TELEVISION

THE FIRST TELEVISION JOURNAL IN THE WORLD

OCTOBER, 1934. No. 80

NEW SERIES
PUBLISHED BY THE PROPRIETORS OF
"AMATEUR WIRELESS"
AND
"WIRELESS MAGAZINE"

Screen Pictures with Disc Machine

The Amateur Experimenter
A New Series

JOHN L. BAIRD TALKS TO THE AMATEUR.
(SEE PAGE 438.)

MONTHLY
ONE SHILLING
NET

Two remarkable NEW Sets for the HOME-CONSTRUCTOR

The W.M. BATTERY STENODE

In this month's issue of the WIRELESS MAGAZINE Paul Tyers describes the construction of the Battery edition of the Stenode. Never before has there been a home constructors' model of a Stenode battery receiver.

In a recent issue of the WIRELESS MAGAZINE the Mains edition was described, which has proved immensely popular. The selectivity of the set is astounding and in obtaining this selectivity the designer has not sacrificed quality in any way—it is, in fact, the only battery receiver of which it can be justly claimed that it overcomes all ether chaos.

The W.M. QUARTZ-CRYSTAL SUPER

Also in the October issue of the WIRELESS MAGAZINE are details of a seven-valve Super Het that tunes from 12 to 550 metres and employs a Crystal Gate for selectivity. It has been designed by Kenneth Jowers and every component used will stand up to the climatic changes both here and in the tropics. Five of the seven valves used are high-frequency pentodes, the remaining two being a triode oscillator, and an output pentode.

This short waver has not been designed for the man in the street, but for the short wave-enthusiast.

Get a copy of the October WIRELESS MAGAZINE, now on sale on all bookstalls, price 1/-, and see further details of these two remarkable fine sets. The WIRELESS MAGAZINE also contains many other features of technical and general interest.

Don't fail to get a copy of this splendid Autumn issue.

WIRELESS MAGAZINE

OCTOBER ISSUE PRICE 1/-

No. 80 VOL. VII OCTOBER, 1934.

TELEVISION

THE FIRST TELEVISION JOURNAL IN THE WORLD

Special Features in this Issue

TELEVISION

Proprietors :
BERNARD JONES PUBLICATIONS, LTD

Editor-in-Chief :
BERNARD E. JONES.

Editor :
H. CORBISHLEY.

Editorial, Advertising and Publishing Offices :
58-61, Fetter Lane, London, E.C.4.
Telephone : Central 4341 (four lines).
Telegrams : Beejapee, Fleet, London.

Subscription Rates : Post paid to any part of the world—3 months, 3/6; 6 months, 6/9; 12 months, 13/6.

Published Monthly—1/- net.

(Last Wednesday in every month for following month).

Contributions are invited and will be promptly considered. Correspondence should be addressed according to its nature, to the Editor, the Advertisement Manager, or the Publisher, "Television," 58-61, Fetter Lane, London, E.C.4.

COMMENT OF THE MONTH

Misstatement

WHY does not the lay journalist before rushing into print on matters relating to television make sure of the facts, and then place the correct interpretation upon them? We raise the point because the Press reports upon the subject during the last twelve months have almost without exception been characterised by misstatement or wrong interpretation. A few weeks ago the B.B.C. in its wisdom thought it desirable to remind the public that no settled policy had been arrived at regarding the thirty-line transmissions and that they may or may not be continued. Here was a fine chance for the imaginative journalist to make the best—or the worst —of a simple statement and he rushed into print with such headings as "Television Transmissions to be Discontinued," etc., etc. A little reflection and the knowledge which he is presumed to have should have made it abundantly clear that the future policy of television in this country is in the hands of the Postmaster-General's Committee and therefore he was either wilfully misleading his readers or was woefully ignorant. Then there has been quite a crop of forecasts and revelations of the work of the Postmaster-General's Committee, and if we are to believe some papers decisions regarding the future of television have already been reached, whereas actually the mass of information received has not yet even been sifted. The curious point about the majority of these statements is that they are supposed to emanate from "Our Wireless Correspondent" who, if he knows anything about his job, should know better.

No less harmful are the exaggerated statements of the progress of development which are constantly being made. It appears that one need only let the imagination run riot and confide in the nearest Press representative and large cinema screen television is accomplished—on paper.

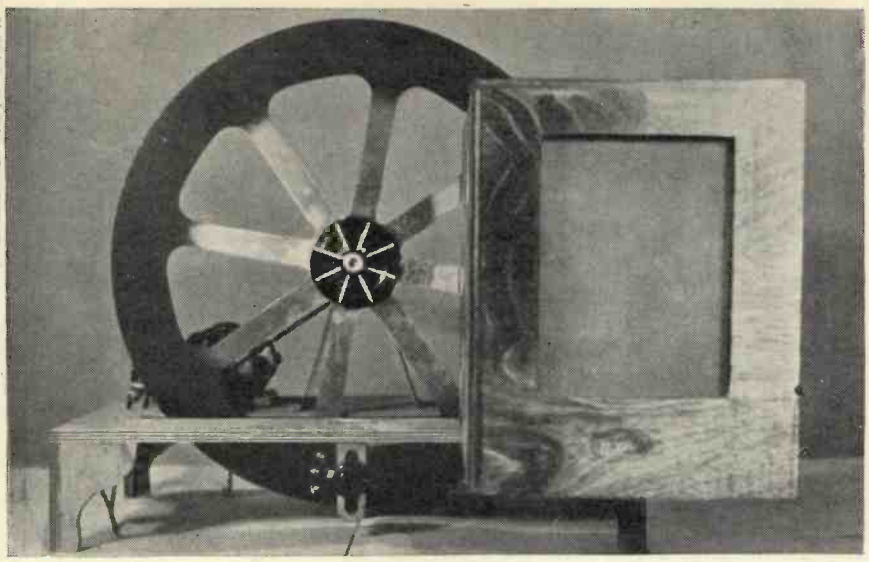
Serious workers are aware of the harm that is being done by misleading the public by such statements as these and it is largely on this account that such reticence is being observed. Many of our readers will be aware of the stage of development that has been reached, and we suggest that they will be doing a real service by contradicting misstatement whenever possible.

The Television Society

The first meeting of the 1934-35 session of The Television Society which is to be held on October 10th marks the seventh season. As we now number several thousand new readers it will be well to point out that this Society exists solely to further the development of problems associated with television and allied subjects. The records of the Society's activities are proof of the valuable work that has been done and the care that has been taken in the exclusion of any suggestion of commercialisation. Amateurs and research workers who desire to be in touch with their fellow workers could not find a better common meeting ground than that which membership of the Society provides.

SCREEN WITH A DIS

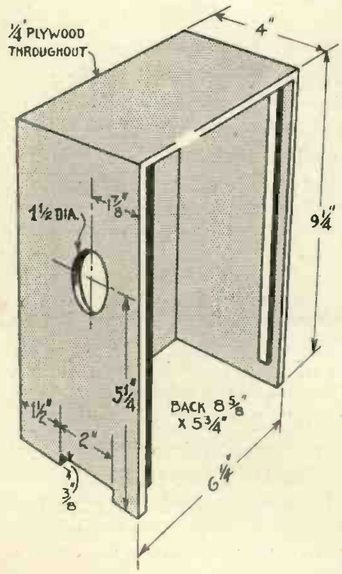
This article gives full constructional details of machine of any type will enable pictures to be have tackled this problem but so far as we are has been produced and it has the merit



As this photograph shows, the projector unit can be used to work in conjunction with any disc receiver.

