistor TV set is a long way off, although just before the Show opened, an announcement was made in the U.S.A. that a manufacturer there had developed a successful set using transistors.

The illustration on page 10 shows some of the features of the modern television set, and in this product of the Spencer-West company, the shortness of the tube, the compact turret tuner and the printed circuit layout show how the overall size has been satisfactorily reduced.

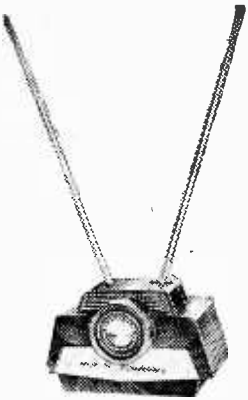
Printed Circuits

The printed circuit technique is now more widely used and though still a point of controversy amongst service engineers it is playing a large part in design. It has resulted in some price decreases by reducing manufacturing time but conventional wiring remains popular.

Separate "boards" for the timebases and other sections—which are easily replaced in the event of a breakdown—are a feature of some receivers. We did not see one printed chassis this year which was complete in itself.

Accessibility

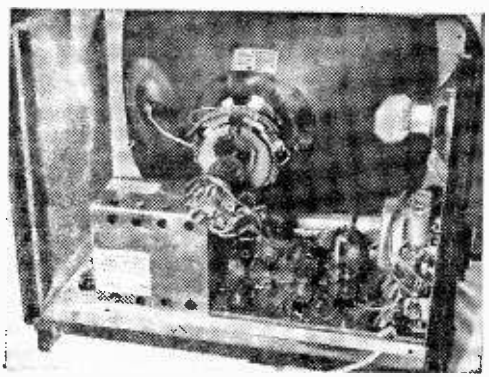
Manufacturers appear to have paid particular attention this year to the serviceman, and various ideas have been adopted to facilitate access to the wiring, etc., for servicing. In the Ekco receivers, for instance, there is a quick-release back cover, whilst the swing-out, or other easily removable chassis, was featured by other firms. It appears that many firms still do not make the front of the screen easily accessible so that the layer of dust and dirt which accumulates owing to electrostatic action can be removed. In most cases the set must be removed and the glass cleaned from inside the cabinet, whereas a simple, hinged implosion guard would appear to be fairly simple to fit to most cabinets, and would surely be a good selling point.



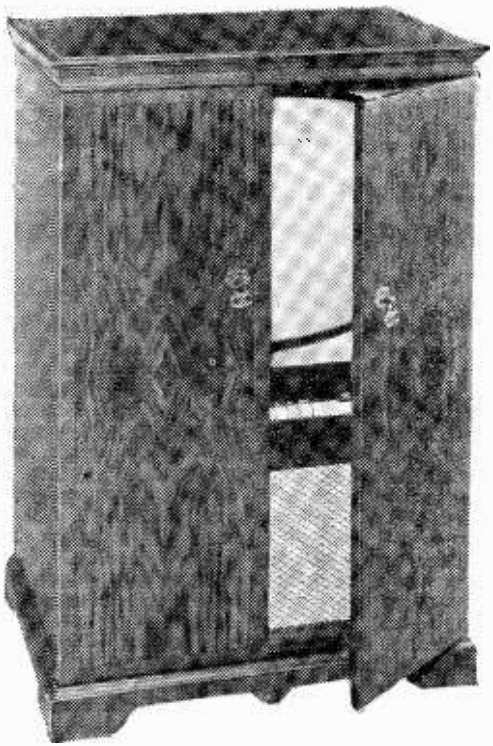
The Belling-Lee "Metropolitan" all-channel set-top aerial, with gold plated telescopic rods and finger-tip tuning.

Push-button Control

One development which appears to be interesting a number of manufacturers, and which is regarded by many amateurs as a retrograde step, is the inclusion of push buttons for control purposes. At one time these were extremely popular on normal radio receivers, but they appeared to die out, either because the mechanism in use at the time was noisy or unreliable, or because the user preferred to turn a knob and feel that he was locating the correct tuning point. With the appearance of the tape recorder, however, there was a return to this type of mechanism, and the majority of recorders now use this method of control for the various functions. The mechanics of the method have now been improved and push-button control should be effective and reliable. In the Dynatron receiver, for instance (see the illustration above), buttons select the programme (including I.T.A.), as well as the normal BBC sound programmes on V.H.F./F.M. In addition there is a remote control device so that stations can be changed without the viewer rising from his chair. In this arrangement a synchronous motor operates the turret-tuner.



The inside of one of the Spencer-West receivers showing how compactness has been achieved.

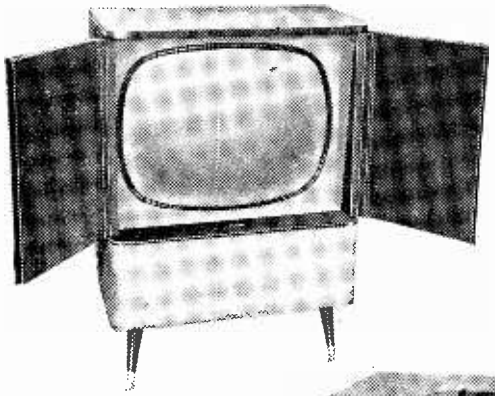


The Dynatron 21in. push-button receiver for TV and F.M. sound.

V.H.F. Sound Radio

Many receivers now include a section or circuit modification for reception of V.H.F./F.M. radio so that advantage can be taken of the higher quality available.

Whilst on the subject of higher quality, it still appears that the majority of manufacturers do not pay sufficient attention to the sound reproduction aspect of the modern television receiver. In view of the very high quality which *can* be obtained on the television frequencies (and with the reception of the F.M. programmes) one would certainly have expected more manufacturers to have fitted a speaker capable of doing justice to the wide frequency range which is available and to have provided a cabinet suitable for housing such



This is the Pam Model 666, with 21in. tube and polaroid filter giving good pictures under all lighting conditions.

a speaker. In many instances there is a small speaker mounted on the side of the cabinet near the front or back with virtually no baffle area, and a very simple audio amplifier section is provided in the receiver. Whilst it may be said that the majority of the programmes on TV are plays or advertisements, there are some occasions upon which good sound reproduction would be worthwhile. Many constructors still use a separate amplifier and speaker assembly but we do not recall having seen one commercial receiver in which facilities are provided for using a separate amplifier. In these days of "hi-fi", one would have expected some facilities to be made available. Perhaps the necessary switching is the main deterrent.

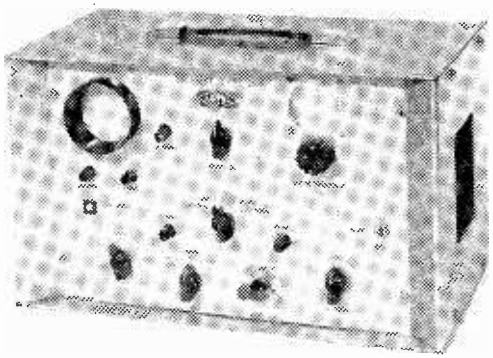
Aerials

Although TV aerials are often thought of as incidental to the set, they are, nevertheless, a vital part of any installation. They ranged this year from elaborate Yagi arrays, down to neat portable units designed to stand on top of the receiver. A typical unit in the latter category is shown on page 10, the Belling-Lee "Metropolitan." This is an all-channel set-top aerial with finger-tip control which enables the aerial to be tuned for maximum performance on all channels. Similar to the previous aerials of this design by the same makers, this aerial is gold-plated on the telescopic elements and covers all channels, horizontal or vertical polarisation, and the F.M. band.

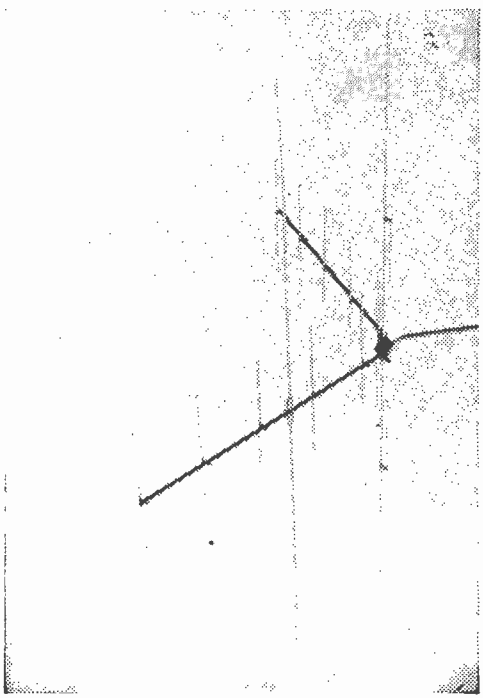
In the field of the larger arrays is the Labgear assembly shown at the bottom of this page. This is a 3-channel model catering for one Band I and one Band III station originating from one direction, and an additional Band III station originating from a completely different direction. With this particular aerial only one feeder connection is needed, no diplexer or triplexer having to be employed. The makers give as an example a viewer living in the Oxford area who may orient this aerial to receive Channel 1 and Channel 9 from London, and Channel 8 from the Midlands, thus having the choice of three stations.

In addition to the standard types of diplexer already well known, Labgear introduced a new design for East anglia. With the opening of the East Anglian I.T.A. station many viewers will have available both Channel 9 and Channel 11, and thus there will be a need for a diplexer to avoid changing aerial leads or introducing switching. This new unit is designed to overcome such difficulties.

It is interesting to note that one manufacturer has withdrawn some models which were previously on the market 10 element arrays have been replaced by a super 11 element array. All horizontal stacked arrays of this company (Antiference) have been withdrawn, but separate stacking bar kits have been introduced so that any pair of single arrays may be stacked as desired.



The very latest model "Televet" tester, which is, in effect, a combined signal generator and oscilloscope, and will be found invaluable for servicing TV sets.



A Labgear three-channel array, providing reception of two stations from one direction and another from a different direction.

Replacing C.R. Tubes—7

MURPHY RECEIVERS

By H. Peters

(*Continued from page 597 of the July issue*)

Latest Models V310, V310A, V310C, V310D, V310CA, V310AD, V320, V320C, V320A, V320AD, V330, V330D and V330F

THE previous article of this series concluded with details for replacing the tube in the range of models listed above. The basic model is the V310 which is illustrated in Fig. 17. The methods of setting-up and boosting the tube are as follow:

Setting Up

Picture tilt is altered by the thumbscrew in the slot in the middle of the scancoils and this adjustment should be made after the ion trap and focus magnets have been correctly set up. The joystick picture position control functions in the same way as the one on the V270/280 series.

KEY TO LETTER REFERENCES IN FIGS. 13-17

- B : Clamping bolt.
- C : Clamping band.
- F : Focus magnet lateral adjustment (focused with user's control set midway).
- I : Ion trap magnet.
- L : Loudspeaker contact.
- M : Adjustment for centring tube in mask.
- P : Picture positioning adjustment (needs unlocking first).
- R : Rubber seating blocks.
- S : Scancoils.
- SP : Spring clips holding tube cradle to chassis.
- T : Picture tilt.

Boosting the Tube (A.C. Only)

A 13 volt low capacity transformer should be used and fit as far away from the tube as practicable to avoid distorting the scanning field. A 40 ohm, 5 watt resistor should be substituted for the tube heater across the existing wiring to pins 1 and 12 of the tube, and the 13 volt winding of the boost transformer connected to the vacated pins. Mains for the transformer can be picked up from between chassis and the set side of the mains fuse.

Model V350—Unboxing

Remove mains and aerial inputs, turn the knobs to BBC and off respectively and lay the set on its face. Remove the knobs by unscrewing their clamps which are inside the cabinet and accessible via the two long slots in the cabinet back. Any attempt to remove the channel selector knob whilst switched to a position other than BBC will break it. Remove the two large bolts at the back on either side of the protective bulge, and lift the cabinet off the set. It will almost certainly be very stiff, and may need holding about ½in. off the bench while somebody else forces down upon the contrast and brightness controls. Do not attempt to "pick" the chassis out. Remove the C.R.T. base, ion trap magnet, and anode cap. Stand the chassis face down, remove the four cross headed screws supporting the side plates and also the two diagonal strengthening stays and lift the chassis off the tube. Clean and replace in reverse order. Picture position is fixed by two rotary magnets, which are controllable from the back via a steel rod which is moved in and out to engage either disc.

Model V230

The tube change on this model follows closely the V240, once unboxed.

Unboxing

Lay set on its face and remove the two gilt screws holding the cabinet handle. Also remove their two opposite numbers underneath. Lift out the three gilt mouldings and the brown foot underneath, when the two halves of the cabinet shell may be parted and withdrawn. Be careful not to catch the brown bakelite feet, as the plastic studs which hold them may fracture.

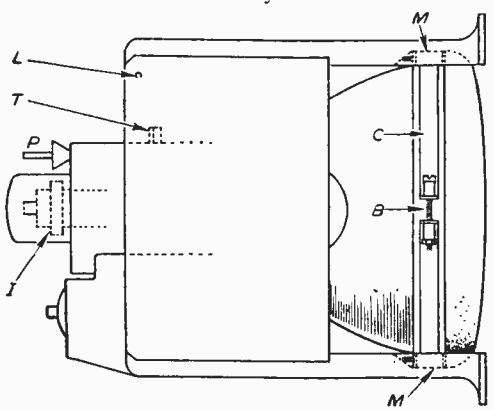


Fig. 17.—Side view of the V310.

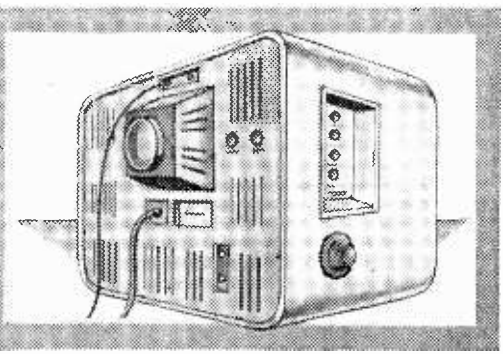
To replace the C.R.T., remove focus dome, C.R.T. base, ion trap magnet, and EHT cap. Remove the four 2 B.A. nuts securing the rubber mask and clamp to the chassis and withdraw the tube and clamp forward. Note the position of the EHT connector in relation to the clamp and unclamp the tube. Clean all parts before reassembling.

Setting Up

As for V310. When reboxing be careful to locate the control knobs in the centre of the bakelite discs, otherwise the disc will spring out

(*Continued on page 20*)

Servicing Television Receivers



No. 49.—RAYMOND AND BEETHOVEN 14 AND 17

THESE receivers employ a five channel (BBC) chassis and include Raymond 14in. and 17in. models. Beethoven B80, B77 and several other less well-known sets such as Puratone, etc. The chassis can easily be identified by reference to the layout diagram Fig. 1 and the disposition of the rear pre-set controls. The I.F. is 38.25Mc/s sound, 34.75Mc/s vision. Suitable turret tuners include the Cyldon P38H and the Brayhead 35s which have wired plugs to replace V1 and V2. The chassis is easily removable once the front control knobs (grub screw fixing) and chassis fixing screws have been removed (or moved sideways in their slots) and the speaker plugs withdrawn from their sockets on the sound output transformer. As the tube is mounted on the chassis, servicing is simplified. When a turret tuner is fitted it is only necessary to withdraw the plugs from the V1 and V2 sockets and remove the tuner complete before sliding out the chassis.

Common Faults

Frequent failure of the EY51 is probably the most common fault and it will immediately be seen that the replacement of this valve is not as easy as it perhaps could be. The temptation to cut away the EY51 housing should be resisted as sparking to the screening case will then result if extreme care is not taken when making the soldered connections. Care and patience will be rewarded when the EY51 is properly fitted and there is no trace of discharge when the screening case is replaced. The reason for the EY51 failing quickly is incorrect setting of the width control which could be more correctly labelled line drive. Operation of this control will show a marked difference of heater glow in the EY51 and as the correct width is exceeded, the heater glow becomes excessive and the EY51 will not endure these conditions for very long.

