MAKING AN INEXPENSIVE AERIAL

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR F. J. CAMM

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& "TELEVISION TIMES"

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Televiews

COLOUR TELEVISION

THE announcement by Sir Noel Ashbridge that we shall have colour television in this country in five years' time is encouraging. It is known that considerable progress has been made in this country and in America in the development of colour television. Colour television programmes have been radiated in America for a considerable period, although they have now ceased for no other reason than the rearmament programme. That same reason has prevented the more rapid development of colour television in Great Britain. It is agreed that we are far ahead of the Americans, and those who have visited America and compared their system with ours are convinced that our system is the better.

GERMAN RADIO AND TELEVISION EXHIBITION

AFTER a gap of two years the German Radio and Television Exhibition is to be held at Düsseldorf from August 22nd to August 31st this year. All factories located in the Federal German Republic and in West Berlin which produce wireless sets, television sets, radiogram attachments and phonograph records, as well as accessories, will be represented in full. They will offer a comprehensive exhibition of the new designs in all fields. There will be a large selection of television receivers on view. German developments have quickly made up the ground they lost in this field, for it was only in 1949 that a few German firms made some faltering attempts to carry on the experience which they had gained up to 1939. In 1950 the Nordwestdeutscher Rundfunk began initial test transmissions from a 100-watt transmitter in Hamburg. In the autumn of this year, however, there are to be four or five television transmitters working for three hours daily with a power of up to 10 kilowatts, while a relay system for the transmission of programmes between Hamburg and Munich via Cologne, Frankfurt and Stuttgart is under construction. There are over 40 different German makes of television receivers and samples from each will be located in the show windows of a whole television street. German television operates on 625 lines according to the C.C.I.R. standards and six channels are used between 174 Mc/s and 216 Mc/s.

VISUAL ASPECTS OF TELEVISION

MR. J. L. H. MOSS, at the Southern Optical Congress at Bournemouth, dealt with the extent to which television is affecting eyesight. The Association of Optical Practitioners had previously submitted a questionnaire to a representative sample of opticians in reception areas served by Alexandra Palace, Sutton Coldfield and Holme Moss. Although this is the first investigation of its kind in this country, the replies confirmed the results of similar scientific research in America. It is stated that almost without exception the opticians reported that they had received complaints from their patients of optical discomfort "in some way associated with televiewing. An analysis of the answers makes it seem likely that up to one half of the televiewing public may associate symptoms of eye-strain with the use of television." The conclusion is, however, reached that it would be a mistake to blame television for the symptoms. "A person may have a minor visual defect, but for normal occupations he gets along without noticing it. He may not be a great reader, or very enthusiastic about the cinema; then he acquires a television set and spends hours concentrating on a small screen." Most of the complaints came from viewers over 45 years of age who wanted to see a clearer image rather than seek relief from eye-strain. Other points made in the lecture were: it is inadvisable to look at television in a darkened room; greater comfort for the eyes will be obtained in a reasonably illuminated room with light either above or behind the viewer; the ideal viewing position is directly in front of the screen looking slightly down; the ideal viewing distance is for the viewer to be approximately eight times the diameter of the cathode-ray tube away from the screen—say, 6ft. to 10ft.; television sets in which there is a light-coloured surround to the screen aid visual comfort; the use of filters or black screens is helpful in removing reflections on the surface of the screen. It was reported that 65 per cent. of televiewers are probably using their sets under conditions which could be improved if more attention were paid to lighting, viewing distance, and the proper adjustment of the brightness control. Opticians agreed that once proper glasses had been prescribed subsequent complaints of eye trouble were negligible—F. J. C.

An Inexpensive Aerial

MAKING AN "H" ARRAY FOR LESS THAN £2

By "Erg"

THIS aerial can be readily constructed by the amateur with the aid of a few simple tools, and should cost not more than £2, including the chimney lashings, and possibly the mast. (The price charged for the metal work may vary from district to district.)

Although designed to be an inexpensive unit for use with the "Argus" televisor, it will function equally as well with other home-built or commercial receivers. Data is supplied for each TV channel.

Fig. 1 gives a general view of the aerial. Although the illustration shows a complete "H" array, those who live within 25 miles of the transmitter can dispense with the reflector portion, mast and chimney lashings, and mount the dipole on the side wall of the house.

The dipole proper consists of two lengths of duralumin tubing ¾in. diameter. They are supported in the junction box in the manner to be described later. The reflector is a straight piece of duralumin of the same diameter; the cross-boom is made from a length of hardwood ¾in. thick and 2in. wide. The dimensions "A," "B" and "C" will depend upon the channel which the aerial is designed to receive, and will be found in the table.

The cross-boom is mounted upon the mast, and the length and material used for the latter will depend upon the supplies available. Wood can be used, and pitch pine, with minimum diameter of 2in., will be found to be very suitable. The maximum length should not exceed 10ft., but the mast can be made up to 16ft. if the butt end is 2½in. in diameter.

Even this height can be extended, provided the chimney stack is sound, by coupling the lengths of pole together with iron ferrules, and staying in three directions, each stay at 120 deg. to the next. Pitch pine is a strong wood with a certain amount of flexibility, and is quite light in proportion to its strength.

As an alternative, dural. tubing can be used. In this case the mast will be heavier, and it is unwise to exceed 16ft. unless the chimney stack is proportionately strong.

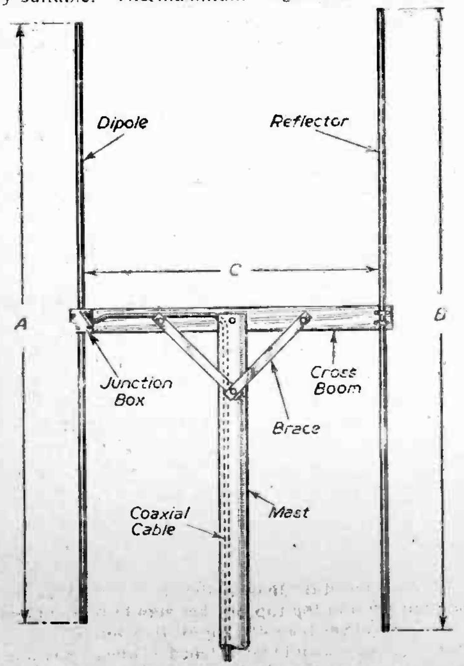


Fig. 1.—The completed aerial with the main parts named. Dimensions are given on page 6.

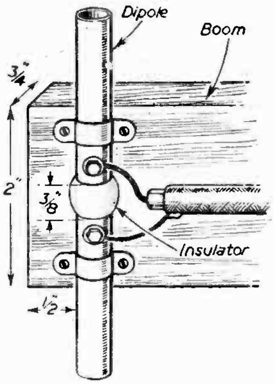


Fig. 2.—Details of fixing the dipole and taking off the lead-in or feeder.

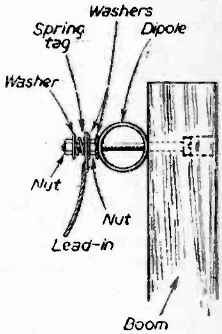


Fig. 3.—Further details of the method of fixing the connecting leads.

Its diameter should be 2in., and it makes a more rigid mast than pitch pine.

The cross-boom is held in position by being bolted in its centre to the mast, and by the provision of two iron braces.

The only difference between the design for the various channels is in the lengths of the elements and the cross-boom. The spacing between the dipole and the reflector has been fixed at ¼ wavelength, though this can be reduced to ⅛ wavelength for those who require greater gain and do not mind the risk of the picture fluttering in a high wind. The figures for the Alexandra Palace transmitter have given the cross-boom as a little under the ¼ wavelength so as to avoid the aerial appearing unwieldy.

Constructing the Dipole

Fig. 2 gives the detail for fixing the dipole elements. The insulator is an ordinary glass marble which fixes the gap at ⅜in. between the two opposite ends. Buckle-type clips (which can be easily made from sheet aluminium) are used to fasten the rods; their diameter should be slightly less than that of the rods, and they are screwed to the cross-boom. The leads from the coaxial cable should be kept as short as possible; tags should be soldered to their ends and they should be bolted to the ends of the dipole by bolts which go right through the cross-boom.

The bolt heads should be countersunk in the far side of the boom and the holes filled in with plastic wood firmly tamped in. Spring washers should be used so that there is no possibility of the connections becoming loose. Fig. 3 shows the method used.

The connections to the dipole are totally enclosed in a junction box comprising two wooden side pieces with a top and bottom piece made of $\frac{1}{4}$in. paxolin, and provided with a paxolin lid. Fig. 4 shows the method of constructing the box.

When the box has been made and the work in Fig. 2

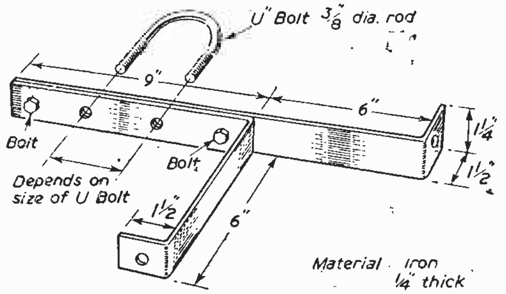


Fig. 7.—Chimney bracket details. Strip-iron is used here.

completed, then, before the lid is fastened on, the box is almost completely filled with molten beeswax (obtainable from a cobbler). The beeswax should completely cover the ends of the dipole and coaxial cable so that they are "sunk" under the wax. When the wax has solidified the lid can be screwed on, using Bostik on the edges to ensure a watertight seal.

Sealing compound should be liberally applied where the dural rods and coaxial cable enter the box. A generous application of Bostik can be used.

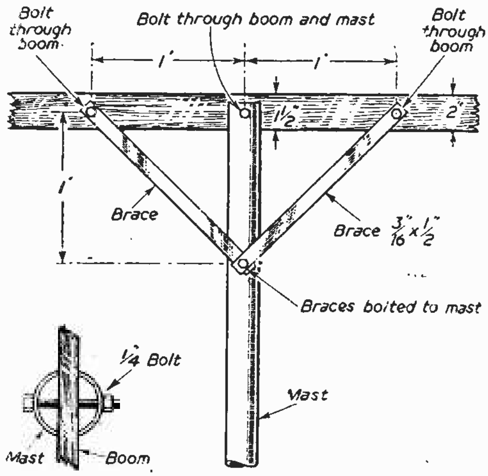


Fig. 6.—Details of the fixing of the cross-boom to the mast.

The open ends of the dipole should be plugged with wooden plugs, but before this is done the rods can be filled with dry, sharp sand, so as to mitigate the humming caused by the rods vibrating in the wind.

Construction of the Reflector

This is a very simple operation, the rod being merely cut to the length required and fastened to the boom in the manner shown in Fig. 5. Bolts are fitted through the clips and through the boom in a manner similar to that employed with the dipole.

The rod can be filled with sand as explained for the dipole and the ends plugged with wooden plugs.

Fitting the Cross-boom

Fig. 6 shows the method of connecting the cross-boom to the mast, and the same method can be employed

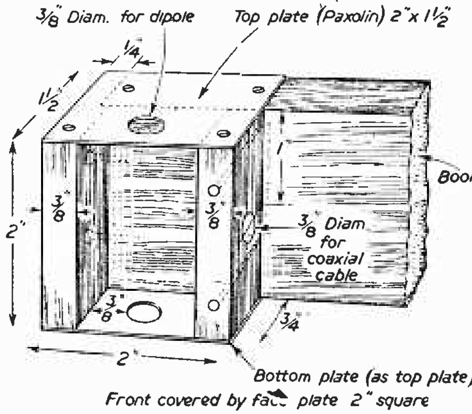


Fig. 4.—Details of the box used to enclose and weatherproof the connecting point

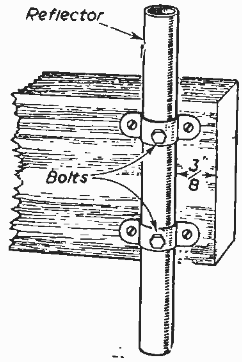
whether a wooden or metal mast is used. The braces should be 17in. long and $\frac{3}{16}$in. thick. The inset figure shows how the boom should be bolted to the mast.

If the mast is made of metal tubing the coaxial cable can be brought down inside it as shown in Fig. 1. If a wooden mast is used the cable should be cleated neatly down the length of the pole.

Construction of the Chimney Bracket

Strip iron is used to construct the chimney bracket. Fig. 7 shows the construction clearly. Two strips of iron measuring 16$\frac{1}{2}$in. long by 1$\frac{1}{4}$in. wide by $\frac{1}{4}$in. thick are required. The size of the "U" bolt will depend

Fig. 5.—Details of the fixing of the reflector. Compare this with Fig. 2, and note that the rod is continuous.



upon the diameter of the mast at the base. Two brackets will be required and the top bracket should be mounted at least three courses from the top of the chimney stack. The second bracket should be fastened as low as possible.

Fig. 8 shows the method of fixing the bracket and the corner pieces; these latter are made of 16- or 14-gauge sheet iron as shown in Fig. 8. Six of these pieces will be required.

The bracket is bonded to the chimney stack by 7/14 stranded iron wire.

An alternative method of tightening the wire is shown, for use if strainers are not obtainable.

Mounting a Dipole

In areas of high signal strength the "H" array will not be required and the dipole can be mounted by itself on the side of a wall. Fig. 9 shows how this can be done. The dipole is mounted on an 18in. length of hardwood as described previously and two shelf brackets used to fasten it to the wall. The coaxial cable can be cleated down the wall.

Adding a Director

Where the signal strength is low it may be beneficial to add a director. This should be a rod similar to the reflector but shorter, and it should be mounted in front of the dipole at the same distance from the dipole as is the reflector. The length of the director is given in the table.

Fitting the director will result in a slight mis-match if 75-ohm cable is used, but the mis-match will be small and will be outweighed by the greater gain.

Before fitting the aerial on the chimney it should be given three coats of paint. The whole array should be painted. Battleship grey is a good colour to use as it becomes very inconspicuous when seen against the sky-line.

The brackets should also be painted, and black can be used here. The main thing is to prevent rust.

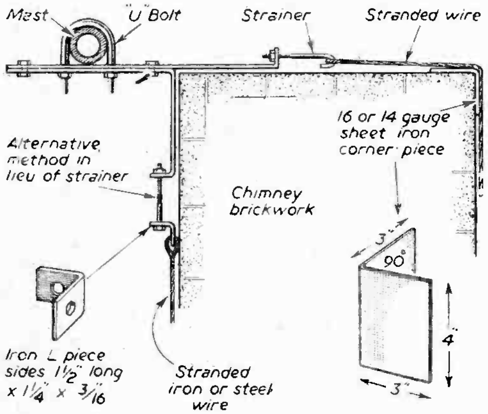


Fig. 8.—Corner bracket and mast-fixing details.

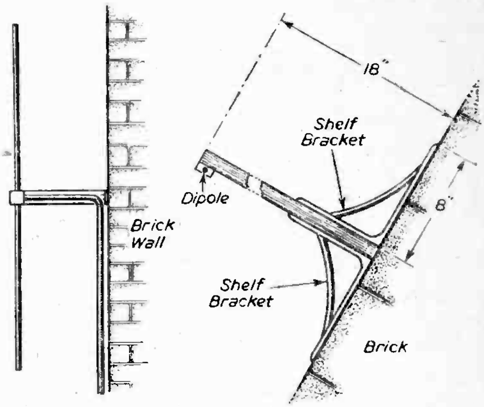


Fig. 9.—Wall-mounting details.

Channel	Dipole 2 Lengths	Reflector	Cross Boom	Director	Station
1	5'-2½"	10'-9"	4'-0"	10'-1"	Alex Palace
2	4'-6"	9'-3"	4'-6"	8'-9"	Holme Moss
3	4'-1½"	8'-6"	4'-1½"	8'-0"	Kirk o Shotts
4	3'-9"	7'-9"	3'-9"	7'-3"	Sutton Coldfield
5	3'-6"	7'-2½"	3'-6"	6'-9"	Wenvoe

Book Review

JOHN BAIRD. By Sidney Moseley. Demy 8vo. 256 pages. 16s. net. Published by Odhams Press, Ltd.

THE author of this book was closely associated for many years with John Logie Baird, who did so much to draw public attention to the possibilities of television. His book sets out to answer some of the questions which have been raised concerning Baird, such as, Why did the BBC adopt another system and reject Baird's? Was Baird badly treated? Did he originate television as we know it to-day? What happened to the million pounds or more which the public subscribed to help Baird develop his invention? The author is certainly well qualified to answer these questions for he was deputy chairman of the Baird Co., and he conducted the secret negotiations with the Gaumont-British Group as well as with the BBC. The book covers Baird's beginning, his early struggles, the financial struggles, the first television programme and discloses many unrevealed secrets of the tragedy as well as the romance of Baird. It is common knowledge to-day that our present television system owes nothing to Baird. It is equally common knowledge that Baird owed much to Paul Nipkow, who as long ago as 1884 demonstrated the possibilities of scanning by means of a spirally perforated disc. I do not know whether Baird ever acknowledged the source of his original inspiration.

It is beyond all doubt, however, that Baird continued the experiments of Nipkow and brought it to a higher pitch of efficiency. As marketed, however, the Baird receiver and the Baird 30-line low definition transmitting system were foredoomed to failure. The receivers were at best a laboratory experiment, and Baird made the fatal mistake of marketing his receivers long before they were ready for the public. Obviously, the Baird system was not the answer, and it was equally obvious that high definition television would replace it. When the Television Advisory Committee issued their report they recommended that the programmes should be radiated on the Baird and the E.M.I. systems alternately so that the public could judge for themselves. There could be no possible doubt as to the verdict, and I suspect that the suggestion was only made to give Baird one final opportunity of improving his system and making it worthy of public demonstration. That, of course, was scientifically impossible.

Baird undoubtedly drew public attention to the practicability of television and he spent the whole of his life in doing it. The fact that he was the apostle of a lost cause and the victim of a belief in a device which all scientific people knew could never be better than it was, does not detract from his work. It is doubtful whether we would have had television to-day had it not been for his belief in it.

This book is an interesting study of Baird's life and work and it should be read by every viewer.—F.J.C.

Improving Your Video Stage

OBTAINING HIGHER QUALITY PICTURES WITH THE MINIMUM OF MODIFICATION

By W. J. Delaney (G2FMY)

DETAILS have been given in various articles in these pages concerning the importance of the video stage, and it is obvious that the best results are not obtained from many receivers in this particular part of the circuit. It is possible to modify most home-constructed receivers so that a better picture may be obtained—in many cases without making any modification either to the tuning or to the earlier stages of the receiver. There are a few special valves, designed primarily for use in a video stage, the main characteristics of such a valve being a very high slope and a low impedance. One of the most popular valves for this stage, and one which is being used by many constructors, is the EF55, but there is an American valve which is almost equivalent—the 6AG7. Both of these valves are available ex-government, the reference for the former being CV173, and for the latter CV1882. To enable readers to appreciate these two valves we give below the main characteristics of them in tabular form.

	EF55	6AG7
Va	250 v.	300 v.
Ia	40 mA.	30 mA.
Vg1	—4.5 v.	—3 v.
Vg2	250 v.	150 v.
Ig2	5.5 mA.	7 mA.
S mA/v.	12	11
Rk.	100 Ω	81 Ω

The greater efficiency of these valves may be appreciated in many circuits merely by plugging them in in place of an existing stage. For instance, in a receiver employing the popular EF50 in the video stage, the EF55 may be plugged in as a direct replacement without any circuit changes and will give greater gain and a different quality to the picture, but obviously for maximum results certain changes should be made.

Load Resistor

It will be found that the two main features of the video stage are the values of the load resistor and the distributed self-capacity. In general the lower both of these are, the better the picture quality, but unfortunately there are other factors which have to be taken into consideration. The majority of receivers rely for their picture quality upon cathode or anode compensation in the video stage, such ideas as using a low value cathode by-pass resistor and resonant chokes being very common, and giving to the stage a rising characteristic visible on the majority of receivers in the form of outlining or black-after-white. Although a very small measure of such outlining is not actually detrimental, and does sharpen up the image, it is not desirable for the quality enthusiast, and an attempt should be made to obtain high quality pictures without any "ringing," outlining or other artifice

For maximum detail a low value anode resistor is required, together with a valve having a low impedance such as one of these already mentioned, and it will be found that an EF55, for instance, may be used with a load as low as 1,000 ohms. It might be argued that this will result in loss of volume in view of the small voltage change across the resistor, but it should be remembered that the anode current is quite high and in an ideal state the valve may be operated without bias, relying upon the signal to bias the valve. However, before going into such details, let us consider what may be done to an existing receiver, where there is no excessive current available, but in which an EF50 or similar valve is employed with a medium value of anode load. First, the anode load should be changed for one of lower value, say, about 2kΩ, and the bias by-pass condenser (if one is fitted) removed. The anode resistor will, of course, have to be of the high-wattage type—one of the small green Welwyn ex-government items proving small and capable of standing considerable heat. If an EF55 is now plugged in, in place of the EF50, there should be an obvious improvement in the picture quality, although it may be found that the gain is too great. In this case the Contrast control should be reduced, and if there was much "noise" on the picture this will assist in removing the spots and blemishes and

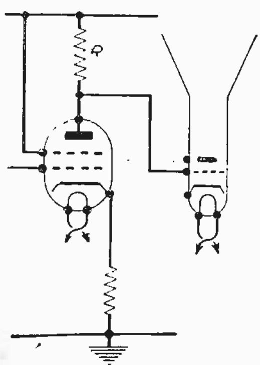


Fig. 1.—Resistance R should be as low as possible.

