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JUNE: 1957

AND TELEVISION TIMES

EDITOR: F.J. CAMM

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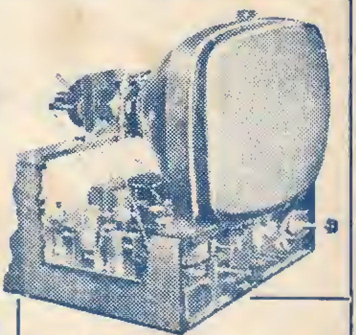

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

Vol. 7 No. 83 EVERY MONTH JUNE, 1957

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

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

TELEVIEWS

COLOUR TV IN AMERICA

An extraordinary situation has developed in America as a result of the too-early publicity relating to colour television. The American public was led to believe that it was just round the corner. As a result, the sales of black and white receivers dropped considerably and several of the large companies were therefore forced to cut their prices below cost in order to clear their stocks. Some of the large firms, such as Columbia and Raytheon, decided to cease manufacture of television receivers, and they disposed of their stocks at low prices. Other manufacturers were forced to follow suit. At the same time, R.C.A. was indulging in an intensive campaign of propaganda on colour television, and its associated network, N.B.C., was putting out three hours of colour programmes a day. As a result, the American public presumed that colour television was near and they declined to buy black and white receivers.

As all manufacturers had cut the prices of black and white receivers, a price level was established for that type which was not really representative of the true value, and so there is a great disparity between the market price of a black and white receiver and a colour receiver, the former costing about 160 dollars and the latter 500 dollars. The American public is therefore not prepared to pay what it wrongly considers to be too high a price for colour TV.

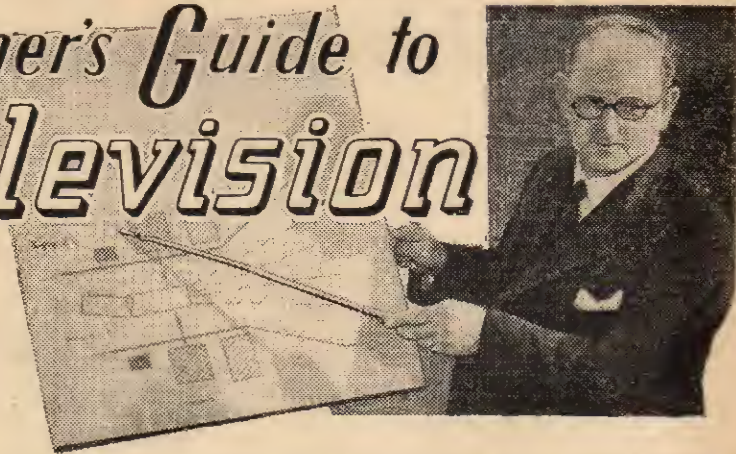
The inevitable result is that there is now only one manufacturer in the market, R.C.A., which manufactured only 102,000 colour sets last year ; yet three years ago, Sarnoff publicly stated that he had budgeted for an annual production during last year of over 6 million colour TV receivers ! It is not surprising, therefore, that the American television industry is in a very bad way. Those who have tried to receive the colour television programmes on black and white receivers, especially those a long way from the transmitter, complain of the poor quality and that the pictures are full of dots and distortion. Equally, reception of black and white transmissions on a colour set is inferior. It is well-known that colour television receivers are troublesome and require a great deal of servicing, and the service engineers do not exist in sufficient numbers. This country can take a lesson from America in this respect and manufacturers should cease to talk airily about colour television being round the corner, if they do not wish to duplicate the American experience.

Although colour television is inevitable it will be some years before it has been brought to the stage where it possesses entertainment value, and the technique at present will need considerable improvement—possibly an entirely new system—

F. J. C.

Our next issue, dated July, will be published on June 21st.

A Beginner's Guide to Television



TECHNICAL TERMS (contd.)

By F. J. Camm

Image Drift

A TERM referring to the drifting movement of the received image on a television screen which sometimes occurs in consequence of slight lack of synchronisation.

Incident Ray

Name applied to any ray of light which falls upon an object or medium.

Indirectly Heated Cathode

A cathode heated by an electrically separate element known as the heater.

Intensity Modulation

The usual method of modulating the output current of a television transmitter by means of variations in the intensity of the light reaching the photo-electric cell of the transmitter.

Intercalation

Synonymous term for interlacing, as related to television scanning.

Interlaced Scanning

A system of exploration of the scene or image in which complete scanning is accomplished in two or more operations, the strips of scanning field successively traversed in the course of one operation not being contiguous. During subsequent operations the lines previously omitted are scanned according to some set rule or order.

Ion

An atom which has been stripped of one or more of its electrons. See Ionisation.

Ion Burn

The dark patch which forms on the face of a tube due to its bombardment with the heavy ions of the electron beam. Avoided by using an aluminised screen or an ion trap.

Ion Trap (Beam Bender)

A small magnet placed at the rear of the neck of a specially made tube to prevent ion burn. The gun is not straight in this type of tube, but is offset so that the beam would normally fall outside the face of the tube. The magnet deflects only the lighter part of the beam and brings it, when properly adjusted, on the face in the normal manner, but the heavier ions carry on the original path and thus do not strike the screen.

Ionisation

In television terminology this expression refers to the production of "ions" within an electric discharge tube such as, for instance, a neon tube.

The neon tube contains a small proportion of neon gas. An electrical discharge passed through the tube strips away some of the outer electrons from each atom of neon gas. Owing to the loss of negatively charged electrons, each atom of neon gas shows a positive charge and it is called an "ion," the electron-stripping process to which it has been subjected being termed "ionisation."

Ions are electrically conductive. Hence, when they are present in comparatively small numbers within a gas discharge tube, they allow the current to pass and they give off a characteristic glow. The glow of electrically excited neon ions is, as is well known, a pinkish-orange shade.

Isochronism

The operating condition which obtains when the reconstruction of the image and the scanning of the object occur at the same time.

Light-sensitive Cell

A general term applying to any electrical device which, on illumination, undergoes a modification in its electrical properties. All photocells are included under this general definition.

Magnetic Focusing

Term referring to a method of focusing the beam of rays in a cathode-ray tube by placing an electro-magnetic coil in their path.

Lissajou's Figures

Any closed figures traversed by a point moving with the resultant of two periodic oscillatory motions at right-angles. Originally applied to certain experiments in connection with pendulums and sound, but now used for a class of records of this nature by such instruments as the cathode-ray oscillograph.

Low Definition

A system of television in which the number of scanning lines into which the complete picture is divided is less than 100. Low definition systems are now obsolete.

Mirror Drum

An obsolete scanning device employed in some early television systems. Essentially, it consisted of a drum-shaped wheel having fixed upon its periphery or outer edge a number of mirrors, each

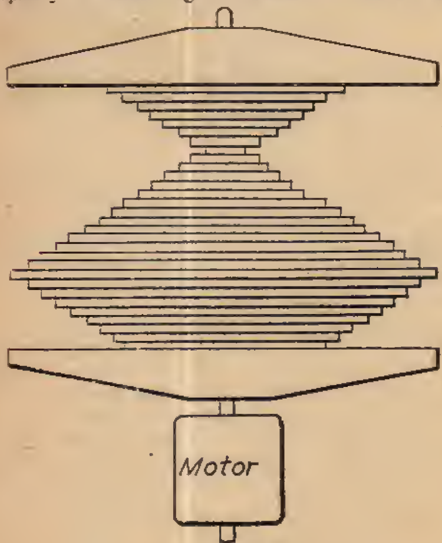


Diagram of a mirror screw.

mirror being tilted at a slightly different angle from that of the preceding mirror. A beam of light is suitably focused upon the edge of the mirror drum, which is rapidly rotated, thus causing a light spot to be flashed in successive lines over the image or object to be televised.

In a similar way, also, the mirror drum is made to assemble the televised picture at the receiving end.

The main advantage of the mirror drum is that it allows a more intense spot of light to be focused upon the object.

Mirror Screw

Another obsolete scanning device comprising a number of mirrors arranged on a frame in the form of a screw spiral. Unlike the mirror drum (which see) the mirrors are not separately tilted in relation to one another, the directing of the light spot on the screen or on the object to be televised being effected by the suitable and exact positioning of the mirrors on the spiral.

The mirror screw does not reflect the light as does the mirror drum. It has, however, the advantage of greater compactness.

Multiple Scanning

Expression referring to television systems in which two scanning devices, as, for example, two mirror drums, reflect the televised picture on to a screen, the object of these methods being to increase the intensity of the illumination on the screen.

Negative Image

An image resembling that shown by a photographic negative, i.e., one in which the light parts of the original picture are dark and the dark portions of the original are light. It is the opposite of a positive image.

Some television receivers will give rise to negative images on their screens when a fault or maladjustment is present in the electrical circuit of the receiver.

Neon Timebase

Name given to a timebase circuit in which a neon lamp provides the means of providing a periodic voltage across one pair of deflector plates in a cathode-ray tube.

Nipkow Disc

Name sometimes given to the scanning disc employed in many television systems. It was originally the invention of the Polish scientist, Paul Nipkow, in 1884. Nipkow employed it in the crude shadowgraph transmitters with which he experimented at the end of the last century.

Objective

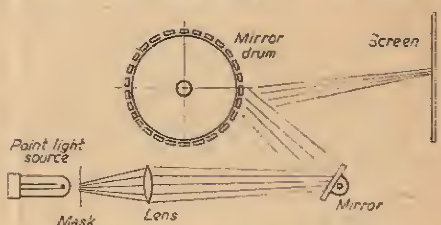
A frequently used term which denotes the image-forming or projecting lens of an optical instrument, as, for instance, the projection lens of a television or film/television apparatus.

Orthicon

The special camera used for television. The American name for the Emitron camera.

Oscillatory Scanning

Name given to scanning methods by means of which the light spot oscillates or travels forwards and backwards over the image to be televised. After each complete oscillation the light spot shifts laterally,



Details of the mirror drum projector.

thus enabling the new area of the picture to be scanned. Oscillatory scanning possesses many practical disadvantages.

Oscillogram

Name given to the wave-like pattern, representing the graphical form of an alternating current, which is traced out by the light spot on the fluorescent screen of a cathode-ray oscillograph tube.

Oscillograph

See cathode-ray tube.

Out of Frame

The state of a televised image when, as seen on the screen of the receiver, it is divided horizontally or vertically, the two portions of the image appearing in opposite positions. The image is correctly "framed" by the manipulation of a small control which influences the synchronising gear of the receiver.

Parabolic Reflector

Name given to a light reflector, usually of highly polished metal, which, being shaped to a parabolic curve (a parabola is the section of a cone cut parallel to one of its sloping sides) causes a beam of parallel rays to be reflected from an illuminating source placed in the focus of the reflector.

Parabolic reflectors are frequently used for obtaining strong beams of parallel light rays in optical experiments connected with illuminating and light-projecting matters.

Parallel Rays

Light rays which travel parallel to one another, as, for instance, the light rays reflected from a parabolic reflector. Light rays coming from a very distant object, such as the sun, are always parallel from a practical standpoint, although, in strictest truth, they are very slightly divergent.

Persistence of Vision

When light rays impinge upon the retina of the eye the impression which they make does not cease immediately the light rays stop. On the contrary, it persists for an appreciable time afterwards, this effect being known as "persistence of vision," or "visual persistence."

It is upon this "lag of the retina," as persistence of vision is sometimes called, that we are able to build up a reproduction of motion on the television or cinema screen, in both instances a series of successive pictures (each differing slightly from the preceding one) being formed or thrown on a screen so rapidly that the eye is not able to get rid of the impression made by the one picture or image before the next one arrives.

Phase Shift

A condition in television reception in which, owing to stray circuit capacities in the receiver, the fluctuations in voltage do not keep in step with those originally transmitted, particularly at high and at low frequencies. This results in some of the details of the televised picture being received at a later instant of time than the remainder of the picture, thereby setting up a displacement or distortion of the televised image.

Photo-electric Cell

A light-sensitive device which, by emitting a stream of electrons under the influence of light rays and in proportion to the amount of light falling upon it, enables light to be turned into electricity.

Photo-electric cells are of two kinds, viz., the Emission type and the Photronic or self-generating type.

Photo-electrons

Name sometimes applied to the stream of electrons which are liberated from certain bodies under the influence of light.

Photo-electric cells operate in virtue of the presence within them of a stream of photo-electrons whenever they are illuminated by light rays.

Picture Elements

Name given to the minute areas into which a picture, portrait, or scene which is to be televised is split up by one means or another. The picture elements are all of the same size, but they differ in brightness. The portion of the scene which determines or is determined by the instantaneous value of the signal current.

Picture Frequency

The number of complete images transmitted per second.

Polarisation

Applied to light rays the term denotes the cutting off of all the rays in a beam of light except those which vibrate in one plane. Light consisting of these one-plane vibrations is said to be "polarised" and, in such a condition, it possesses peculiar properties of its own. Light rays are usually polarised by passing them through certain crystals, such as Iceland Spar, which effect the process automatically.

Positive Image

The image as it is normally seen on a television screen. A photograph or any other type of illustration is a positive image, the lights and shades of it being a true or approximate reproduction of those of the original. A positive image is, as its name implies, the opposite to a negative image.

Primary Current

A term used in connection with gas-filled photoelectric cells to signify the actual minute current set up by the impact of light upon the sensitive cathode of the gas-filled cell.

Prism

A triangular-shaped piece of glass or other transparent material used in practical optical work for bending rays of light through a right-angle, and also in the spectroscope, for splitting up rays of light into their component colours.

