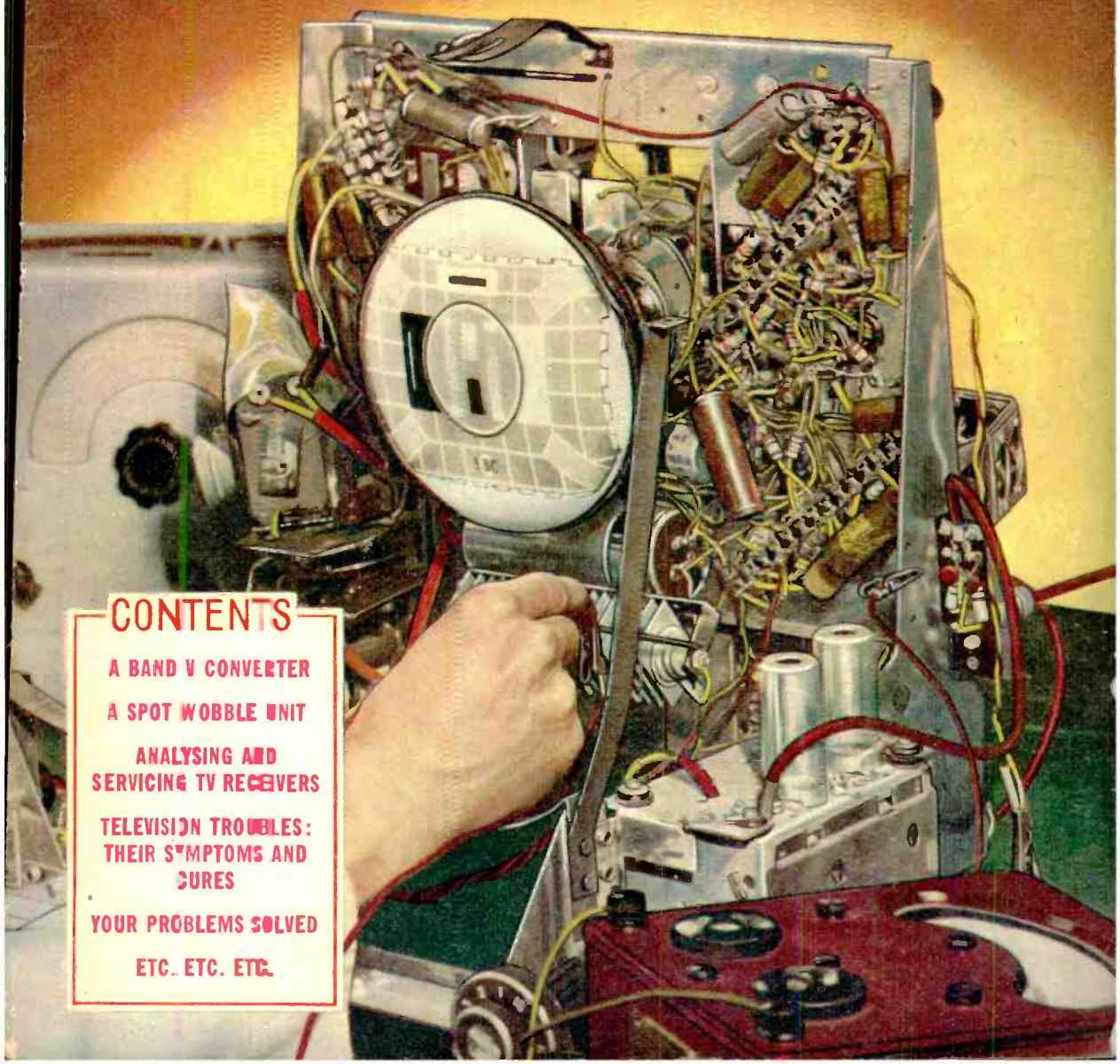
A NEW AID FOR SERVICING

Practical Television

1/3

AND TELEVISION TIMES

JUNE 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

REPLACEMENT C.R. TUBES

IN our Editorial in the April issue we pointed out that if cathode ray tubes were rebuilt, Purchase Tax had to be paid by the customer unless his own tube was rebuilt and returned to him. We showed that if P.T. were paid on a rebuilt tube, then, since tax had already been paid when it was new, H.M. Customs and Excise would have received tax twice.

This anomaly was removed in the recent Budget. There is now no purchase tax on any replacement cathode ray tube. This means that tubes being rebuilt need not retain their identity throughout the process. There is no doubt that but for the tax on replacement tubes many viewers would not have put up with inferior quality pictures.

The Chancellor said in his statement : "I propose to free replacement TV tubes from tax. This tax has been suggested to me as being unduly burdensome, and technical developments in the reconditioning of tubes have made it difficult to administer the tax with equity.

"I must, of course, take care that the concession does not give an opportunity for tax avoidance on the sets themselves, and a Treasury Order to safeguard this point will be laid before the House."

This Treasury Order became effective on April 8th, and means that TV receivers (whether or not in a cabinet) which are complete or substantially complete, except that they lack a cathode ray tube at the time when they become the subject of a chargeable transaction, are to be treated for tax purposes as if a C.R. tube formed part of the receiver, and the value of a new tube of appropriate size and character is to be included in the full value of the receiver upon which tax is to be charged.

Thus, tax cannot be evaded by marketing TV sets without tubes. Kits of parts for building receivers are, however, exempt from the Order.

OUR QUERY SERVICE

WE must once again remind readers that, whilst we are always pleased to help them with their technical difficulties, they must provide evidence of their readership by enclosing with their query the "Queries Coupon" from the current issue (to be found on the last page of "Your Problems Solved"). A stamped, addressed envelope must also be enclosed.

We cannot supply diagrams or provide instructions for modifying surplus equipment unless a relevant article has appeared in PRACTICAL TELEVISION and then only if copies of the issue concerned are available for sale.

We are receiving so many letters from those who are obviously not readers of the paper that we are compelled to insist upon rigid adherence to our rules.

Our next issue, dated July, will be published on June 19th

A New Aid for Servicing

DETAILS OF A SPECIALLY-DEVELOPED CATHODE-RAY TUBE AS A SERVICING ACCESSORY

IN pursuance of our policy of keeping readers informed of the latest developments, we now have much pleasure in giving details of an entirely new approach to the servicing problem.

As most readers will know, the servicing of television receivers can be one of the most difficult of the serviceman's tasks. Apart from the many different sections of the complete circuit which may have to be tested, and perhaps rewired, one has first to gain access to the wiring. In many receivers this is underneath a chassis which can be of quite large dimensions, and to add to the serviceman's difficulties, there is probably an elaborate structure mounted on the top of the chassis into which is firmly mounted the picture tube. If it is a receiver of the console type it may be found that the tube is firmly attached to the front of the cabinet, and the chassis may be removed a short distance only, not sufficient to enable the wiring to be made accessible until the tube has been detached from the cabinet.

Several methods of simplifying the task have been proposed and, in fact, one manufacturer now makes the chassis in vertical form, hinged on one side so that it may be swung back (after the back of the cabinet has been removed) and there is no need to disconnect any leads. All parts of the wiring may thus be checked. Another manufacturer constructed the assembly on metal tubing with the various sections disposed round the tubing which carried, in the centre, the picture tube. The entire unit could then be placed on the bench, and it could be rolled and turned very easily to permit any section to be tested.

The G.E.C. have, however, attacked this problem from a different angle and have produced a special picture tube, which they call a "setting-up" tube. This is a 6in. unit with magnetic focusing, and it is claimed that not only does it facilitate the servicing of receivers but, as a result, the work is more economical and should thus reduce the overall cost of service work.

Advantages and Applications

The new tube will plug into the majority of television receivers which use a 14in., 17in. or 21in. rectangular tube, and it operates directly from the available supplies. The small size and weight compared with the standard picture tubes makes this an extremely useful accessory for setting-up or checking a receiver either on the test bench or in a customer's own home.

Typical advantages and applications are :

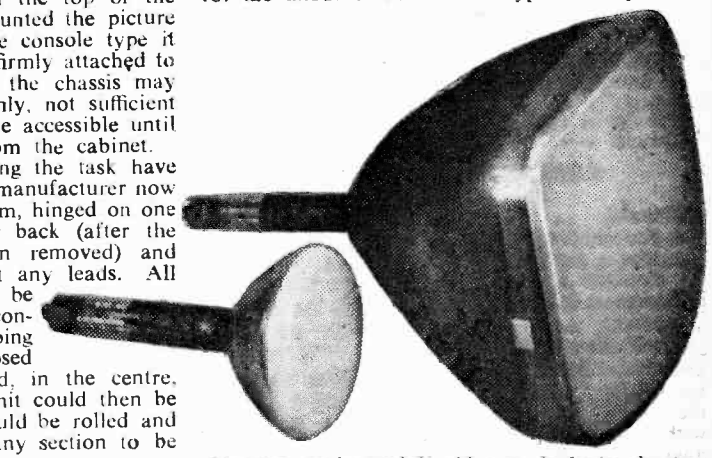
1. The avoidance of unnecessary handling of heavy and bulky picture tubes during any test of a receiver.

2. The use in cases where a large picture tube is suspect to ascertain quickly and easily whether the fault is in the picture tube or elsewhere.

3. In sets in which the picture tube is fixed tube to service the set. The risk of damage to the large and expensive picture tube is therefore avoided.

4. In sets in which the picture tube is fixed to the chassis, the small size of this "setting-up" tube increases the accessibility of the components on the chassis.

This new tube will normally not require any special mounting arrangements, the focus magnet or deflection coil mountings sufficing to hold it in position. An electrostatic model is also available, and the reference type numbers are 1668VMM for the magnetic model and 1668VTM to the cabinet, there is no need to remove the for the electrostatic model. The standard duodecal base is fitted (B12A) and the side contact for the anode is of the CT8 type. The price of this tube is £7 10s. nett to the trade, and a specially designed wooden carrying and storage case is available.



The new tube (on the left) with a standard tube, showing its small overall size.

International Transistor Exhibition and Convention

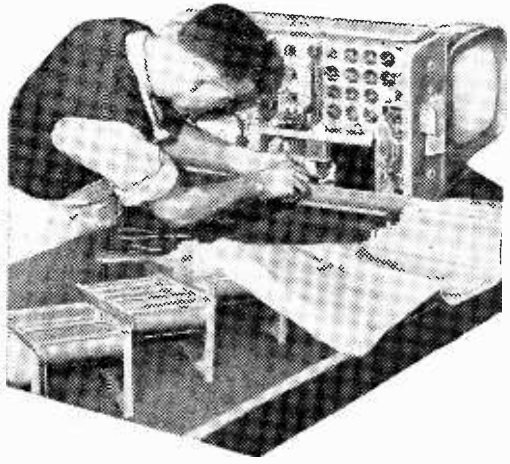
21-27 May, 1959, Earls Court, London

FINAL details for receiving convention delegates and exhibition visitors have now been resolved, and tickets for admission to the exhibition are now available.

Both convention and exhibition are being promoted by the Electronics and Communications Section of The Institution of Electrical Engineers. Some 2,000 delegates from all over the world are expected to attend the convention, very ably organised by the I.E.E.

Visitors to the exhibition will include scientists and engineers representing all developments and applications of transistors and semiconductor devices, and also science students from schools, technical colleges and universities.

Application for exhibition tickets, whether from individuals, scientific bodies, engineering companies, government departments, or from universities, technical colleges and schools, may therefore be sent to: Industrial and Trade Fairs Ltd., Drury House, Russell Street, London, W.C.2.



Analysing and Servicing TV Receivers

No. 7.—THE EHT SUPPLY

By "Diadem"

LINE flyback EHT.—Fig. 26. Although we are only to discuss different methods of obtaining EHT it will do no harm to diagnose briefly the whole circuit in Fig. 26 as it is all tied up with the high voltage supply. The scan coil circuit is coupled back to the grid of the oscillator, V1, by C2; this enables part of the output of V2 to be fed back into the oscillator, V1. This pulse is clipped by the triode V1, its phase is reversed and the output from V1 anode is fed into the grid of V2 through the coupling condenser C1. The frequency of the oscillator is controlled by the sync pulses at the end of each line. These pulses are fed into the anode of V1 thereby enabling the repetition frequency of the timebase to keep in step with the transmitted line frequency of 10,125 c/s. The line transformer is auto-wound. This gives it much greater efficiency than if it were a double wound type. The output of V2 is passed through the auto transformer to feed the scan coils.

Boosted H.T.

In the older type of television receiver the power generated during the line flyback was wasted in a series condenser and resistor arrangement shunted across the scan coils. this was done to improve the waveform, prevent ringing and to give a more linear scan. A large amount of power was wasted in this damping resistor. To-day this power is reclaimed and rectified by the efficiency diode V3 and smoothed by C3, about 150 v. extra being achieved by this method. The H.T. line voltage is added to this and then passed to the line amplifier anode V2, bringing the voltage on this anode to 350 v. This enables a larger line scan to be obtained than would be possible with only 200 v. As a large flyback pulse (up to 4 kV) appears between the cathode and heater of V3, a special type of rectifier is employed with much greater insulation than is normally required.

The "Overwind"

The EHT voltage is obtained from the rapid flyback pulse developed across the scan coils, this maximum to minimum change causes a high voltage pulse to be induced in the line transformer. By extending the winding (points 1 and 2), sometimes referred to as an "overwind," and by connecting the end of this winding to a suitable rectifier, this pulse may be rectified to supply a steady voltage of 10 kV or more to the tube. The smoothing condenser is C4.

Rectifier Heater Supply

The heater supply for V4 is obtained by induction: a winding consisting of a few turns of wire is placed near the high potential winding. Providing the line circuit is working correctly the

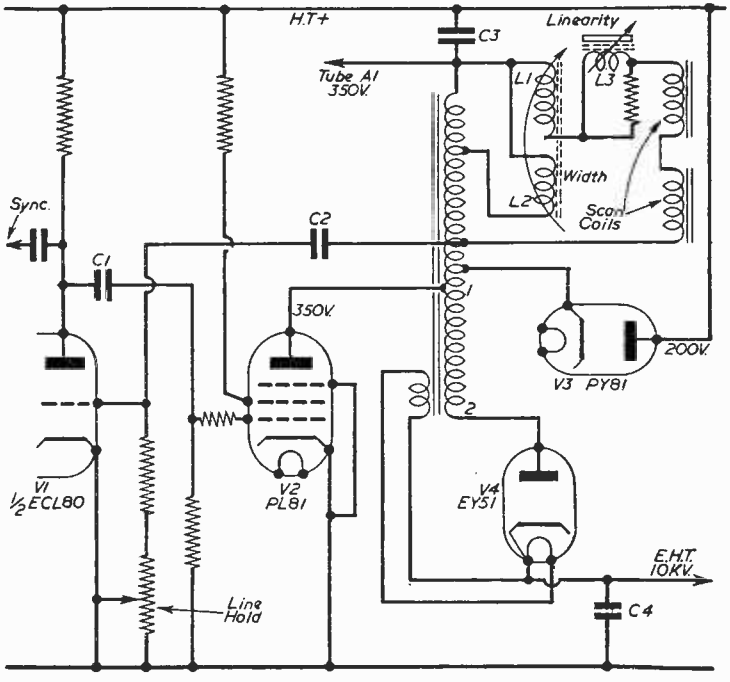


Fig. 26.—Circuit for line flyback EHT.

correct heater voltage will be supplied to V4. Although the voltage on V2 anode is stated to be 350V. readers are advised not to take a voltage reading at this point as a pulse of several kV is present. The width is controlled by sliding a

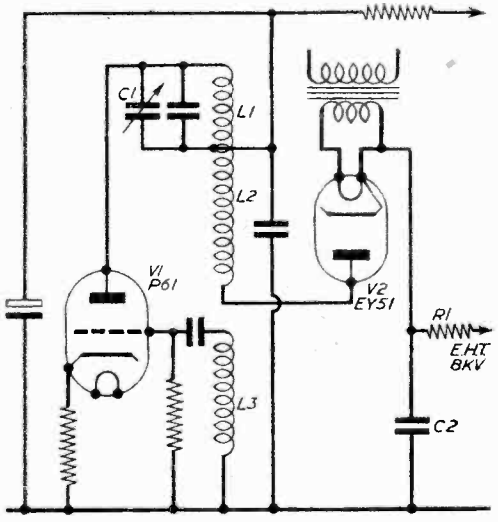


Fig. 27.—R.F. EHT supply.

ferrite rod through coils L1 and L2. This method does not affect the linearity or the EHT potential. L3 is the linearity coil and the core is also a ferrite rod. The correction of the waveform is carried out by adjusting a magnet with respect to the core.

R.F. Oscillator

Fig. 27.—EHT is obtained by means of an R.F. oscillator V1. The coil L1 is a tuned anode winding inductively coupled to the grid winding L3. The frequency of the oscillations is controlled by the variable trimmer C1. The oscillating voltage formed across L1 is fed to L2, the EHT winding; this voltage is stepped up by L2; rectified by V2 and smoothed by C2 and R1. The EY51 heater voltage can be obtained by a separate winding on the R.F. coil as in the case of the flyback system. By adjusting C1 it is possible to alter the EHT output by several kV. This might cause a greater voltage to be induced across the heater winding and "blow" the rectifier heater. This trouble can be overcome as shown by using a separate heater transformer of high insulation.

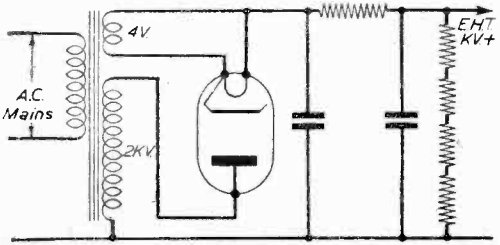


Fig. 28.—Mains driven EHT (positive supply).

Figs. 28 and 29.—These diagrams show two methods of obtaining EHT from a mains transformer. These two types of supply are dangerous and more costly than other forms of EHT generation already described and are not used by manufacturers to-day for television receivers. No explanation of the circuits is given as they work in the same way as a normal H.T. supply.

Fig. 30.—This diagram shows another form of EHT supply known as the ringing choke. A sawtooth drive is derived from a separate oscillator and the EHT output can be varied by reducing the output from the oscillator by means of variable control R1. For a working description of the remaining circuit refer to the notes already given on flyback EHT.

EHT Faults

No EHT.—Where line flyback is used, lack of EHT can be caused by a faulty line generator or amplifier, line transformer, rectifier, tube or booster diode. A faulty transformer or line valve will prevent the rectifier from lighting up. Rotate the line hold control and listen for the whistle varying in pitch. Check the line valve top cap for a small spark. If a spark is present, turn down the brilliance control. If the rectifier lights up orange-red check for a large spark at its anode and a small spark or fizzy sound at its cathode. If the spark at the cathode diminishes or cuts out when the brilliance control is advanced suspect low emission of rectifier. If there is no spark with the brilliance at minimum remove the cap from the tube and test the cap for a spark. If

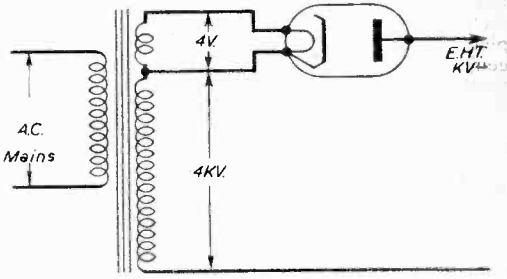


Fig. 29.—Mains driven EHT (negative supply).

a spark is present, suspect a faulty tube. Check the voltage on its grid and cathode and if it is a tetrode or pentode tube check A1 for a short. The tube may be soft or consuming excessive current. If there is still no spark disconnect the rectifier anode from the transformer; try the anode tag for a spark. If there is one suspect the rectifier for an internal short or filament winding leakage. Examine the EHT smoothing condenser and its resistor if one is fitted. The condenser can be disconnected temporarily. If the rectifier does not light examine the line valve and its components and if found to be in order suspect a shorted turn on the line transformer EHT overwind, or open circuit of the heater winding.