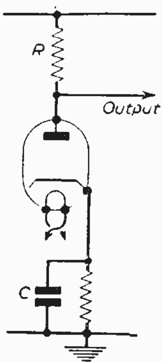


Fig. 2.—Condenser C should be as low as possible or omitted.

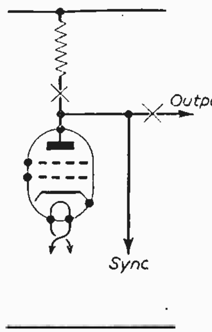


Fig. 3.—If any resonant chokes are used they should be inserted at the points marked "X."

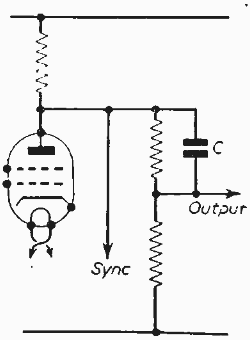


Fig. 4.—To reduce the voltage on grid or cathode of the valve, a voltage divider as shown here may be used.

giving a cleaner picture. It may be found, however, that the whites will be flattened as a result of the removal of the bias by-pass condenser and experiments should then be carried out with different values of bias resistor and by-pass condenser.

Cathode Drive

If the tube is grid modulated, as shown in Fig. 1, it will be preferable to change this to cathode modulation,

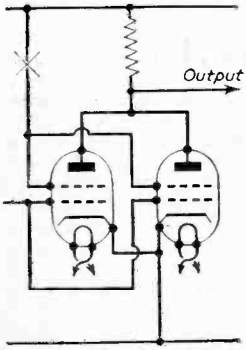


Fig. 5.—Two valves may be paralleled to give improved results, and if the tube is grid-modulated, bias components may be removed entirely.

a procedure which necessitates a reversal of the rectifying diode. The arrangement in Fig. 1 is not ideal as the grid of the picture tube is joined to the H.T. positive line (which is probably 250 volts or more) through the video stage anode resistor, and should the valve fail, there will be no drop across R, which means that the grid of the tube will go immediately 250 volts or so positive, a fact which will not be counteracted by the Brilliance control. In view of the expense of the tube, connecting the cathode to the anode is desirable as should the video stage fail it merely means that the cathode goes more positive, which is the same thing as making the grid more negative and the tube is protected from harm.

Resonant Chokes

In some circuits special chokes will be found in the anode circuit to improve the middle and H.F. response and these should be removed whilst experimenting with a new output valve. If it is subsequently found that slight adjustment of the trimmers in the vision receiver, or adjustment of the bias resistor and anode load do not effect sufficient gain at the higher frequencies, and more "white" is required the chokes may be added one at a time, but they should be inserted only at the points marked with an X in Fig. 3. They are best kept out of the sync circuits, and the effect may be tried of putting them in singly at each of the points marked, and then of using two, if necessary. Generally speaking, if the tuned circuits are properly adjusted it should be quite unnecessary to use these aids.

Tube Feed

One device which may be used without detriment is a tapped output as shown in Fig. 4, to feed the tube. The taking of the tube feed to cathode from the anode direct as shown in Fig. 2, means that the cathode may be at 250 volts or so compared with the heater under "no-signal" conditions. If there is a separate heater winding on the mains transformer this need cause no trouble as the heater winding may be used to feed the tube, and the heater left "in the air," that is, not joined to earth, whilst a 100 kΩ resistor may be joined between cathode and heater to keep both heater and cathode at the same potential. It will be remembered that the tube makers recommend a heater-cathode potential not in excess of about 150 volts. The arrangement shown in Fig. 4, however, lowers the voltage at the output point, the two resistors between anode and earth being each of 47 kΩ for general use, but again experiments may be carried out with different values here. A condenser C is required across the first resistor and this will affect picture quality. Experiments may be carried out with values from .01 up to 8 μF for this component, and in general it should be about 1μF although its presence does in some way detract from the desired direct coupling. In all the illustrations the suppressor grid has been omitted, as it is connected to earth or is internally joined to the cathode.

B7G Valves

For those who are using the special miniature B7G type of video stage, with special high-slope pentodes such, for instance, as the Z77 or EF42, the experiment may be tried of connecting another similar valve in parallel to simulate the effects previously described for an EF55, etc. The valves are wired directly in parallel—grid to grid, etc. A single anode load resistor of low value as already described may be fitted, and again the bias circuit may be experimented with in an endeavour to use the best value without by-passing. If the picture tube is grid modulated, bias can probably be removed entirely.

The changes described may not result in every receiver being improved and there are certain technical flaws in some of the suggestions mentioned. However, the old axiom holds good that the proof of the pudding is in the eating, and the changes should be made whilst watching either a good Lime Grove transmission or Test Card C, and the effects of the changes may be readily observed. With a properly run video stage, there should be a very wide range of tones visible in the picture and it should be markedly different from the type of picture one associates with the average type of receiver—very similar, in fact, to a comparison between a high-class professionally-made bromide photographic print and an amateur gaslight print. It is a quality which cannot adequately be described in words but which can readily be seen, and it is well worth the trouble of experimenting in this part of the circuit to obtain this improved performance.

G.E.C. Conversion Kits

THE General Electric Co., Ltd., announces its arrangements for the conversion of their existing television receivers for the reception of Kirk o' Shotts and Wenvoe transmissions.

Super Heterodyne Models

For receivers BT 3443, BT 3839 and BT 9144 M, conversion kits are available with full instructions to G.E.C. dealers at a net price of 7s. 6d. each. The modification consists of substituting aerial and oscillator coils, realignment, etc. The kit for the Scottish frequency is BT 42C and for the Western frequency BT 42E.

To convert models BT 1091B, BT 1093 and BT 4640 a conversion kit (also priced 7s. 6d. net to the Trade). BT 42D will be needed to change to the Scottish frequency and a conversion kit BT 42F to change to the Western. It should be noted that models BT 1091A, BT 7092, BT 7094 and BT 9144L cannot be converted for use on single-sideband transmissions.

The Northern Radio Show

A BRIEF REVIEW OF SOME OF THE EXHIBITS AT THIS YEAR'S SHOW AT MANCHESTER

ALTHOUGH obviously on a scale much smaller than the London exhibitions, this year's Northern show gave a good preview of some of the new season's lines in both radio and television. The keynote was viewing and considerable numbers of visitors saw television for the first time, whilst viewers at home had a show practically every night during the exhibition on their screens at home.

The principal manufacturers were showing at Manchester but a few of those whom we always see at Olympia or Earls Court were missing—mainly, we understand, due to the fact that Government contracts have resulted in a reduction of the home-market apparatus and as a result they found it undesirable to exhibit any of their products.

On the opening day the E.M.I. group announced the introduction of a new range of "Highlight" models, pictures of two of which are seen on page 10. On the H.M.V. stand were a table model (No. 1814) and a console model (No. 1816) in each of which special arrangements had been made to improve the quality of the picture by circuit and tube modifications. In these and the new Marconiphone models a 12in. aluminised tube is employed, and the circuits incorporate a five-channel selector so that each model may be set up in any part of the country without difficulty. This device is particularly valuable in fringe areas of more than one station, as it is a simple matter to tune the receiver to each station and ascertain which gives the most satisfactory results in that particular area. It is claimed that the reception is satisfactory in the most remote fringe areas and that good pictures are obtained with inputs as low as 25 microvolts. An inbuilt attenuator takes care of the excessive signal in areas of high signal strength. All that is necessary is to insert the aerial plug in a suitable socket on the receiver, and even the user may carry out this adjustment without difficulty.

Another feature incorporated in these models is a variable picture interference limiter, and this operates in addition to a beam-limiting device embodied in the special C.R. tube which is fitted, and further to add to the enjoyment of the viewer there is an "aeroplane flutter" limiter and special sound channel interference suppressors. Above all the price has been kept at a very low level, the table models costing only 69 gns. including Purchase Tax.

Big Screen

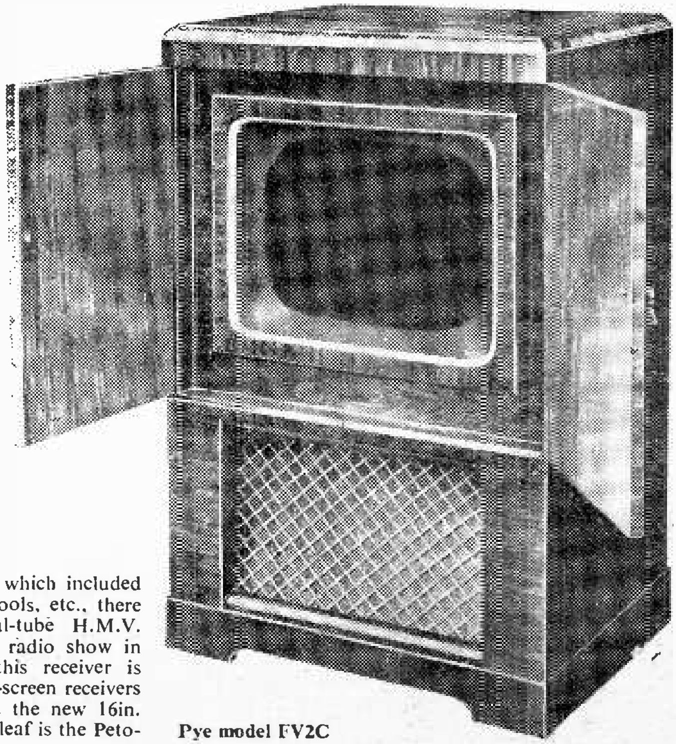
Among the many big-screen models, which included screen-projection models for clubs, schools, etc., there was also the direct-view 21in. metal-tube H.M.V. receiver which was seen at last year's radio show in London. The picture produced on this receiver is approximately 18in. by 14in. Other big-screen receivers exhibited by several firms incorporated the new 16in. metal picture tubes, and illustrated overleaf is the Peto-Scott model TV168, in which the actual picture size is 14.2in. by 10.8in. This particular receiver is a 19-valve model and has full-length folding doors to protect the tube face.

Components

Space does not permit us to pick out each of the many items which were on show, but mention can be made of such items as the range of television downlead cables shown by the Telegraph Construction & Maintenance Co., which included both screened twin and coaxial, as well as solid and air-spaced low-loss cables and accessories suitable for operation at frequencies as high as 3,000 Mc/s. For the amateur transmitter there was a new type of 300-ohm feeder, with stable characteristics in varying weather conditions, known as the K.35B tubular twin cable.

The G.E.C., in addition to various television receivers of both table and console types, were showing their special flat-ended glass C.R. tube, in which the end is welded on to the glass "funnel" in a process very similar to that adopted with the metal type of tube.

The "talking television set" on the Ediswan stand attracted considerable attention and explained to many how the modern receiver functions. Mazda valves and C.R. tubes were also to be seen, together with many small accessories which find their place in a modern television receiver. The Clix valveholders, for instance,



Pye model FV2C

which we have used in some of our receivers, were well displayed and possess many attractive features.

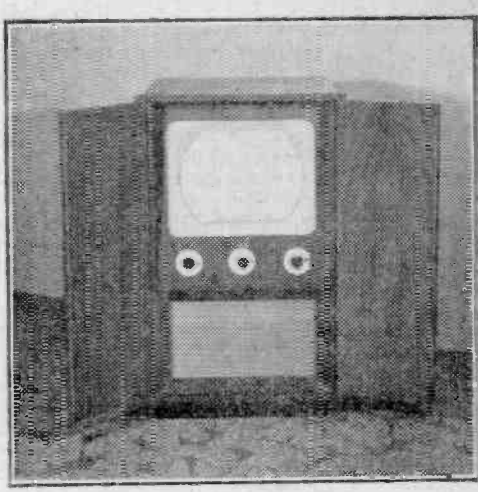
Ekco appeared to be the only firm to be incorporating "spot wobble" in their receivers, although this appears to be used in only two of the Ekcovision receivers. As readers are aware, this aims at removing the "lininess" which a properly functioning receiver displays when viewed at close quarters, and there is considerable difference of opinion as to whether it is worth while. However, the makers have fitted a switch to the receivers so that it is easily switched off, either for comparison or when not needed.

Philips were featuring their "original" projection receiver, and were displaying receivers also of the direct-view type. The largest picture produced by their projection apparatus is 16in. by 12in., and, of course, it produces a flat "back illuminated" picture which may be viewed by a large number of people without difficulty.

Marconiphone model VT59DA at 69 gns.

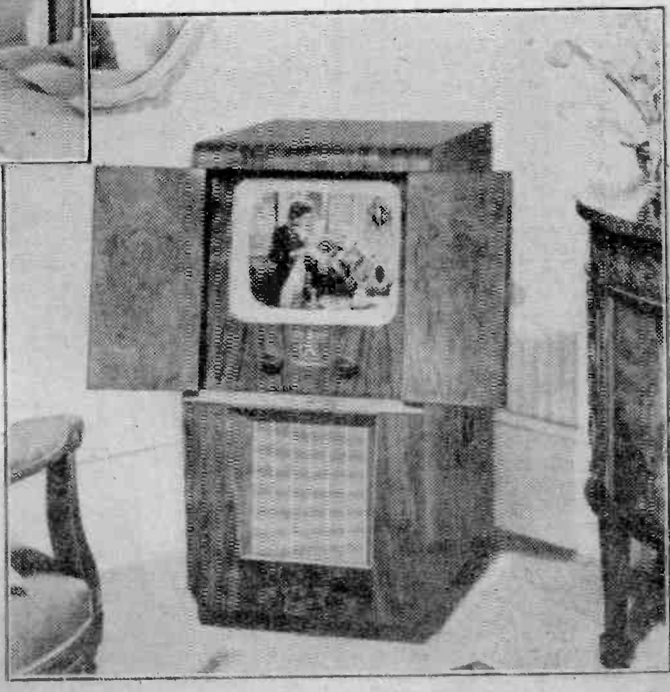
Pye "Big Picture"

Among the new Pye models, Model FV2C, shown on page 9, utilises the new 16in. tube in which the picture has been made 13⅝ by 10¼in. (the average size being 13¼ by 10in.), and upon which the new more or less standard "black screen" has been fitted. This particular model is a 19-valve five-channel A.C./D.C. receiver and costs £93 3s. 2d., plus P.T. A feature found in this model, and which we cannot remember noting in any other television receiver, is the provision of A.V.C. on the sound section, so that this model should prove very useful in fringe areas where it is often found that fading, which affects both picture and sound, often spoils a programme which would have better entertainment value if the sound could be maintained, as this makes up to some degree for the faded picture. The front of these large 16in. tubes is obviously more in need of protection than the smaller receivers, and folding doors are accordingly fitted to this model.



Peto-Scott model TV168.

Several manufacturers, including Dubilier, were showing miniature condensers, etc., which are now used in many modern television receivers, whilst small valves were seen on the Mullard, G.E.C. and Marconi stands.



HMV model 1815, an AC/DC receiver.

Birth of a Name

HOW "TELEVISION" FIRST ARRIVED

TV! Everyone nowadays recognises this most modern of the many generally accepted technical abbreviations which we all permit ourselves in our written and spoken English. There is no better shortening of "television." It is an abbreviation which, in many respects, has come to stay.

But now comes the interesting question of how, when, where and by whom the expression "television" itself first came to be used? It is, perhaps, not really a very important question, but, curiously, it is one which has never yet been settled fully and authoritatively. Take up your family dictionary. Better still, examine any standard Victorian dictionary. You will fail completely to find therein the now homely and everyday-employed term, "television." This is rather strange, if only for the reason that the Victorians and their immediate successors, the Edwardians, were fond enough of the "teles," as witness the long list of "tele"-prefixed words which give such massive and learned compilations both authority and comprehensiveness.

"Telescope," "telegraph," "telephone" and, perhaps, "telepathy" are all long-used and eminently obvious and respectable "tele"-words. But what, for instance, do you make of *telephonographic*, *teleseme* and *telekinesis*? Or of *telephote*, *telethermographic*, *teleplastic*?—all of which somewhat mysterious looking, high-flown expressions are to be found in any competent dictionary which is fifty years old or more.

Latin and Greek

"Tele," we are told, is a Greek word meaning "distance," "far," "away," and so on. "Video" is a Latin verb for "I see." Clearly, therefore, *television* is fairly self-explanatory, despite that mixing of Latin and Greek words which is so repugant to classical scholars. But, strangely enough, the early television experimenters seem to have had no idea of how to designate or describe the aims of their various systems. They seem to have been quite satisfied by the use of expressions such as "Seeing by Electricity," "Electric Vision," and so forth. Ultimately, as their experiments developed, they gave us the expressions "electrical telescope," "distancevision," "teletroscope" (with its consequent "telestroscopy"), "electro-magnetic vision," "electrical vision," and, finally, the rather more elegant "telescopy," which latter term was a favourite with the British Patent Office, it being used officially therein as late as 1908.

An Inaccurate Term

Why the first experimenters failed to agree on a simpler term for their experiments is rather a moot point. We are inclined to think that the word "television" should have been obvious to them. Yet, on reflection, it will be seen that this word, used universally as it is at present, is not, in fact, a perfectly accurate one. An astronomer when he regards a distant planet or even the moon through his instrument is not utilising the science of television as we understand it. Yet he is obviously seeing at a distance. The term "television" has become a permanent one in nearly all languages, yet it does not perfectly describe the essentially electrical character of the technique which is employed. One has, of course, yet to hear a professional astronomer describing himself as a pure televisionist, but if such an argument were to develop it would, strictly speaking, be difficult to disregard the claim.

Hugo Gernsbach, a very popular American magazine editor, writer and publisher, once put in a strong claim to be the first to have made use of the word "television." "This word," he wrote in 1928, "was first coined by myself in an article entitled 'Television and Telephot,' which first appeared in the December, 1909, issue of my *Modern Electrics*."

There is no doubt that H. Gernsbach believed his statement to be correct, but as a matter of fact subsequent investigation has shown that such was not the case. A Frenchman named Perskyi used the word some eight years before Gernsbach.

Perskyi was a literary man. At the beginning of the century he was engaged in making up subject-lists for a publication of the International Congress of Electricity which was held in France during the summer of 1900. Among his published lists of electrical apparatus, projects, inventions, instruments and devices, Perskyi has the word *télévision* which he uses in precisely its modern connotation. The issue of the publication containing Perskyi's *télévision* ("Annexes Congres International d'Electricité") is dated "August 18-25th, 1900."

So far as we know at present this constitutes the world's first use of our modern word. TV, therefore, in its origins, turns out to be a French-devised and applied word, not a British or even an American one. Which is rather a pity because, for the most part, modern television has been, almost exclusively, the product of British and American brains and technical enterprise combined.

New Underwater Television Equipment for Admiralty

AS we close for Press it is announced that new underwater television equipment, incorporating a strong water-tight casing for a modified standard television camera and special lighting, has been developed for the Admiralty by Messrs. Pye.

One complete set has been assembled for immediate delivery to undergo sea trials in the deep-diving vessel *Reclaim* (Lt.-Cdr. J. N. Bathurst, O.B.E., D.S.C., R.N.). A second camera has been ordered for experimental work at the Admiralty Research Laboratory, where a different type of casing is being developed.

Both these cameras will be capable of reaching depths of 1,000ft. They will have built-in facilities for changing lenses, focus and aperture while under water, this being done by remote control. With a maximum visual field of 70 deg. this equipment is of the most advanced design available.

A large fin is fitted to the exterior of the casing to steady the camera and to facilitate its use in difficult tidal conditions. This also serves for mounting the lighting.

The principles of the equipment result from lessons learned by Royal Naval Officers and scientists with the improvised equipment used for the identification of H.M.S. *Affray*, but, with the new equipment, the unwieldy external framework has disappeared. With its neat shape, it is anticipated that it will be easier to handle at sea.

SOUND REJECTION

AN EXPLANATION OF A COMMON TROUBLE AND CIRCUITS FOR ITS REMOVAL

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

ALTHOUGH the Pye development of pulse modulation—enabling modulation of sound on the vision carrier to be performed during the 10 micro-second line synchronising pulses—has shown gratifying results, the current method of using two separate channels is, at present, still favoured by the BBC, due, quite probably, to the lack of adjacent channel interference around this part of the spectrum. This state of affairs may not exist for long, however, as with the opening of the new television transmitters, receivers located in certain parts of the country may suffer from interference on the sound channels due to sound breakthrough from an adjacent channel transmitter unless, of course, they have a high high-frequency vision rejection ratio !

Sound on Vision

The problem presented at the present time, however, is one of minimising the vision channel response to the sound frequency, for unless this is satisfactorily achieved, the picture tube will produce the sound modulation in the form of dark lines across the picture varying in sympathy with the modulation content.

The character of the sound and vision transmissions are approximated by the curves of Fig. 1 ; at (a) the London double sideband transmission is shown, while that at (b) is the single sideband characteristic radiated by the others and potential television transmitters. Observation will show, in either case, that the sound carrier is located at the low-frequency side of the vision signal and that the sound and vision carriers are separated by a frequency of 3.5 Mc/s. Quite a reasonable frequency separation and discrimination between the two channels would not be difficult to secure if the problem was as simple as this, but obviously the vision signal must extend for at least 2.75 Mc/s in the low-frequency direction in order to convey the picture intelligence. This applies equally to the double and single sideband transmissions, for it is the upper sideband which is partially eliminated in the latter case, while the upper sideband of the former extends equally in the high-frequency direction.