IT has always been appreciated that the two greatest limitations of the disc receiver are the rather small size of the picture and the fact that it can only be viewed in comfort by two people at the same time. Naturally attention has been directed to improvement in these respects but until the present without much success. Screen pictures are obtainable with a lensed-disc machine but apparatus of this type is distinctly different from the simple disc and has never attained a fraction of the popularity of the latter.

The advantages of a screen picture need not be stressed; that which can be produced by the apparatus about to be described can be viewed in comfort by any number of people up to about a dozen and it is not necessary to view it from a position directly in front. Before proceeding with a description of the apparatus it will be as well to state exactly what results are obtainable. Actual tests have shown that a picture, sufficiently bright to be seen in comfort in a room which was not entirely dark, of a size $2\frac{1}{2}$ inches by 4 inches is produced. This size, it will be realised, is about twenty-five per cent. less than that ordinarily obtained with mirror-drum apparatus. It was found possible to project a larger picture by a simple adjustment of the optical system, but with some sacrifice of brightness. With the size mentioned the brightness of the picture is quite satisfactory. As the picture is projected on a ground-glass screen and is not viewed through a magnifying lens there is no observable distortion.



Details of the construction of the lamp box.

PARTS REQUIRED.

- T.I. neon-mercury lamp (**Television Instruments, Ltd.**).
- One 2 in. concave reflecting mirror (**Television Instruments, Ltd.**).
- One condenser lens $1\frac{1}{2}$ in. dia., 2 in. focal length (**British Television Supplies**).
- One projection lens, 1 in. dia., $1\frac{1}{2}$ in. focal length (**British Television Supplies**).
- One double convex lens, 4 in. dia., 12 in. focal length.
- One plano-convex lens, 6 in. dia., 18 in. focal length (**British Television Supplies**).
- Wood for boxes and lens mounts ready cut to size (**British Television Supplies**).
- Meccano parts for lamp stand.

The colour of the picture is a bluish white; in this respect it corresponds very closely to the picture obtained with mirror-drum apparatus using an ordinary projection lamp and Kerr cell; in fact, generally speaking, it may be said that the results attain very closely to those obtained with the mirror-drum but on a slightly smaller scale.

Used with any Disc Machine

Examination of the photographs on this page will show that the unit is accessory to the

The lamp stand is made up from a few simple Meccano parts which allow of easy adjustment.

PICTURES

C RECEIVER

a unit which used in conjunction with a disc projected on a screen. Many research workers aware this is the first successful apparatus which of being adaptable to any disc machine.

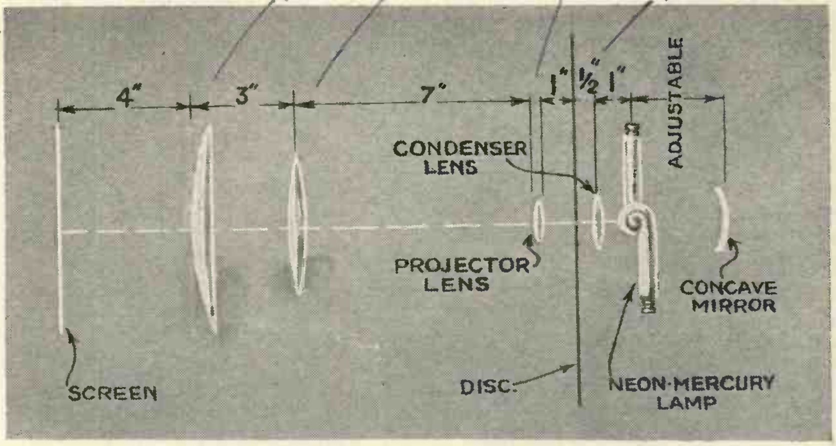


Diagram showing the arrangement of the optical system.

ordinary disc machine, and that any machine of this type can be adapted. Some slight modifications are required but these are of a nature that can be very simply carried out. Anyone, therefore, who has a disc machine can use this apparatus in conjunction with it and obtain the results described above.

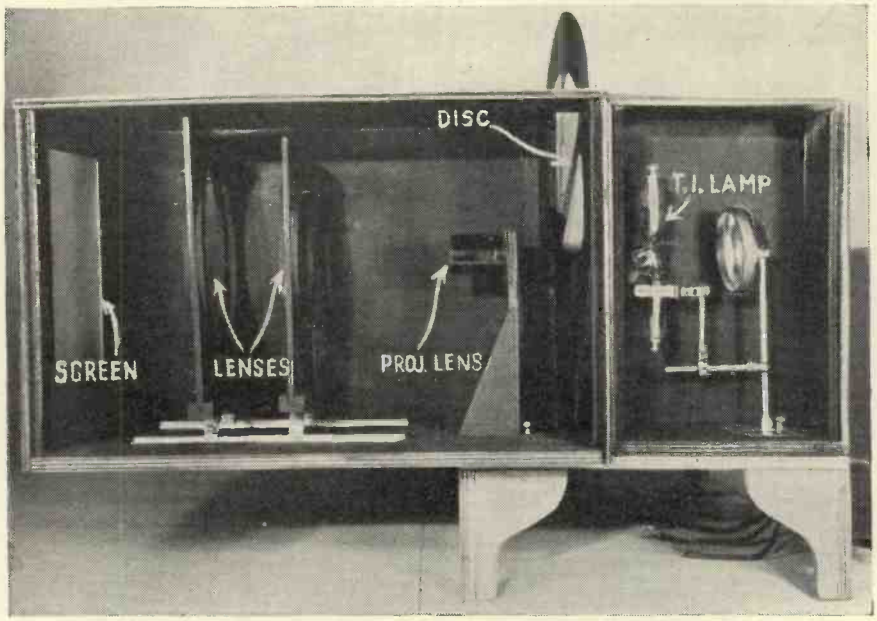
Scanning is effected in exactly the reverse way to the usual practice; that is, the disc is arranged to run so that if the viewing was to be direct the scan would commence at the top left-hand corner and travel across from left to right, each scan being downwards. A reversal takes place in the optical system so that on the screen the scan appears normal. The accomplishment of this is one of the modifications that must be made to the disc receiver and all that is necessary is the turning of the motor round. In the photographs an indirectly-driven disc is shown (the B.T.S.) and the motor has been moved to the opposite end of the baseboard to that at which it is ordinarily fixed. For convenience the motor control and terminals have also been moved so that they are more accessible.

The Optical Unit

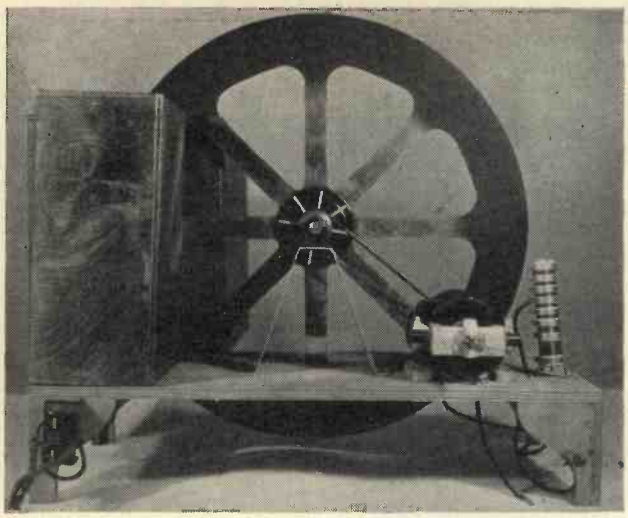
The optical assembly is in two sections; first the lamp, concave mirror and condenser lens, and secondly the optical system, consisting of three lenses and the ground-glass screen. In the model shown the entire optical assembly is contained within two boxes; these boxes, or covers, are not really essential as the lenses, etc., can be mounted on a baseboard and a support arranged for the first condenser lens, but the construction shown will be more convenient and the covers prevent any extraneous light reaching the screen.

