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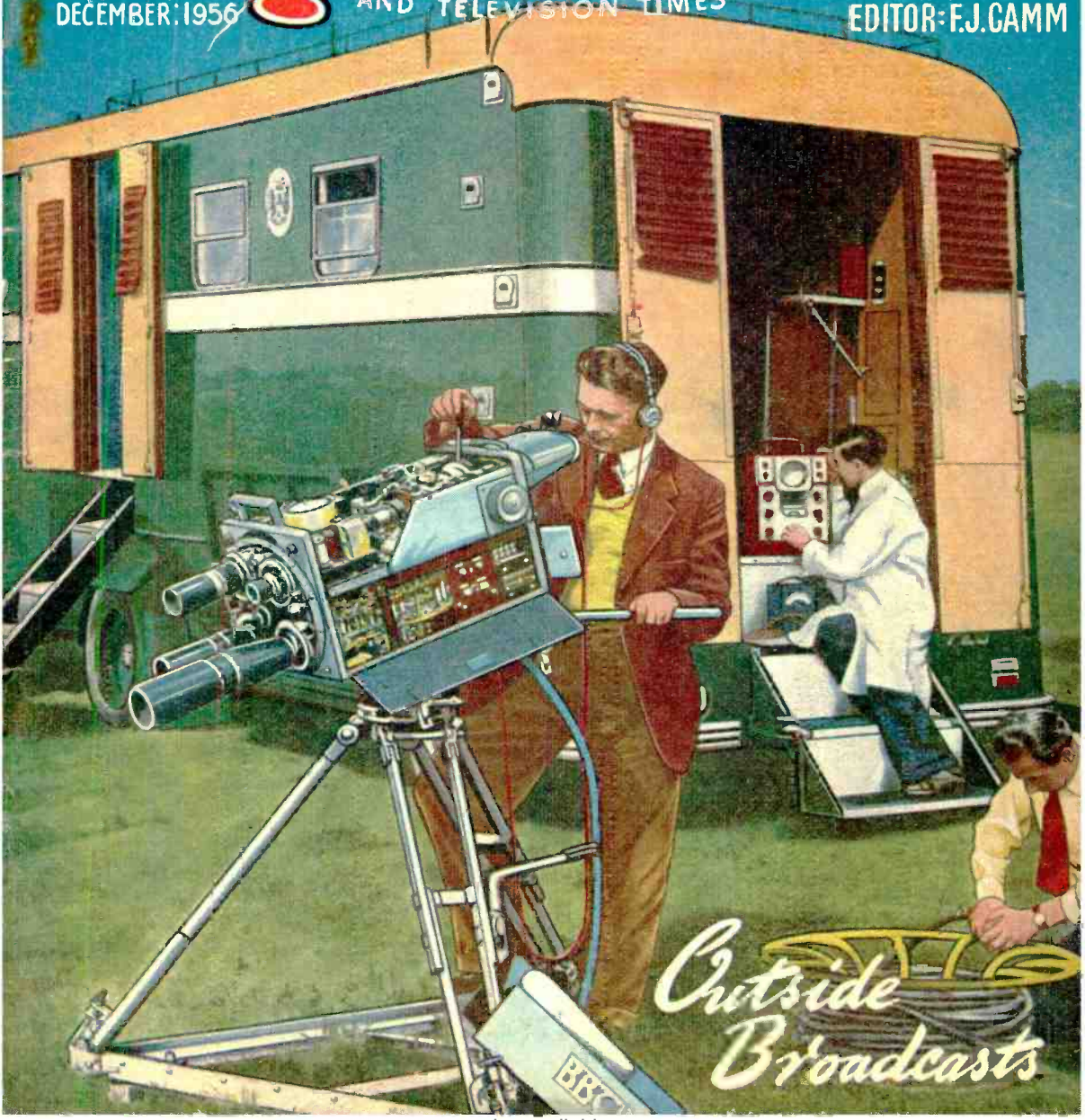
Practical Television

1'3

DECEMBER: 1956

AND TELEVISION TIMES

EDITOR: F.J.CAMM



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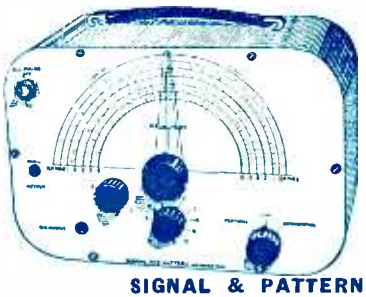

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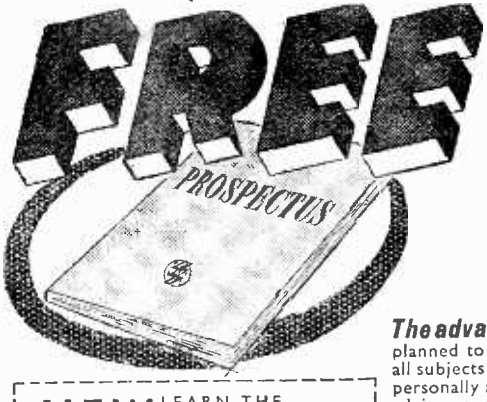

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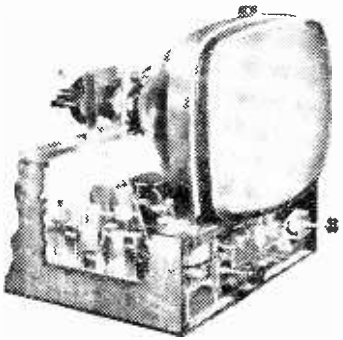

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

Editorial and Advertisement Offices : "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone : Temple Bar 4363. Telegrams : Newnes, Rand, London.

Registered at the G.P.O. for transmission by Canadian Magazine Post.

Vol. 7 No. 77 EVERY MONTH DECEMBER, 1956

Televiews

NECK AND NECK

BY the time these words appear in print, the number of television licences will be equal to if not in excess of the number of sound broadcast receiving licences. During the month of September the number of television licences increased by 95,443. The total number of broadcast receiving licences, including 6,139,773 for television and 308,314 for sets fitted in cars, was 14,397,723, these totals relating, of course, to Great Britain and Northern Ireland. Thus we are witnessing the gradual decline in sound radio, which must inevitably be overtaken by TV. The advent of commercial TV has of course been responsible for the increase in TV licences.

More and more viewers now watch TV and according to viewer research, commercial TV holds the palm. Indeed, one only has to examine the figures to see the enormous strides which ITV has made in its first year, when the number of homes receiving I.T.A. transmissions rose from 190,000 to 1,850,000, or 46 per cent. of all homes with television in the three areas.

The Editor and Staff Join in Wishing Every Reader a Very Happy Xmas

BINDERS FOR BINDING YOUR VOLUMES

READERS who have their annual volumes of this journal bound have often complained that they have to wait a year before they can preserve their copies in this permanent form. We are pleased, therefore, to announce that we have arranged for self-binders to be supplied so that issues may be inserted month by month without having to wait for the full number of issues. This will avoid the possibility of separate copies becoming damaged or mislaid. Full details of this service appear on page 211.

RADIO FILM SHOW

WE recently witnessed some excellent films dealing with transistors, valves and cathode-ray tubes and their methods of manufacture. These films were so interesting that we made the suggestion to the producers that they should be shown to a wider audience, and accordingly, the films are to be shown at the Caxton Hall (Great Hall Site) on Thursday, February 21st, 1957. Admission will be free, but by ticket. There will be an interval for refreshments. Readers wishing to attend this film show should send in requests for tickets immediately. Address your letters to "Film Show," PRACTICAL TELEVISION, address as on this page. The meeting will commence promptly at 8 o'clock in the evening.

There is bound to be a large demand for seats, and accommodation is limited. Please, therefore, apply early. Mr. F. J. Camm will be in the Chair.

THE VIEW MASTER TV TUNER

READERS who were unable to obtain the issues containing constructional details of the modification to the View Master and of the three-station tuner (which may also be used with other receivers) will be interested to know that the articles have been reprinted and copies of the reprint may be obtained for 2s. 6d. (2s. 8d. by post) from The Editor (address as above). The edition is limited.

TEMPORARY STATION FOR SANDALE ?

IT is possible that a temporary TV station will be opened at Sandale, about 14 miles south-west of Carlisle, towards the end of the year. This will make television available in Cumberland, the permanent station to cover which is not due for completion until the end of next year.—F.J.C.

THE JANUARY, 1957, ISSUE WILL BE PUBLISHED ON FRIDAY, DECEMBER 21st.

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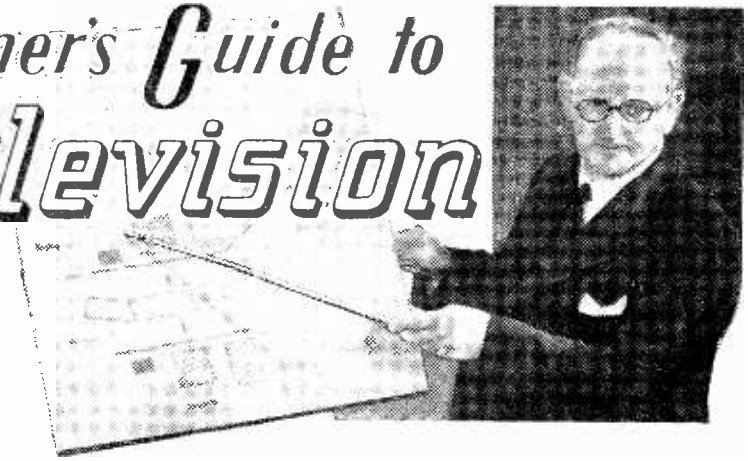
A Beginner's Guide to Television



A NEW SERIES

9.—THE N.T.S.C. SYSTEM —TRICOLOUR TUBES EXPLAINED

By F. J Camm

THE BBC has installed experimental colour television equipment at the London station at Alexandra Palace, where it is radiating a signal based on the American N.T.S.C. standard. (N.T.S.C. stands for The National Television Systems Committee.) The main features of the BBC signals are: the colour signal is transmitted in the same radio frequency channel and by the same transmitters as carry the established monochrome service; it is claimed that the system is "compatible." In other words existing monochrome receivers can receive a monochrome version of the colour picture which is of as good a quality as if the picture had originated from a normal monochrome camera; and it is further claimed that the standards are such as to allow for the considerable and inevitable future development in the quality of the colour picture, just as the original specification for the monochrome service provided for continuous improvement in the course of the years.

We have already seen that the BBC (excepting the war period) has since 1936 operated a successful monochrome service employing 405 lines, 50 frames per second interlaced. The scanning and transmission standards of the U.S.A. and this country differ in important particulars, and the advent of the N.T.S.C. colour system arouses interest in the question as to whether it would show the same advantages here when modified to suit British TV standards. As a result of experimental work, the stage has been reached where satisfactory transmission equipment is available and the investigations can now be extended to a wider field. The Television Advisory Committee has been asked to report on the subject of colour television.

The equipment at Alexandra Palace generates a modified N.T.S.C. type of colour signal, and at present the purpose is to explore the degree of compatibility of the system by making observations on a large number of black and white receivers. It is also desired to find out whether the system is capable of producing a consistently good quality colour picture.

The test transmissions have at present no entertainment value and are in no sense a public service. They take place outside normal programme hours.

The N.T.S.C. Colour Signal

A brief résumé of the essential features of the N.T.S.C. colour signal is now given.

The main items of equipment installed at Alexandra Palace are: colour slide and film scanner—designed and made by Research Department, Engineering Division, BBC; colour camera; signal coding equipment; colour picture monitors; colour test equipment—designed and made by Marconi's Wireless Telegraph Company Limited.

The colour slide and film scanner is the source of the pictures which are being transmitted for the present series of tests of the compatibility of the N.T.S.C. signal. It produces pictures from slides either 3¼in. 2¼in. or 2in. 2in. or from 16mm. film, by selection of the appropriate optical system.

The scanner employs the flying spot principle and the source of light is, therefore, a cathode ray tube of which the phosphor emits light as evenly as can be achieved over the whole of the visible spectrum. The light from the raster on the face of the scanning

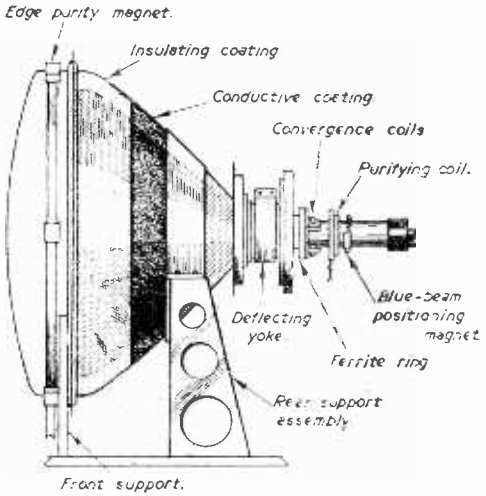


Fig. 39.—Sketch showing a modern colour tube with all the essential parts identified.

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tube is passed either through the slide or the film as desired, and the coloured image so produced is then split into three separate parts, which represent respectively the red, green and blue information in the picture. This colour analysis process is performed by a combination of dichroic mirrors, coloured filters, plane mirrors and lenses. The three-colour separation pictures, which emerge from the analyser as three physically separate rays of light, are then focussed each on to a photo-multiplier tube which turns the intensity of the light, which is varying in accordance with the scene being scanned, into corresponding electric voltages. The three voltages

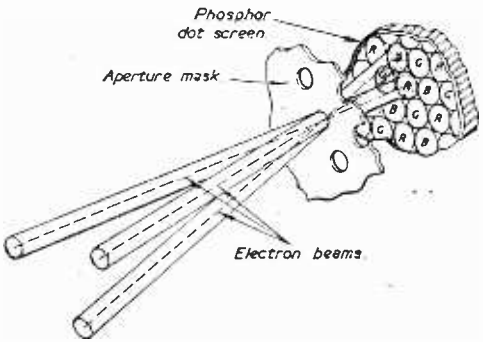

Fig. 40.—The 3 beams converging on the screen.

are then passed through three separate and identical chains of electronic equipment which supply gamma correction, correction for the distortion introduced by the finite decay time of the light from the scanning tube phosphor, and equalisation for aperture loss, exactly as in the case of a monochrome flying spot scanner.

The film transport mechanism is a standard intermittent motion 16 mm. projector with a "pull-down" time of about 4 milliseconds. Since the time available for "pull-down" is only 1.4 milliseconds if all the lines of the television picture are to contain information, some picture information is inevitably lost. This loss occurs at the top and bottom of the picture, where about 15 lines are presented as black. In order to preserve the usual aspect ratio of 4 : 3 an equivalent area at the sides of the picture is also black. The picture, therefore, appears as in a black frame, but this disadvantage is accepted because the arrangement permits of a simple and efficient optical system. Synchronism between the film motion and the television picture repetition rate is achieved in a

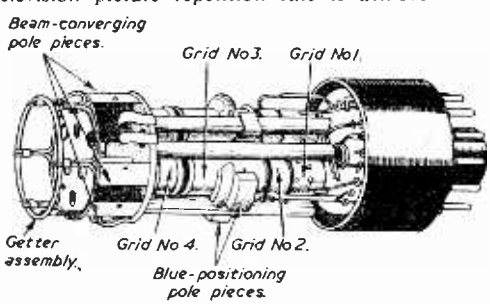

Fig. 42.—A sketch of the 'gun' assembly of a modern colour C. R. Tube.

simple way of supplying power to the synchronous motor of the film transport mechanism by amplifying the 50 c/s component of the frame pulses.

The Colour Camera

Coloured light entering the lens of the camera is split into three colour separation images by a colour analyser similar in principle to that used in the slide and film scanner. In place of the three photo-multiplier cells are three Image Orthicon camera tubes of a type developed specifically for colour work. These tubes produce the three colour separation signals in

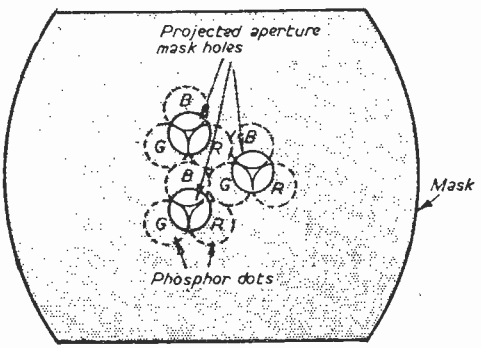

Fig. 41.—The colour grains seen through the shadow mask.

electrical form. Each of the tubes is supplied with the necessary scanning waveforms and electrode potentials just as in the case of the single-tube monochrome camera. It will be realised that the output of each tube is a separate picture of which not only the transfer-characteristic between light input and voltage output must be maintained in a precise manner for the three signals, but the geometry of the three pictures must be the same within very close limits so that any particular detail of the picture occurs at the same point in the scanning cycle of all three.

The signals from the tubes are amplified in the camera and transmitted to the control room over three identical cables. In the control room each signal is gamma corrected and equalised in a manner very similar to that used in monochrome equipments employing the same type of camera tube, and finally emerges as a colour separation signal of the same form as that produced by the slide and film scanner.

Two general views of the camera are given in Figs. 44 and 46. The control desk of the camera is seen in the foreground of Fig. 47. The three sets of controls, one for each camera tube, can be clearly seen. The

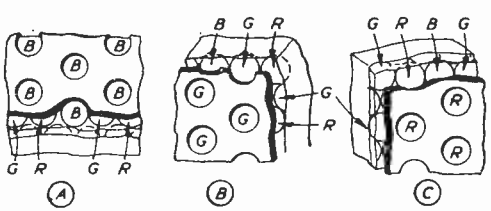

Fig. 43.—Arrangement of the colour 'dots' on the screen.

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electronic equipment for the camera is mounted in the cubicle nearest to the control desk.

Signal Coding Equipment

The signal coding equipment includes the special colour waveform generating equipment and the "encoder" in which the luminance and chrominance signals are formed from the incoming three-colour information. The "master" frequency, from which all the other scanning and pulse waveforms are derived, is obtained from a temperature controlled crystal oscillator whose frequency is 2.6578125 Mc/s ± 8 c/s. This frequency is multiplied and divided to produce the usual double line frequency of 20,250 cycles/second (i.e., $\frac{4}{525}$ times sub-carrier) from which the standard 405-line interlaced waveform is generated. (It will be noted that the frame repetition rate is synchronous with respect to mains frequency, in contrast to the existing monochrome service in which synchronous working is always employed.) Multiple outputs of line and frame trigger impulses, mixed synchronising pulses and mixed suppression pulses are available.

The input to the encoder consists of the three gamma corrected colour separation signals (red, green and blue) which are produced by either the slide and film scanner or by the camera. The encoder may be considered as performing a single linear transformation of the three incoming signals, red, green and blue, to the other three quantities, Y, I and Q, of which Y is the luminance signal. The colour sub-carrier is then modulated by the I and Q signals in such a way that the amplitude of the resultant signal conveys the saturation information and the phase conveys the hue. In the absence of colour information the sub-carrier is suppressed. The complete chrominance signal is added to the luminance which is, of course, in video form. Finally, the synchronising waveform is added to produce the complete waveform. The synchronising waveform is of the normal type except that a "burst" of nine cycles of the colour sub-carrier is added in the suppression period following every line synchronising pulse. This "burst" is used at the receiver to synchronise a sub-carrier generator which is needed for detection of the quadrature modulated chrominance signal.

The waveform generator and the encoder are mounted in the two cubicles adjacent to the camera control equipment. The three other cubicles in the background at the right supply power for the whole of the equipment, with the exception of the slide and film scanner.

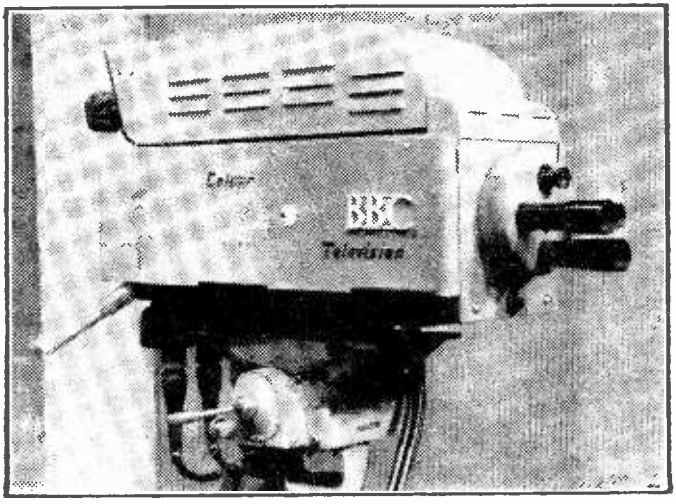

Fig. 44. A BBC colour camera.

Colour Picture Monitors

There are two colour picture monitors. One employs three separate tubes, the phosphors of which emit respectively red, blue and green light. The application of the colour separation signals to the grids of the tubes produces three colour separation images which are combined optically by dichroic mirrors to produce a direct viewed colour picture. This method brings with it the attendant difficulty of superimposing the three separate images accurately, just as in the colour cameras. However, up to the present, this method produces the best pictures and its complication is worth while in a monitor intended for technical purposes. This monitor is seen in the centre of the Fig. 47.

The other monitor uses a 15in. R.C.A. shadow-mask tricolour tube which was dealt with earlier. Since the monitor incorporates its own decoder, the input signal is of the N.T.S.C. type and the unit is, therefore, used for general checking and monitoring of the transmitted signal. It can be seen on the extreme right of the Fig. 47.

Colour Test Equipment

The complicated nature of the N.T.S.C. signal requires a special test signals and measuring apparatus to ensure that its specification is met. The main signal for this purpose, "colour bars," is generated electronically and produces on the picture monitor

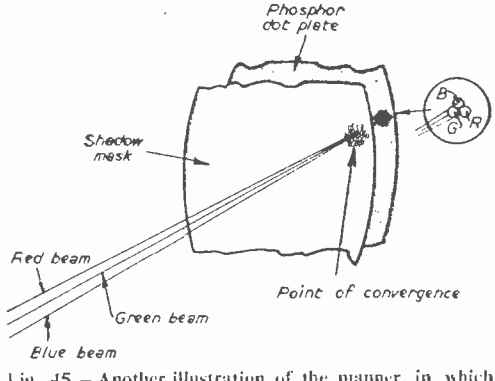

Fig. 45.—Another illustration of the manner in which the shadow-mask tube operates.

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seven vertical strips which, from left to right, are white, yellow, cyan (blue-green), green magenta (purple), red and blue. These signals represent saturated colours for which the amplitude and phase of the colour sub-carrier are known. The amplitude is measured in the usual way with a waveform monitor; the phase is measured by a special piece of test equipment known as a Colour Signal Analyser. Distortion occurring in the transmission of the signal after it has left the encoder, of course, can be measured similarly.