It will be seen, therefore, that virtual separation between the sound carrier and the low-frequency side of the vision signal is in the region of 0.75 Mc/s only. This, then, is the factor that creates the sound rejection problem, for unless the response of the vision receiver is such that a sharp cut-off at the low-frequency end is secured, the response of the vision channel will embrace that of the sound—see Fig. 2. This, of course, will result in the vision channel being acceptable to responses at the sound frequency.

One way of overcoming this—with London receivers anyway—is to align the vision channel to the *upper sideband* of the double-sideband signal. This has the effect of shifting the vision channel response away from the sound carrier, as shown by Fig. 3. Obviously, such adjustment is applicable only to channel 1 receivers, but even so, a stage of sound rejection is usually deemed desirable.

Unless an impracticable number of stagger-tuned circuits are employed in the vision channel, the necessary sharp low-frequency cut-off in receiver response is unobtainable from the selectivity aspect, for it must be remembered that in the interest of picture quality the 2.75 Mc/s bandwidth must be maintained.

The superhet mode of reception helps a little in this respect, especially when transformer-coupled I.F. amplifiers are employed, since then the overall vision channel comprises a larger number of tuned circuits. Further, the sound and vision channels are reduced in frequency (to the intermediate frequency) by the same ratio, and the separation frequency is then not such a small ratio of the carrier frequencies.

Sound Pick-up

Tied up with the problem of sound rejection is the circuitry employed to facilitate sound pick-up from the stages common to both sound and vision. Usually the first two valves are common to both channels. In the case of the superhet the R.F. and mixer stages are invariably common, the two channels being separated in the mixer load.

One method of performing this function is depicted by Fig. 4 (a). Here two coils L1 and L2 constitute the anode load, coil L2 is tuned for the correct vision passband, while the other—if tuned to the sound carrier—produces a trough in the overall response curve as illustrated at (b). Such a trough is desirable if it corresponds to the sound carrier where maximum rejection is needed. It is usual, therefore, not to tune L1 for maximum sound, but to tune it for *minimum sound on vision*. This effect is illustrated at (c), where a point noteworthy to observe is the very slight frequency mutation necessary.

It should be noted, of course, that (c) corresponds to the response curve of the coupling to the vision channel only. The coupling to the sound channel, being much sharper, responds solely to the sound carrier. Therefore it does not follow that when tuning to the trough on the overall response curve one is doing this in the sound channel. As far as this is concerned

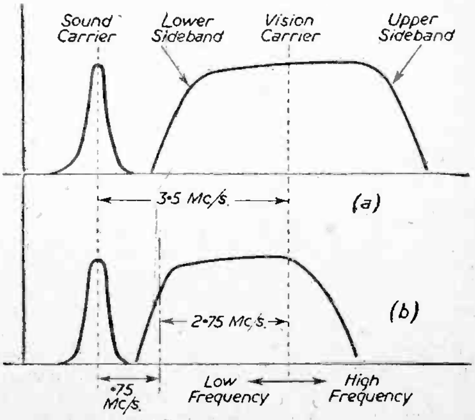


Fig. 1.—The characteristics of sound and vision transmission, above double sideband (London), and below, single sideband (other channels).

the circuit is being slightly detuned. The sound will, of course, be attenuated due to this, but the extra sound rejection derived far outweighs this loss, which is easily counteracted in proceeding stages.

Other methods of sound pick-up produce the same effect in some degree or other, provided the sound pick-up circuit is tuned to minimum sound on vision and not maximum sound.

Rejector Circuits

The basic rejector circuit can take the form of either (a) or (b) at Fig. 5. The series-tuned (acceptor) circuit of

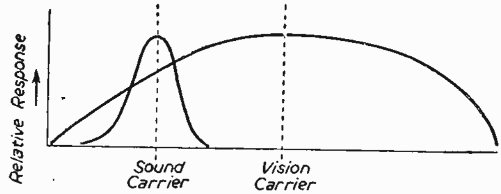


Fig. 2.—Vision channel response without rejector circuits.

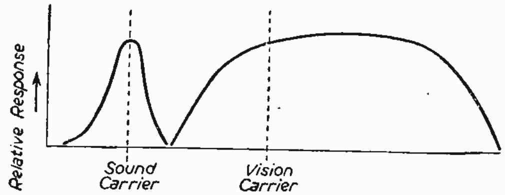


Fig. 3.—The response of a London receiver tuned to the upper sideband.

(a), when resonant, shows, across its terminals x y, a very low impedance to the resonant frequency. While, inversely, the parallel-tuned (rejector) circuit under the same conditions represents an infinitely high impedance.

Now the problem is to introduce a deep and narrow trough at the correct point in the overall response curve without seriously modifying the latter. This has been accomplished to some degree by means of the sound pick-up circuit. Actually—in practice—this circuit produces about a 10 db sound signal rejection. It is desirable, however, in most cases to achieve a sound signal rejection ratio in the order of 40 db (100 : 1 voltage ratio). To this purpose it is therefore necessary to include additional rejection circuits in appropriate sections of the vision channel.

From the foregoing reasoning two methods become obvious. One is to place an acceptor circuit in parallel with the signal path, and another is to insert a rejector circuit in series with the signal path, so that in either case the sound channel is filtered relative to the vision signal.

The principle, therefore, of the series-tuned circuit used for rejection is that at the sound frequency its impedance is so low that it presents a virtual short circuit to the vision coupling it shunts, whereas away from the sound frequency its impedance is so high that it affects very little the vision coupling.

In practice, however, a circuit such as (a) Fig. 5 shunted across one of the tuned couplings of the vision channel would hardly come up to this requirement. Its purpose would be served so far as sound rejection was concerned, but at frequencies above and below the sound rejection frequency it would become respectively inductive and capacitive, and so would tend to reduce or increase the frequency of the tuned vision coupling. This, of course, would distort the vision response curve and of a consequence would produce the undesirable manifestations on the picture associated with such phenomena.

This effect can be minimised by connecting the rejector to a tapping on the tuned coupling as shown at Fig. 6 (a). A similar effect can also be secured by coupling the rejector coil itself to the vision coupling—see Fig. 6 (b). With this arrangement the coupling between the two coils can be varied to procure a compromise between maximum rejection and minimum effect on the vision response curve.

A circuit which is becoming progressively more popular with designers of commercial receivers is depicted by Fig. 7. Here a series- and parallel-tuned circuit combination is employed. C and L form the parallel arrangement and are chosen to resonate at a frequency corresponding to the lower edge of the vision passband. At this frequency the circuit as a whole subjects a negligible shunt impedance across the coupling coil L1, and so the vision response curve, at this point anyway, is unaffected. The parallel circuit becomes inductive as the frequency is reduced towards the sound carrier, and in association with C1 resonates to form a series circuit of low impedance across the coupling coil L1. A sharp cut-off is, therefore, obtained at the low-frequency side of the vision signal and extends, in the form of a deep trough, to the frequency of the sound carrier, thereby providing the desired sound rejection.

A noteworthy feature of this circuit is that as the frequency extends into the high-frequency side of the vision passband the circuit as a whole becomes capacitive to an extent governed by C1. Usually the value of this is extremely low, and provided it is less than the shunt capacitance of L1 the circuit effect within the vision passband is negligible. A tapping is quite frequently made on L to facilitate the pick-up of sound as previously described.

With component values modified the circuits described are suitable for inclusion in either a superhet or T.R.F. style of circuit. It should be understood, however, that in the former case it is possible for the sound channel

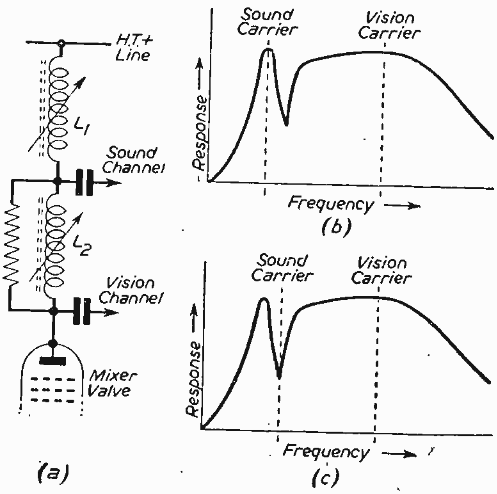


Fig. 4.—A style of sound pick-up at (a) producing a vision response curve at (b) when L1 is tuned to the sound carrier and (c) when L1 is tuned for minimum sound on vision.

—when converted to the intermediate frequency—to be on the high side of the vision passband. This occurs when the frequency of the local oscillator is higher than that of the signals. When this is so it is necessary for the converted vision signal to have a sharp cut-off at

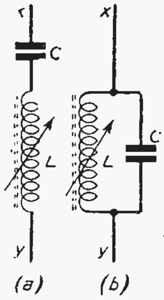


Fig. 5.—An acceptor circuit at (a) and a rejector circuit at (b).

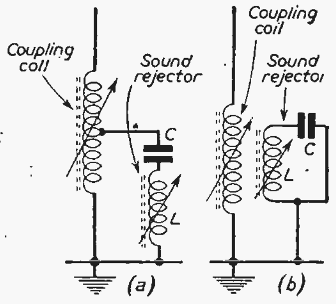


Fig. 6.—Two ways of using a series tuned circuit as a sound rejector.

the high-frequency end of the passband, as opposed to the low-frequency end when the local oscillator frequency is lower than the signal frequencies.

While passing it might be of interest to recall that at least one manufacturer of a five-channel receiver has included an adjacent channel rejector to function and give an attenuation of 40 db at the high-frequency end of the vision passband.

Another Method

The parallel-tuned rejector circuit is frequently employed in commercial practice to form a sound rejector circuit in the cathode lead of a vision-amplifying valve. The basic circuit is well known, but for the sake of completeness is depicted by Fig. 8.

The circuit L C is tuned to the sound frequency and at this frequency the impedance of the tuned circuit is solely resistive. This results in heavy negative feedback, thus reducing the gain of the stage at the sound frequency. Away from this frequency the feedback reduces owing to the fall-off in tuned circuit impedance and the stage resumes its normal gain.

It is usual practice to make the cathode connection via a tapping on the rejector coil. This minimises the load placed on the rejector circuit by the valve circuit and, therefore, enables the circuit to operate at high efficiency.

It is worthy of mention that at frequencies far removed from the sound carrier the circuit is liable to oscillate.

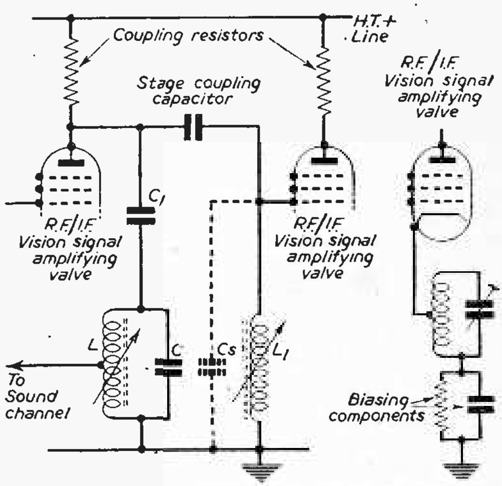


Fig. 7 (left).—A rejection circuit having negligible effect on the vision channel response provided C1 is less than Cs, and Fig. 8 (right).—the cathode circuit rejector unit.

This should be borne in mind by experimenters and service engineers for it tends to complicate the adjustment of this circuit—in fact, it may even be mistaken for a fault elsewhere in the vision channel.

Pioneer's Jubilee

THE first engineer to spend fifty years in the Wireless Industry is Mr. Raymond Dorrington Bangay, of Marconi's Wireless Telegraph Co., Ltd., who celebrated his Jubilee on May 15th.

Born at Lyme Regis in 1883, Mr. Bangay joined the Marconi Company and went to the world's first Wireless College—the Marconi College, at Frinton-on-Sea—in 1902. Later that year he went to America for the Company and, during the next five years, helped to instal many stations, including the first U.S. Coastal Station, at Babylon.

On his return to England in 1907, Mr. Bangay began his now famous study of wireless for military purposes, including the original experiments in air-to-ground communication. He later achieved the distinction of writing the first wireless text book, "The Elementary Principles of Wireless Telegraphy," and was later to follow up with "The Oscillation Valve."

The experiments and developments he made in the military field led to the establishment, in the Marconi Company, of a "Field Station Department" and he took it over, as Chief, in 1914.

In 1921, Mr. Bangay was appointed Chief of Designs and, with the knowledge and experience gained during all these years he became the Technical Representative abroad in 1925. His present appointment of Foreign Manager was made in 1935.

There are few countries in the world that Mr. Bangay has not visited and he is well known as a technical authority all over the world.

During his extensive travels it has been inevitable that many adventures have befallen him and, even in his Jubilee Year, Mr. Bangay is maintaining the pace and tremendous scope of his travelling.

During the first three months of 1952 he has already visited Norway (twice), Sweden (twice), Finland, Belgium, Germany and Switzerland. There can be few companions of his schooldays (Epsom College 1896-1899 and Finsbury Technical College 1899-1901) who still maintain the immense vitality and industry of Raymond Dorrington Bangay.

UNDERWATER TELEVISION

FIRST DEMONSTRATIONS OF THE NEW STANDARD EQUIPMENT PROVE HIGHLY SUCCESSFUL

THE use of television under water has been the subject of much research and experiment during recent months. When, 12 months ago, the Admiralty requested the help of Marconi's Wireless Telegraph Company Ltd. in an attempt to find the lost submarine *Affray* with a Marconi television camera chain, a new field of television applications was opened.

Since then the Marconi Company have been investigating this application, and, during the past few months, had the fullest co-operation of Siebe, Gorman and Co. Ltd. in the design of pressure cases and lighting gantries.

A recent demonstration, at the works of Siebe, Gorman's in Tolworth, shows the extreme sensitivity of this camera, and illustrates the importance of this new development. It is of primary importance in any type of underwater work where it would be dangerous for a diver to descend, and for use at depths far greater than a diver's limit.

In major salvage operations one of the greatest drawbacks has so far been the " blindness " of the surface officers directing operations. With the Marconi-Siebe, Gorman underwater television equipment they will now be able to follow the operations, direct movement and technique, and brief relief divers *visually* before they go down to take over. This will lessen the reliance on a diver's verbal report and will be of inestimable help to those in charge on the surface and to the divers themselves.

A television camera can work for far longer periods under water than could a diver; the Image Orthicon pick-up tubes in the Marconi cameras are far more sensitive and accurate than the human eye, a point of particular importance under water where visibility is necessarily bad, and, in matters of interpretation, it allows scientists and experts to *see* what is below, thus eliminating the discrepancies which must creep into a diver's report—the diver often having no specialised knowledge of the flora, fauna, machinery and geological vista he is sent down to inspect. At great depths pressure has an adverse effect on a diver's judgment, and discrepancies of size and distance become all too frequent.

Another very important advantage is that the television picture received on board a ship from a submerged camera can be filmed and a permanent record obtained.

So far standard Marconi cameras similar to those used by broadcasting authorities all over the world, and used extensively by the British Broadcasting Corporation for outside television broadcasts, have been used. The new camera is fitted with extra facilities designed to allow flexible control from a remote position in lieu of a cameraman.

The full facilities which are required for underwater work with a television camera chain include:

(a) *Remote focus control.* This allows the camera to be focused, while submerged, by the operators aboard ship, and, as indication of setting is shown at the control point, it is possible to estimate the size and distance away of an object with reasonable accuracy.

(b) *Remote iris control.* Remote indication is again provided with this facility. The main advantage of remote iris control is that the lens aperture can be varied to obtain the best possible picture under conditions of considerable light variation. Such variations are present when an object is viewed at 20ft. distance, and then the camera is moved in for a close-up view at 4ft., without varying the light intensity.

(c) *Lighting system.* This must be very flexible to allow for use in waters of various densities and content, and at various depths. The unit provides eight lamps which can be controlled, in pairs, from the surface.

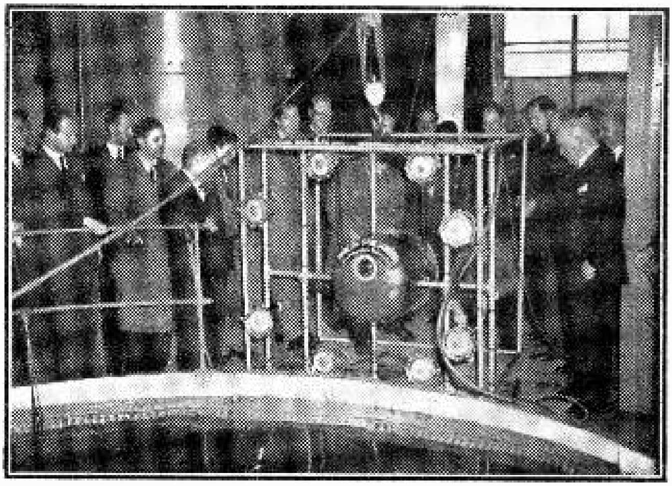
(d) *Mounting facilities.* This must also be a flexible system so that camera and lights can be set up for viewing at various angles, as well as at varying distances.

(e) *Inclinometer.* This gives indications. at the control point, of the unit's angle when submerged.

(f) *Water indicator.* Moisture within the pressure casing, which houses the camera, is extremely detrimental to all the equipment, and this facility detects and warns the operators of any moisture entering the casing.

(g) *Orientation.* A remote bearing compass to indicate the correct orientation of the camera.

Apart from the experimental side of underwater television the Marconi equipment has already proved highly successful in the finding of the *Affray* at a depth of 280ft.



The underwater television equipment, designed by Marconi's Wireless Telegraph Co., Ltd., was shown to Naval Attaches and Admiralty Officials at the works of Siebe, Gorman and Co. Ltd., who have designed the pressure casing and lighting gantry. The Attaches (representing the Argentine, Brazil, Chile, Denmark, Holland, Italy, Norway, Spain, Sweden, Turkey and Venezuela) together with Admiralty and Scotland Yard Officials saw divers working in murky water through the " eye " of the Marconi-Siebe, Gorman underwater television camera.

Knowledge gained on that occasion is now being put to use and a pressure casing for containing the camera is being designed and produced. These casings will have viewing windows through which the lens of the cameras will "shoot" the underwater scenes. A new type of gland has been devised for the camera cable. The cable is of special construction, and is capable of being operated at depths of over 1,000ft.

The Marconi cameras have been used at varying depths and it has been found that in certain conditions good pictures are obtained as deep as 80ft. without the aid of artificial light.

Tests made under practical conditions at sea show that artificial illumination of the object is of doubtful value when the water is clear, but many more results will have to be compiled and obtained before firm conclusions can be justified. Another interesting point shown by these sea tests is that tungsten lighting appears to give better results than either sodium or mercury vapour light.

Under test conditions some applications have already been thoroughly tried out—study of wrecks, finding of objects, and the investigation of the sea bed—and others which present themselves are the study of fish in their natural surroundings, the investigation of trawl nets under operational conditions, identification and control of oyster and scallop beds, inspection of dock gates and ships below the water line without employing divers or using dry docks, and the possibility of undertaking really deep-sea research to depths exceeding 1,000ft.

A photograph taken of the screen of a television receiver, showing a "frogman" at work below the surface—using a cine camera.

New Use for Colour : B.S. for Colour Codes

A NEW use for colour television which adds another dimension to biological research was described recently to the Institute of Radio Engineers by three R.C.A. scientists, Dr. V. K. Zworykin, L. E. Flory and R. E. Shrader, of the David Sarnoff Research Centre at Princetown, N.J. They said the use of colour television will enable the biologist to obtain more information about microscopic specimens than with present methods.

The development was made possible by hooking up an R.C.A. tricolour picture tube to a sensitive new ultraviolet vidicon camera, which is mounted over a microscope trained on a specimen. The absorption of ultraviolet light by the tissues of the specimen differs among them. By arbitrarily assigning different colours to the tissues, the biologist can make them emerge with individual clarity. This method supplants the old system of staining the tissues.

The new technique adds colour artificially to cells or tissues by translating different wavelengths of invisible light into electronic energy. This energy is then translated into the three different primary colours on a colour television picture tube.

A specimen or thin slice of tissue which, to the human eye, appears colourless and flat through a microscope then can be viewed on a television screen as a dynamic picture in colour.

It was pointed out that the use of colour television in biological research represents an extension of the television microscope technique which was introduced by R.C.A. last year. This development permitted instantaneous examination of microscopic specimens under ultraviolet light, and represented an advance over the earlier system of filming biological specimens.

A NEW British Standard, B.S. 1852, "Colour code for fixed resistors for telecommunication purposes," sets out what has now become, with one or two minor divergencies, the internationally agreed colour code for resistors of the type commonly used for telecommunication purposes. The colour code has been in use in this country and elsewhere for several years and is based upon that originated by the Radio Manufacturers' Association of America.

Preferred Method

The Standard specifies the colours to be used and describes alternative methods of marking; the coloured band method is given as the preferred method. Tables giving an interpretation of the code are included.

The Standard applies only to resistors for which colour coding is used to indicate resistance value and certain other characteristics, and does not preclude the continued production of resistors on which ratings are indicated in a non-coded form.