Progressive Scanning

A system of exploration of the scene or image in which continuous strips of the scanning field are traversed in order.

Raster

The rectangular picture area built up by the scanning spot on the end of the cathode-ray tube.

Recurrent Vision

Name given to the phenomenon of an image recurring one or more times to the eye after the actual light rays from the object have been cut off.

Recurrent vision was first noted by Young in 1801, who observed that after an object had been intensely illuminated by an electric spark, the image recurred to the eye several times after the spark had passed, the image becoming fainter with each successive recurrence.

Reflection

The recoil of light rays from the surface on which they impinge.

(To be continued)

AN AUTOMATIC TV CLOCK

A MECHANICAL DEVICE FOR SWITCHING ON OR OFF A TV OR RADIO SET

By Michael Dunn

IT can so easily happen in a large and busy family that the beginning of a much-desired television (or radio) programme is missed, simply because nobody remembers to switch on at the right time; in fact, it is sometimes remembered only after the entire programme has ended. With the device to be described it is possible to set the timer at leisure, any convenient time prior to the programme, so that it will switch the set on automatically at the desired moment. It has proved its value over and over again.

Essentially the unit consists of an "alarm" clock which will switch on the set and an auxiliary circuit which will maintain it switched on indefinitely. Although the following details refer to the writer's own model, the principles involved can be subject to personal variation and improvement, both as regards the choice of components and the general layout. The entire unit was made from oddments already to hand and it is, therefore, not really possible to estimate the total cost. For instance, the telephone bell box was purchased on the surplus market for ninepence, is very nicely made in solid mahogany and makes the finished job look most professional—at any rate from the outside. The central feature is the electric alarm clock movement and it is around this that the circuit is designed. The telephone bell box was found ideal for the purpose and hangs on the wall beside the radio, serving also the additional function of telling the time. Being easily transportable it can also serve as an ordinary alarm clock, since the bell was retained *in situ* and switched in parallel with the output. The bell can, therefore, serve the very useful purpose of calling the family from remote parts of the house or garden, at the same time as the set is switched on.

The original idea was simply to use the clock to switch on the television, but it was soon realised that a great improvement would be effected if the set could be kept on indefinitely and this is done by utilising the current drawn from the mains by the set itself to drop a few volts which will operate a relay.

The best way to describe both the layout and the function of the unit is to follow the circuit diagram (Fig. 1). It will be seen that it interrupts the mains supply to the set, but that for normal operation there is a by-pass switch which simply short-circuits the automatic timing switch circuit so that the TV can be turned on and off by its own switch in the usual manner. The clock, however, is permanently connected to the mains so that it keeps and tells the correct time. When wishing to make use of the automatic switching, the procedure and mode of operation are as follows:

1. With the by-pass switch closed, turn on the set in the normal way and tune to the desired station. The volume can then be adjusted to optimum level.

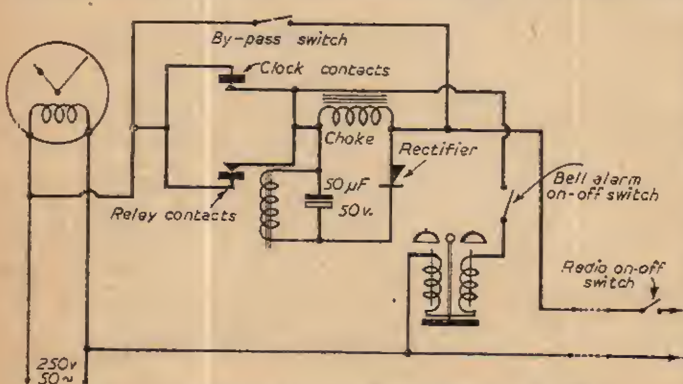


Fig. 1.—Theoretical circuit of the automatic clock switch.

LIST OF COMPONENTS

(1) Electric alarm clock movement (or equivalent electrical timing device).
(2) Dial, hands, bezzle and glass for same (optional).
(3) Suitable low impedance inductance (see text).
(4) Metal rectifier: 12 volt 0.25 amp. or less (optionally F.W.).
(5) Low voltage relay (less than 12 volts).
(6) By-pass switch. S.P.S.T. toggle.
(7) Electric bell (optional).
(8) On/off switch for same. S.P.S.T. toggle.
(9) Capacitor. 50 µF, 50 volts working (or less), electrolytic.
(10) Container.

(Of course, if the station is not on the air at the time as, for instance, during some parts of the day, this will have to be done by eye and not by ear.)

2. Leave the set switched on, but open the by-pass switch which will effectively separate it from the mains.

3. Set the alarm clock indicator to the time of the desired programme.

At the appropriate moment the clock contacts will close and switch on the set. This will draw current through the inductance, across which will be dropped from six to 12 volts which, after rectification, operate the relay whose contacts are in parallel with those of the clock. Thus the set will remain switched on independent of the clock contacts, which will eventually open again and otherwise break the circuit. When the set is switched off (e.g., at the end of the programme) current will cease to flow through the inductance, the relay contacts will open and the cycle of events will return to its starting point. The set cannot, then, be switched on again until the by-pass switch is closed. Because the set is independent of the clock contacts the moment the relay has closed, the timing indicator may be re-set any time after that for a further programme if desired; or alternatively the by-pass switch may be closed for normal operation.

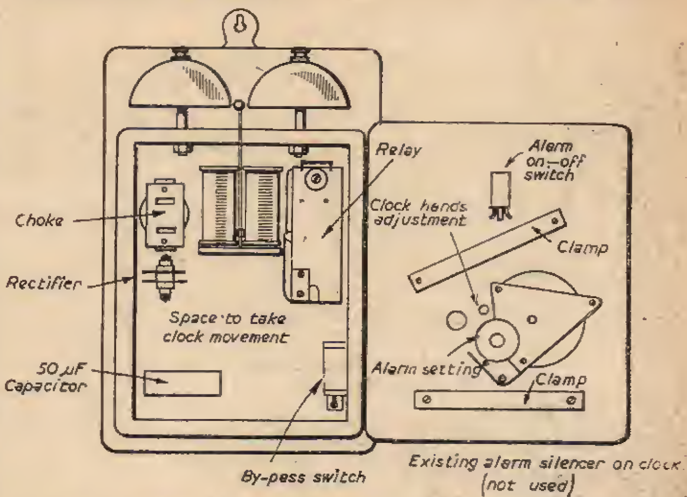
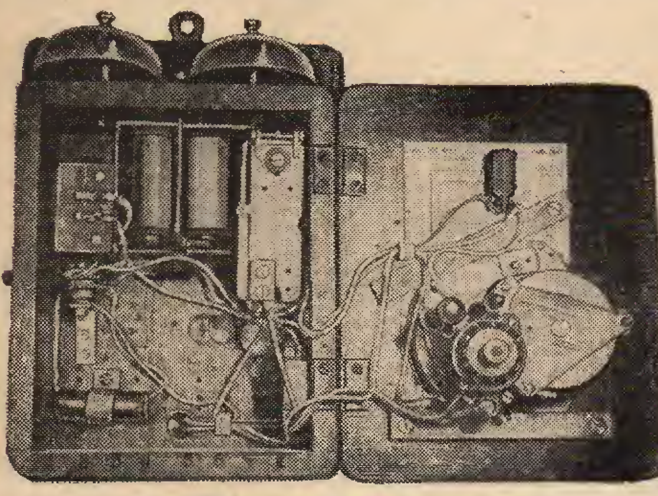


Fig. 3.—Details of the parts. The silencer is the large central circle.



A view of the clock as shown in Fig. 3 above.

This timing unit can, of course, also be used to switch on any relatively low-powered apparatus at a predetermined time. If one considers the mode of working, it is manifest that the initial flow of current is made by the closing of the clock contacts—those of the relay closing a fraction of a second later when the current is already flowing. The current is *broken* solely by the on/off switch of the set (or other relevant apparatus) itself, so that neither the clock nor the relay contacts ever have to *break* the current. The power limitations of the timer are, therefore, those of the capacity of the clock contacts to *make* the circuit and of both these and those of the relay to conduct it. So long as these are robust, it can serve many useful purposes as a delayed action switching device.

Components and Constructional Details

The clock movements used by the writer was an old one from a disused Smith's alarm clock. As it had no dial or hands these were provided from another broken and useless (mechanical) clock of suitable size. A circular hole of the right diameter was cut in the door of the box so that the glass and bezzle fitted friction tight. The dial and hands were fitted to the movement which was then clamped to the inside of the door so that it appeared quite central.

(*Concluded on page* 528)

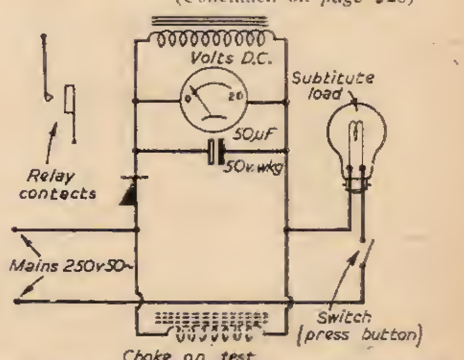


Fig. 4.—Experimental circuit for obtaining suitable value of inductance.

set-screws, through exact centre of each slot.

Next cut out the short wood block. The author used ordinary wood dowelling to fix after treating the block with glue.

The ¼in. Perspex panel can then be cut out and drilled with the four holes, two being to attach the panel to the block, and two to fix the dipole back to the panel. Plywood could be used instead of Perspex without much loss, but the plastic will be found less likely to warp.

Cut the directors to the correct lengths from the ⅜in. duralumin tubing, and the reflector from the ⅜in. copper tubing. Cut off a sufficient length of copper tubing for the dipole, the details of which are shown in Fig. 1. This is quite a tricky business especially the bending, and a full-size paper drawing should preferably be made, as shown in Fig. 1, but without dimensions. As the bending proceeds this will act as an accurate guide or template. A piece of string measured around the outside of the drawing will give the exact length of tubing required. Do not worry too much if the tube is somewhat out of its true tubular section on the bends, and the author's does actually appear flatter at the bends than shown. Heat can be used, but care is required, as copper conducts heat very readily and unlike iron or steel the metal is softened if quenched in water. When exactly to shape, cut out and drill a piece of copper sheet for the flange, drill this with fixing holes, and sweat it in position at the top of the lower limb. A soldering iron is useless for this job, and it can only be done by heating the job over a gas flame, or by use of a blowlamp.

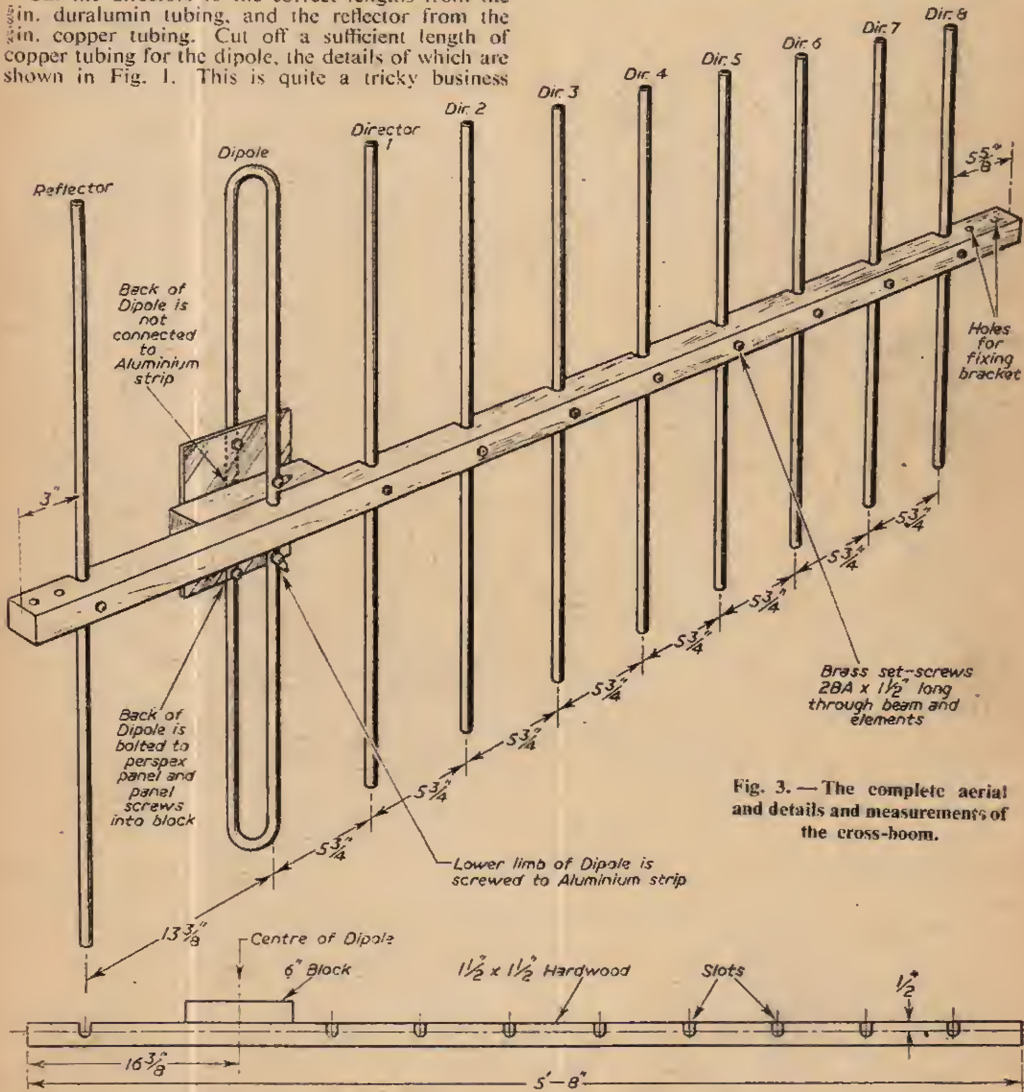


Fig. 3.—The complete aerial and details and measurements of the cross-boom.