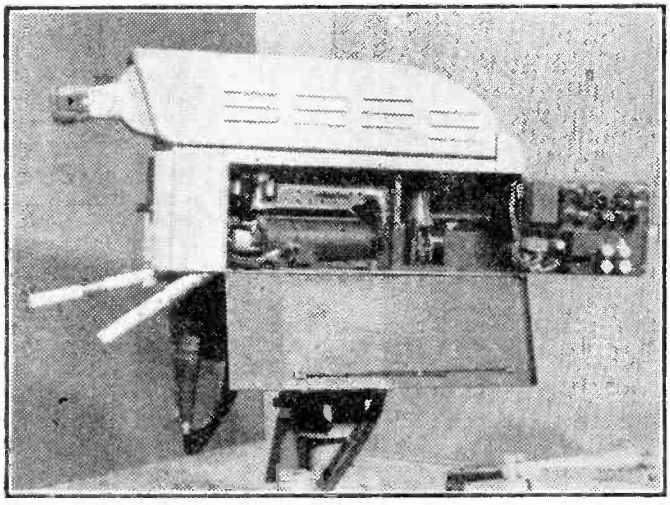

Fig. 46.—The camera shown on the opposite page opened for servicing.

As already explained, because of the physical make-up of the human eye, the sensation produced by practically all the colours encountered in real life can be reproduced by the additive mixture of red, green and blue lights. Therefore, it is a common feature of all colour television systems with any pretensions to accurate colour reproduction that the receiver employs coloured lights of red, green and blue, whose intensities are controlled by three separate signals from the transmitter. The N.T.S.C. signal transmits these three signals as: (a) a luminance (brightness) component; and (b) a chrominance (colour) component, having two separate parts.

The luminance component is the same as that which would be produced by a panchromatic monochrome television camera looking at the same scene, and this signal therefore produces a normal monochrome representation of the coloured scene on a monochrome receiver.

The chrominance component consists of two colour-difference signals, which in the simplest terms may be said to convey the hue and degree of saturation of the colour information. In the colour receiver these three signals representing brightness, hue and saturation are combined to produce the required intensity from each of the red, green and blue lights. The fact that a monochrome receiver and a colour receiver can simultaneously produce each its own version of the scene from the same signal gives the N.T.S.C. system its valuable feature of "compatibility."

It would be possible to transmit the chrominance signal quite independently of the luminance signal and in this case the compatibility would be virtually perfect. However, the second unique feature of the N.T.S.C. signal is that the two components have been combined in such a way that they occupy the same total bandwidth as that used by the equivalent monochrome signal. Due to the manner in which the human eye perceives colour, the separation of the luminance and chrominance enables the bandwidth of the chrominance signal to be reduced to about one-third of that of the luminance. Further saving of bandwidth is achieved by placing this reduced bandwidth information at the upper end of the luminance band in such a way that the inevitable interference (cross-talk) between the two signals has a minimum effect on the compatible picture on the monochrome receiver. The actual mechanism by which this band sharing takes place employs a colour sub-carrier (in the British version 2.66 Mc/s) which is simultaneously modulated in amplitude and phase by the two-colour difference signals, the carrier itself being suppressed so that the chrominance signal exists only when colour is present in the scene being transmitted. The colour sub-carrier is an odd multiple of half the line-scanning frequency, and under these circumstances the visibility of the best pattern produced between it and the scanning lines is a minimum.

(To be continued)

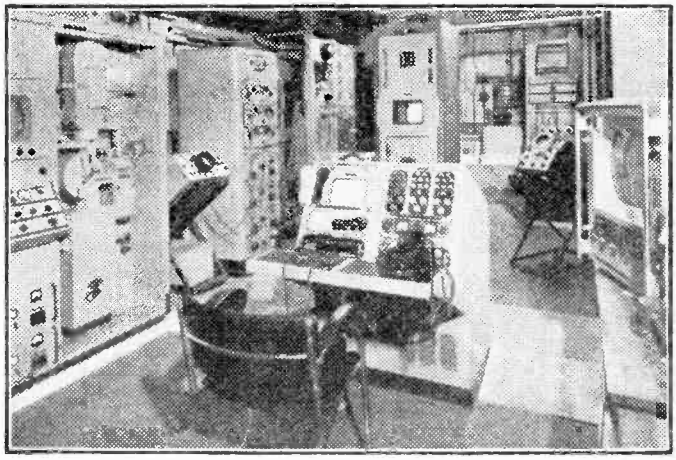

Fig. 47.—A general view of the BBC's colour studios control room.

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New Map of London I.T.A. Area

THE recent doubling of the power of the I.T.A.'s Croydon transmitting station has been one of the factors which has helped to accelerate the rate of conversions in the London area so that there are now over one million homes which can receive independent television programmes from this station.

A map has been prepared, and is shown below, showing the official limits of the new service area in which nearly 11½ million people live: of these, just over 10 million are in the primary and the remainder are in the secondary service area. In the primary service area, most viewers, unless they are situated in particularly unfavourable positions such as behind high ground or screened by high buildings, should receive a consistently satisfactory service: in the secondary service area, a substantial proportion of viewers should receive a satisfactory service, but in a few unfavourably situated places reception may be poor. On the fringes of the secondary service area, reception may often be possible in particularly favourable places, but these places cannot properly be considered to lie within the official service area and hence cannot be shown on the map. Wide variations in reception conditions can occur in such localities between points within quite short distances of each other.

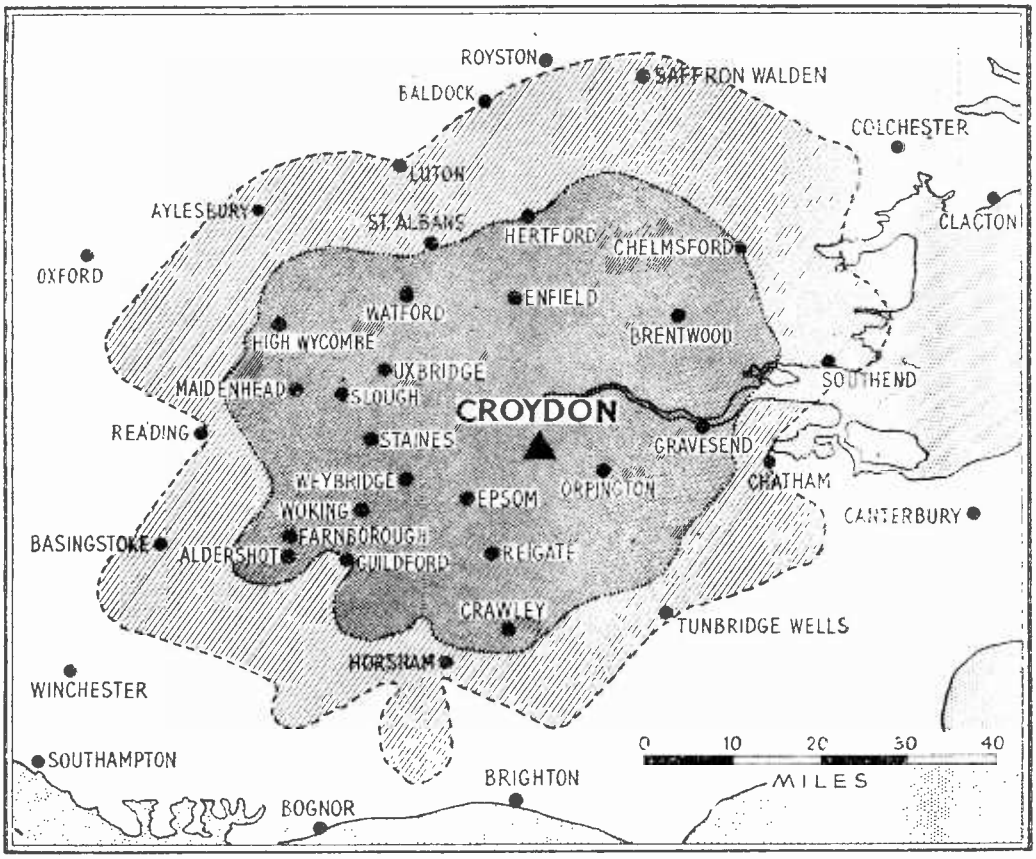
Fringe Reception

In "fringe areas" meteorological conditions can have a disturbing effect on reception so that it is by no means consistent. Conditions were, in fact, abnormal during the latter part of October, and in these areas some viewers experienced interference from distant stations. This interference can often be reduced, and picture quality improved, by a careful re-alignment of the viewer's receiving aerial.

Coverage

The map shows the estimated approximate coverage of Croydon station with 120 kilowatts effective radiated power. The total population of this area is 11.44 million (approx.). The Primary Service area serves 10.1 million (approx.) and the Secondary Service area 1.34 million (approx.).

The full details of Channel 9 are: E.R.P. 120 kW omnidirectional. Frequencies: Vision, 194.7567 Mc/s; Sound, 191.27 Mc/s; Site height, 373ft. above sea-level; Mean aerial height, 550ft. above sea-level.



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Adding a Turret Tuner

HOW TO MODIFY AN EXISTING RECEIVER, WITH PARTICULAR REFERENCE TO THE LYNX AS AN EXAMPLE

By W. J. Delaney

ONE of the questions which occurs most often in our correspondence is "How can I add a turret tuner to my set?" Many readers do, of course, confuse a turret tuner with a Band III converter, and really mean to ask how to add a converter. There are, however, a large number who think that whilst they are modifying a set to accommodate a converter it might be worth while making a better job of it by using a turret tuner instead of a converter. Actually, it is rather pointless to fit a turret tuner to a home-constructed set (or a purchased one, for that matter) if the user does not intend to travel about the country with the set. This type of tuner was developed for the set manufacturer so that he could produce a range of receivers which could be sent out to any part of the country, and the user could adjust the set to his local transmission as easily as one now tunes to Band I or Band III. This avoids the necessity of the manufacturer having to produce different models for different stations, or as did one particular manufacturer, having to produce a range of R.F. units which could be supplied to their dealers to fit in each area. Theoretically, therefore, all that any viewer needs in any locality is a receiver which will tune to the local Band I and Band III station. It is true that in various parts of the country viewers may be within range of two BBC or ITA stations, but for the majority of the time the stations are linked and there is not sufficient programme difference to justify a Band I multi-tuner, whilst many of the converters tune to two ITA stations.

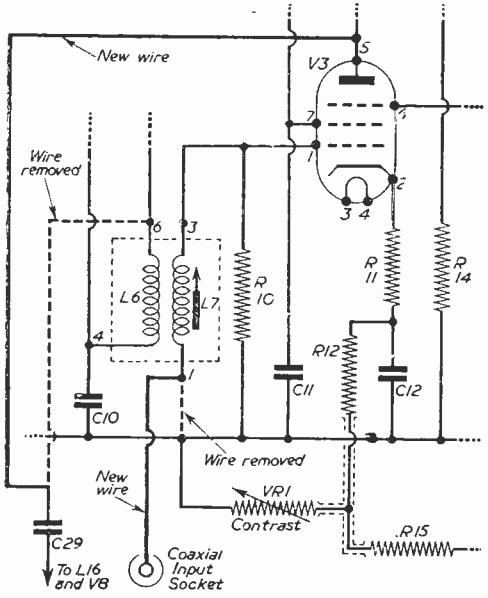


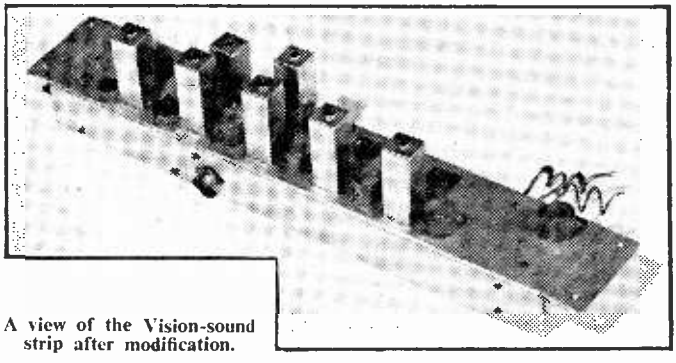
Fig. 1.—Circuit of the first I.F. stage of the Lynx, showing modifications.

13 Channels or Continuous Tuning

However, in order to satisfy those who wish to fit some form of multi-tuner the following notes have been prepared. Firstly, looking round the available tuners it will be found that the majority are of the type fitted with a rotating section into which the various coils are clipped—hence the name turret. This type of tuner is adjusted so that it tunes to the 13 usable television channels. The Valradio tuner, however, is not of this type but has a 9-position switch, with a concentric knob which controls the movement of brass and iron cores in a number of coils. These coils are actually wound to cover the highest wavelength covered by the tuner, and then tapped for the lower ranges. The coils are heavily doped to prevent movement and it will be found that under all normal usage it will hold its settings. The dial supplied with it will show that in, say, position 1, channels 9 to 13 may be tuned,—that is, from 190 to 225 Mc/s. In addition to all the BBC channels, it covers those of Band III and also the F.M. channel from 65 to 100 Mc/s. It consists of the usual cascode R.F. stage with pentode-triode frequency-changer, and the output consists of a small coupling coil which has to be included in the I.F. stage of the receiver with which it is used. The output is, therefore, at I.F. and models are available for the I.F.'s of 9-14, 16-20, 19-24 and 34-40 Mc/s.

Set Modification

To indicate the lines of approach, as all receivers will vary slightly, an example is given of the addition of this type of tuner to one of our own receivers, the Lynx. It should be mentioned, of course, that the instructions will follow the general lines to be adopted



A view of the Vision-sound strip after modification.

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with any form of turret tuner which has an output at I.F.—although the method of connecting the power supplies will vary from model to model.

The first thing to be done is to get at the sound-vision strip, and again this will vary according to

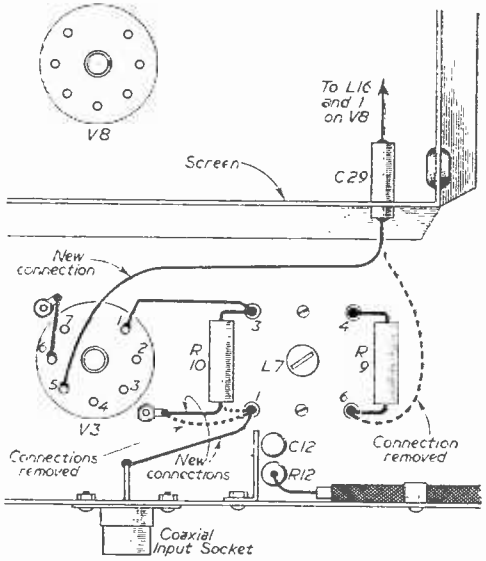


Fig. 2.—Wiring diagram of the Fig. 1 circuit.

the receiver design. In the Lynx, however, the strip may be removed entirely and the accompanying illustration shows the strip after modification.

The Lynx receiver has three I.F. stages, and if the receiver with which the tuner is to be used has only two I.F. stages it may be desirable to add a third stage, or to convert the existing frequency changer to an I.F. stage. Fortunately this is not a difficult matter, as the F.C. stage has in its output circuit an I.F. coil or transformer, and therefore all that will be needed will be one coil to replace the oscillator coil. The number of turns will depend upon the I.F. used in the set and will range from about 40 turns for an I.F. of 9/13 Mc/s. to 15 turns for an I.F. of 34-40 Mc/s.—assuming the standard type of I.F. transformer which is just over ¼in. in diameter. In the case of the Lynx and any receiver similar to it, the grid coil of the first I.F. stage is tuned to the I.F. band and although this is wound as a transformer, the primary may be ignored without ill-effect.

The other point in design which must be mentioned is the sound take-off point. Again, referring to the Lynx the sound was taken through a 5 pF fixed condenser from the anode of the frequency changer. As this stage is cut out (there being already the necessary frequency changer in the tuner), it becomes necessary to transfer the sound take-off point to the anode of the first I.F. stage. Again this should, theoretically, cause no trouble although if the tuning of the grid coil of the first I.F. stage is too sharp to give sufficient pass-band to cover sound and vision adequately, the shunt resistor across the grid coil may be changed, or the tuning modified slightly and the I.F. tuning on the tuner adjusted so that these two together give the required bandwidth. It will be

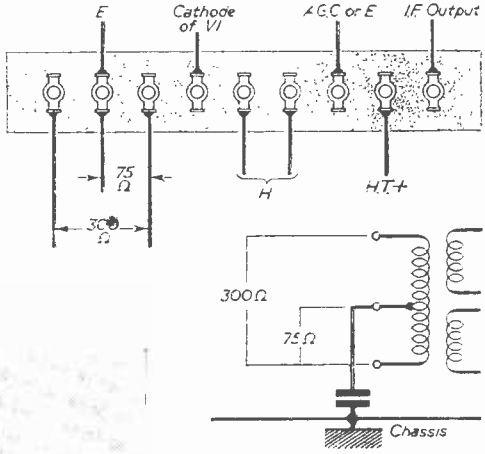
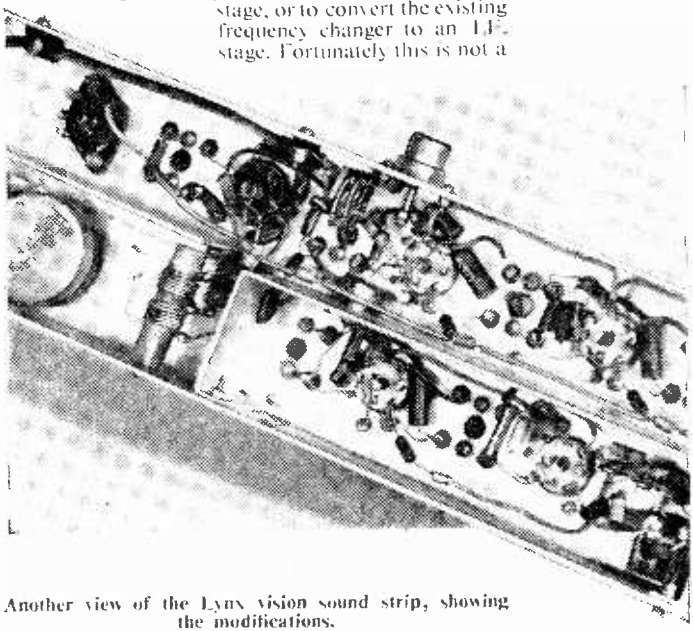


Fig. 3.—Terminal strip of the Valradio tuner and the aerial circuit.



Another view of the Lynx vision sound strip, showing the modifications.

noted, of course, that with this modification the real intention is to avoid any modification to the tuning circuits in the receiver, which may have been set up and adjusted after much hard work and are now functioning perfectly satisfactorily.

Summarising on the Lynx, therefore, the modifications consist of transferring C29 (the sound coupling condenser) from pin 6 of L7—or in other words from the anode circuit of V2—to pin 5 (the anode) of the first I.F. stage. Disconnect both R10 and the earthing lead from pin 6 on L7, and transfer the R10

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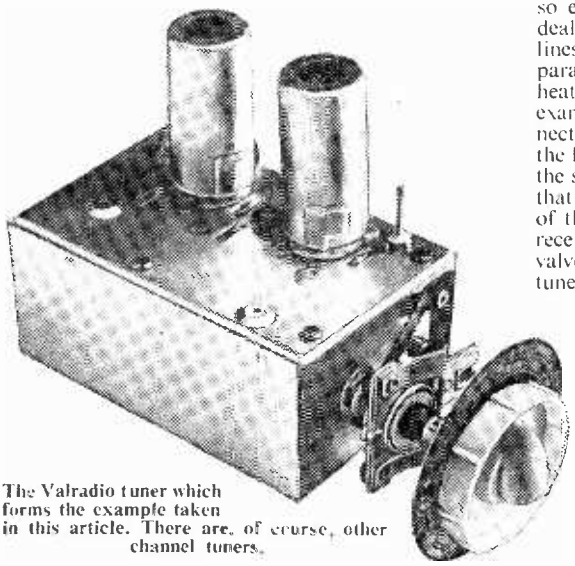
lead to earth. The now vacant pin 6 should be connected to a coaxial socket conveniently mounted. Again in the case of the Lynx the original aerial socket was mounted on a separate strip at the rear of the vision chassis, and as it is now no longer needed the socket was removed and mounted in the position shown in the photographs and drawings.

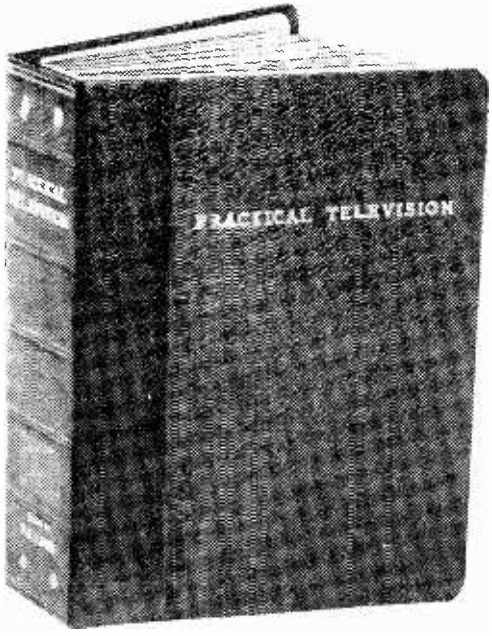


The Valradio tuner which forms the example taken in this article. There are, of course, other channel tuners.

Power Supplies

When the tuner is added, the first two stages—or the frequency changer and any pre-amp R.F. stages—are cut out and the valves may be removed. The now vacant 7-pin holder in the Lynx is then rewired to provide the power supplies for the tuner, or if another type of set is being modified, one of the vacant valveholders is modified, provided that it is of a type for which a plug can be obtained. Octal plugs are readily available, as are B7G's, but the B9A's are not so easily found. For the tuner with which we are dealing we require H.T. and two low-voltage supply lines, one of which may be earthed, in the case of parallel heater wiring, or may be separate if series heaters are used. Again taking the Lynx as our example, the heater wiring to V1 and V2 is disconnected and the two valves in the tuner are fed from the B7G base so that V1 and V2 in the tuner follow in the same order as V1 and V2 in the original wiring—that is, between the two sound stages and the rest of the heater chain. Connect the H.T. feed in the receiver to any of the remaining pins on the spare valveholder and then wire the terminal strip on the tuner to the appropriate pins on the plug which is being used. Fig. 3 shows the Valradio terminal strip from which it will be seen that provision is made for series or parallel heater supplies. When ordering the type (reference to which is the I.F.) is followed by P or S for parallel or series heaters.