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

Television Technique as an Aid to Observation

FURTHER EXTRACTS FROM A PAPER BY J. D. McGEE, M.Sc., Ph.D., A.M.I.E.E., OF E.M.I. RESEARCH LABORATORIES, LTD., READ TO THE ROYAL SOCIETY OF ARTS

(*Continued from page 551 May issue*)

Televising of Dangerous Processes

THERE are many cases in which it is desirable to watch closely events which are either inherently or potentially dangerous. Thus, in atomic energy work there are operations which must be performed in the presence of intensive and lethal radiation. These have been done by remote controls while observing through a mirror system, which enables the operator to see over an intervening radiation screen, or through 3ft. thick windows of special lead glass. These operations could be watched by television, and possibly with greater facility than by the use of mirrors. The advantage to be gained is the means of keeping the operator well away from the source of dangerous radiation—distance being the best and cheapest form of protection—while by means of remote controls of the camera—focus, iris, lens turret or zoom lens and even direction—he could have greater freedom of observation than when using a mirror system.

It is possible, though by no means certain, that to compete with the mirror system a colour television equipment would be necessary. Insufficient first-hand evidence is available to enable a worthwhile opinion to be given on this point. However, if colour television is necessary this, like operative surgery, is the kind of situation in which it could be applied, since the technical and economic difficulties arising in broadcasting colour television do not arise. Probably the only technical question arising in this application is what effect will such intense penetrating radiation be likely to have on the operation of such a sensitive and temperamental electronic device as a television pick-up tube. Such tests as the author is aware of have shown that the effect is negligible. A C.P.S. Emitron camera was completely unaffected by being exposed to a powerful beam of γ-radiation.

Many other similar applications can be visualised. For example, in the testing of atomic weapons a television camera might be used to give, at a safe distance, a close-up picture of events up to the moment when, presumably, the camera would disintegrate and evaporate in the intense heat of the atomic explosion. Similarly, television cameras could be used to give pictures of the results of such a trial at distances where a human being would, but a camera would not, be damaged by radiation.

Again, it may be necessary to observe closely a new device being tested, or tested to destruction—a process which may involve considerable danger to an observer close at hand. One hypothetical example will be given. It may be desired to test some part of the structure of a new aircraft to the point where it fails. This is a very hazardous thing for a pilot to have to do, since the machine would probably have to be flown at supersonic speeds for the failure to occur, thus making it difficult for him to escape by parachute. However, it would be a comparatively simple technical problem to arrange a television camera to watch the critical point and to transmit the picture to a receiver on the ground by radio where the experts concerned could watch the failure occur in detail from the safety and comfort of an armchair. The 'plane, of course, would be flown by remote radio control in the ordinary way.

Television Guided Weapons

This is an application that was envisaged at a very early stage in the development of television and has received some publicity in recent years. (See *Time*. May 19th, 1951.) In 1938-39 we, of E.M.I. Research Laboratories, fitted a television camera, control equipment and radio transmitter in an aircraft from which pictures of the ground over which the aircraft was flying were transmitted back to receivers at the laboratories. Ground targets were easily identifiable when the aircraft was 25 or 50 miles away over land and 50 to 100 miles over sea. This immediately led to the proposal to put the camera in the nose of the aircraft, load it with explosive, and fly it by remote control, and directed by the television picture, into the selected target on the ground; the aircraft and camera equipment being treated as expendable. It was hoped that the accuracy of bombing selected targets would compensate for the expenditure of so much equipment.

Quite clearly such a scheme is in principle still a possibility, but to discuss it in more detail is outside the scope of this paper.

X-ray Image Television

Radiologists have been, and still are, very anxious that some device be found, possibly by the utilisation of television technique, by means of which adequately bright X-ray images might be obtained while using less intense X-ray beams. This is important both for the doctor and the patient.

Electromagnetic radiation of very short wavelength, such as X-rays and gamma rays, liberate very few photo-electrons when they fall on a surface such as the photo-sensitive surface of a television pick-up tube. Hence a television signal cannot be obtained by the direct action of these radiations on such a mosaic target.

The only feasible approach to this problem, therefore, was to direct the television camera at the fluorescent screen which is normally viewed directly by the radiologist. However, in this comparison, as noted earlier in the section on the televising of surgical operations, the camera compares badly with the human eye if reasonably rapid movement must be observed.

Television Memory

All television pick-up tubes make use of " memory " to some extent. That is, the effect of the light of liberating photo-electrons, which is instantaneous, is integrated in the form of electric charges on small, highly insulating condensers which can retain or remember the charge image until they are discharged in rapid succession by a scanning electron beam to produce he picture signal. In normal television, substantially all charges collected on the mosaic during one frame period are discharged at each transit of the scanning beam, otherwise objectionable lag would appear in the picture. Now this capacity of the tube to integrate and store electric charges can be used in various ways, a few of which are now described.

Transmitting Pictures Over a Narrow Frequency Band Circuit

The normal television system requires a 400- to 500-line picture repeated 25 times per second and if good detail is to be reproduced this requires a band width of about 3 Mc/s. To transmit such a picture signal requires a very special and expensive transmission channel. There are cases in which it would be worth while sacrificing something in the picture to enable it to be transmitted over a more or less simple, narrow-band, channel. Picture detail cannot be sacrified, but rapid reproduction of movement sometimes can. Suppose, then, it is agreed to send only one complete picture per second. This will reduce the frequency bandwidth by a factor of 25 to say 100 kc/s. In the C.P.S. Emitron camera the noise is due to the amplifier and is proportional to the square root of the band-width required. Hence the noise will be reduced by a factor of 5, and so for the same signal to noise ratio, a signal current of only one-fifth is required. The signal current must equal the charging current to the mosaic condensers, which in this case must integrate one-fifth the normal charging current for 25 times the normal frame period. Hence the mosaic capacity must be five times that of the normal C.P.S. Emitron.

If such a picture signal is transmitted over a communication channel, received and used to modulate a cathode ray tube scanning one complete picture per second, the result would be very unsatisfactory to look at because of the violent flicker. A high capacity C.P.S. Emitron type tube can, however, be used to give a steady picture. The reconstituted picture on the receiving cathode ray tube is focused optically on to the mosaic of the high capacity tube, where strong charges are built up by photo-emission. These charges are then scanned off slowly by the scanning beam operating at normal television frame frequency. The picture signals so generated are then reconstituted on a conventional television receiver to give a flicker-free picture. The frame period might be increased to, say, ten seconds with a proportional decrease in the required band-width to 10 kc/s., thus making transmission over communication channels easier. Thus a fixed chart, document, photograph, or even a slowly changing picture such as a radar display could be transmitted over great distances without special wide-band channels.

Stroboscopic Television

The problem sometimes arises of observing closely a moving object at some point of its cyclic path over which it moves too rapidly to be followed accurately by the unaided eye. It is comparatively simple to arrange a mechanism which is triggered by the object at the appropriate point on its path and fires an electrically operated flash lamp which illuminates the object brilliantly for a sufficiently short time to effectively arrest its movement, say, 0.001 second. If a high capacity type C.P.S. Emitron is focused on the object at this point, a brilliant image of it will be formed on the mosaic and a strong charge image of the object will be built up on the mosaic which is sufficient to give an adequate signal to noise ratio when the tube mosaic is scanned in the normal way at, say, 25 frames per second for the next second or so until another charge image is built up on the mosaic. Thus a rapid succession of pictures of the moving object arrested at any chosen point in its cyclic path will appear on the television display screen.

This kind of investigation has usually been done by cinematographic methods, but these suffer from the disadvantage that some time must elapse before the film can be developed and projected.

Television in Astronomy

If we compare the picture from a modern television camera operating at 25 pictures per second, with a photograph taken with the same effective exposure time of 1/25 sec. using the fastest available commercial film (Super XX) we find that the television camera is the more sensitive by a factor of 5 to 10. Also a television pick-up tube of the C.P.S. Emitron type allows charges produced by very weak light images to be integrated on the mosaic since they are not lost or confused by electrical leakage. When sufficient charges have been accumulated they can be scanned off rapidly by the scanning electron beam to produce a signal picture. In tubes already made such a " time exposure " of a C.P.S. Emitron tube has been continued for several minutes and there seems to be no reason why tubes cannot be made to enable time exposures lasting some hours to be made. Thus there is a good reason to hope that a television pick-up tube might surpass the photographic plate in sensitivity even when used for long time exposures. It is true that the picture reproduced from the storage tube after a long exposure would last for only a few picture frames, but it could be photographed, and there is good reason to hope that it will be possible to reproduce it for quite long periods by use of other storage tube devices.

The most important feature of this possible application is that the photo-electric emission, on which the whole process depends, is strictly proportional to the incident light down to the smallest amounts of light known as quanta. This is not the case with the photographic process which shows a discontinuity at low light intensities, and so cannot be relied upon to give accurate reproduction of very faint images. Thus it is possible that this application of television technique to the recording of very faint light images may both extend the range and improve the fidelity of recorded images.

Space does not permit a detailed description of the type of apparatus envisaged for this application to be given, but the main requirements are :

1. The photo-electric efficiency of conversion of light into electrons must be as high as possible, thus indicating a continuous photocathode rather than a discontinuous mosaic.
2. The integration and storage of these electron charges must be efficient over long periods which requires a storage mosaic with extremely good insulation.
3. The reproduction of the stored charges must be done in such a way as to avoid spurious signals, shading effects and other defects so common in television pictures.
4. The reproduced picture must be recorded for prolonged study in detail.

It seems quite possible that in the not too distant future electron tubes of this general type may be used for recording very faint optical images as, for example, in the large astronomical telescopes.

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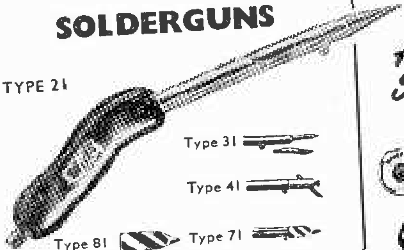

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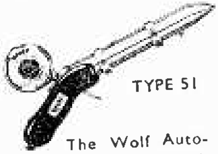

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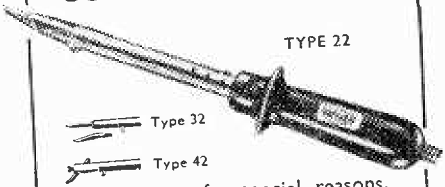

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Line Flyback E.H.T.

METHODS OF OBTAINING DIFFERENT VOLTAGES

By P. Dodson

THE high-voltage pulses generated at the anode of the line output valve in a magnetically-deflected receiver make it possible, with the addition of a suitable rectifier, to obtain E.H.T. simply and cheaply. It is a method favoured by the majority of commercial manufacturers. The actual voltage is usually fixed, being determined largely by the amplitude of the pulse. This varies with different line output transformers, type of valve and H.T. potential. These pulses reach an amplitude of 2 to 2.5 kV. above earth and occur at the line frequency of 10,125 cycles per second. They can be stepped up by means of an overwind on the line output transformer, or by a multiplier circuit, then rectified to produce E.H.T. Sometimes it happens that the E.H.T. is not correct if another type of C.R.T. is to be used, the voltage being either too high or too low.

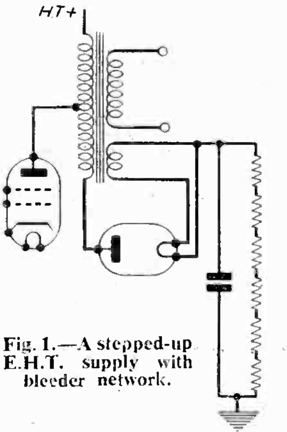


Fig. 1.—A stepped-up E.H.T. supply with bleeder network.

Should the voltage be too high a bleeder network consisting of half a dozen or so fixed resistors to a total value of, say, 50 megohms may be connected from E.H.T. line to earth (Fig. 1). The correct operating voltage can then be obtained from a point on the network.

If a metal rectifier, such as 36EHT100, is used instead of a valve, it could be connected to either the anode of the line output valve or the transformer. If the transformer ratio is 2 : 1 then the anode connection will give 1½ times instead of double voltage. A valve rectifier cannot be connected to the anode of the line output valve with an overwound transformer, as the rectifier heater would run at too low a temperature. This is due to the fact that the heater winding has been designed for operating the valve from the overwind on the transformer. A separate heater transformer could, however, be used, but it would need to be highly insulated, as the inverse peak voltage from heater to earth is double the input peak voltage.

When it is desired to fit a modern tube in an old television receiver an increase in E.H.T. will be necessary. There are several ways in which this can be accomplished. If the receiver derives its E.H.T. from the line fly-back, the voltage can be increased by using the pulse at the anode to supply a boost rectifier. The output of this is added to that from the transformer overwinding (Fig. 2). If the ratio is 2 : 1 the increase in E.H.T. will be approx. 1½ times. So, if the original voltage was 6 kV., then the augmented E.H.T. will be 9 kV. If the tube requires a lower voltage a bleeder network can be fitted and the correct operating voltage tapped off.

A booster can also be applied to an existing mains-driven E.H.T. supply (Fig. 3). If the original E.H.T. was, say, 5kV., then the augmented voltage will be approximately 7.5 kV., the additional 2.5 kV. being supplied by the booster circuit from the anode pulse.

Fig. 4 shows a method whereby 4.5 kV. or 6 kV. can be obtained by a multiplier circuit using miniature metal rectifiers on a line output transformer without overwound primary or heater winding. For a 4.5 kV. output omit MR3, C2, C5 and R2.

In addition to the systems outlined a further variation of E.H.T. voltage can be effected by varying the H.T. applied to the anode of the line output valve. This, as mentioned earlier, varies the amplitude of the pulse at

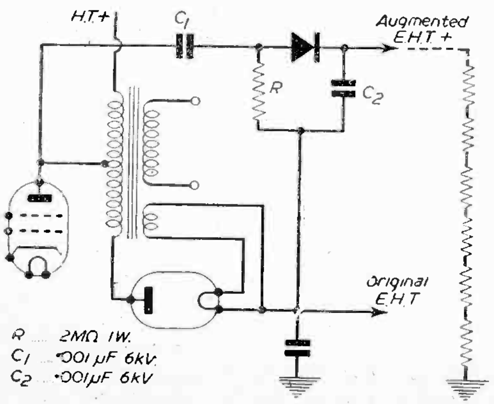


Fig. 2.—Circuit showing booster diode added to a line flyback circuit.

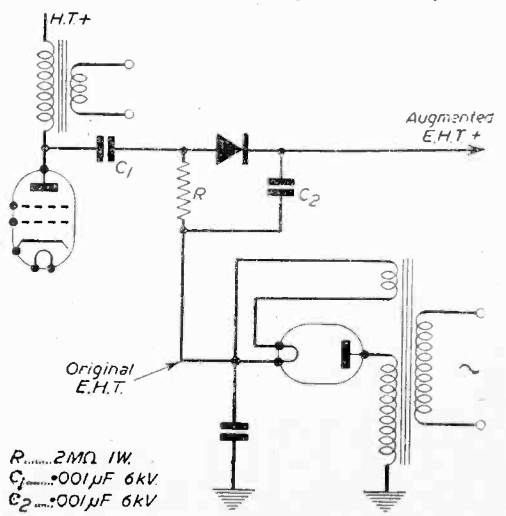


Fig. 3.—A booster added to a mains-driven E.H.T. supply.

the anode. If further control is desired a wirewound variable resistor may be fitted to supply the screen volts. The cathode bias resistor may be made variable and used to alter the amplitude, and this will vary the E.H.T. voltage. For this reason the amplitude (width) control is best placed in the leads to the line coils or across a separate winding on the line transformer.

A Warning

It is as well to repeat here the warning that the efficiency of the line scanning circuits is dependent upon the value of the E.H.T. For instance, if it is thought that more E.H.T. is desirable, and any of the changes mentioned above are made, it will undoubtedly be found that the picture will be reduced in width. Therefore, it must be remembered that increased E.H.T. calls for increased scanning power and vice versa.

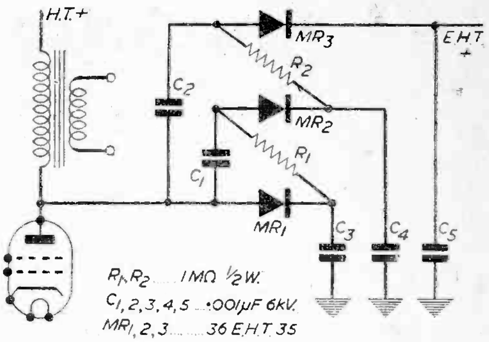


Fig. 4.—Multiplier using metal rectifiers.

Irish Television

By J. Gray

THEY say that the average human is very prone to boasting ; and with many long-range television enthusiasts this remark is particularly true. Possibly the Celtic background has something to do with it ; for somehow when your video signals reach us in the Ulster hills they have a peculiar way with them. By some they are reflected by the clouds, and by others the reception reasons are due to ground drag. More mystical reasons are given by outer circles of the public, however, so perhaps no more need be said of these.

Somehow the "little folk" seized the writer, and he felt compelled to dabble in the enchantment. His magic box was a 1355 unit, with an RF26 tuner (how these horrible numbers break spells). At first the choice was apparently Sutton Coldfield, and then Holme Moss ; but, as the stations drew closer and still no picture materialised, so also did the spirits drop. A detailed study of a map of the British Isles, however, showed that the local Castlereagh Hills (S.E. of Belfast), in the shadow of which the writer lives, were providing an effective screen. Until the Kirk o' Shotts station opened, therefore, it was decided to study receptions in other parts.

Now the spell returns, when visits always bring forth tales of previous wonderful reception. Perhaps it was just the night before, or was it two or three nights ago ? My fellow enthusiasts, stout chaps all, will excuse me here. It is all in good fun, and one cannot resist poking a finger of fun now and then. Preserve us from TV bigotry. The main point was that always there was snow, lots of it, more than the North or South Poles ever saw. And then the cars and amateur transmitters, and Radar stations—and cement mixers. Have you ever had your reception spoilt by a cement mixer ? Still, all joking aside, there were one or two bright periods, particularly on the high ground north of the city.

At last the hour arrived, and Scotland came on the air. For some weeks there had been a warming-up period, when the tuning signal was transmitted and the clock was duly noted (yes, it was badly out of shape, crushed to one side, and holding badly). Still, if you can do better at 120 miles and 5 kW. you are welcome. There is a certain temptation to sum up the previous receptions by the haughty remark : "Oh, high ground, you know" ; but then look at the distances—220 miles Sutton Coldfield and 180 miles Holme Moss. The reception set-ups were similar—1355 unit with RF26, and, incidentally, VCR97.

Since those first exciting days Kirk o' Shotts has come on to the regular programme, though still at 5 kW., and results are variable. Sometimes they are fair ; but more often there just aren't any. There is certainly nothing entertaining about the reception, and the best that could be said about it is "novelty." Then again there is the ever-present urge to boast, to display that rare thing the TV aerial (this is a three-element array, cut for, and directed towards, Kirk o' Shotts), or to say in that nonchalant way, "yes, I saw it on the TV the other night."

Still, to break through the enchantment, and the blarney, some facts do emerge. First, results improve with temperature and pressure rise. Then reception is usually better after dark. Finally, the sound reception is generally quite good. Before concluding, the author must point out that there is still a vertical black line cutting across his picture three-quarters to the right, and all his spells to date have been unable to remove it.

A Grid-dip Meter and Bar Generator

A TELEVISION TEST SET FOR THE AMATEUR AND SERVICEMAN

By E. N. Bradley

DIFFICULTIES with the coils of an experimental sound strip were the spurs which finally prompted the writer to transform a long-standing idea into an accomplished fact—the construction of the grid-dip meter and bar generator the circuit of which is shown in Fig. 1. An hour after the construction work was completed, and before the instrument was finally calibrated, it had proved its worth, and certainly seems likely to become one of the most useful pieces of equipment in the writer's workshop.

Basically a grid-dip meter is an oscillator tunable over the required frequency band, the grid current of the oscillator being indicated on a suitable moving-coil meter. This meter does not require accurate calibration, since it serves merely as an indicator—the only requirement is that the grid current shall establish a reasonably full-scale reading without driving the pointer hard against the limit stop. Provision is made for coupling the oscillator into any tuned circuit resonant within the oscillator's tuning range, and when the oscillator tuning is brought to the resonant point of the coupled tuned circuit, power is absorbed from the oscillator by the external circuit. This causes a dip or fall in the reading of the grid current meter. If the oscillator is calibrated in terms of frequency the resonant frequency of the external circuit can, therefore, be found with accuracy by reference to the oscillator frequency at which the greatest grid current dip is found.

The present instrument covers the range from 40 to 68 Mc/s and so covers all five television channels. The original instrument is calibrated at 40, 45, 50, 55, 60 and 65 Mc/s as well as at the sound and vision frequencies on all five channels, and so permits of experimental work on all the television bands.

The possibilities of the instrument are further extended, however, by providing it with switched modulation. For frequency-measuring purposes modulation is not required, but for test purposes the carrier can be modulated with a 500 cycles note from an audio oscillatory circuit without detectable effect on the accuracy of the oscillator tuning. This gives an audio signal for the testing of sound strips and a set of ten horizontal bars for vision testing; besides the actual reception test the bars can be used to show lack of frame linearity, give an indication of the effectiveness of frame sync. circuits, and show up feedback in the tuned circuits of the vision strip should this exist.

The Circuit

The circuit of the grid-dip meter is shown in Fig. 1, from which it can be seen that the oscillator is built round a B7G triode, the 9002. The coil is tuned by a small split-stator capacitor and is coupled by a one-turn link to an output socket. An external one-turn loop can be plugged into this socket to serve as a "probe" loop for coupling into normal coils, or the loop can be removed from the socket and a tuned circuit such as an aerial plugged in. The absorption of a dipole aerial should be sufficiently great at its resonant frequency to stop the oscillator from working, so reducing the grid current reading to zero, this providing a valuable check on the functioning of a suspect aerial. It is a good deal more convenient to plug the feeder into the meter and to check for a strong dip than to lower a dipole or H aerial for inspection of the feeder joints!