EHT rectifier glows blue.—The valve is "soft" or overloaded. Check its smoothing components

and "Metrosil" if fitted. Check the C.R.T. and for leakage across transformer windings.

Picture expands on whites and defocuses or "blows up" on advancement of the brilliance control. This is poor EHT regulation and low EHT. Check the rectifier for low emission. If the heater is dim check the line output valve.

Inability to obtain raster with aerial connected, and on removal of the aerial the raster becomes visible. Check for very low EHT rectifier.

R.F. EHT Supplies

The faults occuring in this type of supply are few. The oscillator valve may cease working as its emission drops. Replace the valve or see if it is oscillating. In some circuits the current consumption will rise considerably and almost double in some cases and the valve temperature will be high when oscillation ceases. Check the trimmer across the coil and resistors and condensers for faults, also test for spark as given in the earlier paragraph on flyback EHT. Finally, suspect breakdown or leakage across oscillator coil transformer. These units are very reliable and safe to handle as the EHT drops to a low value if the supply leads are accidently touched. Therefore if there is a leakage occurring across any components in the unit, oscillation may cease altogether.

Ringing Choke EHT

This particular method is very similar to the flyback system except in this case the line output valve deals with the scanning only and a separate EHT generator supplies the tube voltage after rectification. Sometimes the EHT unit is complete with its own sawtooth generator, EHT generator and rectifier, and in others the sawtooth drive to the EHT generator is supplied by the line output valve, and if the line timebase breaks down there will be no EHT. Fault tracing and spark tests on the lines of flyback EHT can be employed.

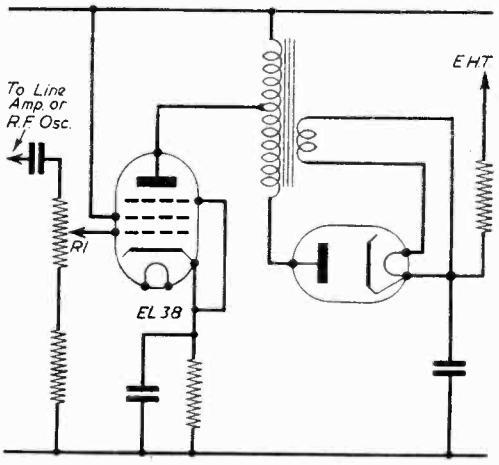


Fig. 30.—Ringing choke EHT.

Mains-driven EHT

In this method the main faults are insulation breakdown in the transformer windings and this usually means replacement. To prevent breakdown between windings and the core, always insulate the core from the chassis and in cases where one side of the secondary is connected to the core, this wire must be removed and the connection taken to chassis. The transformer should not be operated without a load, and bleeder resistor chain across the EHT supply should be carefully checked for open circuit. This type of supply can be lethal and great care should be taken when handling it. If the bleeder chain goes open circuit the smoothing condensers will remain charged up and these can hold a very dangerous charge for some time after the set is switched off. Intermittent arcing in the transformer, condensers or resistor chain will be noticeable on sound as a clicking noise and on vision as interference spots or "snow."

(To be continued)

E.M.I. Colour TV

WHEN the Anatomical Society held a symposium recently at the Department of Anatomy's lecture theatre, University College, London, E.M.I. Electronics Ltd.'s new colour television equipment was used to give the capacity audience a close-up view on a 4ft. × 3ft. screen of experiments being carried out under a microscope in a small laboratory several floors away.

The lecturer demonstrated how to prepare biological specimens for use in an electron microscope. As thin sections of tissue vary in colour, when viewed in reflected light according to the thickness of the slice, colour was the most important factor to be conveyed to the screen. The E.M.I. colour TV camera was connected to the optical microscope under which the tissue was being cut.

This is believed to be the first time in this country that this technique has been televised in colour.

Insulated Instrument Wire

SIEMENS-EDISWAN P.T.F.E. instrument wire for use in electrical instruments is now available from them. Initially, two types are available; for use at voltages up to 500 volts r.m.s. and 1,000 volts r.m.s.

The wire, for use where conductor temperatures of between −75 deg. C. and 250 deg. C. are experienced, has either single or stranded annealed copper wires each silver plated to a radial thickness of not less than 0.00003in. The P.T.F.E. is extruded, which permits a high degree of concentricity to be obtained. Whilst the insulation is not loose, it can be cleanly stripped for connections. Electrically, P.T.F.E. has high dielectric strength and low power factor. It offers complete chemical resistance to all known solvents except molten sodium and fluorine gas. The wire is non-chafing owing to the low coefficient of friction: it is highly flexible, and will not harden or perish.

Transistors in TV Receivers

THE SIXTH ARTICLE OF A SERIES DEALING WITH THE USE OF TRANSISTORS IN MODERN TELEVISION EQUIPMENT

(Concluded from page 513 of the May issue)

AS will be gathered from the details which have already been given, scan magnification offers possibilities of simplifying the line timebase circuit which are yet to be explored.

Field Timebase

The system of scan magnification used in the experimental receiver reduces the power requirements of the field timebase by a factor of four. Thus even allowing for the good knee of the transistor collector characteristic, the power requirements would be considerable if conventional techniques were employed; a consumption of 150 mA from a 12 v. H.T. line is a realistic estimate.

The circuit used is shown in Fig. 25(b). This circuit is not put forward as an engineered design or as a practical proposition for the future. It is, however, an experimental embodiment of some novel ideas of D. R. Birt which are thought-provoking and offer some guide to future techniques. These ideas may be developed as follows :

The information given in this short series is taken, with permission, from a Paper read to the Television Society by B. R. Overton, B.Sc.(Eng.), A.M.I.E.E., and published in the Journal of that Society.

The use of transistors and a low potential H.T. line suggests direct drive of the deflection coils from the output stage. (The elimination of the output transformer represents at least a halving of the power consumption.) One method of direct drive is single-ended push-pull. If class B operation is possible then a further saving in power consumption is achieved. There is the difficulty, however, of providing the pulse of voltage required to effect the flyback in the inductive component of the deflector coils. In the circuit used in the receiver this flyback voltage pulse is supplied to the deflector coils by a pulse generator independent from the output transistors. Thus the full H.T. is used for the power functions of the timebase and maximum economy is achieved.

A block schematic of the circuit is shown in Fig. 25(a). This should be studied before proceeding to the more detailed description of the experimental circuit which now follows.

The timebase oscillator is a multivibrator (Tr29 and Tr30, Fig. 25(b)) producing a short current pulse which by the grounded emitter transistor Tr31 and fed to the pulse transformer L41. The positive going output pulse from this transformer is fed via the resistor RV12 and the diode D14 to the deflector coils L42. The diode D15 prevents the collector of the lower output transistor Tr38 conducting during the flyback pulse. The pulse is also fed via the diode D13 to the base of the upper transistor (Tr39) so that the peak potential stress appears across the base to collector junction of this transistor. By lengthening the flyback pulse as far as the blanking period will allow and making the pulse as square as possible the peak potential is minimised.

The positive-going pulse from the pulse transformer, L41 is also fed via a diode, D10, to the Miller integrator type of sawtooth generator, Tr34 and Tr32. The output sawtooth is fed via an amplitude control (RV8) and a balancing control (RV9) to a phase reversing transistor, Tr35, and an emitter-follower driving stage, Tr37. This emitter-follower drives the lower of the two output transistors into conduction during the first half of the scan. The phase invertor transistor has a constant current grounded collector transistor Tr36 in its collector circuit so that the whole of the change of collector current (Tr35) is fed into the base of

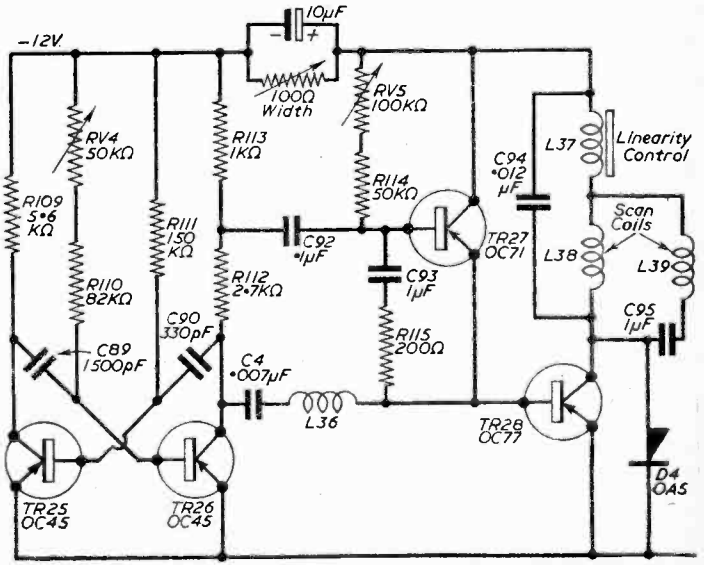


Fig. 24.—The line timebase.

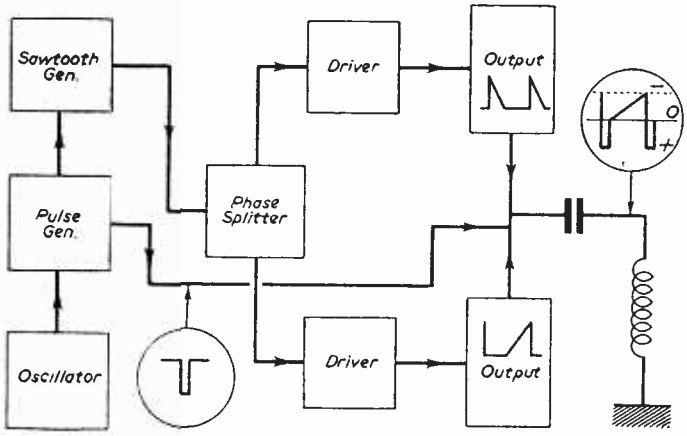


Fig. 25 (a).—A block schematic of the circuit.

Tr39 which is the upper of the two output transistors.

Adjustment for cross-over distortion is made by setting the bias of the output stages via their respective drivers with the resistors RV11 and RV13.

EHT Generation

The EHT potential must be stabilised against change in beam current and against change in battery potential within ± 0.3 per cent. if focus is to be retained with the scan magnification system. Furthermore, it had been decided to operate the picture tube at an ultor potential of 18 kV as this eased the problems of achieving a good spot size with the scan magnification system and also a bright picture with a limited video drive. Thus, the EHT generator presented a problem not covered by the existing literature on the subject of D.C. converters.

A circuit which gives the required performance is shown in Fig. 26. The heart of the generator is a square wave oscillator employing a saturating-core transformer (T4) and two transistors (Tr45 and Tr46). A further winding on the transformer, connected to a voltage doubler circuit (D22, D23, C110, C111) produces the EHT potential. Valve rectifiers are used for convenience. Their heater windings and a further winding to supply a 70 v. H.T. supply for the video stage are also on the transformer T4, but they are not shown in the diagram.

The essence of the stabilising system is to maintain constant the H.T. potential at point A (the supply to the square wave oscillator) using a Zener diode D17 as a reference. A change of potential at point A appears at point B owing to the high output impedance of the transistor, Tr44. The potential at B is compared with that across the Zener diode D17 by means of the long-tailed pair Tr40 and Tr41. The resulting change of potential at the collector of transistor Tr41 controls the series transistor Tr43 via the emitter follower Tr42 thus completing the feedback loop.

The inherent output impedance of the EHT unit, for constant potential at point A, is approxi-

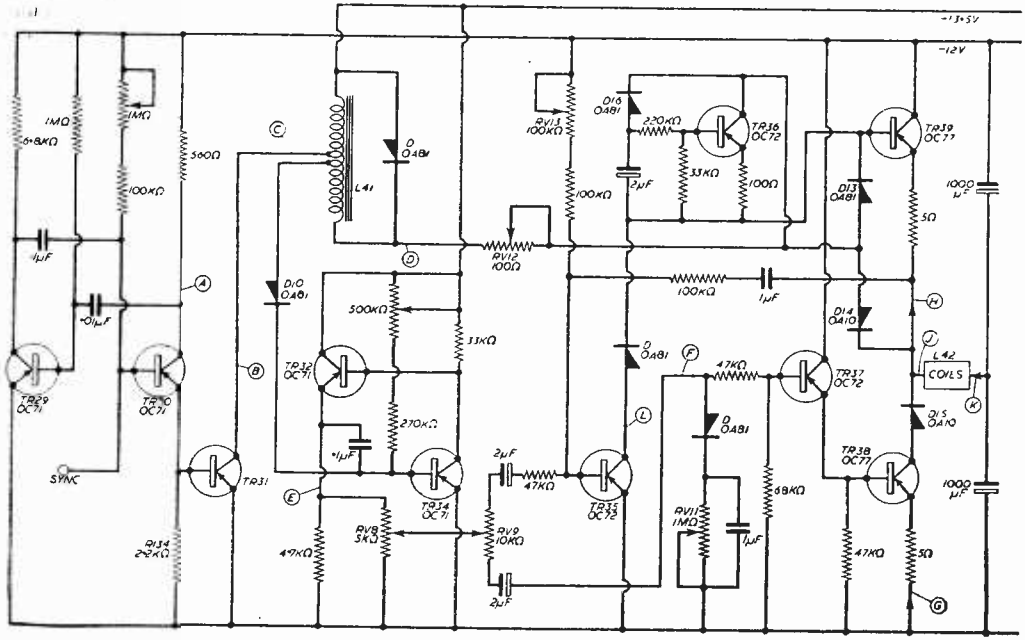


Fig. 25 (b).—The circuit of the field timebase.

mately 3 MΩ over the range 60 to 360 μA. (At lower currents the switching transients produce much higher output potentials. Hence, a bleed resistor (R130), (actually voltage dependent) is used to maintain a minimum drain of 60 μA). This output impedance is reduced by direct control of the feedback loop previously described with the EHT output current. The earthy end of the EHT winding is connected to chassis via the base bias network (R125, etc.) of the transistor Tr44. An increase of EHT current causes point C to move negative, point B to go positive, point D to go negative and so the potential at point A to go more negative also.

Pre-set Control

The pre-set control RV15 is primarily used to adjust the EHT source impedance to zero, but it does interact with the main "Set EHT" control RV16. Some care has been taken in stabilising this circuit against temperature changes (e.g., use of a long tailed pair, very low resistance base circuits throughout) and a good long term stability is expected.

The emitter follower Tr42 requires, for proper operation, H.T. potentials in excess of that of the main H.T. line. At present a −22 v. supply derived from the output stage (rectifiers, D20 and D21) and an extra 1.5 v. battery are used. Further development of this stage will depend on the answers to the questions posed earlier (under line timebase), but if a separate unit is required then some simplification of the present circuit is desirable. The following points require study.

With such a large power handling capacity a fault may have disastrous effects on other parts of the circuit. Hence, the effects of various faults must be investigated and every effort made to confine the damage done by the more likely dangers such as short circuit of the output terminals.

At present the operating frequency is low (400 c/s) and the final smoothing (required to achieve straight vertical edges to the picture) involves very large smoothing capacitors.

For the mean current being used with the presently available video drive the EHT unit is very inefficient. A unit matched more accurately to the requirements of the rest of the receiver would reduce the battery consumption considerably. More fundamentally, the sources of the losses need to be analysed and attacked.

Power Supply

The main H.T. supply of

(*Continued on page* 548)

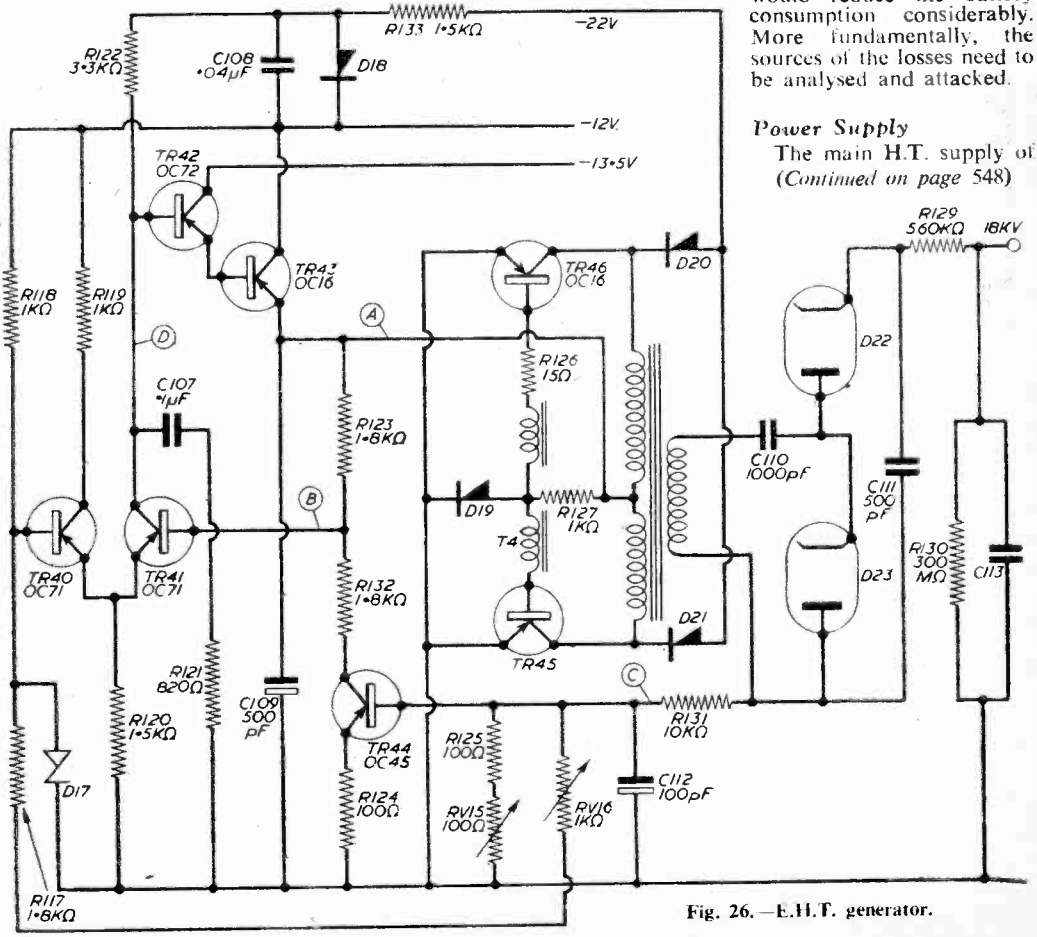
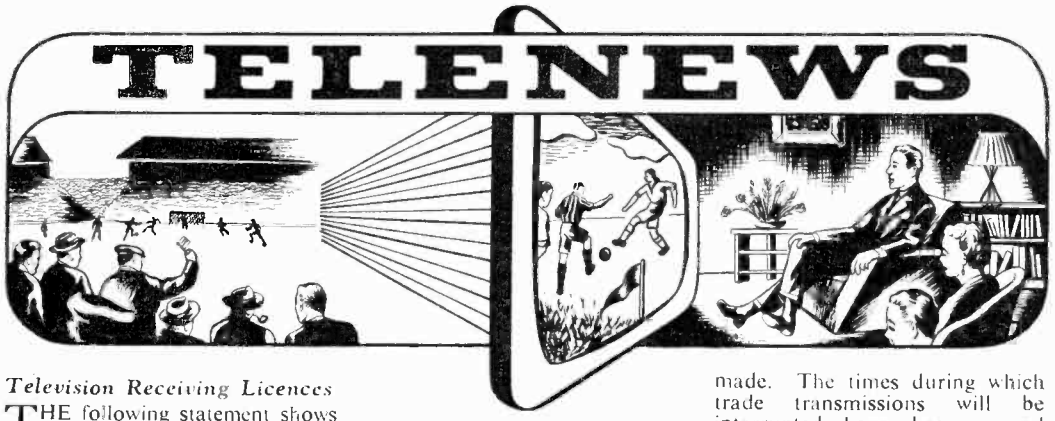


Fig. 26.—E.H.T. generator.