All that now remains is to connect the aerials—two separate aerials or a combined aerial being needed if the F.M. band is not to be used. As there is only one aerial connection in effect on the tuner under discussion, it will become necessary to use a combiner or similar device as described in previous issues. The tuner should be mounted inside the cabinet with the spindle protruding and the dial can be attached to the spindle and the receiver should then function throughout the range.



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FOR

"PRACTICAL TELEVISION"

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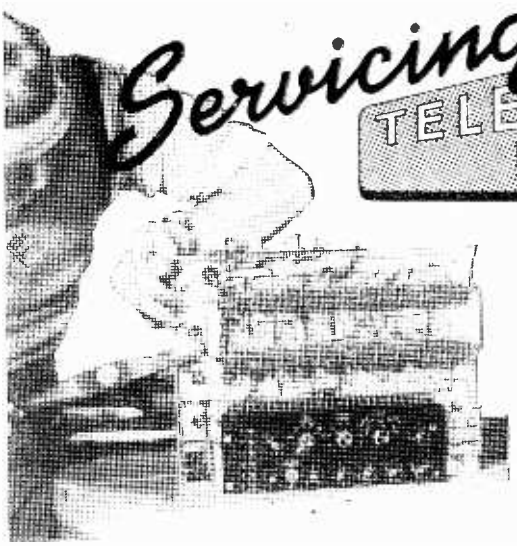
Servicing TELEVISION RECEIVERS



No. 25.—THE RGD 2351T

By L. Lawry-Johns

THESE notes are mainly applicable to most of the models in this range, but several circuit variations occur between the "B and H" models and the "L." The L2351T is a T.R.F. receiver with an additional R.F. stage (6F13) in place of the local oscillator (6L18) of the "B and H" superhet models. Also the values of some of the controls are different, and, of course, circuit variations occur to suit the two methods of reception. However, so far as general servicing is concerned these notes will be found applicable.

As these models are now some years old a few words upon tube replacement may be of value. Alternative tubes may be found fitted. These are the Mazda CRM121 and the Ferranti T12/44 or T12/46. The T12/46 has not been available for some time, and as this had a 6.3 volt heater the replacement T12/44 should be connected only when the connection on the mains transformer has been changed from 6.4 volts to 4.1 volts. For the CRM121, of course, the 2.1 volt tapping is provided. Readers wishing to fit Mullard tubes of the MW31-16 or 31-74 type will find that the octal tube holder will need to be changed to duodecal; an extra H.T. supply is required to be connected to tag 10 of the duodecal base as the Mullard tubes are tetrodes. The 330 volt H.T. line is suitable and the supply should be taken through a fairly high value resistor in order to limit the current in the event of an internal short in the tube. Also an ion trap magnet will be required and this, of course, fits on the tube neck and is adjusted for maximum brilliance. Its exact position depends upon the influence of the focus magnet.

It is not proposed to deal at length with the sound and vision R.F. and I.F. stages, as these are fairly conventional and trouble free. The type of valves fitted and their holders demand a good connection if fading effects are to be avoided. The circuit begins to become a trifle uncommon at the vision detector (6D1) stage, where the I.F. signals are fed to the cathode of the diode so that negative going detected signals at video frequency are fed to the control grid of the video amplifier. This method of video injection necessitates a low value video amplifier cathode bias resistor. In this receiver this is 47 ohms shunted by a .01 μF capacitor. The actual circuit is shown in Fig. 2. This has been simplified by the omission of the vision noise limiter circuit.

It will be seen that positive going signals are coupled to the tube grid by coupling capacitors, and this arrangement necessitates the inclusion of a D.C. restorer which in this circuit is coupled with a sync limiter (V15 6D2).

The cathode of the tube is joined to one side of the heater and the H.T. applied is varied by the brilliance control. The 10MΩ resistor in the cathode circuit can be ignored since it is normally shorted out at the radio adaptor panel. Before leaving the tube circuit and video amplifier we would point out the fact that the brilliance control network is derived from the screen circuit of V11. Also that this point is decoupled to chassis with an 8μF capacitor. In the event of a short developing in this capacitor the H.T. would be removed from the brilliance control, thus provoking the symptom of uncontrollable brilliance.

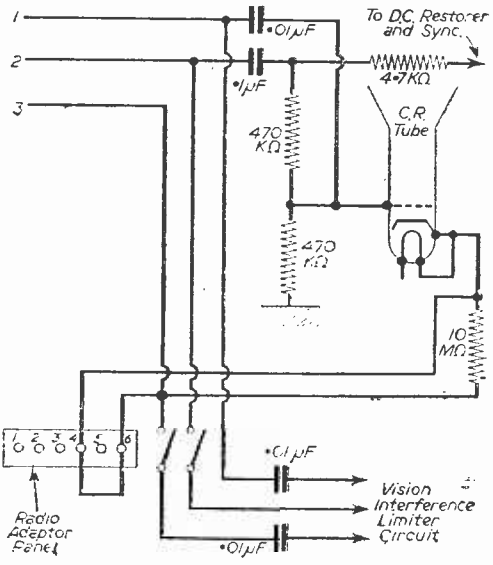


Fig. 1.—Tube circuit. See also Fig. 2.

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Sync Separation

Once again a slightly unconventional circuit is employed. From the limiter circuit the composite signal is applied to the first sync separator control grid, V16 (6F14), which has the sync control in its cathode circuit. The setting of this control is critical, but once set it should need little adjustment.

From the anode circuit of this valve a 22pF capacitor connects to the T41 line oscillator (V18) control grid. Also from the anode circuit a connection is taken to the control grid circuit of V17 (6F13), which functions as a further separator stage to filter out the remaining line pulses before passing on the clean frame pulses to the frame oscillator V19 (T41).

The presence of electrolytic capacitors in the circuits of both V16 and V17 should not be overlooked when sync troubles are experienced. It is often the case that sync separator defects are not recognised as such and the timebase valves are often replaced without need.

If, for instance, the picture can be made to roll both upward and downward and yet will not lock reliably the fault is that the pulses are not reaching the frame timebase and that this in itself is blameless. Therefore, V16 and V17 should be suspected, especially V17 if the picture is locking well horizontally. On the other hand, if both timebases have unreliable lock, i.e., are inclined to slip sideways and roll over frequently, V17 will hardly be at fault, since it is not concerned with the line timebase, and therefore V16 should receive priority attention; first, of course, the sync control and then the electrolytic capacitors when the valve itself has been tested and found good.

In the case of the line timebase poor sync separation or no pulses at all are evidenced by the refusal of the picture to lock horizontally, even though it can be made to "hover" first one way and then the other by the operation of the line hold control.

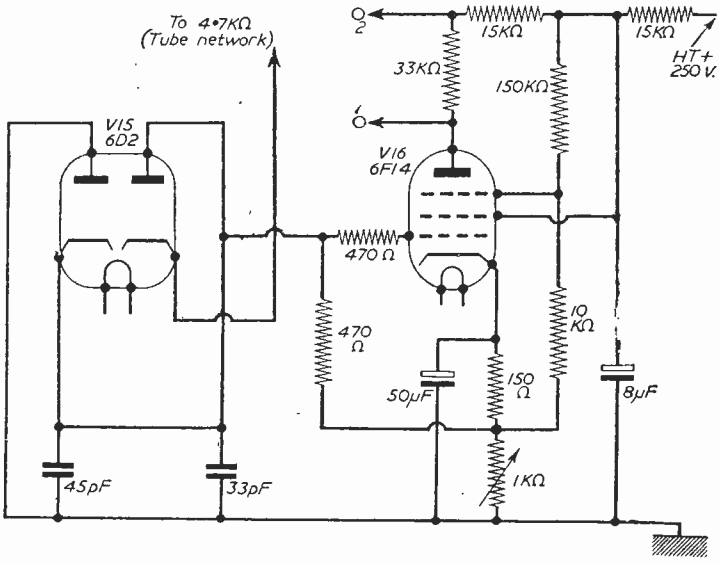

Fig. 3.—D.C. restorer, limiter and 1st sync separator. 1, 22pF to line oscillator, and 2, 56K to V17 frame sync separator.

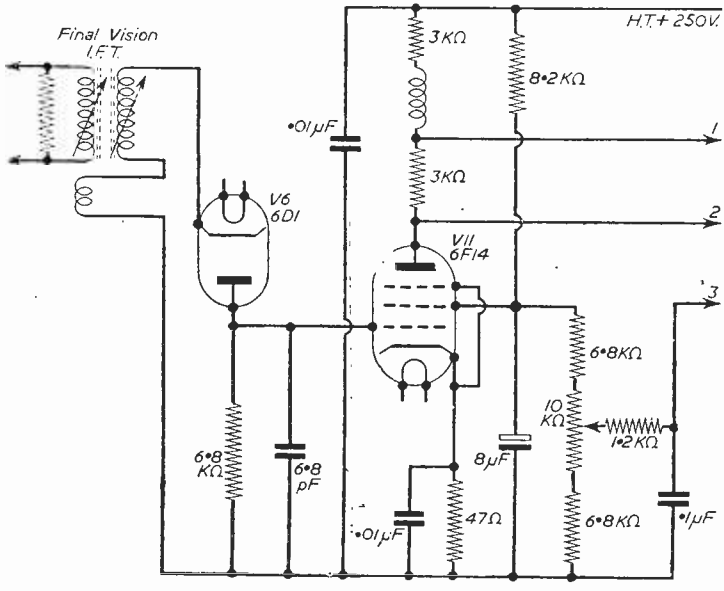

Fig. 2.—Video detector and video stage. See also Fig. 1.

Poor hold and a general unevenness of the overall illumination of the picture should direct attention to the V15 (6D2) D.C. restorer and limiter valve, and then to the .1μF video coupling capacitor C23. If the insulation of this is good check C22 .01μF for leakage. Light and dark bands across the picture should direct attention to V15 (6D2) and V11 (6F14), which should be suspected of having poor heater-cathode insulation. If these are in order check the 6D1 (V6).

The Line Timebase

The line oscillator is a T41 (V18) thyratron and the line hold control is in the cathode circuit of this valve.

The sawtooth voltage waveform present at the anode is coupled to the control grid of the EL38 line output valve via a .01μF capacitor and the grid stopper resistor of 470 ohms.

The circuit of the EL38 is quite straightforward and the faults which commonly occur are those

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due to defects in the valve itself which may not be immediately recognised.

Quite often a vertical white line down the screen can be traced to an open-circuited line amplitude control which is wired in the cathode circuit of the EL38. When this is replaced all may be well for a period of time, when the same thing may happen again. In the event of this happening first check the 4.7KΩ screen dropping resistor, which may have decreased in value, and then, if the resistor is in order, replace the EL38 itself.

In some cases the resistor, the EL38 and the amplitude control may require replacement before conditions are restored to normal.

Unfortunately, another eventuality must be considered. If the primary winding of the line output transformer becomes open circuited no H.T. is applied to the EL38 anode (top cap). As well as the white line appearing down the centre of the screen excess current will flow through the screen dropping resistor, which, to say the least, will not take kindly to the consequent rise in temperature.

If it is discovered that the resistor is burned out, or has badly overheated, and the H.T. *is* present at the anode end of the primary winding of the line output transformer, check upon the EL38 and the .5μF capacitor, which is connected between the screen grid and the cathode, which may have shorted.

The Frame Timebase

This consists of a T41 thyratron oscillator working in a similar circuit to that of the line, with, of course, different component values to suit the much lower frequency. The output voltage is fed to the EL33 (V13) frame amplifier by a .5μF capacitor feeding the frame linearity circuit and control which are in the EL33 control grid circuit. The frame amplitude control is in the cathode circuit of this valve. The screen grid is fed from the H.T. line through a 22KΩ resistor and is decoupled by an 8μF electrolytic to the cathode. A horizontal line across the screen will normally indicate a defective T41 or EL33 whilst poor linearity with a fold up at the bottom should focus attention upon the EL33 (low emission), the 8μF electrolytic or the .5μF coupling capacitor.

The Sound Circuit

The volume control is wired in the cathode circuit of the first sound I.F. amplifier, or, in the case of the L2351, R.F. amplifier. This is in place of the more normal A.F. section control. 6F15 valves are used as sound I.F. amplifiers, a 6D2 as a detector and A.V.C., whilst a WX6 metal rectifier acts as the noise limiter. The sound output valve is a 6P25, with a connection from the control grid to the radio adaptor panel.

In the event of low and distorted sound the resistors associated with the WX6 should be checked. The anode resistor is 560KΩ whilst the cathode resistor is 10 megohm.

The EHT Supply

This is of the R.F. oscillator type, an EL33 (or 6P25) being used as the oscillator and an EY51 as the EHT rectifier. This unit is fairly trouble free, except for occasional EY51 failure. As the EY51 fails on emission, the symptoms are that the picture "blows up" and blurs on light picture content or as the brilliance or contrast is advanced. As the emission falls still farther the picture will expand and fail completely as the controls are advanced.

The oscillator does not give a lot of trouble but the symptoms are similar when it does. A variable capacitor in the anode circuit gives some control of

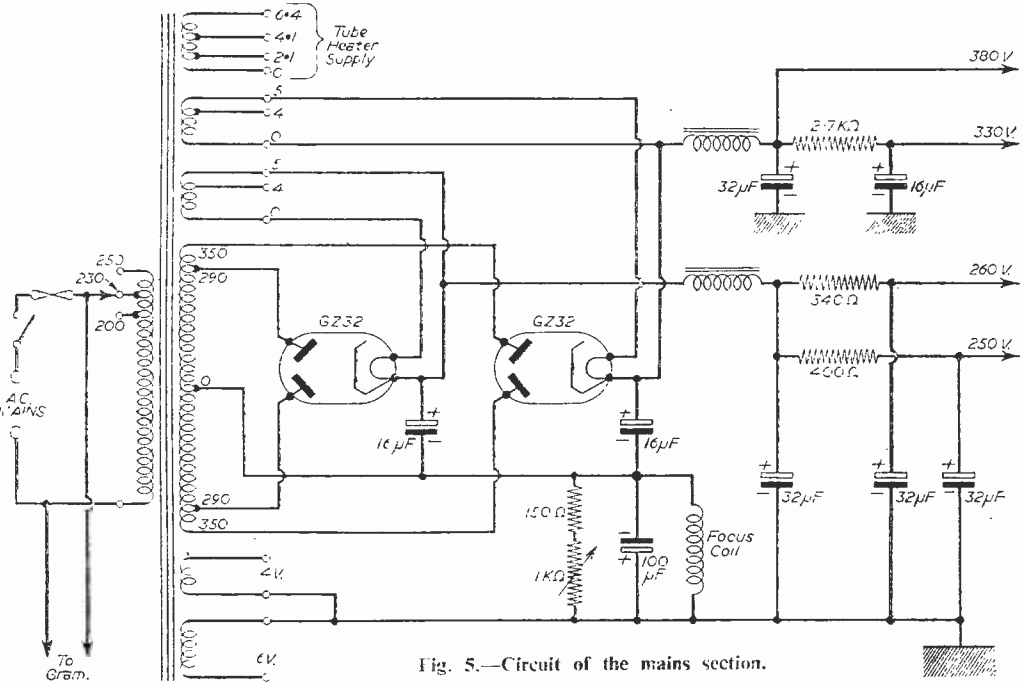

Fig. 5.—Circuit of the mains section.

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EHT (which should be 7kV) by varying the oscillator frequency.

Power Supply

A double-wound transformer has multiple windings as shown in the diagram, and it will be seen that each GZ32 has its own circuits to supply.

The sound and vision circuits, including the sync separator stages, are fed from the 250-260 volt supply points, whilst the line and frame timebases and the EHT unit derive their supply from the 330- and 380-volt points. The H.T. negative centre tap on the transformer is connected to chassis through the focus coil, this being shunted by a fixed 150Ω and a variable 1 KΩ in series for focus control. It is also shunted by a 100μF electrolytic. As mentioned earlier, electrolytics can give trouble and in this particular part of the circuit failure to control focus should first of all lead to a check on this particular condenser. Check for short-circuit, which would have the effect of cutting out all control here. An open-circuited focus coil or 1 KΩ control will, of course, give similar symptoms.

Failure of either of the rectifiers will be self-evident, but in the case of low emission, changing round the two valves will serve as a ready check.

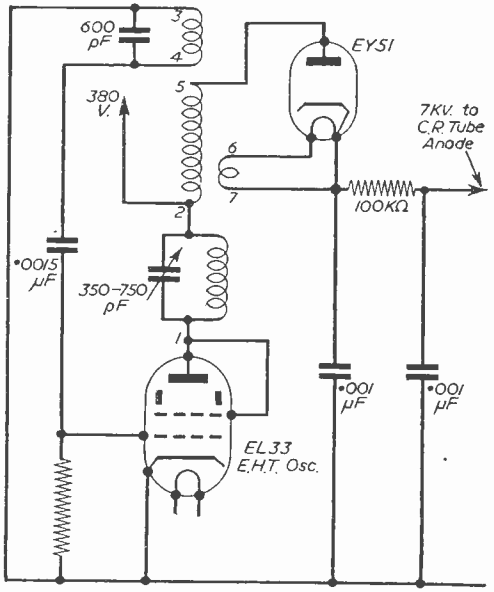
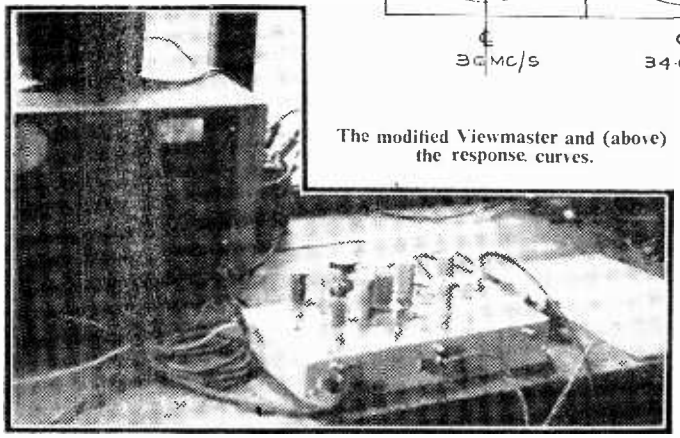


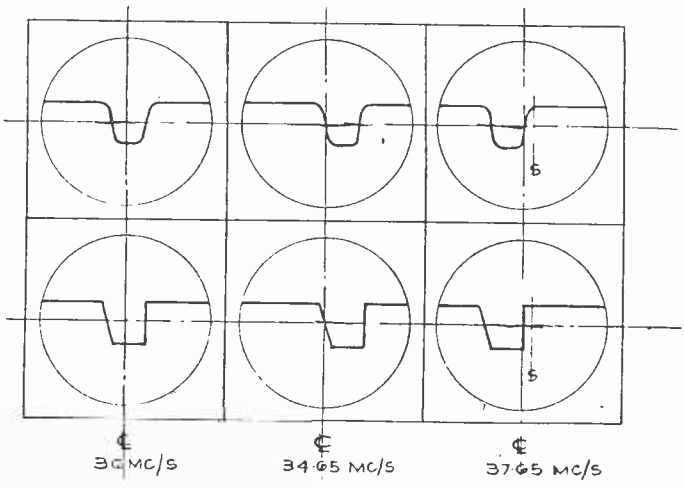
Fig. 4.—The EHT circuit.

Amateur's Results

I WAS interested in your article on the conversion of a Viewmaster chassis to be used as a 35-40 Mc/s I.F. amplifier. I had previously found the original Viewmaster a very easy unit to obtain good band-width, so decided to build one on the lines indicated by you, excepting that I modified the valves to suit modern type instead of EF50 which are subject to base troubles. Also the additional coils you show above the chassis have been re-arranged with one above, the other below, each of them in screening cans to present a neat appearance.



The modified Viewmaster and (above) the response curves.



The accompanying diagram shows the ideal response curve for the three major frequencies positions. Also actual curves obtained on the tube of a Televet tester. The results obtained are, in my opinion, quite good. There is a slight cutting as will be seen on frequencies above 2½ Mc/s, but if required this could be offset by arranging the bottom of the curve to have an outward slope to give a boost at this part. The reason I have not done this, although this is commercially normal, is that such a boost tends to give a form of harsh brilliance which I think undesirable.—GEO. T. LAYTON (Eccles).

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THE P.T DATA SHEETS

No. 1.—MARCONIPHONE MODELS VT68DA, VC68DA, VT69DA, AND VC69DA H.M.V. MODELS 1840, 1841, 1842, 1843, 1844, 1845 AND 1846

A NUMBER of features are common to all the H.M.V. and Marconiphone receivers listed above. These are as follows :—

Tuner Unit.—14-point switch, with 14th position to switch to I.F. for future connection of—say—a U.H.F. tuner.

Incremental Inductance Tuning.—Since the tuning of each channel is dependent on a small increment of inductance only, the chance of any channel being out of tune is greatly decreased. There is, therefore, no need to trim each channel individually, but only the start and finish of each band. Hence there is less drift, less maintenance and more reliable production.

Vision I.F.—Use of adjacent sound channel suck circuit to take care of two signals on adjacent channels in the same area, e.g., channels 9 and 10 in Yorkshire.

2nd Vision I.F.—Uses a bridge-T sound suck circuit giving 40 db rejection with but little attenuation at 3 Mc/s.

Use of small coil formers in Vision I.F. circuit close to chassis eliminates screening cans and aids accessibility.

High impedance frame linearity circuit gives control of linearity both at top (after fly-back) and overall, and prevents the line pulses from the scanning coils getting back to the grid of the frame output valve and spoiling the interlace by small amplitude variations. Also it completely compensates in terms of linearity for all production valve, transformer, and scanning coil variations.

Video Amplifier.—A high-level video contrast control allows constant sync amplitude to sync separator, constant picture amplitude to black spotter, and constant delay voltage to A.G.C.

It also provides the best definition at normal setting of contrast for use in the home, but greater drive at slightly lower definition for use in bread daylight.

An aluminium shroud around the scanning coils reduces the risk of line timebase interference with radio sets.

Electrostatic C.R. tube gives fine centre focus and better overall focus. It saves the weight and cost of a focus magnet, and permits the focus control to be put in a convenient position on the front of the set. It rarely needs adjustment in normal use since the focus is extremely free from drift.

Features of H.M.V. Models

Use of over-coupled bandpass circuits for optimum stage gain-bandwidth—for instance, the 1st common I.F. is 3.5 Mc/s flat.

It also gives correct rate of fall-off at carrier to keep the phase-shift of L.F. side bands very small. Hence a small tuning error results only in the loss of 3 Mc/s definition and does not introduce smearing and overshoot due to L.F. phase distortion.

Anti-blocking or overloading features, e.g.—sound A.G.C. is applied to Vision A.G.C. line to prevent overloading should the vision carrier fail ; hence sound announcements can still be heard.