With S1 in its short-circuited position the meter is returned directly to earth (i.e., the chassis), but with S1 open the meter connects through R2 and the secondary of a small transformer to earth, the primary of the transformer being left permanently connected in the anode supply line. With S1 open, therefore, there is coupling

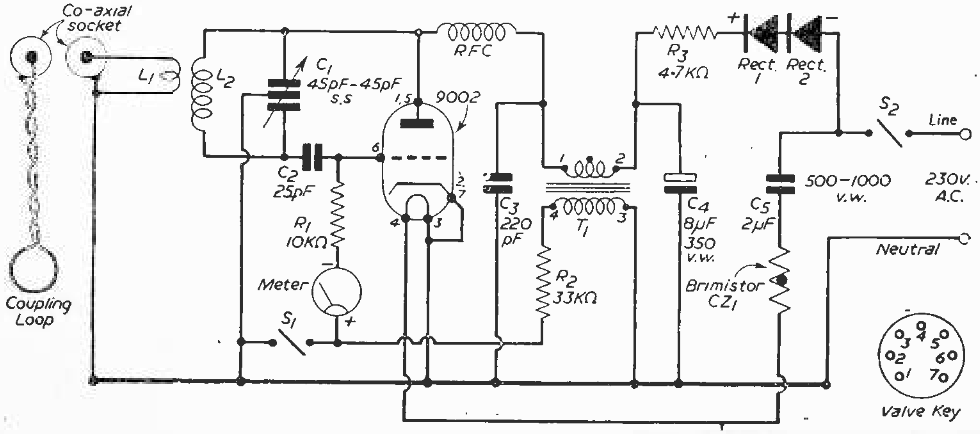


Fig. 1.—Circuit of the complete meter and bar generator.

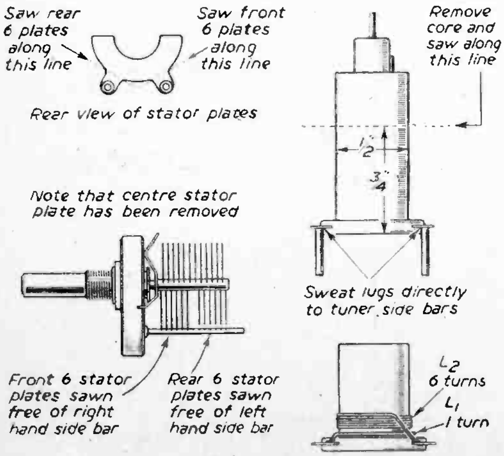
between the grid and anode circuits of the triode sufficient to cause strong low-frequency oscillations ; the original high-frequency oscillations of the circuit are thus strongly modulated and what is, in effect, a "pulsed" carrier is transmitted. If the one-turn coupling loop is plugged into the output socket this will be found to serve as a sufficient aerial for good signal injection into a nearby televisor, the televisor itself being coupled into a suitable dipole. It is generally preferable to test televisors with a dipole connected into the aerial sockets to give the first tuned circuit correct loading if a properly matched signal or pattern generator is not available.

Since only a low H.T. potential is required (of the order of 150 volts), a simple power pack suffices. That shown in Fig. 1 employs a 250 volts half-wave rectifier (two SenTerCel RM1 units in series), with no reservoir capacitor, the rectifier feeding directly into the smoothing resistor R3. An 8 μF 350 v.w. capacitor provides adequate smoothing, a slight residual hum on the supply line serving to lock the audio oscillator to a multiple of 50 cycles per second.

In a single valve unit of this description where the H.T. is drawn directly from the A.C. mains there is little purpose in tying up a heater transformer for the valve heater supplies, and a series-capacitor heater circuit is, therefore, employed; a CZ1 Brimistor being placed in series with the capacitor and valve heater to take up undesirable starting surges which might otherwise overload the valve heater. For the benefit of constructors to whom this method of heater power supply is new it can be said that the regulation of the system is remarkably good so long as the heater load is kept reasonably low—for 0.2 amp. valves regulation is good until the voltage drop across the series heater chain is as high as 100 volts. In the present case where only one valve is in circuit, regulation might be said to be almost perfect—shorting out the Brimistor, for example, once the circuit has risen to operating temperature, gives practically no variation in heater voltage, and mains fluctuations are similarly made ineffective. In the grid-dip meter this is not a point of great advantage, but in some types of test gear, such stability of the heater supply confers considerable benefits.

The value of the capacitance required may be calculated from the formula :

$$C = \frac{Ih \times 10^6}{2\pi f\sqrt{Vs^2 - Vh^2}}$$



Figs. 2 and 3.—Details of the condenser and coil modifications.

where C is the capacitance in microfarads,
Ih is the heater current of the valve chain,
Vs is the mains supply voltage and
Vh is the voltage drop across the heater chain.

The term $2\pi f$ may, for 50 c.p.s. mains, be taken as equal to 314.

In the present case Ih is 0.15 amp. and Vh, taking into account the Brimistor whose final operating resistance is of the order of 100 ohms, is approximately 21 volts (6.3 volts for the valve heater plus approximately 15 volts dropped across the Brimistor. The Brimistor, when cold, has a resistance of about 3,000 ohms, so that when the circuit is first switched on the valve heater draws very little current at all. The Brimistor rapidly heats up, however, its resistance falling as it does so, until the valve is drawing its correct current).

Logarithmic working of the formula gives the value of capacitance required as 2.085 μF but a 2 μF capacitor will serve in the present circuit. If possible, the component should be bridge checked, for its value should not be much higher than the calculated figure otherwise the valve heater may be overrun. In the original model the capacitance of the component proved to be rather lower than the 2 μF marked on the can, so that the valve heater was found to have only 5 volts across it. Nevertheless, the circuit worked well so that no adjustment was made ; in this case the low H.T. potential made it possible to underrun the valve heater without bad effects, though it must be remembered that as a general rule underrunning of a valve heater is as bad as overrunning.

The term in the bottom line of the right-hand side of the equation, $\sqrt{Vs^2 - Vh^2}$, gives the R.M.S. voltage across the terminals of the capacitor—in this case practically the full mains supply taking the supply voltage as 230 volts. The capacitor, therefore, must be chosen with care not only from the point of view of correct value, but also for its ability to withstand A.C. operation. The D.C. rating of the component should be at least 500 v.w and preferably 1,000 v.w. and if there should be any doubt about the component it should be tested in an equivalent circuit for a long run, using a 120 ohms 5 watt resistor in place of the valve heater and Brimistor. The mains supply line to such a test circuit should be well fused. *Remember that a paper capacitor MUST be used, never an electrolytic component.*

Construction

It was required not only that the unit should be small and compact, but also that it should be cheap to construct, and for that reason no special parts were obtained, everything being drawn from the spares box. The meter movement was taken from an 0.5 amp. thermo-couple meter whose thermo-couple had seen better days. The meter was stripped down, due care being taken with the delicate pointer and bearings in

LIST OF C

L1—1 turn 26 S.W.G. rubber or polystyrene covered wire.
L2—6 turns 28 S.W.G. enamelled wire, close-wound and touching L1. ½ Windings on adapted Aladdin ⅜in. former.
R.F.C.—40 turns 32 S.W.G. D.S.C. wire, close-wound on Erie Type 8 33 KΩ resistor.
C1—Adapted 100 pF J.B. C804 Air Tune tuner, or normal 50-0-50 pF split stator. See Text.
C2—25 pF S.M. 350 v.w.
C3—220 pF S.M. 350 v.w.
C4—8 μF 350 v.w. El
C5—2 μF 500 or Paper Mansbridg
R1—10,000 ohms, ½
R2—33,000 ohms, ½
R3—4,700 ohms, ½ v
Brimsitor—CZ1.
Rec. 1, 2—SenTer rectifiers.
T1—Midget 5 : 1 o former. See Text.

order that these should not be knocked, and the thermo-couple was removed from the meter base (the movement being placed under its cover during this operation in order that no dust or metal filings should fall into the gap). The meter movement was then re-mounted on its baseplate, its two leads being taken to the original thermo-couple mounting blocks and sweated to these to connect the movement directly to the external terminals.

The scale was then removed from its mountings, the two limit stops on their screws being handled by tweezers, and a piece of fairly thick white paper was cemented down on the scale face by rubber solution (bicycle tyre repair solution is perfectly satisfactory). When the solution was dry the paper was trimmed round the scale with a very sharp razor blade, the scale then having a new and unmarked surface. On this, with draughtsmans' bows, was drawn in India ink a new scale arc to suit the pointer length, the arc not being calibrated in any way but left blank. Below the arc the scale was lettered "TV Grid-dip Meter" to relieve the plain whiteness of the meter face. The scale was remounted, the limit stops being adjusted for the correct pointer travel, the cover was cleaned and the meter re-assembled, not forgetting a check on the zero-correcting pip before the cover screws were replaced. It remained to check the polarity of the meter terminals and to ascertain the sensitivity of the movement—this was found to be approximately 2 mA.

It would be possible, of course, to employ any meter with a sensitivity of 2 mA or better in this instrument, and many constructors will probably have surplus 1 mA meters which they will wish to use. It will almost certainly be necessary to place a small shunt resistance across a 1 mA meter, if used in this circuit, to bring the pointer off the full-scale stop, but such a shunt can soon be made of a small resistance or length of resistance wire. If the 1 mA meter has a common resistance of 100 ohms or thereabouts, the required shunt need be no more elaborate than a 220 or 150 ohm resistor, chosen by trial and connected directly across the meter terminals. It is repeated that it is only necessary to bring the meter pointer to any convenient position on the scale arc, preferably near the full-scale reading point, so that a dip in the reading can be seen immediately.

A somewhat unelaborate metal case had already been chosen for the instrument, which was to be housed in a large Rowntree's cocoa tin, and it was found that when the power supply components and the meter, together with the two switches, were housed in the tin, little room was left for the oscillator itself. This was accordingly mounted on the lid of the case and connected to the rest of the circuits by leads of sufficient length to allow the lid to be withdrawn well clear of the tin. Remember, when such a form of construction is used, *that the lid must be bonded by a length of flex to the main case.*

Some little ingenuity was required so far as the split-stator tuning capacitor was concerned. A split-stator component with an earthed rotor was essential for the complete avoidance of hand-capacitance effects, and no component of that type possessed by the writer would fit the available space. Finally a split-stator tuner was made from an ordinary 100 pF ceramic-mounted variable capacitor of the Jackson Bros. Air Tune C804 type, as shown in Fig. 2. In this tuner the stator plates are supported on two side rods and the 100 pF capacitor

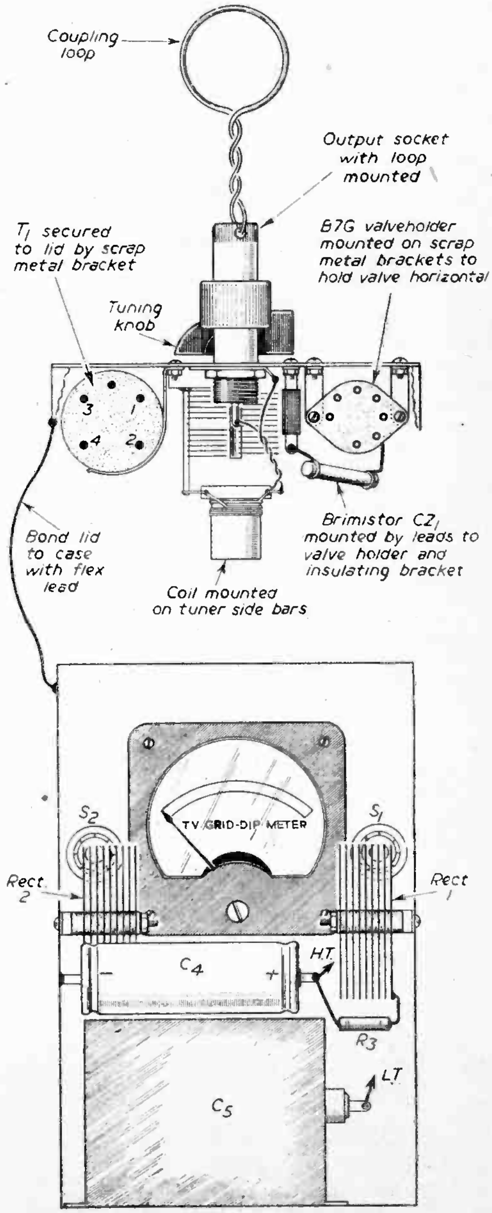


Fig. 4.—Pictorial layout of the unit.

MPONENTS

ectrolytic. ,000 volts working.	M—2 mA moving coil meter or 1 mA etc., shunted. See Text.
ype.	V1—9002 triode.
watt. watt.	1 B7G valveholder, small size (paxolin preferred).
att.	S1, S2—On-off switches, toggle or push.
Cel RM1 selenium	1 Belling-Lee co-axial socket and plug. Insulated wire loop.
r 3 : 1 audio trans-	1 Pointer knob.
	Case, card, nuts, bolts, etc.

has 13 stator plates. By means of a fretsaw the centre stator plate (No. 7 from the front) was sawn out, and the front six plates were sawn free of the right-hand bar. In the same way the rear six plates were sawn free of the left-hand bar, and all the sawn edges were gently cleaned by a fine, thin file. This left the original rotor as a coupling between two sets of six stator plates each, the two sets of stators being insulated from each other, and supported each by a single side bar. The only slight weakness introduced into the tuner was a tendency for the side bars to rotate in their mountings in the ceramic front plate, but since the coil former lugs were sweated directly to the ends of these bars this restored the lost strength, and both anchored, and established the spacing between, the two stators. The final tuner has a capacitance of approximately 45 pF per stator and gives a suitable frequency swing with the specified coil. It is recommended that this split-stator tuner should be duplicated even if the grid-dip meter is built up in a different form, unless a normal 50-50 pF split-stator capacitor is employed. A tuner with a lower capacitance will not give a sufficiently wide frequency swing to cover all five television channels.

The coil and coupling link, L2 with L1, is wound on a coil former in order that complete stability may be obtained. L1 consists of a single turn of polystyrene-covered 26-gauge wire (practically any similar wire may be employed) and L2 is wound immediately beside L1, consisting of six turns of 28 S.W.G. enamelled copper wire. Again, similar wire will serve, and it is not essential to use the original gauge, though obviously a very great departure from 28 S.W.G. will change the coil inductance. Enamelled wire should be used. L2 is wound with its turns touching.

The original coil former was made from a $\frac{3}{8}$in. diameter Aladdin former cut down to a length of $\frac{3}{4}$in. as shown in Fig. 3, the base section with its connecting lugs being employed. These lugs give added strength to the stator rods of the adapted tuner, and this type of coil former is therefore recommended.

The high frequency choke, R.F.C. in Fig. 1, is wound with 40 turns of 32 S.W.G. double silk-covered wire on a 33,000 ohm Erie Type 8 resistor, this type of resistor being suitable since it has a ceramic shell. The turns are protected by a single layer of cellophane tape, and are soldered at each end of the choke to the resistor connecting wires. Enamelled wire could be used in place of D.S.C. wire, but a thicker wire than 32 gauge should not be used.

The audio oscillator transformer, T1, was also found in the spares box, and doubtless can be duplicated by many constructors. It is of the Wearite "Hyperloy" type, cylindrical in form and measuring only 1$\frac{7}{8}$in. overall length by 1 3/32in. diameter. Its ratio appears to be of the order 5 : 1, though no accurate check has been made, whilst the winding resistances are: Primary (points 1 and 2, with centre-tap), 250 ohms approx.; Secondary (points 3 and 4), 1,500 ohms approx. The original component was taken from a three-valve mine-detector amplifier widely sold as surplus some time ago, the amplifier containing three 1T4 valves on a small panel, the transformer being mounted at one end of the valve shelf. In the writer's component tag No. 4 was found to be shorting to the shielding case, whether deliberately or accidentally is not known. A wrapping of cellophane tape round the transformer to isolate its can from the metal instrument case made this defect unimportant, however.

Obviously, it is not essential to employ an exact duplicate of this transformer in the audio oscillator, and practically any small inter-valve transformer of ratio 3 or 5 : 1 will serve; the most important point is to obtain a unit which will fit into the available space. A different component will probably give a different modulating frequency, but this can be tuned by a capacitance across the secondary, if necessary, until a frequency bearing a relationship to 50 c.p.s. is obtained. A multiple of 50 c.p.s. is required to give a definite number of bars across the screen with the frame time-base running at its correct speed. The required capacitance must be found by trial.

The Brimistor, as is shown in Fig. 4, is supported between a stand-off mounting support and the heater pin on the valveholder so that it is not in close proximity to any other component.

(To be continued.)

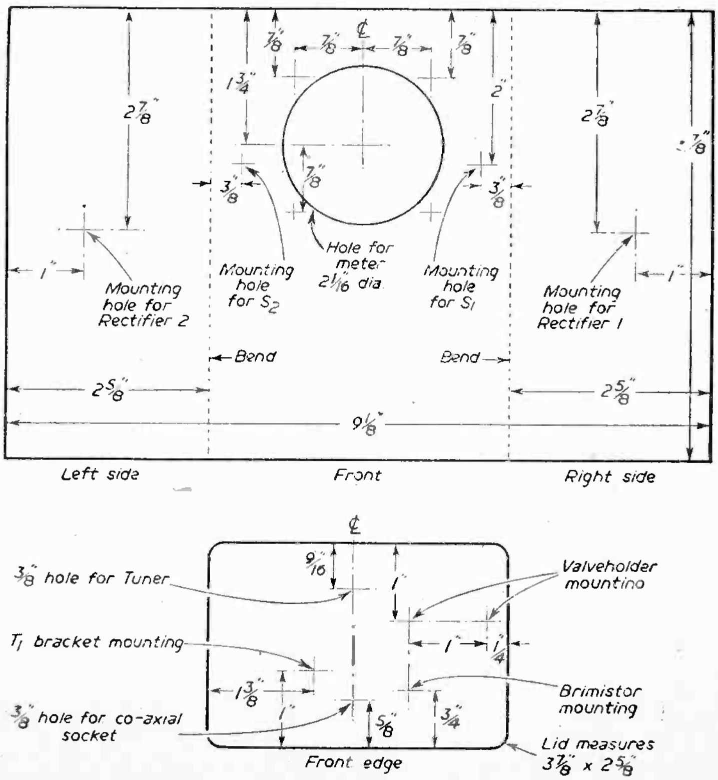
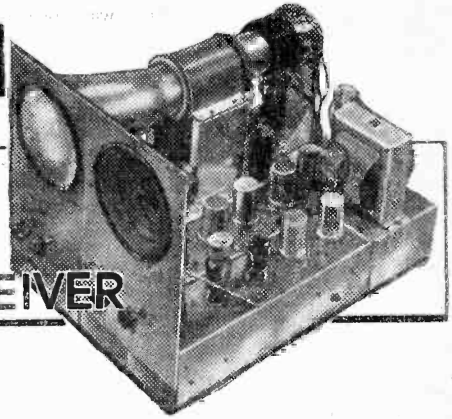


Fig. 5.—Drilling and cutting data of the panel and chassis.

The "ARGUS"

BUILDING OUR *Free Blueprint* TELEVISION RECEIVER



4.—FINAL DETAILS AND A LIST OF SUPPLIERS AND PRICES

NOTE:—Reprints of the Blueprint and instructions are now available for 2/6 *each.*

AMONG the various queries received on this receiver the most common was undoubtedly, "Can you tell me where I can get the parts for the 'Argus' at the price quoted?" Some readers even went so far as to challenge the cost given in the opening article, and in one case a trader is reported to have said it was impossible to obtain the parts for anything like the price given and suggested that it would cost at least double.

In order to satisfy those readers who are in doubt on this question we give below a full shopping list of the parts which were obtained for the prototype, and it will be seen that the firms are all advertisers in these pages or those of our companion paper *Practical Wireless* and, in fact, most of the items were obtained as a result of their advertisements.

