PRACTICAL TELEVISION, SEPTEMBER, 1951

A BLACK SPOTTER

PRACTICAL TELEVISION

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EDITOR F. J. CAMM

& "TELEVISION TIMES"

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IN THIS ISSUE

PRACTICAL TELEVISION

& "TELEVISION TIMES"

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Televiews

897,000 Television Licences

AT the end of June, 1951, 897,000 television licences had been issued. When this journal was launched in April, 1950, there were 285,500 television licences, so in the space of 15 months no less than 611,500 people have purchased television receivers. This is an indication of the rapidly growing interest in television. Approximately 12,459,800 broadcast receiving licences had been issued up to the end of June, 1951. That figure includes the television licences, so approximately one licence holder in 14 is also a television viewer.

At the present rate of accretion, in five years the ratio will probably be one in two, and in ten years, presuming that the erection of other television transmitters proceeds according to plan, it is possible that 90 per cent. of the licences will include television licences.

The Government's White Paper on the Beveridge Report indicates their policy in relation to its recommendations. The Government in principle approves of most of these, including that the B.B.C. monopoly should be continued. The Paper states that it is impracticable at the present stage to reach any definite conclusions on the problem of television for public showing, but generally the plans for the development of television are approved.

It is worth reminding readers here that when installing television sets they should not wait until their 20s. sound licences have expired but should purchase without delay a £2 television licence which also includes sound reception.

A rebate on the unexpired portion of the sound licence should be claimed from the Post Office.

HOLME MOSS

AS we go to press we learn that the official opening of the Holme Moss transmitter will take place on October 12th. Preliminary tests have given some phenomenal results, and satisfactory reception has been recorded from districts far beyond the calculated fringe area.

The greater coverage of the new transmitters may have far-reaching results on the design of receivers and transmitters. It may even become possible to produce satisfactory receivers with fewer valves.

TELEVISION IN COAST AREAS

GOOD reception is predicted for North Wales coast areas including Colwyn Bay and Llandudno and district when Holme Moss in the Pennines is opened. It is stated that a test signal received on a standard set without pre-amplification gave a picture of sufficient brilliance to be viewed in broad daylight with the contrast control at its minimum position. Llandudno is, of course, beyond the estimated coverage of Holme Moss. Perhaps this is because the signal has not to traverse high land.

The results in general are superior even to those obtained from Sutton Coldfield, in spite of the lower power used in the tests.

TELEVISION IN N.E.

THERE have been strong protests against the decision to cease work on Pontop Pike, and the Stanley U.D.C., at a recent meeting, voiced a vigorous protest and decided to raise opposition in Parliament through their M.P.

The B.B.C. has been unfairly blamed for this decision which has nothing to do with them. The rearmament programme, and the need to divert raw materials to the manufacture of munitions, was responsible for the decision made by the Economic Advisers to the Treasury, who said that apart from the raw materials position the opening up of Pontop Pike would create a demand for television receivers and hence for raw materials for building them which could not be supplied under present conditions of material shortage. This decision may, however, be set aside.

The Postmaster-General has already stated that three new high-power television transmitting stations, including that at Wenlow, are to be completed, and this is running contrary to the recommendations of the Select Committee on Estimates. The P.M.G. also announced that the construction of the five low-power stations will be postponed in accordance with the Committee's recommendations. The Wenlow station, which was to be completed in 1952, will serve a population of 3,590,000 people. Perhaps if there is a general election this decision may be similarly reversed.—F. J. C.

A Combined Television-broadcast Receiver—3

A 21-valve Circuit with Single Power Pack

By S. A. KNIGHT

THE tube used in the original receiver was the Mullard MW 31-18. The triode tubes require a stronger magnetizing field than the tetrode types to obtain correct focus, but magnets suitable for both types are readily available.

A suggested mounting for the tube is shown in Fig. 9 where provision is made for its fixing above the main chassis. Some aluminium or brass angle is useful here for the side supports. The sketch is self explanatory and can be readily modified by the constructor to suit his particular tube. This sort of mounting is useful because all leads to the tube base and scanning coils are kept at minimum length, and the e.h.t. lead can pass freely across to the tube side connection from C_{52}. The assembly must, of course, be very rigid, and impose no strain on the actual tube neck or bulb.

Alignment

The alignment of this receiver is critical and a signal generator of good accuracy must be considered essential. The following procedure should be carried out with the receiver fully operative (with regard to the correct valve voltages as given in Table 2), although the C.R. tube need not be in circuit. The scanning coils should be wired up, however, to load V_{11} and V_{12} appropriately. It is assumed hereafter that the voltages are normal and that there is no gross fault in the receiver.

1. Broadcast receiver. Switch the receiver to long waves, set the tuning gang to somewhere about 2,000 metres and advance the volume control to near maximum. Connect an A.C. voltmeter (about 10 volts range) in parallel with the speech coil of the loudspeaker to work as an output indicator. With a modulated signal, of course, maximum audible output may be used as an indication, but the meter is recommended, particularly for television sound alignment.

Inject a modulated 465 kc/s signal to the grid of V_{15} and peak the trimmers (or cores) of TR_2 for maximum sound output. Transfer the signal to the grid of V_{14} and peak the trimmers (or cores) of TR_1 similarly, reducing the signal input as necessary. Without moving the input from V_{14} grid, recheck the settings of TR_2. Seal the trimmers (or cores) of both I.F. transformers.

Transfer the signal to the broadcast aerial terminals through a standard dummy aerial. Set the main tuning dial to 300 kc/s exactly. Inject a 300 kc/s signal and adjust T_3 and T_1 for maximum sound output. Set the tuning dial to 100 kc/s exactly, inject 100 kc/s signal and adjust P_1 for maximum sound output. Now return the dial and the generator to 300 kc/s and readjust T_3 and T_1 as before.

Switch the receiver to medium waves, set the dial and the generator to 1,500 kc/s exactly and adjust T_4 and T_2 in that order for maximum sound output. Set the dial and the generator to 500 kc/s exactly and adjust P_2 for maximum sound output. Now return the dial and the generator to 1,500 kc/s and readjust T_4 and T_2 as before. This completes the broadcast alignment and this section of the receiver may now be checked on actual signals. It might be advisable *slightly* to readjust the oscillator trimmers to bring the known stations and the dial markings exactly into coincidence. The I.F. transformers must *not* be touched again.

2. TV-sound receiver. Before alignment is begun, the dust cores should be "stiffened" in their formers by inserting a piece of rubber band alongside them as they are screwed in, or, alternately, they should be well smeared with Plasticine and then screwed home. A trimming tool is used that will penetrate into the former holes; this *must* be non-metallic, and a piece of suitably shaped ebonite rod is suitable.

Switch the receiver to TV, leaving the sound output indicator and the volume control setting as before. Inject a large 10 Mc/s signal at the grid of V_{15} and adjust the cores of L_{14-15} for maximum sound output. This transformer is unscreened and the tuning is very sharp. It must be set precisely. Transfer the generator to the

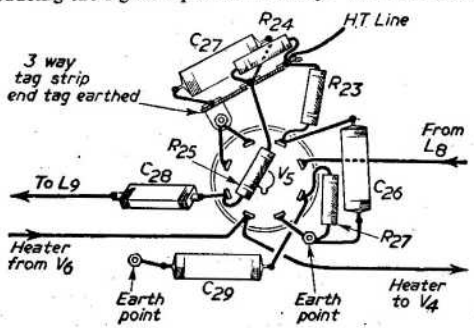


Fig. 7.—Layout of I.F. stage in the vision receiver. Actually this shows V5, but all three stages are very similar.

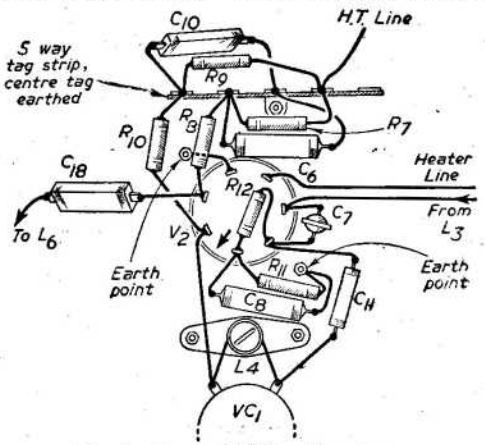


Fig. 8.—Layout of the mixer stage.

grid of V_3 and tune L_{13} core for maximum sound output; the tuning here is rather less sharp. *Recheck* the settings of L_{14-15}. This completes the TV-sound alignment for the moment. Do not seal the cores for the time being.

3. TV-vision receiver. Connect a 0-1 mA. meter in the earthy end of R_{35} and shunt directly with a 0.001 μF. condenser. Set the contrast control near maximum. Remove V_2.

Inject a *large* 10 Mc/s signal to the grid of V_6 and adjust sound-trap L_{12} for *minimum* output. The setting is very sharp and must be set exactly. Alter generator output to 11.75 Mc/s and adjust L_{10} for maximum output. This setting will be very flat. Transfer the generator to the grid of V_5, set it to 10 Mc/s and with a *large* output adjust sound-trap L_{11} for *minimum* output. Recheck the setting of L_{12}. Alter the generator to 10.6 Mc/s and adjust L_9 for maximum output. Transfer the generator to the grid of V_4 and with it set to 13 Mc/s, adjust L_8 for maximum output.

Now insert V_2 but short out the oscillator coil L_4

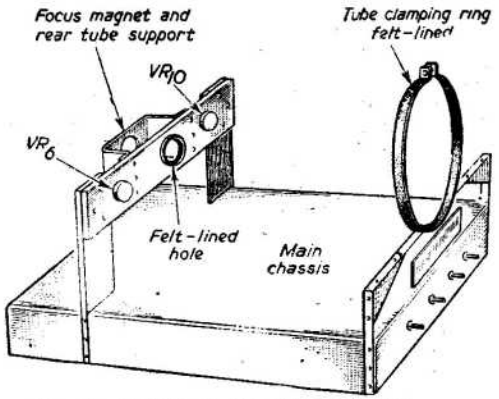


Fig. 9.—Details of the tube mounting.

with a very short length of wire. Connect the generator to the grid of V_2 (mixer half), set it to 10 Mc/s and adjust L_5 (upper core) for maximum output on the *sound* meter or speaker. Now recheck the cores of L_{13} and L_{14-15} and then seal carefully with polystyrene varnish or Durofix, etc. Alter the generator to 10.8 Mc/s and tune L_7 (lower core) for maximum output on the *vision* meter.

Remove the short circuit from the oscillator coil, set VC_1 to half capacity, and inject a 41.5 Mc/s signal (58.25 Mc/s for Birmingham) to the grid of V_1. Adjust the core of L_4 for maximum *sound* output. Seal the core. Now set the generator to 43 Mc/s (60.25 Mc/s for Birmingham) and adjust L_2 for maximum vision output. Transfer the generator to the input socket, set it to 45 Mc/s (61.75 Mc/s for Birmingham) and adjust L_2 for maximum vision output. Seal all cores carefully. This completes the alignment of the receiver.

On an actual signal it will almost certainly be necessary to reset VC_1, but this must be so tuned that the *sound output* is at maximum. The vision response curve will then be correctly set for lower sideband reception, and the vision signal will be one-half of maximum.

On initial signal tests, put the vision interference suppressor VR_3 out of action by setting the slider at the earthy end of the track. Work with contrast and volume at maximum positions and adjust VC_1 for maximum sound as above, reducing volume as necessary. Brightness in conjunction with contrast, line and frame-holds and focus should be set to enable some sort of picture to be received. If this is reversed or laterally inverted, change over the appropriate deflector coil connections. Then set width and height controls, in conjunction with the line and frame Linearity controls, to give a correctly sized picture within the mask area.

TABLE OF VARIABLE RESISTORS

VR_1—2KΩ	VR_6—2KΩ
VR_2—2KΩ	VR_7—1MΩ
VR_3—50KΩ	VR_8—100KΩ
VR_4—25KΩ	VR_9—1MΩ
VR_5—200Ω	VR_{10}—100KΩ
VR_{11}—.5MΩ	

If interference is experienced from cars, advance VR_3 until the blobs disappear to pin-point size, but not enough to take the highlights out of the picture; this control must not be abused or picture definition will suffer badly.

This receiver has a good range, but for very great distances an external pre-amplifier of conventional design might well be employed.

VOLTAGE TABLE

This table gives an indication of the voltages to be expected on various valve electrodes. They are taken with the receiver switched to Television, synchronised and contrasted at the lowest setting to produce a satisfactory picture. Meter used on highest ranges practicable, resistance 1,000Ω per volt. All readings with chassis negative.

In a duplicated receiver, reasonable voltage tolerance of 5 per cent. on those given must be allowed. It is better that voltage differences should be on the low side if at all.

TABLE 2

Valve	Anode	Screen	Cathode
V_1	210	260	2
V_2*	140	—	5
V_3	240	160	2.6
V_4	200	220	2 to 8
V_5	200	220	2.2
V_6	200	220	1.9
V_8	190	250	3.5
V_9	230	60	—
V_{10}	30	270	—
V_{11}†	—	280	10 (across R_{36})
V_{12}	260	250	8
V_{13}	160	260	—
V_{14}‡	250	80	2.5
V_{15}	240	80	2.3
V_{17}	50	40	2
V_{18}	240	260	7.5

* This is the *mixer* anode voltage. No oscillator anode voltage can normally be taken because oscillations cease when a meter is connected.

† No attempt must be made to measure this anode voltage with a normal meter.

‡ This is measured with receiver switched to Broadcast reception.

Industrial Television Equipment

TV as a Versatile Aid to Science, Industry and Education

By F. B. HICKMAN

TO the average viewer, used to settling down to his nightly ration of drama, variety or films, television begins and ends with the fare provided by the B.B.C. Already, however, television equipment and technique are being used in industry for a wide variety of applications and in research work for extending human sight far beyond its normal limits. Some of these experimental uses of television equipment may seem so far from B.B.C. practice that the average viewer may be forgiven if he does not recognise the art. Some details of such applications are given in the following paragraphs.

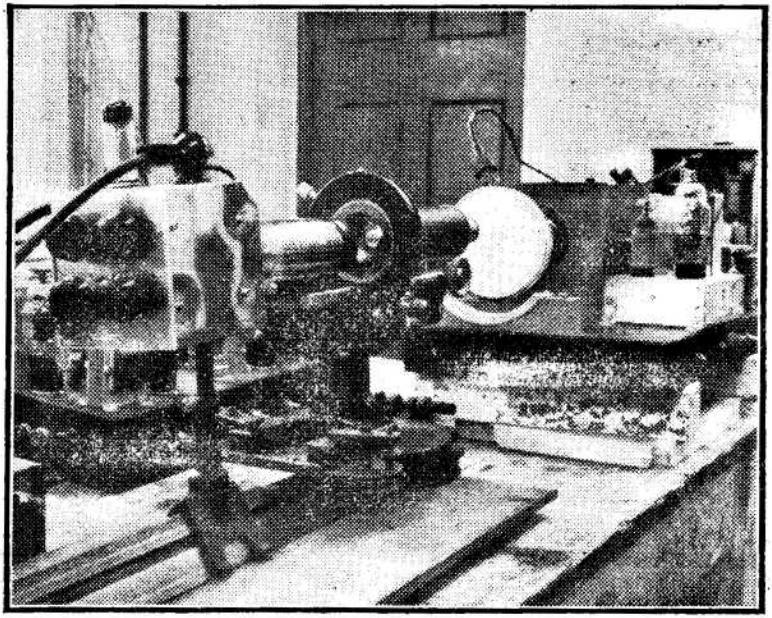
Typical television applications in industry are to be found wherever the most useful point of observation of a certain process or experiment is too dangerous, inaccessible or uncomfortable for a human observer. Great heat and noxious fumes such as may be generated in chemical processes often preclude the presence of a human observer but have little effect on the operation of a TV camera. Processes involving harmful radioactive materials may be successfully watched by a TV camera. The famous Bikini tests are perhaps the best known use of remote TV observation of atomic reactions. In coal mining industrial television equipment has been used to permit remote control of cutting machines in difficult seams. The motor-car and aeroplane industries have used television cameras during tests to observe the reaction of vital components from normally inaccessible or dangerous points of vantage.

Temperature Recording

A television camera has been used as a kind of temperature recording device in the qualitative evaluation of combustion efficiency of jet aircraft engines. The reader is probably already aware that a television camera consists essentially of an electronic camera tube together with the necessary amplifying equipment, time bases and deflection circuits for producing the desired electrical signal. The camera tube is a light-sensitive device and has the property of converting a visual signal, formed on its screen by a conventional optical lens system, into an electrical signal. Various types of camera tubes, each with their own characteristic properties and modes of operation, are in use by the B.B.C. and others, and go by such names as the Iconoscope, the Super Emitron, the Image Orthicon, etc. One of the ways in which these tubes differ from each other is in their rendering of colour values and in this they also differ to a greater or lesser degree from the human eye. The image orthicon tube, for instance, can readily be made highly sensitive to infra-red radiation which, of course, is not visible to the unaided human eye. This is the property which has proved of great value in the combustion experiments. Using an image orthicon camera to view a heated steel plate it was found that distinctive colouration was visible on the received image long before any red colouring could be detected directly by the naked eye. It was found possible to calibrate the grey tone scale of the image from such a camera so as to provide a continuous evaluation of the performance of the jet engine.

Hospitals

In addition to its use in industrial applications television equipment has been used with conspicuous success in hospitals. A television camera suspended directly over an operating table provides a detailed and intimate view of the operation and makes the surgeon's technique visible with clarity and ease to each one of a large number of observers at a remote point. In biology and allied sciences the use of a television camera combined with an optical microscope makes it possible for a large group of students to watch simultaneously the details on a microslide.



A typical Medical Television set-up, consisting of microscope and scanner capable of magnifying living tissues up to 25,000 times.

Most of these industrial or educational applications of television equipment can be undertaken using standard camera units and associated equipment such as is normally used by the B.B.C. This type of equipment is, however, needlessly elaborate, expensive and bulky and a very compact and simple closed-circuit system has recently been developed in the United States especially for industrial applications. The complete equipment consists of two units only—a television camera roughly the size of a 16 mm. cine-camera and a control and monitor unit which is the size of a large suitcase. The camera tube itself is known as a Vidicon tube. Only 1in. in diameter and 6in. long, it operates on the principle of photoconductivity in contrast to the photoemissive action of normal camera tubes. The Vidicon possesses great simplicity of construction and operation, and is capable of extremely high orders of light sensitivity and resolution. Such a compact camera unit lends itself admirably to the development of a stereoscopic system which for many industrial applications increases its usefulness enormously. It is also anticipated that this equipment could readily be adapted to produce colour pictures.

Bigger Pictures

One of the constant cries of the television viewing public is for bigger and bigger pictures. Pre-war the usual size of picture screen was 9in., nowadays 12in. is thought rather small and one well-known manufacturer has just introduced to the British market a 16in. tube. In the U.S.A. 17in. and 19in. tubes are already available and 22, 24 and even 28in. tubes are being developed.

A recent article suggested that we ought not to be satisfied until we could obtain in our own home an image showing all of Mr. Leslie Mitchell's 6ft. and so many inches life size!

Whilst not necessarily subscribing to this view the author would point out that with the development of theatre television it will be necessary to produce images which may be as big as 20ft. by 15ft. Pictures of such dimensions have been demonstrated in theatres both in this country and in the U.S.A. Two methods of producing the enlarged image for the cinema screen are at present in development by various companies. They are the so-called " direct projection " and " intermediate film " methods. Each method has its own special merits and advantages and considerable work is being done to prove which system is most practical for any given project. In the intermediate film method the television signal is received at the theatre on a receiver comparable with that used in the home and the image formed on the picture tube is photographed on to special motion picture film. This film can, if necessary, be developed and printed extremely quickly and the resultant images projected through the normal sound film projectors with a total delay of a few minutes only. If required, of course, the film may be processed in a normal manner and the programme material stored until a convenient time for projection. In the direct projection system, however, as the name suggests, the picture is produced on the theatre screen immediately it is received. In place of the conventional picture tube, such equipment uses a high intensity projection system, similar in general principle to the household projection receivers. In the theatre equipment the actual picture tube may be only 5in. diameter but it may employ final anode voltages of up to 80,000 volts, so that a small but exceedingly brilliant image is formed. This is then enlarged by a reflective optical system comprising a spherical mirror and a correcting lens. There are many difficulties, operational, political and financial, to be overcome before theatre TV can become an accepted part of a film-goer's fare, but there is little doubt that technically acceptable pictures are already possible.