The lamp used is one of the new T.I.'s, a neon-mercury type of special construction which gives a fairly large and even field of light. This is supported on a stand made up from Meccano parts and behind it is a concave mirror. Immediately in front of the lamp is a condenser lens which is 1½ ins. in diameter and 2 ins. focal length; this is supported in the front of the first box which is behind the disc. The next lens is the projection lens and this is placed immediately in front of the disc, being mounted in a short tube supported on a wooden stand. This lens is 1 in. in diameter and 1½ in. focal length.

The remaining lenses are a 4-in. double convex with a focal length of 12 in. and a 6-in. plano-convex with a focal length of 18 to 20 in. These two latter are supported in wooden mounts of which particulars are given in the drawings. The mounts can be easily cut out with a fret saw, or the whole assembly including the wood for the cabinet (ready cut to size, but not assembled) can be obtained from advertisers in this journal.



This photograph shows the assembly of the complete optical unit including lamp and screen; the disc revolves in a space between the two boxes.

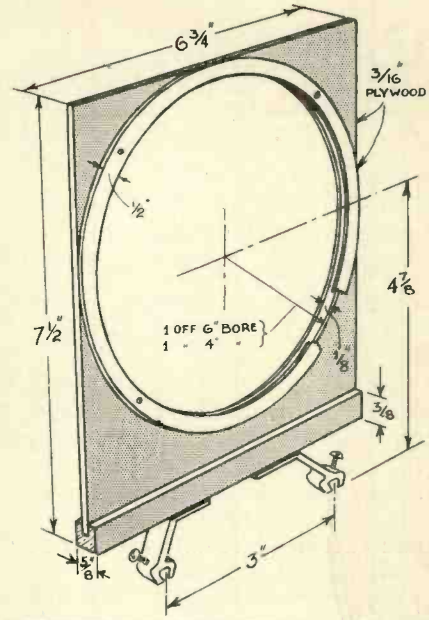


The light boxes are made from ¼-in. plywood fastened together with thin wire nails, two sides being left loose so that they can be removed for adjustment of the positions of the lenses. These boxes are secured to the baseboard of the actual receiver by screws which project through the latter and are provided with thumb nuts. This allows of the unit being removed without difficulty. The details of the boxes are given in the drawings and it should be noticed that these are so placed that there is a space between them equal to the width of the disc slot in the baseboard of the receiver.

The neon lamp stand is held in position by the thumb nut which secures the box to the baseboard and, as the base is slotted, adjustment of the stand within fairly wide limits is possible. The two large lenses in the front light box are movable on short lengths of curtain rail which is obtainable from 6d. stores; the feet on the mounts are the sliders supplied with this rail.

Left: A rear view of the disc machine with the unit fitted.

Right: Details of large lens mounts.

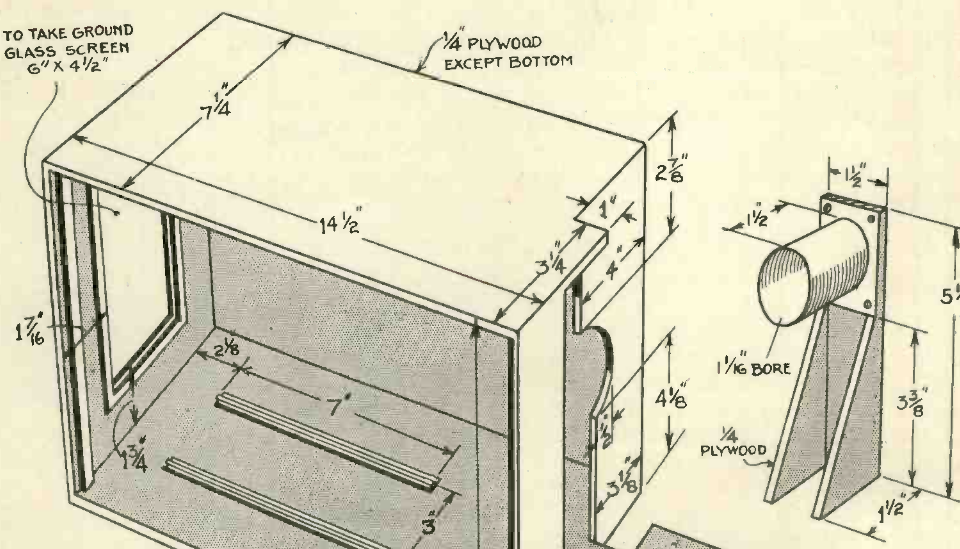


In order to make the assembly of the lenses quite clear the following are the correct spacings between the lamp and each successive lens:

T.I. lamp to 1½-in. condenser lens	1 in.
Condenser lens to disc	½ in.
Disc to back of projector lens	1 in.
Front of projector lens to 4-in. condenser lens	7 in.

(Continued on page 470.)

The T.I. lamp used as the light source.



Details of main optical box with baseboard and (inset) projection lamp holder and stand.

B.B.C.'s IMPROVED 30-LINE SERVICE

By Our Special Commissioner

WHAT may be fairly described as a victory for the 30-line television enthusiasts has just been won. The B.B.C., after "sitting on the fence" over its attitude

Droitwich, which is also to house the Midland Regional transmitter.

to 30-line transmissions, has now given a definite decision.

The 30-line programmes now being sent out from London National, with accompanying sound from Midland Regional, are shortly to be enlarged. Also the times of transmission are to be changed.

At present, as you know, half-hour television on the 30-line system is broadcast on Tuesday nights and Friday mornings.

This arrangement has not proved of any great value to lookers—either amateur or trade. Very few people have a chance to listen on their apparatus in the mornings, much less look.

As a result, for most enthusiasts television reception has been restricted to one evening per week—and only half-an-hour at that. Everyone who handles television apparatus is agreed that this period is just not long enough. By the time the apparatus is properly adjusted the programme is half over—very unsatisfying.

Evidently the B.B.C. has fully recognised the failings of the present service, experimental though it naturally is. The point of view seems to be growing at Broadcasting House that if they are going to do anything at all with 30-line television they may as well do it in a way that will benefit experimenters who are working at the receiving end.

Wednesday Nights and Saturday Afternoons

From October 8 onwards, therefore, the 30-line television signals will come to you on Wednesday nights and Saturday afternoons. This is great news, as we are sure all our readers will agree.

Moreover, the period will be extended from half-an-hour to three-quarters. On Wednesdays, for example, you will be able to look in from 11 to 11.45 p.m. On Saturday afternoons the television will be on the air from 4.30 to 5.15 p.m.

To most of us it does not matter whether we get the night programme on Tuesday or Wednesday, but it most certainly does matter that the period has been extended. Similarly, on Saturday afternoons most of us will be able to take full advantage of the new television period—especially as the dull autumn days are looming ahead.