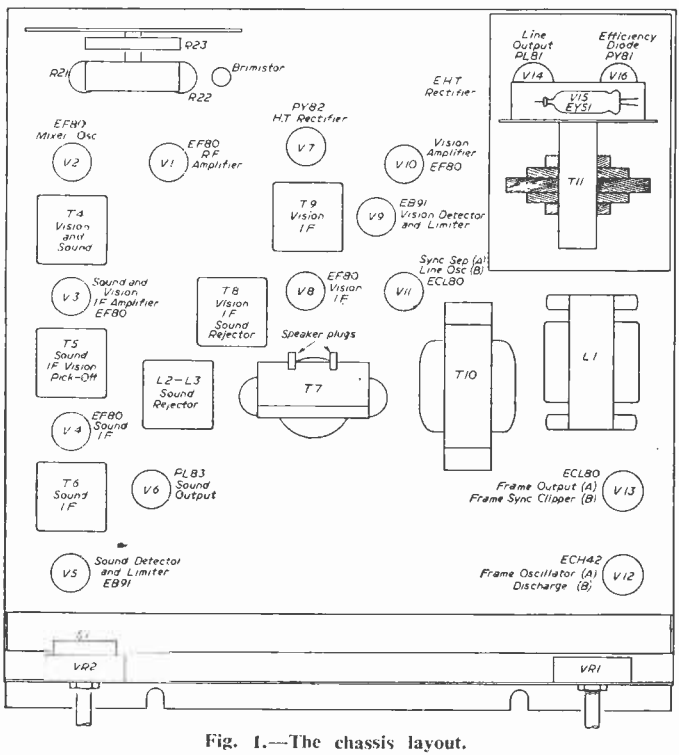


Fig. 1.—The chassis layout.

Adjustment and Wear on Controls

Both hold controls and the width are of the compression type (variable capacitors). Heavy handed operation causes the brass thread to strip resulting in inability to set the control to the desired position. When this occurs, as evidenced by a sudden loss of tension as the knob is being turned clockwise, the control must be replaced or a suitable fixed capacitor shunted across it so that the desired setting is obtained where the thread is good. To achieve this a 100pF is usually required for the line hold and about 300pF for the frame hold.

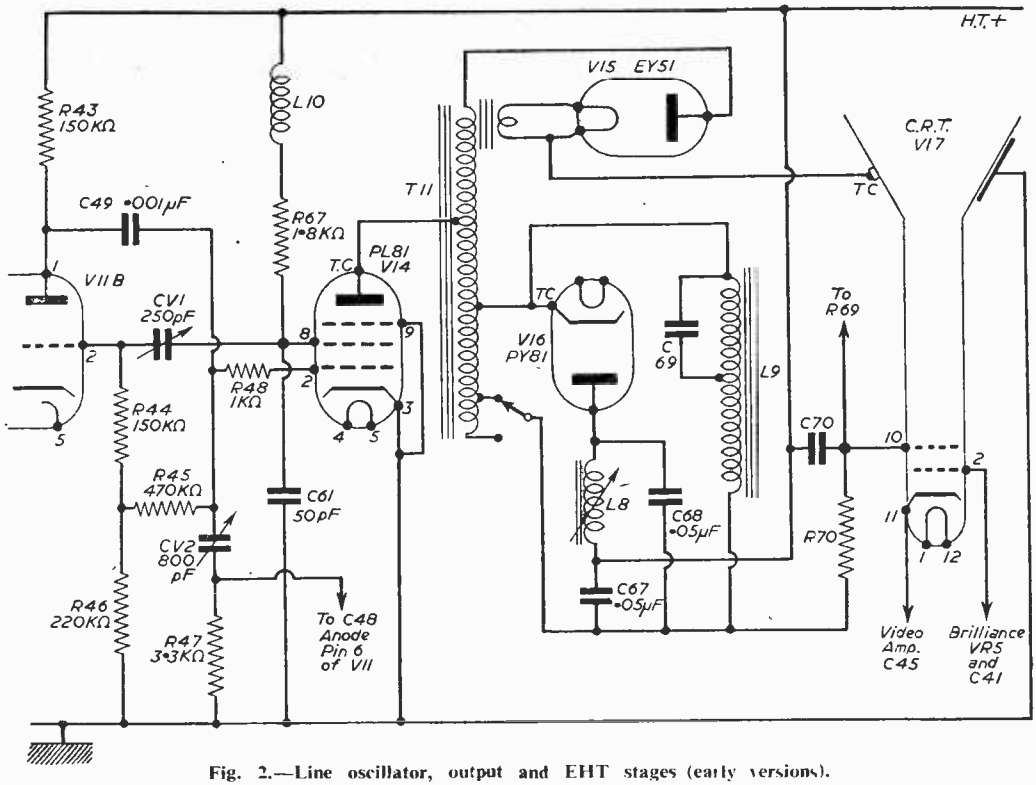


Fig. 2.—Line oscillator, output and EHT stages (early versions).

No Picture

Advance *brilliance*. If there is no raster remove rear cover and screening case of line output section. Listen for the characteristic whistle of the line timebase and note EY51 EHT rectifier heater. If line whistle is absent the EY51 will be out whereupon V14, PL81 and V11, ECL80 should be checked. If line whistle is audible but the EY51 is out check for spark at the single wire end of the EY51. If a heavy spark is available the EY51 is probably at fault due to an o.c. heater. If the spark is subdued or the EY51 is glowing blue, or both, remove the EHT clip from the tube. If the glow subsides but the spark obtained at either end of the EY51 seems of the same (rather vicious) quality, the valve should be replaced as it is probably shorted internally. If the spark at the heater end (EHT clip) is thin as compared to the anode (single

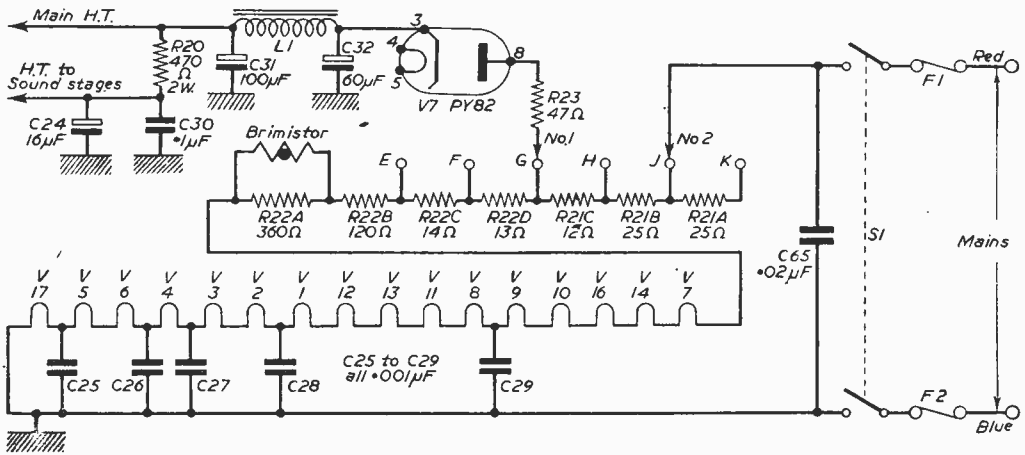


Fig. 3.—Heater wiring and the H.T. supply.

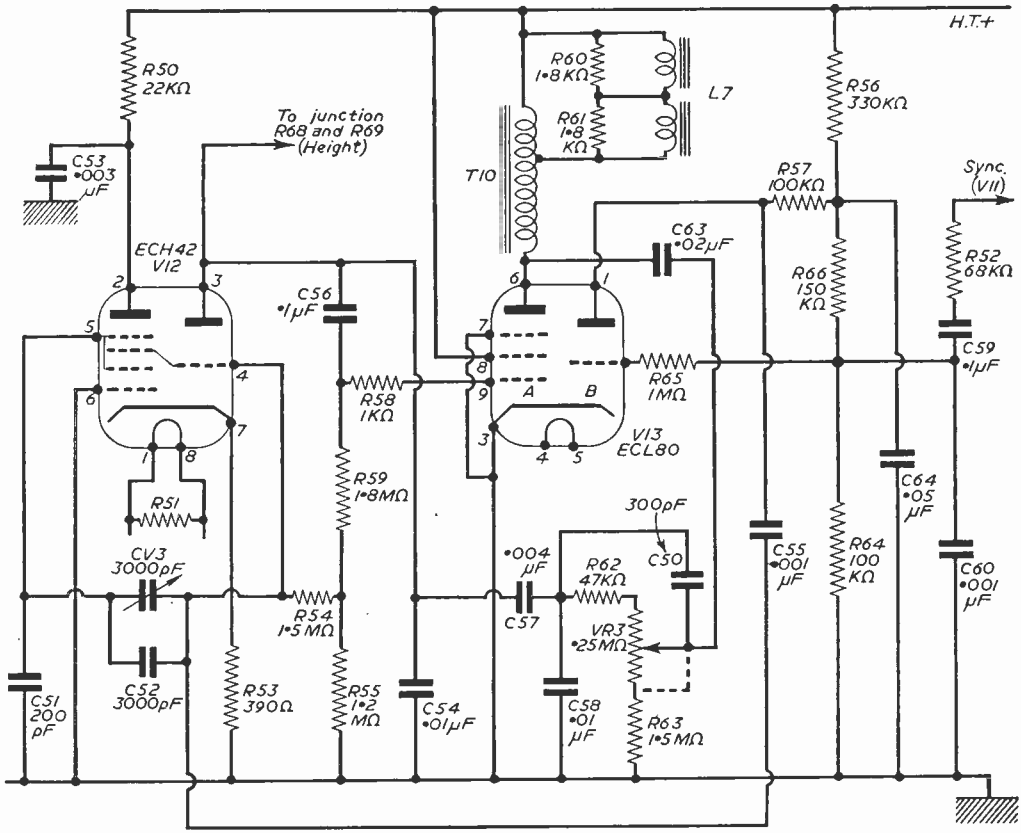


Fig. 4.—Frame oscillator and output stages.

wire), replace the clip on the tube, remove the tube base socket and short pins 1 and 12 (to preserve heater continuity). If the EY51 now behaves normally and the EHT is present, the tube can be assumed at fault.

Lack of Width

Check valves PL81, PY81 and PY82 after having checked the setting of CV1. If there is no improvement, check V11 (ECL80) and R43 (150kΩ). The 1.8kΩ resistor R67 to pin 8 of the PL81 can change value but this is not very common. The line timebase circuit given is the early version and the wiring may be found to differ but only as far as the line output transformer and scanning coils are concerned.

Lack of Height

If the loss is even top and bottom check R68, 8.2MΩ and R69, 20MΩ. If these are in order, check V12, V13 and resistors R54, R55 and R59, capacitors C56 and C54. If the bottom of the picture is compressed, first check V13 (ECL80) then C56, C54, etc. If the top of the picture is compressed, check the linearity circuit components C63, VR3, R63, C57 and C58.

Inability to Lock

If CV3 is at the end of its travel, i.e., screwed right in, check V12 then R54, 1.5MΩ. If CV3 will not screw in but just clicks, note previous remarks concerning stripped thread.

If the picture rolls up or down but will not lock, check R37, C59 and C60, then V11 and V13, R56 and R57.

Horizontal White Line Only

This denotes a complete absence of frame scanning. Check V12 and V13 and then V10. If these valves are in order, check T10, the frame output transformer, by taking a voltage check at pin 6 of V13. Absence of H.T. will denote an open-circuited winding. If this is in order ensure that CV3 is not shorted.

(To be continued)

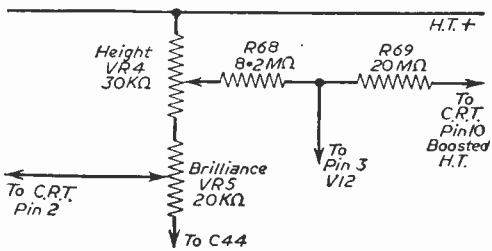
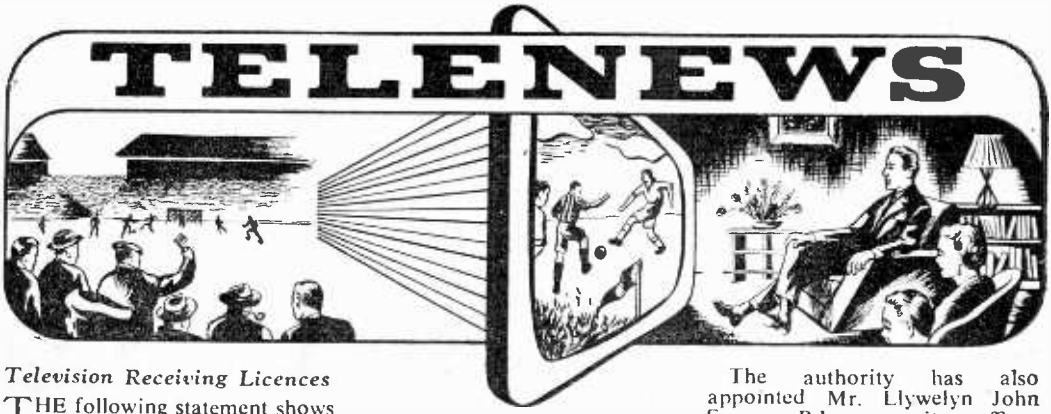


Fig. 5.—Height and brilliance control network.



Television Receiving Licences

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

Region	*Total*
London Postal	1,726,212
Home Counties	1,241,324
Midland	1,475,326
North Eastern	1,557,792
North Western	1,303,231
South Western	778,463
Wales and Border Counties ...	566,033
Total England and Wales ...	8,648,381
Scotland	784,843
Northern Ireland	116,565
Grand Total	9,549,789

Anglo-Dutch Church Service

SOMETHING new in Eurovision is to be undertaken on Sunday, September 27, when two church services—one in Hull, the other in Rotterdam—are to be televised together. The services will be held simultaneously, the congregations singing the same hymns and listening to their respective ministers speaking in Dutch and English. The churches are Holy Trinity Church, Hull, and the Morning Star Dutch Reform Church, in Rotterdam. The latter church is new and not yet equipped with an organ, so the organ music for both congregations will be provided by Hull.

ITV Area Survey

A PRE-TRANSMISSION survey to determine the number of Band I (BBC only) and Band III (potential BBC and ITV) sets in the area to be covered by the new ITV transmitter at Mendlesham, Suffolk, is now being carried out by Television Audience Measurement Limited. The survey will also determine the composition of audiences in homes with television sets and, separately, in homes with Band III sets.

I.T.A. Appointments

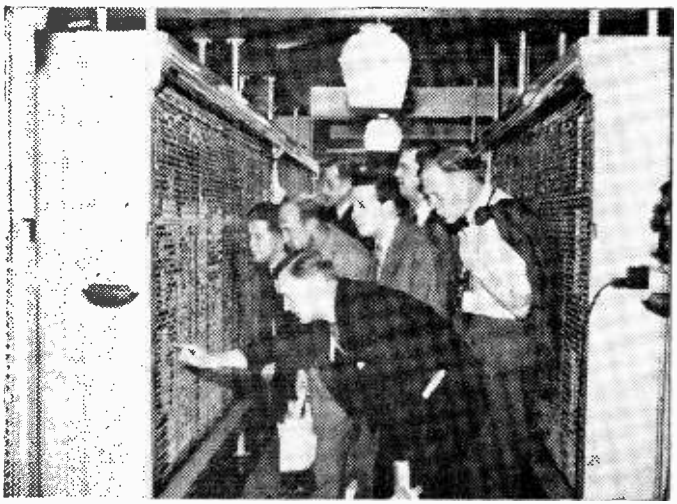
THE INDEPENDENT TELEVISION AUTHORITY has appointed Commander Guy W. Alcock, O.B.E., R.N., M.I.Mech.E., as its officer in East Anglia. Commander Alcock, aged 50, has recently been attached to the authority's headquarters in London. He will act as the authority's representative in the area to be served by its Mendlesham station.

The authority has also appointed Mr. Llywelyn John Evans, B.L., as its officer for Wales and the West of England.

Mr. Evans is 45 and Welsh speaking. He was educated at Aberaeron, Cardiff and Aberystwyth and until recently held the position of Welsh Editor of the "News Chronicle." Before that he was with the Central Office of Information, the "Daily Herald" and the "Western Mail." He has made a special study of industry and Welsh affairs and was called to the bar in 1945.