Anti-blocking diode (triode) operates when unmodulated carrier is radiated (as when the transmitter warms up), and so prevents overloading of vision I.F. valves and video output valve.

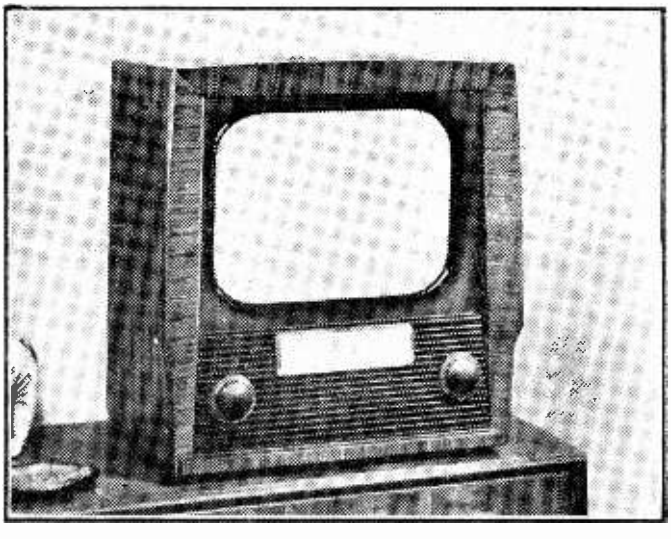
Variable A.G.C. applied to R.F. valve, preventing cross-modulation in strong signal areas but providing for minimum noise in weak areas.

Line output transformer in special insulating grease which becomes semi-liquid when the set is in operation, so sealing any voids or air-bubbles—yet can be transported when cold without any risk of leakage. Hence elaborate sealing methods are not necessary.

Features of Marconiphone Models

Sync-cancelled A.G.C. provides A.G.C. dependent on sync pulse amplitude and not picture content. It is not dependent on the line frequency being correctly in lock as in line-gated circuits.

Selenium rectifier in video cathode looks like approximately 120 ohms at D.C. but has very low



H.M.V. Model 1845.

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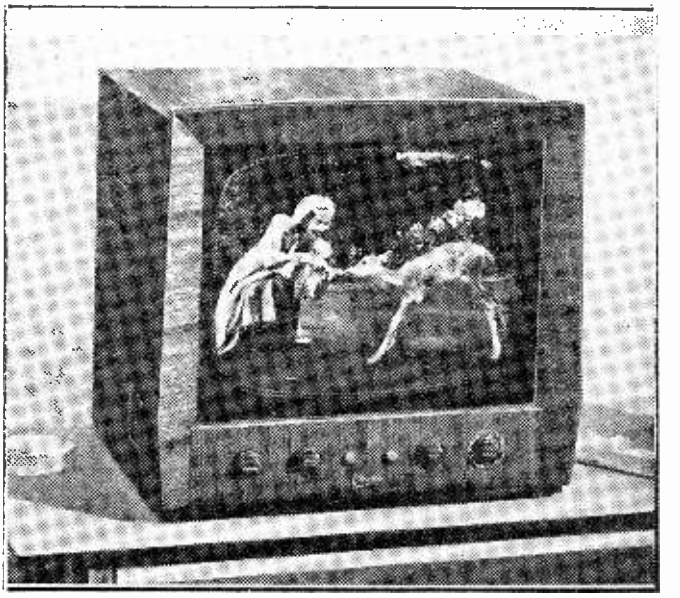
A.C. resistance ; hence it eliminates a by-pass capacitor which would tend to remove L.F. or D.C. components.

It should also be noted that because of the use of A.G.C. on the R.F. and I.F. stages the pre-determined contrast level is reasonably constant across the anode load, and also a constant D.C. potential on the C.R.T. cathode is maintained by connecting the contrast control between equi-potential points, i.e., the lower ends of the anode and screen resistors of the video stage. The video interference limiter is of the phase inverter type, that is, the video signals are fed to the cathode of the limiter and the grid potential is controlled by the picture interference limiter control. The grid potential is adjusted so that this valve will conduct only on the interference pulses with a greater amplitude than that of peak white. The amplified interference pulses formed on the anode of the valve are in a negative sense and are fed to the grid of the C.R.T. to cancel interference pulses fed with the signal to the C.R.T. cathode.



Marconiphone Model VT69DA

MARCONIPHONE SPECIFICATION

Physical Dimensions

Model	Type	Height	Width	Depth
VT68DA	14in. Table Model	16½in.	17⅛in.	20⅝in.
VT69DA	17in. Table Model	19½in.	20½in.	22¾in.
VC68DA	14in. Console Model	32⅝in.	18in.	20⅝in.
VC69DA	17in. Console Model	36½in.	21in.	25in.

Mains Supply

195-255 D.C. or A.C. 50 cycles per second.

Consumption

130 watts approx.

Channels

Operative on British Band I and Band III Channels 1-5 and 6-13 respectively.

Intermediate Frequencies (Carrier)

Vision 34 Mc/s. Sound 37.5 Mc/s.

Valves

V1 or PCC84 / B319	R.F. Amplifier	Sound	
V2 or PCF80 / LZ319	Frequency Changer	and	
V3 or Z152 / Z719	I.F. Amplifier	Vision	
V4 or Z152 / Z719	Vision I.F. Amplifier		
V5 or N153 / N309	Video Amplifier		
V6 or ECC82 / B329	Picture Interference Limiter and Auxiliary A.G.C.		
V7 or Z152 / Z719	Sound I.F. Amplifier		
V8 or Z152 / Z719	Sound I.F. Amplifier		
V9 or Z152 / Z719	A.F. Output		
V10 or Z152 / Z719	Sync Separator		
V11 or Z152 / Z719	Line Oscillator		
V12 or N152 / N339	Line Output		
V13 or U153 / U329	Efficiency Diode		
V14 or U151 / U43	EHT Rectifier		
V15 or LN52 / LN309	Frame Oscillator and Output		
V16 or U154 / U319	H.T. Rectifier		
V17 or U154 / U319	H.T. Rectifier		
C.R.T.	14in. Type 4/14G / 17in. Type 4/15G	Emiscope Tube	

Loudspeaker

Table Models—5in. diameter electro-magnet.

Console Models—10½in. elliptical permanent magnet. The speech coils of these loudspeakers have an impedance of 5 ohms at 1,000 c.p.s.

Sensitivity	*Band I*	*Band III*
For normal picture	30μV	100μV
Sound for 350 mW output	15μV	50μV

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H.M.V. SPECIFICATION

Physical Dimensions

Model	Type	Height	Width	Depth
1840	14in. Popular Table Model	18½in.	17½in.	20½in.
1841	14in. Console Model—without doors	33½in.	33½in.	21½in.
1842	17in. Popular Table Model	20½in.	20½in.	23in.
1843	17in. Console Model—with doors	38in.	21in.	24½in.
1844	17in. Console Model—without doors	36in.	20½in.	24in.
1845	14in. De Luxe Table Model	18½in.	17½in.	20½in.
1846	17in. De Luxe Table Model	20½in.	20¼	23in.

Mains Supply

195-255 volts D.C. or A.C. 50 cycles per second.

Consumption

140 watts approx.

Intermediate Frequency (Carrier)

Vision 34.65 Mc/s. Sound 38.15 Mc/s.

Channels

Operative on Band I and Band III Channels 1-5 and 6-13 respectively.

Valves

V1	PCC84 or B319	Cascode R.F. Amplifier (sound and vision)
V2	PCF80 or LZ319	Frequency Changer (sound and vision)
V3	EF80, Z152 or Z719	I.F. Amplifier (sound and vision)
V4	EF80, Z152 or Z719	I.F. Amplifier (sound and vision)
V5	PCF80 or LZ319	Vision I.F. Amplifier and Vision Auxiliary A.G.C.
V6	PL83, N153 or N309	Video Output
V7	PCF80 or LZ319	Picture Interference Limiter and Sync Separator.
V8	PCL83 or LN309	Frame Generator and Output
V9	PCF80 or LZ319	Line Generator and Vision A.G.C.
V10	PL81, N152	Line Output
V11	PY81, U153 or U329	Efficiency Diode
V12	U151 or U45	EHT Rectifier
V13	EBF80, ZD152 or WD709	Sound I.F. Amplifier and Sound Auxiliary A.G.C.
V14	EF80, Z152 or Z719	Sound I.F. Amplifier
V15	EF80, Z152 or Z719	Audio Output
C.R.T.	14in. Models Emiscope Type 5/2, pentode aluminised	
	17in. Models Emiscope Type 5/3, pentode aluminised	

In addition, Metal Rectifiers are used as frame integrator/clipper, sound interference suppressor, focus potential rectifier and H.T. rectifier. Germanium diodes are used as vision and sound demodulators.

Loudspeaker

Table Models—8in. elliptical moving-coil permanent-magnet with a speech coil impedance of 5 ohms at 1,000 c.p.s.

Console Models—10½in. elliptical moving-coil permanent-magnet with a speech coil impedance of 5 ohms at 1,000 c.p.s.

Sensitivity

	Vision	*Sound*
Band I	10 μV	5 μV
Band III	30 μV	15 μV

BBC Colour

ON Monday, November 5th, the BBC started its third series of experimental colour television transmissions. The two previous series of tests were transmitted from Alexandra Palace in October, 1955, and in April of this year. The new series, which will continue for about six months, is on Channel 1 (Vision, 45.0 Mc/s; Sound, 41.5 Mc/s) from the BBC's new London television station at the Crystal Palace.

The system of transmission is the same as that used for the earlier experiments, namely a modified version of the American N.T.S.C. system adapted to suit the British television standards of 405 lines, 25 pictures per second. The signals are, therefore, compatible; that is they will produce black-and-white pictures on monochrome receivers as well as colour pictures on colour receivers.

The earlier experimental transmissions were mainly concerned with problems of compatibility. The new series will have as one of its main objects the assessment of quality and acceptability of the colour pictures produced by the complete chain of colour equipment from the studio to colour receiver.

The pictures will consist of "live" studio items, colour films, still pictures, and test patterns originating from the BBC's experimental colour television cameras and equipment at Alexandra Palace, from where they will be sent over G.P.O. circuits to the Crystal Palace transmitter. The transmissions will be received at a number of selected points in the service area of the Crystal Palace station on colour receivers specially developed by the British radio industry for the BBC tests. They will also be received on black-and-white receivers which will provide more information about compatibility.

The colour transmissions take place after normal programme hours on Mondays, Wednesdays and Fridays, starting at 11.10 p.m. approximately and lasting for about 40 minutes. Because of their experimental nature they will be subject to alteration in time, interruption, or cancellation without notice.

These BBC experimental colour transmissions, like the previous series, are being made in co-operation with the radio industry, and in agreement with the Television Advisory Committee, which has been asked by the Postmaster-General to report on the whole field of colour television.

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1A7	11/6	6A7	13/-	6C9	10/6	6L18	11/6	6X5GT	7/6	12H6	3/-	EABC80	10/-	EY51	11/6	PY80	10/-	VR91	
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								955	4/9	25Z4G	9/-	EP89	12/6	Pin	5/-	VR53		VU39	
								956	3/6	25Z5	9/-	EP92	8/6	N78	12/6	(EF39)	6/6	(MU12/14)	
								10C1	12/6	25Z6GT	9/6	EL2	12/6	P61	3/9	VR54			8/9
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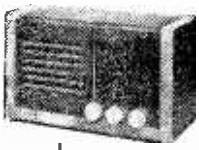
																(SP41)	3/-		



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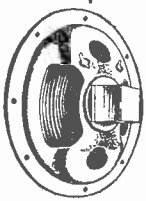

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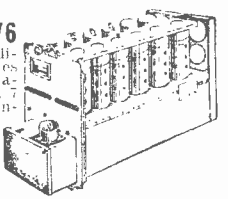

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Eliminating Breakthrough

PREVENTING PATTERNING AND INTERFERENCE FROM BBC CHANNELS ON I.T.A. CHANNELS

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

BY now a large number of our readers will have discovered that one of the biggest problems involved in converting Band I receivers for reception of the I.T.A. by means of superhet type add-on converters is in eliminating BBC breakthrough on the I.T.A. picture and sound.

This undesirable feature often precludes the use of this simple method of conversion when the receiver is situated some 10 to 20 miles from a powerful BBC station. The symptoms are becoming well known. On the picture severe pattern effects detract from the quality of the I.T.A. reception and, in certain cases, in the background can be observed the BBC picture. The sound may also be affected either by a whistle, due to the unwanted and wanted signals or by the BBC sound breaking through on the I.T.A. sound.

The trouble is caused, of course, by the fact that even when the combination is adjusted for reception of the I.T.A. the receiver itself is still responsive to signals in the local Band I channel. Direct pick-up of the BBC signals thus occurs either on the link connecting the converter to the receiver or on the first stage wiring of the receiver.

Two signals, therefore, are fed to the receiver ; the converted Band III signal and the BBC signal. These two signals beat together and give rise to the familiar patterning on the picture and whistles on sound.

The extent of the disturbances depends to a large degree on the ratio of the local signal strengths of the BBC and I.T.A. If, for example, the BBC signal is much larger than the I.T.A. signal, it will be necessary to advance the receiver contrast and sensitivity controls in order to secure a viewable I.T.A. picture. This action increases the gain of the receiver and thus makes it respond to the strong BBC signal, even though an aerial is not actually connected to the receiver itself.

On the other hand, if the I.T.A. signal is stronger than, or equal to, the BBC signal the sensitivity of the receiver need not be unduly advanced when receiving the I.T.A. and consequently the stronger converted I.T.A. signal generally masks any slight spurious BBC signal which may be present on the converter link or first stage wiring of the set. The problem is eased considerably, and picture noise is made less noticeable, if the converter's gain or sensitivity control is turned right up.

Before attempting this mode of conversion in swamp areas of the BBC transmission it is a good idea to find out just how strong the local signal is and how it is likely to affect the converted receiver. This can be done by removing the aerial and in place using a 3ft. length of coaxial feeder terminated by a 75-ohm resistor. If a picture and loud sound can be received on this hook-up in place of an aerial, then breakthrough of the BBC is bound to occur when an add-on converter is used.

Removing the BBC Signal

There are several ways by which one can attempt to remove the unwanted BBC signal. Some success may be attained by screening the inside of the receiver cabinet and, if necessary, thoroughly screening the first (and possibly second) stage wiring and components including the valve—not forgetting to make provision for ventilation !

Most converters feature a socket for the Band I aerial and a Band Changeover switch. In the " Band III " position the Band I aerial is removed from the receiver and possibly short-circuited. Unfortunately, though, the capacitance of the switch and associated wiring reflects a certain amount of Band I signal into the converter link, and thus aggravates the effect of interference. This can be avoided by removing the Band I aerial from the converter when receiving the I.T.A.

If Band I signal is getting to the receiver by way of the converter/receiver connecting link, the link should be cut to a critical length to act as a stub. Good quality close-woven coaxial should be used, and for Channel 1 sets should be cut to exactly 66in. A length of 48in. should be used with Channel 4 sets, 57in. for Channel 2 sets and 52in. for Channel 3 sets. If the use of a critical length does not help matters the link should be cut as short as possible.

A Patterning Removal Unit

Sometimes a complete cure results by the use of one or more of the previously described palliative measures. But more often than not, although the interference is alleviated, there still remains a trace of breakthrough. And in very severe cases a more drastic approach to the problem is demanded.

A perfect solution to the problem has been provided by Spencer-West, Ltd. in the form of a small unit which serves to cancel out the interfering signal.

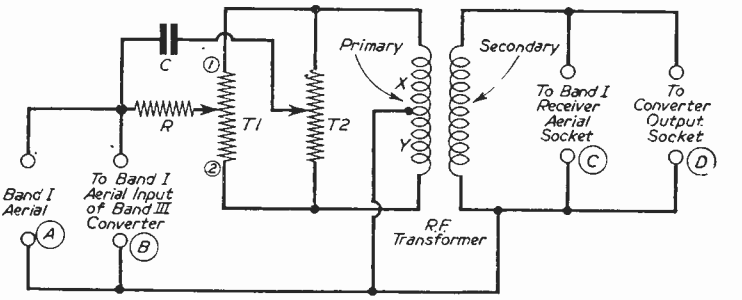

Fig. 1.—Circuit of the Spencer-West Patterning Remover.

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Hitherto, engineers and experimenters have often been obliged to abandon the simple add-on mode of conversion purely on the grounds of BBC breakthrough. Now, however, aided by the unit, conversions of this nature can be carried out with complete success even close to a powerful station.

A sample of the BBC signal is applied to the unit, which modifies the signal strength and phase so that it appears as an exact mirror image of the signal picked up on the receiver's first stage and converter

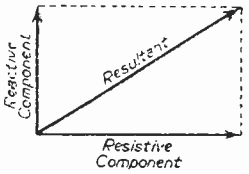

Fig. 2(A)—The phase and amplitude of a signal depends upon the vectorial sum of the reactive and resistive components as shown.

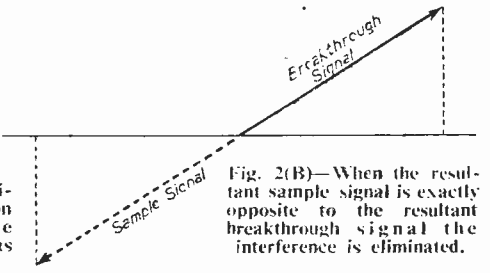

Fig. 2(B)—When the resultant sample signal is exactly opposite to the resultant breakthrough signal the interference is eliminated.

connecting link. It is then applied, together with the converted Band III signal, to the receiver aerial socket. Thus, because the sample signal is the exact opposite of the interfering signal, the interference is completely eliminated.

The circuit of the unit is shown at Fig. 1. The Band I aerial feed to the Band I socket on the converter is made via the unit at points A and B. Similarly, the converter connection to the Band I receiver is made via points C and D. This means that when the converter is switched to a Band III position some of the signal in the Band I aerial is purposely conveyed to the receiver aerial socket by way of the unit's R.F. transformer.

This is what is wanted provided the signal is exactly opposite to the breakthrough signal. The make-up of any signal is determined by two components. These are a resistive component and a reactive component. Moreover, the phase and amplitude of a signal depends upon the vectorial sum of these two components. This is shown vectorially at Fig. 2A. At Fig. 2B is shown vectorially the resultant breakthrough signal, and the resultant sample signal which has been altered in phase and amplitude so that it is opposite to the breakthrough signal. When this condition exists the breakthrough signal collapses to zero and has no disturbing effect on reception of the I.T.A.

Now we have a fair idea of the operation of the unit we shall find it easier to understand how the phase and amplitude of the sample signal is modified to cancel out the breakthrough signal. Since there is no indication as to whether the breakthrough signal is predominantly reactive or resistive, the unit features two pre-set potentiometers, T1 and T2 (Fig. 1), which serve to render the sample signal opposite to the breakthrough signal. T1 alters the amplitude of the resistive component of the signal, since the signal is applied through resistor R, and T2 alters the amplitude of the reactive component, since the signal is applied through capacitor C.

Actually, the amplitude of the make up signals can be varied from positive 90 degrees through zero to negative 90 degrees. The two pre-set controls can thus be used to provide an output signal which has any amplitude (limited, of course, by the amplitude of the input signal) and any phase angle.

Let us consider T1. When it is set at the centre of its travel equal and opposite signals flow in sections X and Y of the centre-tapped primary of the R.F. transformer. These two signals thus cancel out and no signal exists across the secondary. When T1 is set, say, at point 1 the input signal circulates in section X of the primary and a voltage is induced across the secondary. When T1 is set at point 2 the input signal circulates in section Y of the primary and a voltage equal and opposite to the former case is developed across the secondary.

The same effect occurs with operation of T2, but this time the voltage across the secondary has a phase displacement of 90 degrees owing to the function of the capacitor C. From this, then, we can clearly realise that the reactive and resistive components making up the resultant signal at Fig. 2A can be altered just as required to provide cancellation as at Fig. 2B.

The unit is self-contained in a metal box measuring approximately 3½ x 3 x 1in. It is known as the Patterning Removal Unit Type 54.

Information Sought

A new feature. Readers are invited to supply information to assist other readers.

E. H. of Willesden wishes to know what ex-Government set, readily available, has been found most suitable for conversion as an I.F. strip for TV at the now standard I.F. of 38 Mcs approx.

Who can suggest the simplest and most efficient way of increasing EHT from a Brandebourgh EHT unit, now delivering 9 kV.? Fifteen kV. is required by **T. J. of Hull.**

Has any reader practical details of a "cage or slot or skeleton" aerial which works on Band III *and* F.M.? **L. M. J. of Woking** asks.

What practical details can be supplied for a combined vision and sound strip which, whilst being used for existing programmes is designed and easily adapted for colour? **E. E. (Pimlico)**

L. O. P. of Mitcham requires a Service Manual of the M.C.R.I receiver—either on loan or to purchase.

How can a commercial receiver be adapted, preferably externally, to receive the French transmissions? The set is a 12-channel 1956 model. **E. M. of Dover** enquires.

Who can supply data for a converter, which can be tuned to any of the existing BBC channels to receive any other channel? **D. S. B. of Rugby** asks.

O. L. of Torquay requires details of an aerial which will enable Wenvoe or London to be picked up with a suitable receiver.

Can any reader supply **H. H. P. of Shawthorpe** with a service manual of the KC.3880?

J. McK. of Paisley asks whether a 15in. tube can be fitted to a Regentone Big 12 (five years old) without any modification.

J. Y. R. of Wimbledon seeks information on avoiding frequency drift in cascode amplifiers as used in converters. Has any reader found a modified circuit which affects this?

HOW TO USE AN OSCILLOSCOPE

WITH regard to the article under the above title which was continued in last month's issue. It is regretted that this month's instalment has had to be held over and it will be continued in next month's issue.

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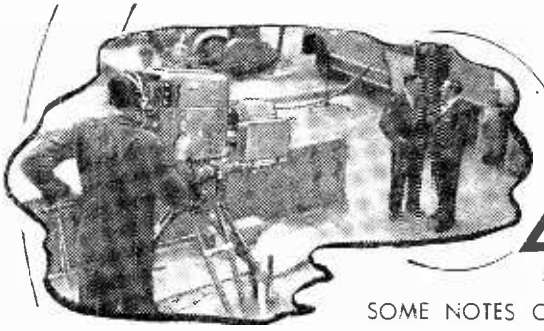


OUTSIDE BROADCASTS

SOME NOTES ON THE COMPLICATED NETWORKS USED BY BBC AND I.T.A. FOR "LIVE" RELAYS

ONE of the most interesting branches of the modern television system, and the one which gives to television the life and sparkle which are missing in the films, is that of outside broadcasting. With the aid of the O.B. Network, as it is called it is possible for viewers in their homes to see events at the actual moment that they take place, and so many of these O.B.s have taken place in recent years that the viewer is inclined to take it for granted and little realises the immense amount of work which is entailed in setting up the system. Viewers who have seen the "Saturday Night Out" programmes on the BBC will have seen something of the headquarters (situated at Wembley) and the type of vans which may be employed. But this is only part of the system. In addition to camera vans there are power supply vans and a complete mobile control room. The inside of one of these is illustrated at the top of page 224. On the extreme left is the television engineer's position, and next to it is the sound mixer panel. Then comes the vision mixer panel and the communications panel. The two latter panels can be transposed, leaving the producer in the centre position if he elects to have a vision mixer instead of mixing the programme himself. Above the desk is the monitor loudspeaker and the main equipment rack containing the camera control units and the picture monitors.