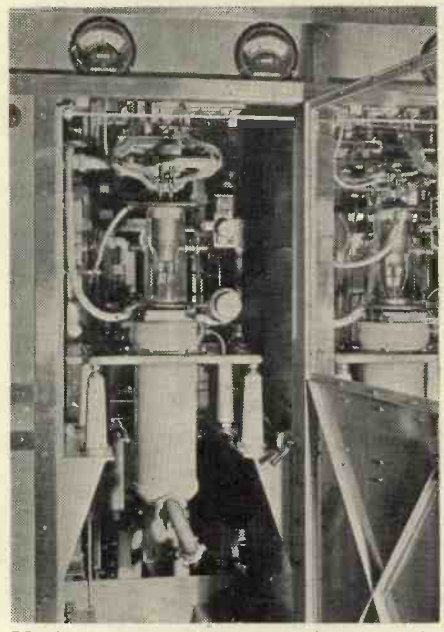
A Gain

The net gain to the vast majority of television workers is more than the extra quarters of an hour—because very few were able to take advantage of the Friday morning transmission. It means, therefore, a full hour a week of extra looking-in—very valuable indeed.

The B.B.C. emphasises that these changes in timing for 30-line television transmission indicate no important change in policy. Lookers must not imagine that the B.B.C. is veering round to the view that low-definition television is better than the problematical high-definition television so favoured by those in the high places.

Indeed, the B.B.C. takes special pains to point out that its policy is waiting upon the P.M.G.'s Committee. Until that body of experts publishes its findings we can expect no change in the non-committal attitude at Broadcasting House.

All the same, in spite of this disclaimer, it is obvious that the authorities have been impressed with the large body of opinion that says, in effect: "Carry on with 30-line television until ultra-short-wave television is practicable enough for the public to participate in."



Vital point in the Droitwich giant's transmitting equipment—one of the mighty valves in what the engineers call a C unit.

The Sound Programme

You may be wondering what will happen to the sound part of the television programmes when the Midland Regional goes from Daventry to Droitwich, which it will do in two or three months' time.

I am able to assure you that the present sound accompaniment for London National television will be broadcast from the new Midland station when it starts up at Droitwich. This again is good news, for it means that in the large London area the sound will be subject to less fading. The new Midland station will have a minimum power of 50 kilowatts, as compared with the 30 to 35 of the old Daventry 5GB plant.

Altogether, then, the immediate future for the 30-liner is distinctly bright.

SCANNING LINES IN TRANSMISSION

Here are some curious facts regarding transmission which may appear paradoxical until the explanation given in the text is understood.

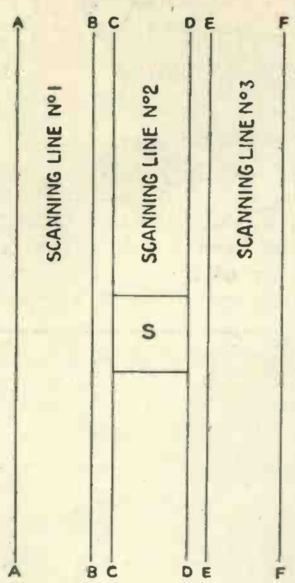


Fig. 1. Spaced scanning line of which the photo-cell takes no account.

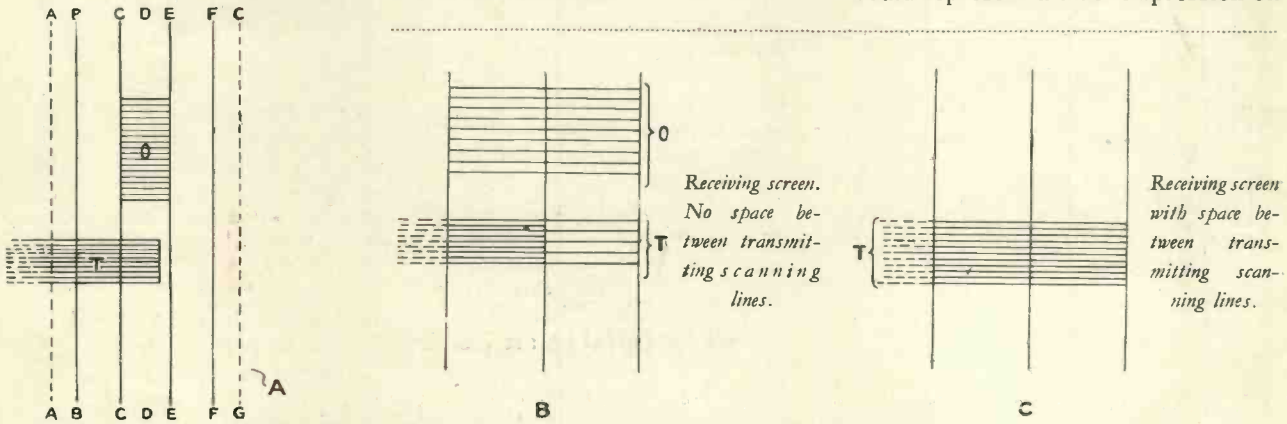


Fig. 2. Three diagrams showing the effect of spacing the transmitting scanning lines.

THOSE of us who have been fortunate enough to have visited the television transmitting studios, either those used for demonstration work at exhibitions, or for broadcasting, may have wondered why such very pronounced black lines appear between the scanning lines and how it is that they do not appear on the receiving screen. Actually these black lines, to the photo-cell, are non-existent, a statement which on first thoughts may be hard to realise.

To explain this let us examine how they are produced. Turning to Fig. 1 we have three scanning lines, (1) the area between AA BB, (2) between CC DD and (3) EE FF, while between the scanning lines 1 and 2, and 2 and 3 are the two areas bounded by BB CC and DD EE, which at scanning speed owing to the persistance of vision would, to the eye of an observer appear as black lines, due to the fact that no light was illuminatin these areas from the actual scanning spot. The photo-cell, however, which has neither persistence of vision and is completely void of any sense of location at any instant only "sees" the spot travelling along a scanning line such as at S and in consequence the black line to the photo-cell is non-existent.

Now let us consider the effect of not scanning the areas which appear to the eye as black lines. In Fig. 2A the areas bounded by AA DD and DD GG would be covered by two scanning lines, but if the scanning spot is made somewhat narrower so as to only cover the areas between the lines BB CC and EE FF, the area CC EE will not be scanned and supposing some object just fitted into the width of this area, as O, it would not be seen. The slightest movement, however, to either side and the object would at once appear visible to the photo-cell.

Further, one generally televises moving objects and it is highly improbable that an object like O would not be seen; also one would not attempt to put over anything of such fine detail as about half a line width.

Now take the case of the object T. If the scanning lines touch, the object will affect both lines, the small portion in the right hand line would be opened out in the receiver to the whole width of the line such as in Fig. 2B. In this figure also note how O would be opened out. On the other hand, if the scanning lines were not touching, only the left-hand line would be affected, and though the object would be slightly shortened it would represent a truer impression on the receiving screen (see Fig. 2C). It can, therefore, be said that the narrow scanning line gives, on the whole, more detail. Again considering the object O, it can only ever be seen by one line of the scanning lines if they are narrow, while if full width there are many occasions when it will be spread out to over the two lines and in consequence in the receiver will appear greatly broadened.

And in conclusion one must not forget to add that it is the appearance of these black lines between the scanning lines which make it possible for the scanning spot to be quickly focused as it is the sharpness of these lines that indicates when the spot is in focus.

COMPONENTS THE AMATEUR CAN MAKE

The amateur, when turning his attention to television, has three courses open to him—he can purchase the receiving equipment complete, he can assemble it from ready-made components, or he can make practically everything. Most people follow the second course, but there is a large proportion of these who desire to make some of the apparatus at all events, and it is proposed to give in the following notes an outline of the possibility of amateur work in this direction.