Drill each director at its exact centre, also the reflector. Aluminium foil was used by the author for the conductor, and this can be purchased in several yard lengths as cooking foil. Cut to the full

1¾in. width, and about 8ft. long or more. Start from one end, and push into each slot, and fixing each director as you go along.

It is necessary to change from side to the underside of the beam for connecting to the lower limb of the dipole. Fig. 2 shows how this is done by four simple folds: no cutting is necessary. Some brass washers may be inserted under the cheese heads of the fixing set-screws, but if the hardwood is a good one they should not be necessary.

It will be noted that a sufficient length of beam has been allowed for, for fitting fixing brackets, although it is quite possible the aerial can be supported on suitable rafters if the direction of the aerial allows.

There are some readers who may prefer to make light trestles for each end. It is important, of course, to get the beam quite horizontal and the elements vertical.

The tubing lengths as used by the author are given below.

1 Dipole = 2ft. 2¾in. As this is folded, *over* twice length should be taken to allow for bending radius.

Reflector = 2ft. 4¼in.	Director 5 = 1ft. 11⅜in.
Director 1 = 2ft. 1⅞in.	Director 6 = 1ft. 10¾in.
Director 2 = 2ft. 1¼in.	Director 7 = 1ft. 10⅛in.
Director 3 = 2ft. 0⅝in.	Director 8 = 1ft. 9½in.
Director 4 = 2ft. 0in.	

Spacing between Directors = 5¾in.

Spacing from Dipole to Reflector = 1ft. 1⅜in.

The aerial described was used in conjunction with a Marconi Model VT.53DA and their special converter type T2211, and it was found to tune in correctly to Channel 9 division of the converter's dial. Pick up was about equal to that of Channel 1, (also in loft) a slight adjustment of contrast control on unit only being necessary once to give an equal picture on both bands for switching purposes.

Additional Notes

The author would stress the point that this aerial was designed primarily for loft or indoor use, and it should not be erected outside where weather conditions would soon warp the wood beam.

When the beam has been slotted and drilled it should be given a coat of shellac varnish. This can be easily prepared by dissolving flake shellac in methylated spirit. This varnish dries quite quickly, and will help against any dampness warping the beam.

Stout brass screws should be used to fix the panel to the block, and make sure the panel, and dipole, are quite perpendicular. A piece of copper wire passed under each of the two screws and under the back tubing only of the dipole, is a small precaution against the possibility of ghost images caused by unconnected metal. This latter point brings up the question of loft junk. Have a look round, and remove any large metal objects lying around which might cause unwanted reflections. Old stair rods, if metal, are not helpful.

If one has a Channel 1 BBC aerial already working in the loft, some experiment will be necessary to find the best location for the new Band III aerial. The latter being more directional will, of course, be restricted to almost one definite angle.

The directors should, of course, be pointed towards the transmitter, with the reflector the farthest away.

Use good coaxial cable for this type of aerial. There is a special air spaced type, having approximately a ¼in. outside diameter. The conductor is stranded copper, and this is another point to guard against in purchase. There are types with a solid single strand core conductor. Whilst satisfactory for the BBC band this type can cause losses on the higher frequency of Band III.

In purchasing copper tubing the inside diameter is usually referred to. It will be found that ½in. tubing measures about ⅝in. outside, ⅜in. tubing equals about ½in. outside and so on.

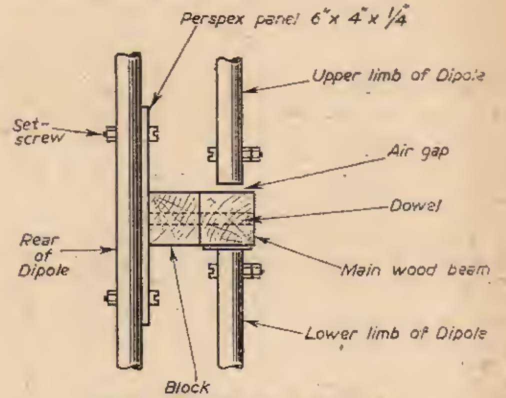


Fig. 4.—Details of the dipole gap.

If it is proposed to silver plate the copper tubing elements, dipole and reflector, the plating operation should be left until last, after all drilling, bending and sweating work is completed. The thin silver skin given by the simple plating powders will not take a lot of after friction, although, thin though it is, this type of plating does give a definite increase in efficiency, so desired in indoor aerials. After plating, remove excess chemical salts by a very light sponging with clean cold water. Do not scrub, of course, or light plating will be removed. There is little object in giving the tubes a heavier electro-plating, and that would, of course, be quite an expensive item. Keep coaxial lead clear from electric wiring cable.

Scottish Radio Show

VISITORS to the Scottish Radio Show, Kelvin Hall, Glasgow, May 22nd to June 1st, will be assured of seeing television pictures at their best. The Exhibition Technical Committee of the Radio Industry Council has made arrangements with the G.P.O. and the BBC for a vision circuit—a special land line—to be available between Kirk o'Shotts and the R.I.C. control room at Kelvin Hall, from which suitable programmes will be piped around the television receivers in the exhibition. There will also be a link between the BBC arena at Kelvin Hall and the R.I.C. control room to provide programmes at other times. And the BBC are planning an additional source of pictures—a dais for celebrity interviews equipped with TV camera.

For the alternative (Band III) television circuit, Scottish Television are to have two tele-cine equipments and two cameras providing popular TV programmes, including films—some of them current on commercial programmes in England—and live pictures from their celebrity dais.

The exhibition, of course, is too early for programmes from the I.T.A. transmitter at Black Hill.

A C.R.T. Quality Tester

ANOTHER VITAL ACCESSORY FOR THE SERVICE WORKSHOP

By J. Brown

CATHODE RAY TUBES and their condition always offer a query to both amateur and professional service engineers. We all know the 100 per cent. test is to replace the suspect with a "known to be good" tube. This means a large stock of C.R.T.s or the monotonous job of dismantling two sets to try the good tube from one. This is not possible to a busy firm or the Ham (who repairs the odd set), as there are at present no fewer than 40-50 tubes in use in various sets. The writer, however, decided to try and solve this "quality of C.R.T.s" problem: after many types of circuits, the circuit that developed is, as far as is known, completely original and most successful. Various modifications were made to the prototype and the final circuit is shown below. The circuit includes both quality test, also electrode shorts test, these are all carried out with the *Heater* at operating temperature. There is also included a method for reactivation or over-running the heater. At this stage, it should be pointed out that this has only been successful in one case out of 16 that were tried; however, this can be carried out at the last resort.

The Circuit

This is normal circuitry, using a small half-wave metal rectifier circuit to supply the small amount of D.C. voltage needed for the operations, there is perhaps unusual switching, also the transformer if built as the final instrument would have to be wound; the cost would be about 30s. Fig. 1 shows the original circuit. This used as the heater supply an Avo valve tester: any valve tester would suffice as the heater supply; this saves the cost of the transformer.

The Method of Operation

To set up to read quality, S1A-D is switched to the No. 1 position, heater voltage set to suit the tube under test, the tube is connected to the correct holder and the instrument switched on. As the heater warms up to the operating temperature, the meter needle moves to the position, giving the cathode current. Examples of readings are given as below.

A 14in. tube with poor emission and poor focus read 20 μA.

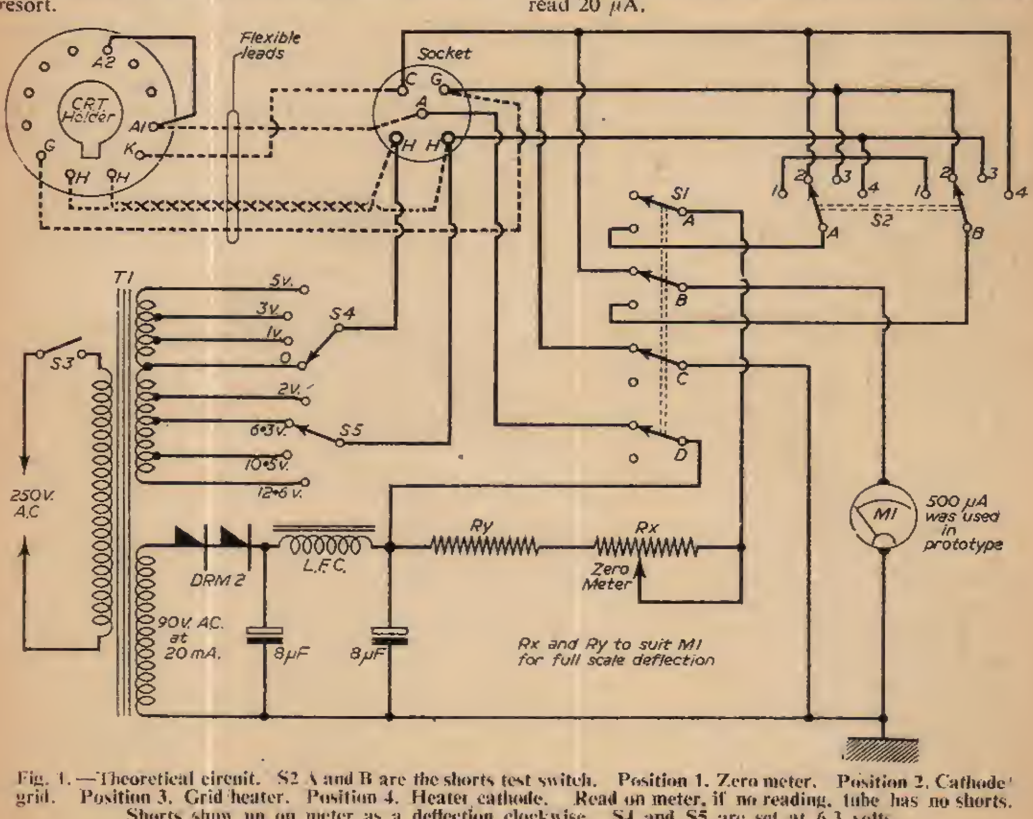


Fig. 1.—Theoretical circuit. S2 A and B are the shorts test switch. Position 1. Zero meter. Position 2. Cathode grid. Position 3. Grid heater. Position 4. Heater cathode. Read on meter, if no reading, tube has no shorts. Shorts show up on meter as a deflection clockwise. S4 and S5 are set at 6.3 volts.

A 14in. tube *brand new* gave a reading of 150 μA.
A *reactivated* tube read 70 μA after 33 mins. of reactivation (previous 25 μA).
A 17in. tube low in emission read 25 μA.
A 17in. new tube read 400 μA.

To Reactivate

Set up as explained, with switch S5 set at the correct voltage, take the quality reading. Switch S4 to 25 per cent. increase, e.g., if tube is 6.3 volts, switch S4 to increase the voltage to 1 volt boost, reactivate for a period and take the reading, if the reading has increased try in the set again. If still no good, increase the boost volts to 3 and reactivate again. This is the maximum of boost 50 per cent., this must never be exceeded at any time. The tube need not be removed from the set during this process. As explained there has been only one success this being a 12in. with poor brilliance. The tube was reactivated for 40 mins. at 2 volts plus 1 volt boost, and the reading increased from 20 μA to 70 μA and the tube gave another 10 months of useful life. The voltage for this test should be approximately 90 volts, at the choke. The meter used was a 500 μA surplus movement, but a 1 mA would be O.K., although the readings would be different and would have to be set up using tubes known to be O.K. These readings are tabulated in a little book for use when required.

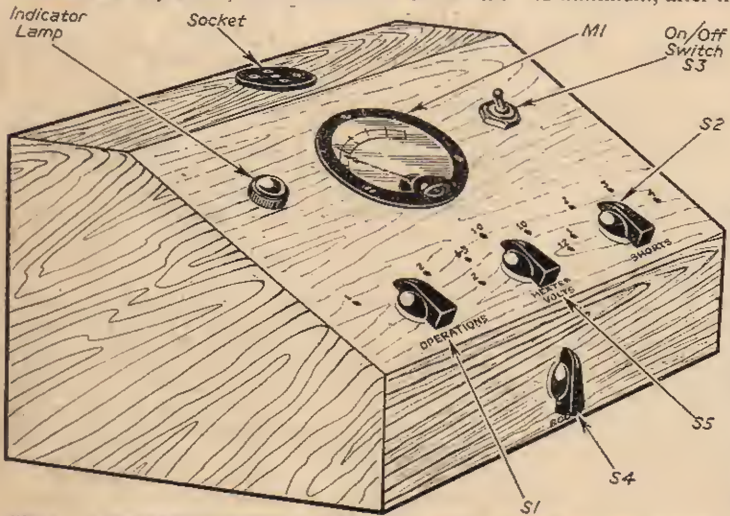


Fig. 2.—A suggested containing case for the tester. S4 should also have a scale.

To Set Up for Shorted Electrode Readings

Switch the instrument on with the zero pot, control to minimum, after the switch is in Position 1.

Position 1. Zero meter
Position 2. Cathode / Grid short.
Position 3. Heater / Grid short.
Position 4. Heater/Cathode short.