Setting Up an O.B.

The work involved to carry out an O.B. at some future fixed date such, for instance, as a relay of a sporting event or from some source of entertainment, is summarised in the following notes, which gives the Associated-Rediffusion system for I.T.A. It should be noted that instead of O.B.s the rival networks use the American term, "Telecast." The various stages are as follows:

1. The subject is decided, e.g., a boxing match, a race-meeting, a theatre excerpt.

2. The programme director, together with his technical advisers, carries out a survey of the location and decides where he wishes to position his cameras and microphones. Consequent upon which the engineer sites the control van or scanner.

The maximum distance a camera may be from the scanner is 1,000ft., though this distance can be exceeded if the camera is treated as a "remote" and the picture is brought into the control van by a video circuit.

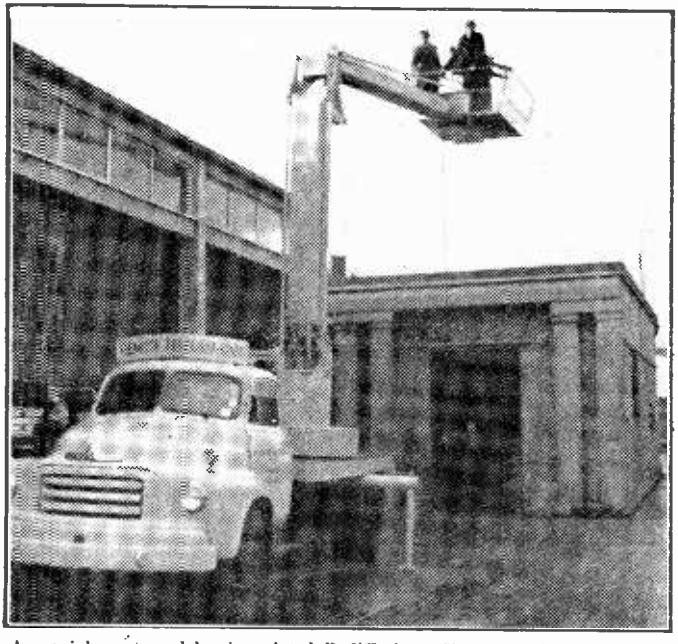
3. The necessary arrangements are confirmed by letter from the Company to the organisers concerned.

4. Arrangements are made for transmitting vision and sound back to Master Control at Wembley. Sound will always be carried by Post Office lines. Vision may be either transmitted by a Post Office line or by a microwave link.

A microwave link consists of a transmitter at the outside broadcast point and a receiver in London. If the distance is great, two or more "hops" may be used, each consisting of a transmitter and a receiver.

5. Commentators and other necessary people are engaged.

6. The equipment is set up either on the day of



A special mast used by Associated Rediffusion. Known as "The Thing" this can be raised to 40ft. or more.

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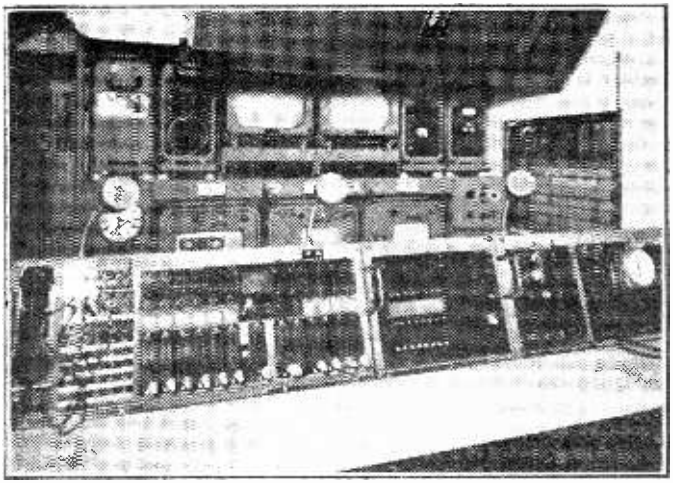

The main BBC vision and sound control desk in the Mobile Control Room.

transmission or previously. This entails rigging all the camera cables and sound lines between the control van and the camera positions and positioning microphones. The director having chosen suitable positions on his survey to cover the spot will direct the programme from the control van, which is equipped with various monitor screens giving him the picture coming in from each camera from which he will choose the picture to be transmitted, which in turn will appear on another monitor screen as leaving the control van. A final monitor will show him "off air" or transmission pictures received back in the control van from the I.T.A. transmitter.

7. The director is in communication with all his cameramen who wear headsets and he can, therefore, direct them to the objects he requires covered.

8. He will also have a floor manager whose job is to position and time interviews, personality spots, etc., and the director is in communication with him also. The picture and sound are carried back to Master Control as described above, whence the programme is relayed to the local I.T.A. transmitter for transmission.

Part of the Monitoring Bay at the G.P.O. Switching Centre in London.

Microwave Links

The relaying of the picture by radio links has proved most successful, as shown by the European relays. Small parabolic reflector aerial systems are used with wavelengths of the order of 7,000 Mc/s, and these are usually not more than 25 miles apart. These points are linked by radio-telephone so that co-operation between the engineers at the transmitting and receiving points may be effected, and this is usually on 89.5 Mc/s. When, as is often the case, the link is required to terminate at one particular building in a large city, it may

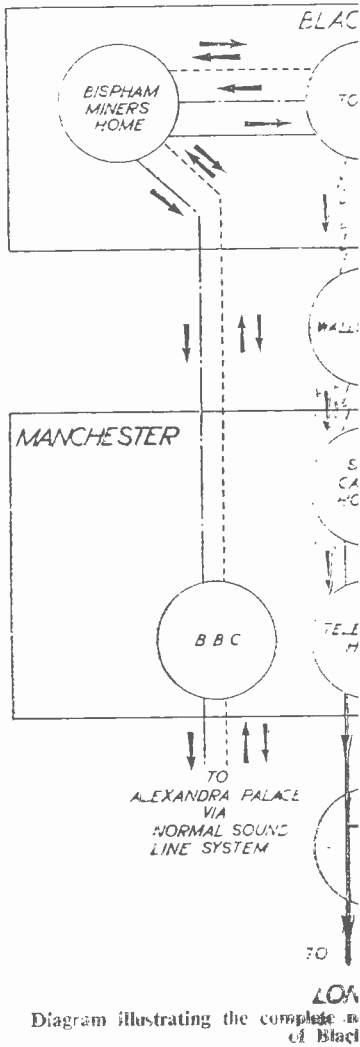

Diagram illustrating the complete n of Blac

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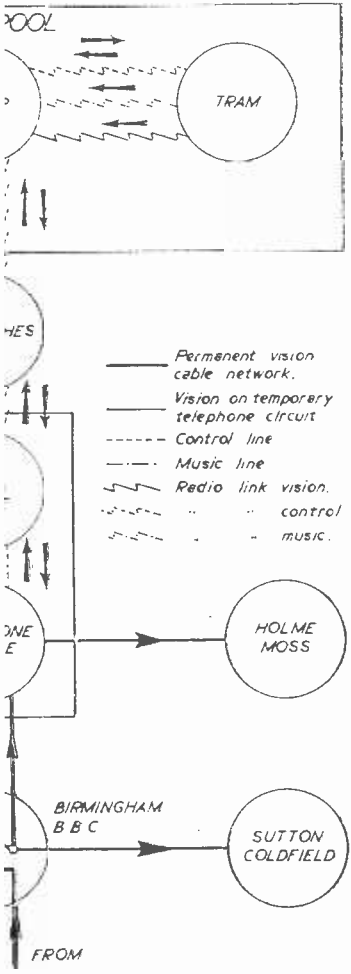
well be found that the path is obstructed by a larger building in the vicinity. It then becomes necessary to convey the signal to its final destination by a comparatively short length of specially equalised line in the G.P.O. telephone system, or use a radio link—provided the path is "optical." This link is usually at a much lower frequency than the main link, generally about 200 Mc/s.

Switching Centre

Situated in the West End of London is a special G.P.O. switching centre. It was mentioned earlier that the speech link on these O.B.s is carried out on normal G.P.O. lines, and that special equalised lines are used for vision relays. All the special cables used for this purpose are brought into a central



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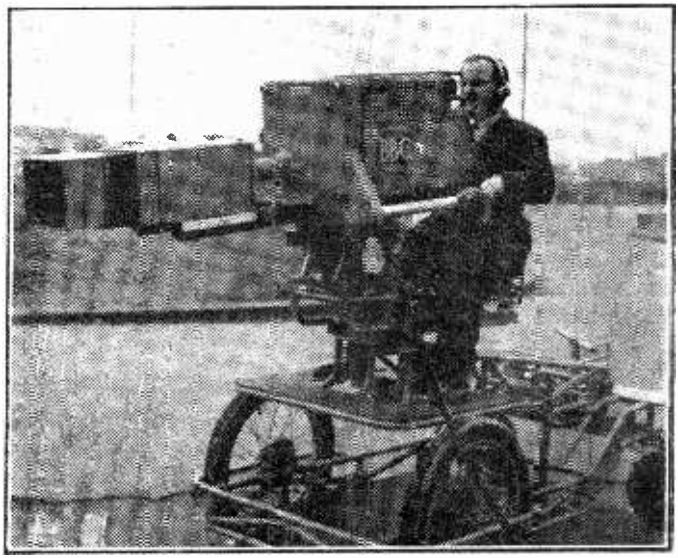
ork used recently for the BBC relay rlights.



This BBC O.B. camera has a Varotal lens with two ranges—20in. at f/4.5 and 8in. at f/8. The lens, by Taylor, Taylor and Hobson, is mounted on a Marconi Mk. III O.B. camera.

building known as the London Television Control Centre and its function is to operate and control the network. A view of one corner of this centre is seen at the foot of page 224, the six screens in this picture being labelled Alexandra Palace to Broadcasting House; next C.E.L. 3 Injection Outside Broadcast; Wenvoe to Broadcasting House; Broadcasting House to Alexandra Palace; Broadcasting House to Birmingham; and Broadcasting House to Wenvoe. It is thus possible to route any picture to any desired point and at the same time to see the quality of the picture which is being relayed.

Wembley Centre

A part of the O.B. Centre at Wembley is seen in the Saturday Night Out BBC relays. This building, which was built originally for the British

A typical scene during an O.B. This is the Hammersmith Palais, and the Mike Boom can be seen out ahead of the camera.

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Empire Exhibition of 1924, was used by the BBC as the Broadcasting Centre for the Olympic Games in 1948. More recently it has been acquired and equipped as an operating headquarters and maintenance base for the Television Outside-broadcast Section of the Engineering Division of the BBC. The floor area covers some 1½ acres and provides adequate accommodation for all the staff, vehicles, workshops, stores and offices necessary to the organisation. The main functions of this section are :—

(a) The advance planning and preparation of outside broadcasts.

(b) The assembly and dispatch of mobile units and crews to outside-broadcast sites.

(c) The efficient maintenance of all the outside-broadcast equipment.

To meet these needs a total technical staff of approximately 100 is employed. An average of 21 programmes per month is carried out, i.e., visits to 21 different sites for one-day events within a radius of 50 kilometres around London.

The mobile technical equipment at present available consists of :—

Four Mobile Control Rooms, each containing the apparatus necessary to operate three cameras and to feed the vision signal to line or to a nearby mobile transmitter. Equipment is provided also to handle the sound component and to receive the broadcast programme, sound and vision, for monitoring and cueing purposes. The apparatus can readily be removed from the vehicle for temporary installation where this is more convenient than using the vehicle itself as the control room.

One Mobile Central Control Room. This vehicle contains the equipment necessary to co-ordinate the operations of two or more mobile control rooms for the more complex kinds of television outside broadcasts.

Two Mobile V.H.F. Transmitters. Where suitable cables are not available these transmitters are used to send the vision signals from the mobile control or central control room to receiving stations at Alexandra Palace and Highgate, London.

Two Mobile Telescopic Masts. These are modified fire-brigade ladder vehicles and can reach a height of about 30 metres in a few minutes.

Two Mobile Power Units. Each carries a 25 kVA diesel alternator set for use where a suitable supply is not available at the point of origin of a programme.

Three Tenders, for auxiliary equipment.

Transportable V.H.F. and microwave transmitters and receivers for sound and vision links.

For servicing this apparatus fully equipped workshops, test rooms and stores are necessary. In the case of camera and associated vision apparatus, duplicate channels of all types are permanently installed, thus enabling all testing to be carried out under operational conditions. The aim is to ensure that all electrical and mechanical repairs and inspections are dealt with in the short intervals between assignments. The stores hold a complete range of spare parts as well as all necessary rigging and installation materials (scaffolding, cables, ropes, etc.).

The advance planning is carried out by a group of engineers who interpret programme requirements and visit the sites beforehand : they have to study every engineering aspect and ensure that full facilities are provided in readiness for the units. This involves negotiation with power supply authorities, County Councils, the General Post Office and many other organisations concerned. This group is also responsible for organising the advance installation of cables and construction of special camera platforms.

In addition there is a small experimental group whose task is to study the performance of new equipment and report operational experience to the design and development authorities.

A Simple TV Signal Attenuator

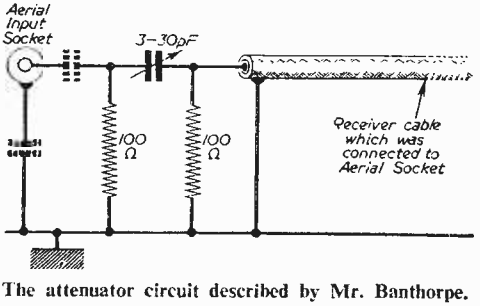
THE ordinary attenuator consisting of carbon resistors is satisfactory for moderate amounts of attentuation, but due mainly to the self-capacity of the resistors is quite useless for high attenuation. If a number of sections of an attenuator are used, each causing a moderate amount of attenuation, it becomes difficult to accommodate the string of resistors in the receiver and it is extremely unsightly outside the receiver.

High attentuation on Band III is even more difficult due not only to the greater effect of the self-capacity of the resistors, but also due to their self-inductance. A method used by the author has proved very satisfactory in practice on Bands I and III and in addition is cheap and quick to adjust.

The circuit is shown here. The cable connected to the aerial socket inside the receiver chassis has to be disconnected from the socket and the attenuator inserted between the cable and the aerial socket. To provide termination for the aerial feeder and loading for the input circuits of the receiver, both have a resistor of 100 ohms connected across them. The "live" connections are then joined together via a small capacitor, either fixed or variable. When the attenuator is used in a receiver with a live chassis, such as an A.C./D.C. type, care must be taken that the safety precautions, such as the capacitors shown dotted, are not rendered ineffective. When the capacitors are included then the attenuator should be connected as shown.

If a small trimmer is used the attenuation can be adjusted merely by adjusting the trimmer ; the smaller the capacity the higher the attenuation.

Using a 3pF to 30pF trimmer the range of attenuation measured on Band I was 120:1 to 8:1. On Band III it became 6:1 to 2:1, both useful ranges. If higher attentuation is required a smaller capacitor may be used and a variable capacitor consisting of two short pieces of pushback twisted together has been found very satisfactory.—(C. H. BANTHORPE).



The attenuator circuit described by Mr. Banthorpe.

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Riverside Studios

SOME DETAILS OF THE NEW BBC PREMISES AT HAMMERSMITH

THE two new BBC Television Studios at Riverside, Hammersmith, with areas of 6,000 sq. ft. and 4,500 sq. ft. approximately are now in operation. Together with the Lime Grove studios they will help to meet the expanding needs of the television service while the BBC's Television Centre at the White City is being built.

Although the Riverside studios have, like Lime Grove, been converted from film studios they come closer to the layout which experience has shown to be most suitable for television. A number of important new technical features have been incorporated which will make for improved pictures both technically and artistically.

The main technical improvements may be summarised as follows:

(1) Centralised control of switching, dimming and hoisting of studio lighting.

(2) Improved layout of control rooms.

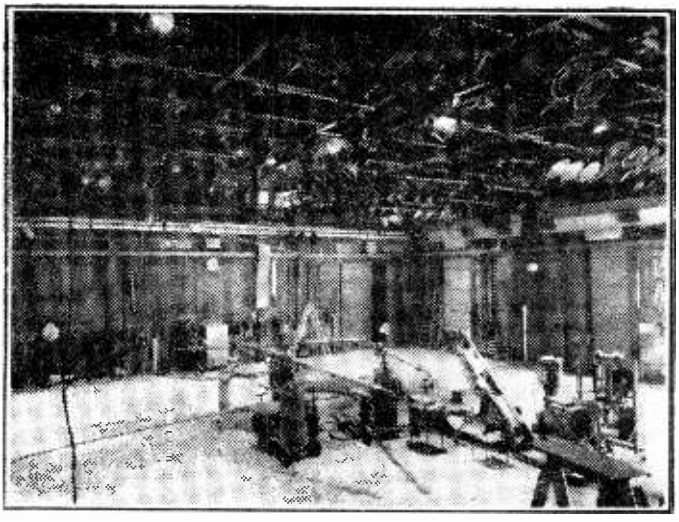
(3) Sound control facilities specially adapted to television requirements.

Each of the two studios has been equipped with new Image Orthicon cameras.

Lighting Installation

Up to the present time it has been necessary in order to meet the needs of the rapidly expanding television service to make use of available film studio lighting equipment in the BBC television studios. This has not provided the mobility and flexibility of control required in "live" television production where it is necessary to change complicated lighting arrangements instantaneously as the action moves from one "set" to another. The need to follow the movements of performers, and to provide special effects when necessary, also demands rapid changes in lighting.

The lighting installation at the Riverside studios has been specially designed and planned to meet the special needs of television and is something quite new in this field. It is possible to switch or dim each illuminator, either individually or in groups, from a lighting control console in (or immediately adjacent to) the Vision Control Room. The illuminators are suspended in groups of four from horizontal battens distributed over the roof of the studio and each batten can be raised or lowered by an electric hoist. All the hoists are controlled from a single control desk at floor level. The lighting cables are arranged to coil themselves around the hoisting cables as the battens are raised. In No. 1 studio there are 79 hoists and 344 lighting outlets (including those not associated with the hoists). In No. 2 studio there are 62 hoists and a total of 308 lighting outlets. This large number of separate battens means that it is possible to provide overhead lighting at any point on the studio floor, simply by lowering the appropriate batten and swinging the lights in the correct direction. This is a great improvement on the old system, in which the lights are suspended by block and tackle from "skids" attached to girders running across the ceiling, and further hauling of ropes is necessary to move the skids along the girders. The lighting control console in Studio 1 offers a total of 166 Control Channels, each with its own dimmer. The majority of these channels control the lighting outlets on the suspended battens; the remainder deal with other lighting outlets on the lighting gallery and studio walls. The channels supplying the outlets on the



A general view of studio 2 from the gallery outside the vision control room.

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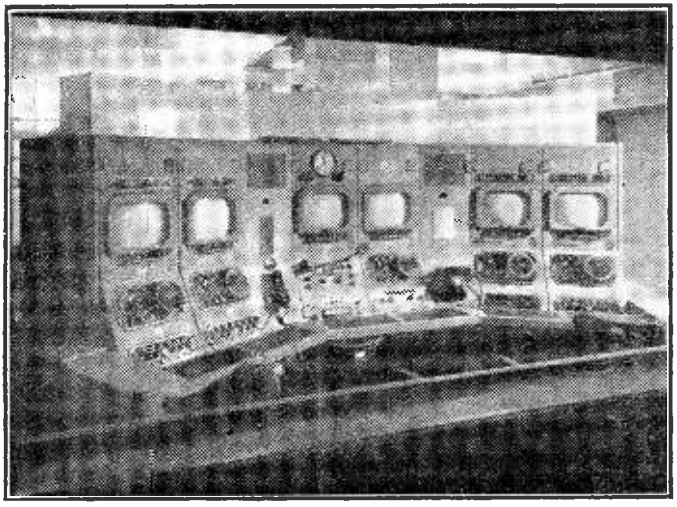
battens each a seven-position switch (located alongside the Control Console) which enables a choice to be made in the lamp connected to each channel.

In Studio 2, the Console provides 96 Control Circuits with dimmers, and 48 switched circuits. The interconnection of lamps to control circuits is done on a large "patching" board in the Dimmer Room.



The camera console control unit in the apparatus room at studio 2.

Both consoles have comprehensive arrangements for switching or dimming selected groups of lamps simultaneously. The switching can also be linked with preset changes in the "set-up" of the picture signal waveform, when special lighting effects are required.

The dimming in Studio 1 is partly by auto-transformers, and partly by resistances operated through magnetic clutches. In Studio 2, thyratrons give direct control of the current passing through the lamps. One important difference between the two systems is that in the first instance, the dimmers remain indefinitely in any given setting after the magnetic clutch has been disengaged, whereas each thyratron requires a constant control current in order to maintain a setting. This makes it possible to offer more extensive control facilities with the mechanical system. These enhanced control facilities should improve picture quality both technically and artistically. Artists and cameras change their positions during transmission, and it is desirable that the lighting should be changing rapidly and continuously at the same time, in order to maintain lighting levels which suit the needs of the type of camera in use, to preserve the balance of lighting and to provide any changes of lighting effect which the producer may require. The maximum lighting load is 150 kW in No. 1 studio and 100 kW in No. 2 studio, while the total number of illuminators of various sorts available for use is 481 in Studio 1 and 348 in Studio 2.

Control Rooms

Experience has shown the desirability of having all three control rooms (Vision Control, Sound Control and Vision Apparatus) immediately adjacent to one another on the same floor level. This was never fully achieved at Lime Grove but it has been contrived for the first time in both the new studios. In Riverside 1, the Vision Control Room has a view of the studio through a sloping observation window, which goes down to the control room floor level. The producer's seating position faces directly through this window, and the picture monitors are mounted near the top of the window. Thus the producer has a view of most of the studio floor, with the picture monitors in the same line of vision.