East Anglian Programmes

THE I.T.A. and Anglian Television announce that Independent Television programmes



Recently a group of Finnish television and advertising executives have been studying methods of TV production, presentation and advertising in Britain. The illustration above shows members of the delegation closely studying the "traffic" room of Granada TV's Sales and Advertising Dept. The indicators in this room record future advertisements, the time and date they will be shown, and their duration.

will begin in the East Anglia area on Tuesday, October 27th. The programmes will be transmitted from the authority's new station at Mendlesham near Stowmarket and more than two million people will be within its service area. This will stretch from The Wash to the Thames Estuary and as far west as Huntingdon.

The Mendlesham station will operate on Channel 11, and it will transmit horizontally polarised signals.

TV in Radio

AN interesting development to speed the presentation of news items in the BBC's Sound Broadcasting Service is the introduction of a closed-circuit television system to provide newsreaders and announcers with news flashes whilst they are actually broadcasting.

When any items of special interest come into the news room a script is prepared and placed under the camera lens. An image is immediately reproduced on a high-grade 14in. picture monitor in the sound studio as required, and the newsreader or announcer can then read the item at a convenient point in his broadcast.

Nigerian TV

AFRICA will have its first permanent television service when two stations begin programme transmissions later this year. The West Nigerian Government, having decided to establish a television service, has placed contracts with Marconi's Wireless Telegraph Company for the supply and installation of transmitting and studio equipment for two stations; these are located at Ibadan and Abafon. A further contract awarded provides for the technical operation and maintenance of the stations for a preliminary period of one year during which Nigerians will be trained to help take over the operation of the new service.

Scottish I.T.A. Stations

THE INDEPENDENT TELEVISION AUTHORITY has ordered Marconi vision and sound transmitters for the proposed two new Scottish ITA transmitting stations, for the Aberdeen and Inverness areas. They are the same type as those which are used in ITA stations at Chillerton Down, Isle of Wight (Southern Television) and Burnhope (North-east).

TV and Radio Despatches

MORE than a million television receivers were despatched by the manufacturers to the radio trade in the first six months of the year, according to the estimates for June, published by the British Radio Equipment Manufacturers' Association. The figures for January-June, 1,033,000, are 80 per cent. above those for the first six months of last year (573,000). Despatches of radio receivers, 645,000, are 17 per cent. above those for the first six months of last year (550,000) and of radiograms, 67,000, 6 per cent. lower. Despatches are net figures of deliveries by manufacturers to the home trade.

TV in Ghana

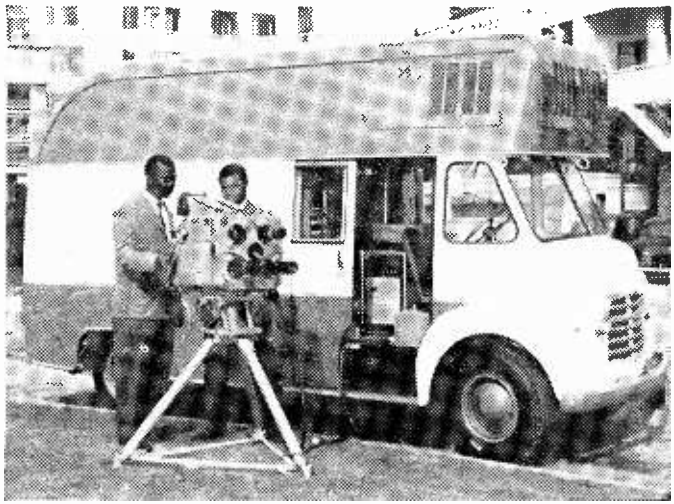
AN order has been placed with E.M.I. Electronics Ltd. for what is believed will be the first television system to go into operation in the new West African republic of Ghana.

The system will be used at a large gold mine as an added security measure to guard against pilfering and unauthorised processing of gold ore. Three cameras are being mounted at vantage points to scan the working area and relay pictures to receivers placed in the offices of senior security officers.

TV "Saturation"

THE United Kingdom, with nearly 9¼ million TV licences at the end of last June, had TV sets in more than 50 per cent. of households. The highest percentage was in the Midland region and the second highest in the North Midlands. The 10 millionth licence is imminent.

Already claiming to have the highest television coverage of any country in the world, the UK networks go on expanding; by the end of the year, 98.7 per cent. of the population will be within the BBC service areas and 94 per cent. within the I.T.A. service areas.

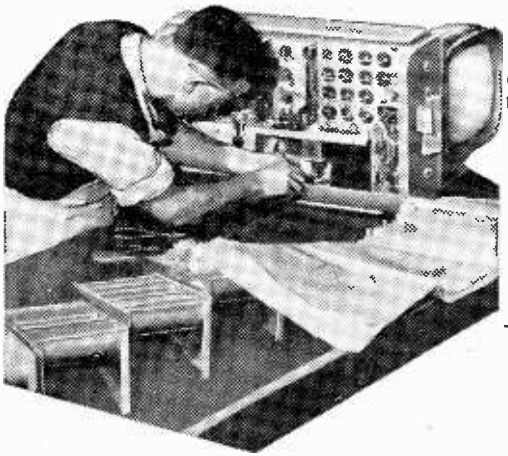


The outside broadcast vehicle which Marconi's have built for operation in Nigeria. Two Nigerian engineers, who are training in England, are examining one of the cameras. (See "Nigerian TV").

German TV

THE German Radio Exhibition at Frankfurt-on-Main, which opened on August 14th and closed on August 23rd, just before the Radio Show opened, presented a number of new features which have not been seen in this country.

Television sets have more automatic control (A.F.C. for automatic tuning, automatic contrast control according to ambient lighting, automatic mains voltage regulation, and automatic width control) all in addition to A.G.C. and flywheel sync that are common over here. Some areas also are already using Bands IV and V (for their second programme).



Analysing and Servicing TV Receivers

No. 9.—THE C.R. TUBE

By "Diadem"

THIS month's article deals with the use of the cathode ray tube in television receivers, and covers grid and cathode modulation, together with faults in C.R. tubes.

Modulation

There are two methods of modulating the C.R. tube with picture information. The first is to couple the output from the anode of the video amplifier valve direct to the cathode of the tube (Fig. 35) and the second is to couple the output direct to the grid (Fig. 36). In the first instance, a negative-going video signal is required and in the second a positive-going signal is required. As can be seen from Fig. 37, in the case of grid modulation it is likely that the C.R. tube will be damaged if for any reason V1 ceases to pass current. In this instance, the anode of V1, and therefore the grid of the C.R. tube, assume the potential of the H.T. supply because there will be no potential drop across the load components of V1 (Ohm's law). This will promote excessive beam current in the C.R. tube. However, with cathode modulation, a faulty video stage can only bias-back the C.R.T. to a point of lower beam current. Fig. 37 shows how grid modulation can still be used without the danger to the tube. Two extra valves and three resistors are needed. If the 6J5 were to fail, the grid of the C.R.T. would assume chassis potential and beam current would be thereby reduced. The 6J5, it will be noted, is functioning as a cathode follower.

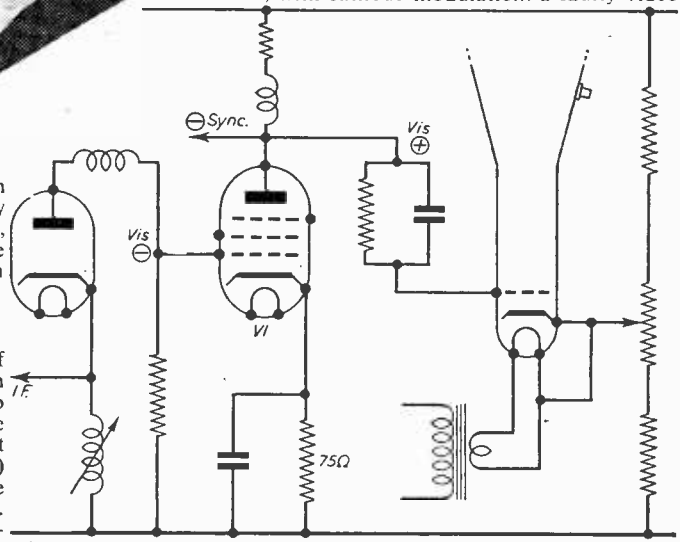


Fig. 36—Grid modulation (and the use of an isolating heater transformer).

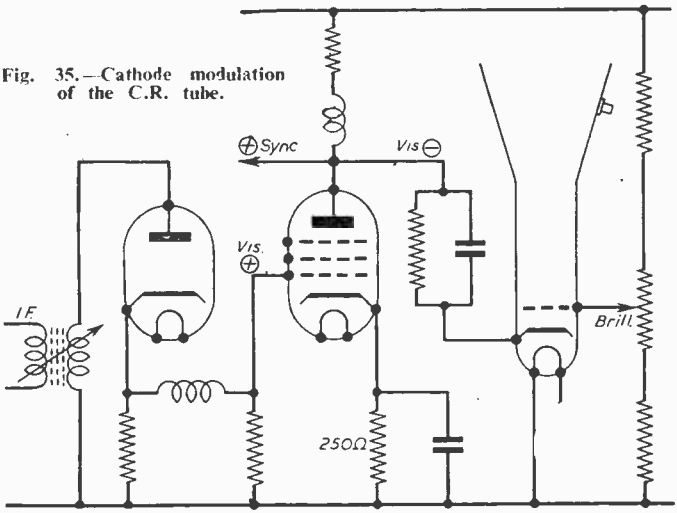


Fig. 35.—Cathode modulation of the C.R. tube.

In modern receivers using cathode modulation the trend is to feed direct from the video amplifier into the cathode follower (Fig. 38). By dispensing with the coupling capacitor, a D.C. restoring diode is no longer required. (If a negative sync pulse is needed it can be taken from the anode providing a load resistor is inserted in the circuit).

Tube Shorts

One of the most commonly occurring faults is a short between heater and cathode. As the heater

of the tube is generally connected to chassis, either directly, or through valve heaters, the potential of the tube cathode is altered. The remedy for this fault is to feed the heater of the tube from an isolating transformer as shown in Fig. 36. One side of the heater can be directly joined to the cathode. However, if this transformer has an appreciable capacity to chassis, the quality of the picture will be degraded. Even the use of "low loss" transformers may produce a noticeable effect upon the quality of the picture and the procedure indicated in Fig. 39 may be adopted. (See Tube Faults.)

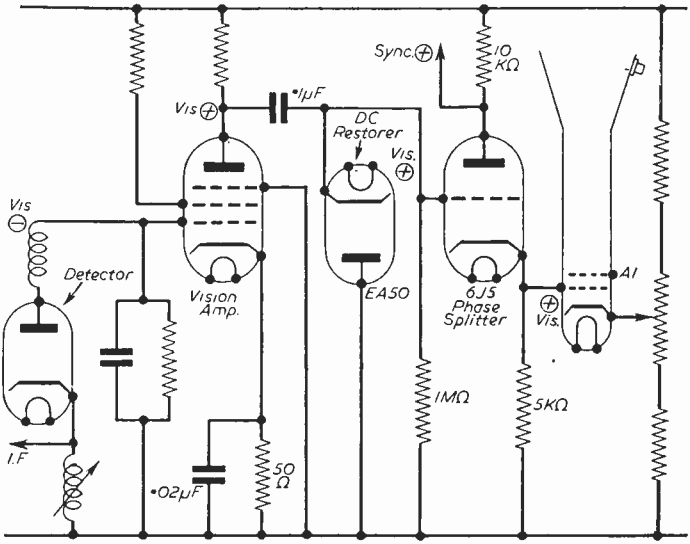


Fig. 37.—The use of two extra valves to remove the danger to the tube when grid modulation is used.

Faulty Tetrode Tubes

The normal circuit for a tetrode tube is shown in outline in Fig. 40a. If a heater-to-cathode short develops, an isolating transformer can be used (Fig. 40b). If a cathode-to-grid short occurs the supply to the first anode is removed and the first anode is then used as the control grid (Fig. 40c). The original control grid (g1) is strapped direct to the cathode.

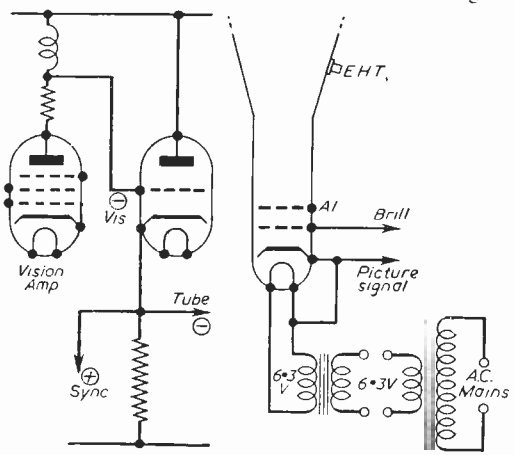


Fig. 38 (Left)—Feeding the cathode follower direct from the anode of the video amplifier.
Fig. 39 (Right)—A method of using an isolating transformer in conjunction with the existing transformer.

Heater Wiring

When removing the heater wires from a faulty tube in an A.C./D.C. heater chain a resistor should be connected across them, the value and wattage of the resistor depending upon the tube voltage and current (Fig. 41). The resistance is obtained by dividing the heater voltage by the heater current. Next multiply the tube heater voltage by its current to find the required wattage of the resistor. For example: 13.3 divided by 0.3 gives 44 ohms and 13.3 multiplied by 0.3 gives 5 watts. A 40 ohm resistor would be easier to obtain and the use of a 10 watt type would give better heat dissipation. For a 6.3V, 0.3A tube, the resistor would be 21 ohms, 2 watt rating. Here again the wattage could be increased if desired.

If a tube is replaced with one having an external graphite coating it is important that this be connected to the chassis with a flexible metal spring, otherwise very high voltages will develop on the coating.

Tube Faults

Uncontrollable brilliance. When the cathode of the vision noise limiter, usually an EB91, is connected direct to the video amplifier anode, and this in turn is connected to the tube cathode, a heater-to-cathode short in the limiter valve will provoke this symptom. A heater-to-cathode or a grid-to-cathode short in the tube will also cause the brilliance to be uncontrollable. If the tube heater is connected to an isolated winding, the same fault will show itself. If the heater is decoupled by a condenser to chassis and this component develops a short or leak, check cathode potential and, if low, suspect a heater-to-cathode short.

Excessive brilliance can be caused if the resistor at the "earthy" end of the brilliance chain goes high or open circuit.

Erratic, excessive or no brilliance. Check the video amplifier valve.

Inability to obtain raster without signal. Check the brilliance control resistor chain for increases in resistance or reduce present resistors in chain, but see that the grid potential does not exceed the cathode potential when the control is at maximum.

Smearing. Heater-to-cathode leak in tube.

Defocused tube. Low emission, heater-to-cathode leak, or low H.T.

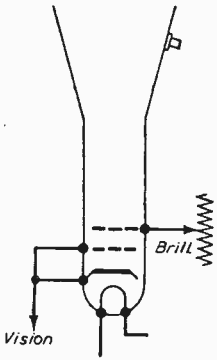
Intermittent dark bands with watery effect, out

of focus double image, and smearing. This is the effect of a cathode-to-heater short when the tube filament is fed by an isolated heater winding from a transformer.

White blurred bands across screen. Picture enlarges or disappears on operating brilliance or contrast controls and sometimes the brilliance control is ineffective. Check for cathode-to-grid short in tube.

Picture enlarges or disappears on highlights. After checking the EHT rectifier for low emission, suspect low emission tube or faulty vacuum. Examine the getter. This should be silver or silvery black, not cloudy white.

Short in tube. The EHT may be overloaded and prevent the line transformer from oscillating with the result that in some circuits the line output valve will get red hot. Remove the tube EHT cap and see if valve and EHT return to normal. It may be necessary to replace the EHT



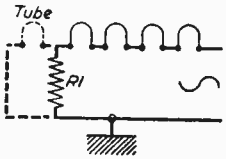


Fig. 41 (Above)—Inserting a resistor in the heater chain to replace the disconnected tube heater.

Fig. 40 (c) (Left).—Using A1 as control grid when a g1-to-cathode short occurs.

rectifier if damaged by short. In tetrode tubes a short from A1 to chassis often provokes this symptom.