The meter is now zeroed up by adjusting the pot so the meter reads full scale. The voltage is not enough to damage the electrodes. Should at any time the meter read below half-scale the tube is doubtful, if it reads low (back to the settled position) there exists shorts. The switch S2 A and B can be switched to the three positions 1, 2, and 3. Any reading will give the state of shorts at the particular electrodes. Example: A 12in. tube read 90 μA on the scale, there was very little definition and was found to have a cathode heater short. The actual resistance with an ohmmeter 26 ohms from one side of heater to cathode and 11 ohms the other. *Again emphasising these tests are carried out with the heater at the correct operating temperature as opposed to shorts trying to be found with an ohmmeter.*

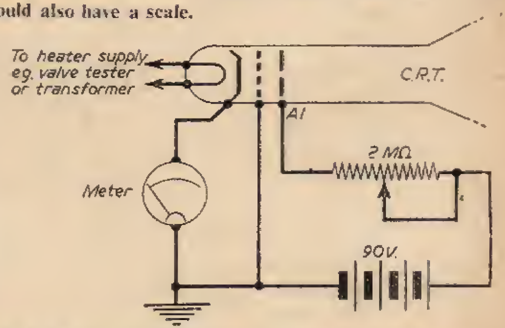


Fig. 3.—The meter may be used in the grid circuit to read grid current, but this was not successful, so the meter was placed in the cathode circuit.

The 5-pin plug and socket is used, so that tubes of different bases may be tested by using extra leads and base to suit the tube. For example: Duodecal Base requires one lead, English Bases tubes use another lead, etc. This little instrument can prove its worth in a short while, as the tube quality can be tested without removing the tube from the set or carton. Whilst it is not claimed 100 per cent. infallible it gives a true report on the quality if used correctly and tabulated figures are available.

COMPONENTS

Mains transformer Special Type. Wound by Majestic Winding Co.
1—DRM2 metal rectifier.
1—Receiver type smoothing choke.
2—8 μF 250 volt working condensers.
RY and RX to suit meter used (RX was 100 K wirewound and RY was made a 1 Meg. variable also.)
S4 Single-pole 4-way.
S5 Single-pole 5-way.
S1A-D 4-pole 2-way.
S2A-B 4-way 2-pole.
500 μA or 1 mA meter.
5-pin socket and plug (similar to the type used on batteries).
Tube holders.
Toggle switch for on/off switch.
Nuts, bolts, wire, etc.
Containing case

A Projection TV Improvement

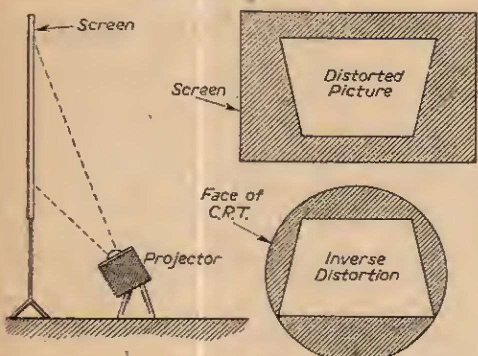
AVOIDING DISTORTION WHEN SCREEN AND OPTICAL UNIT ARE NOT PARALLEL

By A. M. St. Clair

PROJECTION television, once hailed as the answer to the simultaneous achievement of economy and big pictures, seems to be on the wane. Yet many serious writers are agreed that if colour is to achieve popularity it will be through a projection system. Certainly the cost of a 21in. colour tube must remain for many years a prohibitive factor. It therefore behoves the amateur, so often the prime mover, all too often later forgotten in new developments, to turn his attention to certain aspects of projection television.

The chief reason for the decline of projection systems is the rather unsatisfactory nature of a rear-projection picture. Even with the best screens, it is highly directional; even with the best optical arrangements, it is appreciably less brilliant than a directly-viewed picture on a good modern aluminised tube. The second objection means that really satisfactory daylight viewing is rarely achieved; the first sadly attenuates the advantages of any big picture set-up, in that it restricts the number of persons who can view simultaneously to those who may conveniently be seated more or less directly in front of the screen.

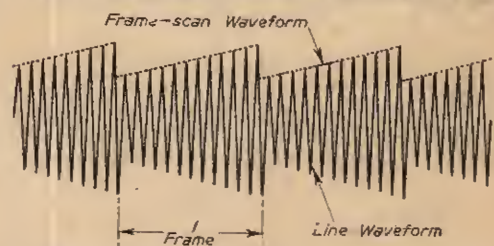
Neither of these disadvantages holds for front-projection systems. With a well-designed screen, less light is lost by reflection than by transmission through a screen in the other method. Moreover, the picture is equally visible from all angles, and even the "hot-spot," so annoying to the best-placed viewers in a rear-projection set, is eliminated. Of course, these advantages are well-known to those whose business it is to provide really large-scale television for sizeable audiences; and I know of several amateurs who have established such apparatus. There are, however, two snags in front-projection for domestic use. In the first place, it means that a screen has to be set up, a separate article from the receiver, and correctly aligned each time that the set is brought into use. And it means that either the projector itself, or a mirror, must lie on the line perpendicular to the centre of the screen, thereby occupying so to speak the best seat in the house. It would be very pleasant if we could arrange things so that the front of the screen was unimpeded; so that viewers could move their heads, or walk about the room freely, without fear of interrupting the picture, or losing sight of it. Even perhaps if we could arrange a front-projection receiver with screen complete in a cabinet of reasonable size—a thing not possible in the ordinary way, precluded by the necessity of having some part of the optical system directly in front of the screen.



Figs. 1, 2 and 3.—A screen and projector at angle to each other and the resultant distorted picture.

A Solution

All of these things can be achieved by a comparatively simple means. Look at Fig. 1. Here we have a projector—television or any other kind, the same laws of optics apply to magic lanterns—on the floor, throwing obliquely on to a vertical screen placed quite close to it. The outlines of a rectangular picture would be distorted into the shape shown in Fig. 2. This is a trapezium, and the effect is a form of trapezium distortion; to distinguish it from the electronic (C.R.T.) effect of that name, however, it is called "keystone effect." In ordinary cinema practice, and in very large-screen television, where both the screen and the projector are above the heads of the audience and the "throw" is a long one, it does not assume serious proportions, and is cured, or partially cured, by tilting the screen a little. Since, for our purposes, it would be desirable to have the projector very close to the plane of the screen, either above or below, and since in these conditions the tilt required would make the picture virtually invisible, we must seek other means of correction.



Number of lines greatly reduced to facilitate presentation

Fig. 4.—Waveform of frame scan.

Consider what would happen if, instead of starting with a rectangular picture, we projected a *reverse* trapezium. It would show on the screen as a rectangle. So what we want on the end of our projection tube is a picture like Fig. 3.

Now think what this means in terms of the scanning waveforms, since it is these which determine the shape of the raster. It implies that each successive line must have a slightly greater amplitude than its predecessor throughout the time of a frame scan. This gives us a form as in Fig. 4, from which we see that the output of the *line* timebase has been modulated by that of the *frame* timebase. How to achieve this ?

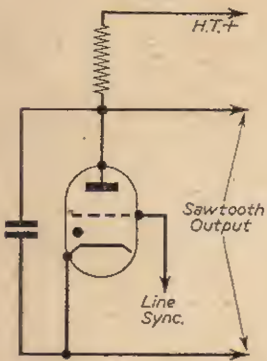


Fig. 5.—A basic timebase circuit.


Fig. 7. — Condenser waveform of Fig. 6.

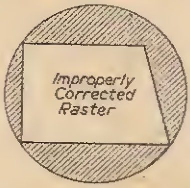


Fig. 8.—Raster shape produced by waveform of Fig. 7.

Circuits

Before we get down to circuitry, a brief word on timebases, as they are dealt with in this article. It will be noticed that in the above discussion no distinction has been drawn between current and voltage waveforms. Fundamentally, a timebase consists of a device for charging a condenser to a small fraction of the applied voltage, or of otherwise ensuring that its charging-rate is linear, and of discharging it very rapidly at the end of certain predetermined intervals. It produces a saw-tooth voltage. This voltage often undergoes modifications to enable a saw-tooth current to pass through a scanning-coil, but in the last analysis all timebases start off by producing a saw-tooth voltage. Inevitably, there are exceptions, or apparent exceptions. Timebases where the condenser is allowed to charge well beyond the point of linearity.

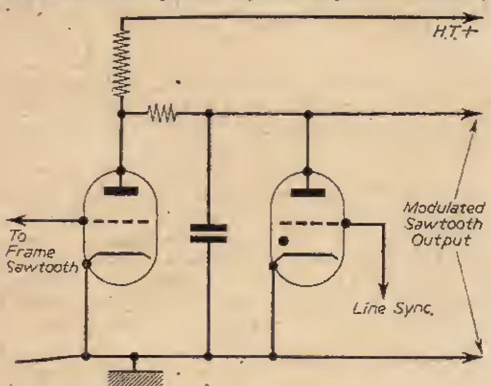


Fig. 6.—A frame timebase circuit.

Timebases where the compression of the circuitry is such that it obscures the fundamentals. But what is said here is true of all normal timebases, and its application in a particular instance requires merely that the experimenter should understand how his timebase really functions. In what follows, therefore, I shall use, for simplicity, the basic timebase of Fig. 5. It is not suggested that this timebase be actually used ; it is serving as a symbol, for which the experimenter should substitute his own line timebase circuit.

The amplitude of scan developed depends on the rate of charge between successive sync. impulses. This in turn depends upon the applied voltage. Suppose we vary the applied voltage at frame frequency as in Fig. 6. Here, the condenser will charge up to a higher voltage each line, as in Fig. 7. But it will return to the same reference voltage each time, also as in Fig. 7. This would give the raster shape of Fig. 8. To avoid this, we must introduce some frame scan voltage between the condenser and the

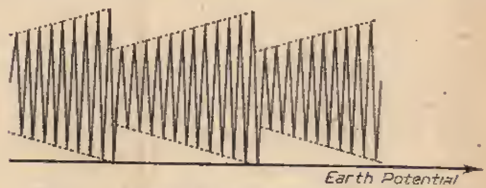


Fig. 9.—Waveform resulting from Fig. 10 circuit.

earth line. This is done as in Fig. 9. The exact amount depends upon the ratio of the total H.T. at X to the normal amplitude of the condenser swing. If the condenser normally is allowed to charge to one-fifth of the H.T. voltage, for example, the signal at A should be one-fifth of that at B. The variation in the upwards excursions of the condenser voltage

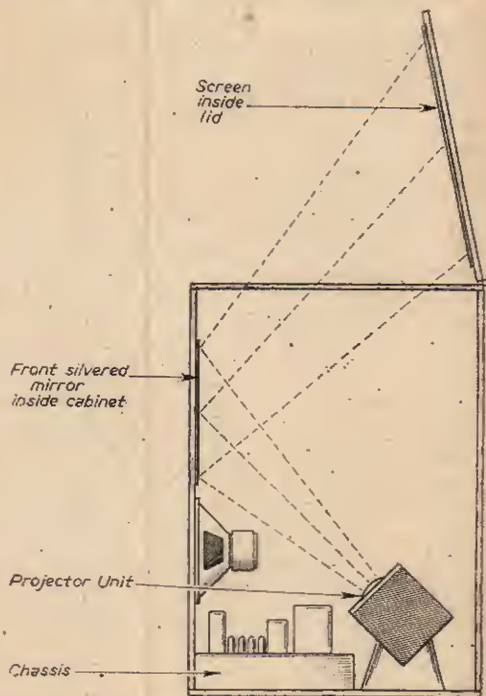


Fig. 11.—A layout to make use of the ideas expressed here.

will then be balanced by exactly opposite variations in the downwards excursions, giving the waveform of Fig. 10. The gain control in Fig. 10 enables us to adjust the slopes of the sides of the resultant raster, so that we can match it exactly to Fig. 3.

Now, we can project from an angle as steep, within reason, as we like. Within reason? Two things to note! The steeper the angle of projection, the greater the difficulty of obtaining satisfactory optical focus over the whole picture. And the shortened lines necessarily offer somewhat inferior definition to the

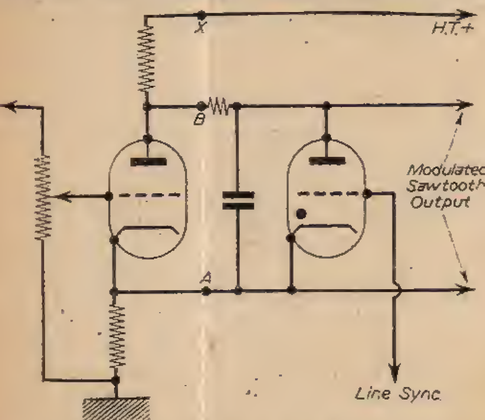


Fig. 10.—Gain control fitted to adjust slopes of sides.

full scan. A *slightly* tilted screen alleviates both effects simultaneously; under such conditions, an overall ratio of longest to shortest line of about 1.5 : 1 can be used. Even in a separate-screen set-up, this will enable the projector to be placed really close to the screen, and well below it, giving a lay-out vastly superior in convenience. It can also lead to the arrangement of Fig. 11.

This arrangement, which is given in rudimentary form, enables us to have front projection in a single-unit construction, with the screen on the inside of the lid of a radiogram-sized cabinet—a thing hitherto virtually impossible for front-projection systems. It has been tested by the author using the usual Mullard projection tube and Schmidt optical system, when the picture, of 36in. diagonal, gave really good daylight viewing; and also projecting a 21in. diagonal picture (equivalent to a 21in. tube in size), from a G.E.C. 9in. direct viewing tube, using as the optical system only an old, chipped two-part lens, diameter and focal length approximately 8in. and 20in., respectively. Its original purpose is unknown to me: it was housed in a brass tube which had the maker's name engraved in fine copperplate, followed by "Paris, 1893." It cost me 25s., and I feel that many similar "treasures" must remain to be found in local "junk shops." In this case, though the tube was given a 20 per cent. overvoltage (E.H.T.—heater volts were kept normal), viewing was satisfactory only in dim ambient lighting. It was, however, not notably inferior to many rear-projection systems of much greater complexity and cost.