Television Receiving Licences

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

Region	*Total*
London Postal...	1,690,174
Home Counties	1,192,030
Midland...	1,430,911
North Eastern	1,508,696
North Western...	1,270,377
South Western...	756,447
Wales and Border Counties ...	549,308
Total England and Wales ...	8,397,943
Scotland	750,891
Northern Ireland	106,588
Grand Total	9,255,422

North-Eastern Electronic Exhibition

THE North-eastern Electronic Exhibition will be held at the Rutherford College of Technology, Newcastle, on May 27th to 29th.

Closed Circuit Television

THE importance of advertising, and in particular television advertising, to the British economy, received official acknowledgment in February last when the President of the Board of Trade, Sir David Eccles, inaugurated the closed circuit television and telecine system at the new Headquarters of L.P.E. Television Ltd., in St. Martin's Lane, London. The system, one of the most modern and extensive of its kind, was designed and installed by Marconi's Wireless Telegraph Co., Ltd.

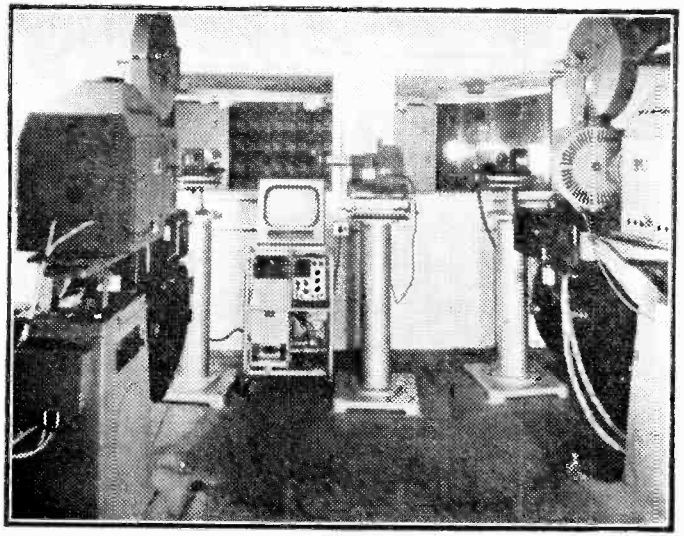
The system enables any executive to audition artistes without leaving his office. The audition is televised by a camera in the viewing theatre and studio in the basement and the signals conveyed by cables to the receivers in the various offices. The executive has only to switch on to see the artistes exactly as they would appear in a TV advertisement.

Trade Transmissions to be Interrupted

TRADE transmissions from the Lichfield, Winter Hill, Emley Moor, St. Hilary and Croydon stations of the Independent Television Authority are in future to be interrupted for a short period each day to enable carrier frequency measurements to be made. The times during which trade transmissions will be interrupted have been agreed with the R.T.R.A. and will be as follows:—Lichfield, 13.30-14.00; Winter Hill, 13.35-13.45; Emley Moor, 13.35-13.45; St. Hilary, 13.45-13.55; and Croydon, 13.45-13.55.

Programme Arrangements for S.E. England

PROGRAMMES from the I.T.A.'s station near Dover are, subject to contract, to be provided by Southern Television Limited. This station will serve an area stretching from the Medway towns to Beachy Head and it is planned to bring it into operation either late this year or early 1960. The area is contiguous to that in



The projection room of L.P.E. Television Ltd., with two Marconi BD871 television cameras mounted on pedestals for telecine work. (See "Closed Circuit Television".)

which Southern Television are already operating.

Southern Television have undertaken to cater for the tastes and interests of the area and intend to open a studio there. They propose to invite prominent people in the area to associate with them. This appointment follows upon the Authority's decision announced last November to make the Dover transmitter the first of a number of satellite stations to serve areas which do not require or make financially possible the operation of independent companies.

Solartron Traps the Transient

TO arrest transient phenomena and be able to study it at leisure by a trouble-free method has long been a need of scientists and engineers in almost every field of scientific research, development and industry. The new Solartron Infinite Persistence Oscilloscope, type QD.910 enables this to be done by "freezing" non-recurrent waveforms and other types of curves on an oscilloscope screen for as long as may be desired.

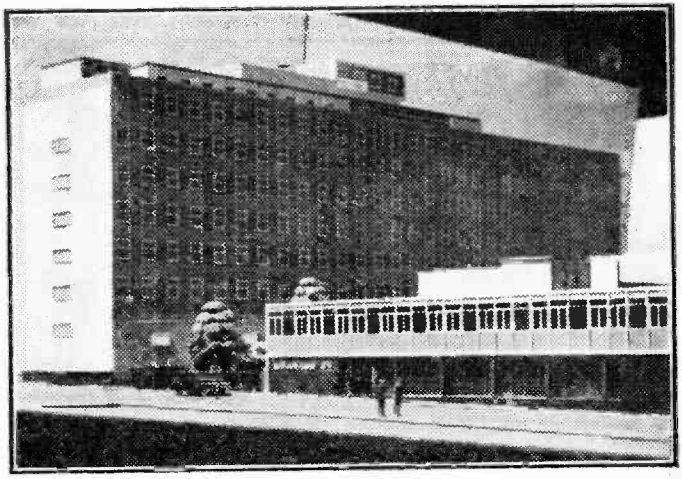
This oscilloscope employs a "Memotron" storage cathode-ray tube which gives an infinite trace persistence. The trace is immediately erasable after each investigation is completed. The QD.910 is a dual-channel instrument, each channel having a bandwidth of D.C. to 1 Mc/s.

Silver Medal for Benny Hill

THE Television Society's Silver Medal, awarded annually for an outstanding contribution to television as an educative or entertainment medium, was this year presented to comedian Benny Hill.

The medal was presented at the society's annual dinner at the Dorchester Hotel, Park Lane, on April 17th, when the Postmaster-General was present. Among the guests were Sir Ivone Kirkpatrick (chairman of I.T.A.), Sir Arthur fforde (chairman of the BBC), Mr. Sydney Bernstein (chairman of Granada TV Network), Dr. J. Bronowski, and many other television personalities.

Last year the society's medal was presented to Mr. Cliff Michelmore. It was instituted in 1948, and is the first of any such awards to be made in Britain.



A model of the new extension to the Granada TV studios in Manchester.

BBC's Election Broadcasts

IN view of doubts that have been expressed about the legality of the arrangements which were announced on March 18 for broadcasting during the next General Election, the Corporation wishes to make its position clear.

The purpose of all the BBC's Election broadcasts will be to help the public to cast their votes with as clear an understanding of the issues involved in the Election as the broadcasts may be capable of presenting. It will be no part of the BBC's intention to promote or procure the election of a particular candidate in any constituency. Candidates taking part in Election broadcasts will be asked to refrain from dealing with any point at issue in terms of their own, or any other individual's candidature.

Twenty-five Thousand Transistor Radios

WHEN Gilbert Davey finished his series, how to build a pocket transistor radio set, in the BBC Children's Television programme "Focus," 25,521 applications had been received for the pamphlet which accompanied the programmes. The writers ranged from a 78-year-old who wanted to make the set in his spare time, to a little boy in Pontypridd who had been run over by a steam roller. The original print order of 15,000 pamphlets had to be increased, first by 10,000, and then by 5,000. Applications, as we go to Press, are still arriving at the rate of 100 a day along with requests from young viewers for further technical information about the pocket size transistor set, about 1in. × 3in. × 5in. which works a hearing aid earpiece and costs about 45s. to make.

Videotape Recorder

AMPEX CORPORATION of America has developed a prototype modification to the firm's standard VR-1000 Videotape recorder permitting one machine to record television programmes on any two, three or all four of the television standards used throughout the world. Previously, television programmes could not be exchanged electronically between Europe and North America, for example, or between England, France and the rest of the European continent. With the Ampex "Inter-switch" modification, however, a Videotape recorder in Hollywood can record a television programme for American television, using 525-line cameras, and then switch to the 405-line system, for instance, to record the same programme with 405-line cameras for British television viewers.

The Problem of Interlace

By D. R. Bowman

IMPROVING PICTURE QUALITY

(*Concluded from page 508 of the May issue*)

AS explained last month line sync pulses are not long enough to allow the flip-flop action to take place; the valve remains cut-off, and only very small line pulses appear in the anode circuit. These are due to feed-through via valve capacitances.

Suppressor Driven Negative

When a 40 μs pulse appears on the control grid, however, the valve is cut-on for 40 μs. During this time the transitron has time to operate; not only is the suppressor driven negative (which has no effect on the anode current cut-off condition), but also there is enough time for C1 to recharge. As seen before, this will eventually cause the anode to draw current, and a steep-fronted pulse appears at the anode. At the end of the 40 μs pulse, the valve is again completely cut-off and the operation ceases until the next 40 μs pulse appears on the control grid.

Critical Time Constant

Thus it can be seen that every frame pulse gives a square wave at the anode, and what is more, identical waves on odd or even frames. Everything depends on the time-constant C1.R3 being adjusted to the correct working point greater than 10 μs and less than 40 μs. The values of C1 and R3 given in the diagram are thus suitable, and adjustment is made by varying R3 until proper interlace is obtained.

This circuit gives negative-going frame pulses at the anode and negative-going line pulses at the screen: both are at low impedance and are suitable for synchronising multivibrator timebase generators.

A very suitable valve is the EF50; the more modern 6F33 is also excellent in this circuit. Other pentodes do not have their suppressor grid characteristics constant enough in manufacture for valves to be readily interchangeable, and some experiment with R1 may be needed if such valves as the EF91 are used.

Patchett's Separator

This separator requires a pentode and also a double diode, and is thus not as economical in the use of components as the foregoing. It gives excellent results, however, and is used by the author in preference to any other. Once set up, it is impossible not to get perfect interlace on both scan and flyback, and the line structure produced on the tube face is exceedingly rigid. The photographs reproduced (on page 508, May issue, and overleaf) were each of three minutes exposure and show the interlace on scan and flyback respectively. It will be noted that the duration of exposure is such that no picture is visible at all, only variations of density, owing to the moving picture. The height of the picture where interlace on scan is shown has been much increased, so as to separate the lines clearly. The distorted appearance of the picture showing interlace on flyback is due to the presence of a temporary loudspeaker with considerable field.

Action of the Circuit

Fig. 7 shows the circuit diagram, and it will be easily understood that the basic device is a Miller integrator. The action is as follows :

A negative-going video signal (sync pulses positive) is fed to the suppressor grid of a pentode connected as a Miller integrator. The capacitor between anode and control grid is characteristic. This video signal is D.C. restored either by a separate diode (or crystal diode) or, if the pentode is a 6F33, by the diode internally strapped to the suppressor grid; the whole waveform is negative and the video part of the signal is cut off by the suppressor base.

During the period between pulses, the suppressor is sufficiently negative to cut off anode current, assuming pulses of about 6 volts or a little more

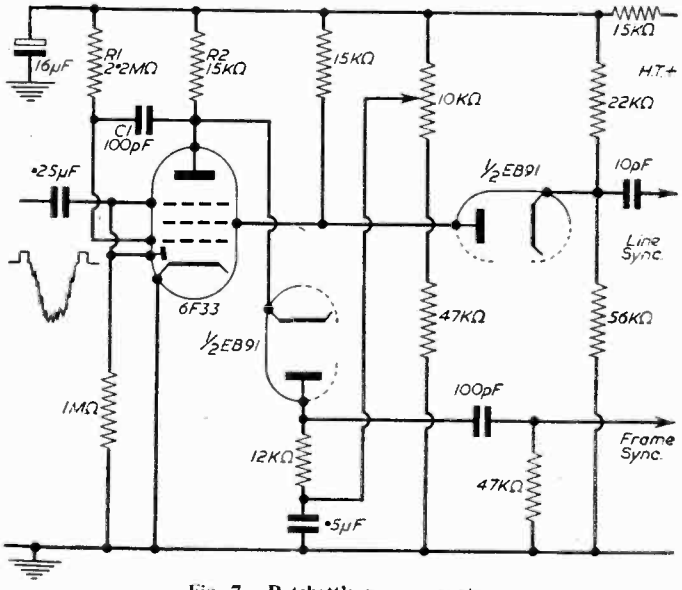
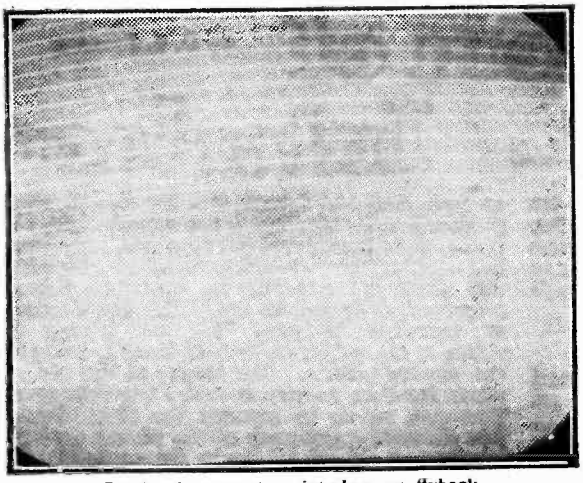


Fig. 7.—Patchett's sync separator.



Patchett's separator—interlace on flyback.

are present. The anode rises to H.T. voltage and the "Miller" capacitor C1 between anode and grid is charged up fully by the flow of grid current—the grid is returned to H.T. and does not interfere with this because the coupling resistor is 2.2M. During a pulse, the suppressor grid rises to nearly zero voltage and anode current begins to flow. Anode potential drops and drives the control grid negative *via* the Miller capacitor, and this tends to reduce anode current; and equilibrium is soon achieved. The Miller capacitor now begins to discharge through R1 and R2 according to the usual "Miller" run-down" effect. At the end of the pulse on the suppressor, the suppressor again goes negative; anode current is cut off and C1 again re-charges.

Proportional Voltages

Since the Miller run-down is linear it is clear that the anode voltage falls four times as much during 40 μs frame pulses as during 10 μs line pulses. Thus, pulses differing in duration are converted into voltages differing in exact proportion.

The smaller 10 μs line pulses are clipped off by the suitably biased diode, leaving triangular pulses at the frame output terminal. These are differentiated by the 47 kΩ resistor and 100 pF capacitor to give exceedingly sharp pulses to synchronise the frame timebase generator.

Since the control grid is driven negative during pulses, line sync pulses are available from the screen grid. Owing to capacitance between suppressor and screen, some video signal also appears at the screen and this is clipped off by the suitably biased diode before the line sync pulse is passed to the line timebase generator.

Polarity

Positive-going pulses are obtained from this circuit. These may be used direct to synchronise thyratrons, blocking oscillators and some multivibrators, though not all. If the pulses are of incorrect polarity, an amplifier of unit gain can be interposed. A 6J6 is hardly suitable, but an ECC81, with separate cathodes each connected *via* 150Ω to chassis (unbypassed) and anode load resistors of 1kΩ, will prove effective without much pulse distortion.

Three very reliable sync separators have been described, at least one of which will be suitable to every experimenter's requirements. Each is, however, subject to noise, and this applies to all circuits. It may well be that in some cases, where fringe area reception is obtained, the very sharp pulse fronts that these circuits give are rendered less effective by the presence of noise. In such cases, the old-fashioned integrator may prove superior—just because its sloping pulse front is less affected by noise.

TRANSISTORS IN TV RECEIVERS

(*Continued from page* 544)

the experimental receiver is 12 v. The current consumptions of the different stages in the receiver are as follow (in mA):

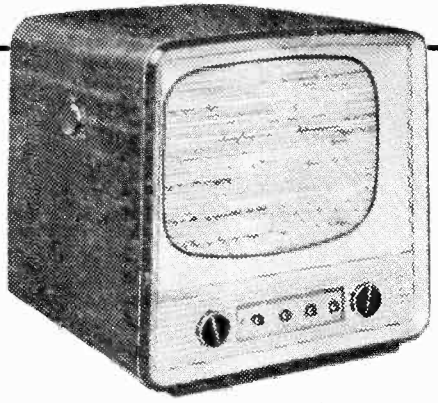
	12 v.	13.5 v.	70 v.
Converter...	6		
R.F. (full gain) Mixer ...	4		
Sound I.F.	6		
Vision I.F.	6		
Audio (typical)	15		
Video Synchronizing ...	2.5		7.5-30
Line	32		
Field	31		
E.H.T.	550-900 (200 μA)	18-35	
Tube heater	150		

A triode picture tube is being used, hence no first anode supply is required. This would be no problem if required but could readily be provided from a tap on the EHT generator transformer. The video stage supply is part of the EHT generator though its power consumption is listed separately above. The EHT unit and the frame timebase require extra H.T. lines (20 v. and 13.5V.). The 20V. supply again is part of the EHT unit but the 13.5 volt line is provided by an extra 1.5V. rechargeable cell.

Clearly future development will lie in the direction of more efficient EHT generators and the elimination of "special" H.T. supplies. In the view of the heavy power consumption inherent in a television receiver it does not seem that a portable television receiver will be fitted with expendable batteries unless some startling new advance in technique is realised.

The 12 volt supply of the experimental receiver is a Venner H705 silver-zinc rechargeable cell. It weighs 2$\frac{1}{4}$lb. and has a capacity of 7.5 Ah at a 1A discharge rate. Such a battery could be recharged at home from the mains after a day on the beach or in the country enjoying television. Something along these lines seems the obvious answer to the problem of power supply if portable television comes in the immediate future.

TELEVISION TROUBLES



Their Symptoms and How They May be cured—10 By G. J. King

THIS month attention is focused on various models in the G.E.C. range of receivers, keeping to the usual pattern in this series of concentrating on timebase and synchronising faults.

Model BT1091

Although this model is of eight-year vintage it is still maintained in use by a large number of enthusiastic experimenters, as indicated by "Your Problems Solved" correspondence.

No Frame Scan

Sudden frame failure on this model, resulting in a bright, horizontal line across the screen, should lead first to a check of the negative feedback capacitor in the frame timebase. This capacitor, shown as C60 in Fig. 1, is valued at 0.005 μF and rated at 500 v. Owing to the relatively high peak inverse voltage to which it is subjected, it is often found to be short-circuit, resulting in the symptom mentioned.

It pays to make a replacement with a component of the same value, but rated at 1,000 v.

Out of Balance Line Hold Control

If, in order to secure horizontal lock of the picture, the hold control requires to be hard over against one of the stops (even then there may be a tendency for the picture to "tear"). The trouble is invariably caused by value increase of the 270 k resistor (R75) connected in series with the line hold control. A resistor of reasonably good tolerance should be used as a replacement.

Poor Line Hold

The lock is by no means definite, although it may tend to occur somewhere within reasonable balance of the hold control. It often happens that a change of camera or a distinct variation in picture content will result in the picture wriggling out of line lock. The first check should be of the 25 μF electrolytic capacitor connected to the cathode (pin 2) of the Z77 video amplifier valve. This may have decreased considerably in value or gone open-circuit.

Gradual Loss of Picture Width

After making the usual valve tests and the symptom still persists, a check of the value of the 470 k resistor in the anode circuit of the line oscillator is well worth while. This is often found to be high in value.

Intermittent Breaking-up of the Picture Horizontally

This can prove to be a difficult fault to pinpoint, and often demands the replacement of a number of components to facilitate location of the culprit.

However, in the majority of cases the trouble can be eliminated by replacing the 270 k (R75) resistor connected to the grid of the L63 (V18).

Horizontal Non-linearity

If the left-hand side of the picture is very much extended, with the right-hand side contracted and a bright, vertical line is present at the cramped side of the picture, attention should first be directed to the two 2,500 ohm resistors (7W) which are both mounted on the top of the rear control panel, and accessible for inspection. In the makers' service data, these are R73 and R74.