Much of the apparatus used in mechanical television systems looks simple—in fact, it is simple—but this by no means implies that it is easy to make by the amateur who possesses few tools and but limited experience if the best results are to be obtained. Perhaps the principal reason for this is that in many instances considerable optical leverage is employed, and therefore a slight error is magnified many times when the ultimate result is obtained. Particularly is this the case with projection apparatus; a mirror which is no more than a hundredth part of an inch out of correct position may reveal an error of the greater part of an inch on the screen—a condition which, of course, cannot be tolerated.

Here are essential data and constructional details of simple television apparatus which is within the ability of the average amateur to make for himself.

Then there is the point that apparatus of this class must in most cases revolve when in operation, and this, in addition to necessitating great accuracy in setting up, means that a fair degree of balance must be preserved, otherwise there will be undue vibration which will bring no end of troubles. Of course, all difficulties of these natures can be surmounted by the skilled worker who has suitable equipment, and amongst this a lathe must be regarded as essential. The average amateur, however, does not possess much in the way of equipment, so it is proposed to discuss what can be accomplished in the way of component construction with tools that are ordinarily available.

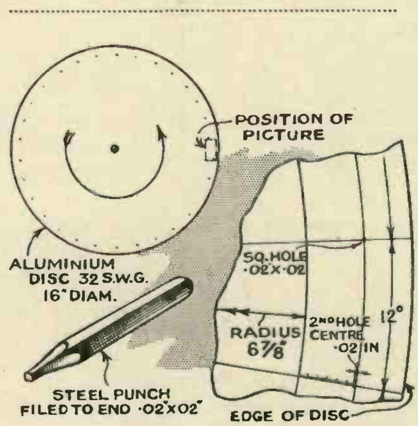
It is not wished to deprecate home construction of apparatus, but it is thought that it is desirable to indicate what can be made by the average amateur and the likely difficulties which he will probably encounter, so that he will be aware what success he is likely to obtain with the facilities available.

THE SCANNING DISC

All the data necessary for the construction of a scanning disc.

Probably the component to which most amateurs direct their attention in the first place is the simple scanning disc. Scanning discs have been made out of cardboard and even old gramophone records, but it is quite certain that makeshift materials such as these are not worth the trouble expended on them, for the finished article will only give inferior results. Actually a scanning disc is not easy to make, even though the material is easy to work and calls for but little more in the way of tools than scissors and dividers. The difficulty lies in the accurate positioning of the holes. The following information will, however, enable anyone to make a disc, providing that the work is carried out carefully.

The material for the disc is No. 32 gauge sheet aluminium, and the most convenient size is 16 inches in diameter. The first procedure is to scribe a circle of this diameter, and in doing this take great care to preserve the centre mark; as subsequent operations depend upon this, it should be quite small but well defined. All scribing should be done upon a perfectly flat surface. A pair of dividers can be used for scribing, or alternatively it is a simple matter to make a trammel. Another circle is scribed 6⅞ in. from the centre, and this indicates the position of the edge of the first of the scanning holes. As each hole is .02 in. square, a series of circles is required with this distance between each. Actually it is not necessary to scribe these all the way round the disc, though by doing this a certain amount of confusion will be avoided when the disc is being punched. Thirty-one circles will be required, which will give the thirty



These drawings give all the necessary details to enable an amateur to construct a scanning disc.

spaces for the scanning holes.

The next requirement is the division of the outer circle into thirty equal parts, and probably the simplest way of doing this is to step the radius of the outermost circle round, which will divide this into six equal parts. Each of these parts can then be divided into five by trial and error when lines can be scribed to the centre. The position of the holes which are to be punched should then be decided upon—that is, whether they are to be to the left or right of the scribed lines.

The holes should preferably be square, so a punch is required of the correct size. These can be purchased from dealers in jeweller's sundries, or one can be made from a short length of $\frac{3}{16}$-in. tool steel filed to a taper and the end finished off quite square. This latter point is most important if clean-cut holes are to be made. The punching should be done with the disc resting upon a block of lead or the end grain of a piece of very hard wood. A little experimenting on a piece of scrap metal will be advisable before operations are commenced on the disc. Any burr, it will be found, can be removed with a sharp knife.

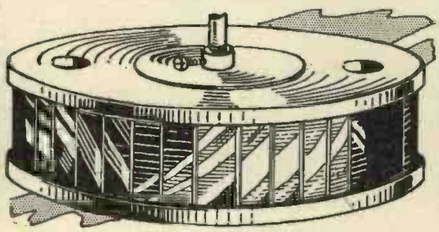
The centre hole can be cut out with a small wood chisel, a circle being scribed the size of the boss upon which the disc is to be mounted in the first place. The first cut should be made well within the circle in the first place, and then be finished to size with a round file, using a piece of wood with a hole in it as a backing for the metal when filing.

The disc can be plain or spoked. In the latter case eight spokes should be marked out and cut by resting the disc at the edge of a piece of wood and using a knife of the type used by shoemakers. The width of the spokes should be approximately 1 in.

A SIMPLE MIRROR DRUM

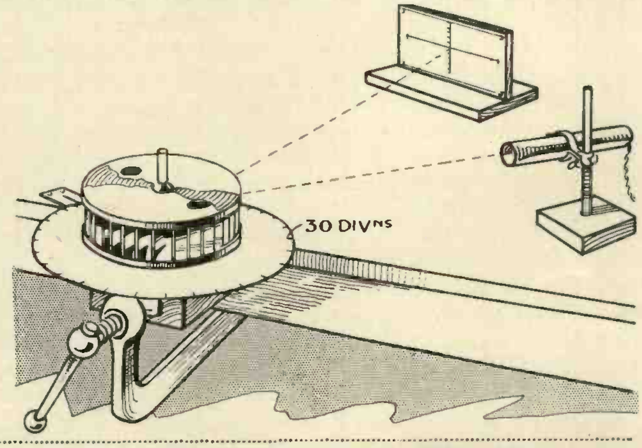
The mirror drum described below is of very novel construction and can be built with the simplest tools

The construction of a mirror drum is a much more ambitious undertaking, though it is not entirely beyond the ability of the amateur. The commercial article is, of course, a metal casting accurately machined and with the mirrors supported in light metal frames secured to the drum by screws or mounted direct on to specially machined faces on the drum and secured by clips. The latter is the Baird practice and it is excellent, but it calls for special machining of the mirror beds, which requires doing with great accuracy. Other drums are constructed so that the frames which carry the mirrors are held by screws.



This sketch shows how the drum is assembled ready for filling with plaster.

Successful mirror drums have been made of wood, but there is always a risk in using this in that it may warp and either put the mirrors out of position or cause them to crack. A method of making a mirror drum with only the very simplest tools was given in this journal some time ago, and it will be useful to give an outline of the scheme. Briefly, this drum consisted of two large tin lids with the mirrors set in plaster of paris. The procedure was as follows: Two tin lids about 7 in. in diameter are obtained and the thirty mirrors. The size of the latter will depend upon the size of the lids, but it should be such that when the whole lot are stood inside the rim of one of the lids they occupy the full circumference with about a sixteenth of an inch between each. They should also be a little longer than what is normally used in order to allow for them being partly covered by the rims of the lids, as will be clear later. The exposed surfaces can conveniently be $1\frac{1}{4}$ in. wide. A hole is made in the exact centre of each lid to take the spindle, and over one of these a boss of the type used for discs is soldered. Two large holes are then cut in the lid, the purpose of which will be clear later.



It is necessary to set the mirrors correctly whilst the drum is in course of construction. This sketch shows how the screen is arranged in order to test the position of each mirror.