Standardisation

One of the major obstacles to the adoption of universal international television standards has been the fact that invariably a television system is designed for operation from the mains voltage and frequency peculiar to a particular country. Mains voltages throughout the world vary from 100-250 and the supply frequency may be anything between 25 and 100 cycles per second. A considerable step towards solving this problem has recently been taken by the introduction of a non-synchronous receiver.

The receiver recently demonstrated will operate from any mains supply between 110 and 240 volt and on any frequency between 40 and 60 cycles per second. The power supply at the receiver need not be the same as that at the transmitter. The receiver can also operate on the American system of 525 lines 60 frames per second or the proposed standard European system of 625 lines 50 frames or on any other system. Such a receiver would, of course, represent a major step towards the establishment of international TV standards and facilitate the interchange of programmes between different countries.

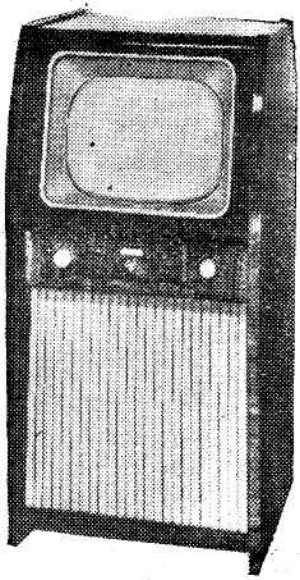
Another significant extension of television technique has recently been demonstrated in the U.S.A. where a television eye has been combined with a light microscope. The new technique of televised microscopy gives promise of a vast extension in the range, power and versatility of the microscope. By the use of interchangeable camera tubes made sensitive to specific wavelengths of light it is possible to obtain sharper contrast than has been possible before by conventional optical methods. The television microscope combination has the immense advantages of making possible the study of living cells at considerable magnifications which could formerly have been watched only by motion picture photography. It is expected that this equipment, which so far has been mainly used in biological studies, will be of great importance in medicine, chemistry, geology and physics.

The above are but a few of the instances in which television equipment and technique are being applied at present. Undoubtedly, as more equipment becomes available and as development of the technique proceeds, more and more methods will be found of using industrial television. The art is at present in its infancy, but that it will rapidly attain a lusty manhood cannot be doubted.

SERVICING TELEVISION RECEIVERS—NEW SERIES

1.—VIDOR RECEIVER

Models CN.4206 (London); CN.4208 (London Long Range); CN.4207 (Birmingham); and CN.4209 (Birmingham Long Range)



General appearance of all the models described here.

TO obtain the best results from any equipment, whether it be mechanical or electrical, it is first necessary to understand the principle of operation. When this is clearly understood, the possibilities and limitations of the equipment can be more readily assessed. It is for this reason the following description of these receivers is given.

To facilitate production they are all manufactured to one basic design, and the same circuit therefore covers the whole range. It will be appreciated, however, that the aerial, H.F. and oscillator coils in the London and Birmingham receivers will differ; also, due to the higher frequency at which they operate, it was found necessary to reduce the value of C3 in the second channel rejector circuit of the Birmingham models. They are, of course, superheterodyne receivers and conform to modern practice by operating on a single sideband, the vision I.F. centre frequency being 9.7 Mc/s and the sound I.F. being 6.25 Mc/s. Actual alignment information will not be given as it is most unlikely that the tuned circuits will give trouble. The iron dust cores and trimmers are sealed during manufacture; readers are therefore advised not to interfere with their settings.

Vision and Sound Circuits

The aerial is correctly matched into the grid circuit of the R.F. amplifier V1 by means of the coils L1A, L1B. L1B and C3 constitute a second channel rejector circuit tuned for minimum gain at 26.5 Mc/s on the CN.4206 and 4208 and at 45 Mc/s on the CN.4208 and 4209. The gain of V1 can be varied at the socket panel located at rear left corner of chassis. This plug may be inserted in three positions which effectively alters the value of the cathode resistance of V1.

The amplified signal developed across the single tuned circuit L3A is applied to the grid of the mixer V2 where it is mixed with the output from the Colpitts oscillator V13.

The vision I.F. signal developed across the single tuned circuit L4 is transferred to the grid of the first vision I.F. amplifier V3. The gain of V2 and V3 (contrast) is varied simultaneously by means of a potentiometer common to both cathode circuits. To improve sound sensitivity and oscillator stability this circuit was modified in later receivers and now controls the first vision I.F. valve V3 only. See Fig. 2.

The amplified vision I.F. signal developed across the single tuned circuit L5 appears at the grid of the second vision I.F. amplifier V4. A parallel tuned circuit L6, C18 connected in the cathode lead of V4 provides rejection of the unwanted sound I.F. signals. The amplified I.F. signal is developed across the single tuned circuit L7A and applied to the second detector (half V5). L7B and C22 provide further sound rejection. The video signal produced is applied to the grid of the video amplifier V6, L8 providing the I.F. filtering. The bias for V6 is developed across R29 by the cathode currents from V4, V6 and V14. The amplified video signal developed across R26 is transferred to the cathode of the C.R.T. V17. L9 provides high frequency compensation. R30 and R31 form a D.C. potentiometer to retain sufficient potential between the first anode and the cathode of the C.R.T. and to limit the voltage between cathode and heater to a safe value. C28 is a by-pass condenser for video frequency. R27 and C26 provide correction of the D.C. component. It is important that the time constants C25, R29, C26, R27 and C28, R31 should be equal. The second diode of V5 is used as a vision noise limiter and limits the interference pulses to peak white when the vision noise limiter control is set correctly.

The sound I.F. signal is transferred to the grid of the sound I.F. amplifier V14 by the sound I.F. transformer L15. C12 connected in parallel with the primary of L15 provides rejection of the oscillator voltage in the vision channel. The amplified sound I.F. signal developed across the single tuned circuit L16A is transferred to the sound second detector (half V15). L16B provides filtering of the unwanted sound I.F. components. Sound volume is controlled by the diode load potentiometer R77 and the signal then passes through the series diode noise limiter (half V15) which ceases to conduct on interference pulses owing to the time constant C61, R79. The signal is amplified by the triode section of V16 which operates as an L.F. amplifier and is then passed on to the grid of the pentode section of V16 which is the sound output stage. The anode of this stage is connected to the sound output transformer L17. The circuit R91, C65 with plug and socket at front middle/left of chassis provides negative feedback to the sound output stage on normal range receivers.

Sync Separator and Time Bases

The video signal appearing at the grid of the sync separator V7 is positive going on the sync pulses. The grid current develops a bias across R33 which drives V7 beyond cut-off except for the duration of sync pulses. The amplified line sync pulses are developed across R34 and applied to the grid of the triode section of V8 which clips the tips of the pulses. The positive pulses produced at the anode of the triode lock the blocking oscillator (pentode section of V8) when the "horizontal hold" control R44 is set to the correct line frequency. Picture width may be adjusted by

R45. This varies the H.T. to the pentode section of V8 and the amount of "drive" to V9. R47 provides a large negative pip at the end of the line scan which increases E.H.T. and serves to keep it constant with variation of drive. Horizontal linearity is varied by adjusting R49. It should be noted that the values C37 and R48 are small and provide part of the linearity correction circuit in conjunction with feedback from the line coils via C40. The high voltage appearing on the anode of V9 during the flyback period is auto-transformed to provide E.H.T., V10 being the high voltage rectifier wired to tagboard inside L11 screening can. The heater of V10 is supplied by a secondary winding on the line output transformer L11.

E.H.T. smoothing is effected by the aquadag coating on the C.R.T. which is connected to the chassis. R53 and R54 are bleeder resistors across the E.H.T. supply.

The sync pulses developed across R37 in the screen circuit of V7 are partially differentiated by C31, R36. Owing to the longer duration of the frame synchronising pulses and choice of C31, R36, a positive pip appears at the grid of the soft valve frame scanning generator V11 at the end of each frame pulse, which is much greater than those which follow the line sync pulses. The first of these positive frame pulses lock the frequency of the generator to that of the transmitter when the vertical hold control R58 is set correctly. V11 supplies a voltage of saw-tooth wave-form to the grid of the vertical scanning amplifier V12. Picture height may be varied by negative feedback from R66. The anode of V11 is connected to the primary of the frame output transformer L13 and circulates a current of saw-tooth wave-form through the frame coils of the deflector yoke L12.

Power Supply

This uses a transformer with two heater windings. The mains supply is auto-transformed to 350 volts and is rectified by V18 with the two diodes in parallel. R89, R90 limit the peak cathode current of V18 to a safe value. C68 is the reservoir condenser and L18, C67 constitute the hum filter. As one side of the mains is connected to the chassis when the set is switched on, the usual precautions for "live chassis" receivers must be taken during servicing. No external apparatus or earth should be connected directly to the chassis.

Auxiliary Controls

These are situated behind the panel between the volume and brilliance control and at rear of chassis. They are normally set up during installation and can be adjusted by rotating by hand or screwdriver. The contrast control may require variation from time to time to obtain the best quality picture, but the remaining three controls should only be adjusted when you have ascertained that it is the receiver at fault and not the transmitter.

Preset Controls

These are accessible when the back is removed.

(1) *R.F. Sensitivity*

The setting of the R.F. sensitivity plug is dependent on the distance of the receiver from the transmitter. The three positions correspond to distant, intermediate and local reception. The correct position is that which centralises the operation of the contrast control. In the case of CN.4208 and CN.4209 receivers, the plug should be left in the "distant" position.

(2) *Frame Linearity*

This is also situated at rear of chassis and should be adjusted in conjunction with the height control at front of cabinet behind panel. Set at best vertical linearity.

(3) *Line Linearity*

This is situated at rear of chassis and should be adjusted in conjunction with the width control at front of cabinet behind panel. Set at best horizontal linearity.

(4) *Focus and Picture Position*

This is located at rear of C.R.T. Adjustment of the lever will correct for small degrees of defocusing. For greater adjustment of focus and for centralising picture set lever in upright position. Centralise picture by means of thumb-screws and adjust focus roughly by equal movement of all three screws in the same direction. Adjust lever for best definition.

(5) *Audio Sensitivity*

This should remain in "normal" position for CN.4206 and CN.4207 receivers, and in "high" position for CN.4208 and CN.4209 receivers.

To remove chassis from cabinet:

Disconnect set entirely from the mains supply. This is important, as the metal chassis is connected to one side of the mains and may be live. Remove card back.

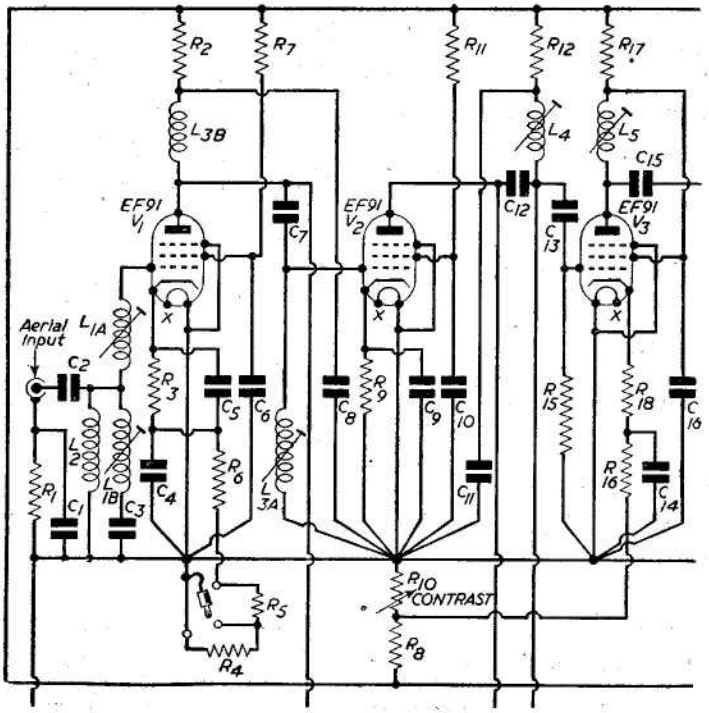


Fig. 2.—R.F. stages showing sensitivity and contrast controls.

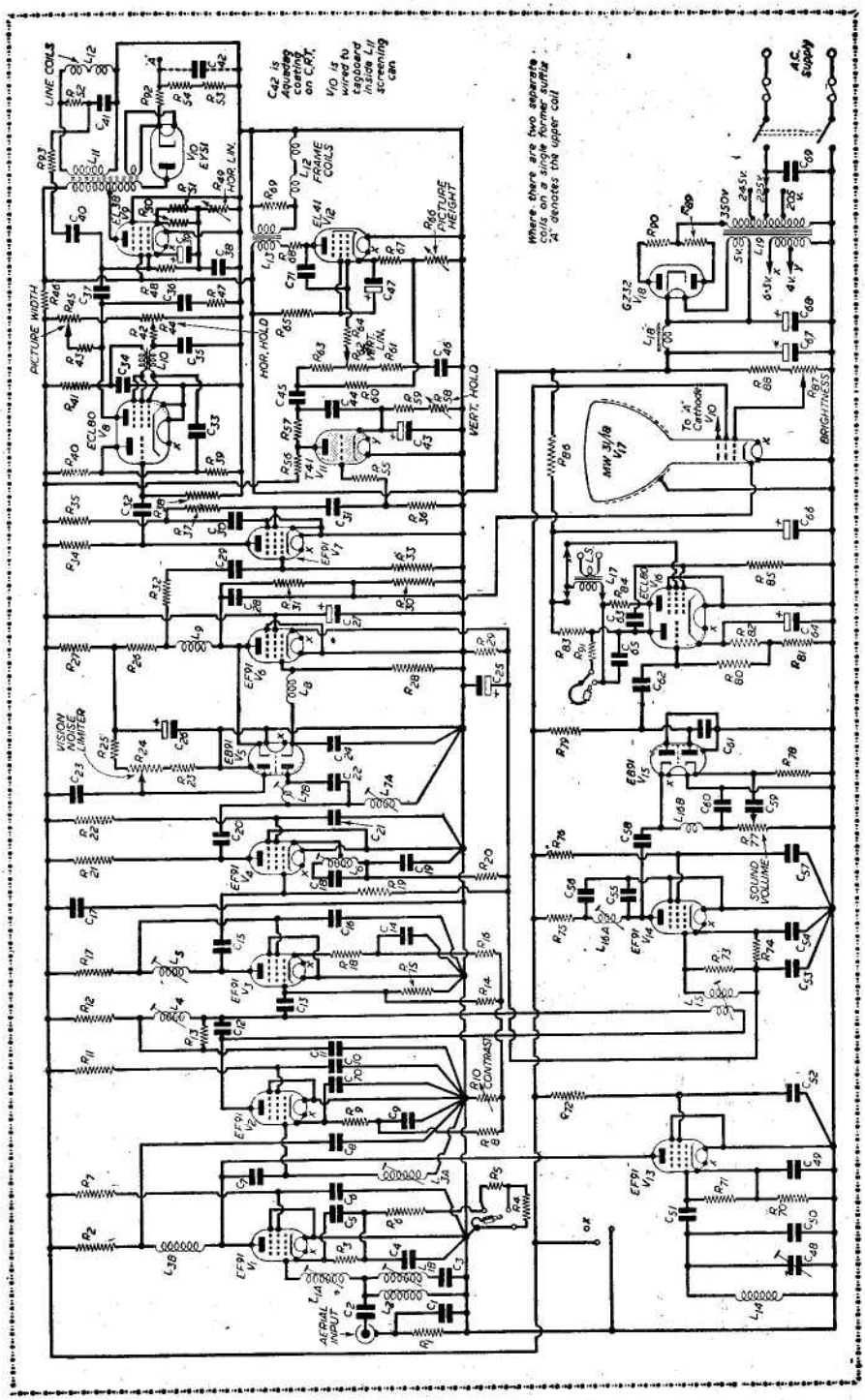


Fig. 1.—Circuit of the Vidor Models CN.4206, 7, 8 and 9.

The above is a complete circuit diagram of the models covered by this article, but no values can be given for the various components. Some older models will differ in various respects but the main features are retained. The R.F. stages are shown separately and enlarged on page 153, and on page 155 will be found a plan layout of the receiver to assist in locating the various parts, valves, etc. To assist in following the operation of the plug-in controls, etc., all sockets are shown as viewed from their front end.

Unscrew two fixing bolts at rear feet of chassis. Pull out speaker plug from socket of chassis. Remove plug from C.R.T. cradle, also socket from C.R.T. base. Release cable from support clip on C.R.T. cradle. Remove anode lead from C.R.T. Remove two 4 B.A. nuts at rear of control panel and two large knobs at front of cabinet. Withdraw chassis and control panel. The C.R.T. cradle may be removed complete with tube by undoing four fixing bolts (two on either side of C.R.T.). The speaker may also be removed by releasing four fixing nuts. The complete receiver may then be conveniently re-assembled on the bench.

Precautions

If available a one-to-one mains transformer of suitable voltage and about 200 watts should be used to isolate set completely from the mains supply. If this cannot be obtained, it is essential that the mains lead be wired to the plug to connect the chassis to the earthy side of the mains supply. *On no account should the set be connected to the mains until one of these precautions has been taken.*

It is not anticipated that the video and sound R.F. and I.F. circuits will require attention, and in cases where they do it will be found more often than not that any defect in these parts of the receiver can be traced to faulty valves by the same procedure that would be followed when fault tracing in a normal broadcast receiver, always bearing in mind that the frequencies encountered in television receivers are somewhat higher than those dealt with by the domestic broadcast receivers.

Faults which can develop in the time base circuits, however, can be elusive unless the reader is well acquainted with this type of circuit. There is one advantage here, though, and that is the fact that the cathode-ray tube serves as a very good indicator, and by studying this it is possible to decide in which circuit the trouble is located. Some typical faults and suggested methods of tracing them are given below They cannot be truly comprehensive, of course, but should be of assistance in identifying defects in these parts of the receiver.

Fault.	*Procedure.*
No raster ...	Check C.R.T. and connections to it. Check L11 for s/c turns or o/c windings (primary 190 ohms, secondary 3 ohms); if turns have shorted, it will usually be indicated by the fact that the wax has run from the transformer. Check V10

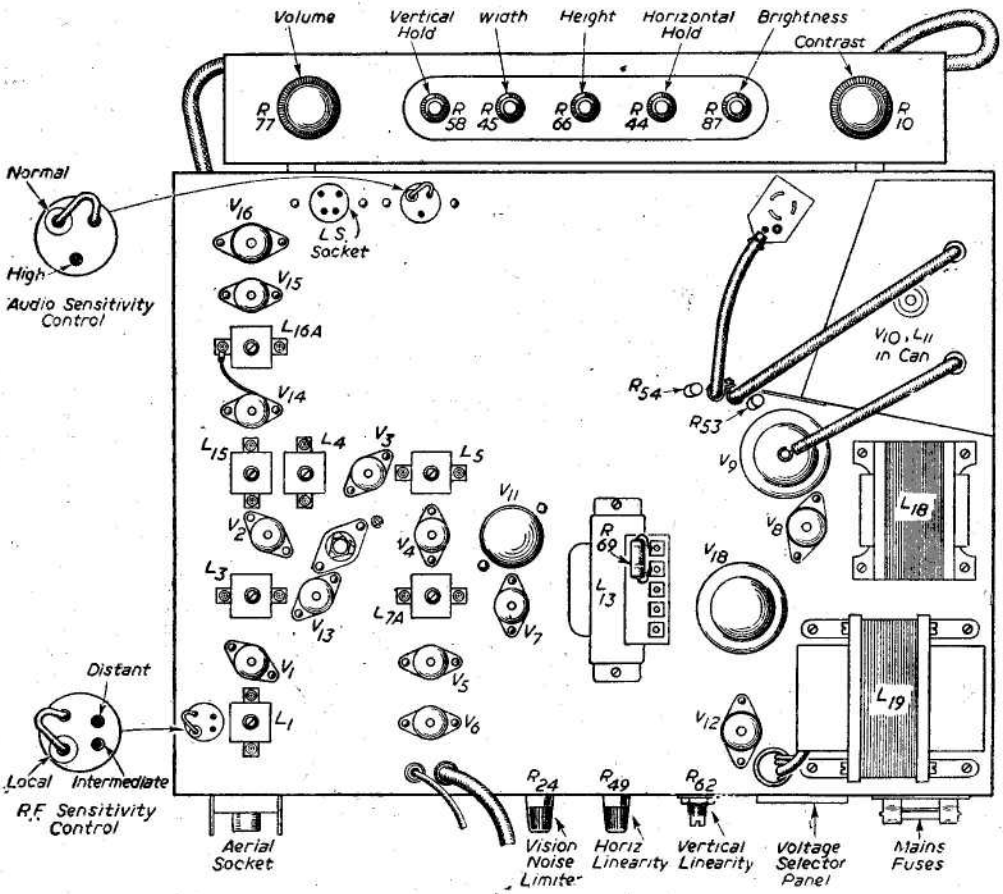


Fig. 3.—Layout of the chassis and controls.