Hints

A few practical points. It is difficult to modulate a line T.B. output stage. It is not impossible, but it should be undertaken only by experimenters having an adequate knowledge of the power- and voltage-handling capacities of the preceding stage. It is better to modulate the line oscillator. In this case, it must be borne in mind that the compensating voltage developed at A, Fig. 10, must be used in such a fashion as to make the final raster symmetrical. This may mean removing true earth from the entire timebase, or using a voltage negative to earth to supply the modulator cathode, or applying the compensating voltage, perhaps suitably shaped by a network, between the bottom end of the line coil and earth. The appropriate method in each case will be dictated by the actual timebase circuitry. Any good home cine screen is suitable for these arrangements, but the best screen is a sheet of finely sand-blasted aluminium. If the folded optical system of Fig. 11, is attempted, a front-silvered mirror should be used. This, of course, is true of all mirrors used in any projection system, since rear-silvering gives "ghosts," and results in a loss of light. If it is felt that it is unsatisfactory to leave the contents of the cabinet in Fig. 11 open to the air when the lid is raised, a sheet of plate-glass may be used as a top-board. This will result in some slight loss of brilliance, and will have to be kept very clean: but it can give a good appearance, if the "works" beneath are suitably boxed, and if the controls are mounted through the glass in the corners, where they will not impede the light from the projector.

It is not claimed that the above notes exhaust the subject. Rather, they are intended as a guide to the experimenter. An idea is suggested, that of the trapezoidal raster, which can improve the performance of, and remove some of the snags from, front projection systems; and a method of realising it, found workable by the author, is outlined. It is not to be doubted that other, perhaps better or simpler, methods exist; and it is hoped that this article may assist others to their discovery.

Making a Kilo-Voltmeter

A CALIBRATED SPARK-GAP VOLTMETER WHICH CAN BE MADE BY THE AMATEUR

By A. C. Kay

THIS instrument enables EHT voltages of up to 20 kV or more to be measured directly and quickly. It consists of a calibrated spark gap, which can be used for high-voltage measurement because the voltage required to spark across a gap of given length is virtually constant for the particular gap. (The required voltage is actually affected by changes in the atmospheric pressure and humidity, but for normal use these effects can be neglected.) In use, the gap is first opened up to its maximum value and the high voltage connected across it. The gap length is then slowly reduced until a spark occurs, at which point the length is read off and the value of the voltage determined from the instrument's calibration chart.

The use of a calibrated spark gap in this way is not new, of course, but this particular instrument is so designed that it can easily be made by the amateur using only simple hand tools and yet is still capable of good accuracy. It does not involve the use of a lathe or other precision work and the design can, without difficulty, be modified to use whatever materials happen to be in the scrap box.

As can be clearly seen from the illustrations, the spark gap itself consists of two brass door-knobs, mounted upon parts of their normal square-section operating spindle, but any similar spherical or nearly-spherical metal parts can be substituted, providing they are free from dents or projections near the middle. The diameter is not critical; in the unit being described, the knobs are $1\frac{3}{8}$in. in diameter. The main framework of the voltmeter is made from $\frac{1}{4}$in. thick "bakelite" sheet and its detailed design is a matter of taste. So long as a rigid mounting for the two halves of the gap is provided, the shape of the remainder is not important, but the "pistol grip" handle shown has been found to be very convenient in use. The pistol grip can be made from a separate piece of the insulating material and bolted to the main body, if desired.

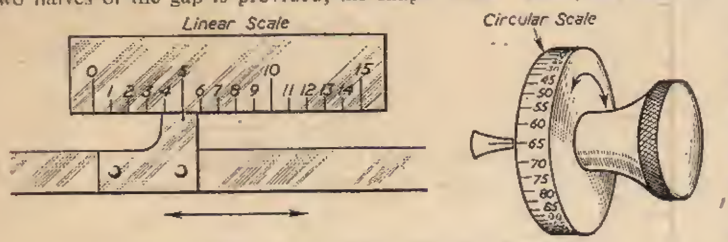


Fig. 1.—The two scales for calibration purposes.

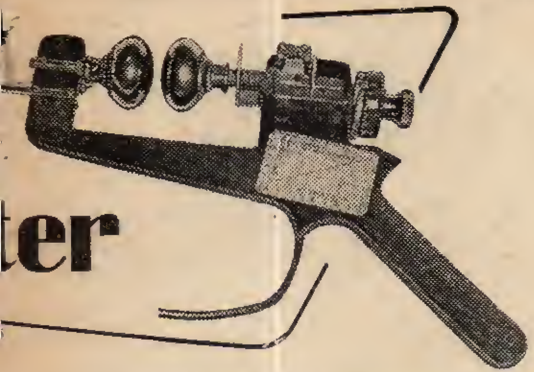
Construction

One of the door-knobs is rigidly fixed to the front of the main framework and electrically connected to the probe. The knob may most easily be fixed by means of a short length of its own spindle, although the version shown in the photograph uses a round-section rod for this purpose, since originally this rod was extended forwards to form the probe itself. The reason for subsequently providing a separate probe will be explained later.

The second door-knob is fixed to a longer piece of its own spindle, which slides in two square holes in a metal bracket fixed to the back of the framework. These holes should be carefully cut to have the least possible side play, but if they are accidentally made a little too large, judicious twisting or bending of one or both ends of the bracket will help to correct the error. At one end of its travel, the moving knob (or "sphere," to give it the accepted term when talking of such spark gaps) is in contact with the fixed sphere, and less than $\frac{1}{2}$in. of movement away from this position is needed.

We now come to the part of the instrument which controls the length of the gap. A short pillar is fixed to the moving spindle, projecting sideways from it for a distance of about $\frac{1}{2}$in. This is drilled and tapped 6 B.A. in a direction parallel to the axis of the spindle, and one end of the operating rod is screwed through this hole. The rod can be a piece of 6 B.A. studding about $2\frac{3}{4}$in. long or a suitably modified long 6 B.A. screw, and the back end of the rod passes through a hole in a substantial metal bracket fixed to the framework and so placed that the rod is parallel to the spindle. Lock-nuts are placed on the rod on the front side of the bracket, and it is a slight refinement in the design if the part of the rod passing through the hole can be left unthreaded. A compression spring slipped over the main spindle tends to open the gap and causes the lock-nuts on the control rod to be kept in contact with the bracket: this completely eliminates back-lash when the voltmeter is in use and greatly contributes to its accuracy. The spring could be replaced by a rubber band stretched between the pillar on the spindle and the bracket supporting the operating rod, but the rubber would naturally not be so durable. A knob is later fixed to the back end of the operating rod, and turning this causes the gap to open or close; the knob, however, is not placed finally in position until the circular scale has been added.

The remainder of the instrument consists of the two scales, one linear (straight) and the other circular, which are so arranged that one complete rotation of the circular scale equals one division of the linear scale. They are thus similar in use to those on an ordinary micrometer. The linear scale is about $\frac{1}{2}$in. long and is fixed to the framework so that it is parallel to the moving spindle and level with its upper surface. Each of its divisions is equal to the pitch of the 6 B.A. thread on the operating rod (i.e., the distance between successive threads). To mark it out, the simplest way



ter

is to press a 6 B.A. screw lengthways on to a piece of paper so that the threads make a series of marks on it ; with a little care, the marks can then be used to mark out the actual scale. This can be made from a small piece of aluminium sheet, and if it is first rubbed lightly with a very fine emery cloth, it will be found that the scale can be drawn on it with Indian ink, using a mapping pen or similar fine nib. It is convenient to lengthen slightly and number the fifth and tenth divisions for ease of reading. A scale 15 divisions long should be ample.

A pointer is fixed to the moving spindle so that it traverses the scale. It can be made from another small piece of aluminium sheet, suitably marked with a cursor line or pointer and should be located on the spindle so that, when the spark gap is closed, the pointer is at or near to the zero end of the scale. The exact position is unimportant, since the scale position is quite arbitrary.

The circular scale is made from the metal cap from a bottle of a well-known make of ink. Almost any circular piece of material, metal or otherwise, could be used, but the ink-bottle cap has been used because it has a fairly wide and reasonably flat rim and can be easily marked with the scale divisions by scratching away with a scriber the paint covering. A hole is drilled in the exact centre to enable the scale, when completed, to be placed on the control rod next to the operating knob and fixed very firmly in position by lock nuts.

The scale is marked with 20 equal divisions round its rim which are numbered 00, 05, 10, 15, 20 and so on up to 95, as indicated in Fig. 1. To set these out, draw a line about 3in. long on a piece of paper and then through the centre of this line draw a series of other lines like the spokes of a wheel, having angles of 18 deg. between them. A protractor will simplify this part of the job. Place the centre of the cap over the point where these lines intersect and mark the scale divisions on the rim immediately over each of the lines.

A small pointer is fixed to the bracket through which the operating rod passes and, as already described, the scale is placed on the rod adjacent to the pointer and fixed firmly to the rod by means of a nut on either side. It is important that the angular position of the circular scale should be such that, when the pointer of the *linear* scale is opposite one of the scale divisions, the pointer of the circular scale should be opposite the "00" mark.

Finally, the means for connecting the two sides of the spark gap to the high-voltage point are added. A flexible lead is attached, by means of a solder tag, to a convenient fixing screw of the metal bracket which supports the moving sphere, and the other end of the lead is equipped with a crocodile clip. This is always connected to the earthy side of the voltage being measured, a point which is important if the operator is to avoid the danger of contact with the "hot" side of the high voltage. A metal rod about 5in. long, with one end tapered to form a probe, is mounted at the front of the main framework close to the fixed sphere and connected to it via resistor of about 2 MΩ. The resistor is not essential and the probe may be connected directly to the fixed sphere, but its inclusion serves to limit the current surge when the gap sparks over. It has a negligible effect on the calibration of the instrument.

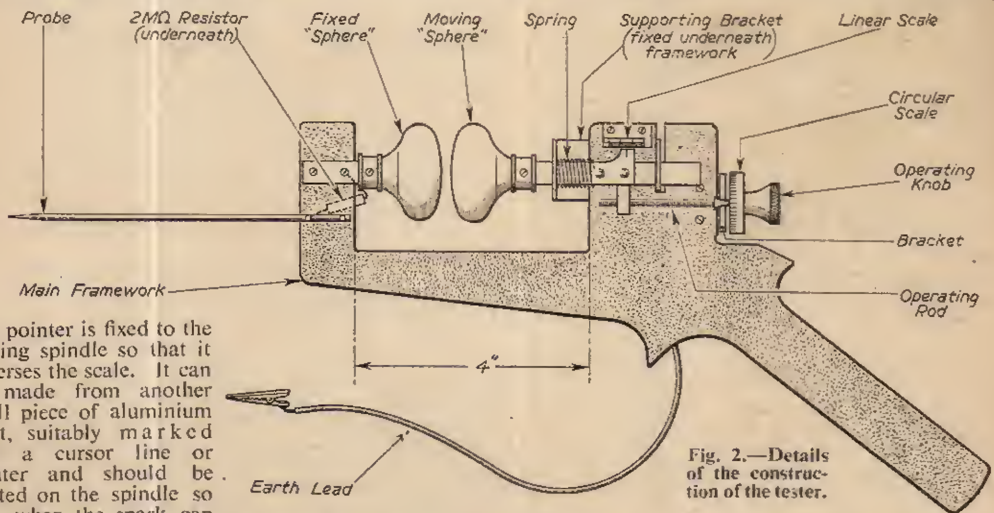


Fig. 2.—Details of the construction of the tester.

Reading the Scales

Reading the scales is very easy. Simply read the number on the linear scale against the nearest scale division on the *left* of the pointer. In the example shown in the illustration (Fig. 1) this is 4. Add to this

(*Continued on page* 540)

Oscillator Radiation

LIMITS OF RADIATION FROM TELEVISION AND V.H.F. SETS AND THE METHOD OF MEASUREMENT

IN 1954, B.R.E.M.A. announced limits which had been adopted by the Association for oscillator radiation from television and V.H.F. receivers, and details were given of the method of measurement. The limits were set out under three headings: (i) direct radiation measured at a distance of 10 m., (ii) aerial terminal voltage, and (iii) oscillator voltage appearing at the mains terminals.

Since then, considerable work has been carried out, both in this country and internationally, on the standardisation of a method of measurement having special regard to (a) simple site and apparatus requirements, (b) simplicity of measurement, and (c) repeatability of results, within reasonable limits, at different sites. As a result of this work, a method of measurement of the total free space radiation at 3 metres has been evolved by the International Electrotechnical Commission and it is anticipated that, with minor amendments, this will be universally adopted.

The method is sufficiently compact in its requirements to permit the apparatus to be set up on, for example, a flat roof. Its features have been extensively considered by the appropriate technical committees of B.R.E.M.A. with the result that recommendations were submitted that this method should now supersede the previous method of measurement at 10 metres: although the former aerial terminal voltage measurement is no longer laid down as part of the measurement, it should be noted as an additional measurement which is useful to designers, and details are given in Appendix "A".