The vision mixing unit in each of the studios has two group panels in addition to the master panel. This enables a special effect, or other special combination of picture sources, to be set up on one group panel while the other panel is on transmission. Thus a preview may be obtained, not only of a single picture source, but also of any desired combination of sources. This preview can also be displayed in the sound control room and vision apparatus room.

Sound Control Facilities

A new type of Sound Control Desk incorporates the features which operations staff have found to be desirable for television sound control. The provision of an attenuator in each microphone channel makes it possible to preset the gain in each channel when balancing. This means that the quadrant faders can always be pushed to the limit of their travel, which also assists rapid cutting. Pre-fade buttons are provided, which enable the signal in each channel to be monitored.

PRACTICAL WIRELESS NOW ON SALE — DECEMBER 1956 PRICE 1s. 3d.

The main feature in our companion paper, "Practical Wireless," now on sale, is a Front Door Intercommunication system. In this, microphones are fitted at the door and in the house or flat, and it is possible for the housewife or anyone in the house to talk to a caller at the door without having to go to the door. In addition, if satisfied with the identity of the caller it is then possible, by pushing a button in the house, to release the door catch and the caller may enter. In addition to this there is a constructional article on a Versatile Valve Voltmeter, how to make an Electronic Metronome, and the construction of a Compact H.T.-L.T. Unit for Personal Receivers. This is a mains-operated device for use in place of All-dry batteries.

In addition to the above constructional features further notes are given on the construction of the Beginners' Short-wave Three and the Radiogram Cabinet which were described in last month's issue, and also further details on the use of 807's in transmitting modulators.

The issue is completed with the usual features—Open to Discussion, On Your Wavelength, Round the World of Wireless, etc.

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C.R.T. ISOLATION TRANSFORMER
Type A. Low leakage windings. Ratio 1 : 1.25 giving a 250 v. boost on secondary.
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Ditto with mains primaries, 12 6 each.
Type B. Mains input 200-240 volts. Multi Output 2, 4, 6.3, 7.5, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, 21 - each.
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NOTE. It is essential to use mains primary types with T.V. receivers having series connected heaters.

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RESISTORS. All values. 10 ohms to 10 meg. ½ w., 4d. ; 1 w., 6d. ; 2 w., 8d. ; 3 w., 1 -.
HIGH STABILITY, ½ w., 1%, 2 -. Preferred values 100 ohms to 1 meg.

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10,000 ohms to 50,000 ohms, 2 w., 1 9 ; 10 w., 2 3.
KNOBS. GOLD ENGRAVED.—Walnut or Ivory, 1½in. diam., 1 6 each. Not engraved, 1 - each.

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MAINS TRANS. 200-250, 50 mA., 6.3 v. tapped 4 v., 4 6., 0 v., tapped 4 v., 2 a., dual 2 a. 21 -.
HEATER TRANS. Tapped primary, 200-240 v. 6.3 v. 1½ amps., 7 6 ; tapped sec. 2, 4, 6.3 v., 1½ amps., 8 6.
VCR97 TESTED FULL PICTURE, £2.
COPPER PLATED AERIAL RODS. ¼ x 12in. push fitting, 3 - doz., p. & p. 1 -.
ALADDIN FORMERS and cans, 1in., 8d. ; 2in., 10d.
FORMERS 5937 8 and Cans TV12. 2in. sq. x 2½in. and 3in. sq. x 12in., 2 - ea. with cores.
TYANA. Midget Soldering Iron 200-240 v. or 220-250 v., 16 9. **Solon Instrument** Iron, 24 -.
MIKE TRANSF. Ratio 50 : 1, 3 9 ; 100 : 1, 10 6.
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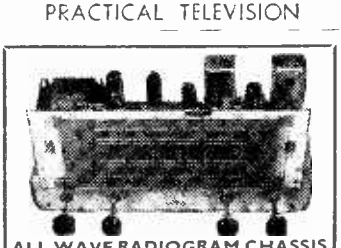
LINE CORD. 3 amp., 60 ohms per foot, 2 amps., 100 ohms per foot, 2 way, 6d. per foot. 3-way, 7d. per foot.
LOUDSPEAKERS P.M. 3 OHM.
6in. Goodmans, 17 6. 5in. x 7in., Goodmans, 21 -. 5in. square, Elac, 21 -. 5in. Elac, 22 6.
6½in. Goodmans, 18 6. 10in. R. & A., 30 -.
18L Tweeter, 18H5, 12 6. 12in. Plessey, 30 -.
Rola M.E. 2.5 k., or 2 k. field, tapped 0-1-2 ohms, 24 6.
CRYSTAL DIODE, G.E.C., 2 -. Crystal Book, 1 -. GEX34, 4 -. Handbook on Germanium Diodes, 2 6.
HIGH RESISTANCE PHONES. 4,000 ohms, 17 6 pr.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1¼ x 2in. Brass finish. Price 6 6. No transformer required.

SWITCH CLEANER Fluid, small spell, 4 3 tin.
TWIN GANG TUNING CONDENSERS. .0005 mfd. midget, less trimmers, 6 6 ; .0005 Standard size with trimmers, 9 - ; less trimmers, 8 - ; ditto, solid, 2 6 ; .0005 mfd. slow-mo, 7 6.
SPEAKER FRET.
Expanded metal. Silver, 15in. x 9½in., 2 - each.
TAPEMASTER RECORD PLAY HEAD, 45 -.

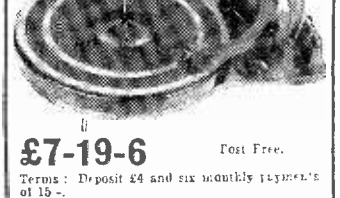
VALVES
A SMALL SELECTION FROM OUR STOCKS

All Boxed			New & Guaranteed	
		1 6		
8 6	5 6	LA10	6 6	10 6
1R5	1T8	954	6AL5	5Z4
1S4	1U5	955	6J5	12AT7
1S5	1X2B	2X2	6K6	13D3/1
1S4	1.5 m.p.	EF13	6K7M	13D8
1X4	5R4G	EH33	EB91	13C8G
2D4	5P4L		6V6G	13D8
6AM6	12P2	2 6	6Y6G	14D12
6AV6		6H6M		14H1
6B7	7 6		7 6	15D8
6K8	6B8G	7 6	14S7	17Z10
6S17	6SW6	6X6G	20P1	KT33C
6SN7		6N4	20P3	MU14
6V6GT	6U6	6N5	20P5	PL81
12BH7	6K7GT	807	1-22	PY81
EB91	6K7M	EF39	VP23	12K7
5Y3G, Rod		11 6		25Z4
12H1	EA50	4 25	PL81	6Q7



ALL WAVE RADIOGRAM CHASSIS
THREE WAVEBANDS FIVE VALVES
S.W., 16 m. - 50 m. LATEST MULLARD
M.W., 200 m. - 550 m. ECH42, EF41, EBC41,
L.W., 800 m. - 2,000 m. EM41, EZ40.
12 month Guarantee.
A.C., 200-250 v. Internal Switch ; Short-Medium-Long-wave, A.V.C. and Negative Feedback. 12 watts. Chassis 13½ x 5½ x 2½in. Cut-out 10 x 4½in. Loudspeaker vertical or horizontal. 2 Pilot Lamps. Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolation from mains. **T.S.L. Tweeter Supplied Free.**
10 gns. Carr. & Ins. 7 6.
TERMS : Deposit £5.5.0 and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS
5in., 19 6 ; 6½in., 25 - ; 12in., 30 -.

★ **R.C.S. SCOOP** ★
Collaro Auto-changer RC531 for 78 r.p.m. 10 and 12in. records. Brand new in maker's boxes. High mass 7mm lightweight Pickup with sapphire needle, will match any Amplifier or Radio. Less than half price.
£5-19-6 Carr. 2 6 extra.



£7-19-6 Post Free.
Terms : Deposit £4 and six monthly payments of 15 -.
Brand new Plessey 2-speed Autochanger Mixer. Xtal Head with Duopoint sapphire stylus. Board required 15" x 12in. Height 5in.
Walnut Veneered Playing Desk 10 6 extra.

EXCEPTIONAL OPPORTUNITY
COLLARO 3-speed Single Record Player, including heavyweight Turntable and lightweight Pickup with Turnover Xtal mounted on Turntable. Valve-operated.
OUR PRICE. **6 gns.** Carr. 5 -.

ALLDRY UNIT POWER PACK. Replaces B40 to B113, etc., 69 x 4in. 115 v. 8m/A and 6.3 v. 4 a. Input. 3-pin Socket. Same as battery. ONLY 15 - a year to run on A.C. 200-240 v. FAMOUS MAKE. LIST PRICE £6 6s. OUR PRICE, 39 6. Ready to use.
B.S.R. MONARCH. 3-speed Motor and Turntable with selecting switch for 33, 45 and 78 r.p.m. records. 100-120 v. and 200-240 v. A.C. 50 cps. Also **B.S.R. MONARCH** Lightweight Pickup with Acos Xtal turnover head, sintered sapphire stylus for L.P. and Standard records. **SPECIAL OFFER. THE TWO : £4.12.6.** Post 2 6.
T.V. PRE-AMP (McMICHAEL). Tunable Channels 1 to 5. A.W.B. Amplify Output of your Receiver (Crystal type). Midget size. Black-and-Fringe Mixed. B.A.A. Valve. Full Instructions. Ready for use. H.T. 200 v., 1.5 m/A. 6.3 v., 3 amp. (required.) **BRAND NEW. 25 - each.**
MAINS POWER PACK for above. 25 - extra.
SUPERHET COIL PACK. 27 6. Miniature size 2½in. x 2½in. x 1¾in. **HIGH "Q" Dust Cored Coils.** Short, Medium, Long and Switching. Single hole fixing. Complete with circuit for 1 stage and circuit.

TELETRON BAND III CONVERTER
For London, Midland and Northern Transmissions.
Suitable all T.V. makes. T.R.F. or Superhet.
Ready wound coils, two ECF80 valves, all components, punched chassis, escutcheon, wiring plans. **COMPLETE KIT** for mains operation 200-250 v. A.C., **£3.10.0.**

As ABOVE less POWER PACK. Requires 200 v. 20 m/A. H.T., 6.3 v., 0.6 a. L.T., **£2.5.0.**
Mains Transformer to above Spec. ... 10 6
Mini. Westinghouse Rect. (H.T.) ... 8/6
B.B.C. I.T.A. Aerial to cover Band III ... 7/6
Punched and drilled chassis ... 3 9
Larger chassis for Mains Model ... 6 -
Teletron Cabinet with plates ... 15/-
Full plans and circuit only ... 6d.

Volume Controls
Long spindles. Guaranteed 1 year. Midget, 10,000 ohms to 2 Meg. No Sw., S.P.Sw., D.P.Sw. 3 - 4 - 4 9
1in. or Log Tracks, 1 6

80 ohm COAX CABLE
Screened sparked Polythene Insulated. 5/16 dia. Stranded core. **9d.** yd.
Low Loss, only 3 db per 100ft. **STANDARD 8d.** yd.
¼in. Coax. yd.

COAX PLUGS ... 1 - **DOUBLE SOCKET** ... 1 3
SOCKETS ... 1 - **OUTLET BOXES** ... 4 6
BALANCED TWIN FEEDER, yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1 -. 80 ohms only.
WIRE-WOUND POTS. ½ WATT. Pre-Set Min. T.V. Type. All values 25 ohms to 30 K., 2 - ea. 50 K., 4 -. (Carbon 50 K., 2 6 ea., 3 -.)
WIRE-WOUND 4 WATT. Pots. 2½in. Spindle. Values, 100 ohms to 10 K., 5 6 ; 100 K., 6 6.
CONDENSERS. Non-inds., .001 mfd. 7 kV. D.C.W., 5 6. Ditto, 20 kV., 9 6 ; 100 pf. to .500 pf. **Micas, 6d. ;** Tubular, 400 v., .001 to .01 mfd., **9d. ;** .02, 1, 1 - ; .25, 1 6 ; .05, 1 9 ; .1, 2 0 v., 0.01 mfd., 1 6 ; .1 .03 ; 1 mfd. 2,000 volts, 4 -.
CERAMIC CONDS., 500 v., 3 pf. to .01 mfd., **10d.**
SILVER MICA CONDENSERS, 10%, 5 pf. to 500 pf., 1 - ; 600 pf. to 3,000 pf., 1 3. **DITTO** 1%, 5 pf. to 500 pf., 1 9 ; 515 pf. to 5,000 pf., 2 -.

I.F. TRANSFORMERS 7/6 pair
465 Kcs Slug tuning Miniature Can., 2½in. x 2in. x 2in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.

NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1 25 v.	2	100 25 v.	2	16/500 v.	5 6
2 50 v.	2,3	8 500 v.	4 6	16 16/500 v.	6 -
4 50 v.	2	16 16 500 v.	2/-	20 450 v.	5 6
8 450 v.	2 3	6 -	32	32,350 v.	4 6
8 500 v.	2 9	CAN TYPES		32 32/350 v.	6 6
16 350 v.	3 6	1 dble	3d.	50 50/350 v.	7 -
16 450 v.	4 -	16 450 v.	3 6	64 + 120 275 v.	7 6
32 500 v.	5 6	32 500 v.	4 -	100 + 200 275 v.	
25 25 v.	1 9	64 350 v.	5 6		12 6
40 25 v.	1 9	500 12 v.	3 -	1,000 + 1,000 6 v.	
40 50 v.	2 -	8 + 16 450 v.	5 -		6 6

Screw Base Type 5/12, 8 mfd. 500 v., 3 - ; 16/500 v., 4 -.
SENTERCEL RECTIFIERS. E.H.T. TYPE FLYBACK VOLTAGES. K3/2 2 kV., 4 3 ; K3/40 3.2 kV., 6 - ; K3/45, 3 6 kV., 6 6 ; K3/50 4 kV., 7 3 ; K3/100 8 kV., 12 6 ; **MAINS TYPE,** RM1, 125 v., 60 mA., 5 - ; RM2, 100 v. A., 6 - ; RM3, 120 v. A., 8 - ; RM4, 250 v., 250 mA., 16 -.
PANEL LAMPS (Screw Fit), 6.3 v., A.C./D.C., 2 6.
COILS Wearite, "P" type, 3 - each. Denco Midget 4 - each. All ranges.
TELETRON, L. & Med. T.R.F., with reaction, 3 6.
FERRITE ROD AERIALS. M.W., 8 9 ; M. & L., 12 6.
T.R.F. COILS 7 - pr.
H.F. CHOKES, from 2 6. 14 M.H., 3/- each.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 1 sides, riveted corners and baffles fixing holes, 2½in. sides, 7 - doz., 4 6 ; 2 x 6in., 5 9 ; 11 x 7in., 6 9 ; 14 x 9in., 8 6 ; 14 x 11in., 10 6 ; 14 x 14in., 12 6 ; 18 x 16 x 3in., 16 6.

FULL WAVE SELENIUM RECTIFIERS. 2, 6 or 12 v., 1 amps., 8 9 ; 2 a., 11 3 ; 4 a., 17 6.
CHARGER TRANSFORMERS. Tapped input 200/250 v., for charging at 2, 6 or 12 v., 1½ amps., 13 6, 4 amps., 21 -.
VALVE MANUALS I & II, 5 - each part.
VALVE and TV TUBE characteristics books, 5 -.
ACID HYDROMETER. New Pre-Govt. Universal, Packed in metal case 7 x 1¼in. dia., 4 6.
WAVECHANGE SWITCHES.
5 p. 4-way 2 wafer, long spindle 6 6
2 p. 2-way, 3 p. 2-way, short spindle 2 6
2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle... 3 6
3 p. 4-way, 1 p. 12-way, long spindle 3 6
VALVEHOLDERS. Pax. Int. Oct. 4d., EF50, EA50, 6d. B12A, CRT. 1 3. Env. and Amer. 4, 5, 6, 7 and 9 pin, 1 -. **MOULDED Mazda and Int. Oct. 6d. B7G. B8A, B8G, B9A. 9d., B7G with can. 1 6.**
VCR97 2 6, B9A with can 2,6. CERAMIC, EF50, B7G, B9A, Int. Oct. 1 -. B7G with can 1'9.
BLACK CRACKLE PAINT, air drying, 3/- tin.

We have no connection with any other firm. Please address all Mail Orders correctly as below.

RADIO COMPONENT SPECIALISTS

307 WHITEHORSE RD., WEST CROYDON
OPEN ALL DAY—(Wed. 1 p.m.) *10 page list 3d.*

Tel. THO 1665, Buses 133 or 68 pass door. **48-hour postal Service.** *P. & P., 1/-. £2 orders post free. (Export Extra) C.O.D. Service 1 6*

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OSMOR VARIABLE Band I ATTENUATOR

Balances reception of ITA and BBC in all areas and avoids constant adjustment of controls. The Osmor is the only variable attenuator that will reduce the signal exactly to the required level. Easily Fitted—just plug in. Reduction ratios variable 2-1 to 10-1. An Essential with all types of Band III Converters. 10/-, plus 9d. p. & p. From your Dealer—or direct.

BAND I FILTER

Rejects BBC from ITA aerial and improves picture. Suitable for all makes. Fitted in 2 minutes. 10/-, plus 6d. p. & p. including instructions.

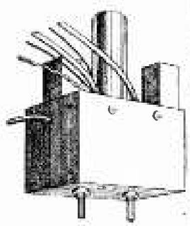
ITA CONVERTERS

LONDON · LICHFIELD · MANCHESTER

A very efficient Band III Converter for all TV sets of any age (including TRF). Approximately one hour to build! Guaranteed no breakthrough of Band I. Will convert any Band III Channel to any Band I Channel. Station switching. A.C. or A.C./D.C. Size 4¾in. x 2¼in. x 3in. Circuits, Wiring Diagrams and full constructional information, ready to fit *inside* your TV cabinet.

Complete Kit 65/- **Completely wired 80/-**

Both plus 2/- post and packing.



FREE We keep right up to date in building the latest circuits published in "Practical Wireless," "Wireless World" and "Radio Constructor" and we stock the components specified. Send 7½d. in stamps or circuits, fully descriptive literature together with coil and coilpack leaflets, component lists, chassis drawings and templates.

ITA Band III CONVERTER KIT

Complete with all components, *including* power unit, for construction of an efficient Band III converter. Nothing else to buy. Circuit, wiring diagram, chassis templates and complete instructions, **£6.19.0.**

Plus 2/6 p. & p.

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Dept. PT5.

TRANSISTOR PUSH-PULL AUDIO AMPLIFIER
(100 Milliwatts Output)
Build this Push-Pull Amplifier which is ideal for Crystal or Magnetic Pick-up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6-volt Dry Battery lasting for months.
Complete Kit of Parts including 4 Transistors and all Components with Circuit (less speaker), £4.10.0

TRANSISTOR SQUARE WAVE GENERATOR
Ideal for signal tracing. **Complete Kit with 2 Transistors and Components and Circuit. 25/-.**

TRANSISTOR SIGNAL TRACER
Complete Kit with 2 Transistors, Components and 'Phones with Circuit. 42/6.

CATHODE RAY TUBES
VCR138A £1.15.0.
VCR139A. 2½in. **£1.15.0**
VCR97. Guaranteed full T.V. picture (carr. 2/-) **£2.0.0.**
VCR517C. Guaranteed full T.V. picture. **£1.15.0.**
MU-METAL SCREENS for VCR97 or 517. **10/-.**
6in. ENLARGER for VCR97 or 517. P.P. 1/6. **17/6.**

TRANSISTORS

JUNCTION TYPE (Red-Spot) (P.N.P.)
OFFERED AT LESS THAN HALF-PRICE.

Designed for A.F. application up to 800 Kc/s and are suitable for use in amplifiers, Signal Tracers, Local Station Receivers, Radio Control, Oscillators, Transistor Voltmeters, Baby Alarms, Microphone Pre-Amplifiers, etc.

10/- EACH

(Tested and complete with Data & Circuits)

N.B. These Transistors may be used in place of Mullard OC71 or similar Transistors.

R.F. TRANSISTORS (BLUE SPOT) 1.6 Mc/s 15/- each.

PRE-SELECTED TRANSISTOR-SIX PUSH-PULL PORTABLE SUPERHET
Just switch to your favourite Station. No tuning, no aerial or earth. Pre-select 3 stations. Complete with all components and six Transistors. 7 x 4 Elliptical speaker. Teletron Superhet Coils and I.F.T.'s. Powered by 7½ v. dry battery which lasts for months. 150 Milliwatts output. All the above with Circuits, etc. Ready to assemble. **£9.0.0.**

Or with Matched Mullard OC72's (200 Milliwatts Output) and 7 x 4 Elliptical High Resistance Speaker **30/-** extra.

Suitable Plastic Cabinet. Easy to assemble **18/6.**

Call and hear demonstration model working.

Please note that these Red Spot Transistors are ideal for most circuits including "W.W." Pocket Transistor Receiver and Transistor Amplifier. All Transistors are British Manufactured and Guaranteed. Send for Circuits and Data.

INDICATOR UNIT TYPE 182A
Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-Metal screen 3-EF50, 4-SP61 and 1-5U4G Offered BRAND NEW (less relay) at **67/6.** Plus 7/6 carr. "Radio-Constructor" scope circuit included.

62A INDICATOR UNIT
Containing VCR97 with Mu-Metal Screen. 21 Valve 12-EF50, 4-SP61, 3-EA50 2-EB34. Plus Pots., Switches, H.V. Cond., Resistors, Muirhead S M Dial. Double Deck Chassis and Crystal. BRAND NEW ORIGINAL CASE, **67/6.** Carr. free.

1355 RECEIVER
Complete with 11 valves 8-SP61, 5U4G, VU120, VR92. As specified for inexpensive T.V.
In absolute new condition, **27/6,** carr. 5/-
R.F.24 **10/-.** R.F.25 **12/6.** R.F.26 **25/-.** Brand new with valves, carr. 2/6.

MINIATURE I.F. STRIP TYPE "373" 9-72 MEG.
Brand new miniature I.F. Strip size 10½in. x 2½in. x 3in. high. Valve line-up: 2-EF92; 3-EF91 and EB91. With circuit.
With valves **45/-** (less valves **8/-**. Post free.)

HENRY'S (RADIO LTD.)