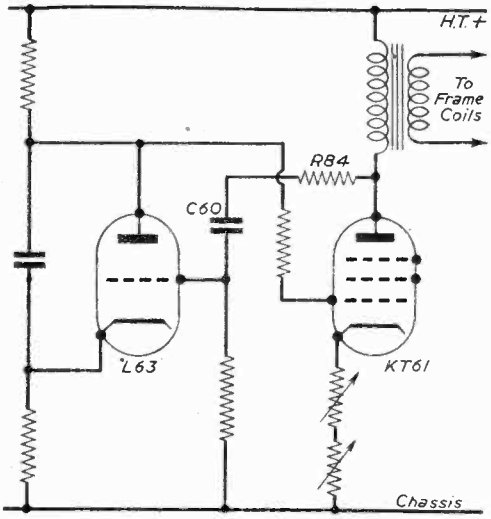


Fig. 1.—Frame timebase of the BT1091. C60 is prone to failure.

and when this symptom is present open-circuit of these components should be suspected. The trouble is also accompanied by failure of the horizontal form control.

Unstable Line Hold

Instability of the line hold with changes in picture content often means that the 1 MΩ resistor (R44) between the grid (pin 1) and chassis of the Z77 sync separator valve (V9) has gone high in

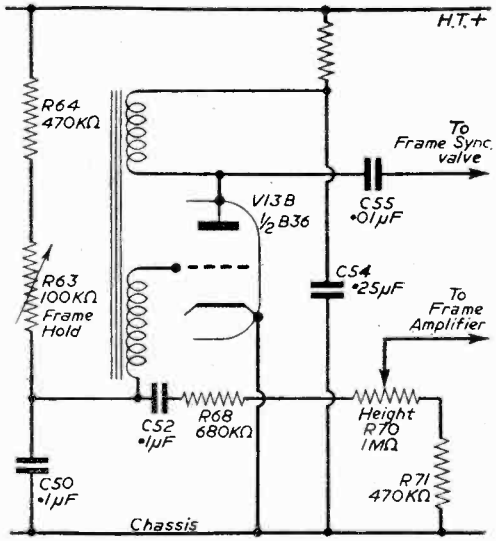


Fig. 2.—The frame oscillator section of the BT2147.

value. Replacement should be made with a ½ W type.

Wedge-shaped Raster

Full width at the bottom of the screen, gradually decreasing towards the top of the screen is the symptom typical of shorting turns in one of the line scanning coils. This can be proved by measuring the frame timebase volts across one frame coil section and then comparing the reading with the volts obtained across the other section. Under normal conditions equal voltage readings should be obtained. If they differ, however, replacement scanning coils are usually required, but in some instances the original coils can be kept in service by removing them from the tube, applying insulating varnish in generous proportion so that it seeps well into the windings and then bake them in a very low oven for an hour or so. After this process they should be re-installed on the tube neck.

Model 2147—White Vertical Band

If the symptom is a vertical series of short, irregular white lines across the left-hand side of the picture, which may be persistent or come and go in a random manner, the trouble is invariably caused by intermittent flashover between the windings in the line output transformer.

Unfortunately, there is little that can be done to alleviate the effect, apart from replacing the transformer. The winter months tend to aggravate the trouble, particularly if the set is switched on from cold, along with the heating, in a room which has been left unheated for most of the day. Condensation is the responsible element initially, but once a flashover of this nature occurs it rapidly destroys the winding insulation.

On very early models of this series, corona discharge was troublesome between the studs on the line output transformer to which the EHT rectifier valve wires are soldered. In extreme cases, the insulation burns out completely, but where the trouble is less severe impregnating the insulation material with a good quality wax is helpful. Anti-corona grease can also be tried.

Weak Frame Hold

Value increase of the 0.01μF frame sync coupling capacitor (C55 in Fig. 2) is one cause of this symptom, but if this component appears to be in good order and the frame "tries" to lock near mid-position of the frame hold control, attention should be directed to the diode interlace filter circuit (V11B).

If the frame hold control, on the other hand, is hard towards one side of its travel, the trouble is almost certainly caused by value increase of R64 in Fig. 2. A good tolerance resistor must be used for replacement, otherwise it will be found necessary to try a number of resistors and select one which gives a reasonable balance of the control.

Characteristic alteration of the B36 (V13B) is another cause of the effect, and to save a valve replacement it is permissible slightly to adjust the value of R64, away from the stipulated 470 k ohms, in an endeavour to secure frame hold control balance.

The best frame lock is obtained on this series

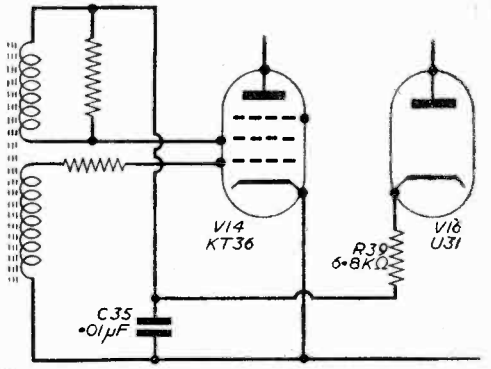


Fig. 3.—Basic circuit of the line amplifier of the BT5145.

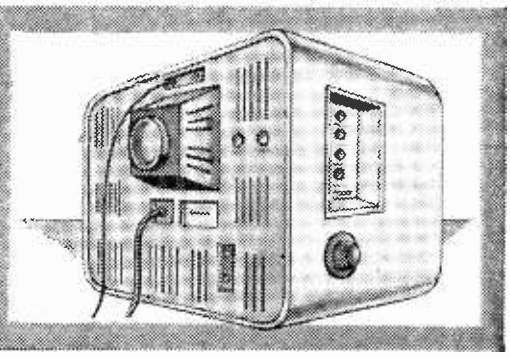
by adjusting the hold control until the picture slips slowly downwards and then carefully re-adjusting the control until the picture *just* locks.

Model 5144 and Series—Frame Bounce

This model uses the same circuit as the BT2147 for the frame timebase. If frame bounce is accompanied with intermittent decrease in height, the frame timebase coupling capacitor (C52 in

(*Continued on page* 561)

Servicing Television Receivers



No. 47.—THE FERGUSON 306T AND 308T

By L. Lawry-Johns

THE 306T is a 17in. table model with a Mullard MW43-69 tube. The 308T is a 21in. model with a Mullard MW53-20 tube. They are not intended for use in the extreme fringe areas. The chassis are identical using a turret tuner and A.G.C. derived from the sync-separator input.

Line Linearity and Width

There are several features which require explanation. One is the width adjustment which also controls the line linearity. This lever is situated on the upper right-hand side. Width is adjusted by moving the lever forward or backward about its pivot. Linearity is adjusted by moving the lever vertically so that the pivot is moved up and down. The adjustments are necessarily interdependent. The picture quality control is provided to vary the video response of V5 as in certain areas, especially in Scotland and Wales, the Band I signals require extra video compensation to avoid smearing and lack of detail. The method employed is simply to increase or decrease by plug and socket adjustment the amount of capacity in the video amplifier cathode circuit.

Frame Linearity

There are two frame linearity controls. Normally only the lower will need adjustment as this affects the overall linearity, i.e., even spacing of scanning lines over the whole of the picture. The upper pre-set control only affects the extreme top of the picture and will not normally require adjustment.

The turret tuner is not quite so conventional as may be thought. To remove the outer channel selector and inner fine tuner knobs, the centre screw must be removed. Hold the fine tuner knob while doing this to prevent pressure being transferred to the "works." Once the centre shank is unscrewed the outer knob may be pulled off. If it is found that this outer knob when turned does not rotate the turret, a new spring clip will be required. As the turret tension is considerable the clip often breaks leaving the knob to revolve on the spindle without actuating it.

Gain Control

The gain control varies the cathode bias of the PCC84 valve and while this control is being adjusted, it is normal for signs of instability to be evident and this must not be regarded as a fault.

The rear cover continues under the cabinet and slides in grooves. It is secured to the rear by sliding clips, not by the screws, which only secure the clips. The screws should only be slackened, not removed when the rear cover is taken off.

Cabinet Construction

The cabinet itself is in two sections; a baseboard upon which the chassis is mounted and a cabinet shell which is removable. This is detached from the baseboard by first removing the rear and bottom cover, unplugging the speaker

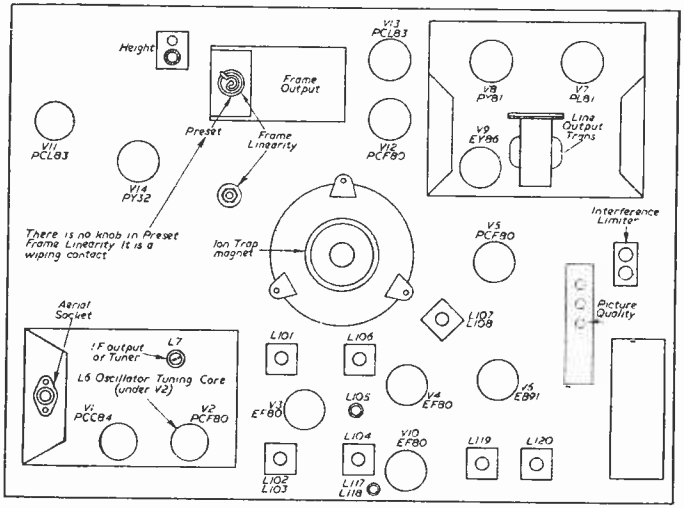


Fig. 1.—Rear view of chassis.

leads at the top left-hand corner and removing the tuner knobs as previously described.

Remove the moulded escutcheon covering the speaker aperture and control panel by taking out the four woodscrews. The control knobs remain on their spindles. Remove the two 2 B.A. screws from the side metal brackets and push the shell forward. It will move about ¼in. It can then be lifted off. A dust-excluding sponge-rubber ring is fitted and this must be carefully refitted when replacing the shell.

We now deal with faults which commonly occur with these receivers.

No Sound, Picture Normal

This is almost always due to failure of the upper left side PCL83 valve which is marked V11 on the chassis layout. Where a certain amount of hum is heard, normal hum that is, and faint noise varied by the volume control, check V10: EF80 (Fig. 1).

Where the background noise is high with perhaps a tunable vision buzz, check the PCF80 (V2) on the turret tuner. Where the sound is completely dead and V11 has been tested, check for H.T. at pin 6 of V11 base as the sound output transformer primary may be open-circuited.

Distorted Sound

Check V11. PCL83, 100 kΩ resistor to pin 1 and 1 MΩ resistor to anode pin of V6, EB91 sound interference limiter. Valve V6 is a double diode; the second section functions as the vision limiter, the operation of which is governed by the right side pre-set control, just to the right of the picture quality clip and plug adjustment.

No Height

The symptom is a bright line horizontally across centre of the screen. This is almost invariably caused by a defective V13 (PCL83) situated top centre. Where V13 is not at fault, check V12 (PCF80) below and make a voltage check to pin 6 of PCL83 as the frame output transformer may be open-circuited.

Insufficient Height

Check V13 and V12, then the 470 kΩ resistor (yellow violet yellow) to the height control (V12 triode anode circuit).

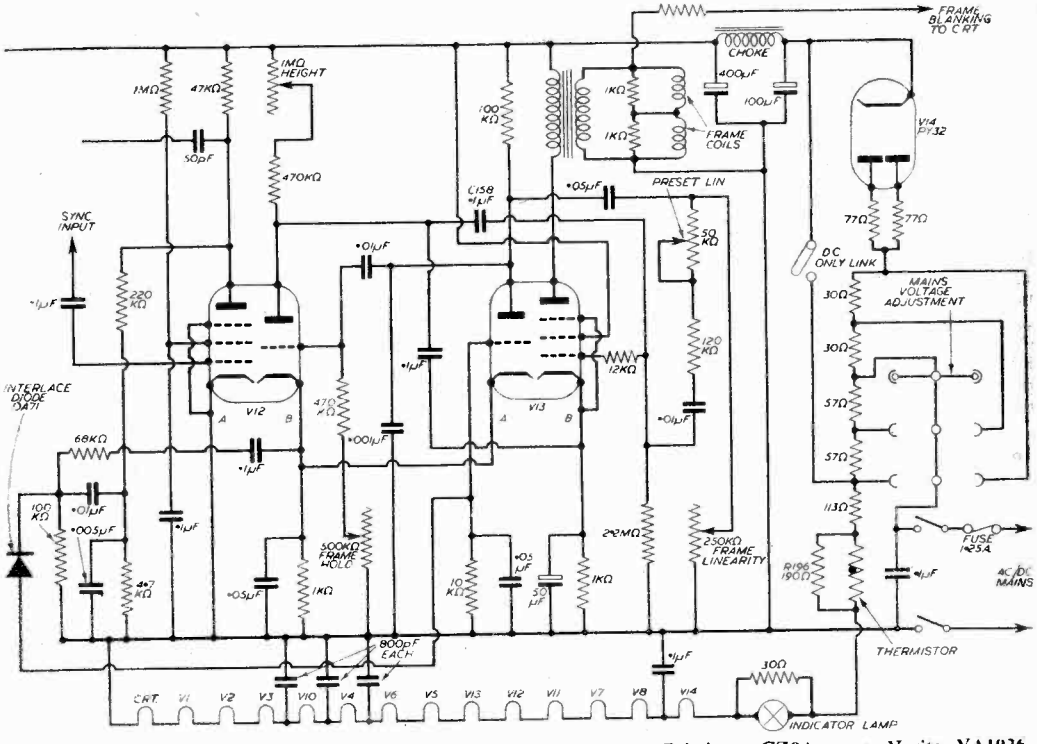


Fig. 2.—Mains, H.T. and frame timebase circuit. Thermistor is a Brimistor CZ8A or a Varite VA1026. When the latter is fitted R196 is omitted.

Frame Hold

If this control is at the end of its travel, check V12, V13 and the 470 kΩ resistor to the hold control.

If the hold control is central, but the picture revolves either way, check the OA71 interlace diode and the components associated with V12A.

Frame Cramping

Severe compression of picture at bottom of screen leaving gap, linearity control ineffective.

Check V13. If the lower part of the picture is folded up check C158 (.1 μF).

Where the top is compressed and the linearity controls do not correct, check C158 (.1 μF) and linearity circuit components.

No Picture, Sound Good

Advance brilliance. If there is no illumination or raster check the upper right side EHT section. Test for spark at EY86 top cap. If there is a healthy sizzling spark, change EY86. If the EY86 fails often, use a TY86F which has a different heater characteristic.

If the symptoms remain, or the line timebase whistle is ragged and the EY86 anode spark subdued, suspect a short in the tube itself and remove the anode clip or if more convenient remove the base socket and short pins 1 and 12 to preserve heater continuity. If now the EY86 lights up and the anode sparks normally with a smooth timebase whistle, rewire C.R.T. base for tetrode working.

If there is no spark and the line whistle is absent, check PL81 valve, then V5 PCF80.

Isolating Transformer

If a raster (bright) can only be resolved at *minimum* brilliance, check C.R.T. for heater-cathode short and instal 6.3 heater isolating transformer, removing the existing leads to pins 1 and 12 and shorting these leads together to preserve heater chain continuity. Where the brilliance control works up to a point and then causes the picture to balloon out and fade, suspect failing EY86 (or TY86F), but bear in mind that a misplaced ion trap magnet on the rear of the tube neck can produce exactly the same effects.

Ion Trap Magnet

This may require explanation. The function of the ion trap magnet is to direct the electron beam through a small hole in the anode plate. If it is displaced, the electron beam will collide with the anode causing a heavy flow of current without the screen being fully illuminated. The EHT rectifier (EY86) is still expected to pass this current although the majority of it is not exciting the screen at all. Therefore, an abnormal current has to flow in order to provide some illumination and the EY86 and its supply are not designed to cope with it. Thus a displaced magnet can give rise to the symptoms normally attributed to a weak EY86. This, of course, is true of any other receiver employing an ion trap tube.

Lack of Width

Where the above symptoms are accompanied by a lack of width, however, the cause is different. If the width is lacking at normal or low brilliance, check the PL81, PY32, PY81 and the 2.2 kΩ resistor to pin 8 of the PL81 in that order.

The previous symptoms can be added, as the EY86 will be inadequately supplied and will not be capable of operating correctly.

No Picture, No Sound

Raster resolved when brilliance is advanced. Check tuner valves PCF80 and PCC84 (in that order), then the EF80 to the right. The PCF80 should also be suspected when BBC can be received but not ITV, i.e., Channels 1-5 quite normal and nothing on Band III. When the Band III signals become seriously detuned so that the fine tuner will not bring in the sound or alternatively the picture, replace the PCF80. Where the detuning is slight so that sound on vision is experienced and the fine tuner is at one end of its travel, check the alignment of L6, the oscillator coil core, adjusted from beneath the tuner, roughly under the PCF80.

Hum on Sound, Sound on Vision, or Both

Reduce the gain control setting or instal aerial input attenuator. These symptoms only occur normally in areas of high signal strength.

Advancing contrast, gain or brilliance causes a silken effect on highlights with whites at a uniform grey. Suspect tube emission and change tube. Send it for rebuilding or try a boost voltage on the heater which may help matters for a limited time.

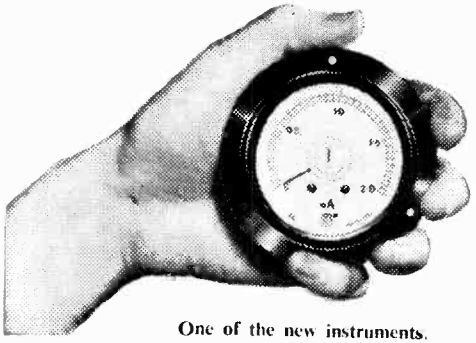
Where the picture signal is weak, but the raster resolves quite brightly, check valves and 10 kΩ 2 watt anode load resistor of V5 (video amplifier section), if it is known that the aerial input is in order and a good picture has previously been received. Also check the OA70 vision detector crystal diode contained in the L107/L108 I.F. transformer.

Coil L101 is the adjacent channel rejector, L105 is the sound I.F. rejector. L101 is adjusted to reject 33.15 Mc/s (min. vision) and L105 to reject 38.15 Mc/s (min. vision).

New Miniature Instruments

A RANGE of panel mounting 240 deg. scale miniature instruments with 2in. and 2½in. dials, is announced by Crompton Parkinson Ltd. The instruments have a limit of inaccuracy of 1 per cent. and have twice the scale length of 90-100 deg. short scale instruments of similar dial diameter. Nine of the 3⅛in. scale (2in. dial) instruments can be mounted in a 6½in. square panel space.

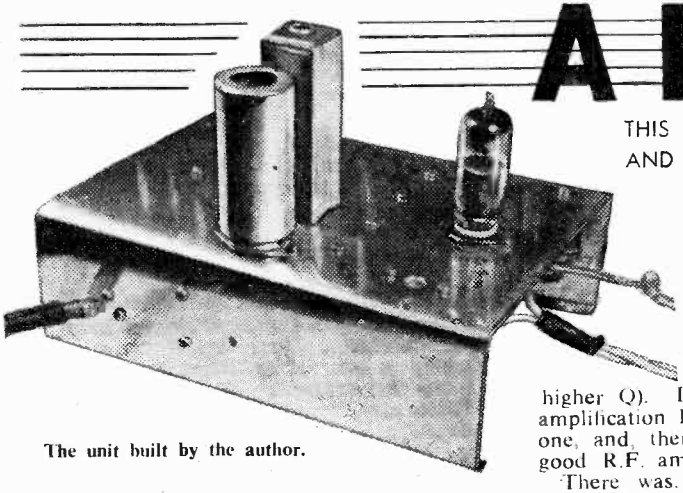
They are available in either moulded plastic or sealed die-cast metal cases. Supplied in the metal case form, the instruments withstand the Admiralty 200g shock test. (Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2.)



One of the new instruments.

A Band V C

THIS UNIT IS INTENDED AS AN EXPERIMEN
AND A SILICON DIODE



The unit built by the author.