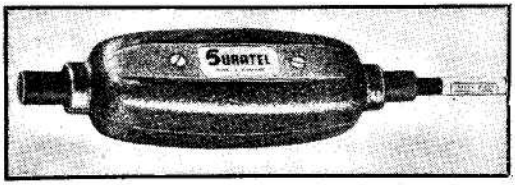
Fault.	*Procedure.*
	(EY51), V9 (EL38), V8 (ECL80). Check L10 (primary 60 ohms, secondary 27 ohms).
No line scan ..	Check line deflector coils L12 (9 ohms), L11, V9 (EL38), L10, and V8 (ECL80) in that order.
No frame scan ..	Check the frame deflector coils L12 (8.5 ohms). Frame output transformer L23 (primary 1,000 ohms, secondary 6.5 ohms), V12 (EL41), V11 (T41).
Fold-over on left-hand side of picture	Check L11 for s/c turns, V9 (EL38). Verify setting of line hold control (R42) and horizontal linearity control (R49).
Fold-over at top of picture	Check frame output transformer L13 for s/c turns, V12 (EL41), V11 (T41) and C43. Check frame hold control (R58), frame linearity control (R62), picture height control (R66) and verify their settings.

Wolf Cub Suppressors

WOLF ELECTRIC TOOLS, LTD., the manufacturers of portable electric tools, announce the introduction of " Suratel " suppressors for the Wolf Cub home constructor drill and for both radio and television. Both suppressors are the successful result of prolonged experiment and research work in close collaboration with G.P.O. engineers.

The " Suratel " radio suppressor is guaranteed to eliminate interference on the B.B.C. broadcast wavelengths to the limits specified in B.S.S.800 and complies with B.S.S.613 and B.S.S.1082.

Compactly housed in a strong pressure diecast which is effectively earthed, it is fitted at one end with a short length of T.R.S. cable for connection to a three-pin plug. The other end is free to take the drill cable which is passed through a cable sleeve and connected to the clearly-marked terminal panel which is exposed by removal of the top half of the casing. All Cub drills in present production include tag eyelets fitted to the cable ends to facilitate this connection.



Iron-cored wavewound inductors are incorporated and all electrical parts are well insulated, making it completely safe from shock hazard.

Designed specifically for the Wolf Cub drill 200/250 voltage range and with a maximum current rating of one amp., it is, of course, most important that the " Suratel " radio suppressor is fitted and used only according to the instructions supplied. Properly connected it will eliminate interference even with a poor aerial installation. The " Suratel " radio suppressor is priced at 23s. 6d. each and is obtainable from Wolf stockists and dealers.

For Television

Unlike the radio unit, the " Suratel " television suppressors are fitted *inside* the Cub drill body, as close to the commutator as possible in order to achieve maximum efficiency. Cub owners should return their machines to the nearest Wolf service depot, where a " Suratel " will be fitted at a standard charge of 8s. 6d., including return postage. Similarly, when ordering a Cub drill the suppressor can be included at the extra charge mentioned. It should be noted, however, that they are available only for use with 200/250 voltage Cub machines.

The Largest Exhibit

ON Stand 48 in the centre section of the National Radio and Television Show, Earls Court, in conjunction with E. K. Cole, Ltd., Multicore Solders will be displaying what is claimed to be the largest working demonstration ever staged at a radio exhibition. Although at all radio exhibitions since the war, Multicore have, with the co-operation of radio and television manufacturers, shown sections of radio or television sets being assembled, never before have they been able to show the production of a complete set. For the first time the public will at an exhibition be able to familiarise themselves with the skill and attention to detail that is necessary in the production of good quality radio receivers.

Ekco works, at Southend-on-Sea, have specially manufactured conveyors, benches and other equipment so that they will be able to compress into the Multicore Stand a complete factory assembly line.

Workers Stay in London

Operatives from E. K. Cole, Southend-on-Sea works, will be especially accommodated in London for the duration of the show and will be engaged daily in manufacturing complete Ekco Model No. U159 radio receivers from the assembly of the parts to the installation of the completed and tested chassis in the cabinet. These operations during the run of the show will involve the assembly of approximately 33,000 components, 22,000 wires and 51,000 joints.

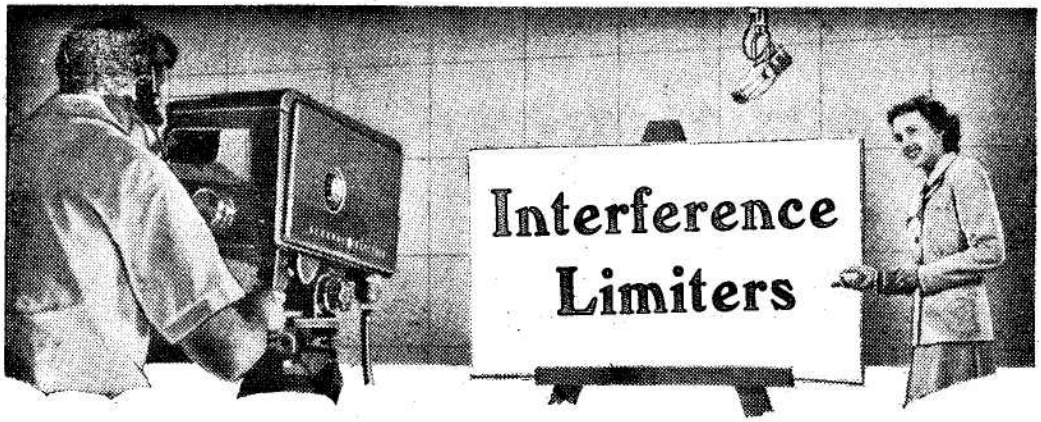
A unique exchange and delivery service has been devised between the Ekco works and the Multicore Stand at Earls Court to allow the stocks of components and the completed sets to be exchanged each evening.

The accent will be on realism, and although the factory atmosphere will perhaps be lacking from the gangways, it will be possible for the public to follow the bare chassis through all its complex assembly, wiring and soldering processes to the final stage when it is given a mains " soak " test.

On another section of Stand 48, Ersin Multicore Solder, which contains three cores of non-corrosive Ersin Flux will be shown in six alloys and nine gauges and only a few of the 400 different specifications will be exhibited. Among these the standard 7lb. and 1lb. reels, together with cartons for processes where a comparatively small amount of solder is used per operative.

Service engineers will be interested in the various size one cartons of Ersin Multicore Solder available in four specifications, retailing at 5s. each. The solder can be conveniently drawn off through a hole in the centre of each carton without becoming tangled.

Intended for radio enthusiasts and model makers the Multicore Solder 2s. kits will be available for workshop or home use. The solder kits contain four specifications of both Ersin and Arax Multicore Solder.



Simple and Effective Sound and Vision Circuits for Addition to Existing Receivers

By W. J. DELANEY (G2FMY)

PRACTICALLY all modern commercial and the majority of home-constructor designs to-day are fitted with both sound and vision interference "suppressors," but there are a large number of older models still in use in which no such circuits are fitted, and requests are often received for details as to how a suppressor may be fitted to such receivers. Unfortunately there is no standard which can be given for all cases, in view of the different methods of modulation which are employed, and other circuit details which vary with different designs. As has been stated in these pages before, there is no real interference "suppressor," the arcing which takes place in car ignition systems and other electrical apparatus (even electric-light switches) radiating a pulse which is picked up by the television aerial or wiring in the receiver and one can only reduce the intensity of such radiated pulse. Suppression must take place at the source, and until it is made illegal to use interfering apparatus all that the viewer or listener can do is to reduce the effects of the interference to a point where they do not unduly interfere with his enjoyment, and it is obviously desirable that the degree of such reduction should be under control.

It should not be necessary now to inform viewers that the effects of normal interference are the production of large white spots on the screen, and a regular "crackling" on the sound side. There are two things which can be done with the picture interference, the most common being the fitting of a circuit which reduces the size and intensity of the spots so that they are not so prominent, but even so it will be found that a car with dirty plugs and contacts will produce a thick row of such dots which will spoil a picture. The other method is to fit a circuit which will reverse the polarity of the spots, making them black, when they do not become so obtrusive. So far, a request that readers might supply details of any such circuit which they have found satisfactory has only brought forth two suggestions, one utilising three extra valves and one employing a single valve, and the latter will be found on page 167 of this issue by those who wish to fit this type of circuit.

Before giving circuits of arrangements which may most easily be fitted it should be remembered that in the majority of receivers in use the tube is cathode modulated, and therefore the strength of an incoming signal will govern the brightness of the tube face. Thus, a very strong impulse will produce a very white spot on the screen—no impulse will leave the screen dark, and so on. If, therefore, pulses can be prevented from reaching the aerial a lot will have been done to remedy matters, and in those cases where an interference limiting circuit is not fitted to a receiver, and roads carrying traffic are behind the aerial in relation to the transmitter direction, an "H" or other directive aerial would be the best step to take. Where, however, the road or roads are on the same directional line as the transmitter a circuit must be fitted to the receiver, and in view of what has been said such a circuit has to limit the *peaks* of interference. In general, the receiver is set so that the peak white of transmitted pictures rises to a certain level and some device is then included so that any signal above that strength will be prevented from getting to the tube. The most obvious arrangement is a diode so biased that it will be non-conductive on signals up to the pre-determined "peak white" level, and beyond that will conduct. By placing such a diode across the video output valve it should be a simple matter to short-circuit interfering peaks, but unfortunately it does not work out quite so simply. The peaks are sudden and of extremely

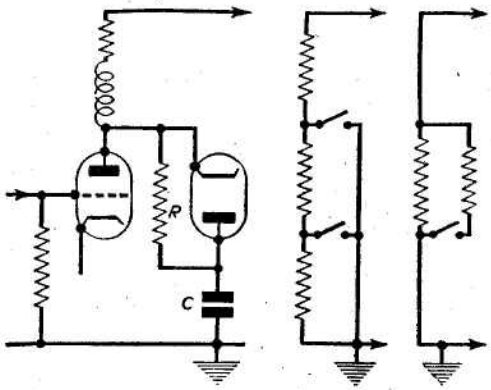


Fig. 1.—Simple video interference limiter and alternative adjustable schemes for the resistor.

short duration and the majority of circuits will only keep down a certain part of the interfering peak, but the resulting reduction in overloading of the video valve also renders the interfering spots of small size and as a result they are not so troublesome. It is obvious that some roads will carry more traffic at one time than another and therefore some adjustment is useful in enabling the degree of limiting to be set as conditions dictate. To be effective, a limiter must affect the brilliancy of the white parts of the picture—the more effective the limiter the more will the whites in the picture be affected, and thus a compromise has to be effected.

Simple Video Circuit

Fig. 1 shows the simplest video limiter which can be fitted to any cathode-modulated circuit, and it may

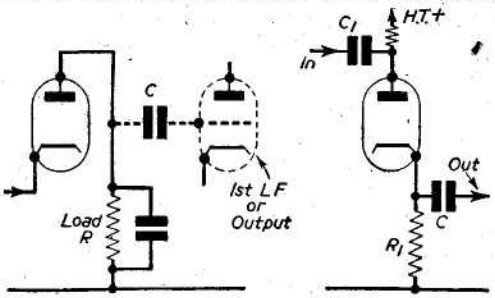


Fig. 2. (a)—Sound demodulator and (b) a simple peak limiter.

consist of a simple diode such as the EA50 (ex-Service VR92) in the case of a receiver with 6.3 volt heaters, or a metal rectifier such as the WX or modern RF type. Condenser C is not critical, a value between .02 and .1 μF being quite satisfactory. Resistance R, however, is the critical component and values from 50,000 ohms up to 5 megohms may be tried, the high value having little effect on the signal and the low value providing maximum shunting effect. The reader may try various values and fit one which gives him the desired effects, or, alternatively, separate resistors may be fitted and short-circuited out by means of rotary selector switches or simple short-circuiting switches as shown in this illustration. One other alternative may be mentioned, and in this, one small-value fixed resistor is used in series with a high-resistance variable. Usually, however, fine variations such as are obtained by a variable resistor are not needed and it is sufficient to make the adjustment in fairly large steps such as would be given by the arrangements shown in Fig. 1.

Sound Circuit

On the sound side we cannot adopt the short-circuiting arrangement in view of the effect on the quality of musical signals, and it is desirable here to employ a series arrangement which means that a lead has to be cut in the circuit and the device cannot be just added on without alteration as in the case of the vision circuit. Fig. 2 shows the normal skeleton sound circuit where the demodulator diode feeds the output valve or a stage of L.F. preceding the output. Fig. 2 (b) shows a series diode circuit which acts somewhat on the same lines as the vision limiter, all sudden peaks being "choked" by the valve and load resistor, only "smooth" variations being passed on. This is naturally rather a loose and non-technical expression but will explain the arrangement for those who are not interested in the technicalities but merely wish to fit a limiter. The circuit of Fig. 2 (b) has to be inserted between the two valves in Fig. 2 (a) and the arrangement is shown in its final form in Fig. 3. Both condensers should be of the same value, and thus condenser C can be either left in position or used for the output condenser in Fig. 3. Resistance R1 should be chosen by experiment to give the desired limiting effect with the minimum of musical distortion. In both the Fig. 2 (a) arrangement and in Fig. 1 the skeleton circuit only is shown, and it may be found that the receiver in use has compensating circuits fitted somewhere in association with these two stages, but they should be left in circuit and the limiters added exactly where shown, so that the compensating circuits or filters are not affected, and in the case of the sound circuit it may be essential to leave such circuits in position to enable the limiter to function properly. Again, in the sound arrangement, the same diode or metal rectifier may be used as for vision.

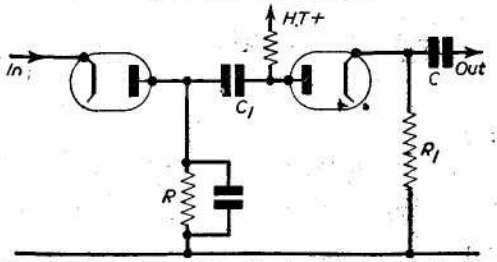


Fig. 3.—How to combine the two circuits of Fig. 2.

Books Received

OSRAM VALVE MANUAL.
Published by the G.E.C. 255 pp. Price 5s.

A valuable guide to all the Osram valves, with circuits and associated data, including a number of complete circuits of amplifiers, radio receivers, tuners, etc.

RADIO INSTALLATIONS, THEIR DESIGN AND MAINTENANCE.
By W. E. Pannell, A.M.I.E.E. Published by Chapman & Hall. 453 pp., 244 illustrations. Price 45s.

With a foreword by G. M. Wright, C.B.E., Chief Engineer of the Marconi Wireless Telegraph Company, this book deals with the principles of design, construction and maintenance of modern transmitting and receiving equipment from the point of view of the practising engineer.

AMATEUR RADIO TELEVISION INTERFERENCE.
Published by the R.S.G.B. 40 pp. Price 2s.

As its name implies, this handy little book deals with the problems of preventing interference with television receivers and includes, amongst other details, the steps which should be taken by the amateur transmitter to prevent annoyance amongst his neighbours if he wishes to go on the air during television broadcast hours.

RADAR AND ELECTRONIC NAVIGATION.
By G. J. Sonnenberg. 272 pp. 196 illustrations. Published by Geo. Newnes, Ltd. Price 31s. 6d.

RADIO VALVE DATA.
2nd Edition. Characteristics of 2,000 valves and cathode-ray tubes. Published by Iliffe & Sons, Ltd. Price 3s. 6d.

TELEVISION EXPLAINED.
By W. E. Miller, M.A.(Cantab). 4th Edition. Published by Trader Publishing Co., Ltd. 104 pp., 75 illus. Price 5s.

Energy from the Line Flyback

Details of E.H.T. Circuits

By GORDON J. KING, A.M.I.P.R.E.

ON the face of it the line output stage appears to be a simple circuit, but really its action is quite intricate, especially where the added complexities of flyback E.H.T. and the efficiency diode are employed. The following notes are therefore intended to assist the constructor in acquiring a better understanding of how these functions are achieved in modern equipment.

It is apparent that a large amount of energy is necessary to return the electron beam to the left-hand side of the cathode-ray tube during the flyback period, and it is this energy which is employed for the production of E.H.T. The induced voltage e in an inductor L is a function of the relationship : $e = L\,di/dt$, where di = the current change flowing through L in time dt.

The current through the primary of the line output

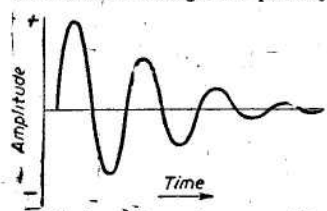


Fig. 1. — Damped Oscillations.

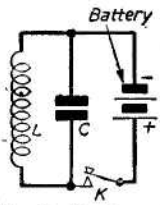


Fig. 2.—Oscillating Circuit.

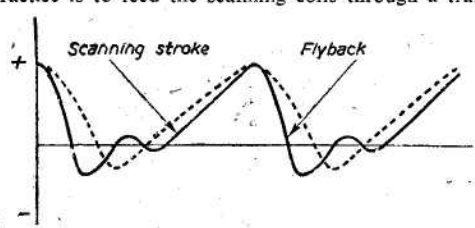
transformer drops from its maximum current value at the end of the scan stroke to zero during the 15 micro-second period taken by the flyback. Now, the anode load of the line output valve can be considered as inductive, due mainly to the reflected inductance of the horizontal scanning coils. Thus, it is clearly indicated that very high peaks may be generated across this load during the flyback period. Further, after the flyback the circuit will "ring" or oscillate at its resonant frequency, i.e., a train of damped oscillations will result across the scanning coils. These oscillations present a very undesirable factor in the line-scan circuit, since they tend to distort the left-hand side of the raster by alternately cramping and expanding it due to variations in the horizontal velocity of the electron beam. By the use of suitable damping circuits applied across the scanning coils during the flyback period, the oscillations may be successfully eliminated. There are two popular methods of achieving damping frequently adopted in modern television circuits : one employs a resistor-capacitor combination across the scan circuit, while the other relies on the conduction of a rectifier, which not only damps the circuit during the flyback, but also converts the energy of the oscillations to useful power which may be used to further the voltage of the line output stage, thus rendering the stage more efficient. The energy of the oscillation in the former case is dissipated in heat across the damping resistor and therefore goes to waste, which is really of no consequence where the H.T. is derived from a mains transformer, but where the H.T. circuits follow A.C./D.C. practice, which is the present trend in modern television design, the available voltage is very limited and after leaving the smoothing circuits rarely exceeds 200 volts. This is insufficient to enable full drive to be applied to the line output stage, but the additional voltage supplied by the damping diode, usually termed the "efficiency diode," allows the valve to receive full drive without distorting the waveform.

Damped Oscillations

A practical illustration of damped oscillations can be a vibrating piano string. If a piano key is struck the appropriate string will vibrate or oscillate, and since there is no device to sustain the oscillation, its amplitude will diminish with time, as shown by Fig. 1. The electrical counterpart of the piano string is the parallel-tuned circuit of Fig. 2. It should be noted that the capacitance C need not be a separate component, but may be formed by the combined capacities of the circuit wiring and the capacitance existing between the winding of the inductor L. Consider a rapid make-and-break of the key K. On the "make" a current will flow through the inductor and, as is well known, a magnetic field will be created. When the battery circuit is broken the field will collapse and induce into the inductor a back e.m.f. which tends to prevent the current from dying away for a time. Since, now the circuit is open, the current can only flow into the capacitance the result is that C is charged. A point is reached where the magnetic field has released most of its energy into C; the charge thus acquired commences to discharge back into the inductor and the cycle repeats with diminishing magnitude until all the energy is dissipated in resistive and circuit losses. The circuit will oscillate at its natural or resonant frequency as determined by the values of L and C according to the equation $f_o = \frac{1}{2}\pi\sqrt{L.C.}$ In the case of the piano string the frequency is dependent on the length and tension of the string. Now, if the vibrating string is damped by means of a pad applied at pressure on the string, the tail-end of the oscillatory cycle will be greatly reduced, and, if the damping is sufficiently heavy, only part of the first cycle will be produced. This effect is made available on the piano by the function of the soft pedal. The electrical equivalent of such damping may be effected by shunting the tuned circuit with a resistor ; the lower the value the more will be the damping effect, which is fairly obvious since the energy in the circuit will be quickly lost across a low-value resistor.