Raster faint picture grey. Check the voltage on the tube cathode, the video output valve and its resistors, and resistors and condenser (if any) feeding the tube cathode. See articles 2 and 3 October and December, 1958, issues.

Poor definition. Besides being caused by a low emission or faulty tube, the voltage on A1 in tetrode tubes affect the scanning spot size. This voltage is not always easy to check when it is fed through a high value resistor or "Metrosil." In this case check with a high resistance meter of at least 20 kΩ per volt. Between 300 to 400 is average voltage.

Brilliance control works in reverse. When the control is at minimum a brilliant raster is obtained which disappears when the control is turned up. Suspect heater-to-cathode short in tube.

Picture too dark. With slight movement of brilliance control, picture becomes too bright. Examine brilliance control resistor chain for high or open circuit resistors.

Tube heater open circuit. Examine carefully the solder joints on the valve pins and resolder to be sure.

Ion trap magnet. If this is tight on the tube neck, leave it alone, and search elsewhere for the fault if a raster cannot be obtained. If it is loose

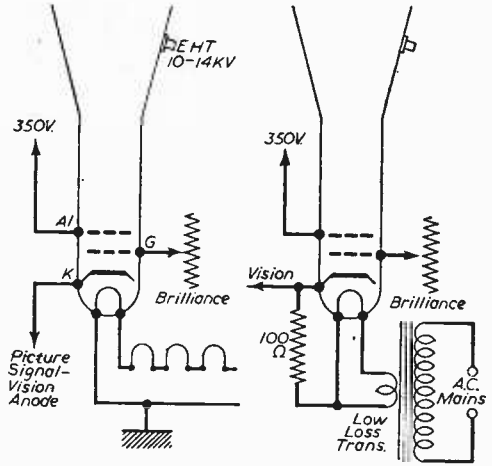


Fig. 40 (a) (Left).—Outline of circuit for a tetrode tube.
Fig. 40 (b) (Right).—Using a heater isolating transformer.

or has been knocked. twist it round slightly each way to see if a raster can be obtained. It is unlikely that it has been knocked forward or back.

(To be continued)

REPLACING C.R. TUBES

(Continued from page 12)

of the spring clip. Should this happen. the clip can be refitted to the disc by equal pressure all round.

Screen Cleaning (Models V230 and V350)

This can be done without unboxing the set by picking the safety glass out of the rubber mask, and carefully replacing in the same way. scoring round the edge with a non-metallic tool.

Earlier Models V180, V178, V176, V120, V118, V116 and V114

These are all designed for easy tube changing. The back is removed. the EHT discharged. and the C.R.T. base connector and anode cap removed. The safety glass or front facia board is then removed and where springs hold the tube mask or the tube is clamped at the back of the neck, these are released. when the tube and mask may be withdrawn through the front of the set.

Picture tilt is corrected by moving the scan-coils after the two locknuts have been slackened in the slots on each side of the focus magnet. Focus and positioning are interdependent, and the user control is set midway throughout all adjustments. Separately moving each of the three thumbscrews projecting from the focus magnet will give picture position. whilst moving all three in or out together will correct focus. Coarse adjustment of focus may be obtained by moving the circular band which supports the tube.

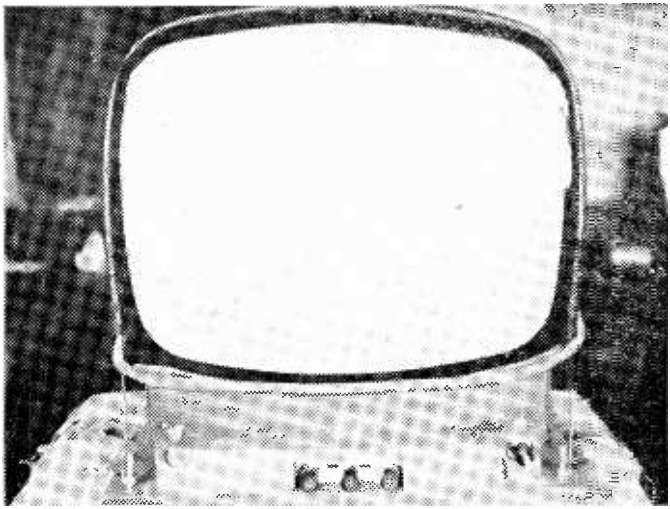
Boosting

Remove the wires from pins 1 and 8 of the tube and tape them back. Fit a 2 volt low capacity boost transformer.

From Metal to Glass

By C. Smallwood, Grad.I.P.R.E.

USING A MODERN TUBE IN FERGUSON 989 and 990



Front view of the modified receiver showing the new tube support.

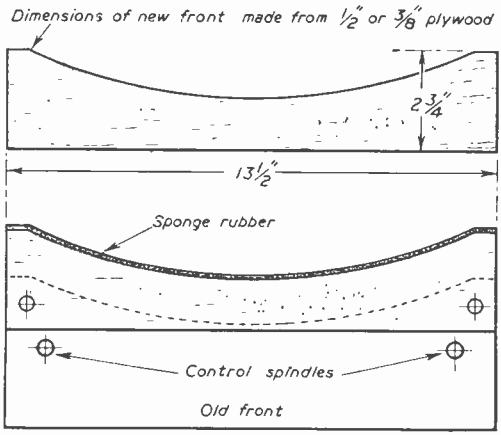


Fig. 1 (above). — Dimensions of the new support and its position above the original support (shown dotted). (Below right)—Side view of the modified viewer.

HAVING had considerable difficulty in obtaining a new 16in. metal tube (MW41-1) for one of the above receivers, and bearing in mind the very high cost of these near obsolete tubes, it was decided to try to modify the set to take a 17in. rectangular type.

Advantages

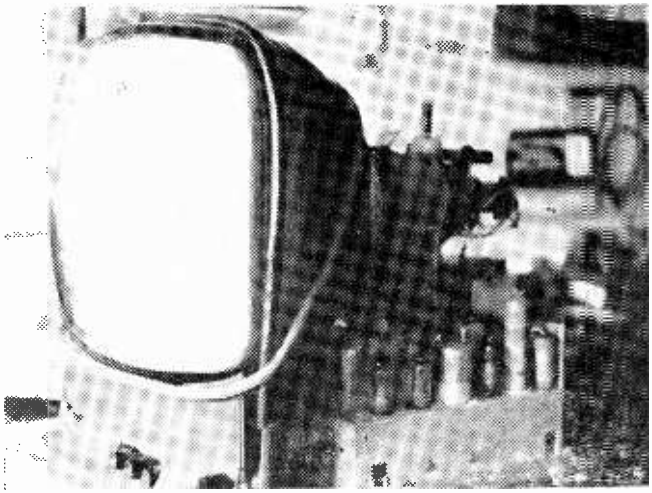
The advantages to be gained were numerous; firstly, there are large quantities of rebuilt and reconditioned 17in. tubes on the market and these cost less than the 16in. metal type. Secondly, an aluminised tube could be chosen to give a far brighter picture, and thirdly, the dangers of servicing a chassis with a metal tube are eliminated. (The metal cone of the 16in. tube is connected to the final anode and therefore to the EHT supply—some 15 or 16 kV.)

It was decided to use an MW43-69, 17in. rectangular tube which is aluminised and also has a filter glass screen. Electrically, it is interchangeable with the 16in. type, except that its external conductive coating must be earthed and that pin 7 must be connected to pin 11 (cathode). The pentode gun gives better overall focus than the tetrode type—another advantage over the 16in. tube.

Mechanical Details

As will be seen from the illustrations the mechanical considerations are small. A new tube rest

(*Continued on page 30*)



TV WITHOUT MAINS

METHODS OF OPERATING TV RECEIVERS IN REMOTE DISTRICTS

By F. G. Rayer

IN scattered country houses where no mains supply is available, private generating plants may be used for lighting. There is a considerable range, both new and ex-service, and although the usual plant does not have sufficient output for heating and similar appliances, it is usually possible to obtain current for a TV receiver or radio. Running a TV set in this way will in such circumstances be the only means of obtaining TV reception, and the best method of securing satisfactory results then has to be considered. In practice, a few snags tend to arise, but these can usually be overcome fairly easily.

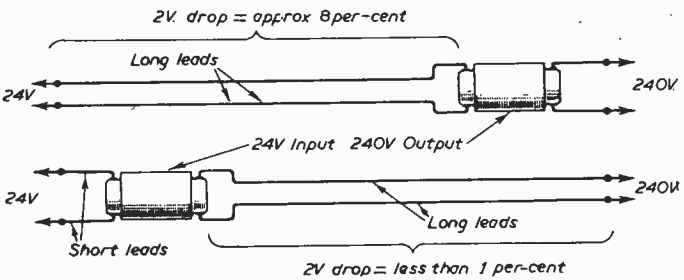


Fig. 1.—With low voltages, voltage drop is particularly serious.

Type of Plant

Home generating equipment can be of several kinds. With large houses, a generator providing 200/250V and of quite large capacity may be used. With such plants, accumulator storage is not normally included, because of the size and expense this would entail. The plant therefore needs to be running whenever any electrical appliance is in use. An automatic self-starting circuit may be included, so that the plant is started when any switch is closed. With such plants, the TV receiver can be run in the same way as when house mains are available, but the exact voltage should be checked, and an A.C./D.C. type receiver used if the current is D.C. The precautions against interference mentioned later will also usually prove to be necessary.

Other large plants provide about 100V D.C., and are used with a bank of about 50 cells. These have the advantage that the generator does not need to be running when moderate current demands are being made, as for lighting, or the isolated use of lights during the night. But a means of stepping up the voltage will be needed to operate a 200/250V TV set, as with low voltage plants.

Low voltage plants usually provide about 24V to 30V so that the cost of accumulators is much less than with the 100V plant. They are only suitable for small houses, or where moderate demands are made on current, and are used for lighting only. With such plants, the TV set can be run by adding a convertor. The low price of such plants, especially as "surplus," means that they are sometimes obtained mainly to provide current for a TV receiver. Large accumulators are not necessary with them. For example, a 24V bank can consist of four 6V or two 12V car-type batteries. For a 30V plant, five 6V accumulators could be used.

Current Required

With low voltage plants, the current required may become rather high, and this must not be overlooked. For example, it may be assumed that the receiver consumes 100W. With a 200V supply, the current would be only 0.5A, which would be insignificant for plants with such a voltage. Given an average efficiency of 50 per cent. for a convertor, 2A would be drawn from a 100V supply. This would also be within the capacity of such equipment. But with a low voltage plant, about 8A would be required at 24V, so it will probably be necessary to have the generator running when the TV is in use, despite the fact that accumulators are present. If this is not done, the voltage is likely to drop so that proper working of the receiver is impossible. With a bigger TV set, the consumption will be over 100W and the current required will then be even larger.

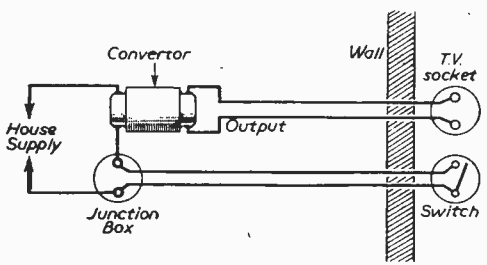


Fig. 2.—Connecting an input switch.

Planning

Thus, with a low voltage plant, it is wise to plan the installation on the assumption that the generator will need to be run when TV reception is required. This will, of course, also be necessary with plants having no accumulators.

The way in which the current increases as the voltage is reduced also means that regular, long

period running of a TV set from a 12V accumulator is not likely to prove satisfactory, unless some means of charging is available. Moderate use of a small receiver, or 12V portable, is feasible from a 12V accumulator maintained in good condition. In a few cases it may be convenient to charge this accumulator from a higher voltage D.C. house supply, as explained later.

Voltage Drop

Fig. 1 shows the importance of voltage drop in a high current, low voltage circuit. Resistance between generator, accumulators and convertor, must be kept as low as possible. With a 200V supply, a drop of 1V would be quite insignificant. With a 100V supply, it would constitute only 1 per cent. But with a 24V supply, it would be over 4 per cent. Furthermore, for a given wattage the current flowing increases. The voltage drop in the circuit with low voltage plants can thus become too large a percentage of the available voltage, unless care is taken. In some cases, the convertor is designed to compensate to some extent for this, as with convertors intended for 11V input from a 12V supply, or the receiver input tapping can be adjusted to suit. For example, if the convertor is rated to provide 240V, on load, but the voltage is only perhaps 210V, due to a slightly reduced convertor input voltage, then the receiver can be set as for 210V mains.

Unnecessary voltage drop will be avoided by using a reasonably short wiring run between accumulators and convertor, and a stout conductor. For example, some 30ft. or so of 15A cable would usually introduce no particular difficulty with a 24V supply. The wiring between convertor and receiver is less important, because the current is so much smaller.

Noise

The better type of plant, designed for house lighting, etc., is often well silenced. But the small, ex-service charging plants frequently use a small, air-cooled petrol engine, and can be rather noisy. This is important when it is remembered that the engine will most probably have to be kept running during periods of viewing.

An outside shed, separated from the house, will thus be a good place to house the plant. If the building is solidly constructed, and perhaps at the other side of the house to the room where the TV will be installed, this will help reduce noise. It may be necessary to replace small, mushroom exhaust fittings by means of a proper silencer. A method sometimes used is to fit a long exhaust pipe discharging into a pit dug in the ground, and covered with stones, or earth supported on stout planks, etc., with small gaps for the escape of exhaust gases. There is, however, a certain amount of noise from the engine and generator themselves, and this can become very annoying unless some care is taken when deciding where the plant shall be situated.

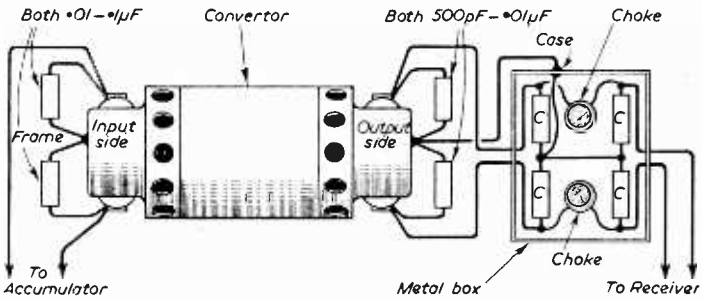


Fig. 3.—Wiring-in suppressor condensers and chokes.

Convertor Noise

The convertor will also produce some noise when running, so that it should not be near the receiver. It may be possible to place the convertor in an adjoining room or passage, where the noise will not be troublesome while viewing. A stout containing case, cover or box, lined with sound-absorbing material, will help to keep the noise down. Direct sound transmission through the floor can be reduced by standing the equipment on sponge rubber blocks, and can be worth while with wooden floors.

In some circumstances the convertor may be housed with the generating plant. Sufficient ventilation must always be allowed to avoid overheating.

With a little care, noise from the convertor need not be troublesome. But if this is entirely overlooked, and the unit perhaps placed behind the set, or in direct contact with a fragile wooden box, the sound when it is running will become a nuisance.

Convertor Wiring

The convertor is only switched on when the receiver is needed, so that a switch must be included in the input circuit. An extension lead may be necessary to allow this switch to be situated at a convenient spot as shown in Fig. 2, but wiring should be arranged to avoid long connections, or excessive voltage drop can arise.

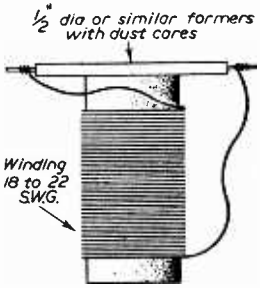
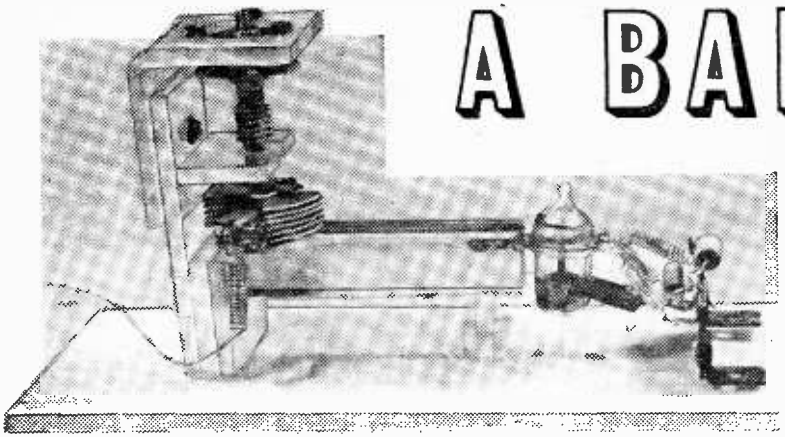


Fig. 4.—Small suppressor chokes.