The lid with the boss fitted is then locked on a suitable length of spindle, which is arranged so that it will turn stiffly in a block of wood secured to a table. The sketch will make this clear. As the mirrors are to be fixed permanently in position the next matter is to set them correctly. How this is done will be clear from the second sketch. A circular scale divided into thirty equal parts is placed under the lid and secured so that it cannot move, and another scale with thirty horizontal divisions is set some distance away so that a spot of light from a lamp can be reflected from the mirrors as they are placed on the drum and thence on to the scale.

In the first place the mirrors are stuck in plasticine and the first one adjusted so that the spot of light falls on the centre line of the screen. Mirror number two is next adjusted so that the light falls on the next mark upwards. When fifteen mirrors have been adjusted the centre line is reverted to and the remaining mirrors set by turning the drum in the opposite direction.

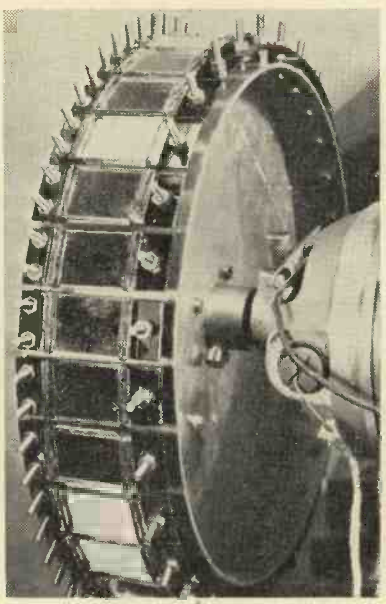
The top lid (which should also have two large holes cut in it) is then carefully lowered into position over the mirrors and the whole assembly very carefully turned over. The mirrors are to be held in position with plaster of paris, and this is poured in through the holes in the first lid, the holes in the second lid having been temporarily stopped up with plasticine. After the plaster has set—and twenty-four hours should be allowed for this—the first lid and the plasticine are removed and the space left by the removal of the latter filled with plaster of paris, the lid being replaced before this has had time to set.

In all probability it will be found that the drum requires balancing, and this can be effected by scraping some of the plaster away. It is not claimed that a drum constructed on these lines will be perfect, but if the work is carefully carried out it will be quite effective, and it is an example of one of the many improvisations that can be made by the ingenious amateur.

A METAL MIRROR DRUM

The mirror drum described below is an efficient type which can be built with a few simple metal working tools

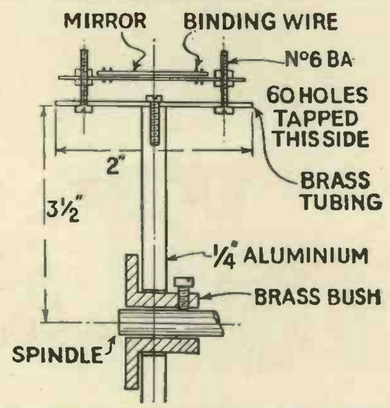
An amateur-made drum which is constructed entirely of metal is shown by the photograph. The body of this consists of an aluminium disc and a short length of brass tube, the latter being secured to the disc by means of screws as shown in the detail drawing. This drum is not so difficult to make as might appear at first sight. It can be made entirely by hand with the exception of the aluminium disc and the flange which holds it on to the motor shaft. These latter it is necessary to have turned.



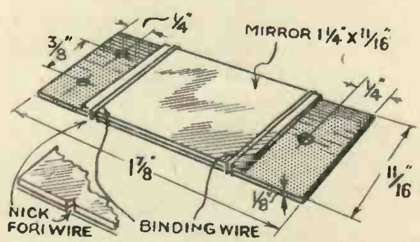
A photograph of the completed drum.

As mentioned, the actual drum is a short length of brass tube secured to the aluminium disc by screws. It is, of course, necessary to ensure that this is fitted very accurately so that it runs true. The positions for the holes for the mirror plate supporting screws can easily be marked out by placing a strip of paper round the drum and marking where the ends meet, and then laying the paper out flat and dividing the intervening space into equal divisions. The paper is then secured to the drum by means of liquid glue and the points where the holes have to be drilled lightly punched. Holes are then drilled and afterwards tapped 6 B.A. to take the mirror plate supporting screws. Alternatively, of course, these screws could be soldered into the holes without tapping.

The mirrors are supported on brass plates of the dimensions shown. These plates are drilled so that they can be slipped over the screws in the drum and the plates are adjustable by nuts which clamp the plates in the desired position. Thin copper wire is used to secure the mirrors in position, and these are prevented from slipping by a touch of liquid glue on the backs.



The drum is built up of a metal disc and brass tube. The method of fixing the mirrors is clearly shown.



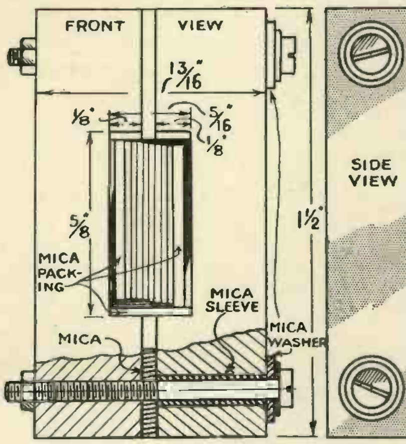
Details of mirror and mirror plate.

MAKING A SELENIUM CELL

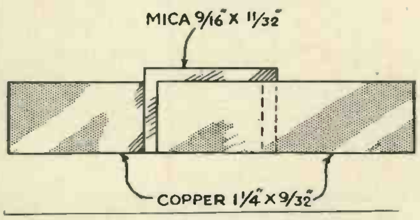
Many amateurs attempt the construction of the selenium cell with but indifferent results. There are two main types—the condenser pattern, which consists of a number of metal plates with mica insulation between them arranged condenser fashion; and the wire type, consisting of a pair of wires wound spirally a short distance apart round a block of slate. Mechanically the construction of either type is simple, the real difficulty being in the coating of the cell with selenium and the subsequent annealing. Both methods of construction are shown by the diagrams.

Attempts to melt the selenium on to the cell over an ordinary gas flame are bound to result in failure. Either a Bunsen burner and sand bath should be used or, what is probably more convenient to the majority of people, the domestic electric iron turned upside down. The two great difficulties lie in obtaining a very thin coat of the selenium and the annealing, the latter calling for a very gradual decrease of temperature. Selenium is purchased in the form of sticks about ¼ in. thick, and it is deposited on the cell by heating the latter until when the stick is pressed on it it melts. The procedure, then, is to heat the cell either on the sand bath or electric iron and then rub the stick on it. A thin coat is obtained by *removing any surplus with the edge of a piece of glass, cleaning this after each time it is passed across the cell. Upon the thinness of the coating depends to a large extent the sensitivity of the cell.*

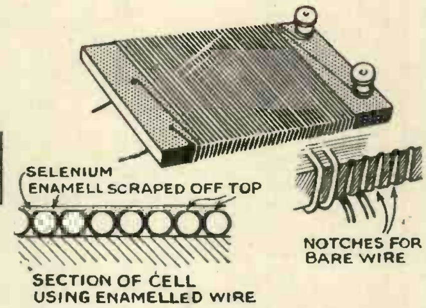
Annealing is most important, and it is absolutely essential that cooling should take place very slowly, which means that draught must be excluded. It is best therefore to surround the cell and heating arrangements with a sheet of asbestos millboard. When a thin, even coat has been obtained the iron should be switched off, and as the selenium cools it will be noticed that instead of it appearing shiny it will turn grey. After a short time the iron should be switched on again for a few seconds, and this should be repeated at gradually increasing intervals over a period of an hour or so in order that cooling will take place gradually. Of course, if a sand bath and Bunsen burner are used the flame can gradually be turned down as the cooling proceeds.