Frequency Selective Damping

Considering now the line output stage, the usual practice is to feed the scanning coils through a trans-



Curve in full line :- Scanning coil current waveform with no damping.

Curve in dotted line :- Current waveform after the application of damping.

Fig. 3.—Scanning coil current waveform.

former, which not only allows low-impedance scanning coils to be employed, but it also isolates the D.C. component of the valve from the scanning coils that are energised only with the induced saw-tooth current in the secondary. During the scanning stroke the line-output valve passes progressively more current through the primary of the output transformer, thereby creating a magnetic field which is at its maximum when the electron beam is at the right-hand side of the cathode-ray tube. It should be noted that at this point the anode of the line output valve is less positive than the H.T. positive side of the output transformer, or is negative with respect to H.T. positive. After reaching maximum scan the valve is rapidly brought to cut-off by the signal on its

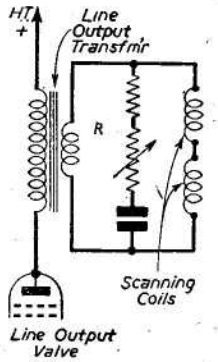


Fig. 4.—A typical flyback damping circuit.

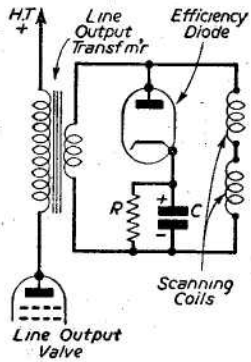


Fig. 5.—Efficiency Diode circuit.

grid; the field collapses and the beam flies back to the left-hand side of the tube ready for the start of the next scan. As explained above, a large back e.m.f. is developed across the primary of the transformer. The circuit will now "ring" at its resonant frequency, usually between 30-50 kc/s, and will continue to do so for the first part of the scan, as indicated by Fig. 3. We have already seen that a resistor across the circuit will effectively prevent the circuit from "ringing," but it will also reduce the width of the picture. The damping circuit is therefore made frequency-selective by including a capacitor in series with the resistor. The capacitor having a lower impedance to the flyback than the scanning stroke, permits greater damping to occur on the flyback. The broken-line curve of Fig. 3 shows the effect of the damping circuit. The resistor is usually a variable element permitting the application of varying degrees of damping. A typical circuit employing this method is shown in Fig. 4. The purpose of the fixed resistor is to prevent the circuit from being shunted only by the capacitor, when R is set at its minimum value. The resistors dissipate a large amount of power in this circuit and therefore should be wire-wound, while the capacitor should be a mica component of good quality.

A More Efficient Scan

By arranging a diode circuit, as shown in Fig. 5, across the line-scanning coils, an efficient form of damping is made available. After the first half cycle of damped oscillation, or on the first positive half cycle, the diode anode swings positive and conducts, which, in effect, is the same as applying across the circuit a resistor of low value. Further oscillation is therefore prevented, and the only part of the damped oscillatory cycle which affects the scanning stroke in any way is the negative half of the first cycle. This may be used to contribute to the total scanning stroke; in fact, at least 20 per cent. of the line scan in a well-designed circuit may be derived by this method. The energy for this is obtained from the charge acquired by the self-capacitance of the transformer during the flyback, which discharges through the scanning coils and the secondary of the output-transformer. Reference to Fig. 6 makes this point clear, where it will be seen that the line output valve does not start conducting until the energy of the charged capacitance has been exhausted in moving the electron beam over the initial line scan. During the flyback period the anode of the diode swings negative and no longer conducts, the transformer, now being undamped, "rings" and the complete cycle recommences.

Since the transformer and scanning coils possess a certain amount of resistance, the capacitance will tend to discharge through them exponentially, which if not corrected will cause the left-hand side of the picture to be expanded. This effect may be counteracted by the inclusion of a linearity correcting circuit, which consists of a variable inductor, or resistor, in conjunction with a capacitor to form a sort of integrating circuit and the variable element is usually termed the "horizontal form control."

Additional H.T.

Referring again to Fig. 5, it is obvious that if the diode conducts on the first positive half-cycles of each oscillatory train a steady D.C. voltage will be developed across R and the capacitor C will acquire a charge; making the side in connection with the cathode positive. The purpose of this capacitor is to hold a charge while the diode anode swings negative and its function is similar to the reservoir capacitor which is used in standard H.T. filter circuits. By judicious circuit arranging, it is possible to add the voltage so obtained to the H.T. voltage of the line output valve, thereby increasing twofold the efficiency of this stage. This method is clearly illustrated by Fig. 7, which depicts the line output stage of an Ultra model V71. It is easy to see that the H.T. voltage is in series with the voltage developed across R, and the total H.T. voltage applied to the anode of the output valve is their sum. The additional voltage may be connected in at the cathode circuit of the output valve and some designers seem to prefer it this way, although the effect is the same. The latter method has the advantage, however, of enabling the cathode of the diode and the scanning coils to be at a low potential to chassis. The circuit at Fig. 8 shows the line output stage of a Pilot model 54S, which employs the cathode circuit arrangement. The reservoir capacitor C charges, making the side in connection with the chassis positive, the voltage across the capacitor is thus added at the cathode. The additional voltage gained by this system is usually in the region of 40 volts, which, as explained previously, is well worth acquiring where

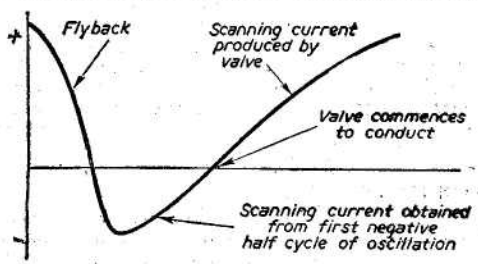


Fig. 6.—Curve showing scanning current.

the receiver is powered by the now popular A.C./D.C. method.

Extra H.T.

Of all the functions accomplished by the line flyback, the production of E.H.T. is by far the most beneficial; its use represents a great saving over the old method of

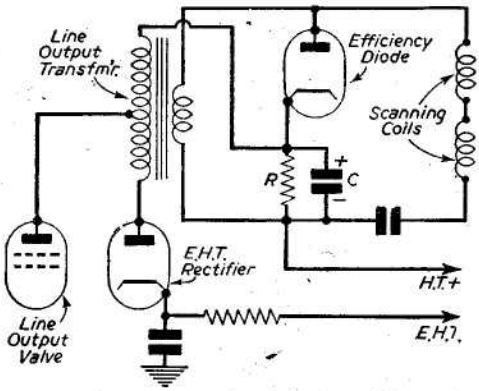


Fig. 7.—Line output circuit of the Ultra V71 model.

employing a bulky E.H.T. transformer powered by 50 c/s. mains. Further, it is non-lethal and its use is not limited only to A.C. mains supplies. The regulation offered by this system, however, is not as good as the mains transformer, which is beyond reproach; nevertheless, if the circuit is well designed very good results are possible.

We have already seen that when the magnetic field of the anode load collapses due to the flyback, a large back e.m.f. appears at the anode of the line output valve, which is usually about 2.5 kV. This is not of sufficient magnitude for E.H.T. purposes, but by arranging another winding on the output transformer these high voltage pulses are stepped up, and after rectification the voltage obtained is suitable for application to the final anode of a cathode-ray tube. Modern receivers using 12in. aluminised tubes as a rule pick up about 10 kV. from flyback E.H.T. circuits, but greater voltages may be obtained by increasing the number of turns on the high-voltage secondary winding.

A complete E.H.T. circuit is included in Fig. 8, where it will be noted that the line output transformer has four windings. The winding L1 is the anode winding, and it is across this that the high-voltage pulses occur, making the anode positive; the H.T. positive end of the winding therefore swings negative, which may be considered as earthy from the A.C. point of view. Induced into L2 by the pulse across L1, is a voltage which makes the anode of the rectifier valve V1 go positive, and of a magnitude proportional to the turns ratio L2/L1, further, the voltages across L1 and L2 are in phase, thus the positive voltage appearing at the anode of V1 is their sum. The windings L1-L2 therefore constitute an auto transformer. V1 conducts, making its cathode positive, the reservoir capacitor C1 charges and E.H.T. is fed via R1, a filter resistor to the anode of the cathode-ray tube.

Non-lethal

Since the positive pulses at the anode of V1 are at the line time-base frequency (10,125 c/s.), the value of C1 need not be so large as its counterpart in the 50 c/s. E.H.T. system, due to the capacitor C1 being recharged more frequently, thereby maintaining a steady E.H.T. potential across a lower value capacitor. A value normally used is 0.001 μF against a 0.1 μF in the 50 c/s. circuit. Sometimes this capacitance is formed by the inner and outer aquadag coating of the cathode-ray tube. The outer coating is in connection with the chassis, while the inner coating is internally connected to the final anode. As their difference in value is 100 to 1, it is obvious that the energy stored by the lower value is one-hundredth of that of the higher value, which is not sufficient to be lethal, although it may produce quite an unpleasant shock. The winding L4 is for heating the cathode of the rectifier valve, and consists of a few turns of specially insulated wire wound round the core of the transformer. The remaining winding L3 being, of course, the low-impedance for energising the scanning coils.

E.H.T. Dependent on Drive

Line flyback E.H.T. is dependent on the drive applied to the grid of the line output valve, and for this reason the control of width is arranged to take place in the circuit of the scanning coils, since it is obvious that the old method of adjusting the line scan, by varying the drive, would not only reduce the width of the picture, but the E.H.T. voltage would also fall. The usual practice is to include a small variable inductor (L5, Fig. 8) in series with the scanning coils. An increase of inductance will result in an increase of series impedance of the circuit and in this way reduce the current through the scanning coils. The series damping circuit comprising R and C2 is sometimes shunted across L5 when this method of line amplitude control is employed, but its effect on the circuit is the same.

Voltage Doubler

A circuit employing two rectifier valves connected so that their respective outputs are in series is shown in Fig. 9, and this is used in certain Philips and the new

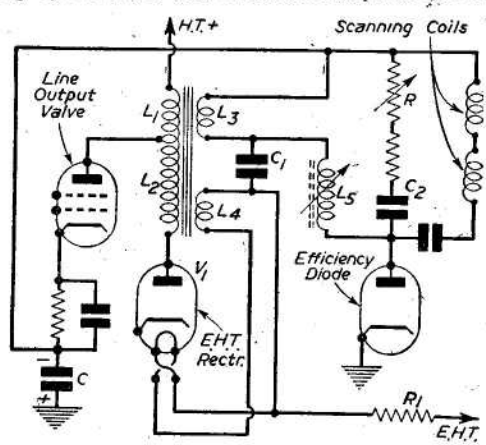


Fig. 8.—Line output arrangement of the Pilot-model 54S.

Stella receivers. The line output transformer in this case is modified to generate a peak of about 5 kV. across the complete primary (L1 and L2). Two low-voltage secondary windings are also included for independent heating of the rectifier valves. Its function may be understood by considering the anode of V1 to swing

positive; the valve conducts and C1 charges, making the side that is in connection with C2 positive. Since the anode of V2 is in A.C. connection with the anode of V1, via C3, V2 also conducts, charging C2, and making the side connected to H.T. positive go negative. The total E.H.T. voltage is, therefore, the sum of these charges, or $Ec_1 + Ec_2$. As the anode of V2 is isolated from the D.C. return circuit of the transformer, the resistor R1 serves to provide a D.C. path for the circuit of V2.

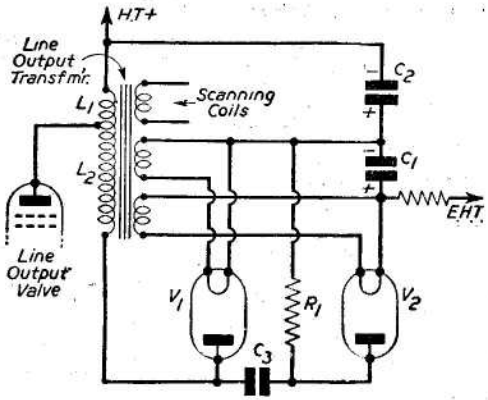


Fig. 9.—Voltage doubler circuit used in connection with flyback E.H.T. circuits.

Lower Inverse Voltage

The peak inverse voltage appearing across the high-voltage rectifier in any circuit employing line flyback E.H.T. is less than with the 50 c/s. system, this being due to the shape of the induced positive peaks which are applied to the anode of the rectifier. The (full line) waveform of Fig. 10 depicts the shape of such pulses, and it can be clearly seen there is a great reduction in their amplitude in the negative directions as compared with the sine waveform (broken line) of 50 c/s. mains. The magnitude of the inverse voltage across the rectifier employing 50 c/s. circuit may therefore be represented by the line (a), while line (b) represents that due to a flyback pulse, and for this reason a smaller rectifier may be used in conjunction with equipment obtaining E.H.T. from the flyback than its 50 c/s. counterpart, for a given output voltage.

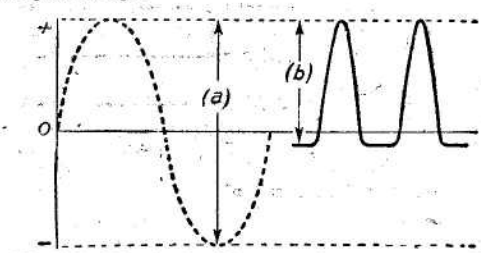


Fig. 10.—Magnitude of inverse voltages across rectifier valve.

Club Report

NORTHAMPTON AREA TELEVIEWERS' SOCIETY

General Secretary: G. T. Wilson, 95, Ennerdale Road, Northampton.

AN interesting tour by 70 members of the society was made in the last week of July, when the Battlefields of Naseby were visited, together with many well-known historic places. This outing was organised by Mr. P. Masters.

The General Secretary, Mr. G. T. Wilson, at the invitation of the O.B. Midland producer, attended the O.B. Unit, and viewed at a recent "Kaleidoscope" programme transmitted from Northampton.

At the July monthly meeting, held at H.Q., Wedgewood Chambers, six different types of aerials were demonstrated by the technical members of the society, and many questions were put to a member of the local G.P.O. staff (Interference Dept.) who was present.

The Social Committee now have all the arrangements complete for the dance to be held at The Angel Hotel, Northampton, on Thursday, September 27th, 1951, when it is hoped that members of the B.B.C. will be present, together with representatives from the British Television Viewers' Society, and the Letchworth Television Viewers' Association.

Alec Bedser takes a closer look at the Ekco TC140 presented to him by fellow-townsfolk of Woking, Surrey. Also in the picture is brother Eric and the chairman of the local Council.

An Alignment Aid

A Useful Device for Superhet Television Receivers

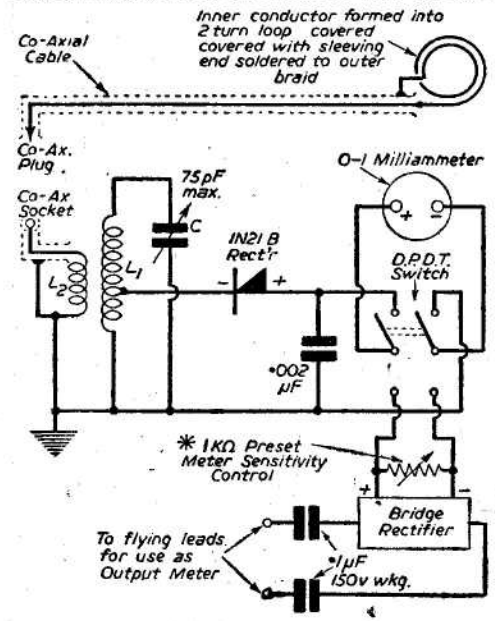
By T. M. RODWELL

THIS article is addressed to the reader who builds and aligns his own superhet receiver. It can also be of use to the technician who wishes to do a quick check of the correct functioning of the oscillator circuit of any set which comes in for servicing.

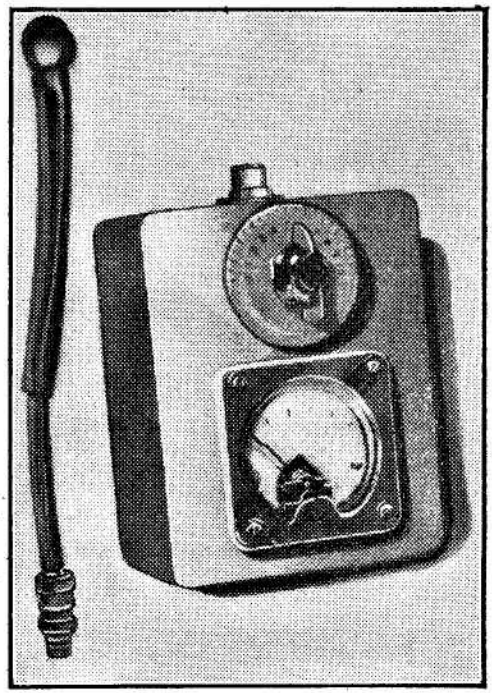
The average home-built television set—and commercial for that matter—has an oscillator circuit whose frequency is determined by a coil and a fixed padding condenser, the available variation in oscillator frequency being small, usually controlled by an adjustable slug or a small variable capacitor in parallel with the main padding capacitor. The author has found in many cases of the building of a new set that, after the alignment of the I.F. strip, time has been wasted in the alignment of the R.F. end. This is because of some doubt as to the correct frequency of the oscillator, owing to the broad characteristic of the I.F.s several responses being obtained from the signal generator at different settings of the oscillator control, or perhaps no response at all. Then the thought arises—"Is the oscillator frequency too high, or too low?" Even if the sound I.F. is coupled into the vision I.F. and the two units are aligned together it is none too easy to get the oscillator on frequency at once.

It was with these problems in mind that the following small unit was designed.

It consists basically of a sensitive absorbtion wavemeter with a 0.1 mA meter as the indicating unit. By means of a double-pole double-throw switch the unit may be used as an output meter to aid in the alignment of the set.



Circuit of the instrument.



The finished unit and coupling lead.

Construction

The unit is constructed in a small Eddystone diecast screening box. A hole is cut in the top of the box (the "lid" being the bottom) to accommodate a 2½in. 0.1 mA meter. A further hole is made for the tuning condenser which is a midget Government surplus air spaced variable of about 75 pF maximum capacity. On one of the front sides is mounted a Belling-Lee coaxial socket and a two-pin plug to take the leads when the unit is used as an output meter. The double-pole double-throw switch can be mounted on one of the long sides. (See diagram.)

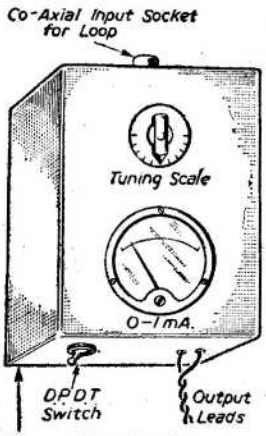
LIST OF COMPONENTS

L2=2 turn link round earth end of L1.
L1=8 turns 16 s.w.g. silver-plated copper wire —self-supporting on C, ¼in. diameter, tapped 1½-2 turns from earth end.

The coil is mounted directly upon the tuning condenser and the crystal on a small block of polystyrene. A word here about the crystal; if the reader can obtain one with pigtail leads already connected, so much the better, but if you have a surplus CV253 or IN21B or some crystal diode with no leads on it, you will have to solder some. The author has not found the practice of mounting it

between a couple of clips to be satisfactory in the long run. A word of caution about soldering leads to the crystal: great care must be taken and the author has found the following method to be satisfactory. First of all check the back to front ratio of the crystal and note it. Then wet a piece of cloth in cold water, and wrap it round the body of the crystal leaving only the end which you wish to solder exposed. Have a good hot soldering iron available and quickly tin the end of the crystal, then tin the lead you are going to solder to it, and then bring the two together and quickly make the joint.

Wait a minute or so for the crystal to cool down and then do the same to the other end. When this is finished, check the front to back ratio of the crystal and make sure that it is the same as it was before.



Details of the completed instrument.

About the rest of the circuit, very little need be said. The rectifier in use when the unit is used as an output meter is a small bridge meter rectifier.

A further word about the crystal diode: the one the author uses is an IN21B. This is a mixer crystal and is nonlinear, but as the meter when connected into the wavemeter circuit is only used as an indication of resonance, this is of no great importance, and almost any sensitive crystal diode might be used.