The convertor will generally be an ex-service unit, and these are quite inexpensive. Its input voltage should suit the supply available. The output voltage must suit the receiver, or the receiver must have an input tapping which can be adjusted to match the convertor output. The convertor must also have a wattage rating at least equal to that of the receiver. The receiver consumption will be indicated in the operating instructions, or elsewhere and should be known when buying the convertor.

(To be continued)



A BAND V G

GEN

THIS INSTRUMENT HA
CONSTRUCTION AND

THE signal generator described in this article will enable testing of apparatus for Band V to be carried out in the absence of the BBC experimental television transmissions. The generator is tunable and has provision for amplitude modulation of the output—a great convenience for alignment purposes.

Components

There is at present a good deal of difficulty in obtaining special U.H.F. components at any price —let alone at a reasonable price. This applies with equal force to valves; one very well-known firm informed the writer on enquiry that at present only "experimental" quantities were available, and those only to manufacturing firms.

However, by using the "surplus" market and some artifices, an apparatus has been evolved which is easily made from readily obtainable parts, and which has a good performance. The moderately experienced will find little difficulty in constructing it, and it is thought that every satisfaction will be obtained.

The Circuit (Fig. 1)

The U.H.F. oscillator consists of a single-ended tuned-line circuit, the cathode being the common electrode. It works in the half-wave mode, and is tuned by a variable capacitor of the "butterfly" type. The modulator consists of a phase-shift audio oscillator of the Wien-bridge type, and this is used to effect grid-modulation of the oscillator. Output is obtained by means of a loop, coupled loosely to the tuned lines, the output impedance being 80 ohms —suitable for feeding into a coaxial lead. This should be terminated permanently in an 80 ohm resistor to avoid reflections (which otherwise might prevent the oscillator from working, if fed back along the cable and appearing at the coupling loop in anti-phase).

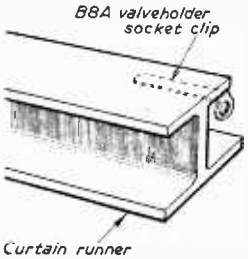


Fig. 2.—Fitting the valveholder sockets to the Lecher lines.

The circuitry is thus simple in the extreme, and the important details are the constructional ones.

LIST OF COMPONENTS

1 Acorn valve type 955.
1 SP61 (CV1065) or EF91.
1 Butterfly 25pF.
1 Muirhead slow-motion drive.
1 Flexible coupler (insulated).
1 Small A.F. transformer.
1 Miniature mains Transformer (output 250V H.W., 30mA, 6.3V at 1 amp.).
1 Metal rectifier 250V 30mA.
1 Valveholder B8A.
1 Valveholder MO or B7G as required.
1 25k TV type pot (wire-wound).
1 1k TV type pot (wire-wound).
1 coaxial socket.
Aluminium sheet, brass curtain-rail (channel type), Perspex sheet, quantity of Tufnol rod ¼in. diameter, self-tapping screws, ⅛in. diameter by ¼in., 1 oz. chloroform.
Conventional circuit components as given in the circuit diagram.

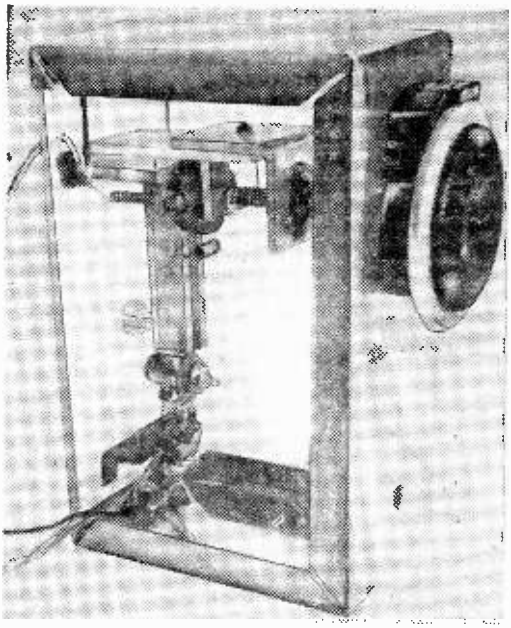
Discussion of Circuit

As is well known, the Q of tuned lines is highest when one quarter-wavelength long. However, experiment showed that not only are the Lecher lines unmanageably short when working with short-circuited quarter-wavelength lines but, because much of the capacitance and inductance is within the valve itself, an actual improvement in Q is obtained by using half-wavelength lines. Any improvement in Q is valuable because it helps in stability of frequency and also allows the valve to operate at a higher frequency. Tuning by variable capacitor is also possible, since by putting this component at the opposite end of the lines from the valve it is at a high R.F. voltage position; the anode and grid are at the other high-voltage position. Besides, the use of a variable short-circuit is tricky to arrange, and although some success was had by using a "slide" incorporating small carbon brushes, the re-setting accuracy was low.

To obtain mechanical rigidity in the Lecher lines, sections of brass curtain-rail have been used, each 7.0 cm. in length. These, silver plated and

SIGNAL ERATOR

'BEEN SPECIALLY DESIGNED FOR EASE OF TABILITY IN OPERATION By R. B. Archer



set close together, afford a pair of lines of good Q and manageable dimensions.

For the tuning capacitor a "butterfly" was selected. This component has the advantage (over a normal variable capacitor) of having no sliding contacts and of being symmetrical electrically. The item, as bought, has to be modified to be useful in this circuit, as it is mounted directly on the end of the Lecher lines. This will present no difficulty, given reasonable mechanical skill.

Valve Supplies

The D.C. connections to anode and grid lines are made at about the mid-point of the lines. This ensures that valve supplies are made at points where the R.F. voltage is near zero, and thus capacitance effects are not introduced into the tuned circuit. The fact that the oscillator is tunable means that the point of zero R.F. voltage is not fixed, but varies with the tuning.

The oscillator works with the cathode choked and, because the heater-cathode capacitance represents only a small impedance at the frequencies covered, the heater is also choked so as to remain at the same R.F. potential as the cathode. The inclusion of chokes in these leads also has

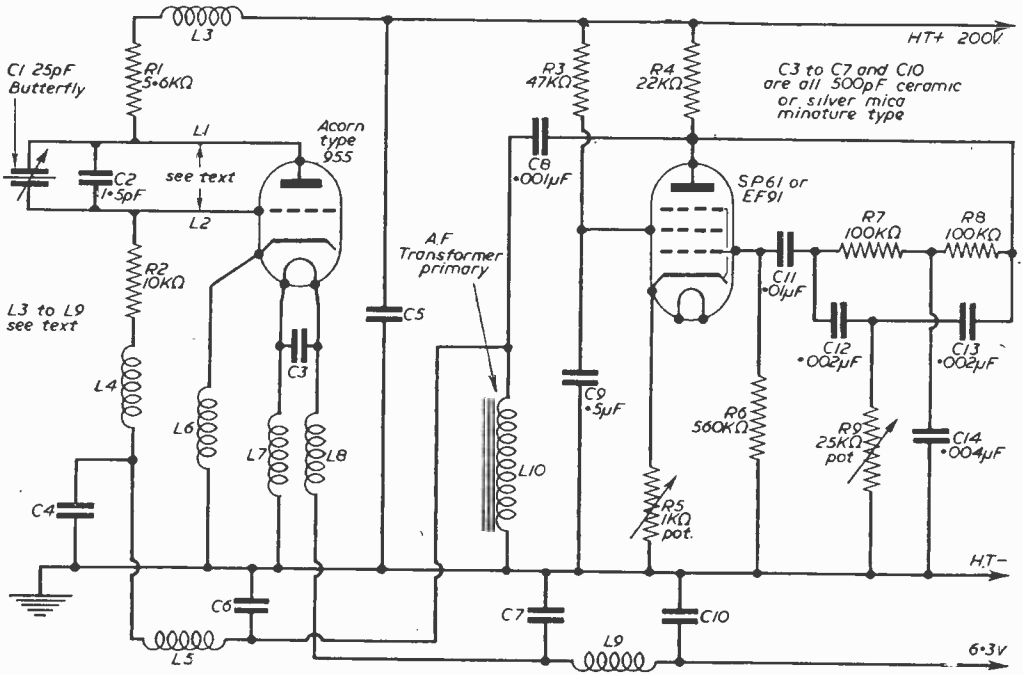


Fig. 1.—The circuit diagram.

the valuable property that the frequency of operation is less affected by capacitances outside the valve and tuned circuit; hence calibration is less upset by valve replacement.

Grid modulation by the generated tone was chosen because it causes noticeably less frequency-modulation in this circuit than does anode modulation. A change of grid voltage from —1 volt to —2 volts causes the frequency to shift by only 4kc/s at 650Mc/s. and this is nearly negligible. Provision is made for altering not only the pitch of the note (by R9) but also (R5) the intensity (voltage). This enables a considerable voltage

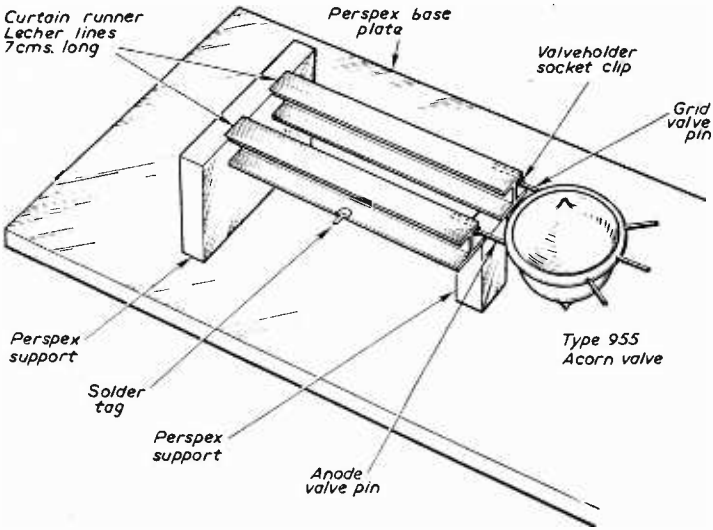


Fig. 3.—Mounting the Lecher lines and valve on the Perspex baseplate.

to be generated at will. and in such a case the frequency deviation of the oscillator is a good deal more: the exact amount is not known and hardly matters since it is only used for alignment purposes and has little entertainment value.

Audio Oscillator

The phase shift oscillator is of conventional design, and requires little comment. The audio tone generated can be varied from about 800c/s to about 1,200c/s. Negative feedback applied by means of R5 helps in securing purity of waveform: as the voltage generated is increased by reducing R5. the tone becomes much more distorted by the inclusion of harmonics. This is caused by running the valve outside the linear part of its characteristic curve.

The writer's final version of the signal generator, which is described in this article. is capable of supplying 25mA of R.F. current into a dipole at 650Mc/s. feeding at 80 ohms impedance. The frequency range is a little below 550Mc/s to a little over 750Mc/s, and thus the BBC is covered with plenty of room to spare. An exactly similar design. using longer Lecher lines, can be constructed to cover Band IV, and so the circuit has a wide range of utility.

The acorn valve was chosen as being easily available and not too difficult to mount. The NR88 has also been used. This is equivalent to the EC52. and it will oscillate up to at least 750Mc/s in this circuit. The Lecher lines have to be cut somewhat shorter however. The acorn is recommended in preference.

The essential constructional details concern the R.F. oscillator. because here the layout is much more critical than is the remainder of the circuit. However. the situation is not unlike that existing when coils and condensers have to be made at home; provided essential dimensions are adhered to approximately there is no difficulty in calibration, and the required waveband is easy to achieve.

The R.F. Oscillator

Two pieces of *brass* curtain-runner are carefully cleaned with metal polish and then in hot detergent solution. After rinsing well in cold water (using tongs or tweezers when handling) they are silver-plated reasonably heavily and are cut down to exactly 7.0 cm. each in length. Burred edges are smoothed with a file.

Silver Plating

The art of plating has an extensive literature. but experimenters need have no qualms about the simple method which can be used for silvering the brass Lecher lines. There is only one solution required and it is made as follows. The chemicals needed are:

2 grams silver nitrate.
5 grams potassium (or sodium) cyanide.

Dissolve the silver nitrate in a teacupful of warm water. and the cyanide in a glass bottle containing about the same amount of water. Add the cyanide solution drop by drop to the silver nitrate; a whitish precipitate forms which redissolves on adding more cyanide. Go on adding drops of cyanide solution until the solution is just clear again.

Then, because the cyanide is dangerously poisonous, pour the rest of it away where it can do no harm. The silver cyanide plating solution is not quite as dangerous, but it should be labelled clearly and kept out of the reach of children. It should never on any account be used anywhere near foodstuffs or where food is prepared.

Plating the Lecher Lines

To plate the Lecher lines, they should first be polished with metal polish and then scrubbed in hot detergent solution. After rinsing thoroughly in cold water, using tongs or tweezers to handle them (never the fingers), a wire is attached lightly to one end and the Lecher line to be plated is immersed in the plating solution.

To a small piece of scrap silver, a second wire is attached, and this piece of silver is also immersed in the solution, not too close to the Lecher line (about 2in. to 3in. separation will do). The wire from the Lecher line is connected to the negative terminal of a 1.5V battery, and the wire from the scrap of silver to the positive terminal.

Plating begins at once and is clearly visible. The solution is stirred while the process progresses, and if discoloration or darkening appears on the Lecher line the separation of the silver and the line should be increased or the solution diluted with water. About half-an-hour will be needed to give a sufficient coating.

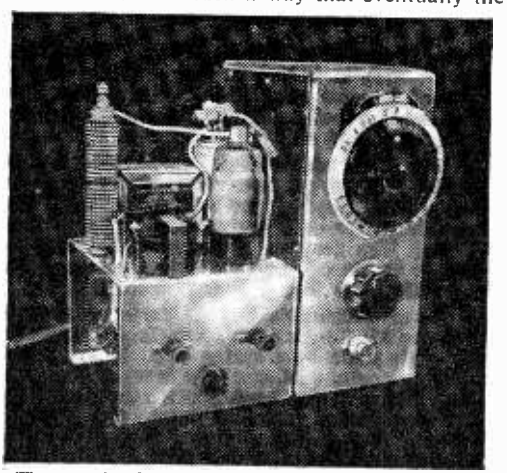
When the plating is finished, a rinse under the tap is needed, after which the Lecher line can be dried and is ready for use.

If desired (and a large enough container is available) the brass curtain-rail can be plated in one operation before cutting to size. In any case it must be emphasised that success depends entirely on absolute cleanliness; the touch of even a well-washed finger will deposit enough grease to spoil the plating at the point of contact.

Photographers who have a bottle of well-used (or better still, exhausted) fixing solution can use it instead of the bath described above. A silver anode is not needed—a carbon rod can be used instead.

Valve Pins

The B8A valveholder is dismantled to obtain the sockets. These are used because they form an edge-grip for valve pins, but other types of socket which can grip a valve pin very close to the valve glass itself can be used. Two of these are required. One is soldered to the underside of the small flange of each curtain-runner, as shown in the diagram (Fig. 2). The soldering has to be done in such a way that eventually the



The completed generator with attached power-pack.

valve pins will lie parallel to the Lecher lines—the pieces of curtain-runner—and both clips are soldered on to the same "hand" side. For soldering to the brass rail either a ½lb. soldering iron or a small blowlamp will be needed since the brass itself has a high thermal capacity

Mounting Plate

Small soldering tags are now attached to some convenient part halfway along each Lecher line. The next operation is to prepare a mounting plate of Perspex sheet, and Perspex supports for the Lecher lines themselves. Fig. 3 shows how this may be done. The supports themselves are cemented to the baseplate by means of a few drops of chloroform. It should be noted that a chloroform-cemented junction takes several hours to dry hard. The smaller flange of each

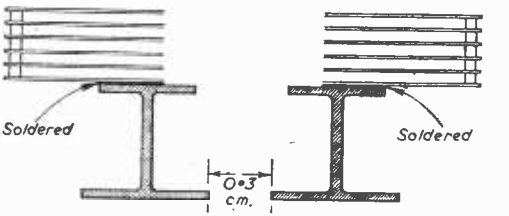


Fig. 4.—The "butterfly" stator plates are soldered to the Lecher lines.