At the same time, limits of radiation were reviewed and recommendations were made as under:

In the range over	30 Mc/s	up to 41 Mc/s,	not exceeding	200 μV/m
,, ,, ,, ,,	41 ,,	,, ,, 68 ,,	,, ,,	70 ,,
,, ,, ,, ,,	68 ,,	,, ,, 100 ,,	,, ,,	200 ,,
,, ,, ,, ,,	100 ,,	,, ,, 174 ,,	,, ,,	500 ,,
,, ,, ,, ,,	174 ,,	,, ,, 216 ,,	,, ,,	200* ,,
,, ,, ,, ,,	216 ,,	,, ,, 250 ,,	,, ,,	1,000 ,,

* *A television receiver tuned to Channel 6 and using the standard I.F. with oscillator high is not required to meet the "in-band" limit, but must not exceed 1 mV/m.*

After making allowances for the differences in methods, the amount of "in-band" radiation in Band I is unchanged from the former limit, but the "out-of-band" limit up to 100 Mc/s has been slightly relaxed and new limits have been established for the range 100-250 Mc/s. The upper frequency limit for mains terminal voltage measurement has been fixed at 100 Mc/s and the limit remains 500 μV into the specified network, or 1.5 mμW, when measured as set out in Appendix "B".

It is hoped that both these recommendations will be widely accepted. With the development of the V.H.F. bands for television and F.M. sound broadcasting, the whole question of mutual interference between receivers is attaining an increasing significance, and it is considered essential that these limits should be met.

It is anticipated that both the method and limits will be incorporated virtually unchanged in the revised British Standard 905 which, it is hoped, will be published later this year.

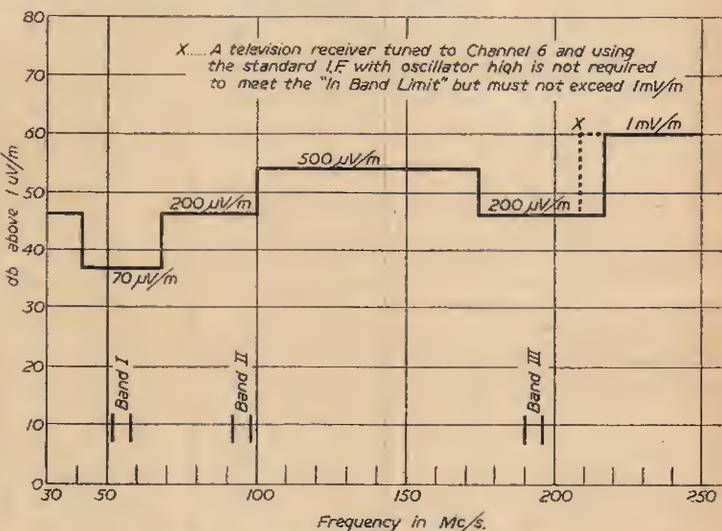


Fig. 1.—Limits for R.F. oscillator radiation.

This method of measurement and the same limits are also applicable to radiation at I.F. harmonic frequencies, which have been found to be troublesome in particular with some V.H.F./F.M. receivers.

Details of the procedure for measurement at 3 metres follow and have been prepared for convenience, prior to the publication of the official British Standard.

Site Requirement

The measuring site should be flat and free from reflecting objects. No extraneous metal objects having a dimension in excess of 15 cms. should be in the vicinity of the receiver under test or of the field strength meter aerial.

Setting-up and Measuring Procedure.

(1) Set up the apparatus as shown in Fig. 2, centrally on a wire mesh ground screen of dimensions 9 × 6 metres. All structures and supports should be

non-conducting material. The structure on which the receiver under test is mounted should be rotatable from a remote point through 360 deg. and the horizontal dipole should be parallel to the face of the receiver and rotatable through 180 deg. relative to it, so as to enable the phase relationship between chassis and aerial radiation to be reversed. This dipole should be 2.25 m. (88 in.) long for radiation measurements on television receivers, and 1.5 m. (59 in.) long for measurements on V.H.F./F.M. receivers, the diameter of the rod being ½ in. in both cases.

The dipole for the field strength meter should be capable of being set either vertically or horizontally, and remotely raised or lowered so that its centre is between 1 and 4 metres from the ground plane. The length of the dipole should be adjustable to resonate at the frequency being measured or 80 Mc/s, whichever is the higher.

The measuring equipment and any unavoidable large extraneous objects should be disposed behind either the receiver or field strength meter aerials.

The receiver should be so placed that its oscillator valve is immediately under the centre of its aerial and 1 m. above the ground plane.

The feeder to be connected between aerial and receiver should be of the type and characteristic impedance for which the receiver has been designed. If the receiver has been designed to operate with either a co-axial or balanced feeder, the latter should be used. The feeder should not be screened and should be directly connected to the receiver and aerial without inter-connection of a transformer, balun or other device.

Additional lengths of feeder corresponding to quarter wavelengths at 67, 100 and 200 Mc/s should be available for stage 5.

(2) Set the field strength meter dipole in the horizontal position at the height shown in Fig. 3 corresponding to the receiver oscillator frequency, with its length resonant to this frequency or to 80 Mc/s, whichever is the higher.

(3) Rotate the receiver to the position which gives the maximum reading on the field strength meter.

(4) Adjust the height of the field strength meter aerial to the position which gives the maximum reading. Note this reading.

(5) Insert the additional length of feeder (mentioned at the end of (1) above) nearest to the frequency in use in the position shown in Fig. 2, and repeat stages 3 and 4.

(6) Rotate the receiver dipole through 180 deg. relative to the receiver and repeat stages 3, 4 and 5.

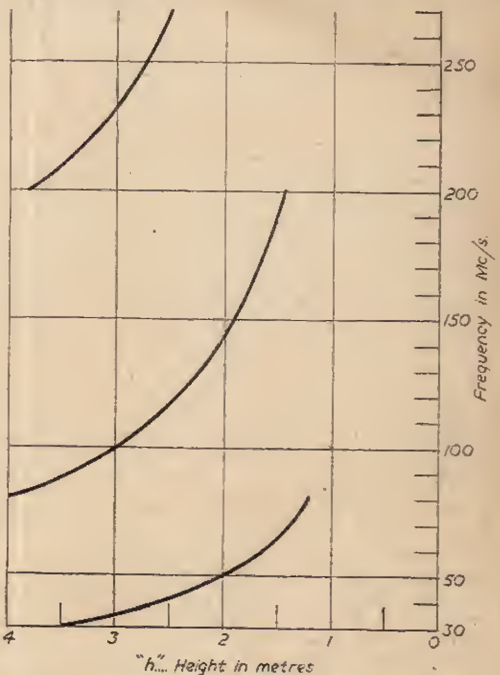


Fig. 3.—Field strength meter aerial height during receiver orientation.

(7) Change the field strength meter dipole to its vertical position and repeat stages 3, 4, 5 and 6.

(8) If the receiver is fitted with an internal aerial, remove the main receiver dipole and repeat stages 3, 4 and 7 with the internal aerial connected. If

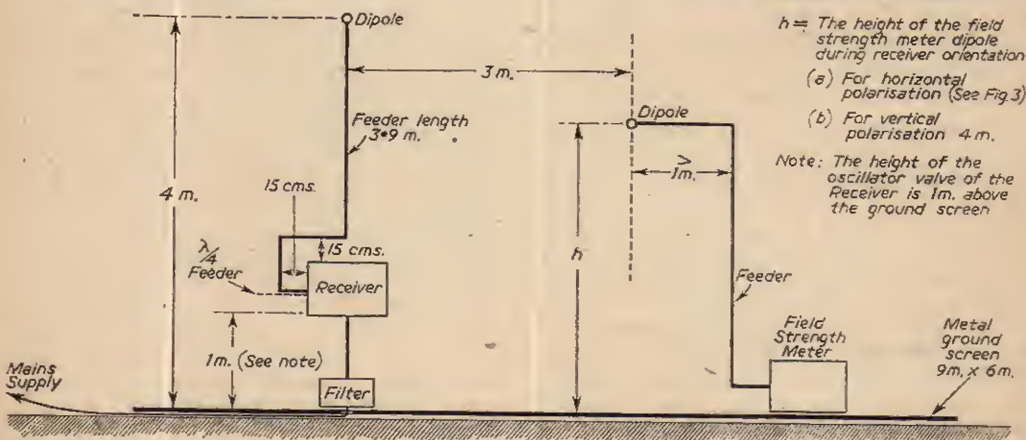


Fig. 2.—Measurement of R.F. oscillator radiation.

the internal aerial has reversible connections, these measurements should be carried out with the connections in both positions.

(9) All the above measurements should be repeated on each channel in the case of television receivers, or at points near the bottom, middle and top of the tuning range of a V.H.F./F.M. receiver.

(10) The highest reading obtained is the radiation figure for the receiver and should not exceed the value shown in Fig. 1.

Appendix "A"

Measurement of Aerial Terminal Voltage

Useful design information may be obtained in the laboratory by making a measurement of the symmetrical component of the aerial terminal voltage across a load equal to the nominal input impedance of the receiver.

The receiver under test is connected through a short length of feeder of the appropriate type to a well-screened measuring set that is used as a selective voltmeter. Where the input impedance of the measuring receiver differs from the required value, a matching pad must be inserted to terminate the feeder and provide the correct load. When a balanced system is measured using a measuring receiver having an unbalanced input or vice-versa, a balun must be used to suppress possible asymmetric currents on the feeder.

The measuring set is tuned to the frequency it is desired to measure and adjusted to give a suitable reference output. The receiver under test is then disconnected and replaced by a signal generator, which is adjusted to give a similar reading on the measuring set. The output of the signal generator will be equivalent to the aerial terminal voltage of the receiver under test.

Frequency Range	Aerial Terminal Voltage	
	Across 75-ohm load	Across 300-ohm load
30– 40 Mc/s	2,500μV	5,000μV
41– 68 Mc/s	350μV	700μV
68–100 Mc/s	750μV	1,500μV
100–174 Mc/s	1,750μV	3,500μV
174–216 Mc/s	*1,000μV	*2,000μV
216–250 Mc/s	5,000μV	10,000μV

* *A television receiver tuned to Channel 6 and using the standard I.F. with oscillator high is not required to meet the in-band limits, but it should not exceed the values for the frequency range 216-250 Mc/s.*

It should be noted that the figures given in the table above will not be valid if the receiver under test is grossly mis-matched when connected to its nominal load impedance.

Appendix "B"

Mains-borne

Limit : 500μV or 1.5 mμW

The measuring technique is that described in B.S.727 (Section 4). Essentially, this consists of measuring the terminal voltage across a standard network or isolating unit (Fig. 4). The primary object of the isolating unit is to ensure that the effective value of the measuring impedance is not materially affected by the impedance of the actual supply mains in use. See Fig. 5.

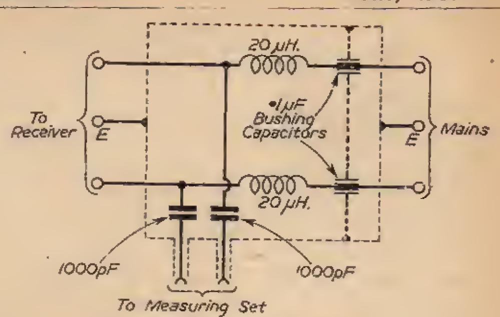


Fig. 4.— Isolating unit.

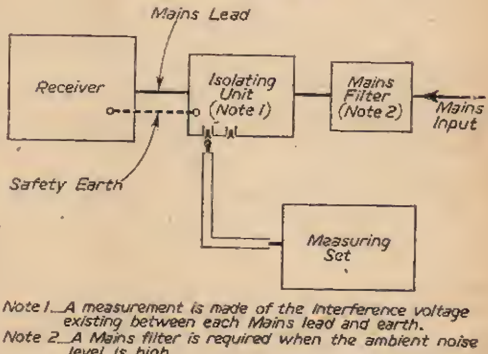


Fig. 5.— Measurement of mains terminal interference voltage.

AN AUTOMATIC TV CLOCK

(*Concluded from page 508*)

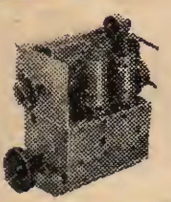
The inductance is placed in series with the mains supply to the set and is such that it drops from 6 to 12 volts at the current drawn by the set. The exact figure is not unduly critical so long as it is within the working limits of the relay. A suitable component was arrived at by experiment. Initially, a resistor was tried, but apart from the disadvantage of it getting hot, it was found impossible, for some unapparent reason, to make the relay operate satisfactorily. Fig. 4 shows an experimental circuit made up of the actual components which will be used in the final unit, and this can be built up on the bench for testing out various trial values of inductance. It is worth while experimenting with some odd low impedance surplus chokes in the hopes of finding a suitable value. Otherwise about 100 turns of fairly thick wire can be wound on a small core (e.g., from an old output transformer) as a starting point. A 60 to 100-watt electric light bulb provides a suitable load.

As a relay coil takes a very small current, the rectifier can be rated at 0.25 amps or less and need not be a large item. The relay itself should be of the low voltage type as it is undesirable to drop too many volts in the supply to the set.

The bell which was *in situ* when the box was purchased is rated at about 75 volts A.C., the current being provided by a hand generator.

The 50 μF capacitor was found to be essential to avoid the relay buzzing.

LASKY'S RADIO



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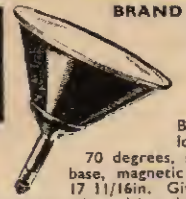

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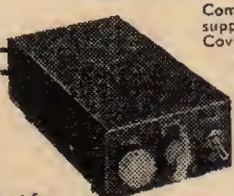

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6K8G	9/9	807	7/9	EF36	4/9
6SJ7GT	6/9	12A6	7/9	EL32	3/9
EF39	5/9	15D2	4/9	EL91	5/9
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		MH4	4/9	MU14	8/9

EX-GOVT. UNIT RDF1.—Brand new, cartoned. Complete with 13 valves, including 5Z4G. Also mains trans. L.F. choke, rectifier, etc., etc. Only 29/6. Carr. 7/9.