VISION RECEIVER

	£	s.	d.	
7 Coil former.		4	1	Alpha Radio
18 500 pF condensers at 5½d. ea.		8	3	Alpha Radio
8 others at 9d. ea.		6	0	Radiolectron, 22, Frances Street, Scunthorpe.
18 Res. at 6d. ea.		9	0	Alpha Radio
VR1 (2 KΩ in lieu of 2.5 KΩ)		1	0	Alpha Radio
5 V/holders		2	6	Alpha Radio
1 V/holders (EA50)			4	Alpha Radio
	£1	11	2	

TIME BASE

		£	s.	d.	
C40	.01 μF			4½	Alpha Radio
41	.1 μF			4½	Melluish, Tolworth, Surrey
42	.1 μF			4½	Melluish
43	.5 μF			4½	Alpha Radio
44	.05 μF			4½	Alpha Radio
45	.1 μF			4½	Benson, 308, Rathbone Rd., Liverp'l
46	8 μF		1	9	Sussex Electrical, Brighton
47	.1 μF			4½	Melluish
48	.1 μF			4½	Melluish
49	.001 μF			4½	Radio Mail
50	.001 μF			4½	Radio Mail
51	.1 μF			4½	Melluish
52	50 pF			9	Radio Electric
53	50 pF			9	Radio Electric
54	.1 μF			4½	Melluish
55	.1 μF			4½	Melluish
56	100 pF			5½	Alpha Radio
57	100 pF			5½	Alpha Radio
58	0-30 pF			10	Alpha Radio
59	.005 μF			5½	Alpha Radio
60	.01 μF			4½	Alpha Radio
VR4	2 M.		2	0	Willetts, W. Bromwich, Staffs
VR5	2 M.		2	0	Willetts
VR6	25 K., 2 w.		1	0	Alpha Radio
R43	2 w.		1	0	T.R.S., Croydon, Surrey
R47	2 w.		1	0	T.R.S.
6 V/holders at 4d. ea.			2	0	T.R.S.
14 Res. ½ w. at 6d. ea.			7	0	T.R.S.
9 Res. 1 w. at 8d. ea.			6	0	T.R.S.
		£1	12	8½	

SOUND RECEIVER

		£	s.	d.	
C27	500 pF			5½	Alpha Radio
C28	500 pF			5½	Alpha Radio
C29	500 pF			5½	Alpha Radio
C30	500 pF			5½	Alpha Radio
C31	35 pF			9	Radio Mail
C32	.01 μF			4½	Alpha Radio
C33	.001 μF			4	Radio Mail
C34	25 μF 12 v.		1	3	Alpha Radio
C35	.5 μF			4½	Alpha Radio
C36	.5 μF			4½	Alpha Radio
C37	.05 μF			4½	Alpha Radio
C38	50 μF 25 v.		1	3	Electrolab Radio, Belfast
C39	.001 μF			4½	Radio Mail
12 at ½ w. at 6d. ea.			6	0	T.R.S.
2 at 1 w. at 8d. ea.			1	4	T.R.S.
VR2, 2.5 K (or 2 K.)			1	0	Alpha Radio
VR3	500 K.		1	9	Alpha Radio
Loudspeaker			12	11	Radio Supply
L/S transformer			3	11	Radio Supply
6 V/holders at 6d. ea.			3	0	Alpha Radio
1 EA50 V holder				4	Alpha Radio
3 Coil forms. ⅜ with cover			1	9	Alpha Radio
3 Trimmer, 0.30 pF			2	6	Alpha Radio
		£2	1	9½	

C.R.T. NETWORK AND E.H.T.

		£	s.	d.	
C61	.03, 2.5 Kv. (nearest equivalent .02, 5 Kv.)		1	6	Benson
C62	0.1, 2.5 Kv.		2	6	Benson

		£	s.	d.	
C63	0.1, 2.5 Kv.		2	6	Benson
C64	0.1, 450 v.			4½	Melluish
E.H.T. transformers		1	17	6	U.E.I. Corpn.
100 KΩ Potr., 3 at 1/- ea.			3	0	Alpha Radio
500 KΩ Potr.			1	9	Alpha Radio
8 Res. ½ w. at 6d. ea,			4	0	T.R.S.
6 Res. 1 w. at 8d. ea.			4	0	T.R.S.
1 Res. 2 w. at 1/-			1	0	T.R.S.
V/holder EA50				4	Alpha Radio
V/holder, ceramic			1	0	Premier Radio
C.R.T.		1	15	0	Electrical Radio, Belfast
		£4	14	5½	

POWER PACK

		£	s.	d.	
Mains transformer		2	9	9	Radio Supply
Choke. 3H Parmeko : cheaper equivalent is :					
5 H.	200 m/a		6	0	U.E.I. Corpn.
16+16 μF	450 v.		4	6	Strange, Pendleton Rd., E.17.
8+8 μF	450 v.		4	0	Strange
2.5 K.	10 w.		2	6	U.E.I. Corpn.
2.5 K.	15 w.		2	6	U.E.I. Corpn.
		£3	9	3	

TOTALS

	£	s.	d.
Vision receiver	1	11	2
Sound receiver	2	1	9½
Time base	1	12	8½
C.R.T. and E.H.T.	4	14	5½
Power Pack	3	9	3
Valves	5	1	0
	£18	10	4½

It will be noted that the total quoted above is £18 10s. 4½d., which, from the originally quoted £19 5s., allows 14s. 7½d. for sundries. It must be pointed out that the figures given are those ruling at the time of going to press with this issue, and, as most readers are aware, prices of ex-service and manufacturers' surplus vary from week to week. When the receiver was first constructed (at the end of last year) prices in some cases were lower and in other cases higher, but these more or less balance out. An instance of price variation is found in the EF50 valves which at the time of writing are available for 5s. each, whereas when the prototype was constructed they were 6s. 6d. each. Against this, however, the price of VCR97 tubes appears to have risen—either because of increased demand or because of growing shortage.

Another instance of price variation is seen in the mains transformer, which was originally priced at £2 9s. 9d. This has since risen to £2 11s. but a similar model is offered by U.E.I. Corpn. at £2 10s., so this makes very little difference to the total quoted.

For those who are anxious to keep down the cost to the lowest possible figure it may be mentioned that certain alternative near-equivalents may be used in certain cases. As an instance of this Sussex Electronics, for instance, are offering .1 μF condensers of 500-volt working at 4s. 6d. a dozen, and these may be used on lower voltage ratings. A 2.5 KΩ 10-watt resistor is specified for the power pack, but U.E.I. Corpn. are offering a 15-watt component of this value which may be used. In the E.H.T. pack a VU120A (cost 3s.) may be used in lieu of the 2X2 (cost 6s. 6d.) or even a VU111 (4-volt heater cost 3s.). The EF39 (cost 8s. 6d.) may be replaced by a SP61 (cost 2s. 6d.) by reducing the screen and anode resistors.

The Blueprint

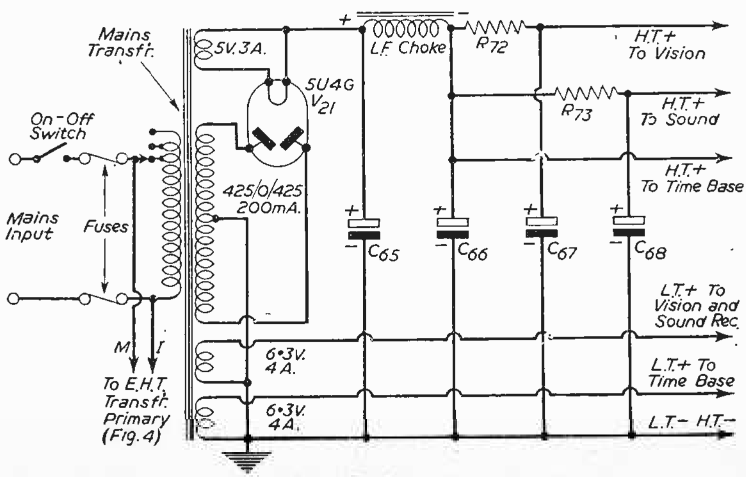
An examination of the blueprint which was presented with the first issue describing this receiver will show two minor omissions—pin 5 of V14 and pin 2 of V16 have not been earthed. A few readers have apparently been confused with the wiring around L5 in the underside of the vision chassis. The reference "C24" has been drawn by the artist across the base of the valveholder for V5, and some readers have apparently thought that this rectangular shape was C24 and have queried the circular shape between L5 and "C24." This is, of course, a circular ceramic type condenser and is C24, and no confusion should exist if the wiring is carefully followed. The point to which C25 and L8 are joined is an insulated anchoring tag.

E.H.T. Transformer

Regarding the E.H.T. transformer, most manufacturers specify a 2-0-2 heater for the E.H.T. rectifier, and the 2X2 valve can be used by employing one-half of the 2-0-2 v. winding.

Coil Data

It would appear from one or two queries that the author has not made sufficiently clear the types of coil former used in certain cases. It was stated that ¼in. formers are used for the rejector coils, and those to whom circuits are not easily read are not certain which are rejector coils. They are, of course, those marked L6 and L7 and these are wound on the ¼in. formers. No difficulty appears to have been experienced with any other parts of the receiver design.



Theoretical circuit of the main power pack.

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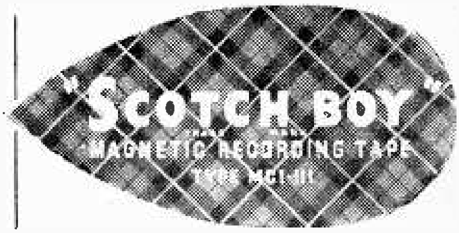

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Pioneers of Television

4.—CAMPBELL SWINTON, AND THE PRINCIPLE OF MODERN TELEVISION

IT is a curious fact that the electrical ingenuity of Campbell Swinton, the London experimenter, enabled him to put forward a working scheme for television transmission and reception long before the notion was ever submitted to the test of practical trial. Indeed, Campbell Swinton was in reality a television pioneer, a television inventor who hit upon the idea of a really practical television system without ever going to the trouble of constructing a television set of his own design. And, rather sadly, this pioneer died within a couple of years of the inception of commercial and nation-wide television practice in America.

Readers who have a good reference library available will be able to study Swinton's now historic scheme for television at first hand, and at their leisure if they so desire, for in the issue of *Nature*, dated June 18th, 1908, there appears an important letter, the writer of which makes the suggestion that the problem of electrical vision could be solved by using two cathode-ray tubes, one at the transmitting and the other at the receiving end of the system. The letter continues:

> "The real difficulties lie in devising an efficient transmitter, which, under the influence of light and shade, shall sufficiently vary the necessary alterations in the intensity of the cathode beam of the receiver, and, further, in making this transmitter sufficiently rapid in its action to respond to the 160,000 variations per second that are necessary as a minimum.
>
> "Possibly no photo-electric phenomenon at present known will provide what is required in this respect, but should something suitable be discovered, distant electric vision will, I think, come within the region of possibility.
>
> "A. A. Campbell Swinton."

Here, clear enough, we have the first glimmerings of the modern tele-transmitter and televisor, both operating electronically through the agency of cathode-rays.

Prophetic Details

In November, 1911, Campbell Swinton greatly augmented his notions of television possibilities and practicabilities during the course of a Presidential Address which he gave before the members of the London Röntgen Society. This speech may be followed in detail in the pages of Volume VIII of the above society's *Journal* which was issued in the year 1912. It is a remarkable Address, containing, as it does, all the fundamentals and even some of the details inherent in our present-day system of television working. Swinton, at that time a highly-active and utterly indefatigable electrical engineer in business practice, and well known among London technical circles, had actually (and as early as 1908) hit on the notion of a transmitting cathode-ray screen on which the image to be televised was optically projected and rapidly scanned by an ultra-fast moving pencil of cathode-rays, controlled by electro-magnetic influence. Additionally, Swinton had allowed for a similar cathode-ray tube in the television receiving equipment, the cathode-ray beam in the receiving tube being synchronised with that in the transmitting tube and thus giving rise to like variations of light, shade and image-motion on the screen of the receiving tube.

But Campbell Swinton was a more than usually active man at that period. Seemingly, he was quite content to establish his televisionary schemes on paper and allow others to do the practical and the detailed experimental work. He never attempted to construct for himself a working model of his proposed system. All he said was "It's an idea only. I do not suppose that it could be got to work without a great deal of experiment and probably much modification."

He was, indeed, correct in this assertion. Nearly a quarter of a century had still to elapse before the first cathode-ray television system was successfully operated by Vladimir Zworykin and others in America. Yet Swinton was not alone in his predictions. About the same time a certain Professor Boris Rosing, under whom Dr. Zworykin had originally studied at St. Petersburg, put forward a similar scheme to Campbell Swinton's, although it can now be proved that it was Swinton who was first in the field with his published notion for televising views and images. Thus it must be that Swinton must justifiably be given chronological priority over Rosing in this most important matter of television development.

A London Scotsman

Alan Archibald Campbell Swinton (the surname is not a hyphenated one, although nowadays there is a tendency to designate it as such) may be described as being almost a Londonder, for he spent the whole of his working days in or around London. His father was a Scotsman, one Archibald Campbell Swinton, who was Professor of Civil Law in the University of Edinburgh. The younger Campbell Swinton was born on October 18th, 1863. He was sent to his first school in Edinburgh and from those immature days he invariably showed a strong inclination to experimental and mechanical science. There is in existence an old oil painting of the lad Swinton which was exhibited at the Royal Scottish Academy's Exhibition of 1873, and which was labelled "The Young Engineer." It shows the boy proudly holding up a small but rather complicated steam engine of his own making.

During these Edinburgh days Swinton was fortunate enough to come under the care of a headmaster who was sufficiently enlightened to encourage him in his mechanical tastes and abilities. He allowed the lad to give school magic-lantern exhibitions of his own designing in which he was wont to demonstrate to the assembled audience the then extremely popular art and trick of manifesting on the screen the ingenious system of "dissolving views." Swinton, at this time, took up photography for the purpose of making his own lantern slides. Soon it became a favourite hobby to him, and remained as such throughout the rest of his life.

The First Telephone

Graduating to a more senior school, Swinton encountered unfortunate circumstances. He began to hate the normal routine of school subjects. He disliked his school-fellows, his teachers, his circumstances. In all, it proved to be a period during which he was continuously unhappy. In 1879 he happened to be present at a lecture-demonstration on the subject of the telephone which had been invented a couple of years before. Returning to school, Swinton, within a week, succeeded in constructing for himself, and with an absolute minimum of electrical knowledge, a telephone transmitter and receiver, and he astonished his housemaster by successfully operating it within the school buildings. But the school powers came down severely on him and made him remove the new-fangled invention on the score of its interfering with his classical studies and with his general application to school work, Swinton being some fifteen years of age at this juncture.

Two years later—in 1881—Swinton was sent to Le Havre, in France, to finish his schooling, and, in particular, to study French and mathematics. Whilst in that town he saw for the first time in his life a large dynamo of the then popular De Meritens type, which was producing current for a local lighthouse. The generator was equipped with steel permanent magnets, and the lighthouse-keeper was having trouble with it. Swinton examined the generator and at once detected the cause of the trouble. He remedied it almost instantly, and, in so doing, he resolved to devote his career to the electrical industry, a decision which was soon afterwards confirmed in his mind when he visited the Paris Exhibition of 1881 and became greatly entranced by the numerous electrical exhibits which he was then able to view and to examine at close working quarters.

Five Years an Apprentice

Returning from France in 1882, young Swinton began a five years apprenticeship in the engineering works of Sir W. G. (afterwards Lord) Armstrong at Elswick-on-Tyne. It was, for him, a period of great activity for, on top of his now essentially practical studies, he found time to write a book on "The Principles and Practice of Electric Lighting," which, dealing with an entirely new subject, proved to be unexpectedly successful. The interest shown in this volume brought to him an added enthusiasm for the electrical side of the Armstrong business, and he began to be employed on the major electrical tasks which the firm undertook. Incidentally, it may be recorded that the apprentice Swinton, during those days, was the first to use lead-covered wiring in ships in place of the old silk-wrapped and surface-varnished cable which was then relied on in order to prevent the slow penetration of water.

A Move to London

In 1887, the year of Queen Victoria's golden jubilee, Swinton threw up his job at Armstrong's. Making a bold move, he went to London, convinced of his ability to set up successfully in his own business as an independent electrical consultant and contractor. Electric lighting was just coming into vogue and popularity. Swinton's idea was to commence business by specialising in the necessary wiring of the many country houses and landed properties around London which, at that time, were eagerly "going electric" for the first time in their history. In this work the enthusiastic and energetic Swinton was enormously successful. He added on other electrical aspects to his business, becoming, indeed, one of the very first of the really practical London "electricians."

The First X-ray

One morning, in the early January of 1896, Swinton read over breakfast a newspaper account of Professor Röntgen's discovery of certain new electrical "rays" which enabled an observer, as it were, to look into the flesh of the human or animal body and to see directly the bones thereof. Having in his possession an old Crookes high-vacuum tube, Swinton instantly repeated Röntgen's original experiment, and within a day or two he was successful in producing an actual "shadowgraph," as he called it, of his hand. It was the first X-ray photograph to be produced in England. At once it was exhibited at the Camera Club in Charing Cross Road, London, and it was reproduced in *Nature* for January 23rd, 1896.

X-rays to Cathode-rays

From X-rays the step to cathode-rays is not a great one. Swinton was not slow to take such a step. Indeed, it was then an age of new electrical "rays" of various kinds, all of which were electronic in nature. Besides the spectacular Röntgen or X-rays there were the Lenard-rays, the Crookes-rays, Hertz-rays, vacuum-rays and, of course, the now well-established cathode-rays. Swinton it was who proved himself to be the British apostle of the cathode-rays, for it was he who experimented with them in a really practical manner and who discovered, among other things, the high-temperature effect set up in a tube by the focusing of these rays or electron-beams. The latter discovery led to a close investigation of the entire phenomenon of "electro-luminosity" or the effect of luminescence which is created on the screen of a cathode-ray tube when building-up the transmitted picture in a televisor set.

Turbine Development

A more versatile inventor and experimenter than A. A. Campbell Swinton would be hard to imagine. In addition to his many-sided electrical work, he was closely connected with Sir Charles Parsons in the latter's development of the early steam turbine and, in particular, with the design and construction of the first turbine-propelled vessel, the *Turbinia*, a torpedo-boat destroyer of 1897 which attained the then unheard speed of 33½ knots.

It was Campbell Swinton, the electrician, who, in 1896, first introduced a young Italian electrical inventor named Marconi to Sir William Preece, then Chief Engineer to the British Post Office Engineering Department, and who obtained for him permission to conduct certain experiments on signalling without wires which Marconi had enthusiastically in mind.

Not only did Swinton become Britain's first radiographer with his "electrical shadow pictures," but he found much time and energy to encourage and to preside at the introduction of a numerous variety of electrical applications. He was a member of the Institutions of Electrical, Mechanical and Civil Engineers, becoming vice-chairman of the former body. His lasting enthusiasm over the many forms of electrical "rays" brought him, in 1911, the Presidency of the then famous Röntgen Society which specialised in Röntgen or X-ray technology. Lastly, in 1915, the august Royal Society opened its door to him, admitting him as one of its Fellows in that year.

For all his honours and distinctions, academic as well as technological, A. A. Campbell Swinton was a very approachable, kindly and agreeable man. He gave many vital services to scientific endeavours. In a way, too, he was something of a philanthropist. And, when he died, unmarried, at his London residence, 40, Chester Square, on February 9th, 1930, some two years before his erstwhile cathode-ray system of television was first practicalised and tried out in America, the scientific world almost intuitively realised that an original and an intrepid electrical genius had departed, the like of which, for sheer versatility and creative, indefatigable energy, would probably not be available again for many years to come.

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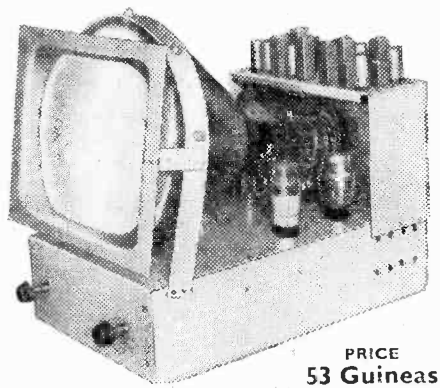

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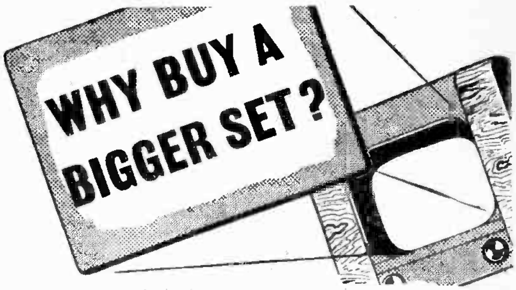

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260-0-260 v. 80 ma., 6.3 v. 2 a., 5 v. 2 a.... **15/9**
350-0-350 v. 80 ma., 6.3 v 2 a., 5 v. 2 a.... **17/6**
260-0-260 v. 90 ma., 6.3 v. 3 a., 5 v. 2 a.... **19/9**
350-0-350 v. 90 ma., 6.3 v. 3 a., 5 v. 2 a.... **21 9**
250-0-250 v. 100 ma., 6.3 v. 4 a., 5 v. 3 a. **23 11**
350-0-350 v. 100 ma., 6.3 v.-4 v. 4 a. C.T. 0-4.5 v. 3 a. **23/11**
350-0-350 v. 120 ma., 6.3 v. 4 a., 5 v., 3 a. **28/11**
350-0-350 v. 150 ma., 6.3 v. 4 a., 5 v. 3 a. **29/11**
350-0-350 v. 150 ma., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a. **29/11**

CLAMPED UPRIGHT MOUNTING
250-0-250 v. 80 ma., 6.3 v. 3 a., 5 v. 2 a. ... **18/9**
250-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., for 1355 conversion **26/9**
350-0-350 v. 100 ma., 6.3 v. 3 a., 5 v. 3 a. **23.9**

FULLY SHROUDED UPRIGHT
250-0-250 v. 60 ma., 6.3 v. 2 a., 5 v. 2 a. Midget type 2½-3in. **17/6**
250-0-250 v. 100 ma., 0-4-6.3 v. 4 a., 0-4-5 v. 3 a. **25/9**
300-0-300 v. 100 ma., 0-4-6.3 v. 3 a., 0-4-5 v. 3 a. **25/9**
350-0-350 v. 70 ma., 6.3 v. 2 a., 5 v 2 a. **18/9**
350-0-350 v. 100 ma., 0-4-6.3 v. 4 a. 0-4-5 v. 3 a. **25/9**
350-0-350 v. 150 ma., 6.3 v. 4 a., 5 v. 3 a. **33/9**
350-0-350 v. 250 ma., 6.3 v. 6 a., 4 v. 8 a. 0-2-6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor **67/6**
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All with 200-250 v. 50 c/s Primaries : 6.3 v. 2 a., **7/6** ; 0-4-6.3 v. 2 a., **7/9** ; 12 v. 1 a., **7/11** ; 6.3 v. 3 a., **10/11** ; 6.3 v. 6 a., **17/9** ; 0-2-4-5-6.3 v. 4 a., **17/9** ; 12 v. 3 a., or 24 v. 1.5 a. ... **17/9**

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s Primaries : 0-9-15 v. 1.5 a., **14/9** ; 0-9-15 v. 3 a., **16/9** ; 0-9-15 v. 6 a., **22/9** ; 0-4-9-15-24 v. 3 a., **22/9** ; 0-9-15-30 v. 3 a. **23/9**

SMOOTHING CHOKES
250 ma. 8-10 h. 50 ohms **16/9**
250 ma. 3 h. 100 ohms **8/9**
200 ma. 5 h. 100 ohms **7/6**
100 ma. 10 h. 100 ohms **7/6**
90 ma. 10 h. 100 ohms **5/9**
80 ma. 10 h. 350 ohms **5/6**

ELIMINATOR TRANSFORMERS
Primaries 200-250 v. 50 c/cs. 120 v. 40 ma. **7/11**
120-0-120 v. 30 ma., 4 v. ½ a. **12/9**

OUTPUT TRANSFORMERS
Midget Battery. Pentode 66 : 1 for 3S4, etc. **3/6**
Small Pentode. 5,000 ohms to 3 ohms **3/6**
Standard Pentode, 5,000 to 3 ohms **4/9**
Multi ratio 40 ma., 30 : 1, 45 : 1, 60 : 1, 90 : 1 ; Class B Push-Pull... **5/6**
Push-Pull 10-12 watts 6V6 to 3 or 15 ohms **15/11**
Push-Pull 10-12 watts to match 6L6, PX4, 6V6, etc., to 3-5-8 or 15 ohms **16/11**
Push-Pull 15-18 watts to match 6L6, etc., to 3 or 15 ohm Speaker ... **22/9**

NEW EX-GOV. VALVES. D1, **1/3** ; EA50, 954, VU120A, **2/9** ; 12H6 Met., **1/11** ; 9D2, **2/11** ; 12SG7 Met, 6J5GT, 12SH7 Met, **5/9** ; 6SG7 Met, 6SS7 Met, 6C5 Met, 12SQ7 Met, 12SR7 Met, **6/9** ; 6K7G, 6J7G, KTZ63, 12A6 Met, **7/6** ; 6K6GT, **8/9** ; 6X5GT, PEN 46, MHLD6, **9/6** ; 5Y3G, EB91, **10/6** ; 6Q7G, **10/11** ; ECL80, EF80, **12/11** ; MSP4, **5/6** ; 6SL7GT, **11/9**.