The frequency range of the instrument is approximately 27 to 90 Mc/s if the coil is wound as described, and this range is enough to cover sets with I.F.s ranging from 5 to 30 Mc/s, providing the oscillator is on the low side of the R.F. carrier.

Pick-up Loop

The pick-up loop which plugs into the unit is made up of a piece of coaxial cable which has had the braiding and the insulating material stripped back for about 2in., leaving only the inner conductor which should be of the thickish single strand type. This is then covered by a piece of sleeving, coiled around a ¼in. former into a two turn loop, and then soldered on to the outer braiding of the cable. A coaxial plug is then fitted to the other end of the cable and it can then be plugged into the unit.

Precautions

It should not be necessary to remind the reader that the presence of the earthed metal box will affect any coil or inductive field into which it may be placed, and therefore, when carrying out any adjustments to a receiver the greatest care must be taken to hold the unit in such a manner that it will not have any effect upon any critical part of the receiver against which the tests or adjustments are being carried out. It should not be difficult with the majority of receivers to obtain access to the coil it is desired to measure without upsetting any other part of the receiver.

In use it is only necessary to bring the loop up to the oscillator coil whose frequency is to be measured, the tuning condenser rotated for maximum reading on the meter, and the frequency may be read off on the calibrated scale.

Calibration

This unit is sufficiently sensitive to be calibrated on a signal generator which has an output voltage of 100 mV. or more. On 100 mV, it is true, you will only get a small reading but it is sufficient for calibration purposes. Connect the output of the signal generator across the input coaxial socket (removing the loop first, of course) and just calibrate the tuning control against the signal generator. Starting at about 28 Mc/s, tune the wavemeter for maximum reading on the 0.1 milliammeter and carry on throughout the entire range.

A BLACK SPOTTER

A New Type of Interference Limiter which may be Added to Almost Any Receiver

By H. CROSS

THE spot limiter to be described is easily the most effective the writer has tried and is comparatively simple. It is actually a "black spotter" type, and its efficiency must be experienced to be believed.

Fig. 1 shows the circuit. The unit is best made up on a small angle-plate bolted to the main chassis as near the CRT base as convenient, and provided with flex leads for joining up.

It should be noted that the limiter is intended for use only with a tube using the usual cathode modulation. No doubt it could be adapted for grid-modulated tubes, but this has not been tried.

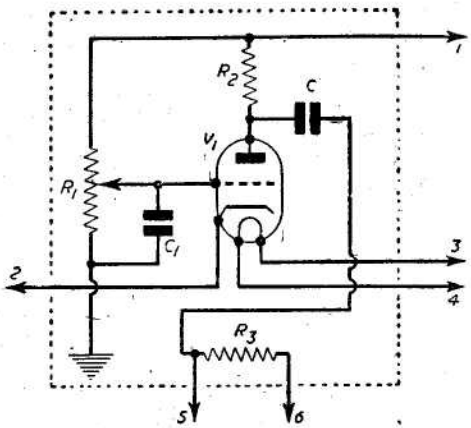


Fig. 1.—Circuit of the spotter. Values are given in the article.

The component values of the unit are not at all critical. R1 is 1.0 MΩ, but can be made up of a 0.5 MΩ pot. with a 0.5 MΩ fixed resistor in series. R2 : 40 kΩ to 50 kΩ. R3 : 15 kΩ to 20 kΩ. C and C1 may be 0.1 μF or 0.05 μF. Any triode with a gain of about 20, such as a 6J5, L63, will be suitable. In my own case I use half of a 6SN7/GT as I have a number of these spare.

For ease in adjustment connect the potentiometer R1 so that the slider is at earth potential when the control knob is fully anti-clockwise.

Connections

There are six leads and these should be clearly numbered as in Fig. 1 before bolting the unit in position. When ready connect lead 1 to the main H.T. supply. Solder lead 2 to the cathode pin of the CRT socket without disturbing the original connections. If the CRT is a 6.3 volts heater type, connect leads 3 and 4 to the heater pins. In the case of a CRM 121A and similar tubes using 2.0 volt heaters, leads 3 and 4 must be taken to the 6.3 volts supply on the vision receiver. This is my own arrangement.

Finally, disconnect the lead from the grid pin of CRT socket and join this free lead to lead 6 of the unit. Connect lead 5 to the CRT grid pin. Make quite sure these leads are not reversed. Tape up any bare leads.

With these modifications completed the unit is ready for adjustment. This must be done on a picture.

Adjustment

Set R1 knob fully anti-clockwise. The unit is then inoperative. Adjust brightness and contrast controls for normal viewing. Having quite satisfied yourself about this, turn R1 knob slowly clockwise until a point is reached where the picture tends to "negative," that is, dark patches begin to appear on white. Turn back R1 slightly until picture is normal—and that's it !

R1 is left in this position and should not normally need much adjustment. It will be found now that advancing the contrast control beyond the point used in setting up R1 will cause the picture to "negative." The best day-to-day operating is just below this point when the black spotter will be most effective.

Action

The action of the device is briefly as follows. In the absence of a video signal, V1 cathode is at the same D.C. potential as the CRT cathode and will be some 100 volts or so positive. Thus, if R1 is fully anti-clockwise, i.e., grid at earth potential, V1 is biased negatively by 100 volts—well beyond cut-off. Adjustment of R1 will reduce this bias until a point is reached where V1 will just begin to pass anode current.

In practice video signals are present on V1 cathode as well as the D.C. voltage, and R1 is adjusted so that the valve is biased just beyond cut-off on peak white. Note that peak white produces the maximum negative-going excursion of V1 cathode, this giving minimum bias.

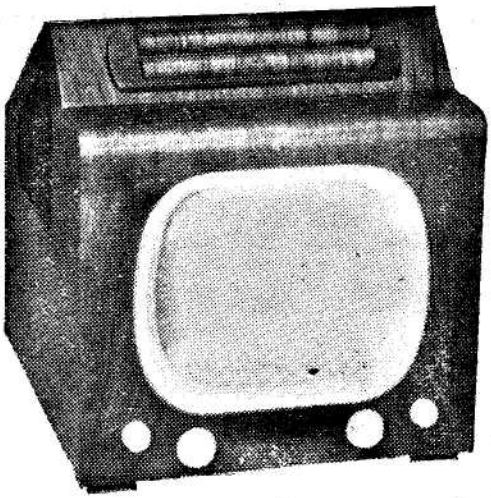
When interference at a higher level (more negative) than peak white reaches V1 cathode, V1 bias is instantly less than cut-off. V1 passes a pulse of anode current, an amplified voltage appears across R2 and is applied via C to the CRT grid in such a direction as to produce a momentary blackout of the scanning spot—as if, in fact, the brightness control has been turned back for a fraction of a second. The purpose of R3 is to prevent the pulse voltage from R2 being shunted through decoupling on the brightness control.

In practice, the momentary cut-off of a fraction of a line on a white patch is barely noticeable ; in a black part of the picture, of course, it is not noticeable at all.

Finally, and not least important, the black spotter had no adverse effect on picture definition, which certainly cannot be said to be so with the usual type of spot limiter.

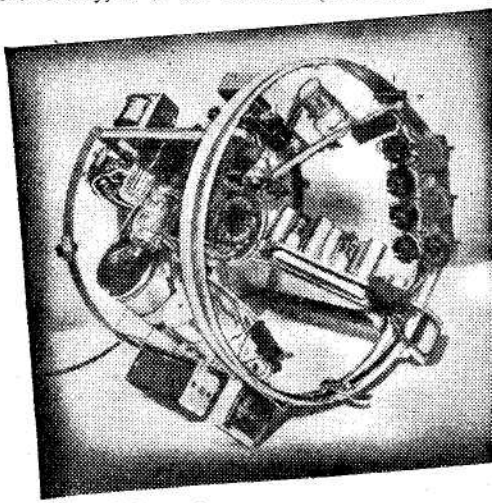
Television a

Details of Some of the Television Rece

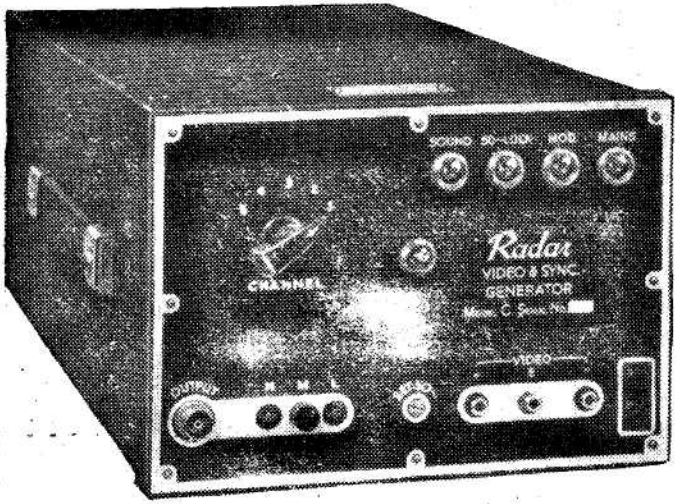


This Masteradio receiver, on Stand No. 80, utilises the same cabinet for a combined radio and television receiver, the upper section of the cabinet housing the tuning scale and radio controls. It employs a 12in. tube.

THE most important feature of this year's television exhibits is the increased size of the viewing screen. The 9in. tube will be conspicuous by its absence, whilst quite a large number of models will be seen using the new 16in. tube. Even in the small table model receivers, the 12in. tube is now standardised, and in spite of the use of this size of tube the overall dimensions of the cabinet are such that in many cases the complete receiver is smaller than the table radio receiver of two or three seasons ago using only four valves. Much of this reduction in size is due, of course, to the introduction of high-efficiency miniature type valves designed especially for television purposes, and many of these may be seen on the Mullard and G.E.C. stands. Furthermore, the heaters of some of these valves are designed for high voltages, and the A.C./D.C. technique is adopted to enable the mains transformer to be dispensed with. Miniature components of all kinds have also been pressed into service and, to give an idea of what can be done, probably the smallest television plus radio receiver may be seen on the Masteradio Stand No. 80. This particular receiver is housed in a cabinet which may be converted to dispense with the radio, and in this condition is illustrated at the top left of this page. The top sloping panel is covered with a wooden inset to match the cabinet when supplied without radio. The radio receiver, incidentally, is of the two-band (M.W. and L.W.) type and the price without radio is £54 18s. 10d., and with radio £63—Purchase Tax being extra in both cases.



A novel form of construction is adopted in this I All the separate chassis are arranged round the tub



A useful television servicing unit, enabling a television receiver to be completely set up when no "live" transmissions are available. It is switchable for the five channels, and may be seen on Stand No. 34.

Screens

The use of tinted screens also shows a marked upward tendency and it would now appear that the ratio of plain and tinted screens is about 50-50, some of the screens appearing quite light. These do, of course, enable the receiver to be viewed without darkening a room completely, and the

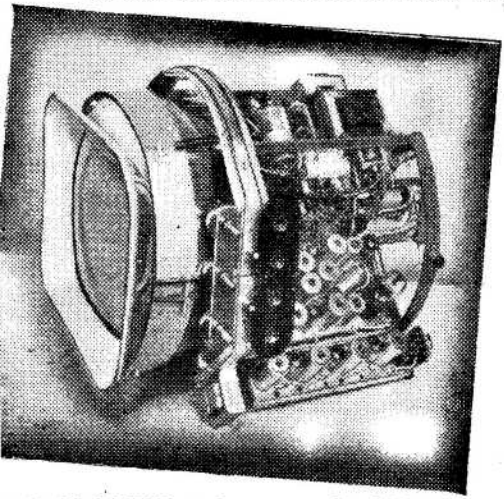
t Earls Court

vers and Accessories which are on Show

opinions of viewers differ as to whether or not the effect is worth it. Some say the details do not appear so clear, and others say that the contrast is so improved that viewing is much more enjoyable with a screen.

Loudspeakers

A noticeable improvement in quality of reproduction is experienced in these new table models, in spite of the small loudspeaker which necessarily has to be used. Advantage has been taken of the improved quality which television frequencies bring to adopt circuit techniques to bring out this improvement without utilising large

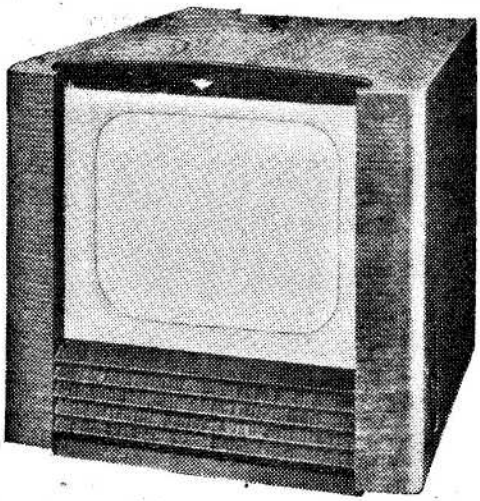


urphy Model V200 to be seen on Stand No. 61. and this not only facilitates testing but also servicing.

speakers and baffles, but doubt may be expressed by some as to whether the overall volume from some of these small models is not too great. The sound should, of course, from an æsthetic point of view, be in keeping with the size of the picture, and in one or two cases the volume appears much too great—but again, that is a point of view for the individual viewer.

Consoles

Of the other range of receivers it is to be noted that more manufacturers are providing

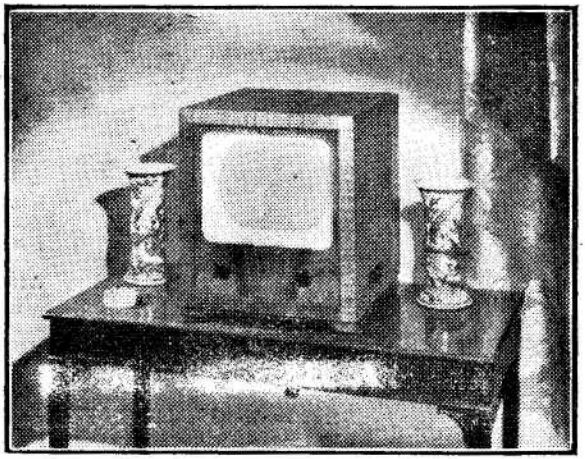


This table model by K.B., to be seen on Stand No. 52, employs a 14in. tube, 6in. elliptic speaker, and costs £85.

doors so that the tube may be covered over when the receiver is not in use. In spite of the shortage of timber this is certainly an advantage, and in many situations it may be found that the doors may be left partly open to act as a screen from lights in the room.

Circuitry

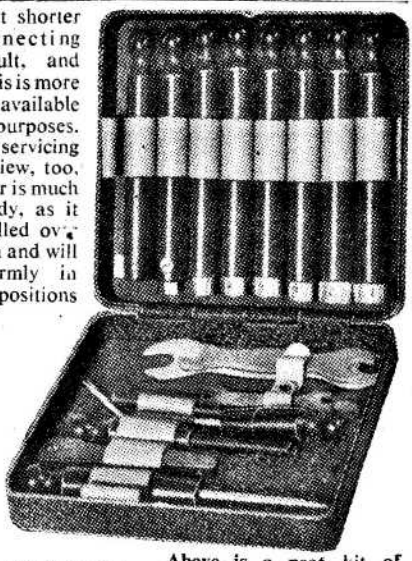
From the point of view of the circuits employed in the new models, there are a number of interesting features. As new stations are now going up there is an increasing demand for the production of a receiver which may be used in any area and this is, of course, more economical than producing a separate model for each area. T.R.F. circuits are not simple from the point of view of enabling service engineers to adapt them, and as a result the superhet is being more widely used. In many cases the oscillator is provided with five separate tuned circuits or the equivalent, and a selector switch or selector plug at



This recently-introduced Pilot Model TM.54 (Stand No. 66) has a 12in. tube and a five-channel receiver easily adapted for any station without additional parts. Price 70 gns.

the back enables any desired oscillator tuning to be adopted, according to the area in which the receiver is used. In this way maximum efficiency may be obtained on each channel and these may be set up accurately in the manufacturer's laboratory, leaving only the simple action of changing a switch to operate the receiver as required.

E.H.T. voltages appear to be slightly higher, due to improved tube characteristics, and the fly-back circuits for the production of this supply seem to be almost universal. There does not appear to be the increase in aluminised tubes which was expected, but instead more tubes fitted with the ion trap appear to have been adopted. At the time of going to press no details have been received of any receivers employing electrostatic tubes—a trend which has been adopted in the U.S.A. due to the shortage of iron and other materials. Large tubes have been produced there working on the electrostatic principle and this does, of course, remove the need for scanning or deflection assemblies and in many ways simplifies construction and operation. Another feature which does not appear to have been exploited by any manufacturer is the "spot wobbler," and we would have expected at least one receiver with this feature incorporated—capable of being switched in or out at the will of the user.

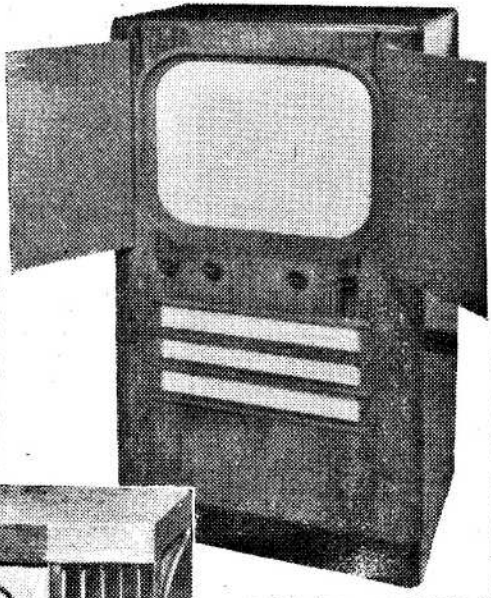


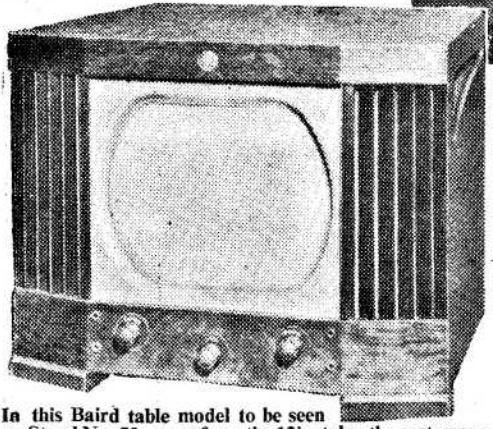
Above is a neat kit of tools which will appeal to the serviceman and which are just as useful on radio equipment as that designed for television. To be seen on Stand No. 29.

On the left is the Valradio projection receiver, giving a picture 19in. by 14¼in. and which may be obtained for A.C. or for D.C. mains supplies. It is available for D.C. private plants of 50 or 110 volts. See it on Stand No. 21.

Construction

Various ideas may be seen on the constructional side, from the unit arrangement where the R.F. chassis may be replaced for different areas, to the single chassis carrying everything including tube and speaker. One of the most novel may be seen on the Murphy Stand No. 61. A complete departure has been made here, and the illustrations on the centre of the previous pages 168/9 show two views of the chassis of the Model V200. The complete equipment is divided into four separate chassis and these are supported by circular strips round the tube. Not only does this lead to a much more compact layout, but shorter interconnecting leads result, and each chassis is more readily available for test purposes. From the servicing point of view, too, the receiver is much more handy, as it may be rolled over on a bench and will remain firmly in various positions without the risk of components or valves being damaged. The section seen outside the hoop at the bottom of the right-hand picture is an R.F. strip which is detachable, and a separate strip is available for each channel. It is easily changed without removing the receiver from the cabinet. The remainder of the circuit is, of course, standardised, and it is a very simple matter for the serviceman to carry out the change when desired. The idea has wide possibilities and is the first main departure we have seen from the orthodox chassis or unit system.





In this Baird table model to be seen on Stand No. 50, apart from the 12in. tube, the customary "Brilliance" and "Contrast" controls have been named "Light" and "Shade."

Accessories

Among the accessories the most important are, of course, the pattern generators and similar test sets designed for setting up a receiver when there are no live transmissions available. A good example is shown on page 168, and this is available for the five channels. Finally, mention must be made of the interesting kit of service tools illustrated at the top of this page. Shown by J. & S. Newman, Ltd., on Stand No. 29, this handy kit contains trimmers of different types, screwdriver, box spanners, etc., and costs 25s. 6d. in a black crackle finish case.