A condenser type of selenium cell built up from copper foil and mica.



Details of the copper plates and insulation.



This is the most simple type of cell made by winding a pair of wires round a block of insulating material.

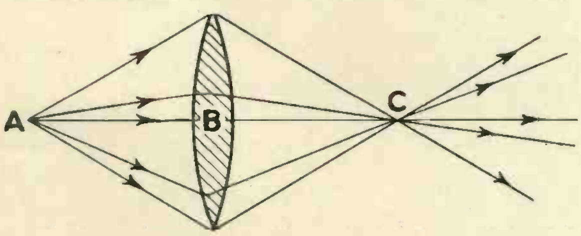
LIGHT, LENSES AND DIAGRAMS

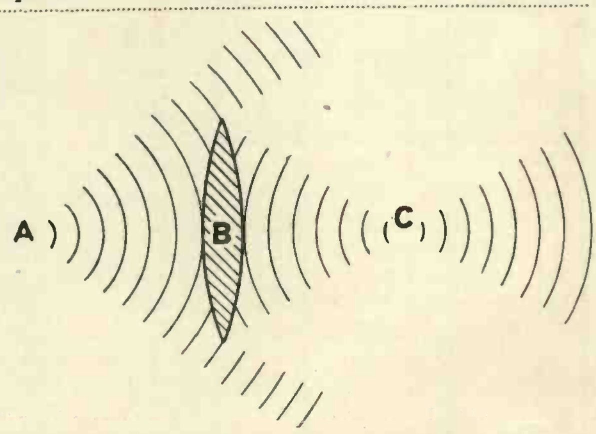
The beginner in the study of optics usually has some difficulty in associating the wave theory of the propagation of light with the "ray" diagrams which are used in explaining optical principles. The following notes are written with the object of making it clear how the two are compatible one with the other.

One of the laws of wave-motion is that every element of a wave surface is propagated in the direction of a normal to that surface. A spherical wave propagated in a homogeneous medium, for example, remains spherical throughout its travel, each little element of its surface being continuously propagated along a radius of the sphere.

In order to understand the relationship between a "wave" diagram and a "ray" diagram as used for explaining the action of a lens, suppose that A *in the diagram represents a source of light so small that for our present purpose it can be treated as a point. The spherical light-waves given out by this source can be represented diagrammatically by a number of equidistant concentric circles spreading out from the point* A.

These two diagrams of the same optical effect show the ray diagram and the corresponding wave diagram.





Assume that in one direction these waves fall upon a lens which cuts out of each successive spherical wave, as it reaches and passes through it, a circular watch-glass shaped disc, or "calotte," as it is sometimes called. As the centre of this calotte has to pass through a greater thickness of glass (in which light waves travel more slowly) than its circular edge, this centre will be relatively retarded and thus fall behind, with the result that if the lens is sufficiently thick at the middle all the calottes passing into the lens, with convex front surfaces, will emerge as concave-fronted ones.

It will be understood then that whilst the normals of the incident waves, in the direction of travel, diverge outwards from a point (the source A*), those of the emergent waves converge to a point (focus* C*).*

The consequence is that the waves emerging from the lens B*, whilst passing onwards, contract continuously into smaller and smaller calottes, with greater and greater curvature, until they come finally to a point or*

(Continued at foot of next page)

The Cossor portable mains oscillograph.

THE COSSOR PORTABLE MAINS OSCILLOGRAPH

A PORTABLE mains oscillograph has been designed by A. C. Cossor, Ltd., as a self-contained, compact instrument for general laboratory and workshop use. The new oscillograph is entirely self-contained, inclusive of power, time-base and calibrating circuits, and operates directly off alternating current mains. The only connections to the apparatus are a mains plug and a pair of terminals for connection to the circuit being examined.

The oscillograph consists of a small cathode-ray tube mounted in a metal box providing magnetic and electric screening, together with all necessary controls and supplies. The tube is mounted at a convenient angle for viewing and can be used, in general, without any special darkening of the room. All the necessary supplies are obtained from the mains.

A sinusoidal time-base sweep is employed, this being taken directly from the mains. The amplitude of this sweep can be varied over a very wide range; in normal operation the length of sweep is several times the screen diameter, so that the visible part of the sweep is effectively linear. A unidirectional traverse is obtained by modulating out the return stroke of the time-base. This arrangement of time-base, in which only the sweep velocity, and not the sweep frequency, is variable, is found in practice to introduce only a very slight limitation; on the other hand it does introduce the very substantial advantages of simplicity and absolute freedom from mains interference.

Control

The tube is viewed through a transparent window graduated in 2 mm. divisions; the nominal deflectional sensitivity of the tube is one division for 4 volts. For accurate quantitative measurement a calibrating circuit is incorporated.

The focus control is a shield biasing potentiometer for the oscillograph and has a mains switch mounted on the same shaft. The negative bias is increased by turning the knob anti-clockwise, and at the extreme end the spot is modulated completely out; the last few degrees of anti-clockwise motion open the mains switch. Four controls are provided, viz., focus, sweep, modulation and shift.

Among the more important applications of the Cossor oscillograph are:—investigation of distortion in radio receivers, investigation of audio-frequency and intermediate frequency wave forms, examination of tone control circuits, fault location, percentage modulation and maintenance measurement on radio transmitters, frequency calibration of oscilators, measurement of percentage modulation of signal generators, etc., measurement of A.C. peak voltages, grid swing, etc., examination of rectifier circuits, examination of commutator ripple on D.C. generators, detection of hunting or winding unbalance in generators, detection of iron saturation in transformers or other causes of bad wave-form in power and radio transformers.

Television Lectures

A COURSE of lectures on television is to be given by J. J. Denton, at the Borough Polytechnic, Borough Road, London, S.E.1. The course commences on October 4 and a lecture will be given on each Thursday thereafter 8 to 9.30 p.m. until the syllabus is completed. The fee for students residing in the county of London is 20s. The lecturer, Mr. J. J. Denton, is well known to our readers as the members' hon. secretary of the Television Society. Forms for enrolment may be had on application to the Principal of the Borough Polytechnic.

It is hoped to inaugurate shortly (on an experimental basis) a combined television and telephone service between Berlin and Munich. The combined transmitters and receivers will be installed at the Post Office headquarters in both cities and will permit the speakers to see each other whilst conversing.

"Light, Lenses and Diagrams"

(*Continued from preceding page*)

focus at C, *through which they pass and proceed once more as convex-fronted, diverging waves, similar to those proceeding from* A.

In the second or "ray" diagram the waves have been left out and replaced by a number of normals, drawn to the wave surface on the one side starting from A, *and on the other side to the wave surfaces converging to* C. *The waves therefore are real things; rays are simply straight lines which show the directions along which waves travel.*

It will be apparent that the visualising and thinking of optical effects can be most easily done in terms of waves—mathematical calculations are generally better done in terms of rays.

It is reported from Germany that it is proposed to allocate a sum of over one hundred million marks for a television publicity campaign.

JOHN L. BAIRD TALKS TO THE AMATEUR

We are gratified in being able to present to our readers this article by Mr. J. L. Baird who is of opinion that the amateur will play an important part in the future development of television.

The Baird Company's ultra-short wave experimental television transmissions are made from one of the towers of the Crystal Palace.