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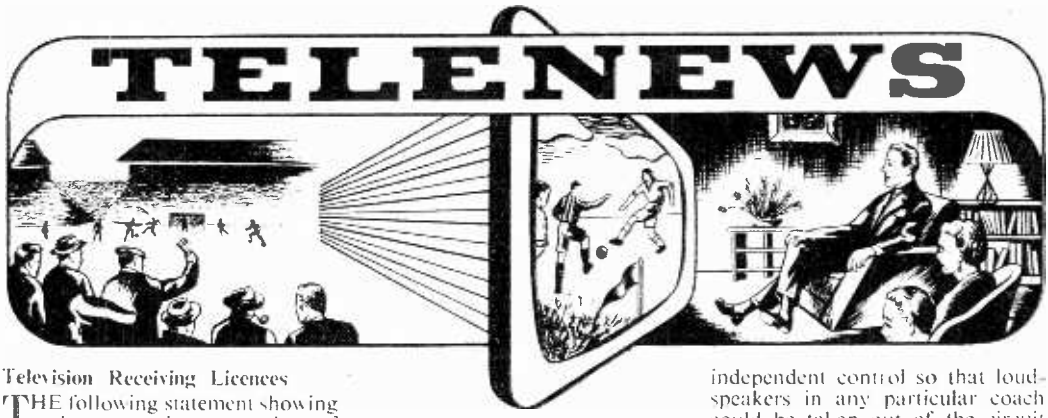


Television Receiving Licences

THE following statement showing the approximate number of Television Receiving Licences in force at the end of September, 1956, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Television*
London Postal	1,354,227
Home Counties	706,867
Midland	1,054,142
North Eastern	939,728
North Western	880,377
South Western	424,715
Wales and Border Counties ...	341,293
Total England and Wales ...	5,701,349
Scotland	389,605
Northern Ireland	48,819
Grand Total	6,139,773

I.T.A. Scottish Station

WORK has started on the construction of the transmitter building at the new I.T.A. Station at Blackhill, Lanarkshire. The foundations for the mast are now nearing completion, and it is hoped to start work on the construction of the mast itself by the time this issue appears.

All the building work at the station will be carried out by John Wight and Company Ltd., Contractors, Grangemouth, and the architects will be F. R. Collister and associates.

The transmission equipment, mast and aerial array will be supplied by Marconi's Wireless Telegraph Co. Ltd., and the whole project has been planned and will be supervised by the engineers of the Independent Television Authority.

Television on Excursion Trains to Oban

FOR the first time on British Railways closed-circuit television was used to screen a variety show to passengers when two special trains, arranged by the *Evening Citizen* newspaper, Glasgow, with the Scottish Region, set out from Glasgow Queen Street Station for Oban on September 24th.

The van space of a second-class brake coach was adapted for use as a studio which accommodated television cameras and lighting. The windows and walls of the brake van were suitably draped to obscure daylight. Music was relayed from this extempore studio by means of a tape recorder. The artistes taking part in this programme occupied the three compartments of the second-class brake vehicle.

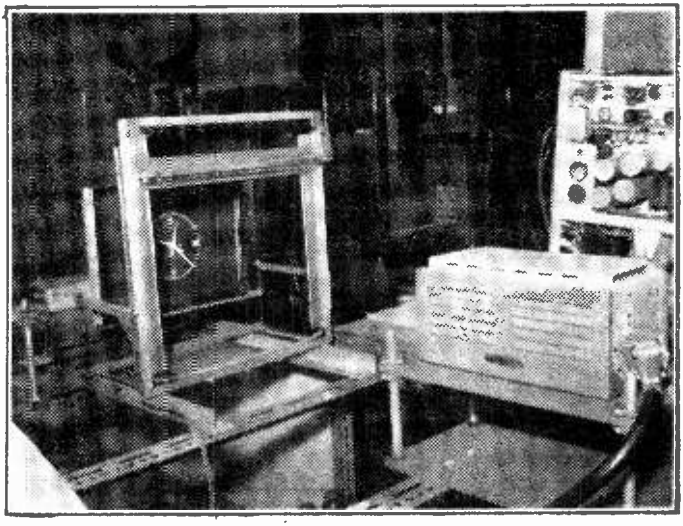
Messrs. Pye Scottish Telecommunications Limited provided TV screens which were erected above the doors at either end of each coach on the train. Each coach was also fitted with loudspeakers with independent control so that loudspeakers in any particular coach could be taken out of the circuit when the artistes were performing in that particular coach.

Within three days of publishing details of this unique tour, 650 tickets representing the complete accommodation on two trains were sold out. The demand was almost as great again.

TV Sales Up

THE monthly retail survey issued by the British Radio Equipment Manufacturers' Association shows that television retail sales during July were 79,000 compared with 61,000 for June this year and for July last year, an increase of 30 per cent. in each case.

Television sales for the seven months January to July, 1956, amounted to 492,000, 9 per cent. less than the corresponding period of 1955.



The set-up for the I.T.A. interval time-signal.

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Hire purchase and credit sales of radio and television in July represented 36 per cent. and 51 per cent. respectively of total sales—in each case 2 per cent. higher than in June. In July of last year the proportions were 41 per cent. for radio and 61 per cent. for television.

A Microwave aerial of the type used in relaying O.B. events. This is an A.-TV unit.

The proportion of radiograms sold by this method has remained constant at 58 per cent. since last May. They were 67 per cent. in July, 1955.

"Colour" TV

AN interesting experiment was carried out by the I.T.A. on Saturday, September 8th. An advertisement was executed in a series of diagonal lines which were so arranged that a flicker occurred, and it was claimed that certain viewers would see the lines in pastel shades of colour. During the transmission viewers reported different effects, the writer seeing quite clearly shades of blue and brown, and reports from the various viewers have not been tabulated at the time of going to press. Readers will remember that we printed a letter from a viewer in our Dec. 1955 issue in which reports of colour were made in a programme carrying flashing matter.

I.T.A. Viewing Figures

SINCE the I.T.A. announcement made recently that a landslide towards I.T.V. programmes was in progress, viewing figures have become available for the week ended September 16th.

These show a preference among those able to choose of over 3 : 1 in favour of I.T.V. programmes. (On release, the latest figures then available, which covered the three weeks ended September 9th, showed a preference approaching 3 : 1.)

In the London region for the week ended September 16th, 77 per cent. of the viewing time was devoted to I.T.V. and 23 per cent. to the BBC by those able to choose their programmes. There was an even higher percentage in favour of I.T.V. in the North, and a slightly smaller percentage in the Midlands.

Emley Moor

THE Emley Moor station of the Independent Television Authority started broadcasting programmes on Saturday, November 3rd. The programmes will be provided on weekdays by Granada TV Network Ltd., and at weekends by Associated British Cinemas (Television) Ltd. Emley Moor will be the fourth transmitting station to be brought into operation by the Authority. It will serve about five million people living in Yorkshire, Lincolnshire, Nottinghamshire and Derbyshire.

The opening of the Scottish and South Wales and West stations next year will together bring in between six and seven million more people. Detailed coverage figures are :

Station	*Opening date*	*Coverage (millions)*
Croydon	22nd Sept. 1955	11.44
Lichfield	17th Feb., 1956	6.07
Winter Hill	3rd May, 1956	7.21
Emley Moor	3rd Nov., 1956	4.93
Scotland	Aug., 1957	3.70
Wales	Late 1957	2.72
	Total	36.07

Ekcovision in Daimler Cars

TELEVISION is now available in the chauffeur-driven limousines operated by Daimler Hire Ltd. This additional luxury is provided by the Ekco portable TV/V.H.F. radio—claimed to be the only receiver of its type in the world.

Due to the screening of the limousine's metal body and the fact that the internal dimensions of the car do not allow full extension of the receiver's own built-in aerial, a small aerial, in keeping with the styling of the car, has been mounted externally. The Ekco portable TV is for operation on A.C. mains or a 12-volt car battery, but it is, of course, in this case worked off the Daimler's own battery.

The receiver is mounted in the limousine's rear compartment and can only be seen and operated by the passengers.

Bought All Your Christmas Presents Yet?

No? Then here's an idea. Why not send your friends who are TV enthusiasts a gift you'd be delighted to receive yourself—a year's subscription for PRACTICAL TELEVISION. For twelve whole months your gift will bring them repeated pleasure, and each new issue will be a renewed reminder of your good wishes.

But the days are flying—you must order now to ensure that first copies arrive before Christmas. Simply send your friends' names and addresses with your own and remittance to cover (an annual subscription for PRACTICAL TELEVISION—12 issues, including postage—costs 17s. 6d.) to Subscription Manager (G.2), George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. An attractive Christmas Greetings Card, made out in your name, will be sent to announce your gift.

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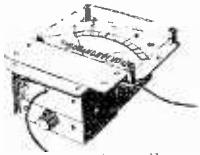
12in. TV. CABINET—15/-

We are offering these at not much more than the cost of the plywood they contain. If not wanted for T.V., many useful items can be made—record storage cabinet, H.F. loudspeaker case, book case, etc., etc.

Price 15/-. Carriage 3/6.

HIGH VOLTAGE TESTER



An instrument that will measure voltages up to 10,000 but which draws no current from the source, will probably be a valuable addition to your workshop equipment. It can be made entirely from odds and ends. Booklet giving full instructions, plans, etc., 2/6 post free.

BAND III PRE-AMP

In difficult areas it will be necessary to increase the signal level and this is the ideal unit for this purpose. It is A.C. mains operated and is fitted with input and output coax. plugs. Price £4, post and packing 3/6.

MULTI-METER KIT

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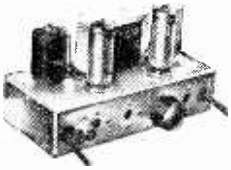

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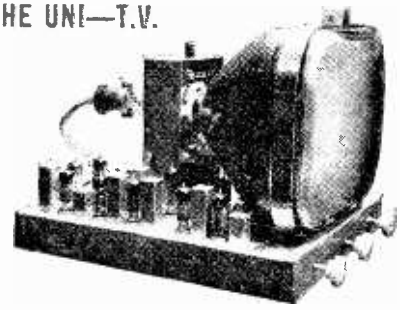

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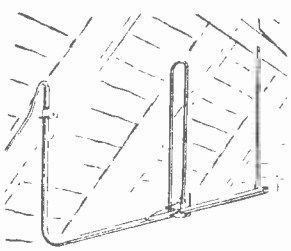

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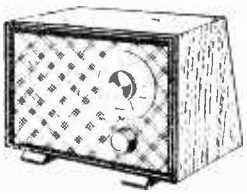

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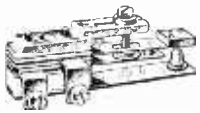

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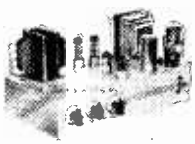

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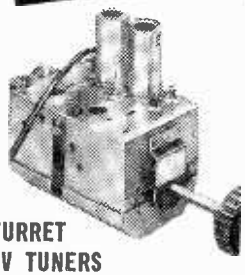

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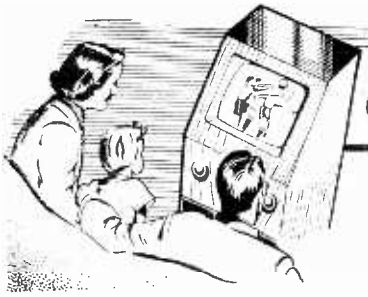


UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

THE CRAZY GANG

I HAVE often mentioned the Crazy Gang in these columns, for I have been a devoted fan of theirs at the Victoria Palace and elsewhere for years. But I must admit that some of their latest escapades on television have been remarkably unfunny, due partly to the well-worn and familiar gags and situations, but also to the uninspired technical presentation. For instance, Bud Flanagan, that king of clowns, was shown as a horse-bus cabby in extreme longshot, a tiny figure in the corner of the screen, singing a mournful number. Played entirely in carefully lit close-shots it might have scored. The familiar burlesque melodrama, with Teddy Knox as the hero and Bud as villain, also failed to click. Nervo and Gould, barracking from the theatre box, were starved of anything bright to say. These inspired comics should be given something to get inspired about, in the age of goon comedy. On the other hand, the indescribable scriptwork of Spike Milligan in the "Fred" series seems to get funnier and funnier. *Son of Fred* has escaped again and that remarkable team of Peter Sellers, Kenneth Connor, Valentine Dyall, Patti Lewis and Graham Stark are being directed once more by Dick Lester, who handles his cameras as brilliantly as he does his actors.

MARKOVA

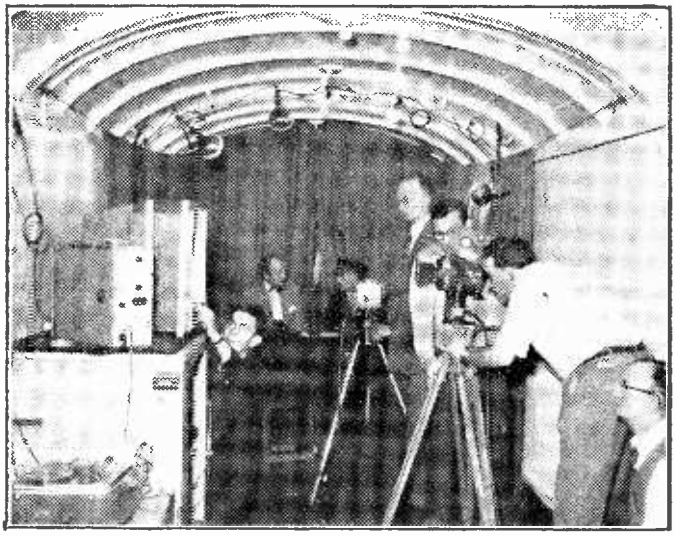
BALLET does not figure very high in the viewing audience measurement rating. Perhaps that is why we so rarely see ballet on its own; it is usually part and parcel of a revue or some other feature. The BBC's *Music at Ten* was a good vehicle in which ballet was introduced in a most delightful manner, with Alicia Markova as guest artiste. Her choice of *The Dying Swan* brought back memories for older viewers of the great Pavlova. Chris Simpson handled his cameras with skill and understanding. It was a beautiful performance on the part of Miss Markova, who, in long shot, was not unlike Pavlova in appearance. The appeal of ballet may be somewhat limited at the moment, but if and when colour television arrives it will become highly important. Ballet is a composite art. The components which make up ballet are the dancing, the music, the decor, the costumes—and the colour. And colour is by no means the least important.

FIRST YEAR OF I.T.A.

THE end of the first twelve months of operation of commercial television is a good moment to survey what has been accomplished, and the gains and losses that have been registered during this testing period. In the gains column I would put: the extraordinary increase of viewers (in spite of credit-squeeze legislation); the added interest of alternative programmes: the rapid improvement of both I.T.V. and BBC programmes and their technical handling and, finally, the new TV stars that have been created. The spur of competition, of course, has been the principal factor—competition in which the lighter and more escapist flavour of I.T.V. programmes has steadily won viewers from the BBC. To the loss column I would put: the equally steady but not unexpected drop in the "non-mass appeal" items on I.T.V. since its commencement; the failure of some I.T.A. contractors to reach the high advertising revenues expected—with consequent reduction of commercial TV facilities and personnel.

THE LATE GRANVILLE

IT is sad to think that, after only one year's operation, certain excellent facilities are already being abandoned. Take, for instance,



The scene in the television van on the Glasgow to Oban train where coaches have been wired for TV and passengers were able to see top-line variety shows.

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Associated Rediffusion's Granville Television Theatre, Walham Green, which I visited only a few days before it was closed down. Here was a fine little 770-seater music hall, convenient to the West End, very well equipped though somewhat shabby, which had had a lot of money spent upon it in the cause of good TV facilities. It had been redecorated, and auditorium seats which had done duty for forty years had been replaced with modern fauteuils. Stage fitments and lighting had been brought right up-to-date; TV cameras, camera runways, control rooms and even telefilm equipment had been installed, coaxial links with Television House and elsewhere had been laid. It seems a pity that such excellent, almost self-contained, facilities might be lost to British television. At the time of my visit great gloom prevailed amongst the staff, many of whom had been associated with the premises as a theatre or music-hall long before television moved in. Nobody seemed to know whether the place was to be stripped and the building sold. Let us hope that it is "mothballed," and that one or more of the provincial TV contractors will use it as a London branch. Of course, there are sound reasons for AR-TV concentrating their activities at Wembley. There are plenty of facilities there, with ample space for extensions, almost literally under the same roof. Only the BBC, with its enormous income, can carry the burden of decentralisation on a grand scale. Some of the potential provincial contractors in areas not yet finalised are contemplating operations on a very cautious scale: facilities on the lines of the original BBC studios at the Alexandra Palace and a programme with the minimum of local live studio transmissions. ITV network programmes will be retailed, plus British and American TV films.

"THEATRE"

SOMERSET MAUGHAM'S books are "naturals" as material for stage plays, films or TV. Elspeth Cochrane's TV adaptation of Maugham's novel, *Theatre*, was an admirable dramatisation, nicely balanced to display the rich subtleties of his character drawing. Peter Potter, who directed this BBC-TV play, made much use of the close-up to stress dramatic points and enable his actors to reveal their feelings in their eyes—which is much more effective than the broader movements necessary when scenes are played in long-shot. June Havoc was an ideal choice for the part of the not-so-young actress, and others in the excellent cast included John McCallum, Bryan Forbes, Nora Nicholson and Joan Sims.

MONOCHROME COLOUR EQUIVALENTS

I DON'T often leave my set switched on to the very end of television when watching either the BBC or I.T.A. But I have noticed certain peculiarities about the Union Jack which flutters at the end of the I.T.A. transmissions. This is a very anæmic national flag in which the red has become a pale grey and the blue a very dark grey, almost black. The flag has, of course, been filmed. The distorted colour rendering is probably due to over-correction by a deep yellow or reddish filter on the camera lens. The prime use of such filters is to increase the contrast of cloud effects on exterior scenes, and most amateur photographers are familiar with them in the form of special glass filters, graduated from clear at the bottom to a deep yellow at the top. Used for facial close-ups orange or reddish filters will very considerably lighten the shade of the deep red lip make-up favoured by the ladies and green filters turn their lips black. The I.T.A.'s Union Jack has suffered a similar fate and requires reshooting, probably with no filter at all. The red on the flag should reproduce only slightly lighter than the blue.

Years ago I suggested in this column that BBC television should end the programmes with the National Anthem, like their sound services did. Within a very few days the BBC repaired the omission. Perhaps the I.T.A. might also react and give us a full-blooded, properly graded national flag.

"DANGLEBERRIES," ETC.

THE Society of Motion Picture and Television Engineers of America recently circulated questionnaires to 341 TV stations in 25 states in the U.S.A., requesting information on studio space, lighting facilities, lamps used, ancillary equipment and the allocation of operating personnel. There were valid answers from 134 TV stations, which revealed that an extraordinary variety of lamps are in use in American studios. There are incandescent spots and follow spots to give the hard specular type of lighting that gives character and modelling to the faces, and scoops and broads, with diffusers to soften the shadows and act as filler light. Other gadgets which fit on the lamps to control the beams in different ways rejoice under such highly descriptive names as snoots, barndoors, niggers, gobos, dangleberries and flags. In case you are curious, "dangleberries" are strips of materials which are suspended in front of lamps and shaken slightly to give the effect of the flickering light of a camp fire on the faces of the actors. Arcs are not used, though experiments are being made with the Xenon gas arc. The main source of light comes from tungsten bulbs, which are used in different types of fittings, together with fluorescent tubes.

FLUORESCENT LIGHTING FOR TV STUDIOS

FORTY per cent. of the stations stated that they used fluorescent and incandescent lighting mixed, though "inkies" formed the main basis of the lighting. None used fluorescents exclusively. One of the troubles experienced with using fluorescent lamps in England either for TV or filming is the tendency to flicker, due to strobing effects with the camera. This can be avoided by using tubes of a type with a phosphor of longer decay time. Carefully and sparingly used, fluorescent lamps, mounted in banks, can be a most useful soft filler light, softening harsh shadows, ironing-out wrinkles and helping the lighting man to make the actors better looking.

"THE SAINT OF BLEECKER STREET"

RUDOLF CARTIER, of *1984* fame, is earning himself a place amongst the best TV producers of serious drama. *The Saint of Bleecker Street* was the first performance in England of the music-drama which had a successful run in New York. This was a certain challenge for the TV medium, crowding its story with dozens of characters. Virginia Copeland, Raymond Nilsson and Jesse Walters distinguished themselves in this fine effort, which, I feel, appealed to the few rather than to the many.

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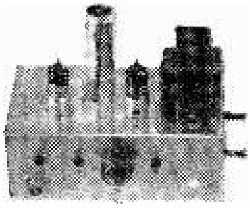

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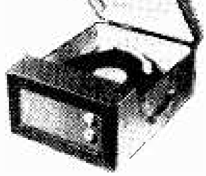

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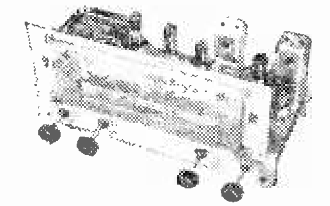

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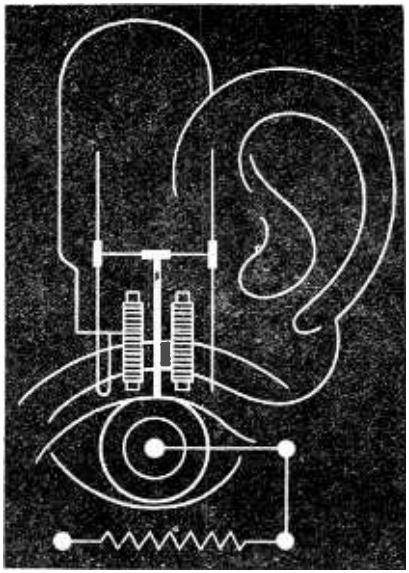

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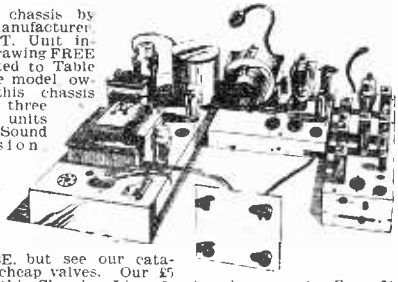

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CORRESPONDENCE

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

A CONTROL TIP

SIR,—I am sure that the following tip will be very useful to many readers.

The measurement of spindles for replacement v/controls, etc., is always found an awkward and tricky job. An easy way out for the service man, who always has his solder handy is—take the solder and place alongside the old control spindle and bend off to the appropriate length. Then all that remains to be done is to place the bent length of solder against the new control spindle and mark it off.—D. BARKAS (E.11).

CONVERTER PROBLEM

SIR,—In reply to Mr. Turnbull's letter on the subject of switched converters (Nov. issue), he will appreciate that the commercial method of using a turret switch with a floating trimmer is a simple answer from a manufacturing point of view in that no matter how the design is prepared there will inevitably be some oscillator drift with warming up. With the commercial arrangement it is quite impossible to arrange a circuit such that the turning of the turret switch alone will effect a change that gives the proper bandwidth on the test card, although the better ones do arrange that the contrast is suitably pre-set. In the arrangement that I described in this journal some months ago on this, a fairly successful answer has been obtained and the result is a switched receiver. This is merely achieved by the simple solution of having two pre-tuned converters always in circuit with the H.T. switched from one to the other.