Lecher line is uppermost, and it is arranged so that the larger flanges, at the bottom, are 0.3 cm. apart all along their length. The mounting must be very rigid, and to this end the L-channels are let into the Perspex supports; the latter are afterwards heated gently and squeezed between hot pliers so as to make a tight fit.

Capacitor

The next process is to fit the tuning capacitor. For this purpose the "butterfly" is completely dismantled, and a pair of stator plates are soldered direct to the ends of the Lecher lines (Fig. 4). Care must be taken that the stators are quite flat, and parallel to the baseplate when mounted.

The next procedure is to remove one set of rotors from the shaft of the butterfly: this gives a spindle of ceramic material with a bearing at each end. One bearing is used as the "top" fixing, but since the other bearing cannot be used it is removed and a suitable hole is cut in a Perspex sheet: this is used as an intermediate bearing to locate the spindle positively. A suitable mount is cut from Perspex sheet, the top and intermediate bearings fitted, and the whole is adjusted so that the rotor can mesh with the stator plates without touching either. The arrangement can be seen in the illustrations. Eventually a flexible coupler will be used to connect this spindle with the slow-motion drive. If it is required to have a positive stop to movement of the rotor at maximum or minimum, this can be devised at this stage.

Case

The containing (and screening) box should now be constructed. This is made in two interlocking halves from aluminium sheet. By this means, the mechanical drive, the coupling loop, and the coaxial output can be attached to the oscillator baseplate and all adjustments carried out with the oscillator working, before finally completing the screening.

(To be continued)

CORRESPONDENCE

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

SMALLER TUBES

SIR.—Much has appeared in the daily press lately about the wonderful new development in picture tubes, resulting in much smaller sets. Surely this is not so wonderful. Did we not see many years ago short neck tubes, I believe by Cossor, and these were surely developments of the radar equipment used in the Services. I also remember a French development, I think it was, which gave a remarkably short tube. However, the point of this letter is not so much on whether or not the short tube is a modern development but whether the development is in the right direction. Is the cathode-ray tube, in fact, the correct approach to the television problem? At the moment it is true, there does not appear to be an alternative, but surely the ultimate in the domestic reproduction of a picture will dispense with this bulky and dangerous device and give us a projection unit which will give a really large picture, on the wall or a screen, from a very simple box. Have inventors forsaken this line of approach ?—G. BUCKMASTER (N.W.).

SPECIAL NOTE

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

TRANSISTOR TV

SIR.—I read with interest the series a short while ago on the use of transistors in a television receiver, and note that there are still no components for this type of set. The articles did not mention the question of heat, and as the transistor seems notorious for its temperature effects, it does not seem that a transistorised TV set will be of much use. It has been reported that the Americans have produced an all-transistor set and it would be interesting if details could be given of where, if at all, their technique differs from that given by your correspondent.—G. R. BRASING (Norwich).

A STRANGE FAULT

SIR.—I have seen from time to time in your pages details of faults and troubles experienced by your readers and in many cases the cures which have proved satisfactory.

Perhaps the following experience will interest other experimenters. I have a home-made TV set, incorporating many commercial products originally intended for other receivers, but have managed satisfactorily to combine them in a set prepared from makers' service sheets and circuits in your pages. It has worked very well for a considerable period, but recently has commenced to become erratic. The picture breaks up exactly in the same manner as when the line hold control is incorrectly set—verticals jump in sections, etc. After trying a few times to obtain a better adjustment I got fed up and left it. It righted itself in half an hour or so, and has worked in this way now for some time. The picture breaks up, rights itself and breaks without any definite time period, and always ends up by righting itself for the rest of the evening. This does not happen every night, but once or twice a week. Can it be due to mains fluctuations, which I thought were now so controlled that they gave a constant output?—R. Cox (Edgware).

AERIAL ARRAYS

SIR.—We are told that the BBC are probably going to use Bands IV or V for future transmissions to avoid crowding on the bands. In certain parts of the country the viewer is within range of perhaps two stations in Band I and two in Band III. If extra bands are added what will the aerial array become? Will he have to use an aerial for each band, each station, or what? Is it not time that some form of pick up device were introduced which would give a good signal on anything from Band I to Band V, or does the receiver technique need revising so that a good signal can be obtained with a modest or inefficient aerial system, to avoid the unsightly arrays which we may at present foresee.—G. F. RIDGWAY (Rugby).

FROM METAL TO GLASS

(Continued from page 23)

is made as shown in Fig. 1 and lined with sponge rubber. This is bolted to the original rest by means of the two existing bolts. Next, the tube clamp is shortened by about 2in. and a piece of sleeving threaded on.

As the 17in. tube bulb is considerably longer than the 16in. type, two measures have to be taken: the deflection coil securing bolts are loosened and the coils pushed back as far as they will go. The Perspex mask must be removed from the inside of the cabinet and mounted on the outside with four chrome headed screws.

It was mentioned earlier that the external coating of the 17in. tube must be earthed and this is most easily done by a spring clip. Mount it on the H.T. smoothing electrolytic fixing screw. This coating acts with the inner coating to provide an EHT smoothing capacitor, and the original smoothing capacitor(s) can be removed, a lead now going directly from the EY51 EHT rectifier to the top cap of the tube. It will be necessary to change the existing top cap connector.

Finally, a rubber dust-sealing band should be slipped over the tube (as shown in the illustrations) and sprung in position between the tube face and mask when the chassis is bolted in the cabinet.

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Cabinet Price **£3.3.0.** Carr. and Ins. 3/6.

2-valve AMPLIFIER Mk. 2

Latest developed circuit giving a higher fidelity response and greater output (2-3 watts) using twin stage valve ECL82 and neg. feedback Tone Control. Complete with knobs wired and tested with 6in. Speaker, etc., ready to fit in above cabinet. Only **£3.19.6.** Carr. 2/6.

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ALL NEW 4-SPEED MODELS

SINGLE PLAYERS BSR (TU9), **£4.10.0.** COLLARO (4/564), 6 gns. GARRARD (4SP), **£7.10.0**, carr. 3/6. GARRARD (TA Mk. II), **£9.5.0**, carr. 3/6.

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5Z4	9/6	EABC80	9/6	EL41	10/6
6K7	5/6	EBC41	9/6	EL84	9/6
6K8	8/6	ECC83	9/6	EM81	9/6
6Q7	8/6	ECC84	11/6	EY51	10/-
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6X4	7/6	ECH42	10/6	EZ81	7/6
7C5	9/-	ECH81	10/6	MU14	9/6
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DAF96	9/-	ECL82	11/6	PCF80	10/6

PCF82	10/6	PCL83	12/6	PL81	12/3
PL82	9/6	PL83	11/6	PY80	7/6
PY81	9/6	PY82	7/6	PY83	10/6
U25	12/6	UCH42	10/6	UL41	10/6
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1R5, 1T4, 1S5 or 3S4, or 3V4 ... ... 27/6
DK96, DF96, DAF96, DL96 ... ... 35/-
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10,000 ohms—2 Megohms. All long spindles. Morganite Midget type. 1¼in. diameter. Guar. 1 year. Log. or Lin. Ratios. Less Sw. 3/-. D.P. Sw. 4/6. Twin Ganged controls, 1 meg., 1 meg. ... 1 meg., less Sw. 8/9 ea.

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SPEAKER FRET.—Expanded Bronze anodised metal 8 x 8in., 2/3; 12 x 8in., 3/-; 12 x 12in., 4/6; 12 x 15in., 6/-; 24 x 12in., 9/-, etc.

TYGAN FRET (Murphy pattern) 12 x 12in., 2/-; 12 x 18in., 3/-; 12 x 24in., 4/-, etc.

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12 v. operation Med. & Long Waves

Development of the famous Brimar Hybrid vibratorless Car Radio Circuit. 5 latest type low voltage valves and Power Transistor. R.F. stage and permeability pre-aligned Cyldon Tuner Unit provide extremely good sensitivity and Signal/Noise ratio. Printed circuit and 7in. x 4in. Speaker. Self-contained in neat Metal Cabinet 8in. x 7in. x 2¼in. with attractive dial. Speaker and Power Transistor stage mounted separately, approx 8in. x 5in. x 3in.

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Complete Kit Bargain Price **£12.19.6**

P. & P. 3/6.

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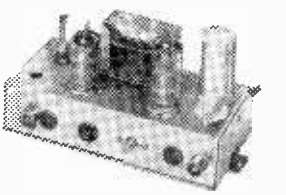

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Medium and Long Wave Midget Superhet Personal Radio. Printed circuit, 6 transistors and 1 crystal diode, and stage by stage instruction manual. Internal ferrite aerial. Push-pull output.

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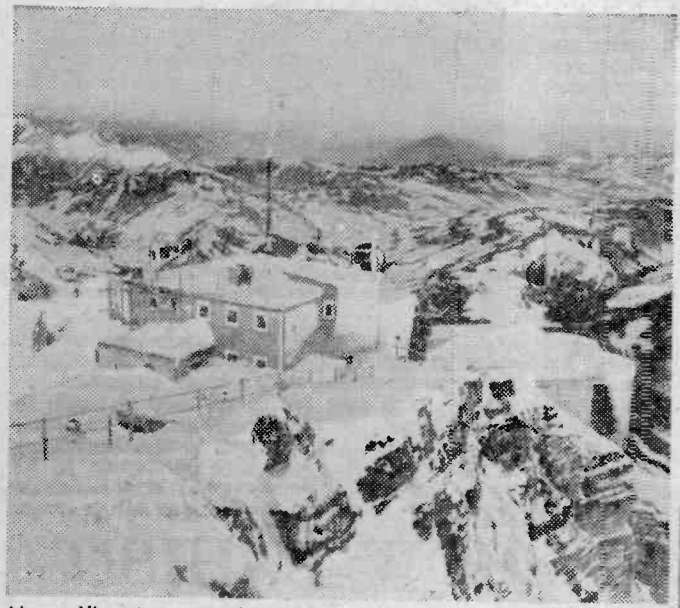
TELEVISION IN THE MOUNTAINS

A DESCRIPTION OF A SWISS RELAY STATION



Above—View of the transmitter with the fantastic panorama of mountains.

Below, right—The transmitter station towers on the peak of the Santis mountain in Switzerland, like some space-age fortification.

AS in the British Isles, television has become a vital part of everyday life in most European countries. Oddly shaped aerials, often much more complicated than those seen in this country, can be seen on many rooftops in Switzerland, and viewers today switch on their television sets with the nonchalance of switching on the electric light.

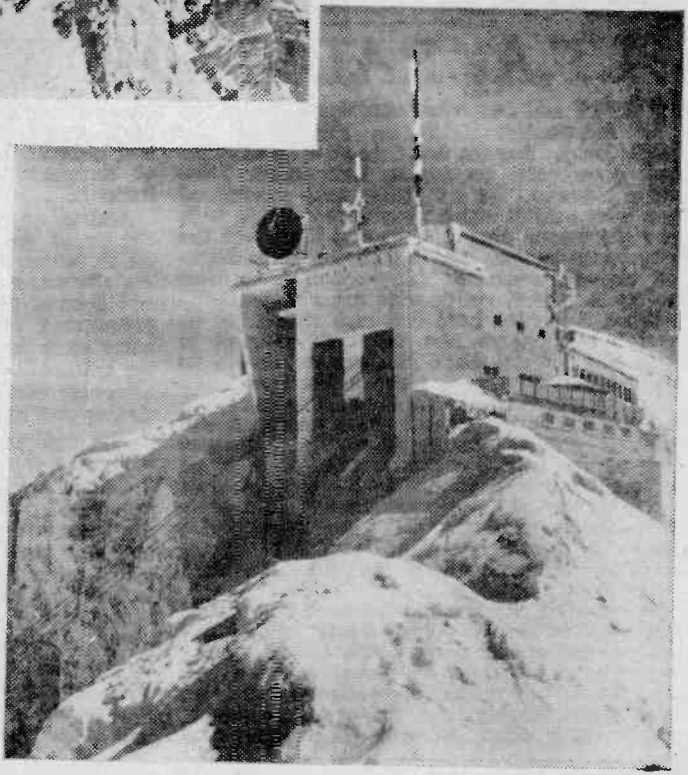
Obstacle

Switzerland has its own particular problems where transmission signals at UHF are required. The range of signals at high frequencies is virtually the "optical" range and the towering peaks of the Swiss mountains are a natural obstacle which make the relaying of television signals extremely difficult. Here, then, the only method open to the engineers was to transmit the signal from mountain top to mountain top. Today, modern aerials and masts now stand in the mountains by the side of that comfort to travellers, the ancient Calvary.

The latest television relay station to be built in Switzerland is at the summit of the mountain Santis which is some 2,500m high. The station covers the north-eastern half of Switzerland as well as Liechtenstein and certain parts of southern Germany. Not only is the station equipped for television, but there is also provision for high frequency radio and telephone signals.

Construction

The Santis transmitter is built at one of the highest levels in Europe and is a good example of



how the problems confronting transmission in mountainous areas can be tackled. The station is reached by funicular railway. The buildings, five stories high, are painted white and blend with the snow masses surrounding them, thus making the station quite unobtrusive.

Santis is exposed to the elements and the engineers at the station report that snowfalls and storms can reach quite unbelievable degrees of severity. These hazards called for the use of special methods when the buildings were constructed. The walls are built with double thickness: the outer layer is reinforced concrete and the inside walls are brick. The hollow part between the walls is filled with granulated cork for thermal insulation, a special method being used to protect the cork from damp and moisture.

The constructional work began early in 1956, the new transmitter was built on to another building which houses the machinery for the funicular railway. More than 1,500 cu. ft. of solid rock had to be cleared with explosive before the work could begin. As one would expect, the mixing and use of concrete proved to be exceptionally difficult as not one of the twelve months in the year is without frost. Many other problems confronted the builders such as transportation of materials, oil, water and other supplies, but eventually all were overcome. The buildings were completed in 1958 and after the equipment had been installed, the station was soon fully operational.

Besides the actual transmitter, the buildings house an emergency electricity unit, worked by diesel engines, store rooms, engineering shops and so on. The top storey of the main building provides modern and comfortable accommodation for those employed at this bleak outpost.

This view shows a portable "mirror" directed at the valley below, where a mobile television unit is transmitting.

Large high gain aerials are used at Santis to receive signals from the nearest transmitter. After amplification, the signals pass to the transmitting system where they are sent into space to be picked up by similar stations on distant mountain tops or by domestic television sets within range.

I.T.A. RADIO SHOW EXHIBIT

"UNITY and Diversity" was the theme of the Independent Television Exhibit at the Radio Show. For the first time all nine independent programme companies, Independent Television News and the T.V. Times were represented in a joint exhibit which showed how I.T.A. with its eight transmitting stations and links, and the programme companies with their studios in different regions, combined to produce unity with variety in a vast, nation-wide organisation.

When it is considered that each region has its special requirements and that each company is essentially individualistic in character, it will be realised that this is no mean achievement. To many people, it came as a surprise to learn that so many different programmes are produced; still more astonishing were the intricate and complex arrangements which enable a programme to be switched from one control centre to another to meet split second timing requirements. The unity of the system was exemplified by the Celebrity Stage—the centre piece and focal point of the exhibit—where artists of all the programme companies were appearing.

The exhibit, attractive in concept and design with effective use of light and colour, had a direct and personal appeal to the public in emphasising how unity and diversity are brought together. The outer "wall" of the exhibit was made up of 43 large panels bearing huge photographs arranged with striking effect, showing the various programmes seen on ITV. Large maps indicated how the various networks fit together. The exhibit was designed by Jack Foxell and a young team of designers from Sir William Crawford and Partners.