THE NATIONAL RADIO SHOW

List of Exhibitors in Alphabetical Order, with Stand Numbers

Name	Address	Stand No.
Ace Radio, Ltd. ..	Tower Works, Tower Rd., Pound Lne., Willesden, N.W.10	41
Admiralty	Dept. of Chief of Naval Information, Admiralty, S.W.1	231
Aerialite, Ltd. ..	Castle Wks., Stalybridge, Cheshire	47
Air Ministry ..	Parliament Sq. Hse., Parliament St., S.W.1	232
Ambassador Radio (R. N. Fitton, Ltd.)	Princess Wks., Pollard St., Brighouse, Yorks.	4
Amplion (1932), Ltd.	230, Tottenham Ct. Rd., W.1	114
Antiference, Ltd. ..	67, Bryanston St., Marble Arch, W.1	94
Association of Radio Battery Mnfrs.	41, Gordon Sq., W.C.1	67
Automatic Coil Winder Co., Ltd.	Winder Hse., Douglas St., S.W.1	9
Avimo, Ltd. ..	Taunton, Somerset	10
Balcombe Ltd., A. J.	52, Tabernacle St., E.C.2	89
Barclays Bank, Ltd.	54, Lombard St., E.C.3	20
Belling & Lee, Ltd.	Cambridge Arterial Rd., Enfield, Middx.	64
Board of Trade ..	Commercial Relations & Export Dept., Lacon Hse., Theobalds Rd., W.C.1	1
British Broadcasting Corporation	Broadcasting Hse., W.1	237
British Railways ..	The Railway Executive, 222, Marylebone Rd., N.W.1	70
Brown Bros., Ltd...	Brown's Bldgs., Gt. Eastern St., E.C.2	T.107
Bulgin & Co., Ltd. A. F.	By-pass Rd., Barking Essex	2
Burndept, Ltd. ..	West St., Erith, Kent	40
Bush Radio, Ltd. ..	Power Rd., Chiswick, W.4	62
Cole, Ltd., E. K. ..	Ekco Wks., Southend-on-Sea, Essex	57
Collaro, Ltd. ..	Ripple Wks., By-pass Rd., Barking, Essex	81
Co-operative Wholesale Society, Ltd.	1, Balloon St., Manchester, 4	91
Cossor, Ltd., A. C...	Cossor Hse., Highbury Gve., N.5	86
Decca Record Co., Ltd.	1/3, Brixton Rd., S.W.9	82
Dept. of Scientific & Industrial Research	Charles Hse., 5/11, Regent St., S.W.1	235
Dibben, Ltd., Horace	Upper Banister St., Southampton	T.108
Dioptric Mfg. & Dist. Co., Ltd.	Cranleigh, Surrey	69
Dubilier Condenser Co. (1925), Ltd.	Ducon Wks., Victoria Rd., N. Acton, W.3	45
Dynatron Radio, Ltd.	Perfecta Wks., Ray Lea Rd., Maidenhead, Berks.	71
Eastick & Sons, Ltd., J. J.	12, Errol St., E.C.1	T.100
Econasign Co., Ltd.	92, Victoria St., S.W.1	11
Edison Swan Electric Co., Ltd.	155, Charing Cross Rd. W.C.2	63
Elwin, Ltd., Henry.	Plumptre St., Nottingham	14
English Elec. Co., Ltd.	Queens Hse., Kingsway W.C.2	58
Ever Ready Co. (G.B.), Ltd.	Hercules Pl., Holloway N.7	49
Ferguson Radio Corporation, Ltd.	105, Judd St., W.C.1	77
Ferranti, Ltd. ..	Hollinwood, Lancs.	74
Gamma Electronic, Ltd.	518, Ipswich Rd., Trading Estate, Slough, Bucks.	15
Garrard Eng. & Mfg. Co., Ltd.	Newcastle St., Swindon, Wilts.	68
General Elec. Co., Ltd.	Magnet Hse., Kingsway, W.C.2	28 & 51
General Post Office	Headquarters, E.C.1	233
Goodmans Industries Ltd.	Lancelot Rd., Wembley Middx.	96
Gramophone Co., Ltd.	Hayes, Middx	84 & 85
Grampian Reproducers, Ltd.	Hanworth Trading Estate, Feltham, Middx	110
Hale Electric Co., Ltd.	Radio Wks., Talbot Rd., W. Ealing, W.13	92
Haynes Radio, Ltd.	Queensway, Ponders End Enfield, Middx	6
Hobday Bros., Ltd.	21, Gt. Eastern St., E.C.2	T.101
Hunt, Ltd., A. H...	Bendon Valley, Garratt Lne., S.W.18	95
Imhof, Ltd., Alfred	112, New Oxford St., W.C.1	93
Invicta Radio, Ltd.	Parkhurst Rd., Holloway, N.7	78
J.B. Mfg. (Cabinets) Co., Ltd.	86, Palmerston Rd., Walthamstow, E.17	33
Kerry's (Gt. Brit.), Ltd.	Warton Rd., Stratford. E.15	T.102
Kolster-Brandes, Ltd.	Footscray, Sidcup, Kent	52
Lee Products (G.B.), Ltd.	90, Gt. Eastern St., E.C.2	16
L.E.S. Distributors, Ltd.	15, Alfred Pl., W.C.1	T.109
Lloyds Bank, Ltd.	Premises Dept., 71, Lombard St., E.C.3	42
London & Provincial Factors, Ltd.	230, Tottenham Ct. Rd., W.1	T.105
McMichael Radio Ltd.	190, Strand, W.C.2	59
Marconiphone Co., Ltd.	Hayes, Middx.	46 & 79
Margolin, Ltd., J. & A.	112/116, Old St., E.C.1	25
Masteradio, Ltd. ..	10/20, Fitzroy Pl., N.W.1	80
Metro Pex, Ltd. ..	42A, Denmark Hill, Camberwell Grn., S.E.5	31
Ministry of Civil Aviation	Aerial Hse., Strand, W.C.2	236
Mullard, Ltd. ..	Century Hse., Shaftesbury Ave., W.C.2	75
Multicore Solders, Ltd.	Mellier Hse., Albemarle St. W.1	48

Name	Address	Stand No.
Murphy Radio, Ltd.	Welwyn Garden City, Herts.	61
National Provincial Bank, Ltd.	Premises Dept., 15, Bishopsgate, E.C.2	26
New London Electron Wks., Ltd.	Boleyn Rd., East Ham, E.6	A.44
Newman, J. & S. ..	100, Hampstead Rd., N.W.1.	29
Newnes, Ltd., Geo...	**Tower House, Southampton St., W.C.2**	**30**
"Ossicaide," Ltd. ..	Suffolk Hall, 1, Upper Richmond Rd., S.W.15	32
Peto Scott Electrical Instruments, Ltd.	Addlestone Rd., Weybridge, Surrey	73
Petter Radio & Elec. Supplies	201/9, Forest Rd., Walthamstow, E.17	T.103
Philco (O'seas), Ltd.	Lion Hse., Richmond, Surrey	54
Philips Electrical, Ltd.	Century Hse., Shaftesbury Ave., W.C.2	83 & 90
Pilot Radio, Ltd. ..	31/37, Park Royal Rd., N.W.10	66
Plessey Co., Ltd. ..	Vicarage Lne., Ilford, Essex	8
Portogram Radio Elec. Ind. Ltd.	Preil Wks., St. Rule St., S.W.8	115
"Practical Wireless" and "Practical Television"	**Tower House, Southampton St., W.C.2**	**30**
Pye, Ltd.	Radio Wks., Cambridge	17 & 65
Radio Gramophone Dev. Co., Ltd.	Pale Meadow Print Wks., Bridgnorth, Salop	76
Regentone Products, Ltd.	New Factory, Eastern Ave., Romford, Essex	88
Roberts' Radio Co., Ltd.	Creek Rd., E. Molesey, Surrey	44
Rola Celestion, Ltd.	Ferry Wks., Summer Rd., Thames Ditton, Surrey	39
Savory & Moore, Ltd.	61, Welbeck St., W.1	22
Scharf, Erwin ..	49, De Beauvoir Rd., N.1	35
Scophony-Baird, Ltd.	Lancelot Rd., Wembley, Middx.	50
Scott & Co., Ltd., Geo. L.	Cromwell Rd., Ellesmere Port, Cheshire	18
Simon Sound Service, Ltd.	48, George St., W.1	13
Skarsten Mfg. Co., Ltd.	21, Hyde Way, Welwyn Garden City, Herts.	19
Sobell Ind., Ltd. ..	Langley Pk., nr. Slough, Bucks.	56
Standard Telephone & Cables, Ltd.	Footscray, Sidcup, Kent	87
Stratton & Co., Ltd.	Eddystone Wks., Alvechurch Rd., W. Heath, B'ham., 31	7
Sugden & Co., Ltd., A. R.	Well Green Lne., Brighouse, Yorks.	12
Stella Radio & TV Co., Ltd.	9/15, Oxford St., W.1	111
Taylor Elec. Inst., Ltd.	419, Montrose Ave., Slough, Bucks.	38
Telegraph Condenser Co., Ltd.	N. Acton, W.3	97
Telerection, Ltd. ..	12, Suffolk Pde., Cheltenham, Glos.	27
Trix Electrical Co., Ltd.	1/5, Maple Pl., Tottenham Ct. Rd., W.1	23
Ultra Electric, Ltd.	Western Ave., Acton, W.3	53
Valradio, Ltd. ..	New Chapel Rd., Feltham, Middx.	21
Vidor, Ltd. ..	West St., Erith, Kent	55
War Office	Directorate of Public Relations, The War Office, Whitehall, S.W.1	234
Waveforms, Ltd. ..	26, Oakleigh Rd., New Southgate, N.11	34
Westinghouse Brake & Signal Co., Ltd.	82, York Way, Kings Cross, N.1	43
Westminster Bank, Ltd.	Premises Dept., 51, Threadneedle St., E.C.2	72
Whiteley Electrical Radio Co., Ltd.	Victoria St., Mansfield, Notts.	60
Winter Tdg. Co., Ltd.	6, Harrow Rd., W.2	T.99
Wolsey Television, Ltd.	75, Gresham Rd., Brixton S.W.9	5
Wright & Weaire, Ltd.	138, Sloane St., S.W.1	112

Tubes and Valves at the Show

THE British radio valve industry by its display in the National Radio Show will demonstrate how, on the one hand, it is encouraging the widest use of electronic devices by designing valves and tubes for specific applications while, on the other hand, continuing the process of rationalisation which permits quantity production of established types and results in a highly efficient product at an economical price.

The industry to-day is enjoying greater advantages in the techniques of design and production than ever before. Facilities for research are far more extensive than they have ever been and the installation of new plant in the past few years has been without precedent. On the marketing side it can be said that the overseas distribution of British valves is now highly organised and that the customer can expect good service.

There is a general trend towards the use of miniature valves in broadcast receivers. The ranges now available include directly heated types for battery-operated sets and indirectly heated types for A.C. and A.C./D.C. sets and also for car radio. One outstanding feature of the new British A.C./D.C. valves is low heater current which greatly helps the set designer. Subminiature valves, primarily designed for hearing-aids and combining high efficiency with extremely low filament consumption, are likely to have applications in industrial equipment and in electronic computing.

Both miniature and subminiature valves are widely employed in all types of radar and navigational equipment for commercial use. Among the more outstanding are magnetrons of entirely new design, klystrons, travelling-wave tubes, special cathode-ray tubes and types in which the circuit becomes an integral part of the valve itself.

In the expanding scope of electronics in industry, science and medicine, quantities of valves are being used, for instance, in high-frequency heating, process control, electronic computing and encephalography. It is, however, the "special" valves which have greatly extended this field of applications. Available devices include atom research valves, photo-cells and photo-multipliers, cold-cathode valves, electrometer valves, accelerometers, gas-filled stabilisers and voltage reference tubes. In addition there are flash tubes for stroboscopes and ultra-high-speed photography.

Transmitting valves of the air-cooled and water-cooled varieties have been progressively improved and both types are equally efficient in their respective functions. In the smaller glass transmitting valves much has been done to add rigidity to the internal structure and to achieve more compact dimensions.

Aberdeen Tests

ALTHOUGH a B.B.C. engineering unit began tests recently in the Aberdeen area for the selection of a new television station site, it is not to be concluded that plans to postpone the building of another transmitter—to serve the north-east—have been reversed.

It merely means that when permission is given to go ahead with erection, no time will be wasted in choosing a suitable site.

Originally planned for a 1953 opening, the Aberdeen transmitter was pushed further into the future when, last March, the Assistant Postmaster-General announced in the House of Commons that, owing to the defence plans, five prospective stations would have to be postponed.

American Survey

A SURVEY conducted in the United States in an attempt to find just how much television has affected the habits of the average American, shows that social life is again centred round the home. Societies to encourage interest in hobbies and handicrafts, arts and drama, etc., have received a set-back, due to the lure of television, while a great interest has been stimulated in politics.

Sales Still Falling

FOLLOWING the doubling of purchase tax on radio and television receivers, sales in London and the Midlands are reported to be still falling.

In the Holme Moss area, where a service is expected to begin in the autumn, business is reported as "steady," whereas a minor boom in sales had been expected.

Masts Erected by the Council

AT a meeting of the Sunderland Rural District Council last month it was decided that council house tenants requiring television would have their masts erected by the council and charged with the cost.

Cinema Reopening

THE Tower Theatre, Skegness, which was bombed in 1941, reopened recently after two years of reconstruction.

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

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

The main features of the cinema are its capability of receiving large-screen television, and its emergency lighting system which removes the possibility of the auditorium being plunged into sudden darkness. Whenever the town supply fails, the emergency system cuts in immediately and fades out as soon as the normal supply is restored.

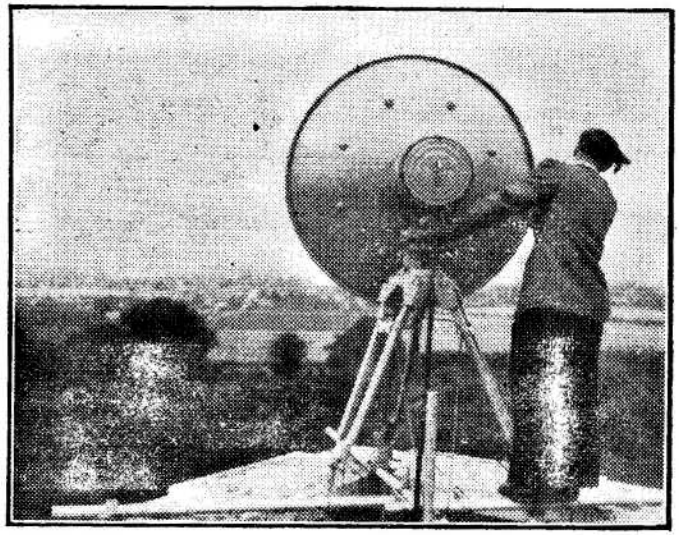
Fifteen Years Ago

IN last month's edition of "The Passing Show," which dealt with the years 1930-39, viewers heard again the first words spoken on television. These words comprised an announcement to Radiolympia by Leslie Mitchell, who then introduced Miss Helen Mackay, singing television's first song—"Here's Looking at You."

Work With, Not Against

GUEST speaker at the Ladies' Day luncheon of the Manchester branch Society of Cinematurians last month was Mr. Buster Keaton, famous star of silent-film days and known universally as "the man who never smiles."

In addition to telling of his experiences in the film world, Mr. Keaton did not appear too happy concerning the cinema's ability to



A B.B.C. engineer with one of the Marconi micro-wave links used to carry the television transmission from the Glyndebourne Opera to Alexandra Palace recently. Three of these Marconi installations were used by the B.B.C. and were reported to have worked well.

cope with the development of television. He said that rather than try to combat it, the trade should work alongside it.

Signals at Llandudno

PERFECT test signals from the new B.B.C. transmitter at Holme Moss are reported to have been received at Llandudno, 88 miles away.

Colour TV?

IT was stated by Jan Philip Boon, director of the Belgian National Broadcasting Institute, in New York recently, that when public television transmission begins in Belgium next December, pictures may be in colour.

New Television City

AS the lease on Alexandra Palace ends in 1956, the B.B.C. has placed a contract for the first section of the proposed television city at White City, West London. It will cover seven of the thirteen acres site and in all will cost £7,000,000.

School Programmes

A REGULAR series of educational programmes will begin in the autumn in the United States.

In addition to the arts, the programmes will deal with science and a wide range of subjects and are primarily intended for students in hospitals or those unable to leave their homes.

Holme Moss Signals

PROSPECTIVE viewers in the Holme Moss area are reminded that until a public announcement is made, no definite hours are allotted to the transmitting of signals. The black cross which appears on some screens from time to time is merely to assist the engineers.

Duke to be Televised

WHEN the British Association holds its annual meeting in Edinburgh on August 8th, the Duke of Edinburgh will be televised giving his presidential address.

He will speak directly to 2,000 people and indirectly, by means of a closed circuit, to 2,000 others on a large screen measuring 16ft. by 12ft. in the city's Usher Hall.

Viewers of the B.B.C. Service will not see the Duke's address which will be heard on sound radio only.

Home-made Midget Set

A MIDGET receiver, measuring 10in. by 8in., with a 2in. by 2½in. screen picture, has been made by Mr. Bernard Poole, of Davenham, Cheshire.

Construction of the receiver, which cost £15, took one month of Mr. Poole's spare time.

Russian Film Received

AT Chichester, Sussex, recently, Mr. Gerald Marcuse, the well-known radio amateur, received a picture which he believes to have been transmitted from a Russian station, possibly Leningrad.

The film, which was obviously Russian, although no sound could be heard, gave a picture at times almost as clear as reception from Alexandra Palace.

The distance between Sussex and Leningrad is about 1,300 miles.

No Breach if Free

ACCORDING to the C.E.A. General Purposes Committee, the installation of television in public houses does not incur a breach of the television licence; provided no admission fee is charged!

Northern Broadcasts

A COMPLETE mobile unit will leave London for Birmingham at the end of October, it was recently announced by the B.B.C.

This will enable broadcasts to come direct from the Midlands and the North of England, including outside events from Manchester and Leeds.

Broadcast Receiving Licences

STATEMENT showing the approximate numbers issued during the year ended June 30th, 1951.

Region	*Number*
London Postal ..	2,370,000
Home Counties ..	1,657,000
Midland	1,767,000
North Eastern ..	1,915,000
North Western ..	1,621,000
South Western ..	1,072,000
Welsh & Border Counties	732,000
Total, England & Wales	11,134,000
Scotland	1,117,000
Northern Ireland ..	208,000
Grand Total ..	12,459,000

The above total includes 897,000 television licences.

Waveguide Technique

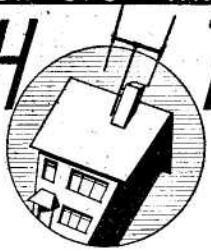
SUPPLEMENT No. 2, 1951, to B.S.530, is now available on this subject. Graphical symbols are included relating to most of the concrete items defined in Supplement No. 1, to B.S.204, Glossary of Terms used in Telecommunication, suitable for circuit diagrams and installation diagrams both in the single and double line forms. The former are mainly based on the standard symbols published in America by the Institute of Radio Engineers.

Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, price 3s., post free.

Fashion Parades are now being televised each Thursday at the Telekinema, South Bank Exhibition, and the illustration above shows Bruce Belfrage describing two of the creations at one of the recent transmissions.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

ANYTHING which "catches on" at all in America seems to go ahead with leaps and bounds. The television craze has caught the public fancy and forces the pace of the engineers and technicians. Large screen television is now proving a big attraction at cinemas and theatres, and threatens to become yet another force in entertainment, separate from regular television and competing for audiences with theatres and cinemas.

THE RISING SPIRAL

TELEVISION networks are outbidding the film industry for exclusive rights for direct TV and filmed records of major sporting events, and the spiral of television costs is steadily rising. It will be interesting to see who secures the combined film and television rights of the coming heavy-weight bout between Ezzard Charles and Joe Louis. Fortunately, advertising sponsors willingly pay out huge sums, and the beneficiaries are the writers, actors and technicians. Home viewers tend to turn over from station to station with the restlessness reminiscent of the earliest days of sound broadcasting. My latest informant on American television, back from New York a couple of weeks or so ago, frankly admits bewilderment over the whole thing. "By comparison, B.B.C. television is so peaceful that I feel relaxed and sometimes drop off to sleep," he said. "But B.B.C. production methods, on the average, are far more polished and professional than the American."