Even here the problem of oscillator drift must still be tackled and it is desirable to adjust the trimmers after the set has warmed up, and such adjustments must be carried out with the converters in the cabinet so that the nearest approach to operating temperatures exists. The direction in which the oscillation drifts, of course, depends on which side of the incoming frequency the oscillator works. In my case the oscillator drifts away from the sound on the BBC and towards the sound on I.T.A. Thus when switching on from cold if the converter has previously been lined up warm to give at least 2½ mc/s. band there will be a tendency to sound break through whilst warming up on BBC and loss of detail on I.T.A. As a matter of interest on the original model as described in this journal I used two separate ready-made chassis, but I have now made an improved model of this on a specially made chassis and have arranged two very small capacity floating trimmers standing out at the back of the cabinet so that if conditions change by way of valves ageing and so on, the necessary very fine trimming can be carried out during a test card transmission. It is possible to arrange matters so that the troubles of warming up are not noticed but this involves an incomplete bandwidth at normal temperatures, and it is better at intervals to check the fine trimmer to maintain a high standard of picture.—GEO. T. LAYTON (Manchester).

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.

EHT ARCING

SIR,—I feel I can help J. H. to cure EHT arcing on low brilliance or contrast settings on his TV.

This fault is due to the "polythene" insulation on the EY51 heater winding cracking, and arcing to the overwind.

Complete replacement of this winding should be made with "solid cored coax cable inner," using same number of turns as before. The PZ30 sparks over due to the EHT condenser not being returned to earth, but to the boosted H.T. point.—J. S. LUNN (Swinton).

USING A 'SCOPE

SIR,—I have been a subscriber to PRACTICAL TELEVISION since January, 1954, and wish to endorse the remarks made by G. F. Raistrick (Manchester) in Nov. issue, re the use of the 'scope and am looking forward to an article on these lines.—TERENCE J. CALLAGHAN (Southwick).

STRANGE SIGNAL PICK-UP

SIR,—I was interested in Mr. J. K. Sims (Barnet) letter in November issue of PRACTICAL TELEVISION, as a friend of mine has had similar experiences. We have discovered that the brief snatches of conversation which we could hear distinctly came from aircraft coming in to land at an R.A.F. airfield about three miles away. We were able to observe the aircraft and noted that the signals were only picked up while the aircraft was in line with receiver aerial and BBC transmitter.—J. R. ADAMS (nr. Peterboro).

SERVICING PROBLEMS

SIR,—I recently wrote asking if you could help me to trace a slight fault in my set. I had had this three years and had never been what you might call really satisfied with the results. You suggested that a certain chain of resistors should be examined and after much trouble I managed to remove the set from its cabinet and locate the resistors in question. Three of them were charred black and altogether there were five condensers connected at various parts of this chain. I replaced all the resistors and checked the condensers to find that three were leaky. I replaced these, too. On switching on again before the set was placed back in the cabinet I was astounded as the set warmed up to hear the improvement in quality of sound, and when full temperature was reached the picture was crisp and detailed beyond anything we had had before. I am more than delighted with the results and my only worry is whether anything is now being overrun and that something will break down. It almost seems too good to be true. Many thanks again.—G. R. Issly (N.W.5).

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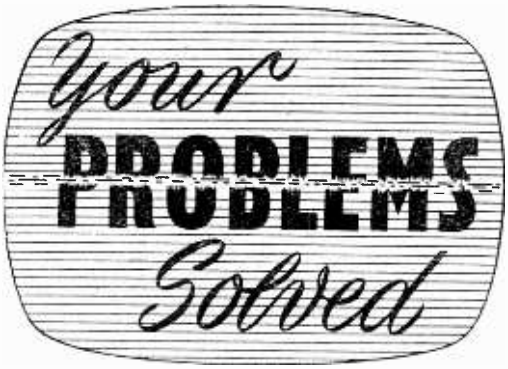

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 247 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

PYE FV1

When I switch my set on the picture comes in broken up, giving you the impression that the line hold is not correctly adjusted, which, to my knowledge, it is, as it is turned back (anti-clockwise) as far as it will go. It has taken as long as an hour to get the picture to settle.

When the picture has finally settled there is a gap of ½in. either side of the picture. I have tried to adjust this, but to no avail.—L. W. P. (Redhill).

We would suggest you first replace the EF80 line oscillator which is mounted behind the left side line output screening box, etc., i.e., in the left-front corner.

If the symptoms remain suspect the H.T. metal rectifier of losing efficiency.

FERGUSON 992T

The trouble is in the frame output/multivibrator circuitry. It is impossible to lock the picture with picture height normal—an uncontrollable shudder develops and vertical lock cannot correct this.

However, if the picture height is adjusted to give an elongated picture (tall thin men, etc.), then the vertical lock can be adjusted to control the picture. Although the picture can be locked satisfactorily by this method obviously the distorted vision is undesirable. I have a set diagram and I suspect some component(s) in this part of the set to be defective.—W. V. S. (S.W.).

In nearly all cases which we have met of this trouble (frame judder) the ECL80 to the left of the tube has been responsible. This is the second ECL80, more in the centre of the chassis.

BUSH TV53

A small projecting brass lever effects sideways and up and down picture control.

However, the picture is slightly askew. I should be obliged if you would inform me where the adjustment is to "lift up" one corner only and put the picture straight. It is more noticeable when printed titles appear.—C. Bessant (Wakefield).

To square the picture in the mask the deflector coils on the neck of the tube should be rotated until the edges of the picture are parallel to the sides of the mask. The adjustment cannot be made until the knurled screw, situated on the underside of the coil assembly, is released. The complete deflector coil assembly should be rotated.

G.E.C. BT7094

I recently purchased a G.E.C. television and all-wave radio console BT7094. It seems to be O.K. except for focusing.

On removing the chassis from the cabinet I found the original control had been replaced by a parallel sliding resistance, which had burnt out. Its value was 15,000 ohms.

I replaced this with a 10,000 one-watt variable resistance, which at one end caused the picture to go very small, and at the other the picture filled the screen, but still did not resolve lines.

The resistance burnt out about one minute after the set warmed up, so could you tell me the correct resistance and wattage this control should have and the correct connections?—P. Ramsey (Sutton).

The focus control should be 10,000 ohms, and a two-watt rating is desirable. This control is connected in series with two parallel connected 3,300 ohm and the combination is shunted across the focus coil. Open-circuit focus coil would probably cause the symptoms described.

VIEWMASTER

I would be pleased if you will give the possible cause of the following fault in my Viewmaster.

Flat grey picture which can be made to jump back to normal contrast by a sharp tap on any part of the chassis. —H. M. Milestone (Hull).

It is quite impossible to tell you with any certainty as to where the fault in your receiver should be, since the effect that you describe may be caused by various components or wiring being at fault and varying the gain of the vision receiver and thereby the contrast of the picture. We suggest, therefore, that you very carefully check the wiring of the vision receiver, gently tapping this in various parts in case a fault should be present there. At the same time we would suggest checking that the bias voltage on V5 which is developed across R70 and C55 is satisfactory and does not vary when you tap it, since this, too, might give the picture an appearance of flatness due to a reduction in overall contrast.

BUSH TV24C

I have recently had some trouble entailing replacement of EY51 EHT rectifier and a condenser, and when the set was returned from the dealer another fault developed. It is in the shape of a vertical, jittering white line about 3in. from the left-hand side of the tube face.

It is only visible when the set is switched to Band III. The dealer said it was reflection, but I have moved the aerial, and it is also visible when the aerial is not connected.—P. Brain (Burton-on-Trent).

This is either caused by a flashover in the line-output transformer or associated inductors during the line flyback or as the result of spurious oscillation in the line output valve (PL81). It is probably the latter, since it would seem that the spurious signal has a relationship to the I.T.A. frequency. Hold a small magnet near the envelope of the PL81, and if the effect on the screen is modified by this action, then replacing the valve will almost certainly solve the problem.

(Continued on page 243)

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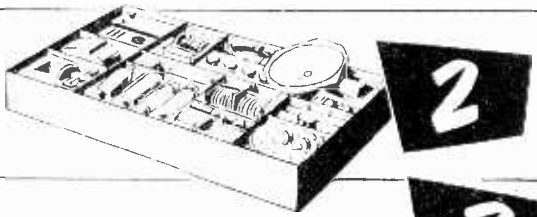

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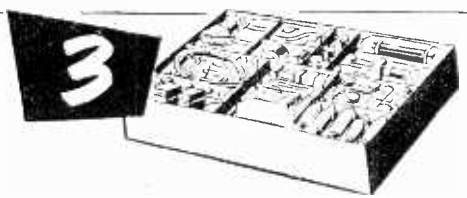

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MURPHY V200

I have a Murphy V200 television and can get no picture raster or even a spot. I have tried a new EY51, and although the line "whistle" is there and there appears to be plenty of spark at the anode of the V10 there is no glow from the filament of the EY51.

Going back on the circuit a little, the anode of V9a is a little high in volts and V9B is low (drops as valve warms up and starts working).

The transformer T1 (reaction coupling) appears in order as to D.C. resistance, as do also the windings of T2, although winding C (the line coil winding) appears to "tick" on application of and breaking of the ohmmeter connections.

There is practically no spark from the tube H.T. connection. Finally, with the EY51 removed the set connected with the filament connections shows only 2 volts, and my own diagnosis of this is that there are shorted turns in the filament winding; in other words, the line output transformer is gone.—L. F. Francis (E.12).

Your remarks are indicative of a defective line output transformer. Shorted turns on the heater winding is a possibility, but the expected 6.3 volts are not generally registered on an ordinary A.C. voltmeter owing to the deviation of form-factor of the pulse potential with respect to that used during calibration of the instrument.

MURPHY V150

My set is a Murphy V150 (A.C.) 12in. screen, which I purchased second-hand about six months ago. The trouble is I cannot seem to get a bright and snappy picture; I have lined up the I.F.s and the R.F. circuits according to the maker's service sheet, which I have in my possession; also I have fitted a transformer to the tube which gives a boost of 25 per cent. without making the slightest difference. (I mean on the heater winding.)

It does not seem to be lack of signal strength as the BBC comes in here with terrific punch although the E.T.A. is considerably weaker, and as a further clue I seem to get bad defocusing on whites; at the slightest excuse, such as an increase in signal strength, the white parts of the picture will go right out of focus. This led me to think of poor EHT regulation, but I have checked the EHT capacitor (C31) and replaced the EHT rectifier (V9) with a new one without any difference at all. I have fitted a new video valve (V6) and changed around the valves in the D.C. restorer and sync. positions, all to no purpose.

The only conclusion I have now come to is that the tube is so far gone that even the boost on the heater cannot give enough response, but I am at a loss to know how to tell if this is so.— R. Saward (S.W.9).

This seems very much like tube trouble, but is almost impossible to prove conclusively without making a substitution test. The effect is generally due to low vacuum, which gives rise to excessive EHT current and overloads the EHT circuit.

AERIAL MATCHING

I have built a 10-element folded dipole from information supplied in an earlier number of "Practical Television," and I am very well pleased with the results I have had. I am receiving Channel 9 Band III from Manchester, a distance of 150 miles from Belfast. I should like to build another such aerial and use it in a broadside arrangement, as I am told this will give me increased gain. I believe the aerials have to be connected in a certain way. Can you please tell me how to do this? The spacing of the aerials and the matching are my difficulty.—Sydney McClure (Belfast).

The arrays should be connected to a common low-loss feeder by *equal* lengths of identical feeder. They should be spaced by half-wavelength, which on Channel 9 is 20.2in. It is generally unnecessary to employ a complex matching section, which, unless very accurately designed, may detract from the signal instead of adding to it.

CONVERTER DIFFICULTY

I have constructed the Band III converter described in the October, 1955, issue of "Practical Television," with a separate power pack for H.T. and L.T. supply, but as yet have not been able to receive any signal—sound or vision—using a standard nine-element array.

Could you please tell me of any salient points to check and answer the following queries:

(a) I have deviated in only one way from your directions, by using enamelled copper wire in place of tinned. Would this have an adverse effect?

(b) I am using the converter on a model B18T Pye which uses twin-balanced feeder on the BBC aerial.

I am using coaxial cable for the Band III aerial. Is this in order?

(c) Is it important which is the uppermost coil of L7 and L8 on the former, and which would be the physical earthy end of L7?

Other than these points I have checked the circuit several times and feel satisfied it is correct and the valves being new I fail to see why I can get no results. —R. G. Dear (Woodley).

The biggest difficulty in the construction and adjustment of any kind of Band III converter lies in the tuned circuits. At Band III frequencies any slight deviation from the stipulated design, particularly of the coils, might well prevent the circuits from tuning to the correct frequencies, even though the remainder of the circuit may be operating properly. In this case, of course, simple voltage and current checks would not reveal the trouble. An accurate signal generator would soon show the trouble, but few experimenters possess such an instrument which covers Band III. We would suggest, therefore, that you rewind the coils according to the article and ensure that the small capacitors associated with the *oscillator* circuit are of correct value.

SOBELL T90

I have a Sobell T90 which although I have changed the tube, substituted new U24, T41s (two) and retrimmed according to the service sheet all I get is a faint picture and low volume sound. The picture is clear in a dark room, and the sound is not distorted, but to get it the volume is turned right up, also the brightness. I've also tried a new oscillation coil, but to no avail.- H. W. Weldrich (St. Albans).

We would suggest that you have the left side valves tested before proceeding farther, and almost certainly you will find at least one is low.

If all valves are in order it will be necessary to check the individual anode and screen voltages at each valve base. The fact that a new tube has been installed and the brilliance control is still well advanced in order to produce a raster seems to indicate a low video amplifier valve (or associated 6D2 double diode). These points should be checked and we will then advise further.

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AERIAL FOR EMLEY MOOR

Please could you give me details for making an aerial for receiving the I.T.V. station which opened on October 3rd near Huddersfield, also what is the transmitting wavelength or frequencies of this station? —S. Gardener (Cossett).

The Emley Moor station operates in Channel 10 with a vision frequency of 199.75 Mc/s and a sound frequency of 196.25 Mc/s.

A dipole tuned to the mean of these frequencies has an overall length of 28½in. The reflector should have a length approximately 5 per cent. in excess of the dipole, and the directors should diminish in length in relation to the dipole at a rate of approximately 5 per cent. Quarter-wave spacing can be used between the elements, which on Channel 10 is 9.38in. For methods of construction refer to past issues of "Practical Television."

ULTRA V600

The tube having failed in my Ultra V600, I am considering replacing the Mazda CRM121 with a Brimar C12D. Operating voltages appear to be similar, but can you tell me whether the flat face of the C12D will introduce pin-cushion distortion or other trouble? Alternatively, can you suggest any other modern tube to use? Two-, 4- or 6-volt heater.—N. McAdam (Newcastle-on-Tyne).

Where possible, we always recommend the use of the correct replacement tube as stipulated by the manufacturer. Nevertheless, the Brimar C12D can be used as a direct replacement in your model in spite of the slightly larger heater current and flat face. Very slight distortion may occur round the edges of the picture.

BAIRD P.167

Can you please advise on the following faults: (1) I can get the screen to light up with full white raster, which has white horizontal lines the full width of the screen, but no picture detail; the sound is perfect.

(2) The EHT takes from two to five minutes to reach its peak and when it does so valve 17 (U801) (mains rectifier) shorts internally, burning out the anode load resistor; if I cut out the EHT by means of VR6 and run on sound only everything is O.K. I have replaced V10 and also con. 52A and 52B, also 51A and 51B without any change.—L. W. MacKenzie (Liverpool).

You will have to check the V10 stage very carefully, since the timebase appears to be running incorrectly, possibly due to a defective R42. It is possible, of course, that V17 (U801) is defective itself and will not stand up to normal current demand.

The missing picture content could be due to a defective V4, V5 or V6 or an associated component.

BUSH TV24C

This is my problem: The picture has slipped out of centre toward horizontal hold, leaving a gap of ½in. at vertical hold end. If I turn width control to fill gap it pulls picture out of shape (lengthways). Which controls do I adjust on tube to re-centre picture?—L. Douglas (Linthwaite).

The picture shift lever is mounted on the focus magnet assembly and is a small metal strip which is capable of a side to side movement as well as in and out. This movement moves the picture vertically or horizontally.

MURPHY V.180 L.C.

I have a Murphy Model V.180 which produces a good picture, but recently an increasing number, now eight and a half, distinct white horizontal (? flyback) lines have appeared across the top section of picture which at times jumps a frame and rolls, vertical hold being critical. There is an occasional smell of ozone, although sound is free from background noise.

As I am without a circuit diagram, can you please advise me how to clear this trouble?—William Jennings (Northwood).

Check the condition of the frame oscillator valve and associated components. A component fault in this section often causes the production of flyback lines coupled with critical frame hold.

The production of ozone is a sure indication that a corona discharge occurs in the vicinity of the EHT circuits. Check the wiring in proximity to the EHT rectifier valve and the tube anode. Ensure that any connections are formed by smooth blobs of solder and completely free of jagged edges and points of wire. Clean the tube envelope in vicinity of the anode connector and the line output transformer where connections are made to the rectifier valve.

G.E.C. BT5144

The fault is cramping at the bottom of the tube. I have changed the B36 and KT36 with no effect. Voltages are normal.—G. Hiscock (Westcliff-on-Sea).

You need not suspect the KT36 as this is the line output. It is the frame output valve which you should suspect and this is the N37 which is mounted on the front left side. As a partial check it may be interchanged with the front right side N37 *sound output* valve.

K.B. DV40FC

After the set has been on for half an hour a pipping noise sets up in the speaker and at the end of an hour the pipping gets louder and faster. This noise varies with the picture strength. I have changed the EHT smoothing condenser, but this does not seem to be the trouble.—H. W. Dennis (Eastbourne).

Almost certainly you will find that an electrolytic capacitor has become open circuit. Most likely you will find that the 16μF in the power unit is responsible.

DEFIANT

A friend of mine has a Defiant 12in. television employing a Ferranti T12/54 tube, which has developed a fatal fault, I think. A perfect raster is visible and the brightness control operates O.K., but no picture until the base of tube neck is given a sharp knock, when it appears perfectly for a few moments and then disappears again. Assuming, nothing can be done to remedy this fault, can this tube be replaced by one of the types advertised recently, Mullard, Cossor, Emitron or Mazda? The heater voltage on the Ferranti is four volts, but I do not know what EHT it operates on.—C. T. Williams (Sth. Ockendon).

There is no direct equivalent to the Ferranti tube. However, by using a separate two-volt heater transformer, an EHT capacitor (0.001μF) and altering the base connections, a Mazda CRM121 could be used.

The fault described is probably that of a heater-to-cathode short in the tube. Additional tube life may be obtained by employing a low-loss isolating transformer.

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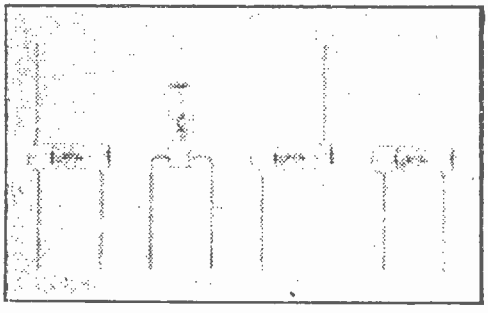
News from the Trade

New Tubular Paper Capacitors

AN entirely new and greatly improved range of wax-protected tubular paper capacitors for use in the radio and television industries has been introduced by the Plessey Company Limited.

Known as "Plesgel," the capacitors have been developed to meet the need for a low-cost, reliable type suitable for use in both conventional and automatically assembled printed circuits.

The basic versatility of these new capacitors is largely due to the provision of three terminal wires, one to the inner foil and two common earth leads to the outer foil. It is thus possible to mount them in



A collection of the new "Plesgel" condensers.

several different ways, according to which pair of wires is chosen. The spare earth lead can then either be removed or used as an earthing point for some other part of the circuit.

The radial connection wires on "Plesgel" capacitors completely eliminate the risk of the seal being opened by a slight bending of the wire as is the case with the normal axial type. The radial wires enter the case through eyelets in the side, which are then filled with solder. The use of this method also prevents the risk of open circuit due to the connections being pulled away from the capacitor during assembly of a chassis.

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"Plesgel" capacitors are available in a complete range of capacities and working voltages.—The Plessey Company Limited, Components Division, Kembrey Street, Swindon, Wilts.

New Projection Television Screen

MULLARD LIMITED announce the release of a new plastic screen for use with their projection television optical system. The screen gives a picture 24in. x 18in., or 30in. diagonal, and is provided with Fresnel and lenticular patterns as in the case of smaller screens.

This new screen was developed for sets intended for larger audiences, as found in schools, hotels, clubs, etc.

With other improvements that have taken place in the optical system an excellent picture under normal lighting conditions is obtainable.—Mullard Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Egen Adjustable Attenuator

RECENT increases in the power of the London BBC and I.T.A. television transmitters have rendered the fitting of an attenuator necessary to receivers in areas where the signal strength of either station is too great. To meet this need Egen Electric Ltd. have developed a new attenuator, Type 141, in which simplicity of adjustment is one of the most important features. Little larger than a standard coaxial plug, it can be easily inserted between the aerial feeder plug and receiver aerial socket to reduce the signal strength of a television station as required.

Adjustment is effected by unscrewing the end cap of the attenuator and rotating the internal moulded insulator to any one of six positions, shown by figures 1 to 6 which appear in a window in the outer casing—figure 1 giving the smallest and figure 6 the greatest attenuation.

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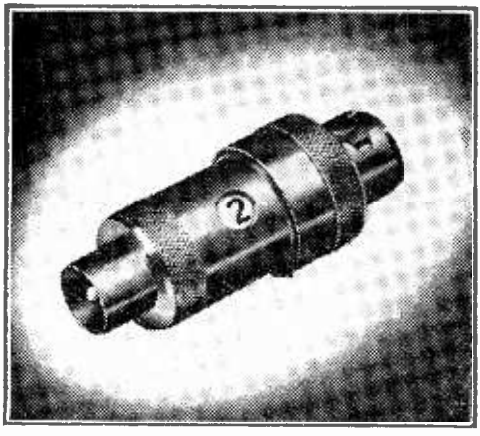

The new Egen adjustable attenuator.

formance or for alterations in the siting of the receiver.

The retail price of the Egen Attenuator Type 141 is 6s. 9d.—Egan Electric Ltd., Charfleet Industrial Estate, Canvey Island, Essex.

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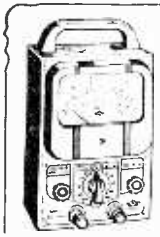

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