Activity on the Celebrity Stage was televised by equipment provided by Tyne Tees Television which serves viewers in North-east England. Activity was continuous throughout the exhibition and showed the preparations involved in a TV programme, and included also personal appearances by a host of TV stars. The public saw the extraordinary camera acrobatics employed in achieving unusual angle shots, and the elaborate staging and backgrounds required in modern TV.

The equipment provided by T.T. Television included a complete outside broadcasting unit and a mobile video tape recording machine. There are already four mobile video tape recording machines in the ITV network and another 19 are installed permanently in the studios. These machines, costing some £35,000 each, record sound and vision simultaneously on a 2½in. wide, plastic based tape.

Unlike movie film, the tapes do not require to be processed. They can be played back immediately or stored for an indefinite time, and produce sound and vision virtually indistinguishable from "live" transmissions.

TUBES

FACTORY REVACUUMED. ALL GUARANTEED 6 MONTHS. Carriage and insurance 12/6.

Enquiries welcomed for any types not listed. Due to the high quality of our tubes and low number of returns, we are able to maintain the following unusually low prices.

6501, 6504, 6505, CRM91, CRM92, MW22-7, MW22-14, MW22-14C, MW22-17, MW22-18. £2/15/-

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17ARP4, 17ASP4, 6706A, C17FM, CRM171, CRM172, MW43-43, MW43-64, 7401A. £4/5/-

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ALL GUARANTEED 12 MONTHS.

Excellent workmanship. Carr. & ins. 12/6.

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MW31/14, MW36/24, £7/19/- MW43/64 £8/19/-

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SPECIAL OFFERS

4-SPD. RECORD PLAYERS

Latest B.S.R. TU9 Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Carr. **£3/10/-** Truly amazing value at 3/-.

STEREO 4-speed Single Player. Famous make. Just released. Limited Quantity. **£6/19/-** Carr. 3/-.

RADIO Receivers, complete with 6 volt Vibrator Pack. 6K7,' 6K8, 6Q7, 6V6, suitable for adaption as car radio. Secure yours now. **29/-** Carr. 5/-.

AVO Valve tested. Standard Two Unit Type in teak case. Bargain at **£9/-/-** Carr. 5/-.

G73 Signal Generator and Wavemeter. 100 Kc s-1 met, crystal calibrator, precision attenuator. **£9/10/-** Carr. top make. 6/-.

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A well balanced range of mainly miniature ceramic and silver mica. From 3PF to 10,000 Pf. A must for your spares box. Only **10/-**

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Tested. top makes, performance guaranteed. 6½in. **7/6** 5in. 7 x 4 **12/-** 10in. 10 x 6 **14/-**

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280L/C679A (240 v 80 mA), 5/-; RM1, 6/-; RM2, 6/6; RM3, 9/-; RM4 (ER4), 15/6; RM5 (ER5), 21/-; 14A86, 17/-; 14A97, 23/-; 14A100, 25/-; 18RA 1-1-16-1, 7 9; 14RA 1-2-8-2, 18/-; 18RD 2-2-8-1, 14/-; 14RA 1-2-8-3, 22/-.

TV SETS

TRULY AMAZING VALUE MADE POSSIBLE ONLY BY THE LARGE QUANTITIES SOLD. PICTURES NOT GUARANTEED, AS RECEIVED IN PART EXCHANGE. ABSOLUTELY COMPLETE, ALMOST ALL ARE LATE AC/D.C. TYPES. CARRIAGE, ETC., 9/- EXTRA ON ALL TYPES.

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1 WATT TRANSISTOR PUSH-PULL OUTPUT STAGE KIT.

Can transform your existing Transistor Receiver or Amplifier into a really high volume set. Two Matched GET15 Power Transistors, correct Push-Pull input and 3 ohms output transformers. Instructions. **£2.19.0.** Post 2/-.

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										DH77	7/6
										DK91	7/-
										DK92	8/6
										DK96	8/6
										DL35	10/6
										DL92	17/6
										DL94	7/9
										DL96	8/3
										EA50	9d.
										EAB80	7/9
										EAC91	5/3
										EAF42	8/6
										EB34	1/6
										EB41	7/-
										EB91	4/-
										EBC3	9/-
										EBC33	5/-
										EBC41	8/9
										EBC81	11/-
										EBF80	8/6
										EBF89	8/6
										EBL31	23/3
										EBL81	11/-
										EC52	3/9
										EC91	4/6
										ECC31	9/6
										ECC32	3/9
										ECC33	7/6
										ECC34	9/-
										ECC81	6/9
										ECC82	6/9
										ECC83	7/6
										ECC84	9/-
										ECC85	8/6
										ECC91	3/6
										ECF80	10/6
										ECF82	10/6
										ECH35	6/-
										ECH42	8/9
										ECH81	8/3
										ECL80	8/6
										ECL82	11/-
										EF36	4/-
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EL38	12/6	MU14	8/-	U22	6/6	UL46	9 6
EL41	9.3	N37	11/-	U24	7-6	UL84	8 3
EL42	9/6	N78	15/-	U25	12,-	UM80	9 6
EL84	8,3	N152	10/6	U26	12/-	UU6	9/6
EL85	11/-	P41	4/6	U31	7/9	UU7	9 6
EL91	4 9	P61	2,3	UCC	11/-	UU8	16 6
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GZ34	12 6	PX25	9,6	UBC41	8/3	Z66	8 6
GZ37	10,6	PY31	8/6	UBC81	12/-	Z77	4 -
	9.6	PY80	7/-	UBF80	8/6	Z152	5 6
		PY82	12/6	UBF89	9/3	Z719	5 6

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Amateur Television To-day

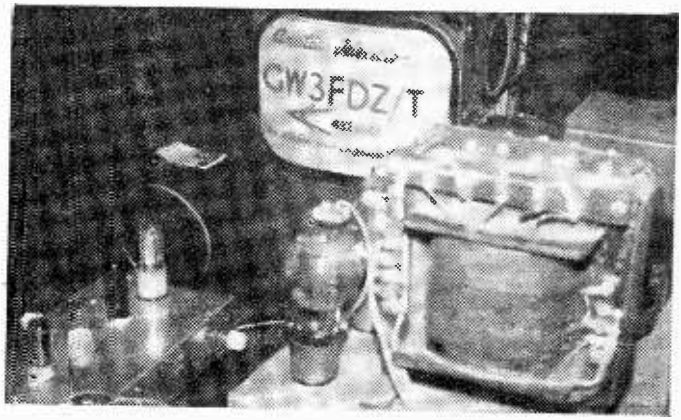
INTEREST IN TELEVISION AS A HOBBY IS GROWING RAPIDLY

By C. Grant-Dixon

THE BRITISH AMATEUR TELEVISION CLUB was founded some 10 years ago as an organisation linking up the activities of those who were interested in the transmission side of television. Initially, membership was confined to this country, but it soon became apparent that there were amateurs in other countries who were interested in television, even in places where there was no public television service. Hence it is not surprising that a fair proportion of the 300 or so members of the club reside overseas.

The activities of the club comprise the publication of a small quarterly magazine—"CQ-TV"—back numbers of which are available on microfilm; the loan of tape recordings on amateur television topics; the organisation of conventions, and the stimulation of interest in amateur television by demonstrations at local exhibitions. The last convention, held on September 6th, 1958, was featured in a subsequent edition of "Panorama" on BBC television. Films taken at the convention were shown and there was a live interview in the studio with G8PY/T's roving eye camera. On this occasion the BBC for the first time transmitted pictures from an amateur-built camera.

In the early days of amateur television in this country there were no camera tubes available except one at a price of £27 10s. This tube, which is now obsolete, was very insensitive, although of convenient size and easily scanned by electrostatic deflection. One amateur was fortunate enough to find one in one of the London surplus stores, but this is the only record of any having been bought this way over here, although in the USA complete surplus TV cameras are still available. With the disappearance of this tube, the British Amateur Television Club managed to persuade certain British manufacturers to part with some of their second grade camera tubes at greatly reduced prices and the Vidicon (Staticon) is currently available in this way. This tube, which is the basis of most industrial television camera chains, is fairly sensitive but should be operated with a high level of illumination to reduce the "lag" which is inherent in the conductive photocathode. The tube is magnetically scanned and focused, and has a special (and rather expensive!) socket. It is only just over 1in. in diameter and standard 16mm cine camera lenses can be used; in fact it is eminently suitable for most amateur purposes.



The 931A (on the left) is set up in front of a scanning tube with a transparency on its face.

The author's colour TV camera on display at a Hobbies Exhibition in Ross-on-Wye.

Not every amateur, however, is able to afford the £25 for a camera tube and quite a large number of satisfactory slide scanners have been built up from surplus material. Basically this involves putting a photomultiplier type of photocell (such as the 931A) in front of a short-persistence C.R. tube which displays a blank raster. A transparency or photographic negative is mounted on the face of the tube and the output from the photocell is then proportional to the light and shade of the

picture as it is scanned and thus constitutes a video signal. A typical arrangement is shown in Fig. 1. For best results, both this type of picture generator and the camera have to be run from a

The " Roving Eye " camera (on the roof of a former taxi) operated by G3KKD/T.

proper pulse generator which consists of three parts.

(i) A timer unit which divides the output of a master oscillator running at 20.250 cycles by 9,9 and 5 in stages; the resulting 50 cycle pulse is then compared with a 50 cycle reference signal obtained from the mains and the error signal is used to lock the master oscillator precisely. This master frequency of 20,250 is then divided by 2 to give the standard line frequency of 10,125 cycles.

(ii) A pulse generator unit which accepts the 50 cycle and 10,125 cycle trigger pulses from the timer unit and produces synchronising and blanking waveforms.

(iii) A blank-sync-video mixer unit which takes the video signal and blanks it with a gate valve so that no video signal passes during the line and frame blanking period. To this signal the sync pulses are added and the result is a composite video signal which can be sent over a coaxial cable or passed to the modulator of a transmitter.

The precise circuits for these units have been the subject of many experiments by B.A.T.C. members with a view to reducing the number of valves without sacrificing too much in the way of reliability. The basic " building blocks " of these circuits are the rectangular pulse generator and the gate valve. Multivibrators are usually used for the former, and a pentode such as the 6F33 or even two triodes in cascade can be used as a gate. By interconnecting these basic circuits it is possible to build up any desired waveform. Circuit designs can be calculated mathematically, but the more " hit or miss " methods commonly employed by amateurs can often be used with complete success. Many books give the theory of these and other circuits and are readily available from any good public library; but the reader who looks for complete circuits with all components values given may be disappointed. It was, in fact, the absence of practical information of use to the amateur which led to the formation of The British Amateur Television Club and the publication of " CQ-TV."

In short, the construction of a complete television camera chain is not a task to be undertaken lightly, and it will undoubtedly baffle the constructor who has had no more experience than the construction of a simple straight radio receiver. For the person who has already built a TV receiver, however, it is a logical step and opens up vast new fields of interest and experimentation; apart from the excitement of producing one's own pictures on the screen, there is the possibility of colour and even of recording on tape. Some members are experimenting with a low frequency television with a view to recording pictures on tape so that an illustrated lecture could be recorded on a twin track tape.

Finally, for those who wish to pursue this further, the secretary of the British Amateur Television Club is D. S. Reid, 149, Ongar Road, Brentwood, Essex, who will be pleased to send further details to any enquirers.

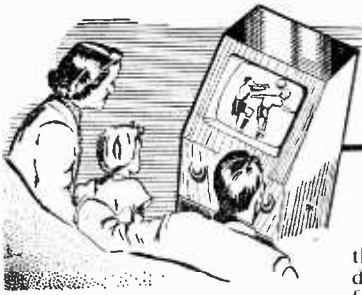
New Thermostatic Soldering Iron

A NEW thermostatic soldering iron, with accurate temperature control, has been developed from an N.R.D.C. patent by a small Scottish engineering company. It is particularly useful for fine work.

The firm is the Cardross Engineering Co. Ltd., whose managing director (Mr. G. S. Meek) believed that there was an urgent need for a high-quality instrument of this kind. His idea was to provide a temperature control of plus or minus 15 deg. C., at a normal setting of 230-250 deg. C. Enquiries at the Patents Library, however, showed that the General Post Office already had a patent in existence covering the idea and as this was in the hands of the National Research Development Corporation for exploitation, Mr. Meek applied for a licence to manufacture.

Cutting Costs

The next step was the development of the basic idea, which was to make the differential expansion of an inner non-ferrous metal rod and an outer case operate a micro-switch by an intermediary magnifying lever movement. Trials showed that a number of points required further investigation and experiment. Mr. Meek, who is an engineer, carried out this work personally, as a result of which he succeeded in dispensing with the expensive Invar steel (an iron-nickel alloy with a low co-efficient of expansion) originally specified. In its place he used ordinary mild steel, cutting costs by about 50 per cent.



UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

DURING recent weeks I have heard several amusing descriptions of the activities and methods of operation at some of the smaller independent television stations in America, which appear to be following the free-and-easy trends of the much older small-town sound radio stations. The happy-go-lucky atmosphere is apparently quite different from the nervous tension of the large network studios in New York, Chicago and Hollywood.

The programmes are based mainly upon sponsored features relayed from the major networks, eked out with hired 16mm. films and a strictly limited amount of local live programmes. In some stations, locally originated live features are limited to interviews and news. Others boast a 16mm. film unit, and, in a very few cases, an O.B. truck. It must be remembered that in some isolated districts in the USA, there are two or three independent TV stations competing for the attention of viewers in areas which have populations of little more than 100,000 persons. Naturally, the income derived from sales of advertising space is not very great. Consequently, stations have to be run on a most economical basis, with the minimum of staff. Quite a few stations are able to carry on a service with only about forty programme and engineering staff —and there is no sharp line of demarcation between the two sides. Some stations employ a number of part-timers, who spend the day in radio shops or garages, before coming along to the TV station in the evening. My informants told me that the average standard of transmission was not very high in these stations (with a few exceptions). But there was no doubt about the enthusiasm of the staff.

Studio Equipment

As for the equipment, many stations operate with "packaged" basic equipment sold by four or five leading manufacturers. This comprises a two-camera studio equipment, with a simple master control for dealing with slit and with incoming network programmes, a 16mm. tele-cine apparatus, and, of course, a transmitter. It should not be forgotten that, unlike the pattern of British television operation, in America the transmitter side is often very much integrated with the studio equipment, and is in the same building, even in the same room! In some cases, the engineers in charge of the transmitter also carry out other duties, such as watching the camera control units and adjusting the racks. One of the results of such a method of operation is that the engineers acquire a very wide knowledge of all sides of their work—in some cases, even of work on the programme and announcing sides.

Tyne-Tees Television's Videotape Recording Unit. This machine was exhibited by TTT on the Independent Television stand at the recent National Radio and Television Exhibition at Earls Court.

Provincial Atmosphere

THE contrast between the large London television centres and the smaller provincial stations in Britain is much less than in America. Nevertheless, the atmosphere in the British provincial stations has some of the informal characteristics of the smaller American stations, at the same time retaining the high pitch of efficiency expected of a metropolitan TV centre. The staffs are much larger, but not as great as the legions of programme and engineering personnel necessary in London or New York. A recent re-visit to TWW's Pontcanna Studios at Cardiff was a pleasant experience. Here, a certain element of informality and a maximum of enthusiasm had not yet been tempered by the frustrations so often noticeable in London. The influence of American master control layout is seen here at its best. Additional camera equipment, presentation studios and camera control rooms had been

added since my last visit and the staff were looking forward to the prospects of using an Ampex video-tape equipment. This will be mounted on a vehicle so that it can be used either at Pontcanna Studio or at TWW's new Bristol studio, due to open in a few months. It will also probably be able to be used on exterior locations, in the same way as Granada's mobile Ampex equipment. The decision to construct a large main studio stage 80ft. × 60ft., and only about 23ft. high to the "grid," has been a wise one, although it was surprising at the time when they started operations. I noticed a number of small sets around the stage which, I was told, were more or less permanent and available for regular features. Heights in excess of 23ft. are rarely required and necessitate more expensive and complicated equipment for carrying the lights.

TWW's new Bristol studio will be slightly larger than Pontcanna and will include many of the newest developments in equipment and techniques that have come to light in the last couple of years.