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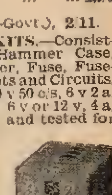

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Handsome well-constructed with walnut veneer finish. Size 18in. high, 20in. wide, 13in. deep. Size of aperture 17in. 13½ins. Fitted Doors. For 16in. or 17in. Tube. Limited number at only **79/6** Plus 7/6 carr.

BATTERY CHARGERS.—For mains 200-250 v 50 c/s. Output for charging 6 v or 12 v at 1 amp. In strong metal case. Only 25/9. Above can also be used for electric train power supply.

Television Receiving Licences

DURING March the number of television licences increased by 103,022.

14,525,099 broadcast receiving licences, including 6,966,256 for television and 306,053 for sets fitted in cars, were current in Great Britain and Northern Ireland at the end of March, 1957.

It's an Ill Wind . . .

SHREWD advertisers are observing that one way of getting good value for money from I.T.V. is buying time opposite certain BBC programmes . . . "Twenty Questions," for example.

More than half of 240,000 London Area multichannel sets tuned to the "The Dave King Show" switched to I.T.V. at the approach of "Twenty Questions" on March 9th, Nielsen Audimeter recordings reveal, thus handing between 300,000 and 400,000 viewers to Val Parnell's "Saturday Spectacular." "Twenty Questions" subsequently averaged 230,000 viewers to "Saturday Spectacular's" 2,700,000.

New Fringevision Factory

THE accompanying illustration shows the commencement of building operations to treble the size of the present Fringevision factory so increasing the factory floor area from 5,000 to 15,000 sq. ft. All the construction work on the extension is being carried out by the firm's own staff and the technical department has assisted by supplying all the various plans and drawings, etc. These additions, it is hoped, will be completed by the end of August and so provide an even greater and more efficient service than in the past, which is anticipated will enable Messrs. Fringevision to despatch orders within twelve hours of their receipt.

Denmark Buys From Marconi Again

ANOTHER notable success has been gained for Britain in the export market. The Danish Posts and Telegraphs Department has ordered transmitting and aerial equipment to a value of £90,000 from Marconi's Wireless Telegraph Company Ltd. for three new television stations which are shortly to be built at Aalborg, Vestjylland and Naestved. The order, which includes monitoring and test equipment and flying spot slide scanning units, was obtained for Marconi's by their agent in Denmark, Sophus Berendsen Ltd.

Marconi equipment is already in use in three of the existing Danish television stations. These stations, fully equipped with Marconi transmitters, have come on the air in the last 22 months.

The three new stations will have identical transmitting equipment consisting of a type BD.366, 4 kW Vision Transmitter and a type BD.317, 1 kW Sound Transmitter, feeding into a sixteen stack quadrant aerial. The vision transmitters will operate to European 625 line standards and will be amplitude modulated, while frequency modulation will be employed by the sound transmitters. To conform to international agreement the Aalborg station will operate at reduced power.

Both the 4 kW vision and 1 kW sound transmitters are of particular interest in that they are new designs representing a very important step forward in engineering practice.

TV for Wales and the West

PLANS for the building of studios and offices at Pontcanna Farm, Cardiff, for T.W.W. Ltd. (Television Wales and the West) have now been given approval at the monthly meeting of Cardiff City Council.

The model of the completed buildings, a view of which is shown

The scene on the site of the new Fringevision factory, with members of the staff at work.

on page 535, prepared by the architects Treadgold and Elsey, of Uxbridge, shows how the "new" has been blended with the "old." The proposed construction makes adequate allowance for any extensions which may be required in the future.

The 45-year-old Ponteanna farmhouse will be left intact and the new buildings will be "blistered" on to its side and back.

It is hoped that construction will start in May.

Lifetime Nuclear Battery Described

USE of nuclear energy for generating electrical current came under the spotlight recently as 50,000 electronics engineers from all over the world met in the National Convention of the Institute of Radio Engineers at the Waldorf-Astoria Hotel and the New York Coliseum.

Engineers at the Air Force's Rome Air Development Centre, New York, discussed a practical source of electrical energy that uses the heat from decay of radioactive isotopes to drive a semi-conductor "thermopile"—a transistor-like device which produces electrical energy when heated. The thermo-electric generator was described as a rugged and stable "sealed-in lifetime power source" which can last "up to 30 years."

Coal Board and Industrial TV

THE first industrial television equipment to be purchased by the National Coal Board is being used experimentally at the Manvers Coal Preparation Plant at Wath-on-Dearne, where it has been installed as an aid to plant control. This plant, which is the largest of its type in Britain, and one of the largest in Europe, processes the entire output of four collieries.

The installation, comprising a Marconi industrial vidicon camera, control unit and 14in. monitor is being used to view the coal input conveyor system at a cross-over point, where several conveyor belts converge. On the monitor, set up in the plant control room, the duty engineer is able to view belt working and loading conditions at this critical point. Any fouling of the belt or failure of the drive system is thus immediately observed. An obstruction or conveyor drive failure of only a few minutes' duration can cause tons of coal to pile up and spill over.

By presenting to the plant control engineer a constant picture of what is happening on the coal input conveyor, the effect of obstruction and drive failures can be minimised. This facility can be of considerable assistance in the efficient working of the complex system in a plant such as this, where obstructions and breakdowns can have very serious effects if not quickly observed by the control staff.

A National Coal Board engineer watching the conveyor system on the new Marconi TV Monitor from the plant control room.

Television Train for Excursion Outings

THE Scottish Region's closed-circuit TV show train, which made experimental excursions to Oban and Blackpool in the autumn of last year, is now to become a permanent feature for excursion outings in the Scottish region of British Railways.

Television screens are positioned above the doors of eight second-class open coaches and are visible to all passengers. Each coach is also fitted with separate loudspeakers for recorded music, and points are provided for use with a roving microphone. The artistes will not only be televised but will also visit each coach and give a number over the microphone.

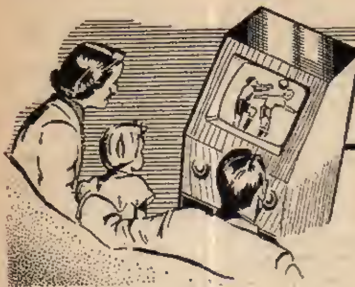
The diesel-electric unit which supplied the power for the broadcast is housed in a separate van.

New BBC TV and V.H.F. Station in West Wales

THE BBC's new television station at Blaen Plwy, near Aberystwyth, was brought into service on April 29th. On this date also the V.H.F. service from the same site which has been in partial operation on low power using a temporary mast and aerial, was brought into full power operation in conjunction with the new 500ft. mast which supports both the television and V.H.F. aerials. This will complete another stage in the BBC's plan to extend its television service and to improve the sound broadcasting service in Wales.

The television transmissions will be on Channel 3 (vision 56.75 Mc/s, sound 53.25 Mc/s), horizontally polarised, and with an effective radiated power of 1 kW. They will serve the coastal belt around Cardigan Bay including the Pwllheli and Portmadoc areas in the north and the Tregaron and Aberporth areas in the south.

The Blaen Plwy station will transmit all three sound programmes on V.H.F., the Welsh Home Service on 93.1 Mc/s, the Light Programme on 88.7 Mc/s, and the Third Programme on 90.9 Mc/s. Until now only the Welsh Home Service has been transmitted, under the temporary arrangement which was put into effect in October last year in order that improved reception of this programme could be made available to Welsh listeners as quickly as possible. The effective radiated power for each programme will now be 60 kW, and the area served by the V.H.F. transmissions will include the southern part of Caernarvonshire, western Merioneth, the whole of Cardiganshire, and parts of Carmarthenshire and Pembrokeshire.



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

IT is not often that I comment in these columns about the commercials. When I.T.A. commenced operations I watched the commercials with considerable interest, though—like most viewers —never admitting that they ever persuaded me to make a single purchase of an advertised product. Then the novelty began to fade. I was able to condition myself and ignore them altogether ; alternatively, to make a cup of tea or a telephone call, or to put the dog out, while they were on.

THE STAR COMMERCIALS

THIS phase has now passed. Many commercials are now so well made and so amusing in content that they outshine the I.T.A. programmes that surround them. The cartoons are sometimes brilliant, the musical snippets are first class and the technical values are improving rapidly.

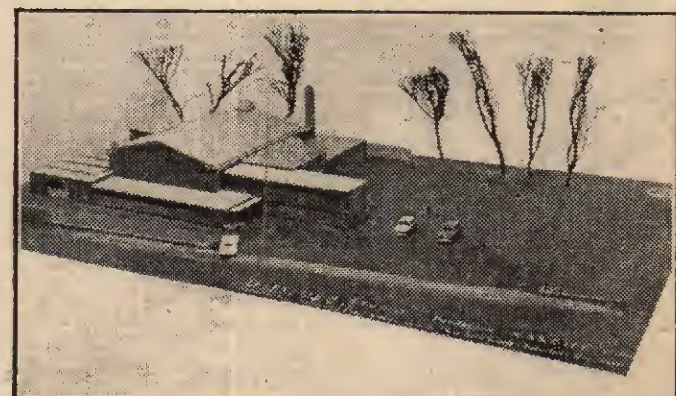
Some of the most popular musical advertising jingles have now become favourites with the children. I have heard of at least two babies whose crying bouts can be turned into contented chuckles when they recognise certain jolly little commercial melodies. This is surely advertising at its very best, indicative of the competition there is between the many small companies who make a living out of this new industry. The bold and blatant commercial no longer scores, it merely bores. The subtle and witty thumb-nail story, whether in cartoon or straight photography, which ends with a novel twist, does the trick. How disappointing it must be for an advertiser to find his latest TV commercial brain-child smothered on each side by some of the feeble programme matter that is appearing more and more on I.T.V. One might almost imagine that some of the brighter script writers are leaving the programme contractors and joining the commercial-making companies.

A CASK OF AMONTILLADO

I MUST admit that I have not seen very many A.B.C.-TV features networked through London in the evenings, and therefore may have been unlucky in the particular programmes I have seen. At any rate, I cannot remember anything outstanding since the "Jekyll and Hyde" series with Dennis Price. For me, A.B.C.-TV hit a new low, technically and artistically with *A Cask of Amontillado*, from a story by Edgar Allan Poe. With the colourful background of a masked carnival, this well-mounted playlet in macabre vein might have succeeded if the producer had restrained his tendency to self-conscious arty-crafty production treatment. Titles were presented skewed, actors had their heads partly out of picture and many camera set-ups, intended to appear clever—merely looked like terrible camera handling. If this is a sample of the technical treatment of the remainder of the series under the title of *Armchair Theatre*, then either the producer should use more conventional camera angles or the A.B.C.-TV technicians take another course at their training school. The producer, Dennis Vance, has given us many good TV plays in the past. I feel sure that he will give us good entertainment in *Armchair Theatre* when he restrains his actors from hamming and his technicians from being ham-handed.

TELEVISED PLAYS

DO television excerpts of stage plays at theatres induce the viewer to buy a ticket to see the live show? Apparently they do—in certain cases. *Romanoff and Juliet* and *The Bride and the Bachelor* are two West End plays which seem to have scored on TV, to the benefit of their own box offices. Not all plays are so lucky, however. It is now essential for TV presentation to be carried out under invited audience conditions, so that the cameras and microphones can be manœuvred to the best advantage. The actors can also play-down a little, not in the broad manner essential to put over lines to the back row of the gallery. This must not be construed as supporting the current tendency of British actors to slur their words, throw away lines and otherwise deliver dialogue in a



A model of the TV studio at Pontcanna, Cardiff, for the new transmitting Station for Wales and the West.

slovenly manner. Even dialect plays have to be presented in a modified form, if they are to be understood outside their own region. The BBC's recent presentation of Sean O'Casey's *Juno and the Paycock* was a model of how a dialect play should be produced. It was a long play—ninety minutes playing time—and I only viewed the last half-hour of it. However, I had seen it on the stage and on films, and heard it on the radio, so that I was able to pick it up with ease. I was sorry I had missed the beginning. The performances of Liam Redmond as the Captain and Noel Purcell as Joxer seemed to me to be perfect from every point of view, with excellent production work by Eric Crozier.

TV STUDIO EQUIPMENT

THE stage equipment to be found in most British television studios is largely made up of items specifically designed for feature films. Camera dollies, microphone booms, lights and their accessories, and many other items familiar in the film studios can be seen every day in use. Some of the equipment is almost brand new, delivered straight to the TV studio and not taken over from a film studio that has gone out of business. The requirements of the two media are on similar lines up to a point, and it was a natural expedient during the rapid expansion of TV studio facilities to make use of existing designs. In practice, television required lighter but stronger equipment, free from noises when being moved about during a scene or, in the case of lamps, when getting overheated through being left on for long periods. Equipment specially designed for television studios is now beginning to appear in Britain as well as in America. The demand for special tripod heads for mounting TV cameras is much larger than the demands of the film production industry in its boomiest days. Development contracts from the BBC are resulting in the appearance of beautifully made accessories, which are being turned out in batches of a hundred or so instead of the batches of ten which sufficed for the film studios. I am thinking in particular of a new Vinten camera head mounting, which admirably keeps the centre of gravity of a heavy TV camera at the same place, no matter how the camera is tilted or panned. The price is modest, due to the large batches ordered.