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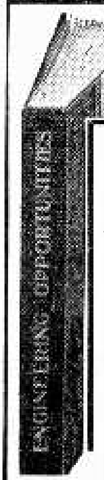

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BIET

Pye Television for Switzerland

THE first Swiss television station will be fitted with British equipment manufactured by Pye Ltd., of Cambridge.

As a result of the recent visit to Switzerland of the Pye technical and export directors, Pye cameras will be ready for delivery towards the end of May for transmissions expected to commence towards the middle of this year.

Switzerland is planning an extensive television network with five stations at Zürich, Berne, Geneva, Lausanne and Lugano.

Danish TV to End?

DENMARK may become the first country in the world to end its television service because people are not interested enough to buy expensive receivers. The Danish State Radio is considering dropping the service for these reasons.

Since television began in Denmark last autumn only 400 sets have been sold, though permission was given for 1,500 to be marketed. The sets cost £195 each.

"Television Topics Quiz"

"TELEVISION is no substitute for radio. In television you are going to enjoy a new form of entertainment—one of the finest I know," said Mr. Harold A. Curtis, London, secretary of the R.T.R.A., in Cardiff recently.

He was one of the speakers at a "Television Topics Quiz" organised by the Cardiff centre of the Association, and attended by 500 representatives of all sections of the radio industry, the BBC, G.P.O., the Electricity Board, other organisations and invited members of the public. They came from many parts of South Wales.

Three hundred applications for tickets had to be refused.

Purpose of the meeting was to discuss some of the teething troubles facing television in the area when the Wenvoe station opens in August.

Mobile Unit for Scotland

IT is expected that Scotland will soon have its own mobile television unit.

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

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

Four vans, each fitted with a camera and other technical apparatus, will cover events within a radius of 25 miles of the unit headquarters in Glasgow.

Mr. Ian Crawford, publicity officer of the BBC, stated recently that programmes with a Scottish flavour had proved to be quite popular even with English viewers.

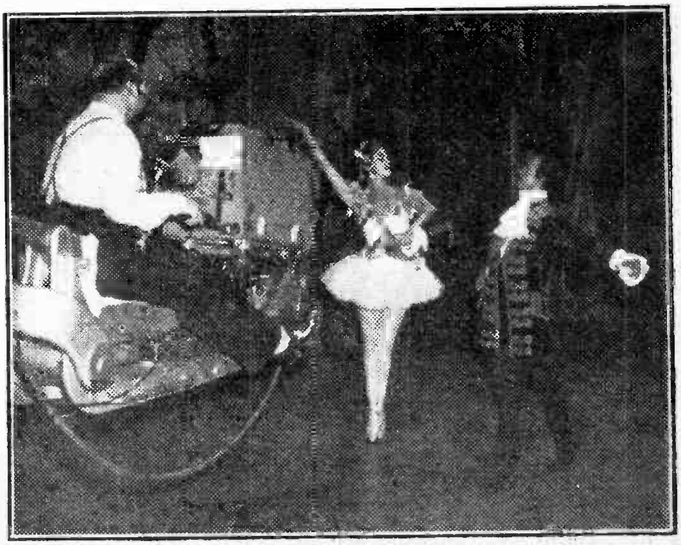
Plaque to Baird

IN addition to the memorial plaque to J. L. Baird, unveiled at 22, Frith Street, Soho, last year, another is to be put up at his one-time home at Bexhill, Sussex.

Protest against Mast

THE BBC's proposal to build a television mast at Hessary-Tor, near Princetown and Dartmoor gaol, has met with strong protests from people who believe that any such mast would spoil the moor's natural beauty.

Residents of Torquay, Exeter, Paignton, Falmouth and Truro would be within range of the new mast which would mean an additional 900,000 viewers.



Television cameraman Friese-Greene, son of the inventor of moving pictures, photographed "shooting" a scene from the "Sleeping Princess" ballet, seen by viewers recently. This scene, in the woods, shows Harold Turner as Prince Floramund and June Brae as the Lilac Fairy.

Strongest protests are being made by the Dartmoor Preservation Society.

Russian Service

ACCORDING to an article in the Russian press, Moscow now possesses approximately 60,000 receivers, half of which were bought in the past year. The Moscow television headquarters televises from three to four hours daily, six days a week. Programmes consist mainly of music concerts and plays televised from actual theatres.

Reception in Ireland

MR. JAMES McKEOWN had been experimenting for months with his receiver behind his jeweller's shop in Ballymoney, Co. Antrim, but had been unable to obtain a picture from either the Sutton Coldfield or the Holme Moss transmitter.

The experiments continued after the opening of the Kirk o' Shotts transmitter until, finally, Mr. McKeown obtained an almost perfect picture on his screen.

He has now placed the set in his shop window.

Cinemas Can Compete

SPEAKING at the Leeds Publicity Club recently, Mr. J. Arthur Rank said that when national sporting events were being televised on the spot cinema takings were likely to be affected, but he believed that the cinema would be able to compete with television "provided we make entertaining pictures."

Television in Canada

THE initial plans for the opening of a television service in Canada are nearing completion. With the aid of a 6,000,000 dollar loan from the Government, the Canadian Broadcasting Corporation is completing an English language station at Toronto and both English and French stations in Montreal. The building of these first stations was delayed for two years by the shortage of materials and equipment owing to the rearmament programme, but closed circuit experiments have taken place since February and it is now expected that public transmissions for about three hours each day will commence in Montreal on August 1st and in Toronto on September 1st.

One in Seven

EVERY seventh householder in Bedfordshire possesses a television receiver.

Announcers' Wardrobes

TELEVISION announcers, by today very much in the public eye, are supplied by the BBC with the clothes which they wear for their screen appearances. The Corporation has, for some time, been considering methods of raising the standards and widening the range of its television announcers' wardrobes.

As a result of discussion with the BBC the London Model House Group, consisting of 13 leading wholesale fashion houses, has agreed to supply television announcers with clothes from their latest collections. The BBC will pay for all clothes supplied by the Group and the clothes will be fitted by the fashion house from which they are bought. The clothes will be selected by the BBC, assisted by members of the London Model House Group. The announcers themselves will also help in the selection. Arrangements to buy clothes for guest announcers will also be made.

A Mark II camera with the rotating lens turret being assembled while the prototype stands complete in the background.

No Outside Aerials in Glasgow

GLASGOW Corporation Housing Sub-committee decided recently that television aerials must not be installed on the outside of their 70,000 council houses.

The tenants of the 35,000 terrace or cottage-type houses may have pole aerials in their back gardens and loft aerials may be fixed by flat occupiers.

Tube Implosion

WHEN Charles Mobely was having a television set installed in his New York City home, the tube imploded, injuring two of his children and wrecking the receiver.

The family was gathered round the set while the installation engineer was instructing them in its method of operation. The set had barely been on five minutes when the tube imploded. The two children were cut by flying glass, and only the fact that Mr. Mobely's coat stopped a lot of the glass prevented further damage.

The cause of the implosion has not yet been determined.

Rise in "Viewmaster" Cost

OWING to increased costs in production, the publishers of the "Viewmaster" envelope have announced that, as from February 15th, the price has been raised to 7s. 6d.

There are three editions: Model "A" for London, Model "B" for Sutton Coldfield, and Model "C" for Holme Moss or Kirk o' Shotts. The increase is the first since the envelope was issued.

Broadcast Receiving Licences

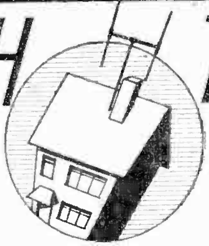
STATEMENT showing the approximate numbers issued during the year ended March 31st, 1952.

Region	*Number*
London Postal	2,394,000
Home Counties	1,677,000
Midland	1,776,000
North Eastern	1,961,000
North Western	1,660,000
South Western	1,085,000
Welsh and Border Counties	749,000
Total England and Wales	11,302,000
Scotland	1,150,000
Northern Ireland ..	213,000
Grand Total	12,665,000

The above total includes 1,457,000 for television, an increase of about 71,000 during the month.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By *Iconos*

ATTACKS ON TELEVISION

EVERY generation seems to produce its Aunt Sally of entertainment, to be blamed, praised, assailed, extolled and condemned—but never to be ignored. The "vulgar" music-halls of the nineties were succeeded by the equally "wicked" musical comedies of Edwardian days which, in turn, gave way to the super-sensations of the silent cinema and the prattling "inanities" of the talkies. Each were frowned upon by the busybodies and meddlers, but rapturously received by the entertainment-hungry public. Each was cited as an example of the decadence of its own particular age, with the sole exception of the sound radio of the twenties (which was blamed for its general level of dullness !). And now comes the great television boom, keeping millions of viewers in their homes instead of patronising the pictures, the pubs, the theatres, the clubs. No wonder the florid impresarios of stage and screen turn pale as they survey rows of empty seats !

THE KNOCKERS

TELEVISION has received its fair share of knocks from busybodies and meddlers, but the biggest knock of all seems to me to come from the BBC's own official survey of the influence of television on British public life and other entertainments. It is apparent that, in spite of much grumbling at the programmes, over 40 per cent. of viewers are at their sets each evening and that no less than 63 per cent. go to the cinema less than they did before. The success of television is so staggering as to be frightening ; its tremendous power is almost too great to be left in the hands of a monopoly ; conversely, its mission too sacred to be fed to the sponsors ! What is to become of it in the New Charter ? And what will become of the empty libraries, the ruins of film studios, deserted race tracks, cobwebbed dart boards and the like ? The national newspapers send up a wail of woe.

COLOUR AND STARS

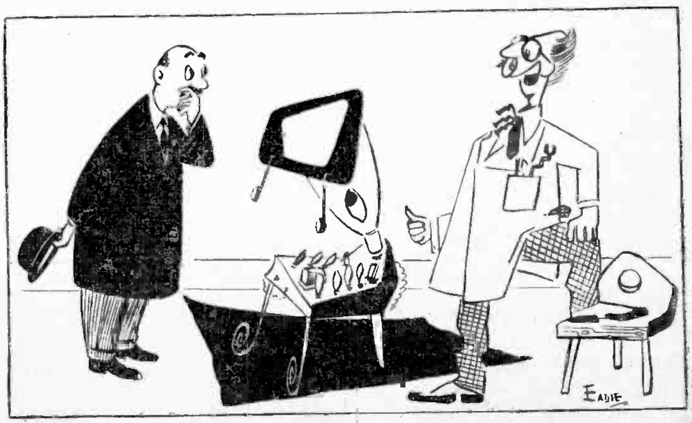
BUT all is not lost. Cinemas and theatres have undoubtedly suffered a fall in patronage, but are preparing to fight back. What can they offer the public to beat the "menace" of television ? The answer is—stars and colour. Star names become more important than ever, since major star salaries are normally beyond the purse of the BBC. New stars will be created, groomed, boomed and billed. And some of television's own stars will find their way into the top-bracket classes of stage and screen acting. Already Gilbert Harding has sampled the glare of film studio lights as an alternative to the television lights, and Terry-Thomas heads the bill of a cheerful music-hall road show called "How Do You View !" which I assume is based on the television feature of the same name.

On the technical side, there is a positive rush to colour. Technicolor, Cinecolor, Gevacolor and Ektacolor are in such great demand both in England and America that the printing of hundreds of copies of colour films will become a problem in itself. Since the plant and equipment required to make colour-film prints is about five times as large and ten times as complicated as for black-and-white, it may be two or three years before all films turn over to colour. But it is quite certain that the end of the black-and-white era of films is at hand—the pace has been forced by TV. Colour, too, will influence the design of stage plays, musical shows and revues. Improved lighting equipments, including coloured fluorescent strips which can be gradually dimmed, will help to put over live shows in a colourful manner.

CELLULOID

THE colossal footage of colour-film prints now required by the film industry does not by any means spell ruin for the manufacturers of black-and-white film. One big American maker of film stock states that they sell five times as much black-and-white film to the American television industry as they ever did to the film industry itself. In England, the film content of BBC TV programmes is high, too, and a growing number of film units are maintained by the BBC in addition to the subcontracting of special subjects to outside producers. It is interesting to note that the BBC have commissioned an outside independent producer, Marcus Cooper, to make a monthly series of films about the stately homes of England. Marcus Cooper made the special morning test film which opened the BBC television after the war.

PROFESSOR BOFFIN



"I feel a different man since I started on television sets for Pablo Picasso !"

TRADE TOPICS

Nera Spot Wobbler and EHT Unit

AREN RADIO AND TELEVISION, LTD., have recently introduced two interesting items for the home constructor, hoth of which are available either as complete units or in the form of separate parts. The Spot Wobbler measures 1½in. by 1½in. by 3½in. and requires 6.3 volts at .3 amp. and an H.T. supply of 2 to 8 mA. at 200 to 300 volts, which may be obtained from the existing receiver. The wobbler coils slip on the tube neck between the scanning coils and the focus magnet, for which the maximum space needed is ¾in. The coils may however, be compressed into ⅝in., where necessary, without affecting the results. The operating frequency is 10 Mc/s and a trimmer is provided so that the best setting may be obtained free from interference with any of the tuned circuits. The complete unit costs £3, and the individual parts available are a chassis and valveholder for 2/6; screening can 5/6; coils 6/6; plug and socket for H.T. and L.T. supplies 1/6 and the necessary kit of resistors, condensers, potentiometer, etc., 6/6.

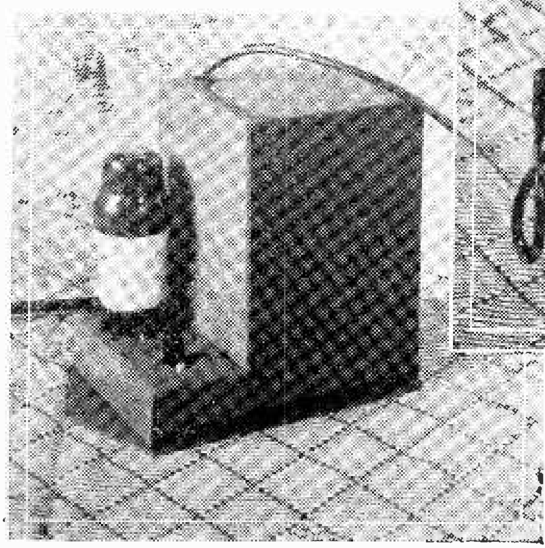
The second item is an R.F. E.H.T. unit which we have had the opportunity of testing. This gives a peak output which may be varied from slightly over 7 kV. to slightly greater than 12 kV. The necessary 6.3 volts at 1 amp. and H.T. at up to 30 mA. may be obtained from the existing receiver, and the unit is screened to prevent interference. The placing of the oscillator valve outside simplifies replacements when necessary, and there is an adjustment by the side of the valve by means of which the output may be regulated. The coil is wound on an "X"-shaped former and the heater winding of the rectifier is not permanently fixed. As the heater supply is R.F. it is, of course, not a simple matter to measure it, and it will vary according to the H.T. applied to the unit. The cover is therefore removed from the unit, and the apparatus connected up ready for use, and the heater of the small U25 rectifier is inspected. For this purpose the unit should be in a somewhat darkened position, and the unit preferably placed on its side so that the end of the heater may be seen. With the unit then switched off, the heater winding should be placed closer to or farther away from the main coil until the heater glows a cherry red. If possible, the valve should be connected to a 2 volt accumulator and the colour of the heater noted, and then the coil adjusted until the same colour is obtained. If the coil is too close the heater will give an orange glow, and if too far away it will be a deep red. The output of the unit, is, of course, dependent upon the heater supply as well as upon the H.T. adjustment. This unit may be used in the PRACTICAL TELEVISION receiver in place of the originally-specified unit which is no longer being manufactured, and the price is £6/10/-, complete. The coil, with the rectifier valve incorporated may be obtained, with a circuit diagram and full instructions for £3/17/6. For those using series-heater operated receivers with H.T. not exceeding 170 volts a specially modified unit may be obtained to give the same output for 7/- extra. The unit may be thoroughly recommended.—**Aren (Radio and Television), Ltd., High Street, Guildford, Surrey.**

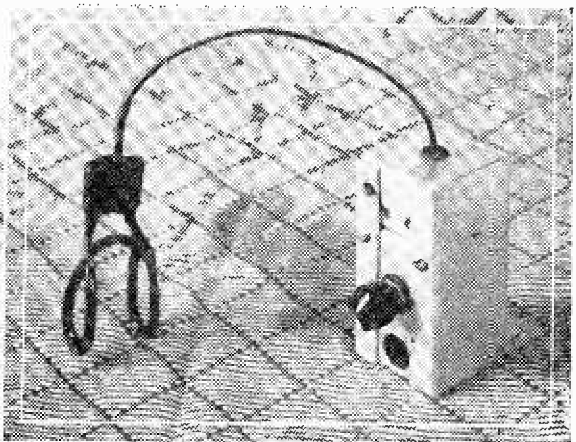
Brimar Teletube Service Depots

STANDARD TELEPHONES AND CABLES, LTD., announce an immediate exchange service for defective Brimar Teletubes, which are *still under guarantee*.

These exchanges will eliminate unnecessary delay while the tubes are being returned to Footscray, and can be made at the following depots: 5, Oldbury Road, Blackheath, Birmingham, Warwickshire; 87, McAlpine Street, Glasgow, C.3.

All other replacements and orders should be sent, as usual, to the Service or Commercial Departments at Footscray.—**Standard Telephones and Cables, Ltd., Footscray, Sidcup, Kent.**





On the left is the Nera R.F. E.H.T. Unit, and on the right the Spot Wobbler. The latter may be home assembled, the separate parts being sold individually. The essential parts of the E.H.T. Unit are also available, with a circuit.

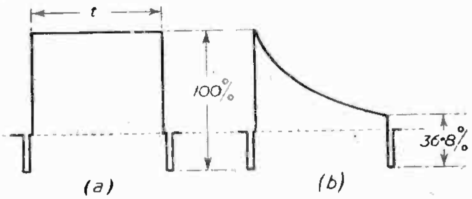
CORRESPONDENCE

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).

DESIGN OF V.F. STAGES

SIR,—I have been reading through the complete series on the design of V.F. stages and am rather puzzled by Fig. 19, in the December issue. After reading the various details I fail to see how the black level or sync pulses are retained in the illustration and I feel that there must be something wrong in this picture. Could you please confirm that the diagram is correct as I am studying the theory of television receiver design very closely and have gained much valuable information from your various articles. I might mention that I knew nothing of television last summer and have now commenced to build my own receiver, including in it various features which I have been able to understand from the different articles on design in your pages.—G. TRIMBLE (Golders Green).

[*There was a fault in the diagram in question, the figures being indicated as ending on the dotted line, instead of going to the bottom of the complete swing. For the benefit of other readers who may be following the series we give the diagram again below, with the figures correctly marked.*—ED.]



(a) Video signal, constant white line ; (b) Video signal after C.R. circuit when C.R. is too small (0.0001 secs.).