ALTHOUGH at present there are no experimental test transmissions on Band V, the construction of this converter will give the amateur valuable experience in operation at frequencies of the order of 600 Mc/s. It is hoped to publish another article in the near future describing a suitable signal generator for Band V frequencies which will enable testing to be carried out in the absence of experimental transmissions.

Noise

The first consideration, at 650 Mc/s, is to minimise noise. The usual method, in conventional receivers, is to employ a stage of R.F. amplification—sometimes more than one stage—before the frequency changer. The reason for this is that since the mixer operates necessarily at a lower conversion conductance than the same valve used as an amplifier (the value is usually less than one third gm) for a given output at I.F. the noise is proportionately greater. For example, measurements at 200 Mc/s with a 955 valve show an equivalent noise resistance of 1,360 ohms, gm = 2 mA/V when used as an R.F. amplifier. The same valve, used as a triode mixer at 200 Mc/s had a conversion conductance of 625 μA/V and an equivalent noise resistance of 6,700 ohms. The noise had gone up by 4.9 times and the mutual conductance had decreased by a factor of 3.3.

At high frequencies, such as are encountered in Band V, the figure is much worse. Experiments conducted at 600 Mc/s show that unless the gain of the R.F. amplifier before the mixer stage is at least six, more noise than signals is introduced and it is actually disadvantageous in most circumstances to use such an R.F. stage at all.

R.F. Amplification

With the above in mind, measurements were carried out to see whether enough R.F. amplification could be achieved with easily-obtainable valves. The 955 was again the obvious choice, though some doubt was felt at the outset about its capabilities. From experience with a 600 Mc/s oscillator it was apparent that though it was possible for a selected 955 to oscillate at 670 Mc/s this was the upper limit; even with silver-plated Lecher wires (which have high Q) or a silver-plated coaxial assembly (which has an even higher Q). In other words, at 670 Mc/s, the amplification had dropped to only a little over one, and, therefore, it was unlikely to make a good R.F. amplifier at such frequencies.

There was, however, the possibility that by using the triode in a grounded-grid circuit useful gain could be achieved. This also was found to be useless: the measured gain at 600 Mc/s was 2.2—far too low to be of any use from the point of view of noise-reduction. The 955 was regretfully given up.

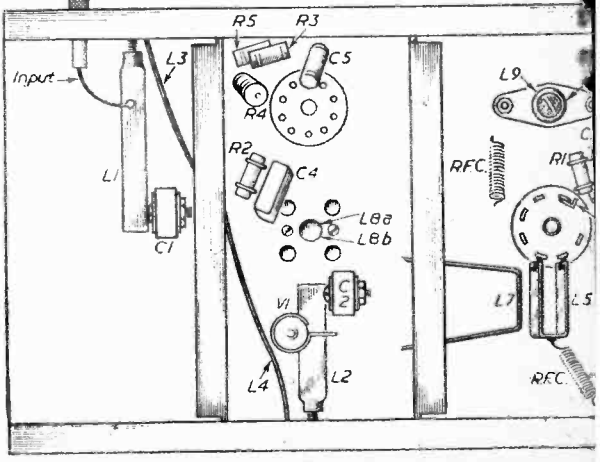
Experiments are still continuing, however, using other valves, and it may be possible to report progress at a later date. Meanwhile, the R.F. front end described here is usable in the optical line of sight from the transmitter, with reasonable results.

The Input Circuits

The writer has experience of the difficulty of obtaining suitable components designed exclusively for the ultra-high frequencies, and has, therefore, attempted to use more conventional ones wherever possible. This has necessarily involved some artifices here and there and these will be mentioned in due course.

Not only must the input circuits resonate without much loss to the U.H.F. frequencies received, but also they must prevent, as far as possible, radiation from the

(Above



onverter

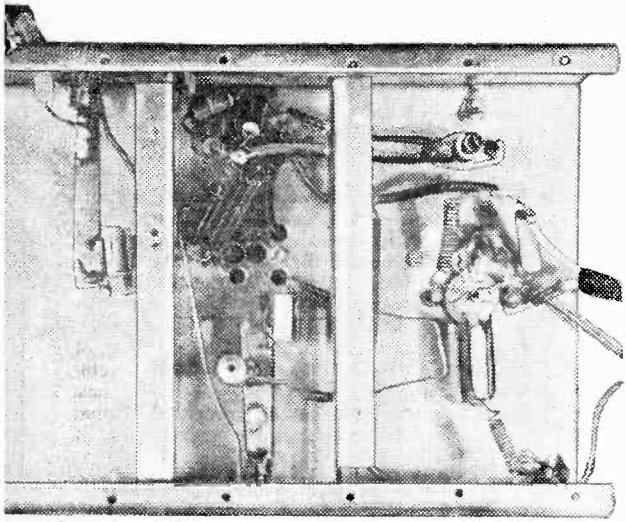
TAL FRONT-END AND USES TWO VALVES

By R. B. Archer

oscillator. For this reason, a filter input circuit has been used. It is not exceedingly efficient, but improves matters to a worth-while extent, while causing little loss in signal strength.

The Crystal Mixer

Essentially the crystal, whether of silicon or germanium, operates as a mixer by introducing non-linearity into the wave-forms imposed on it. In this it resembles a pentode, operated under non-linear conditions, as, for example, when both signal and locally generated oscillations are



Underchassis view of the converter. (Below)—Diagram for the identification of parts shown in the illustration above.

impressed simultaneously on its grid—the usual practice in television and V.H.F. technique. The crystal, of course, does not amplify—there is actually a loss. Both crystal and pentode introduce noise. With the valve, however, the input and output impedances are relatively large, although at very high frequencies the input impedance does tend to diminish very appreciably. The crystal, however, has relatively a very low impedance, and behaves more like a transistor than a vacuum valve. For this reason it is necessary to match the circuit to the crystal so that correct impedance is presented by the circuit connected to it. Matching is usually accomplished by some kind of transformer; in the circuit described here an auto-transformer is used.

It is also important in using a crystal to ensure that the crystal current is of the right order of magnitude. This is not only to prevent damage by excessive current but also for the following reasons. First, a large crystal current—derived, of course, chiefly from the rectification of the local oscillator output—causes a large D.C. bias across the crystal and this tends to cause a serious increase of noise. Secondly, too small a current causes a large loss of signal—"conversion loss." The correct compromise is usually about 0.2 to 0.4 mA. This, fortunately, is relatively easy to arrange.

The I.F. Amplifier

Because there is no amplification before the I.F. amplifier, it is essential that a low-noise first I.F. stage is employed. The oscillator and crystal introduce some noise; this cannot be avoided altogether. The I.F. amplifier must, therefore, introduce as little as possible, and the usual pentode is not good enough. For this reason, a cascode stage of simple design has been incorporated. Such a stage introduces almost as little noise as a triode. While in this circuit it is a necessity; in more usual TV practice a cascode stage is not needed in the I.F. amplifier. For the R.F. stage it is, however, quite rightly very popular. Fig. 1 shows the theoretical diagram, which is of conventional appearance because the usual symbols for inductance, capacitance and so on have been employed. The actual construction is, however, far from conventional in appearance, as the diagram of the underside of the chassis shows. The reason is simply that, at Band V frequencies, the inductances reduce to flat strips of copper or plain lengths of wire. Actually, L6 disappears from view almost completely—reduced to the length of the contacts in the valveholder.

Circuit

The mixer, oscillator and first I.F. stage together comprise the "converter," which is designed to feed into a suitable sound/vision double I.F. amplifier. The oscillator consists of a tuned-anode, tuned-grid stage, using a 6J6 operating at about 620 Mc/s. This gives vision and sound I.F.'s of 34.25 Mc/s and 39.75 Mc/s respectively, which feed nicely into a modern I.F. amplifier, retuned somewhat as necessary. The 6J6 is operating near its limit at 620 Mc/s

COMPONENTS LIST

V1—Silicon crystal diode.	
V2—6J6.	V3—PCC84.
R1—22 K.	R4—100 K.
R2—100Ω.	R5—100 K.
R3—0.22 M.	
L1 to L9—See text.	
C1—5 pF max. trimmer.	
C2—5 pF max. trimmer.	
C3—5 pF Erie ceramic N750 K.	
C4—, C5— } .01 µF Mica or ceramic.	

and consumes 24 mA at 200 volts; for this reason it is mounted so that good ventilation is assured and it is not enclosed in a screening can. The rating of the valve is 3 watts anode dissipation, and it is undoubtedly overrun. It seems, however, to show no signs of distress. This valve was selected as being easily available cheaply.

With the tuned-anode tuned-grid circuit used here, the valve capacitances (which limit the maximum frequency obtainable) are in series with each other. Moreover, the cathode does not carry R.F. and so cathode lead inductance is not a limiting factor.

Inductances

Fig. 2 shows the details of the circuit. L5 consists of a strip of silver-plated copper, 22 s.w.g., 1.5 cm wide and 2.6 cm in length, folded into a "hairpin," the sides of which are 0.6 cm apart internally. It is soldered direct to the two anode pins of a P.T.F.E. or ceramic valve-holder and is self-supporting 1.0 cm above the chassis. The mid-point of the "hairpin" is connected direct to the R.F. choke which consists of 17 turns of 22 s.w.g. tinned copper wire, spaced wire diameter, wound on the shank of an $\frac{1}{8}$in. drill as a temporary former. From the H.T. end of the choke a mica condenser of capacity 100 pF is taken to chassis by the shortest route (this is not shown on the circuit or chassis diagrams, but can be seen in the illustration of the chassis).

The inductance L6 consists only of the valve pins and the sockets in the valve-holder. A piece of 22 s.w.g. wire is soldered across the socket tags as near the valve-holder as possible, and the R.C. network C3R1 is attached between its mid-point and chassis by the shortest route.

Input Filter

For the signal input filter the inductances L1 and L2 each consist of a strip of silver-plated copper 22 s.w.g. 0.6 cm wide and length 5.6 cm from the C1 or C2 end to the chassis, where they are secured by means of a brass screw and nut. C1 and C2 are preferably of the miniature type. The author, however, used a couple of Government surplus ceramic mounted air-spaced variable trimmers, each reduced to two moving and one fixed plates. The capacitance should be about 0.2 to 4.0 pF.

The aerial input coaxial lead is brought direct through the chassis, no socket being used, otherwise its capacitance (which is rather large) will have to be tuned out. (If a socket is used, a 3 cm length of 22 s.w.g. wire will have to be connected, so as to *appear* to short-circuit the input.) The coaxial inner conductor is soldered to L1 at a distance of 2.8 cm from the chassis end, and the "outer" of the coaxial cable soldered to the chassis end of L1.

L3 and L4, together with the connecting link consist of a piece of 18 s.w.g. silver-plated copper wire soldered to the chassis ends of L1 and L2. The wire is run close to L1 and L2 for a short distance—the adjustment is made so as to obtain best signal-to-noise ratio in use—and the wire passes through a B7G size hole in the screening partition wall. The fixing must be rigid, and the wire is then self-supporting.

Mixer

V1 consists of a silicon crystal diode, preferably a "low-noise" type—the author bought a surplus CV291 for 2s. 6d. Clips are fashioned from brass strip, silver-plated, to hold this diode. One clip is soldered to L2 at a distance of 3.7 cm from the chassis end; this gives best matching for the CV291, but some adjustment may be needed if other types are used.

Inductance L7 consists of a piece of wire connected to the other crystal clip, brought through the screening partition and run close to L5 before passing into the I.F. transformer can. L8a consists of 9 turns of 28 s.w.g. enamelled wire, close wound directly on top of L8b. The latter is of 16 turns 28 s.w.g. enamelled wire on a 0.3in. former, with purple-coded dust core. The reader may have suitable I.F. coils by him; if so, a matching winding of about one half the turns is about right, but may need some adjustments for the type of crystal used. Since no tuning for the oscillator is provided, it may well be necessary to modify the I.F. amplifier to tune to whatever I.F. is produced. If the oscillator frequency is determined by means of a two-wire transmission line, the I.F. can be forecast to a

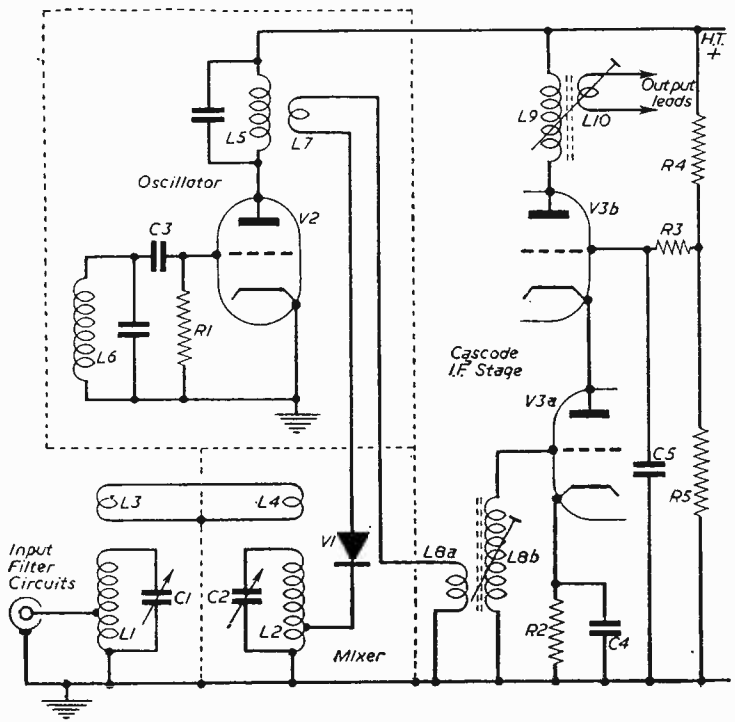


Fig. 1.—Circuit diagram of the converter.

megacycle or two: the I.F. amplifier can then be tuned to suit. A small adjustment of oscillator frequency can be made by judicious alteration of the position of L5 relative to the chassis, as this affects the capacitance of the anode circuit.

Setting Up the Circuit

The following adjustments will have to be made to bring the circuit into alignment. (a) L1 and L2 will have to be tuned, each by its capacitor

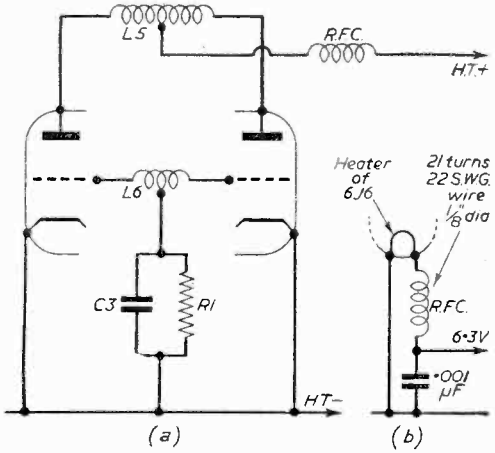


Fig. 2(a) (Left)—Tuned-anode, tuned-grid oscillator circuit.

Fig. 2(b) (Right)—The heater supply circuit.

(C1 and C2); (b) the oscillator frequency may need slight adjustment; (c) the tapping-point of the aerial input on L1 may need altering; (d) the coupling arrangements L3 and L4 will need adjustment for best results; (e) the crystal tapping point on L2 will need slight alteration; (f) the tuning of L8 and L9 will have to be made to correspond with that of the I.F. amplifier in use. This is not dealt with here, as it is thought that an experimenter capable of tackling U.H.F. circuits will be able to manage that for himself. It should be noted that in the underchassis illustrations L10 (output coupling coil) is not shown, as the constructor may wish to vary it for his own use. The inductance L9 is the same as L8b, except that it is not screened. About three turns tightly coupled to the coil—over-wound on the H.T. + end will match the coil to 80 ohm coaxial cable. (g) The position of L7 relative to L5 will need to be varied to get good "conversion" without undue noise. The minimum coupling should be aimed at as this assists in ensuring good oscillator stability.

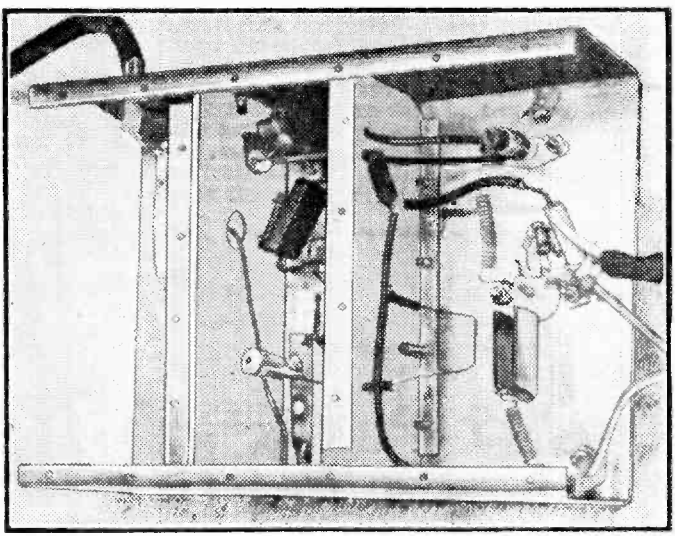
Alignment

First of all, the input circuits should be aligned. For this, an oscillator working at about the right frequency is needed, and this is not a simple matter to arrange. The stray radiation from an oscillator working on Channel 8 may be found useful—the third harmonic will be at 673.2 Mc/s. This applies to television receivers having I.F. of 34.65 Mc/s (vision). For sets with an I.F. of about 16 Mc/s, the third harmonic of the Channel 10 oscillator (about 64.8 Mc/s) may also be used. It would be better, however, to construct a separate oscillator operating on 65.7 Mc/s or, more practicably, on 32.8 Mc/s. This may be a simple Lecher-line oscillator. The distance between the minima on the transmission lines should be 45.7 cm and for constructional purposes the anode and grid lines could start off at 25 cm each, gradually reducing the length until the exact frequency is achieved. The "acorn" works well at this frequency and a strong second harmonic is radiated, which is easily picked up.

It will be seen from the photograph that holes to secure a cover plate are provided: it is fixed by a large number of self-tapping screws. This cover plate should be on for the adjustment of C1 and C2; the latter condenser is reached by way of a hole in the screening partition. When the input circuits have been adjusted for best results, the aerial tapping point may then be altered for maximum signal strength.

Crystal Tapping Point

Next, the crystal tapping point may be adjusted, each variation in position may need readjustment of C2 and at the same time, the position of L7 should be brought to the optimum. Variation of the placing of L7 will alter the oscillator frequency a little, and the position of L5 relative to the chassis must then be changed until the signal is back in tune. It may be realised that these adjustments require patience; nevertheless, it will be found straightforward enough.



Another view of the underchassis which shows more clearly the wiring of V3.

Building a Spot-wobble Unit

FILL IN THE GAPS BETWEEN SCANNING LINES WITH THIS ONE-VALVE UNIT

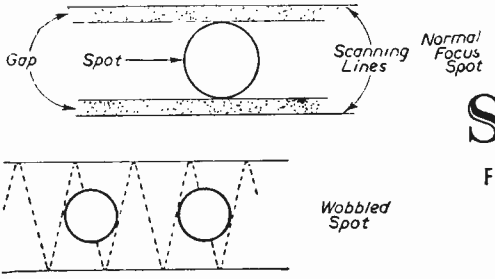


Fig. 1.—With a normally focused spot, there are gaps between the scanning lines. If the spot is "wobbled," the gaps are filled.

READERS who have not tried out a spot wobble unit may like to experiment with the one described here. Any TV R.F. pentode can be used, such as the 6F1, 6F13, 6BW7, EF91, EF80, EF50 (VR91), or triodes such as 6L18, EC52 (VR137), etc. When using the unit, definition is slightly impaired, just as it is when a filmed telerecording is shown, as this usually is spot wobbled before photographing.