CHROMIUM-PLATED GADGETS

THEN there are camera dollies of various types, which can "crab" about the stage in any direction without the use of metal or wood tracks. Knocking nails or screwing screws into the very level floors of TV studios is taboo, to enable these trackless dollies, cranes and velocilators to be used. Therefore, the scenery has different methods of bracing, which usually depends upon weights for holding it in position. There is now a new type of microphone boom, made by Scanners Ltd., which has some special advantages for television. In a model recently exhibited, however, the width between the wheels was too great to go through the average doorway in a set, a point which will shortly be remedied. Some of the equipment I have seen sparkles with smart-looking chromium plate, for which TV management seem to have a weakness. This is a mistake. A dull black finish is much more practical and avoids undesirable reflections of lights.

TELERECORDING PROGRESS

AS noted in this column a few months ago, the ITA programme contractors have been cautious in deciding to instal telerecording equipment for the British Standard 405 line, interlaced, picture. In addition to the Marconi equipment, recently announced, a new type of telerecording camera has been developed by High Definition Films in association with Pye. Both of these equipments give results far superior to the type of camera which photographs only half of the interlace, unavoidable owing to the slow mechanical pull-down of the film in the camera between photographing each frame. These new equipments, together with the elaborate flying-spot film scanners for reproducing film, made by Cintel and EMI, must be in the very front rank of television developments, and far ahead of the best in America.

NEW TV CAMERAS

THE latest type CPS Emitron cameras are coming into use at some of the BBC studios, signifying a victory for those BBC engineers who were unconvinced that the image orthicon camera was the answer to all television camera problems. It is interesting to note that the horizontal angle of acceptance of a CPS Emitron camera lens of 75 mm. focal length is the same as a 50 mm. lens on an image orthicon or a 35 mm. lens on a standard cine camera. That angle is approximately 25 deg. Rarely do TV producers require wider acceptance angles than this. The feature film cameramen regularly use lenses of much shorter focal lengths, such as 18.5 mm. and 25 mm. These give interesting camera compositions, but tend to give peculiar distorting effects: thus, facial blemishes are exaggerated and the actors' noses seem to become more prominent in close-ups, while background perspective treatments are sometimes quite false. Nevertheless, carefully handled, these very wide gauge lenses have great dramatic value.

THE "CHELSEA REVUE"

FOR some months past Sidney Bernstein, of Granada, has been extending his entertainment commonwealth from films to television and from television to the music-hall. This is no backward step—it is the inevitable and natural link-up of an entertainment "combined operation." Granada-controlled music-halls now include the Metropolitan, Edgware Road, the Palaces at Chelsea and Walthamstow and the Empress at Brixton (which has now been turned into a cinema and renamed "The Granada."). The Walthamstow Palace is closed for the time being. The Metropolitan and the Chelsea Palace are gradually being modernised so far as the comfort of both audience and patrons are concerned, and bright new shows are being put on. The Chelsea Palace has already begun to play its part in connection with Granada TV, when an excerpt from a revue there was networked. This revue is being run on a resident season basis and is of a new style, about mid-way between the intimate and sophisticated West End revue on the one hand and the music-hall on the other. The first transmission on TV was excellent. Terry Scott was the star, and with him were Hugh Lloyd, Baker and Douglas, and Roma and Bob Dale.

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).

BEGINNER'S GUIDE TO TV

SIR,—I feel that the title of the item " Duration of Vision " included in your current feature of " A Beginner's Guide to Television " is rather inapt. Duration of vision would more correctly be described as the length of time which the eye continues to " see " an image after the removal of that image. This property of the eye is of importance not only in the case of TV but also in the case of films where it is utilised to give a sensation of continuity.

As you so rightly state, it is extremely difficult to measure the minimum length of time in which the eye must be subjected to a stimulus for it to be " seen," and the situation is further complicated by the fact that the magnitude of the stimulus has also a bearing on what can or cannot be seen.—L. M. ARROWSMITH (West Hartlepool).

SLOT AERIALS

SIR,—I was very interested to read your articles on " Slot Aerials," January and February, 1957, and also the letter on this subject from E. Lawton of Stoke.

As the materials were so cheap, although I am over 90 miles from the nearest I.T.A. transmitter I decided to make a Band III aerial. I had to hand a sheet of aluminium 36in. × 20in. and in this I cut a slot 27½in. × 5in. I used a 13½in. rod mounted on Perspex spacers in the slot as a matching device and mounted the whole on a wooden frame for outdoor use. I set the aerial up on my roof to face the Emley Moor transmitter, and I found that I could receive a powerful sound signal some 90 per cent. of transmission time, a picture which would not stay locked for 75 per cent., and a picture of entertainment value for about 50 per cent. of transmission time.

Spurred on by this I added a simple upright rod reflector to the slot about three weeks ago and I have found this to give some improvement. I also tried adding a director but this gave me a weaker signal I should imagine due to the aerial impedance not matching the feeder or set.

My biggest difficulty was in making a mounting for the aerial strong enough, as this design has a very high wind resistance.

I would have liked to try a Band I slot but my local transmitter is horizontally polarised and a slot would be rather cumbersome mounted vertically.

I hope this information may be of some interest to the writer of " Slot Aerials for Television."—J. W. DACHEY (Bircham Newton).

STRANGE SIGNAL PICK-UP

SIR,—I have been interested in the recent correspondence and would point out that I have met some similar instances, and think that many of these freak cases are due to reflections coupled with abnormal conditions. It is well known that conditions can be favourable or unfavourable to radiation (witness the reception of BBC in Australia and the cessation of telephone signals across the Atlantic, for instance) and a signal from a certain direction may be reflected to a receiving aerial, but under poor or perhaps normal conditions there may be no signal present in that direction. On conditions when a signal is present it would be reflected and cause trouble, but its source would not be apparent due to the reflection. A case would be the police and similar services which could be heard in one house when conditions are right but not by a neighbour, so it would be no use asking neighbours if they had heard the interference.—G. DOUGLAS (Cardiff).

SPECIAL NOTE

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

VALVE DESIGN

SIR,—I wonder if other readers have experienced a difficulty which I have met with, or whether I am unlucky. For some months now I have been keen on experimenting and to this end I have obtained a number of the noval based valves and the associated holders. I have found, however, that these have been a frequent source of trouble due to one or more of the pins failing to make good contact in the small holders. These appear to be fitted with a thin edge type contact between the two faces of which the valve pins pass, but it appears that there is a tendency with some valves for the adjacent edges to turn and the springy nature of the material then makes them pass on each side of the pin, with the result that that particular pin has no contact. The trouble is sometimes aggravated by the spring contained screening cover made for the valve base which, when pushed down over the valve, holds it firmly perhaps in the " off " position. I discovered the trouble when an experimental hook-up failed to work as required, and although everything was checked and found in order no satisfaction could be obtained. The valve was going to be changed, and as the screening can was twisted to release it the circuit came to life and the trouble was traced as above. Since that date I have had dozens of cases where bad or no contact has resulted in a circuit not acting as required, and it depends, of course, upon which pin fails to make good contact. It would be interesting to hear whether other readers have had this experience, or whether I have just been unlucky.—G. GOODSON (N.W.).

INTERMITTENT FAULTS

SIR,—It is often stated that one of the serviceman's biggest bugbears is the intermittent fault. This is of a type which only occurs from time to time and accordingly one has to spend a long time waiting for it to turn up. Has anyone yet found a way of tracking such a fault ? I am not over technical, but was thinking of this recently and had an idea which might help. If a device such as a relay, etc., is connected in place of the loudspeaker it could be so adjusted that it remained in a certain position whilst a steady note such as obtained from a signal generator was received. If the set suddenly went off, the relay could open (or close) and actuate some device such as a tester connected in each anode circuit. If an alarm were also joined up, the service man would hear this and could immediately attend to the set and see by the anode indicators which stage was responsible and this would simplify matters. Is the idea practicable ?—H. WELLS (Edgware).

THE RF.26 UNIT

SIR.—I have just finished testing out your Band III converter built round the ubiquitous RF.26 Unit and am more than pleased with the results. This is truly a wonderful ex-government unit, and I have used it to build at least 10 different sets. In not only your paper but in *Practial Wireless* and in other journals I have read of tuners, pre-amplifiers, etc., and I have used a single unit to make up most of these, pulling them down when a new design came out, but only now have I used it for TV. The same parts are used and I only found about three condensers which needed replacing, otherwise I have used most of the original parts. I wonder if any reader has had war-time experience of this unit and could let us know what it was used for, as I have been told that the Government incorporated it in several different designs also, as it was such a good piece of apparatus.—G. H. TREEBY (Harrow).

TESTMETER DESIGN PROBLEMS

SIR.—In the February issue you gave an article about Testmeter design, and I have for a long time been making up test sets built round ex-army meter units. There is one point, however, which appears a problem in connection with these meter movements, and it concerns the question of a fuse. I have burnt out more than one, and it seems to me that the makers could protect the instruments and at the same time help the user by connecting the hair-spring to a small fitment which could carry a small plug-in fuse. This would make one connection, and the hair-spring could be so fixed that removal of the fuse would in no way affect the instrument, but in the event of an overload the fuse would blow and the meter remain undamaged. The fuse-holder could then be withdrawn and a new one (or suitable piece of fuse wire) replaced and the meter would be ready for further use. For those making up test sets I definitely recommend that a safe-guarding fuse be incorporated as a part of the design in such a lead that it is in circuit all the time.—R. B. REECE (Bradford).

STABLE CONDITIONS

SIR.—Some years ago we used to read your paper avidly to see what was new. This occurred also in radio, and one was continually hearing of new circuits and new applications. For years now there has been nothing new in radio (I exclude F.M., which is, of course, not new but merely the BBC development), and now for a long time television has been in the same position. Does this mean that the technicians have dried up or run out of ideas, or that the science has found its level. Surely it cannot be that, as both radio and television are far from "perfect." There must be lots of room for improvement, say, in timebase circuits to prevent drift and similar things, but I am surprised that all the experts seem to be doing now is simply putting transistors in place of valves and printed circuits in place of wires, but there is nothing really new in these. I am sure there must be hundreds like me longing for some new circuits to try out.—H. G RYDER (Dover).

MAKING A KILO-VOLTMETER

(*Concluded from page 525*)

a decimal point followed by the number on the circular scale nearest its pointer—in the example, this is 65, making a reading of 4.65. (The decimal point may be omitted if desired.)

Calibrating the Instrument

To calibrate the spark-gap all that is necessary is to connect it to different known voltages and, for each voltage, to start with the gap wide open and gradually close it until it sparks over, reading the gap length from the two scales each time. Then the voltage is plotted against the gap length as can be seen in the chart on the instrument in the photograph. In connecting to the high voltage source, of course, the flying lead terminated in the crocodile clip should first be connected to the earth point and the probe then applied to the high voltage terminal.

If access can be obtained to a calibrated high voltage supply, the above process is simple. The average experimenter, however, is unlikely to be able to do so, but the EHT supply of a normal TV receiver, or a similar source, can be used instead. The voltage of this can be determined by connecting a suitable high resistance in series with a milliammeter across it and measuring the current; the meter, should, of course, be connected at the earthy end of the resistance. The resistance should have a value of up to about 50 megohms and may be composed of a number of smaller resistances in series, but it is desirable to know the total value as accurately as possible, since it directly affects the accuracy of the calibration. The milliammeter should preferably read 0-1 mA or less. The required value of the voltage, in kilovolts, is then given by

Kilovolts = megohms × milliamps

The addition of the resistance to a TV EHT supply will almost certainly reduce its voltage, but this does not matter so long as the spark gap voltmeter is applied whilst the resistance is in circuit. It does, in fact, enable different voltages to be obtained by using two or three different values of the resistor and thereby obtaining two or three calibration points for the chart. Since, for practical purposes, the calibration curve is a straight line above about 3 kV for this particular instrument, these points are sufficient to enable the whole curve to be drawn up to 20 kV or so by merely drawing a straight line through them.

It is convenient in use to stick a small-scale copy of the calibration chart to the body of the instrument, as seen in the photograph, but for greater accuracy the chart should be drawn to a larger scale.

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5Y3GT	7/6	7Y4	7/11	DF96	9/6	EY86	10/3
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6AT6	7/11	12J7GT	9/6	DL96	9/6	PEN46	5/11
6BA6	7/3	12K7GT	8/11	DM70	7/11	PCC84	10/11
6BJ6	7/11	12Q7GT	9/3	EABC80	7/6	PCF80	9/11
6B8G	3/6	1457	10/6	EB91	6/11	PCL83	11/9
6F1	12/11	19AQ5	11/6	EBF80	9/-	PL81	11/6
6F15	12/11	25L6GT	8/6	ECC81	8/11	PL82	8/11
6J5M	3/11	25Z4G	8/11	ECC82	7/6	PL83	11/6
6K7G	2/11	35A5	10/6	ECC83	8/3	PY81	8/3
6K8GT	9/6	35L6GT	8/11	ECC84	10/11	PY82	8/3
6Q7GT	8/3	35W4	8/11	ECC85	9/-	UBC41	8/11
65N7GT	7/11	35Z3	10/3	ECH35	9/-	UL41	9/11
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		807	3/11	EF80	8/3	VU111	1/6

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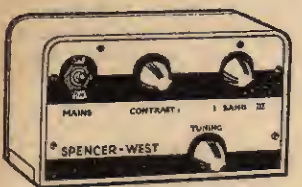

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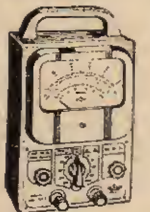

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