R.G.D. MODEL 1700

SIR,—Re your advice to E. L. T., of Liverpool, and lack of width on R.G.D. 1700. The usual cause of this is the metal rectifier going low. We find that these often drop 20 to 40 v. in the first few months, and give the same symptoms. Replacement will cure the fault.—M. PRINCE (Pontypool, Mon).

COST OF UPKEEP

SIR,—With reference to your correspondent who has spent £16 4s. in two years, on his television set. It is stated that this included one C.R.T. and 12 valves. There is obviously something wrong with this statement, as these items could not be purchased for this sum, even at the old rate of P.T., assuming new valves and not surplus.

There appears to be some inaccuracy in your statement with regard to the guarantee on commercial sets. Surely the position is, six months on the C.R.T., three months on valves, and 12 months on the components. Your observations on this point would be greatly appreciated.

My own receiver has been in constant use for three years (it is home constructed), and so far has cost me 1s. 6d. for a resistor. The total of valves is 24 and although these have been removed from ex-R.A.F. units by me they are still functioning.

A colleague of mine has had the "Premier Radio" Magnetic Kit working for a little over two years and replacements for this have been nil, with the exception of the C.R.T. which was changed under guarantee, free of charge.

In conclusion I would say that if the manufacturers consider the above-mentioned sum to be normal, the answer seems to be, invest in a subscription to PRACTICAL TELEVISION and "build it yourself."—ERNEST E. FENN (E.12).

SIR,—In your Editorial of the May issue, mention was made of the cost to a reader to maintain his commercial television receiver over the last two years.

Actually the figures quoted were extremely difficult to assess. Surely 12 valves and a C.R.T. costs more than £16 4s. !

Even at the old rate of purchase tax, a 9in. tube costs £11 6s. 10d. Therefore, we can only assume that the 12 valves cost £4 17s. 2d., an average of 8s. each, including purchase tax !

Now, is the answer to it all that several valves or the tube or both, were replaced under guarantee ? If not, were surplus valves used as replacements ?

Further, too. Who serviced the receiver ?

Incidentally the B.V.A. guarantee is for three months only on valves and six months on C.R.T.s.

After all, whatever the true facts are, it must be seen that the cost to maintain an average receiver over say the first three years of its life is near enough to three shillings per week.

This is in keeping with the costs quoted by many dealers for comprehensive maintenance for 9in. tube receiver over a period usually of two years, and in my opinion is a fair price to both parties.

I am a trade engineer, and I maintain hundreds of television receivers every year, and am fully aware of the costings. I would, therefore, like to state that a set owner who does not profess the ability to service his receiver, and is also sensible enough to realise that his set is a highly scientific instrument, and that it will *definitely* need the attention of a skilled engineer from time to time, would be safe to assess his running costs at say 2s. 6d. to 3s. per week over a period of three years.

I stress that this is an average. A 12in. model would be about 6d. per week more.

A 9in. tube costs around £13 4s., and the average valve costs 25s. This includes purchase tax.

Assuming a new C.R.T. and, say, three valves needed over a period of three years, this not including any other components, this would average about 2s. per week for replacements only. No consideration is yet given to the skilled labour involved, which generally in most trades is the highest expense.

Surely then, any set owner would be extremely glad to pay the very modest sum of 1s. per week for the services of a skilled engineer to maintain his television receiver, and pay for the material himself.

A further check of these figures may well be taken from the rental firms. Comparison with the normal hire-purchase prices, and then allow for the "free" maintenance, will disclose that the figures I have mentioned are very near the mark.

May I, therefore, conclude, and sum up by saying that although I am unable to see how the owner of the set mentioned in the Editorial, arrived at his costings, I do think that the cost even on those figures, is substantially about right.

It is useless to quote isolated examples as these will err on both sides. The average taken from hundreds of receivers can be the only way of arriving at an approximate price of expectant running costs.—A. B. CHINN (Romford).

TV BLANK SUNDAY

SIR,—I must reply to K. Norton (Surrey), who evidently forgets the Sunday staff which provides him with gas, electricity, transport, etc., etc. There is the obvious staff rotation of free time to provide for these essentials and who will deny the growing importance of TV in our lives?

We have paid now nearly £1,500,000 for TV service and we are entitled to the great extension of time we all urgently demand.

There is no valid reason at all why we could not make Sunday the TV day of the week, with continuous programme from say 2 p.m. to 10.30 p.m.

Surely it is obvious that this period is the whole nation's leisure time of the week.

Hope you keep plugging away for this essential service.—LEO TAYLOR (St. Annes-on-Sea).

7BP7 TUBE

SIR,—May I add some information to the query about the tube 7BP7 on page 523 of "PRACTICAL TELEVISION" April, 1952.

In the R.M.A. nomenclature the fluorescent screen of cathode ray tubes is described by the code P1 to P14, the figures denoting the following properties:

	Colour	Contrast	Persistence	Application
P1	Green	20 : 1	Medium	Oscilloscope (Exp. TV).
P2	Green	20 : 1	Long	Long pers. oscilloscope.
P3	Yellow	20 : 1	Medium	Oscilloscope.
P4	White	30 : 1	Short	TV
P5	Blue	10 : 1	Very short	Transients—60 Kc. oscilloscope photography.
P6	White	30 : 1	Short	TV
P7, 8	Yellow	20 : 1	Long	Radar slower 1 scan/sec.
P9	White	30 : 1	Long	High definition radar.
P10	Dark trace for radar	1.2 : 1	Long	Radar slower than 1/5 scan/sec.
P11	Blue	10 : 1	Very short	Photog. of transients—9 kc/s.
P12	Orange	20 : 1	Long	Radar 4-16 scans/sec.
P14	Orange	20 : 1	Long	Radar 1 scan/sec.

Thus while tubes 7BP1 to 7BP11 are electrically similar only the types with screens of short to medium persistence would be satisfactory for television. P7 is a double phosphor screen with a short persistence blue screen actuating the long persistence yellow screen.

This afterglow of over one second might be absorbed by a suitable filter in front of the screen. Since it has been reported that filtering has made this type of tube suitable for amateur flying spot scanning, its application to TV reception might be possible.

The making of deflector coils for similar tubes is discussed in "Cathode ray tube displays," Vol. 22 of the Radiation Lab. Series," McGraw-Hill.

In the hope that this may help Mr. Profaze in his experiments, I remain.—P. LEWIS (N.10).

TIME BASE SYNCHRONISATION

SIR,—Surely your contributor G. J. King is in error in his diagram of integrated line pulses Fig. 1(d) on page 484 of the April issue, where he shows the line pulses used for synchronisation.

He has indicated with an "x" the fourth pulse from the left as being one used to trigger the line oscillator. This pulse is coincident with the onset of the frame pulses as is the third pulse from the left in Fig. 1(c). If, therefore, No. 4 pulse is used as shown, the line oscillator will have to jump half a cycle when the odd frame pulses arrive, frame and line triggering pulses will be in phase and interlacing will be upset. Furthermore, if the line oscillator is adjusted to jump the half cycle as shown, it must of necessity jump all the following half cycles also, and the top of the picture will be distorted. Mr. King himself points out that this is incorrect.

A correct diagram would be one in which Figs. 1(c) and 1(d) are the same. The line oscillator is at all times triggered by pulses placed one line apart and the interlacing achieved by bringing forward the frame pulses by half a line each time. There is no change of line frequency or phase at any time.—R. W. SWABY (Northumberland).

[*I wish to thank Mr. Swaby for pointing out the slip in Fig.* 1(*d*) *in my article entitled "Time Base Synchronisation."*

Under the section Interlace Problems I stated that to secure a good interlace the start of a frame scan must coincide with the start of a line scan every other frame only; this condition is shown by Fig. 1(*c*). *Fig.* 1(*d*), *however, shows the line pulses formed during the end of the following frame; here my mistake is obvious, for again I have indicated the differentiated pulse formed by the leading edge of the first framing pulse as the one used to "fire" the line generator.*

The inclusion of the half line during odd frames successfully ensures that the start of a frame scan is not coincident with the start of a line scan during odd frames. Replacing the two left hand "x" of Fig. 1(*d*) *one pulse to the right will then, of course, satisfy this condition.*—G. J. KING]

A.C./D.C. RECEIVERS WITH SAFETY

SIR,—As far as I can see all good commercial TV sets are fitted with a safety device and all home-made sets should definitely be so constructed.

It would indeed be very dangerous to switch on the set with the chassis at mains potential.

To prevent this danger and to give the necessary warning, a small neon bulb is fitted in series with a resistor (about 2 megohm) between the chassis and a well insulated lead taken direct to an earth point.

If the neon bulb lights up when the set is switched on, then the chassis is alive and dangerous to all concerned.

If the neon bulb does not light up, it is not live.

If the neon bulb lights up, it is necessary immediately to switch off and reverse the mains plug before switching on again.

On the surface this method appears to be quite satisfactory, but to my mind, it is not quite good enough. Why not remove the danger for good. There is always the danger between the periods of switching on and off with the mains plug the wrong way round on any further occasions.

Why not an eccentric fitting (3 point) plug so that the plug cannot be inserted the wrong way round?

After fitting this type of plug and socket the set can be switched on and if the neon bulb lights up, it is only necessary to reverse the H.T. cables in the mains plug. (The third pin in the plug would be dead) and the danger would be removed for good.—D. KEATING (Bradford).

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(Continued on page 46)

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(*Continued from page 45*)

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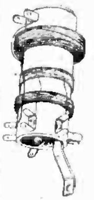

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Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles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

TUBE FAULT

"I have had my Philco television set (model No. T1551) just three months and have been receiving a good black-and-white picture from Holme Moss until recently. Now I find at the commencement of a programme the picture is quite good, but deteriorates after about one hour viewing into a sepia picture. What should be white is a warm cream, and black becomes dark brown. I would be much obliged if you could enlighten me whether this trouble is a fault in the C.R. tube which is fitted with an ion trap."—R. H. C. (Sheffield).

The trouble is almost certainly in the tube itself, as there is nothing else that can possibly affect the colour of the picture apart from a chemical change in the screen phosphors. Apparently there is a change of some sort occurring in the screen materials after an hour's scanning or so. As the receiver and tube are still under guarantee, you should contact your dealer and get the tube replaced as soon as possible.

THE "ARGUS"

"I am constructing the Argus television receiver, and I have an American type 5½in. 5 C.P.I. cathode-ray tube which I would like you to tell me if it would be all right to use.

"Please let me know the voltage for the heater and the anodes for the tube?"—A. J. Evans (E. Croydon).

The 5 C.P.I. can be used but the whole of the C.R.T. network will have to be altered as the tube requires a minimum of 4,000 volts E.H.T. The heater is 6.3 volts. The base connections numbering from the key in a clockwise direction are: 1. Heater. 2. Cathode. 3. Grid. 4. Blank. 5. Anode 2. 6. Blank. 7. Y1. 8. Y2. 9. Anode 1. 10. X1. 11. X2. 12 and 13. Blank. 14. Heater, side connection intensifier.

MODIFICATIONS FOR CHANNEL 2

"I enclose drawings of a Houghton and Osborne televisor for which the coils are for Sutton Coldfield. As I now want to change them for Holme Moss, I should be glad if you could supply me with the coil data for Holme Moss, as I have already written to the above people but I have never had a reply from them. The set was built in 1950."—F. Naylor (Nr. Wakefield).

You need only modify the turns slightly on your coils to make the set suitable for Holme Moss. For every 5 turns on a coil at present, add another 1½ turns; this applies to the sound rejectors as well. The tapping points on these latter is central as before. Nothing else need be modified in the circuit.

NO DANGEROUS RADIATION

"I purchased a 9in. table model television set a few months ago and have found that on the other side of the wall behind the set the lime which had been put on the pantry wall 12 months before has now turned a vivid yellow in colour in a circle on two walls.

"There is no other explanation to account for this strange fact other than the TV set.

"What I am actually worried about is, if these rays are emitting from the back, are there any rays which come from the front and, if so, are they injurious to health, as we have a very small baby in the house?

"Have you heard of this before and can you give me an explanation?"—R. Owen (Sheffield).

The discoloration of the pantry walls behind the television set is a rather unusual phenomenon, but it appears to be the result of having the receiver in its present position. No obvious explanation is possible without examination and careful analysis, but there are no rays emitted from the normal television receiver that are injurious to health, either from the back or the front.

VIEWMASTER ON D.C.

"I have recently had the opportunity of watching a 'Viewmaster' television receiver in operation and would like to build such a set for myself, but observe that it is designed for operation on A.C. mains only.

"My home supply is 230 volts D.C. and I was wondering if you could kindly inform me whether it is possible to modify the 'Viewmaster' circuit for operation on this type of mains by arranging for the heater circuits in the usual way, etc.?"—R. C. S. Tugwell (Epsom).

It is not possible to modify the "Viewmaster" for use on D.C. mains since this would involve a complete redesign of the receiver. We can, however, recommend the use of the "Viewmaster" with a converter of either the rotary or vibrator type and have received many excellent reports of reception on D.C. mains. If a vibrator type converter is used, then it is necessary to fit a full-wave rectifier instead of the half-wave rectifier normally specified.

HEATER-CATHODE SHORT-CIRCUIT

"As a reader of your 'Problems Solved' articles, I have not as yet come across a peculiar fault that has developed in my particular set—a commercial one. At times the set will run with a clear picture, but on odd occasions it will suddenly go out of focus with streamers going to the left. This may persist for the whole evening programme. On another occasion this defocusing may only last a minute or so and the picture will snap back clear again; this may occur two or three times. I would like to add that I tested the cathode to the filament of my tube and got a dead short reading on my ohmmeter, but I run the set for five minutes and test straight after switching off and there is no short for about five minutes and then it appears as before. The signal is injected to the cathode on my particular set."—F. Fleetwood (Ilford).

The fault is due to the heater-cathode short on your cathode-ray tube. You must either replace the tube or run its heater from a small separate transformer. If you decide on the latter, let the heater winding float completely, rather than connect the heater and cathode together.

"VIEWMASTER" BOOSTER

"Can you assist me in locating fault of 'Viewmaster' which I have recently finished which is as specified and all new material? It does not give desired width as I have a border each side the screen about ½in. width, and controls will not move it. I have tried all your instructions to alter same, such as M.R.4 rectifier, scanning coils,

valves, C42 condenser, line transformer, M.R.2 rectifier, which, according to the working of same, is loss of E.H.T. I cannot get boost volts as compared from your instruction book. Hoping you can assist me in this matter and oblige."—N. Green (Darlaston).

We assume from your letter that you are unable to measure any boost volts across C42. If this is the case then very obviously the line scan will be short. If, as you say, there is no fault in the line transformer M.R.2 rectifier, or C42 condenser, then we suggest that there must be a faulty connection somewhere in your line scan circuit, though we are unable to advise as to its exact location. We suggest disconnecting all components around the line transformer, checking each component invidually, and carefully re-wiring.

POOR SYNC

"I have made a 'Premier' television set, 'Holme Moss' model, using a VCR97 tube. The sound reception is very good, but I cannot get any satisfactory results from the vision side. The vision signal is present, and I can hear it through a pair of 'phones connected to the end of the coaxial cable to the tube and to earth. When the brilliance is turned down and contrast up the modulation is there on the tube, and a raster at other times when brilliance is at full and contrast down, which completely fills the screen.

"For the first five minutes or so a picture appears but it does not seem to fill the tube, either in height or length, and it keeps moving downwards as if on a revolving drum, and then when the set has got warmed up disappears and on the screen appears a complex pattern of little dots and streaks. I have an idea that it is the timebase that is wrong somewhere. I have checked all the wiring, and moved the valves around, etc., as instructed in the 'Premier' book, and the picture is reduced even further in height and width when these are removed, also I have tested all the condensers but not resistors, having no meter available."—G. Shore (Huddersfield).

The receiver appears to lose synchronism, even though the vision signal is still present. The cause may be, of course, a fault in the vision strip itself which causes the signal strength to fall after a short while and so allows the set to lose synchronism; you should check on the valves in this strip by changing each in turn with one of the sound valves. If there is no improvement, check on the sync separator circuit, as both your line and frame appear to be equally affected. Finally, your H.T. supply may be failing, and, if possible, you should borrow a voltmeter in order to check on this.

VALVE-PIN CONNECTIONS

"I am in the process of building the 'Viewmaster.' There is a point that I am not quite sure about, valveholder No. 4. Are the tags of the holder (Nos. 3 and 6) bent over and soldered to the chassis? It looks as if they are in the drawing, though there are no instructions to this effect. The shop where I bought my kit of parts say they are, but did not seem too sure about it. I should be pleased if you would assure me on this part."—H. E. Barrow (Beckenham).

Tags Nos. 3 and 6 on valveholder V4 are connected to chassis and for convenience may be bent over and soldered direct to chassis or, if preferred, a very short wire may be used.

LINE WHISTLE

"I am having trouble with my Marconi TV and would be grateful for any advice that you can give me. The trouble is that my picture breaks up or moves irregularly across the screen, leaving for a few moments a black strip about 1in. wide at the right of the picture.

"The trouble gets worse during interference, and there is a persistent high-pitched whistle. I have tried correcting the trouble with the pre-set controls, but this only holds the picture for a short time."—E. Hudson (Hendon).

The high-pitched whistle from your receiver is the line time-base output valve circuit, and you will have to screen it with some absorbent material if you wish to eliminate this. You must take care, however, that the heat of the valve can be dissipated away safely. The slipping of the line hold points to a faulty sync separator valve or line oscillator valve, and you should check these by replacement.

E.E. TELEVISOR FOCUS

"I have built an E.E. Televisor, and for some time it has been giving very good results, the picture being very clear. It has, however, developed a fault in the focusing. At first, on switching on, the focus was perfect, but a few moments later the picture became all blurred, and altering the control brought it back, until the control would go no farther; now, it wont focus properly at all. To try and counteract it I have fitted a P.M. in place of the electro, but I can't obtain a spot anywhere on the tube neck where the lines would become clear and distinct. It also now has a tendency to pull what lines there are to the left, making everything pointed. I thought it would be the electro condensers leaking and I replaced these, but they have made no difference. I also replaced the E.H.T. condenser; this didn't alter it any. I have replaced both the line and frame amplifier valves. Hoping you can help."—A. Heaven (N.1).

It is not clear from your description as to whether a fault has developed in the focus circuit itself or in some other section.

If you find that it is now necessary to reduce the value of R.91 to bring the focus in, the fault may be due to a variation in the H.T. supply, in which case the size of picture would vary and it would become smaller, or, if it was due to a fault in the E.H.T. supply causing the E.H.T. to fall, then the picture would become larger.

An indication of the type of fault which is occurring may be obtained by noting whether R.91 has to be reduced in value or increased in value. We suggest checking whether the picture is in fact becoming smaller or larger during those periods that it goes out of focus. If the picture becomes larger, then it is due to a fall in E.H.T., whereas if it becomes smaller it is due to a fall in H.T. If possible, voltage measurements should be carried out from the grid of the cathode-ray tube to chassis to check whether there is any change during the periods when the picture is in focus as compared to the periods it is out of focus.

You mention that there is a tendency to pull the lines to the left, making everything pointed. We are not clear by what is meant by this, but if the left side of the picture is narrower top to bottom than the right side, then it would indicate that a fault has developed in the scanning coils.

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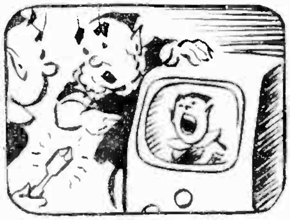

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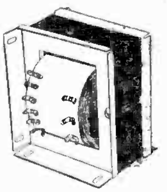

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½-watt—100Ω, 330Ω, 470Ω, 2,200Ω, 15kΩ, 30kΩ, 150kΩ, 220kΩ, 270kΩ, 470kΩ, 680kΩ, 1MΩ, 3MΩ, 3.3MΩ 3/- per doz.
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Air Spaced Trimmer, 0-100 ... 1/9 each
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Tubular Paper Condensers—.0001, 450vt. 4/- doz.; 0.2, 350vt., 6/- doz.; 0.25, 350vt., 6/- doz.; 0.5, 350vt., 8/- doz.
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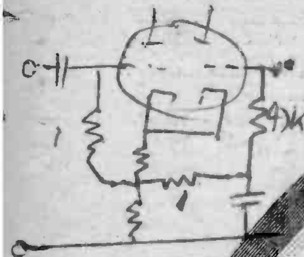


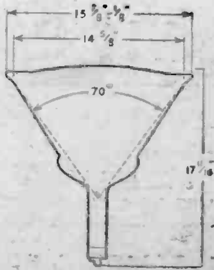
ADVANTAGES OF THE 'ENGLISH ELECTRIC' METAL C.R. TUBES

5. Wide Angle Scanning

The introduction of wide angle scanning has made it necessary to obtain an even higher degree of efficiency in scanning circuits. The requirements of scanning power for the 70° short tube and for higher E.H.T. voltage (14 kV) of which advantage can be taken, mark a considerable departure, as well as an advance in technique, from that necessary for earlier type tubes of 50° deflection angle using lower E.H.T.

By using high Q coils, low loss Ferrite cores, and a "booster-damper" type of circuit, it is now possible to scan fully a 70° tube over the full screen area (Double D) at 14 kV. And it is worth noting that current consumption will be no greater than that required for a resistance-damped scanning circuit driving a narrow angle tube at low E.H.T. voltage.

High efficiency components are now available for the home constructor, and full technical details concerning them and the scanning circuits may be obtained on application to the address below.



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