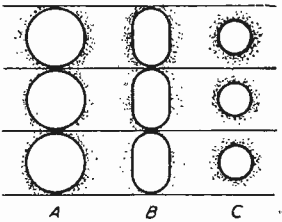


Fig. 2(a).—If the spot is defocused, the gaps disappear, but definition is impaired.
(b) Improving horizontal definition.
(c) A correctly focused spot leaves gaps.

Operation

As is well known, a spot moves across the screen from left to right, and as the tube fluorescence has a medium persistence (afterglow) horizontal lines are traced. When the spot is small and the trace is sharply focused, gaps will appear between the lines. If an alternating current, at a frequency greater than the line frequency, is applied to a pair of coils on the tube neck, the spot is made to move rapidly in a vertical direction, as well as horizontally, thereby filling up the gaps between the lines (Fig. 1). The ideal spot size for an inconspicuous line structure is one that fills the gap completely in a vertical plane (Fig. 2(a)), but with this size and type of spot, definition would be below standard. If good definition is required in the horizontal plane, the spot should be small in horizontal diameter (Fig. 2(b)). When the spot is correctly focused for the best definition the spot is reduced in size both vertically and horizontally and the inevitable gap appears between the lines (Fig. 2(c)).

Before attempting to vibrate the spot in a vertical direction, particular attention must be paid to the picture definition. If this is as perfect as possible, the slight deterioration in picture quality caused by the vibrating spot will be quite bearable.

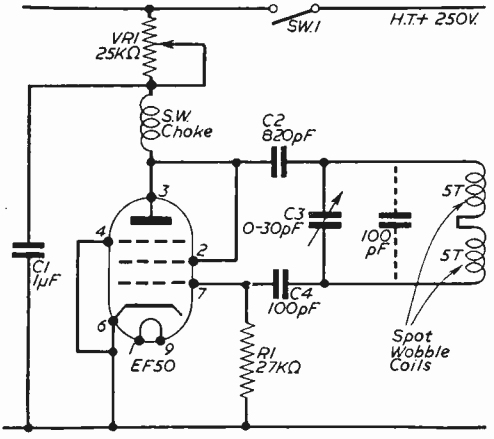


Fig. 3.—Circuit of the oscillator using an EF50.

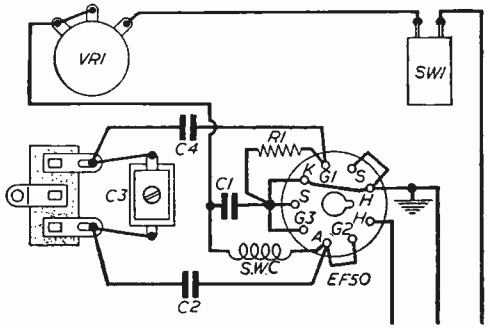


Fig. 4.—Wiring diagram.
Note: Earth the valve holder spigot.

Defocusing

It has been said that deliberately defocusing the spot will fill the gap between the lines and have the same effect as a spot wobbler. However, defocusing with older tubes completely spoils the definition at the sides of the picture. In any case, it is not possible to defocus some of the latest models as no external control is provided.

Low EHT enlarges the spot size, so if the picture is overscanned or dull, or has an exaggerated expansion on operating the brilliance control, it would be wise to check over the line timebase valves and voltages.

Interlace

Prominent line structure is sometimes caused by poor interlacing and may be another reason

for wanting to fit a spot wobble unit. There is no point in fitting the unit if interlacing is bad. The article, "The Problem of Interlace," which began on page 506 of the May issue and which is concluded in this issue, will be of assistance if it is considered necessary to improve the interlace.

The Circuit

The spot wobble unit (Figs. 3 and 4) consists of a triode-connected pentode oscillator, the output of which is fed to a pair of deflector coils mounted on the tube neck adjacent to and at the rear of the existing line and frame scan coils. As these deflector coils are fitted between the scan coils and the focus magnet, it would be wise to check that there is sufficient space before building the unit. In some cases it may be necessary to fit the coils partly inside the focus magnet and picture centring assembly. As the coils lie flat and take up a very small space it is usually possible to do this.

The frequency at which the oscillator works is important; it must be at least 9 Mc/s, as if it is less, a wavy pattern will be present on the line

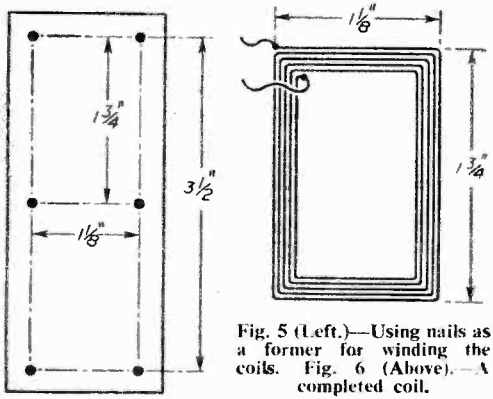


Fig. 5 (Left.)—Using nails as a former for winding the coils. Fig. 6 (Above).—A completed coil.

structure when the raster is correctly focused. There is also the problem of seeing that the oscillator frequency or its harmonics do not fall within the receiver's R.F. or I.F. channel. These problems could be forgotten if a frequency greater than 39 Mc/s were used, but then the frequency losses would be much greater and would affect the efficiency of the unit, which is designed to oscillate around 12 Mc/s (25 metres). Trimmer C3 across the spot wobble coils will allow the frequency to be varied so avoiding any frequency beating which may occur in individual receivers. The TV screen should be watched while setting this trimmer.

The potentiometer VR1 is rotated to a position where the lines just merge; any further increase will spoil the definition. The switch SW1 is a necessity and allows the unit to be switched off so that the focus control can be correctly set for best definition.

The Coils

The quickest way to wind the coils is to make a rectangular former, consisting of a small piece of wood with four shoe nails hammered in about ⅛in. (Fig. 5). The nail heads should be snipped off and the measurement round the outside of the nails should be 1⅛in. × 1¾in. The two coils require five turns each of 26 or 28 s.w.g. enamelled wire and are both wound in the same direction (Fig. 6). The five turns are wound carefully side by side and before slipping them off the nails a small band of transparent tape should be stuck to each of the four sides to keep the turns in place. The tape should be wound round once only, as bulk must be kept to a minimum for ease of fitting.

The coils are shaped by pressing them round the tube neck with the 1⅛in. dimensions parallel with the tube axis. In other words, the 1⅛in. measurements lie across the "top" and "bottom" of the tube neck and the 1¾in. is at the "side" of the neck. If the spot wobble effect cannot be obtained, reverse the connections to one set of coils. Start and finish the windings with both ends at one corner, the corner nearest to the scan coils at the top, as part of the coils will no doubt have to slide inside the focus magnet when they are fitted.

(To be concluded)

TELEVISION TROUBLES

(Continued from page 550)

Fig. 2) should first come under suspicion. It is as well to be on the safe side and replace this component, since it is difficult to apply an artificial test which is anyway comparable with the operating stress to which the component is subjected.

Model 5145 and Series—Narrow Line Scan, Possibly Intermittent

Either the B36 or KT36 valve may be to blame, and an emission test of these is first desirable. If they both appear to be reasonably normal, the 47 k resistor in the grid circuit of the KT36 warrants examination. This often increases in value and causes the symptom, and in some cases it tends to become intermittently open-circuit and results in an intermittent reduction in line scan amplitude.

Hum in Line Timebase

The symptom here often resolves as a raster of considerably reduced width with S-shaped vertical edges; the typical symptom of hum accompanied by suppressed line scan and defocusing.

If the smoothing appears to be normal, indicated by a freedom of hum in the sound channel, the KT36 should be checked for heater-to-cathode insulation and a screen-to-heater short. If this proves to be the case, but a replacement valve fails to provide any horizontal scan at all, attention should immediately be directed to the 6.8 k 1 W. resistor feeding the screen of the KT36 (R39 in Fig. 3).

This will probably be found in a charred condition due to an overload. Replacement of this component, along with the valve will clear the trouble.

(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).

9in. PYE MODIFICATION

SIR.—In reply to correspondent C. W. Brooks (see the March issue), I modified an Ekco 9in. TV (TSC30) a few years back. In my case the 50 c/s EHT transformer was burnt out but H.T. transformers (two in number) were O.K. I only modified for EHT off the flyback thus:

Discarded U22 rectifier but retained the M.O. valveholder; removed burnt-out EHT transformer; fitted line EHT Ferroxcube transformer 6-9 kV. costing 19s. 6d. (advertised at 17s. 6d. March issue) and a Govt. surplus VT127 (9s.) which is the Mazda PEN46. I removed the two .1 μF EHT smoothing condensers and fitted one .001 μF 10 kV. The heater and screen supplies were taken from suitable points to take this extra load and the grid of VT127 was tapped into the damping circuit across the line scan coil. The EHT rectifier was a Westinghouse 36 EHT 100, but an EY51 could be used as a heater winding on EHT transformer. —E. BULL (Walthamstow).

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.

REPLACEMENT DROPPER RESISTANCE

SIR.—Your correspondent, J. H. Pope, London N.W.10 (Your Problems Solved, April, 1959) who has been troubled with barretter type 305 burning out in his G.E.C. BT1252, and other owners of G.E.C. sets using the 305, may be interested to know that Messrs. G.E.C. have produced a replacement dropper resistance which can be screwed into the existing 305 holder in a number of their TV models, thus curing this particular trouble.—A. SILVESTRI (Elgin).

EARLY TV RECORDINGS

SIR.—I wonder whether any reader remembers the records of 30-line television pictures which could once be bought. I have often wished that I had bought one when they were offered for sale at that time for 7s. so that I could demonstrate the crude pictures that were obtainable. I wonder whether anyone can suggest a source of supply of a tape-recording of one of these records, as I do not suppose an actual record could now be bought.

I remember that even though pictures were crude, it was possible to recognise faces, although the only one I can recollect now was Lupino Lane. I have appeared once myself on the other side of the cameras at Alexandra Palace in 1948, the programme being "Inventors' Club." There seemed a very cheerful atmosphere in the studios and quite a lot of leg-pulling between the camera operators and our announcer Macdonald Hobley.

I am still using the timebase section of a Baird T26, designed in 1938, with the scanning coil yoke extended beneath the chassis. Most of the original valves are still working, including sound output, but with a different vision unit and EHT supply and a PRACTICAL TELEVISION Band III converter.—W. E. ANSON (Northfleet, Kent).

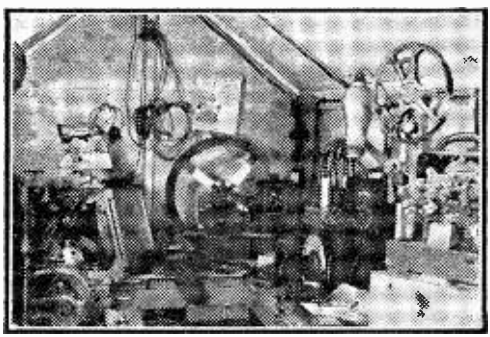
COLOUR TELEVISION DEMONSTRATION

SIR.—With reference to a letter from a correspondent, published in your April issue, regarding a demonstration of colour television given at the Radio Hobbies exhibition last November, I feel that there are so many mistakes I must put them right.

Firstly, the colour TV demonstration was not put on by the British Amateur Television Society as your correspondent stated, but by Dr. Moss and his associate Mr. Rodgers of the Bush Colour TV laboratory at Kew.

Secondly, R.C.A. did not supply the line output components; these were manufactured by Dr. Moss at his laboratories and were of original design.

Thirdly, a price figure of £300 was certainly not quoted by anybody in authority. It is very difficult, if not impossible, to price an apparatus of this type at this stage. It must be appreciated that the cost of components is itself no guide,



Mr. W. E. Anson's den showing some early TV apparatus. (See "Early TV Recordings.)

since the bulk of the price is made up of development costs. It will suffice to remark, however, that R.C.A. market a 21in. table receiver in the U.S.A. for about £188.

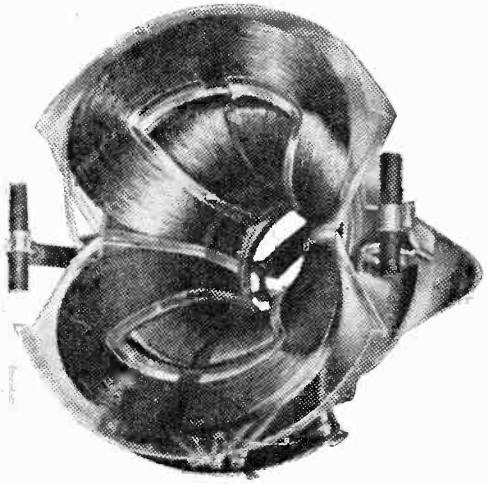
Fourthly, colour TV tubes and components are readily available over here to anybody interested. As an agent for all U.S. tube companies, with the exception of R.C.A. and Sylvania (the latter can, however, be supplied to order) I should be happy to arrange supplies to any interested parties.—B. C. TERRELL (14, Southgate Street, Bath, Somerset).

Radio and Electronic Component Show

NEW TUBES AND AERIALS WERE THE MAIN TV FEATURES OF THE EXHIBITION HELD IN LONDON FROM APRIL 6th TO 9th

IMPROVED components which will lead to increased reliability of all electronic equipment, from television and radio sets to missile guidance systems, were seen at this year's exhibition of the Radio and Electronic Component Manufacturers' Federation. This was the last show of the series to be held at Grosvenor House, Next year there will be no components show, and commencing in 1961 the exhibition will be staged every two years at Olympia. It will then take place in the third week in May.

More compact electronic assemblies are made possible by the use of very small components



This 110° scanning coil assembly by Elac incorporates a new Ferroxcube core enabling a "pull-back" of 4mm. to be achieved without loss of sensitivity.

which now retain the same reliability as their larger counterparts.

Several exhibitors were showing equipment that foreshadows the opening of new television channels. Turret tuners, for instance, have facilities for switching to the so far unused UHF bands. (Plessey, Brayhead).

New Tubes

Several firms featured the new 110 deg. television tubes which enable a big-picture television set to be considerably reduced in back-to-front depth. The Mullard 21in. 110 deg. tube shows a saving of more than 8¼in. in length compared with the 70 deg. counterpart and 5in. saving over the 90 deg. tube. Siemens Edison Swan and Standard Telephones (Valve Division) were among the other exhibitors of this kind of tube.

The latter also exhibited the PCC89 a high-sloped vari-mu double triode and the PL84, recommended for 110 deg. frame output stages. Mullard showed a new H.F. cascode double triode for use in television tuners, particularly for fringe area reception. It has frame grid construction and, it is claimed, a very much higher stage gain than previous types as well as an improved noise factor.

A Ferranti valve which was shown entirely eliminates the use of glass. It is of ceramic construction and is claimed to be of particular value where reliabiltiy and size are important considerations. This, the UL11, is an R.F. oscillator/amplifier capable of operating at 1,000 Mc/s, with a maximum peak power of 15 kW.

A range of Ferranti cathode ray tubes has been produced to present radar displays of sufficient brightness to be viewed under conditions of high ambient lighting.

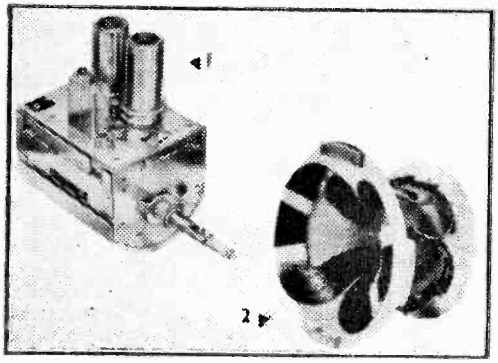
Several new valves were shown by the M.O. Valve Company, including the KLS2, a new three-cavity S-band amplifier, giving a C.W. output of 1.7 kW with a power gain of 40 dB. A new convection-cooled travelling wave tube, the TWC 4, for use in the 5,000-8,200 Mc/s range gives an output of 2 watts with a power gain of 40 dB.

The use of silicon rectifiers for television power supplies was featured by several firms, including S. T. and C., Westinghouse and Mullard.

All-purpose Aerials

There were some particularly interesting developments to be seen in aerials. Antiference Ltd., have redesigned their aerials to reduce the weight and wind-frontage of the arrays, yet without reducing robustness. Elements that automatically click into positions of correct alignment were featured.

A completely new aerial design for operation on Bands I, II and III, with independent directivity and with the facility of adjusting the

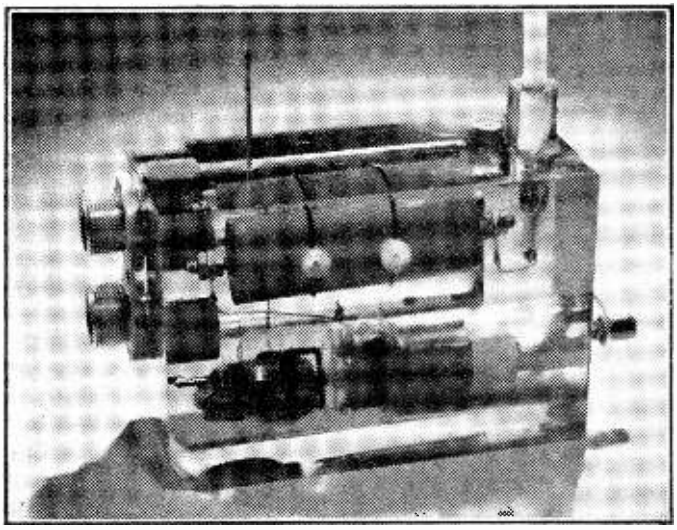


An 18 channel Tuner and a 110° scanning coil assembly were among the Plessey exhibits.

Band I signal pick-up to match that of Band III, was introduced by Kimber-Allen Ltd.

Another new aerial introduction comes from Labgear, who exhibited a range of high-gain, small-size dual band aerials which, they say, function on a principle never before used commercially.

J-Beam Aerials Ltd. (who announce price reductions) are one of the firms to show aerials with wide-band characteristics, capable of being used at all frequencies in Band III, so providing aerial facilities for a possible third television programme.



An E.H.T. block encapsulated in Araldite epoxy resin, shown by Ekco.

The use of common aerials for both television services and V.H.F. radio has called for triplexers, to combine the inputs of the aerials into one coaxial lead and to separate the outputs at the receiver end. Wolsey Electronics, amongst others, showed a triplexer that is equally suitable for use inside or outside.

Improved Instruments

There was a wide range of electronic instruments to be seen. A cathode-ray tube rejuvenator, shown by Labgear Ltd., is of value to television service departments. It measures the cathode emission and applies a controllable excess heater voltage to re-activate the cathode, a meter indicating when the rejuvenation process has been completed.

British Physical Laboratories showed a Megohmmeter (Model RM 185) which has been developed to measure insulation resistance up to 400 million megohms (4×10^{14} ohms). Dawe Instruments exhibited a "True R.M.S." valve voltmeter which measures the effective value of waveforms other than sinusoidal, giving accurate R.M.S. readings of voltages or currents associated with non-linear circuits.

Whitely Electrical Radio introduced a transistorised field cable test set which enables an operator to locate a break in a multi-wire cable by running a capacitative probe along the outside of the cable. An inductive probe can be substituted for locating shorts between conductors.

An electronic thermometer was the main feature of the Wayne Kerr exhibit. A temperature-sensitive probe is connected by cable to a small battery-operated D.C. bridge measuring circuit. The probe can be positioned some distance from the indicating apparatus. A prototype is now with a geological party operating in New Zealand, who are using the probe for earth temperature measurements at the end of a 1,000ft. cable.

An instrument that quickly and accurately determines the temperature of soldering iron bit or the solder in a solder bath was shown by Multicore Solders Ltd. It is claimed to be particularly useful in work with printed circuits. Known as the BIB solder thermometer it comprises a meter movement connected to a thermocouple, giving direct temperature reading in Centigrade and Fahrenheit, up to 400 deg. C (752 deg. F).