TV's Growing Power

COMPETITION between BBC and I.T.A. grows, and, in spite of all the network tie-ups, so does rivalry between the various commercial programme companies. The major four, A-TV, Associated Rediffusion, Granada, and ABC Television, now wield enormous power, and even the smaller companies are able to buy their way into the newspapers, radio relay companies, foreign and Commonwealth TV and radio fields, and equipment companies. They have undertaken their responsibilities with great discretion, and even dignity. The major mistakes have occurred when unfettered politics have occupied the television screens.

Video-tape

THE standard Ampex video recorder, now used by nearly all the British television organisations, including the BBC, is a streamlined looking piece of equipment. Nevertheless, it is heavy and bulky, intended for use in a large control room. Granada TV have modified one of their Ampex machines to fit in a much smaller console, with its monitor and racks. This smaller sub-divided version of the Ampex has been fitted into one of the Granada "Travelling Eye" mobile trucks, which carries complete equipment for a single TV camera, sound channels and control apparatus. The camera can be operated on the roof mounting or remote, with lengthy cables, and both vision and sound can be recorded while the event is taking place. Power is supplied from a mobile generator, which can be towed behind the camera truck. Thus, the television camera and microphone can be sent at short notice on news assignments without the necessity of microwave links or post office lines for communication with the studio, and is independent of the mains electricity supply.

The Theatre

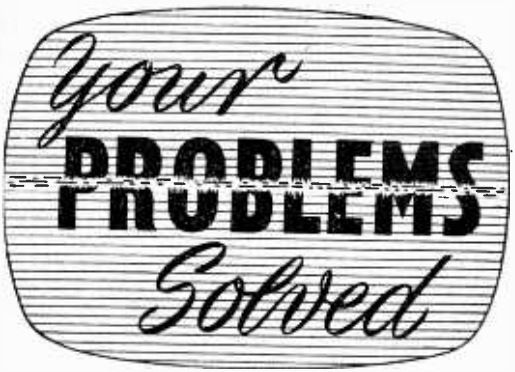
THEATRES, one by one, seem to be closing their doors. Television is partly, but not wholly, to blame for this. A few theatres in London and provincial towns continue to attract large audiences, principally through a combination of good and well-known actors, good plays, modern seating comfort and ventilation. A few would like to bring their houses up to date with such modern refinements as multiple channel dimmer switchboards, the latest types of lighting, new decorations, fixtures and fittings.

Alas ! They cannot afford it. That is where television comes to their aid, and in various ways both the BBC and I.T.A. programme companies help considerably and several theatres have cause to be grateful for financial help received.

The Organ and TV

THE organ was more or less exclusively used by the Church and the fairground for many, many years—for it is an ancient instrument. Then, in the 1900's, a few large organs were used in big halls for concerts other than religious ones. A little later, huge travelling organs, which could be divided up into small sections for mobility, toured the English music-halls. Max Erard and Zona Vevey were exponents of the most famous of these 20-ton monsters, which required quite a team of skilled removal men to take them down and assemble them. Next, the cinema took up the organ as an interval turn—still huge, but operated partly by electrical controls. The electronic organ was developed over many years before it became a practical and reliable proposition. Its portability compared with any of its predecessors was striking, to say the least.

Cinema organs have lost popularity for the moment, but the organists have found other employment, playing these highly portable, and now quite reliable, electronic devices. Television studios, particularly the I.T.A. programme companies, find that they fulfil programme requirements of all kinds, from parlour games to epilogues, and at the same time are sufficiently light to move around from studio to studio. They vary in size from the small monophonic type, used in conjunction with other instruments, to elaborate multi-keyboard instruments, at prices from about £100 to over £2,000.



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

PYE V14

There is a 1in. gap all round the picture, although I have improved this by adjusting the width plug to the maximum. When switching the set on, there is no line lock, but by turning contrast to maximum then back to normal, the picture locks. Adjusting the picture vertically only results in cramping on foldover at the top. Could this be low H.T. volts as both line and frame are affected although frame locks perfectly? —B. Canter (Tooting, S.W.17).

The metal rectifier, contact cooled type 14-RA-1282 should be replaced. If the poor line lock continues, replace the top centre PCF80.

FERGUSON 3081

The sound is all right but the picture is very dark on both ITV and BBC. I have replaced valves PCF80, PL81, PY81 and EY86, also H.T. rectifier. With the gain control full on and increasing brilliance control picture goes negative, but does not get any brighter.—C. P. Johns (Sheerness).

The tube appears to have lost emission. However, the rear focus cone should be removed and the ion-trap magnet on the tube neck adjusted for maximum brilliance. Check the 220kΩ feed resistor to pin 10 of the C.R.T. base and the .01μF decoupling capacitor, also 10kΩ anode resistor (pin 6) of the PCF80 video amplifier.

FERRANTI T1205

There is a bright ½in. vertical bar at the left of the picture with a gradual darkening of the picture towards the right hand side. Thus, if the right hand side of the picture is visible the left hand side is far too bright. All capacitors and EL38 in the line timebase have been checked by substitution and also resistors (except the two pots). The line lock is O.K. and little non-linearity of the trace is apparent except the bright bar at the left hand side.—F. B. Pemberton (Cheshire).

The 560kΩ resistor which feeds the EL38 suppressor grid does not connect the H.T. as may be thought. It is connected to the brilliance control and if the grid of the tube is not properly decoupled, the grid will be modulated at line frequency. The 0.1μF capacitor wired from the feed to pin 5 of the C.R.T. to H.T. should, therefore, be replaced.

Quite apart from this we would direct your attention to the 120kΩ 2W resistor situated at the top of the line output transformer which is a common cause of timebase trouble.

DEFIANT TABLE MODEL TR1756T

For about the last year I have been having trouble with picture size. After about an hour's running figures on the screen become elongated and the raster widens into thick lines, after which, if I don't switch off, the picture seems to move up from the bottom of the screen. It begins to black out until I am left with a line of light about an inch wide across the centre of the screen. The sound is perfect.—F. Hurley (Liverpool).

You should replace the front left side ECL80 valve (as viewed from the rear). This is the frame output valve and the symptoms given describe the effect of loss of emission in this.

VIEWMASTER

My set has been in use now for almost nine years, with the original C.R. tube, a Mullard MW31/17, still in good order. On switching on, sound is normal, but line and frame hold controls must be adjusted to get a picture. After about ten minutes the picture fades slightly (gradually) and starts to slip, needing readjustment of both sync controls. After about an hour picture brightness returns to normal, but during a viewing period occasional adjustments to sync controls are necessary to hold the picture.

This happens each time the set is used, picture quality seems about normal, but frame and line holds are very sensitive and need to be readjusted occasionally to resolve picture. I have checked valves by substitution and also tried realignment, but no improvement. These symptoms have developed gradually during the last 12 months.—H. E. Tonkin (Yatton).

There may be several causes for the poor synchronising you now experience. We suggest replacing R21 and C18: also checking, and if necessary replacing, R70 and C55. Also check that the alignment of the vision receiver is as specified.

COSSOR MODEL 932

This set uses a Mullard MW31/74 tube (round). When the set is first switched on, the picture appears, but the vertical edges do not fill out and have a wavy appearance. This gradually fills out as the set warms up. The tube is certainly on the low side, and is boosted. I tried a new tube at one time and the effect stayed at all times, never filling out, whilst the wavy edge just kept changing shape all the time. With the new tube there was pronounced fold over with a light star-shaped impression from corner to corner across the screen. The EY81 is new and I tried a new PL81 and PY81, but these had no effect.

I should also like to replace the present tube with a 14in. rectangular tube. What components, if any, would have to be changed to make this possible ?—J. Running (Aberdeen).

The wavy edge on your screen is due to glass charges on the tube and is present to some extent on all the Mullard 12in. tubes. A remedy which sometimes works is to clean the screen with an anti-static paste. allowing as long as possible between its application and removal.

The substitution of a 14in. tube into your set presents the problem of scanning power, as we doubt if the 932 will be capable of providing enough width for a 14in. tube.

EKCO T216

This set is five years old; I have fitted a transformer for boosting the tube, and have now got a good picture. Now I would like to fit a converter or turret tuner. Could you please suggest a suitable one which would be simple and easy to fit (for channels 5 and 10) ?—G. Corbin (Newport, Mon).

You may either use the Cyldon U16H or the Brayhead 16S with 16BA4 converter (if you use the latter ask for it to be supplied with UCC84 and UCF80). They both plug in to the holders of the first two valves in the set, but are both rather large for inclusion in the receiver cabinet. They will go in but you may be better advised to purchase the external mounting type in its own box

PYE CONTINENTAL

Some time ago, the picture started to close, a broad black line shows at the bottom of the screen, and a narrower line at the top and sides. I have renewed the PCL82 frame output valve, with no improvement. The picture also, whilst being very steady, is losing definition, and appears "hazy" except in close up. I also notice, at times, the picture and sound "dim" together, and there is a noticeable mains hum present.—E. J. Webber (Fulham, S.W.6).

The metal rectifier may easily be the cause of your trouble, as other readers have experienced similar failures. Our own remedy is to use an Automat TV5 metal rectifier. This needs mounting on top of the EHT unit on a strip metal bracket.

COSSOR 937

After the set has been working for some time noise somewhat like a motor cycle develops. It continues on and off for lengthy periods, but I can get rid of it by switching either over to channel 4 or channel 2 and back again. Can you please tell me where the trouble lies ?—S. H. Hewings (Norwich).

This is usually caused by a faulty decoupling capacitor (.001μF) associated with the sound I.F. stages. These are the two 6BX6 valve stages at the rear of the R.F. unit. The capacitors are wired from pin 8 to chassis in each case. The valves may also be suspected.

FERGUSON T103

I have not been able to obtain EHT. I have renewed the line output transformer, PY81 and PL81, also EY51 but cannot hear any whistle at all. All the valves light up except EY51. I have tried spark tests. Could the trouble lie in the oscillator can ?—I. Bevan (Rhondda).

If there is no whistle at all, not even a faint one. check the two EF80 valves on the left side of the chassis. If both are in order, check the 4.7kΩ 2W resistor connected to pin 8 of the PL81. The line output transformer may then be suspected.

PHILIPS 1115U

I would be very pleased if you could help me with a fault which has appeared on my set. After it has been on for about 30 minutes a series of white lines appear, covering the bottom inch of the screen. After a while these change to a black band blotting out that part of the picture.—W. Hirons (Tipton, Staffs).

The PL82 frame output valve on the front left side chassis is to be suspected. then the ECL80 to its rear. The capacitors associated with the PL82 should be checked if the fault remains.

SOBELL T347

My trouble is lack of brightness with the control fully turned up. On looking at the back of receiver I find the voltage selector flange wrongly set at 230V, the voltage in this district being 240. This was set by the supplier 18 months ago.

I would also welcome instructions regarding removal of the chassis from the cabinet, together with methods of making condensers safe to handle.

Could you tell me whether it is possible to replace the EY51 without removing chassis ?—Wm. Hunter (Lydiate).

Lack of brilliance can be due to low EHT. in which case the EY51 could well be responsible. We also suggest you check the voltage on the grid of the C.R.T. It should read 0-110V. dependent upon the setting of the brilliance control. If, however. with control at maximum. the voltage is not about 75 volts, this could then suggest that your C.R.T. is suffering from low emission.

The fact that your mains voltage is 240V and the tapping is for 230V should not be detrimental in any way.

To remove the chassis. remove mains plug—back and front control knobs. side escutcheon. inspection panel and speaker leads. Finally. remove the four chassis bolts and the chassis can then be withdrawn. Normally. on switching off a receiver. the electrolytic condensers discharge through the circuit.

Before touching EHT components. short circuit them to earth.

It is possible to replace the EY51 without removing set from the cabinet. Remove screening can and lay the set on its side: the tags can then be soldered, making good, rounded joints.

REGENTONE "BIG 12"

I cannot obtain sharp focus on this set. There seems to be no medium between white and black and at its best the focus is poor (for example, one

(Continued on page 49)

cannot read small print on the screen). Also, after operating for about 30 minutes, the picture suddenly becomes very bright, although this can be adjusted by the brightness control. I have just renewed the EL38 and the EY51 and also the resistor R68. The metal rectifier, which was 14A100, has been replaced by 14A86. Do you think this will be suitable for any length of time? —S. Berry (Chorley).

The voltage applied to a 14A86 should not exceed 250, and as a higher voltage is applied to the "Big 12" the life of the 14A86 may be curtailed.

We advise you to check the video amplifier stage components, resistors, etc., adjust the focus magnet gantry for optimum focus and then suspect the tube itself.

FERGUSON 992

This set has been converted to I.T.A. with the maker's own converter, type "A." The BBC is perfect but I cannot get sound or vision on I.T.A. When a probe is placed on L2 of the converter heavy "mush" results on sound and vision. There is no response whatever when tuning pedals are pressed. All valves have been checked by substitution. The gain control is in order but valve voltages are not stated on the service sheet. Is it possible that the oscillator is not working? When the switch on the converter is turned, usually loud clicks and flashes on the screen are evident.—F. Johnson (London, S.W.6).

It would appear that the oscillator stage is not working although defective aerial or aerial plug could give rise to similar symptoms. We mention this since the probe at L2 does promote "mush." The suspects are the 8.2k triode anode feed receiver, its 800pF decoupling capacitor and the grid components. Upon inspection it may be found that the 8.2k resistor is overheating owing to the capacitor having developed a short circuit.

DEFIANT TR1252/TA

The tube is soft, and I am going to replace it with a new one, but could you tell me if it will take a larger tube? Will it take a turret tuner, or will it need one that runs off the mains, for converting to I.T.A. channel and BBC channel? —R. E. Perrett (Peterlee).

Although the CRM152a 15in. is strictly speaking a wide-angle tube, the deflection angle is only 67 deg. and the existing scanning circuits should be able to fill it. A duodecal base is required. A turret tuner can be used and the Cyldon U10L or Brayhead 10s (with "U" series valves) is recommended.

PHILIPS PROJECTION TG1800A/15

The picture has collapsed to a thin line across the screen. I cannot get height by adjusting the height or frame hold controls. What valve or component do you advise checking or replacing in the frame section? I have no service sheet for this receiver.—L. Blackburn (Oldham).

The first component we would advise you to check is the frame blocking oscillator transformer. This is a small black component with four tags, secured by two screws under the rear centre of the chassis. Check the continuity of each pair of tags: normally, one winding will be found open circuited. The thin line should not be observed on the screen unless the protection circuit is inoperative or the frame scanning coils are disconnected or defective. We presume, therefore, you have observed the line on the face of the actual tube.

C.R.T. BOOSTING

I wish to boost my C.R.T. The set is a Cossor 932 and the tube a Mullard MW31/74.—W. Smeson (Donnington, Salop).

We would make one point clear before dealing with your query, it is that the M.W. 31/74 should not have excessive boost applied to its heater as this will almost certainly result in complete loss of emission. To moderately boost the heater, wire a 5kΩ 10W resistor from the live fuse to pin 1 or 12 of the tube base socket, whichever causes the heater to glow more intensely.

KOLSTER-BRANDES FV40

There is no picture, though the sound is in order. Valve EY51 will light up only when the width plug is left out. Then I get only a line from top to bottom of the screen and this line is broken in two places. I can then draw about a ¼in. spark from the anode of EY51 with a screwdriver. I have a service sheet for this receiver.—H. Gass (Nottingham).

First check the 0.25μF capacitor wired from the boosted H.T. line to the 5V4 anodes. If this is in order, a short could be present in the line scanning coils or the line output transformer could have shorted turns.

BUSH TV24

The picture keeps on rolling downwards. When I do get it to lock the vertical hold control is fully anti-clockwise. I replaced the first ECL80 and the PZ30. It stayed all right for a week and then started rolling again and sometimes it is hours before I can get it to relock.—S. Brett (London, E.17).

There are a number of resistors connected with the frame hold control. Check the 680k (blue-grey-yellow) feed resistor which has probably "gone high." If this restores the optimum position to approximately the centre but the sync is weak (no positive lock) check the WX6 interlace rectifier (small red and black rectifier).

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6C6	7/6	12K7	8/6	EF91	8/6	UBC41	10/6
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6J6	7/6	80	10/6	EM81	12/6	UY41	10/6
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