THE FIGHT FILM

THE recent big fight—Randolph Turpin versus "Sugar" Ray Robinson—gave every indication at one time of developing into a free-for-all between the man who secured the filming rights, the cinema trade and the B.B.C. Michael Goodman, a film producer who specialises in making featurette, documentary and fight films, paid a considerable sum of money for the exclusive right to make a film record of the Turpin-Robinson fight, but was unable to obtain a circuit booking from Odeon, Gaumont or A.B.C. circuits. Faced with an almost certain loss, he offered the film to the B.B.C. for television, thus provoking the indignation of the entire film industry. Many cinema exhibitors who had booked the film telegraphed cancellations, and the situation looked grim for the producer. The fight took place, and Mr. Goodman must have heaved a sigh of relief when the fourth round had passed, giving him sufficient celluloid to make a film. His next anxiety must have been that the fight might go to the fifteenth round, with consequent huge consumption of film stock on several cameras. Well, the fight went the full distance, literally packed with punches and incident, filmed throughout and also the subject of breath-taking commentary on sound radio by Raymond Glendenning. This commentary, in turn, was the subject of controversy and a great deal of newspaper publicity—resulting in a large crop of unexpected bookings from cinemas, notwithstanding the full-length film version prepared from Mr. Goodman's negative by the B.B.C.

STORM IN A TEA-CUP

IT is interesting to note that the B.B.C. film of the big event lasted about an hour, whereas the length of the cinema film version was less than half-an-hour. Both versions were highly successful and the storm subsided. Cinema exhibitors—apart from the big circuits—suddenly acquired a new interest in the film and showed it, later reporting excellent business, notwithstanding the competitive television version. Viewers also expressed satisfaction, though in my opinion there was a lack of variety of shots and particularly of close-ups of the fighters mixing it up. However, the "Goodman gamble" came off, and this producer more than recouped his heavy investment. All's well that ends well!

16 mm. TELEFILM

THE B.B.C. have concentrated on using 35 mm. film in their telefilm section, for all filming purposes, including telefilm recording. In the U.S.A. the 16 mm. film has been adopted by some of the networks on the grounds of economy. There seemed to be little to choose between the two gauges of film in the early stages of kinescope recording, but improvement in quality has been so rapid that the difference is quite noticeable on closed-circuit tube reproduction. It really looks as though the cautious approach of the B.B.C. to 16 mm. film has been the right one.

HORSES AND OPERA

FILMS of great sporting events are good television material, but few films can equal the fascination of direct O.B.'s. The transmissions on the same evening of the International Horse Show at White City and the Glyndebourne Opera made up a mixed bag of great interest. Glyndebourne Opera House, erected in 1934 in the grounds of a country house, has become a great national asset, and its 600 expensive seats are filled throughout the short annual season. It is to be hoped that the transmissions from Glyndebourne will be an annual affair, though I am not certain that opera is entirely satisfactory on television. Technical difficulties are great—as with stage plays transmitted from theatres — and various acoustic troubles affect the sound, due to the engineers having to use hidden microphones not always placed in the best positions. The situation would be very different if a microphone could be moved about, over the heads of the artistes. The Horse Show, on the other hand, is perfect for television, and the electric atmosphere in the great arena at White City during "jump offs" between champion horses, comes over very well. The B.B.C. are learning that it is not necessary for the commentator to be talking away all the time; occasional pauses with natural crowd noises, etc., but with no commentary, are welcome. I would certainly say that these horse shows are in the top class so far as suitability for television is concerned.

SPECIAL EFFECTS

THEATRE Royal, Drury Lane (to give it its full title), has long been noted for its spectacular scenes and is probably still one of the finest stages in the world, so far as trap doors, lighting and gadgets for "transformation scenes" are concerned. On that stage have been run horse races (in "The Whip"), balloon ascents (in "Sealed Orders") and sandstorms (in "The Desert Song"). Actors groped about the stage in the acrid fumes of smoke pots or drain testers, simulating London fog, while the orchestra and audience in the front rows of the stalls at the first night coughed themselves sick.

On another occasion, this time on the last night of an unsuccessful play, the property men decided to burn the remaining stock of incense used for a Chinese scene. The result was alarming—stopping the orchestra altogether and giving the auditorium a distinctive odour which clung to it for many weeks. But the days of such hand-made special effects are now past; the films, television and the war requirements of Combined Operations having resulted in new and painless ways of achieving these effects. The Besler artificial fog generator, used for providing cover for attacking troops during the war, provides a ready supply of fog, mist or steam. This has now appeared in new portable form in the shape of a fog pistol for stage use, a recently patented device used in various stage shows, including the International Ballet and at film studios. A special kind of oil is blown (by compressed carbon dioxide, from a "Sparklet" bulb) through an electrically heated tube and is atomised, blowing out a jet of pleasant smelling white-coloured vapour when a trigger is pulled. When the fog gun is fitted with a special dry-ice cooler on the nozzle, the vapour becomes heavier than air. This is the secret of the novel effect seen in "The Sleeping Princess" in which the dancers appear to be moving about on the top of a cloud. It is of particular interest and will undoubtedly soon be seen from Lime Grove.

Picture Tube Testing

THE following valuable notes are supplied by the Mullard Company and will interest every serviceman.

Before considering the tests necessary and desirable to undertake when a tube fault is suspected, it is worth while considering the type of fault that may develop. In general, the faults which are most likely to come to notice are those which result in one or other of the following symptoms :—

1. Complete black-out of the tube.
2. High brilliance but no picture.
3. Ion burn.
4. Burns due to time base failure.
5. Loss of tonal value of picture.

Using Receiver to Diagnose Faults

All the above points are observable while the tube is in operation in the receiver. Some of them denote straight away a faulty tube ; others could be due either to a defect in the tube or alternatively in the circuits of the receiver itself. For instance, ion burn is obviously a tube defect and cannot be cured by making any adjustment to receiver circuits, whereas a complete black-out of the tube might be due to either cause.

There will be little point, therefore, in the service engineer installing elaborate apparatus to carry out tests which the receiver itself can undertake.

Briefly considering a few of these faults we can note that bad insulation between cathode and heater results in virtual earthing of the cathode and that this will, therefore, either cause the tube to glow brilliantly with lack of modulation or alternatively to be completely blacked out according to the circuits employed in the particular receiver in which the tube is used. Defective insulation or a short circuit of the cathode to control grid may produce similar effects. A completely blacked out tube may also result from a broken heater.

Poor tonal gradation is usually the result of low emission, but it should be noted that lack of grid drive from the video circuits of the receiver may produce a similar effect.

A less usual reason for poor tonal gradation is the effect of stray emission. Such stray emission is not modulated by the grid, and therefore manifests itself as a low value unmodulated glow on part or the whole of the tube face. Its effect is chiefly to destroy the true tonal value of the darker portions of the picture.

Precautions Necessary

It is important to note that in the case of a picture tube, the cathode surface is comparatively large, but that under normal operating conditions the beam current is drawn from only a portion of it. Any attempt, therefore, to test the emission of the cathode by using the cathode and grid as a diode rectifier will give entirely misleading results. When a test of this nature is made, the emission from the whole cathode surface will be measured and this will bear no relationship at all to the emission available from that portion of the cathode in use for providing beam current under normal operating conditions.

Loss of vacuum in the tube will usually result in the early formation of a burn similar in appearance to ion burn. In especially bad cases where serious leakage has taken place, it will often be noticed that there is a white deposit in the vicinity of the gettering.

Insulation leakage between grid and cathode has already been referred to. It is not usual for leakage to occur between the first anode and the grid. The second anode has its own connection in the cone of the tube and internal leakage between this and other electrodes is, therefore, rarely come across—if present it is usually manifested by arcing or sputtering.

Burnt-in lines, or spots on the face of the tube due to the time base having ceased to operate, are self-apparent. It is perhaps worth while mentioning that in testing and repairing a receiver in which the time base has been at fault, the brilliance control should be turned to minimum to avoid further damage should the defect not have been remedied before the trial is made.

A quick test for insulation between cathode and heater and between cathode and grid, together with a check of continuity of the heater, are useful tests. If it can be quickly diagnosed that the tube is faulty in this respect, much time will be saved in looking for faults elsewhere.

An Inexpensive Sound Adaptor

A Relay-operated Unit for Use with a Standard Broadcast Receiver

By "ERG"

THIS adaptor is designed to be used in conjunction with an ordinary broadcast receiver. The circuit is shown in Fig. 1, and it will be noted that a relay is used for switching purposes.

The provision of this relay makes the operation of the unit fully automatic. H.T. and L.T. are obtained from the existing vision receiver supplies, the extra drain imposed by the unit being negligible.

When the vision receiver is switched on the relay will operate as soon as the H.T. current flows, and will switch on the mains supply in the broadcast receiver ; at the same time the grid of the first L.F. in the receiver is changed over to the output of the adaptor. The relay is mounted inside the cabinet of the broadcast receiver and a suitable plug and socket fitted to connect the receiver to the adaptor. Screened lead must be used between the two units.

The use of the relay saves switching on the broadcast receiver and plugging the adaptor output into the receiver's pick-up sockets every time the televisor is used.

The Relay

Any ex.-Gov. relay can be used provided it takes only a few milliamps to operate, but it is advisable to obtain one with heavy-duty contacts for switching on the mains supply in the receiver. They can be obtained for as little as 1s.

"Rx" is used to control the current through the relay, and its value will depend upon the current which the relay requires to operate.

The adaptor consists simply of a single H.F. stage, using an EF50 which feeds into a 6H6 detector. The second half of the 6H6 provides limitation of ignition interference, and the volume is controlled by VR1.

Where extra power is required an extra H.F. stage can be added. A circuit for this stage is shown in Fig. 2. The addition of this stage will necessitate changing L1 from 1½ turns to 8½ turns. As an alternative, and to avoid overloading the power supply, the first H.F. stage of the video receiver can be tapped, its bandwidth being made broad enough to cover both sound and vision channels. A simple method is to couple the adaptor

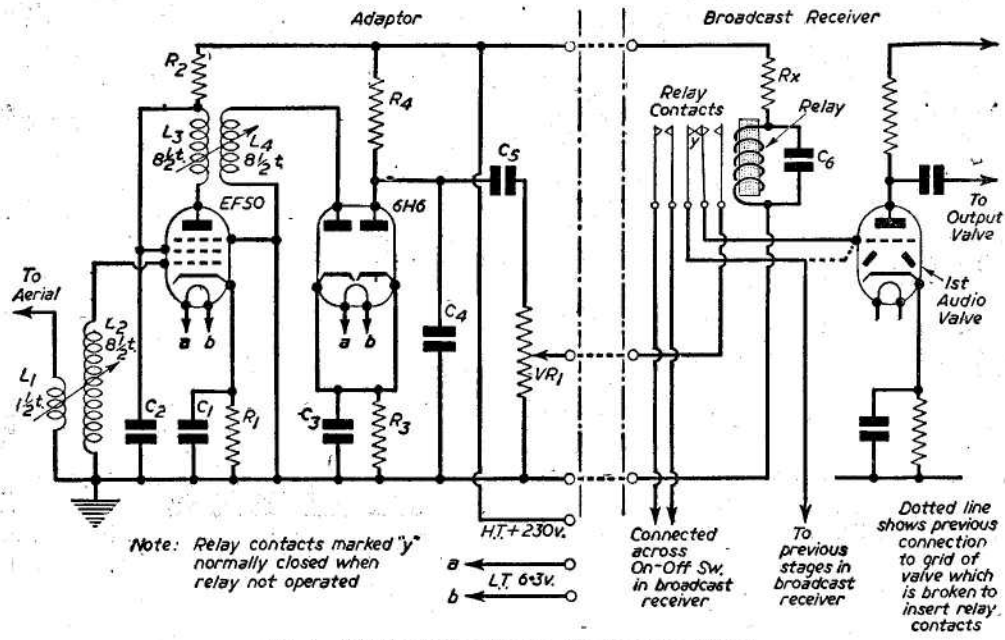


Fig. 1—Circuit of the adaptor, showing relay wiring.

LIST OF COMPONENTS

C1—0.001 μF.	C4—0.001 μF.	R1—270Ω.	R4—2.2 MΩ.
C2—0.001 μF.	C5—0.01 μF.	R2—4.7 KΩ.	Rx—See text.
C3—35 pF.	C6—0.1 μF.	R3—4.7 KΩ.	VR1—2 MΩ.

to the video receiver by a 1½-turn coil, as shown in Fig. 3.

The unit can be constructed on a simple metal chassis measuring 3in. x 4in. x 1½in. deep. A screen should be erected between the H.F. and detector stages.

Aladdin ¼in. formers are used for the coils and the turns of 22 s.w.g. wire (insulated windings) are shown in the diagrams. The turns given are for Sutton Coldfield and should be modified for other transmitters accordingly.

For the benefit of those readers who have no data available, it may be stated that in the case of the normal grid windings approximately 1½ to 2 turns extra should be added for the Holme Moss transmitter and a similar number of turns for the London frequency. In most cases similar coils may be used for London and Holme Moss.

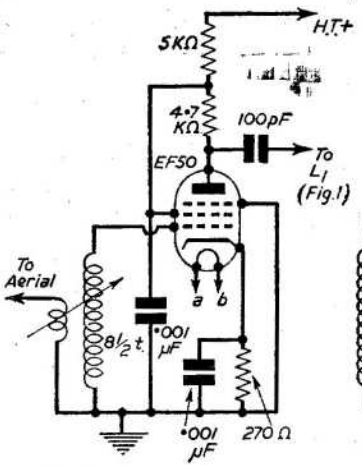


Fig. 2.—Details of a suitable H.F. stage.

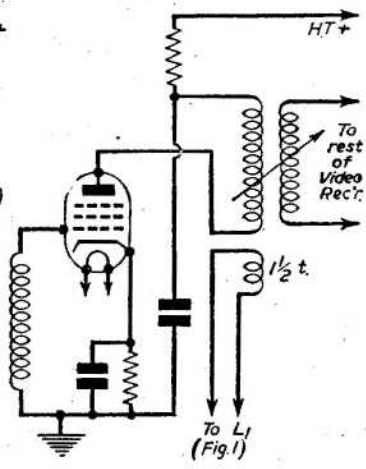


Fig. 3.—Method of obtaining coupling from video stage.

Aerial Comparison Tests

Some Interesting Details of Aerial Efficiency

By R. PINKEY

COMPARISON tests were first carried out between a quarter-wave-spaced "H" and a folded dipole with director and reflector.

The height of the centre of the "H" was 40ft., but owing to the extra weight the folded dipole could only be raised to 33ft.

At first nothing was received on the folded dipole and it was found that, though this aerial had been designed to present an impedance of 70 ohms to the feeder, the close proximity of structures and telephone wires had brought the impedance down to about 40 ohms.

A 50-ohm matching piece was fitted between the dipole and feeder; it was then found that the signal was about the same strength as that received on the "H," the folded dipole being more directional and with a slightly increased signal-to-noise ratio. Comparison was then made between the "H" and a half-rhombic aerial.

It was found that the signal was stronger in the "H" by a ratio of about 5 to 4, but the signal-to-noise ratio in the half-rhombic was much higher where the interference was from the sides or behind. The half-rhombic was also very directional.

Tilted Wire

The capacity-loaded tilted wire was then tried but the signal pick-up was appreciably less than the "H," but with a good signal-to-noise ratio, though not so good as the half-rhombic. This aerial is also very directional.

"X" Aerial

An "X" aerial was then tested, being raised to the same height as the "H." No appreciable difference in signal strength could be noticed, but in this test severe interference was being experienced from behind the aerials and this had less effect on the "X" than the "H."

The "X" and "H" were compared in a different area where there was much less interference and once again there was no appreciable difference in signal pickup; the "H" may have been slightly better, but the "X" balanced this with a slightly better signal-to-noise ratio.

Conclusions

The conclusions I reached after these tests were: For all general purposes the "X" aerial is the best.

It is much lighter and easier to erect and, because of the reduced weight, can be raised to a height which offsets advantages which may be possessed by other types of aerial. It matches into 70-ohm cable.

Under conditions where the signal strength is not less than 500 microvolts, and severe interference is being experienced from the sides or behind, the half-rhombic is worth considering, providing space is available for its erection. The output impedance is 400 ohms and has to be matched to the feeder.

The tilted wire comes in where the signal strength is over 500 microvolts and it is not convenient to erect a rod aerial. The 300-ohm output has to be matched to the feeder.

All tests were carried out in the Fareham-Portsmouth area which is outside the official fringe for reception; nevertheless, even the aerial with the lowest pick-up produced a picture of sorts.

The Amplitude Filter–2

A SUITABLE circuit is shown in Fig. 13, complete with D.C. restoring diode. The pulsations in the anode current caused by the sync signals are converted to positive-going voltage pulses by the load resistor R3. Incidentally, the resistor R2 in series with the grid of the limiter is of considerable importance. If this were absent there would, in effect, be two diodes in parallel connected anode to cathode and cathode to anode. Since one would always be conductive a low resistance path would exist across R1. The effect is

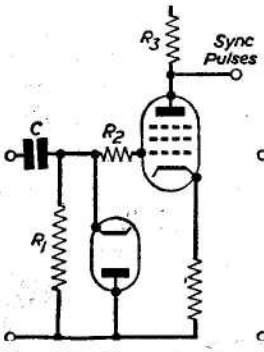


Fig. 13.—The circuit completed by the addition of the limiter.

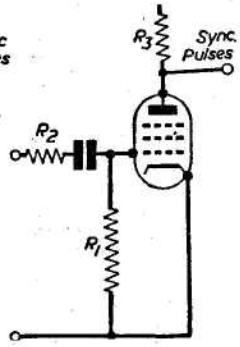


Fig. 14.—This circuit dispenses with the use of a separate diode for D.C. restoration.

minimised by making R2 as large as possible. Typical values for the above circuit are C=0.5 microfarads, R2=0.5 megohms, R1=1 megohm.

A circuit, Fig. 14, which overcomes the defects of the previous arrangement dispenses with a separate diode and achieves D.C. restoration by forcing the limiter into grid current. Since no bias is applied to the grid this electrode will, in conjunction with the cathode, act as a diode across R1. Now whatever the direction of the applied signal, whether negative or positive going, the final effect will be the same. In the first case operation is as in Condition 1, but with the diode connections and the polarity of the input reversed. The second case is covered by Condition 3, and the waveform will be inverted. In both instances, therefore, the voltage fluctuations appearing across R will be negative going. The D.C. component will be retained or restored and the tips of the sync pulses will rest on the zero line. The waveform applied to the grid of the valve appears in Fig. 15 by the anode current/grid volts curve. The action now proceeds as follows: As the sync pulse ends, the signal, rising to black level, drives the grid 3 volts negative to the point X and the anode current drops to zero. The picture modulation being to the left of line XY sends the grid further negative and produces no effect in the anode circuit. The sync pulses, however, drive the grid in a positive direction to zero and the current jumps to 0.7 mA. The circuit utilises the bottom bend of the characteristic for elimination and the upper flat portion is not required. The arrangement is eminently satisfactory and practical values are given as R2=10KΩ R1=1MΩ and C=0.1μF.

An extremely interesting arrangement appears in Fig. 16, which illustrates the use as separator of a double diode. The input is obtained from the cathode circuit of the previous stage, a vision frequency amplifier, and the line and frame pulses are fed from the independent cathodes to their respective time base circuits.

Let the no-signal voltage at point X on the potential divider R5, R1 be 40 volts. The application of a negative-going signal to the grid of V1 will drive X in the same direction since the anode current will decrease.

To conform with previous examples let the voltage drop by 10 from 40 to 30 volts during a picture line of maximum amplitude (white).

Consider the position when the signal is at black level. The P.D. across R1 being 37 volts (40—30 per cent. of 10) electron movement takes place in an anti-clockwise direction through the diodes and C1 charges, developing an E.M.F. equal and opposite to the input. Essential elements of the circuit are reproduced in Fig. 17, where it can be seen that a state of equilibrium has been reached between the input and capacitor E.M.F.s. The onset of a white line of picture drops the input to 30 volts. The effective E.M.F. of 7 volts acting clockwise produces no electron movement through the diodes but C1 commences to discharge through R2.

The sync pulse results in the P.D. across R1 returning to the original 40 volts. The effective balance now acts anti-clockwise. The ensuing current passes through R3 and R4 and charges C1. By careful choice of circuit values matters can be so arranged that the charge so gained by C1 equals exactly the amount lost during the previous half cycle. Since current only flows during the sync periods the resulting voltage pulses developed across R3 and R4 can be separately fed to the respective line and frame time base circuits.

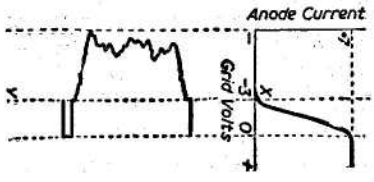


Fig. 15.—Operation of the arrangement shown in Fig. 14.