A Transistor Exhibit

AT the Transistor Exhibition, Messrs. Siemens Edison Swan will show an experimental small-scale crystal growing apparatus enabling very thin base layers to be produced so that the transistors will operate at higher frequencies. Experiments are carried out using as little as 25 grams in the melt and under conditions that permit very good visual observation of the process. A p.n.p. crystal produced by the wafer dip method in this furnace will be shown, a wafer of P type germanium having been used as a seed and a melt prepared containing antimony, gallium and indium. Whilst the crystal was being grown the antimony diffused into the original slice and formed a thin N type layer.

Special properties of the symmetrical transistor type XS101 have enabled an improved form of modulator to be developed. Considerably less power is required than with diodes, resulting in a lower level of carrier leak. The impedance of the transistor is much lower and no special matching or selection of transistors is required.

Digital circuits operating at 1 Mc/s have been designed for data processing operations. The circuits use an experimental alloy junction transistor with an alpha cut-off frequency exceeding 10 Mc/s and an experimental aluminium-bonded diode.

Production of a germanium p.n.p.n. switch will be demonstrated. Elsewhere applications of the p.n.p.n. switching diode are to be shown, this device having very low resistance in the forward direction and high reverse resistance: such applications include electronic telephony.

TV CONVERTORS

INTERNAL FITTING. Tunable to any Band I station plus any 2 Band III stations—switch tuned, T.R.F. Band-I, superhet Band III. Famous make complete with escutcheon knobs, gain controls, instructions, PCF80, PCC84 valves, easily adaptable almost all sets. Listed over £7. Carr. 3/-. **£3/10/-**

EXTERNAL I.T.V. CONVERTORS WITH INTERNAL POWER PACK. Well-known make at a very competitive price, completely enclosed. Finished in hammered gold. Very compact. Can be put inside practically all T.V.s. Gain and Trimming controls. Listed at £7.7.0. Our Price. Carr. 2/6. **£3/19/6**

TURRET TUNERS. Compact 13-channel, with all coils. PCF80, PCC84 valves. 38 Mc/s or 1d Mc/s if as fitted in Pye T.V. sets. **£2.15.0.**

TV AERIALS

LABGEAR SPIRAL COMBINED BAND I AND BAND III T.V. AERIALS. For localities of high signal strength. Adjustable matching unit incorporated. Plug into standard co-ax socket—e.g., either straight into the back of the T.V. set or into a wall socket. (Price 3/6 if required.) Listed 27/6. Our Price, **9/6.**

BURWELL T.V. AERIALS. Complete illustrated Price List of 1 to 12 element Band I and III aerials at amazing competive prices. (3d. stamp.)

CO-AX CABLE. Low loss High Grade 70/80 ohms. 1-19 yds., **7d.** yd.; over 20 yds., **6d.** yd.

LATEST B.S.R. TYPE AU8 AUTOCHANGERS. Gold and Fawn finish. 10 records all sizes, unopreadable value at **£8.19.0.** Carr. 4/-.

TWO-TONE REXINE PORTABLE AUTOCHANGER CABINETS. Attache case type with lift-up lid and front speaker cut out complete with uncut motor board, amplifier back, snap fasteners, carrying handle. **£3.5.0.** Carr. 3/-.

B.S.R. 4-SPEED AUTOCHANGER PORTABLE RECORD PLAYERS. Consisting of the above type AU8 autochanger and 2.2 watt amplifier with speaker, assembled in a two-tone rexine case. Truly amazing value. (Listed over £26.) **£13.13.0.** Carr. 6/-.

4-SPEED SINGLE PLAYERS

COLLARO 4-speed RCC554	**£6.19.0**
GARRARD 4-speed 4SP	**£7. 7.6**
GARRARD 4-speed TA MKII ...	**£8.19.0**

Carr. and pack., 3/-.

10 RECORD AUTOCHANGERS

COLLARO RC511 3-spd.	**£3.19.6**
COLLARO CONQUEST 4-spd. ...	**£8.17.6**
B.S.R. AU8 4-spd.	**£6.19.0**
GARRARD RC75A Senior	**£7.19.0**
GARRARD RC80M A.C. D.C. ...	**£10.19.0**
GARRARD RC88/4	**£12.15.0**
GARRARD RC120D MKII	**£9. 7.6**
GARRARD RC121/4 MKIII ...	**£9.19.0**

Carr. and pack., 4/-.

TV 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/-

C12FM, CRM121, CRM121A, CRM122, MW31-7, MW31-14C, MW31-17. MW31-18, T12 54. £3/5/-

3/16, 3/31, 14KP4, 14KP4A, 108K, 121K, 141K, 7201A, 7202A, 7203A, AW36-21, C14FM, CRM141, CRM142, MW31-16, MW31-74 MW36-24, MW36-44, T12-54B. £3/15/-

17ARP4, 17ASP4, 6706A, C17FM, CRM171, CRM172, MW43-43, MW43-64, 7401A. £4/10/-

3/6A, 4/15, 6901A, C14BM, C17BM, CRM151, CRM152A, CRM152B, CRM153, MW41-1, MW43-80, TA15, TR14-2, MW43-69. £5/5/-

C21HM, C21NM, CRM211, CRM212, MW53-20, MW53-80. £6/15/-

Supplies of a few types, particularly 15 inch round types, are at present irregular.

TRANSISTORS AND DIODES.

RED SPOT. Transistors for I.F., L.F. and Output up to 500 kc/s. **6/6. WHITE SPOT.** R.F. and I.F. 2.5 Mc/s., **9/9**; **XA103, 15/-**; **XA104, 17/6**; **XB104, 10/-. GET15, 25/-. GERMANIUM DIODES.** General purpose famous make, **9d.**, 8/- doz. **DIODES.** Equivalent to GEX 44, **3/9. RECTIFIERS. SPECIAL OFFER. Fully guaranteed ex-equipment.** RM4, **9/6**; 14A/86, **9/6**; 14RA 1-2-8-2, **9/6**; 14RA, 1-2-8-3, **9/6.**

REGUNNED TV TUBES

All guaranteed 12 months. Excellent workmanship. Carr. 12/6.

MW31/16, MW31/74, 121K, 12KP4. £5/10/-

MW36-24, AW36-21, 141K, 14KP4, CRM141, CRM142. £5/15/-

CRM152A, CRM152B, CRM153, CRM171, MW43/64, 171K, 17ASP4. £6/15/-

MW53-20, MW53-80, CRM211, CRM212. £9/10/-

TV SALE

SATURDAY IS BARGAIN DAY. At our store at the junction of Somers Street and Green Road, Southsea. 100's of Televisions from **£2 COMPLETE.** Cabinets, Chassis, etc. etc.

TV SETS

5-CHANNEL T.V.s. Modern. Table 12in., tested pictures before dispatch, all good tubes, tunable all B.B.C. stations, all top makes. **£6/15/-** Carr., etc., 12/6.

14in. T.V.s. 5-channel. Absolutely complete as above. Special Offer. **£9/15/-** Carr., etc., 12/6.

13-CHANNEL T.V.s. 12in. 5-channel B.B.C. T.V. with separate mains-driven Band III converter (new, listed £7). **£9/10/-** Carr., etc., 12/6.

14in. T.V.s. 13-channel. As above. Absolutely complete. Special offer. **£12/10/-** Carr., etc., 12/6.

T.V. CHASSIS. Complete with line trans., focus magnet, R.F. strips, etc. etc. In Table Cabinets requiring only valves, tube and speaker to complete. Most makes. Carr. Free. **29/-**

T.V. CHASSIS. As above. But 5-channel. Carr. Free. **45/-**

GUARANTEED P.M. SPEAKERS. Standard 3 ohms, ex-equipment, tested, top makes, performance guaranteed. 5in., 12/-; 6½in., 9/-; 7 x 4, 12/-; 8in., 9/-; 10 x 6, 14/-; 10in., 14/-.

14in. T.V CABINETS. Table, Mask Glass, 7 x 4in. speaker baffle. **19/-.** Carr. 5/-.

W.A. FOCUS MAGNETS. Centring and Focus controls, **9/6.** Ditto Double Magnet, **12/6. W.A. DEFLECTION COILS.** Standard Ferroxcube **19/-. 3in. ALADDIN FORMERS,** Tags, slugged, **5d.** ea., 4/- doz. Ditto Screened, 1¼in. high, **6d.** ea., 5/- doz. **EKCO TYPE T.V. COILS.** Screened, 1¼in. high, 1in. deep. Slugged, **5d.** ea., 4/- doz. **L.F. CHOKES,** 5H 250 mA. Small, **4/6**; 7H 300 mA, **6/6. E.H.T. CONDENSERS.** 500 pF 18 kV., 3/6; .001 12 kV., 2/6; .002 18 kV., **4/6.**

45 Mc/s MIDGET I.F. STRIPS. Takes 6 EF91 Less valves, **7/6**; with valves (tested), 30/-.

H.T. RECTIFIERS

250/U6/79A (240 v. 80 mA.), 5/-; B30, 6/-; RM2, 6/6; RM3, 9/-; RM4 (ER4), 15/6; RM5 (ER5), 21/-; 14A86, 17/-; 14A97, 23/-; 14A100, 25/-; 18RA 1-4-16-1, 7/9; 14RA 1-2-8-2, 18/-; 18RD 2-2-8-4, 14/-; 14RA 1-2-8-3, 22/-.

CHARGING EQUIPMENT

RECTIFIERS. Iron selenium full wave. 12 v. 1 amp., 5/-; 12 v. 2 amp., 8/-; 12 v. 3½-4 amp., 9/6.

TRANSFORMERS. (Primary 0-210 v. -240 Secondary 0-3.5 v., 0-9 v., 17 v.) for charging 2 v., 6 v. or 12 v. batteries. 1 amp. size, **9/9**, 1/- post. 2 amp. size, **14/6**, 1/6 post. 4 amp. size, **19/-**, 1/9 post.

4-SPEED RECORD PLAYERS. Latest B.S.R. TP5 Turntable, together with lightweight Sonar Galaxy dual sapphire crystal turnover pickup head. Truly amazing at **£3.15.0.** Carr. 5/-.

VALVES

GUARANTEED 3 MONTHS. 24 HOUR SERVICE FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money Back Guarantee on goods if returned unused within 14 days.

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozens). Post: 1 valve, 6d.; 2-11, 1/-.

1A3	2/6	5Y3G	6 6	6BW6	8/6	6J5	5 -	6Q7G	8/6	12J5GT	4 -	185BT	16/-	EB91	4/6
1A7	14/6	5Y3GT	8 6	6BW7	8/-	6J5G	3 -	6Q7GT	10/6	12K7GT	6 6	807E	5/-	EBC3	9/-
1C5GT	11/6	5Z4G	9 -	**6BX6**	6/6	6J5GT	4/6	6S4A	7/-	12K8GT	808	15/-	EBC33	6/-	
1C6	6/-	5Z4GT	11/6	6C4	3/6	**6J6**	4/6	6S6GT	5/6			813	45/-	EBC41	9/-
1D5	15/-	6A8G	8 -	6C5GT	5/6	6J7G	5 -	6SH7	5/-	12Q7GT	6 6	2050	3/6	EBC91	9/-
1H5GT	10/6	6A8G	11 -	6C6	4/6	6J7M	9 6	6SJ7	7/-	12SJ7	8/6	EBF80	9/-		
1L4	4/6	6AC7	5 -	6C9	9/6	6K6GT	7 8	6SK7GT	7/-	19AQ5	9 6	AZ31	9/-	EBF89	9/-
1N5GT	10/6	6AG7	5 -	6C10	9/6	6K7G	3 6	6SL7GT	7/-	20D1	9/6	B36	9/6	EBL31	23/3
1R5	7/6	6AJ7	5 -	6CH6	11/-	6K7GT	5 6	6SN7GT	5/6	20F2	9 6	CBL31	24/4	EBL81	11/-
185	6/6	6AK5	7 -	6D2	4/6	6K8G	7/-	6U4GT	11/6	20L1	15 6	CCH35	8/6	EC52	4/-
1T4	5/6	8AL5	4 6	6D3	6/6	6K8GT	10 6	6V6G	6/-	20P1	14 -	CL33	9 6	EC91	4 6
2A7	8/6	6AM6	5 -	6D6	5/-	6K25	9/-	6V6GT	6 6	20P3	15 -	CY31	7 6	ECC31	11 -
2D21	4/6	6AT6	7 6	6F1	9/6	6L1	13 6	6X4	5 6	20P4	27 10	D63	4 -	ECC32	9 -
3Q5GT	9/-	6B8G	4 -	6F6G	7/-	6L6G	8 -	6X5G	5/-	25A6G	8 -	D77	4/6	ECC33	7 6
3S4	7 6	6BA6	6 -	6F12	5 -	6L7	6 6	6X5GT	6 6	25L6G	6 6	D152	5/-	ECC34	9 -
3V4	8 6	6BE6	6 -	6F13	9 6	6L18	9 6	7A7	11 6	25L6GT	9 6	DAC32	10/6	ECC81	7 -
4D1	2 6	6BG6G	12 -	6F14	9 6	6L19	11 6	7B7	8/-	25Y5G	9 -	DAF91	7 6	ECC82	7 -
5R4GT	11/-	6BJ6	7 -	6F15	9 6	6LD20	9 6	7C5	8/-	25Z4G	8 6	DAF96	9 6	ECC83	8 -
5U4G	7 -	6BH6	8 -	6F33	6 6	6P25	9 6	7C6	7/-	25Z6	9 6	DD41	4 6	ECC84	9 -
5V4G	9 6	6BR7	11 -	6H6M	2 6	6P28	11 -	7H7	8/6	27SU	16 -	DF33	10/6	ECC85	9 -
								7N7	10/-	30C1	9 -	DF91	6 -	ECC91	4 6
								7V7	8 -	30FL1	9 6	DF96	9 6	ECF80	12 6
								7Y4	8/-	30L1	8 6	DH63	8 6	ECF82	11 -
								10C1	9/-	35L6GT	9 6	DH77	7 6	ECH35	8 6
								10C2	12/6	35W4	8 -	DK91	7 6	ECH42	9 -
								10F1	9/6	35Z4GT	6 6	DK92	10/-	ECH81	9 -
								10F9	10/6	35Z5GT	8 6	DK96	9 6	ECL80	11 -
								10LD11	12/6	42	7 6	DL35	11 6	ECL82	12 -
								10P13	14/-	50C5	10 6	DL92	7 6	EF36	4 -
								10P14	12/-	50L6GT	9 6	DL94	8 6	EF37	7 -
								12AT6	9/-	53KU	11 -	DL96	9 6	EF39	5 -
								12AT7	7/-	54KC	11 -	EA50	9d.	EF40	14 -
								12AU7	7/-	61BT	9 6	EABC80	9 -	EF41	9 -
								12AX7	8/-	61SPT	11 -	EAC91	6 6	EF50	
								12BA6	8 6	80	7 6	EAF42	9/-	Brit.	3/-
								12BE6	9/-	83	7 6	EB34	1 6	Red	3/6
								12BH7	9/6	90AV	4 6	EB41	7 6	U.S.A.	4 6

EF42	9 6	KT45	9 6	PY82	8/6
EF54	3 6	KT61	9 6	PY83	9/-
EF80	6 6	KT66	12 6	PZ30	9 6
EF85	7 -	KT81	8/-	SP4B	9 -
EF86	14 6	KTW61	6 6	SP41	3 -
EF89	9 6	KTZ63	5 6	SP61	3/-
EF91	5 -	L63	3 -	SU2150A	5 -
EF92	5 -	LN152	11 -	T41	7 6
EF95	7/-	LZ319	9/-	TH30C	12 6
EF98	7/-	MU14	8 6	U18	9/-
EF183	8 6	N37	9 6	U22	6 6
EF184	8 6	N78	11 -	U24	12 6
EL32	4/-	N108	9 6	U25	15/-
EL33	9 6	N127	9 6	U26	13 6
EL34	9 6	P41	4 6	U31	8/-
EL41	9 6	P61	2 6	U33	9 6
EL42	7 6	PC84	8 6	U35	9 6
EL84	10/-	PC86	11 6	U37	9 6
EL85	11/-	PC88	11 6	U45	9/-
EL91	4/-	PC95	11 6	U50	6 6
EL95	10 -	PC97	9/-	U52	7/-
EM34	6/-	PC900	9 -	U78	5 6
EM80	10/-	PCC82	11 6	U191	9 6
EM81	10/-	PCC84	9 6	U251	9 6
EM84	10/-	PCC85	13/-	U281	9 6
EM85	10 -	PCL82	12 -	U282	22 6
EN31	12 6	PCL84	16/-	U301	9 6
EY51	10 6	PEN25	5 -	U403	9 6
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UCL82	14 6		
UF41	9 -		
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UF80	10 -		
UF85	10 -		
UF89	16 -		
UL41	13 -		
UL84	9 6		
UM80	10 6		
UU6	9 -		
UU7	9 6		
UU8	27 10		
UU9	7 6		
UY41	8 -		
UY85	9 6		
VP1	6 6		
VP4	6 6		
VP133	9 -		
VP13C	7 6		
W76	6 6		
W77	5 -		
X61M	9 6		
X65	11 -		
X66	9 6		
X78	12 6		
X79	9 6		
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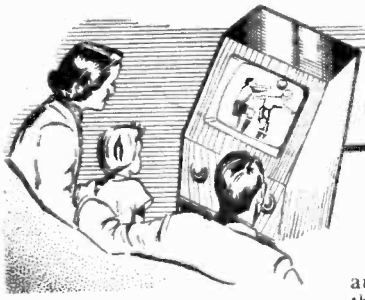


UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

THE swing of the pendulum applies most appropriately to the relative quality and appeal of the BBC and I.T.A. television programmes.

I seem to swing in my personal preference from one service to the other every five or six months. Just at the moment it puzzles me why the viewing public continues to like I.T.A. programmes so very much better than those of the BBC. According to various public opinion research organisations more than twice as many of the viewers who can pick up both programmes tune to I.T.A. To me this would have been perfectly understandable six months ago, but the fierce competition has forced the BBC programme organisers to try to improve their programmes —which they have done in no uncertain manner in my personal opinion. Not only are the BBC comedy programmes on the whole brighter and more original, but the interest features, live and filmed, are of a higher standard. The technical qualities of the BBC pictures are more consistent and considerably more flattering in the reproduction of the faces of actors and actresses. Sometimes, the I.T.A. cameras put years on their apparent age by way of rings under the eyes and lines on their faces.

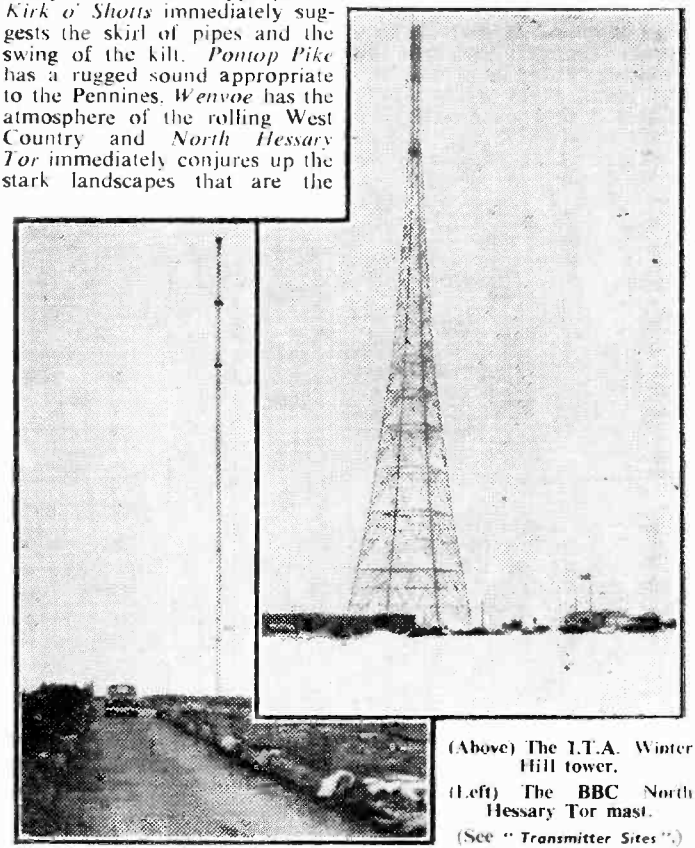
BBC Ahead?

OF course, there are occasional I.T.A. programmes which register very well indeed, but in my opinion the BBC programmes have, albeit momentarily, overtaken them. Yet the public as a whole prefers to remain tuned in to I.T.A. What can be the reason? It may be due to sheer laziness, or it may be that they enjoy the advertisements. This, I think, is the real reason. Some of the brightest and most amusing moments in the television programmes are the really good advertising filmlets, which are the product of first-class craftsmanship. Slick and witty, the best of them provide an admirable thirty-second diversion. Sadly, this high standard is not maintained throughout, and many will agree when I say that.

Transmitter Sites

I HAVE long admired the names of the BBC television transmitter sites. They always seemed so appropriate. *Kirk o' Shotts* immediately suggests the skirl of pipes and the swing of the kilt. *Pontop Pike* has a rugged sound appropriate to the Pennines. *Wenvoe* has the atmosphere of the rolling West Country and *North Hessary Tor* immediately conjures up the stark landscapes that are the backbone of the pleasant counties of Devon and Cornwall.

The I.T.A. have not been quite so lucky with their site names, though *Mendlesham* has a distinct Suffolk flavour and *Emley Moor* has the atmosphere of the Brönte county. *Winter Hill* and *Black Hill* are excellent sites with discouraging names. *Burnhope* sounds like the name of a music hall act of 25 years ago—Burr and Hope—while *Croydon* recalls the old London Airport and the earliest aircraft radio telephony network, on



(Above) The I.T.A. Winter Hill tower.

(Left) The BBC North Hessary Tor mast.

(See "*Transmitter Sites*".)

900 metres. It will be interesting to see what names turn up for the I.T.A. transmitters for Devon, Cornwall, Carlisle and North-east Scotland. The I.T.A. have yet to obtain approval for the sites by various authorities. Up to now, the I.T.A. have scored full marks in their choice of sites, and the designers of their transmitter aerial arrays have included some daring directional designs.

TV and the Election

THE BBC, I.T.A. and the various contracting programme companies all have their ideas of how the General Election should be put over to viewers. The impact of television has been recognised by the two great parties, who have spent quite a lot of money on equipment and personnel to groom their speakers for live appearances. This is all to the good and provided the organisations keep the intrusion of politics well under control, as has happened in the last two or three General Elections, the viewers will not be overwhelmed or bored. The suggestion by Granada that all candidates in their area might be given the freedom of the microphone and TV camera is fraught with danger. I remember some incidents in *Under Fire* which accidentally got out of hand and might well have broken the conditions of the licence. Far better for the I.T.A. companies not to play with fire nor to risk annoying at least half of their customers. The BBC handle these things so much better than I.T.A., and their treatment of the results on election night is always absolutely first rate.

Lighting Progress

A VERY comprehensive survey of past, present and future lighting equipment for film and television studios was recently given before the British Kinematograph Society in the lecture hall of the Royal Society of Arts. T. E. Knight (Pinewood Studios) and Mr. R. de B. McCullough (BBC) read papers on their own particular spheres and B. Honri dealt with lighting in silent film days and forecasts of types of studio lighting of the future. Into this last category came 150 and 500 watt, internally silvered reflector, spot and flood lamps of very high efficiency; motorised lamps which can be moved by remote control; very low voltage incandescent bulbs giving a bright and hard spotlight beam; and a new type of xenon arc, which is instant starting and does not require water cooling. The internally silvered reflector lamp has been in use for some time for shop window lighting. In its latest, highly efficient form, it should become a useful and popular lamp in both film and television studios. Not so popular, though, with the lamp-housing manufacturers. Studio lamps usually collect peculiar slang names, such as "foo-foos," "inky-dinkies," "bashers," and so forth, and as the reflector lamp is virtually its own lamp-house, an ideal slang term springs to mind—"snail."

"Canned" Entertainment

AS an example of the use of "canned" goods take a recent evening when ITV offered *Song Parade*, *Double Your Money*, *The Cyril Fletcher Show*, *Variety Jubilee* and *The West Warlock Time Capsule*. The last two mentioned were films, the first two presumably telerecorded. On the face of it, a good evening's entertainment. I like Hughie Green very much, but the mixture for this show is "as before." But does Hughie Green have to look so much older than he really is? *The Cyril Fletcher Show* was completely ruined by the most phoney sounding laughter and applause interpolations I have ever heard. But this kind of dubbing butchery is murder on the work of any comedian, and Cyril Fletcher, of "Odd Ode" fame, deserved better treatment.

The West Warlock Time Capsule was preceded by one of those lengthy, uninspired introductions and explanations by Alfred Hitchcock, which is usually the cue for the family to make a cup of tea. *Variety Jubilee*, a film made about 1934, proved to be the best I.T.A. entertainment of the evening for me, with remarkably good technical values, good songs and the sight of George Robey, Florrie Forde, Gus Elen and other music hall favourites of twenty-five years ago. Why didn't I turn over to the BBC? On this particular evening, something was temporarily wrong with my BBC aerial circuit, giving a weak and fuzzy picture. So I missed Cliff Michelmore, Vera Lynn, amateur boxing and *Nina and Frederik*, all reported to have been first class in their different ways.

I.T.A. N.I. Coverage

A MAP issued by the Independent Television Authority shows that in the area to be served by its new station at Black Mountain, near Belfast, there is a population of over one million. Practically all these people will be in the primary service area where most viewers, unless they happen to be situated in particularly unfavourable positions, should receive a consistently satisfactory service.

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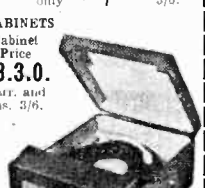

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PCF82	10/6	PL81	14/6	PY81	10/6
PCL83	12/6	PL82	10/-	PY82	8/6
PL81	14/6	PL83	11/6	PY83	10/6
PL82	10/-	PY80	9/6	U25	13/6
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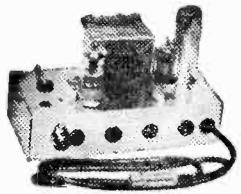

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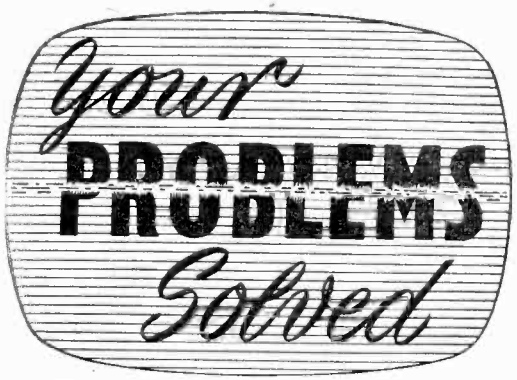

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 574 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

ULTRA V817

During the past two years I have had seven 6K25 valves fitted in this set, and approximately every three to four months this valve fails, producing a horizontal line across the screen, which indicates timebase failure. I am wondering if you could give me any information that will enable me to eliminate this trouble. Is this defect caused by resistors associated with this valve, or is it possible there is a defective preceding valve?—M. England (Pontyclun, Glam).

The rapid failure of the 6K25 indicates that its heater is overrun. This is normally the result of the mains transformer being set to operate upon a voltage lower than is actually applied. Raise the setting to 236-250. If still troublesome, run 6K25 from separate 6.3 v. transformer (rather than replace the mains transformer).

DERWENT RT5126

This set is about 1951 vintage which I have converted from 9in. to 12in. Unfortunately the metal H.T. rectifier (4DQ of unknown make) is disconnected. There appear to be two loose leads, one from the top of the transformer and one going to the red tag on the 100μF-100μF smoothing condenser. I believe it should be connected up as half-wave, i.e., transformer lead to green end of rectifier and condenser lead to the other end of the rectifier. As there is also a rectifier centre tap I would welcome your guidance on connecting up.—P. J. Wild (Plymouth, Devon).

If the rectifier has almost square fins or plates, wire transformer to the centre tag, strap the outer plates together and connect to H.T. (smoothing capacitor). The rectifier should be a Westinghouse 14A100, connected as above.

COLUMBIA 12in.

My set has been working perfectly for five years, but recently it started to give trouble. When I switch on all is well, but if I switch off for a time and switch on again it is dead. If I leave it till the next day, it comes on all right and continues till I switch off. I took it to a dealer but all the time he had it, it would not go wrong, so I brought it home and tried it, and now it is dead again.—W. R. Gilbert (Sheffield, 7).

We would advise you to replace the CZ1 thermistor. This is wired in series with the valve heaters and is almost certainly cracked. It is wired from the mains dropping resistor to the first heater in the valve chain.

EKCO T217

This set went off with a crack. After inserting two new fuses in the set, and switching on, the rectifying valve, U801, comes to a purple glow then flashes, after this has happened twice the fuses blow in the set. There is no sound or picture.—J. Wesley (Sheffield).

Your fault is almost certainly the U801 itself, although if replacement fails to cure the fault suspect a short to chassis from the U282 filament winding of the mains transformer.

BUSH 53

The line-hold on the above set has become very erratic, mostly when the power is low. Also, at the base of the screen, there is a ½in. wide bar which develops after the set has been running for a while. Adjusting the height control distorts the picture.—J. Nichols (West Lothian).

You should replace the ECC82 valve situated on the right-hand side of the chassis, behind the PY81. You will have to remove the metal screen (two P.K. screws) to gain access. The frame cramping can be corrected by means of the vertical form control, on a bracket on the same chassis under the tube. Alternatively, the PCL83 valve, near this control, may be failing.

G.E.C. BT1846

The above set is tuned to Channel 5, Band I, and Channels 8 and 9, Band III. Could you please advise me on how to tune it to Channel 10?—T. E. Davies (Cwmbran, Mon).

Tilt the set slightly, so that trimmers on the tuner unit are accessible. Set the contrast, sensitivity, and volume to maximum, and switch to one of the Band III ranges. Adjust the oscillator trimmer for maximum sound; aerial and R.F. for maximum picture brightness. Re-adjust the oscillator for minimum sound on vision, and re-adjust aerial and R.F. for best picture quality. During these operations, it may be necessary to reduce both sensitivity and volume.

PHILIPS 485U15

The frame lock is very critical—picture rolls badly when the hold control is moved, and also when the contrast control is moved. Flyback lines are visible all the time, and there is considerable "pulling on whites."—W. K. Buckley (Manchester).

The symptoms suggest that an electrolytic capacitor associated with the UL46 video amplifier (on the left of the tube) has become open circuited. Two 5 μF and one 50 μF are concerned (white cardboard covered).

ULTRA W817

I am having a great deal of trouble with lack of height and frame jitter. I have tried checking condensers, resistors, etc., as you advised another reader with similar trouble, but in my case the only cure seems to be a new 6K25 frame oscillator. Would it be possible to alter the circuit to enable the use of a hard valve frame oscillator? —D. Brown (Staines).

Ensure that the mains voltage is correctly set, so that the valves receive their correct current and no more. The .001 μF line pulse filter capacitor (junction of 100 K and 500 pF to chassis in 20LI-6K25 circuit) should be checked. Normally, the 6K25 is not troublesome, and a change to a blocking oscillator circuit hardly seems warranted.

FERGUSON 988T

Could you please help me cure sound distortion, also picture and sound fading?—L. C. Lee (Waltham Cross).

For sound distortion, check front left-hand side ECL80 valve and resistors associated with the front right-hand side EB91. For fading, check seating of EF80 valves in their sockets, the rear three EF80 valves by substitution, and the resistors, etc., associated with the bases.

PYE LV51/F

The picture shimmers and is often too big for the screen and the frame hold needs constant readjustment. The picture inclines to the left, and adjustment does not rectify this. The contrast control is not very good, and tends to act as brilliance control. The sound crackles slightly now and then. All the valves are O.K. Do you think a new choke is required?—P. J. Edwards (Stretford, Lancs).

We do not think so. If it runs hot, an excessive current flow is indicated. This could be due to leaky electrolytic capacitors, and these should be checked. Check the frame timebase ECL80 (jitter and frame hold), and hold control series resistor. Check the EY51 by replacement (picture too big). Check and clean volume control and inspect contact. Centre the picture by means of the shift plates on the front of the focus magnet.

FERRANTI T1505

Ten minutes after switching the set on, the left half of the screen goes blank, while the right half breaks up into horizontal lines. After 30 minutes, the whole screen is covered by these lines, with one big vertical white line in the centre.—J. Hupton (Leigh, Lancs).

Inside the top of the line output transformer is a large resistor, probably charred. Its value should be 120 KΩ. Check this and replace if necessary. Check EL38 valve and 5.6 KΩ resistor, 8-watt wire wound, to pin 4 of EL38. The "shedded" appearance of this, and nearby resistors does not, however, indicate that they are faulty.

EKCOVISION T217

Recently, the picture has become very blurred. If the brightness is advanced, the picture goes off, but if the contrast is turned down at the same time, the picture improves slightly. I have fitted a new U801 and U282, also a new 20PI without success.—C. Orrah (Sheffield).

You should replace the EHT rectifier, type U25. This is the small glass valve with a single soldered connection at one end and two at the other. The soldered connection must be left well rounded, with no sharp edges (use a hot iron), which could promote corona and arcing.

COSSOR 937

After the above set has been on for about half an hour, the picture starts to get smaller from the top and bottom, till it disappears altogether. After switching off for about half an hour, the picture is restored to normal for a while, and then the process repeats itself.—T. Walker (Billingham).

If, when the picture fails, a white line is left horizontally across the tube face, replace the right-hand 6AB8 (ECL80) on the main deck. If, however, the picture fades completely, leaving nothing on the screen, replace the .1 μF capacitor, which decouples the first anode supply to pin 10 of the tube base, and .001 μF, which decouples the height control.

MURPHY V350AD

Upon switching on, the picture is very blurred and the width is not sufficient to fill the screen. As the set warms up this slowly corrects itself until after about 15 minutes a perfectly satisfactory picture is obtained.—W. Prewett (Salisbury).

We advise you to check the two valves inside the screened compartment, as one of them is obviously slow in heating. The most likely one is the efficiency diode type U251 (U301 on earlier sets), but the 20P4 can also cause the symptoms you describe.

SOBELL TS17

My set is fitted with a Mullard MW43-64 tube. The picture just disappears and does not reappear for days. There are no inter-electrode shorts and the tube appears to be in order. All valves light up, and movement of the ion-trap magnet has no effect. The sound is perfect and controls are O.K., but there is no raster.—D. Provan (Carnock, Stirling).

Assuming that you have tested for EHT and found it present whether the fault is existent or not, we would say that the cause is an intermittent break in the C.R.T. cathode connection (usually inside the tube). Check for dry joints around the tube base and also short the grid and cathode pins of the tube. If all is in order this should produce an uncontrollably bright raster.

RAYMOND F89

When the set is switched on, the frame hold has to be reset, and again as the set warms up. There is considerable frame jitter present. I have replaced three valves, and most of the condensers and resistors in the frame timebase.—J. H. Wilson (St. Helens, Lancs).

We advise you to replace resistor R54, and capacitor C60, as these are most likely to be at fault. If you suspect CV3, remove it, wire a

(*Continued on page* 574)

fixed capacitor of .002 μF across C52 on tag panel, disconnect white lead from one end, also R54. Connect white lead tag in its place, then instal a 2 MΩ variable resistor in place of CV3. Use a pre-set control with 2-screw fixing.

COSSOR 937A

Recently, a black line has developed on the right side of the screen. At times, this pulls over to the left, forming a wavering line. On other occasions, the whole screen shimmers and none of the controls will stop it, though it settles itself after a few moments.—R. W. Farrow (Redhill, Surrey).

We suggest you change the 6AB8 situated on the main deck, left-hand side, viewed from the rear. If the trouble continues, check the 12AU7, farther to the left, and then check the components associated with the 6AB8 valve base. The 21A6 and 17Z3 on the near left side (with top caps), should also be tested.

FERGUSON 203T

Will you please give me instructions for cleaning the front of my tube, and also behind the safety glass. What cleaning medium do you recommend ?—J. B. Wilson (Workington, Cumberland).

Pull off the front control knobs; remove the rear cover and turn the cabinet on to its side. Remove the bottom cover, and bottom chassis fixing screws. Pull the speaker lead plugs from their sockets. Turn the cabinet upright and remove centre screw from the side control panels and take out panels. Now slide the chassis carefully out of the cabinet. The screen should be cleaned if possible with an anti-static screen cleaner, but if this is not readily available, household window-cleaning fluid will do the job.

PYE LV30

The frame scan in my set has failed, and only a bar appears across the screen, varying from $\frac{1}{2}$in. to 4in. high when the height control is adjusted. I interchanged V14 (frame output valve) and V12 (sound output), and also interchanged the two EB91s without any improvement. While the set was working, I noticed intermittent high-pitched squeaking noises coming from the timebase. When this noise was heard, a slight blue flashing was seen inside the frame output valve (ECL80). As the height of the scan is varied by the height control, I suspect either the frame output transformer, or the blocking oscillator transformer.—C. H. Pugh (Haileybury, Herts).

The frame oscillator transformer of the B18T may be used, and it is possible that this is at fault. Check the frame hold control and the 470kΩ series resistor, also the 12μF and 50μF capacitors.

MURPHY V214

Just before Christmas, I fitted a booster to this set. For a time, all was well, but now I find that the picture is blown up, and any attempt to increase brightness results in the picture enlarging still further and disappearing altogether.—R. M. Clark (Mexborough, Yorks).

Your present fault should clear up if you replace the U25 EHT rectifier. Be sure to round off all soldered joints, using a really hot iron, or corona will result. Check also the ion trap magnet inside the focus dome. This should be set for maximum brightness.

AERIALS—HOLME MOSS AND SUTTON COLDFIELD

Could you please tell me the dimensions of an "X" aerial for these two stations?—M. L. Piercey (Cymmau, Wrexham).

For Holme Moss the aerial should be 9ft. and the director 8ft. 4in., and for Sutton Coldfield the aerial should be 7ft. 7in. and the director 7ft.

PYE V4

The sound on the above is working all right, but I cannot get a picture. The EHT rectifier valve (EY51) was not lighting up, so I replaced it, but it made no difference. Then I found that the 250 mA fuse had blown. I renewed this, but it fused again at once.—R. Looker (Waterhouses, Co. Durham).

You should have the PL81 and PY81 valves tested. One of these almost certainly has an internal short, but if this is not the case, the timebase will have to be checked with a meter for shorts.

COSSOR 946

When I increase brightness, the picture enlarges and fades out. Also, when I switch the set off, white spots appear on the tube.—J. H. Pritchard (Bethesda, Caernarvonshire).

Your symptoms are those of a displaced ion-trap magnet, and this should be set for maximum brilliance. If this does not improve your picture, we suggest you change the SU61 EHT rectifier, which is inside the aluminium case on the left of the set as viewed from the rear.

AERIAL—ST. HILLARY

I am interested in making an ITV aerial for St. Hillary. Could you please tell me the dimensions and spacings for this ?—T. H. Kernick (Dawlish, Devon).

The transmitter in question operates on Channel 10, and the dipole should consist of 1ft. 1$\frac{3}{4}$in. each half, the reflector 2ft. 5in. and the directors 2ft. 3in. each. The spacing should be 1ft. 1in., which might be reducible to 10in.

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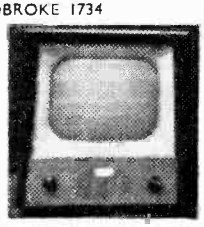

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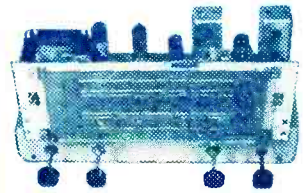

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