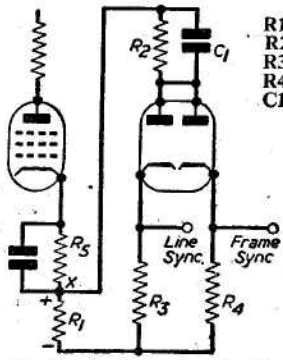


Fig. 16—An interesting circuit employing a double diode.

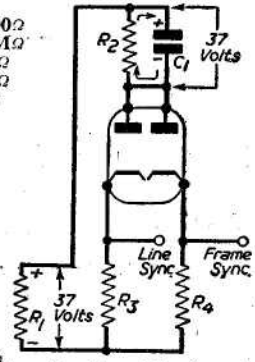


Fig. 17.—Essential elements of Fig. 16 reproduced.

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).

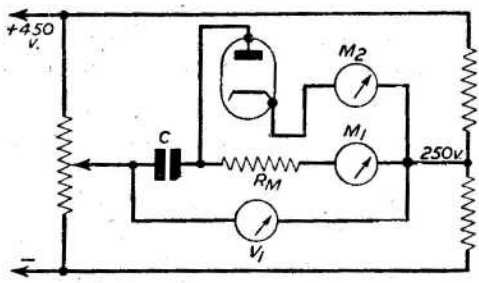
TELEVISION DANGERS

SIR,—In reply to Mr. T. J. Mulligan's query in the June issue of PRACTICAL TELEVISION, I would suggest that the reason in the case of a man being electrocuted whilst making an adjustment to his television aerial was not due to the E.H.T. at all, but to the fact that his television receiver was of the type where the chassis can be "live" depending on which way the mains plug is connected. If the aerial was erected with the set plugged into the mains, it is quite possible for the aerial to be "live," and since the roof, chimney-stack, etc., are all earthed, the person erecting the aerial could hardly fail to get a nasty shock, which could prove fatal.—F. P. ANDREWS (Romford).

D.C. RESTORER

SIR,—In reply to Mr. T. H. J. Watson, I should like to say that the subject of the action of the various types of detector is one that is best investigated by experimental means. I will describe the experiment that I devised to illustrate the action of the shunt diode (that is the case with the diode in parallel with the load resistor). The equipment usually used in my class for this consists of one each of the following: variable voltage stabilised power unit of range 100 to 400 volts; 250-volt fixed stabilised power unit; centre zero voltmeter; 0-10 mA. meter (D.C.); Avominor on the 100 volt D.C. range with the zero off-set, and one 10μF paper condenser, or, if possible, one of larger capacity.

The components are joined up as shown below, with the centre zero voltmeter across from the variable to the fixed power unit so that the voltage difference may be



Mr. Kendall's arrangement for showing the working of the shunt diode.

measured. As the voltage difference is raised the condenser is charged through the diode and a current will be read off on M2, whilst at the same time a back kick will be registered on M1. Adjust the voltage so that the variable end is negative and an increase in the reading on M1 will result but will stop when the condenser is fully charged.

So much for the static conditions of the circuit. If the voltage is varied continuously from negative to positive and then back continuously, then the actual A.C. rectification of the unit can be studied. It will be observed that the condenser, having once received its full charge, only receives small "make-up" charging pulses, whilst at the same time there are slight back kicks on the meter M1, showing that there is a reverse current present for a very small part of the cycle only. Also that the voltage registered during the various parts of the cycle range from a slight back kick to nearly double the voltage on V1. As the speed of the variation is stepped up the back kicks will nearly disappear, and the current through M2 will be lower in its peak value. These effects are due to the time-constant of the voltmeter and the condenser. If an output is taken and smoothed it will give a voltage reading of just under the average of that on M1.

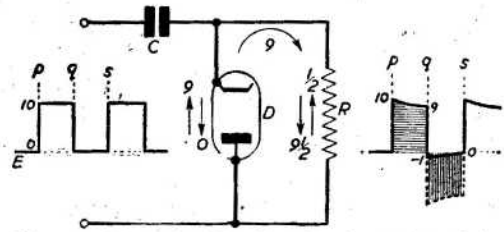
I hope that this little experiment will help to put some of the readers' minds at rest over this problem. I have not gone into the highly complex mathematics of the subject as I maintain that there is nothing better than practical proof for the practical man.—JAMES S. KENDALL (Birmingham).

SIR,—With regard to the problem posed by the differing points of view of Messrs. Barnard and Howells, I suggest that the real solution shows a justification for both points of view.

I believe that the whole dispute arises over a too loyal adherence to Ohm's Law. It must be remembered that the excellent Mr. Ohm intended his law to be applied only to circuits containing *linear elements* (components which conduct a current directly proportional to the applied voltage). The moment we introduce a non-linear element such as a diode we have to think again, for a diode passes differing currents according to whether the applied voltage is positive or negative. Fortunately, we may regard a diode as being one linear element for positive voltages and a different linear element for negative voltages, and, therefore, we may apply Ohm's Law to the problem *provided we treat positive and negative half-cycles separately.*

To make the explanation quite clear, let us take some numerical values and apply them to the diagram below.

Suppose a square wave of amplitude 10 units is applied to the input. Initially the whole 10 units appear across R,



Diagrams illustrating Mr. Storr-Best's solution of the D.C. restorer problem.

as the condenser looks like a short-circuit at first. After the interval p—q, however, the condenser has charged a small amount, say by one unit, so that there now remains nine units across R. When the input wave returns to zero, at time q, this is equivalent to applying 10 units in the reverse direction, so that the voltage across R is now 9—10 = —1/unit. Hitherto we have ignored the diode as its cathode has been zero or positive with respect to its anode and, therefore, has been non-conducting: in other words we have regarded it as a very high resistance. Now that the voltage across R has become negative, however, the diode will conduct, and we must now regard it as a low resistance. Had there been no diode the condenser C would now discharge during the period q—s at the same rate as it was charged, i.e., having gained 1/10th of the applied voltage during interval p—q it

(*Continued on page* 190)

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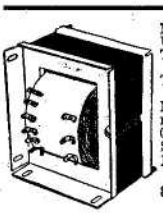

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(*Continued from page* 188.)

would now lose 1/10th of its charge during q—s, so that at times the voltage across R would be 0.9. With the low-resistance diode there, however, the discharge time is much faster than the charge time and so we may suppose that, at times, the condenser has just lost its charge, the voltage across R returning to O. By symmetry, the succeeding positive and negative cycles will be exactly the same, the potential across R going successively through 10, 9, —1 and 0.

Now since C can pass no average D.C. current it follows that if there has been current through it proportional to the horizontally shaded area shown in the first half-cycle of the waveform of the illustration, there must have been an opposite current in the second half-cycle exactly equal to it, as shown in the vertically shaded area. The area between the dotted and full lines containing the vertical shading, therefore, shows the current conducted by the diode.

Averaging things out, we can say that during the first half-cycle the resistance R passes 9½ units of current and the diode 0 units. During the second half-cycle R passes ½ unit and D passes 9, as shown by the arrows (indicating *current* flow !).

Thus, Mr. Howells is right in saying that the currents through D and R are in the same direction (they are for each half-cycle, where Ohm's Law applies), and Mr. Barnard is right in saying that there is, therfore, a resulting circulating current. (In this case, 9 units over a complete cycle.)—J. L. STORR-BEST (N.W.7).

INTERNATIONAL TELEVISION

SIR,—So far all efforts in the direction of international television unification have failed due to the bandwidth problem. Except the very important cost price aspect, we have to examine other obstacles in this respect.

The number of available channels in the V.H.F. bands reserved for television purposes is governed by the bandwidth of the television system to be used. The total bandwidth of the 41—68 Mc/s band is 27 Mc/s, and with a channel bandwidth of 5 Mc/s (as is the case with 405 lines and a picture frequency of 25) five channels are at our disposal with a surplus of 2 Mc/s. The Continental channel bandwidth for 625 lines (also with a picture frequency of 25) is 7 Mc/s, and in this way the 41—68 Mc/s band may be divided in four channels, on the condition that a surplus of 1 Mc is permitted.

The British five television channels allocation of the 41—68 Mc/s band would become infeasible if the 625 television standard was introduced in Great Britain.

Taking this situation into account the only practical "compromise" between 405 and 625 television should be 525 lines and a picture frequency of 25 with a channel bandwidth of 5.5 or 6 Mc/s, but also this proposal will only be acceptable if a small expansion of the 41—68 Mc/s band is allowed.

It is obvious that at present with regard to the number of lines, European television uniformity (the ideal of many television enthusiasts who are conscious of the television possibilities of to-morrow) brings along a controversy, but that should not be a reason why in other respects international agreement is postponed (picture and sound modulation, aerial polarisation, etc.).

Television policy always ought to be based on the science that in the near future international television is ineluctable. Taking this development into consideration we have to remember that changes in one way or another are to-day less expensive than to-morrow, since the cost of a switchover will increase in proportion to the television extension.

Neither the Continent nor Great Britain is served with television isolation, hence it should be a wise decision to continue international television discussion. Mass-production of television receivers on a large scale to reduce cost is only possible if we come to international television standardisation. Moreover, European co-operation and understanding (especially West European) is inconceivable without an international television programme exchange. Dutch television circles will deeply regret it if, for technical reasons, a direct contact with the British television service is not possible. The film medium is only a substituion for *real* television.—C. L. ZAALBERG (Overshie, Holland).

PICTURE PAGE

SIR,—You state that *all* viewers were disappointed when it was announced that Picture Page was to be discontinued.

You are greatly mistaken, because out of 32 viewers that I have mentioned various programmes to, 27 have told me that they are not interested in the Gilbert and Mitchell saga.

Quite a number of viewers are fed-up with the sameness of the Picture Page programme, and those of us who have been viewers for a number of years (also pre-war) can remember that each so-called interview is just a lot of rot.

Who wants to see the same type of programme year in and year out? How are we ever going to get better programmes when the Press starts to boost old and worn-out shows such as Picture Page.

We are gradually drifting back to "Seagull" and "Lady Precious Stream" days. Admitted that after the two repeats of the last-named bit of rubbish programmes did improve slightly. We *have* had some very good plays, the best of which was "Madame Butterfly."

We do not need so much so-called sport, although I never watch it, for my job is to service and sell radio and television receivers, but what can I do when I have to give a demonstration and the prospective customer says: "Well, if that's a sample of the evening's entertainment, I would prefer to save my cash."

Before you again say anything like that in your article, get the opinion of outsiders and take no notice whatever of the B.B.C.'s viewers' panel.—ALBERT E. WILD (nr. Salisbury).

TELEVISION MAINTENANCE

SIR,—The article in your July issue on the above subject conveys the impression that the particular form of Insurance is not in existence. I should like to point out that this Company is running such a scheme through dealers who are members of the Radio and Television Retailers' Association, from whom we have been able to obtain certain assurances and safeguards.—R. T. Sharpe (Managing Director, Telesurance, Ltd., 217, Westminster Bridge Road, S.E.1).

USING VCR97

SIR,—In reply to P. Jennings, with regard to VCR97 tube, I experienced the same trouble with regard to the tube's brilliance. The cure seems as follows: Referring back to Vol. 1 No. 6, connect up tube for double modulation (see Fig. 3, page 258). The 2 MΩ resistance between pins 2 and 3 of the tube seems to me very important. This method has given me satisfaction. —A. Rushton (Essington).

YOUR Problems SOLVED

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

LINEARITY

"I am having difficulty in my commercial receiver with linearity. The picture does not quite fill the area and at the narrow edge the objects are thinner and seem cramped up. Letters in captions and titles for instance are crowded and if anyone walks across you can see how they get thinner. I cannot control this with the linearity control. Can you say what component might be in need of replacement or how I can find just where to look for the cause of the trouble? The set is out of guarantee."—G. Rosen (Edgware).

You do not state whether the trouble is on frame or line, but in any case the same general remarks will apply. The oscillator in most time bases is of the blocking type and depends upon the charging and discharging of a condenser. The curve of such a device is exponential and it is thus necessary to pick out either the straightest portion, or so operate the oscillator that there is a substantially straight portion available. An amplifier usually follows this and this is adjusted to operate so that its curve is of opposite sign to the output of the oscillator and thus straightens out the curved portion, or distortion is avoided by using the small straight part of the oscillator output and merely amplifying this up to the required degree. Obviously, therefore, in the majority of cases the oscillator has to be operated to provide an output which matches the amplifier and you must therefore look in both stages to find the cause of your trouble. Generally speaking it is a question of the H.T. on the oscillator and the H.T. and bias (or feedback circuit) of the amplifier. We hope to publish an article in the next issue on the oscillator which will no doubt be of interest to you.

HOLME MOSS MODIFICATIONS

"I have been using my receiver in London for some time and am shortly being moved to the North of England with my firm. Before selling my set I should like to know whether this may easily be converted when I get there or whether it would be better to dispose of it. A friend who knows something about radio tells me that it may be usable just as it is, and in that case I should prefer to keep it as it is a very good little job."—G. Hendersen (Pimlico).

It is not possible to state definitely, but the following points should be considered. If it is a single-sideband London receiver it will undoubtedly have been adapted for upper sideband and the circuits may not lend themselves to lower sideband reception. Theoretically most London coils may be adjusted by means of the core to cover the Holme Moss frequency, but with the lower sideband reception greater selectivity would be needed to avoid sound channel interference, and additional circuits may have to be included in some areas to cut out adjacent channel interference. If it is a superhet some of these difficulties may be removed, but you should also bear in mind that as in the case of the Midland transmitter converters may appear on the market which will enable an existing receiver to be used without alteration merely by including the converter between the aerial and the receiver and adjusting this for the new station.

SMOOTHING CONDENSER LEAKAGE

"I have been experiencing a peculiar fault for some time and it takes the form of a gradual reduction in the brightness of the picture accompanied by a reduction in the width. The height does not seem to be affected, but the picture loses about 1in. over the width after the set has been on about an hour and I have to turn up the brilliance although this seems to degrade the tone of the picture. Do you think it is the tube, or how can I test where the trouble is? I have had the set just over two years and it has worked perfectly until just recently."—J. G. Homer (Southgate).

As you have used the set for a considerable period there is the possibility that one or more valves may need replacement or a condenser has developed a leak. Taking the symptoms and ignoring the period of use of the set, you state that the picture darkens and the width shrinks. The line time-base amplifier requires greatest "drive" compared with the frame, and thus a reduction in H.T. would be more noticeable on line than frame. Thus the line output valve could be suspected, and if fly-back E.H.T. is used, falling emission in this stage would result in reduction of E.H.T. However, this would generally be compensated for by the greater efficiency of the output valve with reduced E.H.T., so although it may be considered it is more likely to be something outside that stage and we would suspect reduced H.T. to the entire receiver or at least to the line time base as a whole. This would most likely be due to the main H.T. rectifier being in need of replacement or more likely to a leaky smoothing condenser which after being thoroughly warmed up develops a leak and the increased current drain results in a falling of the H.T. voltage. Checking is most easily carried out by connecting a good voltmeter across the H.T. negative and positive of the receiver and noting whether the reading falls when the decrease in scan takes place.

CATHODE-HEATER SHORT

"My set has developed an annoying fault which I have been told means a new tube. Some nights when we switch on after a few seconds the tube lights up bright all over with no picture. I find now that if I leave it for a while it may go off and be normal for the rest of the evening. Some nights it won't go off unless I switch it off, leave it for a few seconds and switch on again. I may have to do this several times, but eventually everything is all right and we can leave it for the rest of the evening with no trouble. Can you check this fault? The set has been in regular use for about three years."—H. Watts (Basingstoke).

The trouble is either cathode-heater or cathode-grid leakage in the C.R. tube. Trouble such as this is best overcome by using a separate heater transformer to feed the tube, and leaving the heater "floating," that is, not connected to earth. A high resistance should be connected between cathode and heater to remove the potential difference between these two elements. This will not, of course, assist in a grid-cathode leakage, but this is the rarer of the two faults. Gas will have been produced in the tube and this can be removed,

but is a risky business and there is a danger of destroying the tube which may give some further period of service if the above change alone is made. If it can definitely be traced to be grid-cathode leakage you can, if you are prepared to take the risk, try the effect of running the tube with heater voltage alone (no signal or E.H.T. voltage) for a short period. Cathode-heater leakage requires "flashing" to produce a probable cure, but these ideas should only be tried out if the tube is very bad and you are prepared to buy a new tube if they fail, as at the best they are merely "stand-bys" for a faulty tube.

AERIAL EXTENSIONS

"My receiver was installed in the front of the house, as this is the room we use during the summer, but with the approach of the darker nights we shall be going back to the other side of the house and I would like to take the television set into the back room. I find, however, that, although there is a suitable power point and earth connection, the aerial lead which is fitted will not permit the set to be moved. Can I join a length of wire on to the present aerial and leave this coiled up now so that the receiver can be moved about without affecting the picture?"—J. Prentice (Northampton).

Theoretically, the answer is "Yes," but there are one or two provisos. Firstly, the added aerial length must be of identical material to the present lead, that is, you must not join twin feeder to coaxial or vice versa. Endeavour, if possible, to obtain exactly the same make of lead to avoid any risk of different characteristics. Do not attempt to solder or otherwise make that type of connection, firstly on account of the risk of modifying the resistance, and secondly because of the difficulty of making insulation at the joint. Obtain one of the special junction pieces such as are supplied by Belling Lee, for instance, and then plug in the additional length. In theory you should be able to add quite a decent length of feeder without noticeable effect on the picture, but if it does make any difference it should only be to the setting of the contrast control.

OSCILLATOR DRIFT

"My receiver has been in use for 18 months and has always suffered from a fault which I thought was natural to the set. When I switch on, after the appropriate warming-up period, everything is satisfactory. Towards the end of the usual evening period, however, the picture becomes slightly 'cloudy,' and there is marked distortion on speech. It is not so bad that we can't use it, but as it is only usually the last half an hour or so we thought it was there all the time and we were just noticing it. Now a friend tells me that there is a fault which should be put right. Can you assist me in deciding upon this? I am afraid I cannot give any technical details other than to say that the picture does not go out of focus—simply 'clouds' and the speech becomes slightly sibilant."—H. Gorden (N.W.9).

We think from your description that the receiver is a superhet and that there is a slight oscillator drift. The frequency bandwidth of the picture appears to vary as the focus remains satisfactory, and the sibilant effect on speech would appear to be sideband cutting, which is experienced when a circuit is slightly off-tune. As this occurs together with the vision tuning, the inference is that circuits common to both vision and sound are affected and in view of the wide bandwidth found in T.R.F. circuits the most likely answer is that a single tuning circuit is affected and this is most likely the oscillator. Warming up of a resistor could cause this, or the oscillator valve may be in need of replacement.

AERIAL DIRECTION

"In my district there is a distinct shadow which I find my neighbour gets as well. Our aerials are opposite each other in a dual garage-way between the houses, and both are pointed correctly as checked with a compass. Is it possible that they can affect each other, and if so, how can we avoid this?"—G. Brandon (N.W.3).

As you refer to the checking of a direction, we assume that the aerials are of the "H" type, as single dipoles do not point in any particular direction. Therefore the two aerials should be parallel to each other and unless they are in line with one another and the signal they are unlikely to affect each other, and the shadow to which you refer (which we presume is a "ghost") must be due to some local metallic structure or the normal ground contour. We suggest that the position of the aerial (probably in both cases) should be changed, looking at the picture whilst someone moves the aerial, until the ghost is removed, ignoring the geographic direction of the transmitter.

EF50 VALVES

"I made a receiver similar to your design some time ago in which I used the EF50 ex-Service valves. I have had considerable trouble with all kinds of faults, all attributable to the valves. They do not seem to keep firm in the holders for one thing and I find that they have to be run much lower than their rating. I had great difficulty in stabilising the circuit to start with and after the set has been on it suddenly goes off and you have to move the valves about to get the picture back. Is this usual with this type of valve?"—B R. Ferguson (Cambridge).

The only point which we have found to be rather doubtful about this type of valve is the connection of the suppressor grid. In some arrangements it is definitely preferable to connect this direct to cathode, whilst in other arrangements it has been found better to connect it direct to earth. The arrangement of the screening and the connections to the two screening pins may also cause a little confusion, but should not create any great difficulty. It is possible to obtain springs or screw rings which will hold the valves firmly in some valveholders in which the sockets are not sufficiently rigid, but there is a paxolin valveholder available in which no such locking ring is required, and no trouble should be experienced due to valve movement.

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