AFTER an apparent lull, there is now a considerable awakening in interest in television and no doubt this is due primarily to the enormous strides which have been made of late towards image perfection. This is an important factor and leads me to recall that the first issue of TELEVISION appeared as far back as March, 1928. At that date the art was certainly very young and the Editorial contained something of an apology for what might be considered the premature appearance of a magazine devoted to a science in such an early stage of development.

The Editor's apprehension was perhaps not altogether unjustified, but the journal has now passed through a stormy and uncertain infancy and safely reached its sixth year with anticipation of

still further growth

In 1928, television was confined to the medium wavelengths, and furthermore in this country, at least, the sideband available on these wavelengths was only 9 kilocycles. There was, therefore, a very definite limitation to the amount of detail which could be broadcast.

In cinematography twenty-four pictures per second are run through the projector and this standard might have been adopted for television at the outset. Reducing this speed to 12½ images per second, however, gave an increase in detail, which more than compensated for the resulting increase in flicker. The number of lines and the shape of the picture had to be adapted to suit the restrictions imposed, 30-line vertical scanning with a ratio of 7 vertical to 3 horizontal being finally adopted, as

the long, narrow picture

was most suitable for transmitting faces and head and shoulder views, these subjects being most frequently and successfully transmitted. Vertical scanning was also found more satisfactory than horizontal scanning for this type of picture.

The first television programmes were sent out from a studio at the Baird Company's offices at Long Acre, being transmitted along a land-line to the B.B.C. transmitters. This studio and new mirror-drum transmitting apparatus was moved to the B.B.C. and since August, 1932, the Corporation has supplied the programmes, these transmissions continuing at the present time, and forming

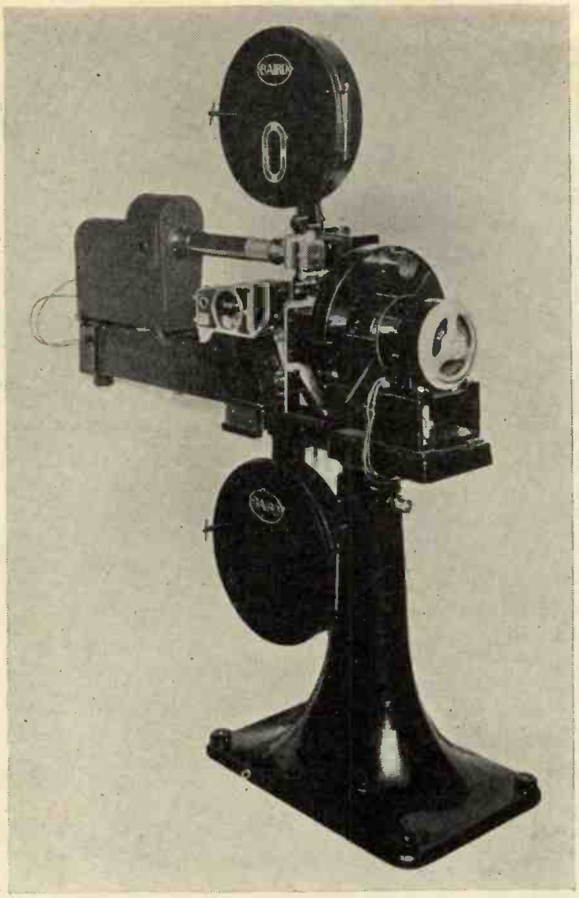
the only public service of television

in this country. When we come to the question of higher definition images, however, that is, those containing a wealth of detail comparable to present talking picture standards, resource is being made to etheric regions much lower down the wavelength scale and

Large Baird cathode-ray tube.

considerable research is being directed towards the solution of problems associated with ultra-short waves as a suitable radio medium for radiating the greatly improved images.

By the use of these ultra-short wavelengths, that is, wavelengths under 10 metres, the restrictions govern-



The Baird 180-line tele-cine projector.

ing the transmission of television by medium wavelengths can be avoided, and at the present moment

images containing a wealth of detail

can be transmitted and received quite readily.

What happens at the transmitting end, although intensely interesting, is probably not the prime consideration of readers of this journal. The majority must be more interested in ways and means whereby any television signals that are on the air can be received and translated into

clear intelligible images

possessing both interest and entertainment value. Do not expect to achieve perfect television immediately—graduate through the preliminary or low-definition stages in the same way as those who made an early start in radio. While great developments may be looked for in the future, none the less television is very much a reality of the present which will give hours of thrill and pleasure. Many experiments can be conducted to effect improvements to home apparatus, even when images are not available, so do not be unduly discouraged at the paucity of the programme time.

The position of television

to-day is one of absorbing intense interest to the amateur. Advances and improvements are being made continually and apparatus for experimental work can be obtained from many sources.

The amateur played a great part in the development of wireless and undoubtedly in the development of television his position is equally important.

John L Baird

JOHN L. BAIRD—THE MAN

By THE EDITOR.

The premises in Frith Street, Soho, where Mr. Baird had his first laboratory.

TO-DAY the name Baird stands for television the world over. But it is only a matter of a little over ten years ago that I climbed a dingy staircase in a small building in Frith Street, Soho, because of a rumour that some worker (I am not sure that I then even knew the name) had met with a certain amount of success in televising simple images.

In those days it was perhaps natural to associate television with delicately poised mirrors and fine optical apparatus, but all that I could see in the semi-darkness of the room I entered was a collection of what appeared to be junk, in which cycle sprocket wheels and chains and sugar boxes seemed very much in evidence.

From amongst this emerged Mr. Baird—and let me say at once that the impression that I got was that he fulfilled exactly the general conception of the inventor. A few minutes chat soon convinced me that Mr. Baird certainly had the courage of his opinions. Not that he enthused or even attempted to make a case out for his system, but he quietly gave the impression that he had something worth while.

A demonstration that day, I was told, was not possible, but he showed me the gear running. The motors, I judged, were somewhere about half-horse power and the noise and vibration were terrific, but for all that I came away with the feeling that the apparatus would work.

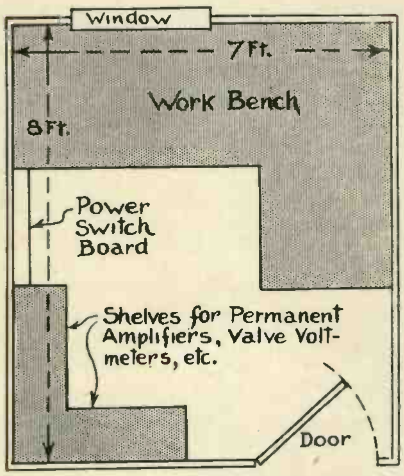
This was the first of many visits to that dingy room and on the second occasion I was privileged to see an image produced which had some resemblance to a face—one could certainly see the mark indicating the mouth, and it certainly altered in shape as the mouth of the dummy being televised was moved. Each subsequent visit revealed additional crude apparatus, but also better results. Success, as it gradually came,

(*Continued on page* 472.)

THE AMATEUR TELEVISION EXPERIMENTER

Television offers a very wide field to the amateur research worker at the present time and in order to assist those who are inclined to experiment we propose publishing a series of comprehensive articles describing equipment and procedure. The series will include both mechanical and cathode-ray systems and will be based on the experiences of two professional research engineers over a period of several years.

IN introducing this series of articles, it is proposed to describe the experimental television equipment of two enthusiastic workers. It is not intended to publish any definite schedule of these articles, though they will tend to first deal with the reception side, and later, with the generation of a television signal. A point which will interest all readers is an idea of the cost involved. This is definitely hard to state—so much depends on the individual. From the recent TELEVISION Questionnaire, figures from £2 to over £400 were given—£12 being about the average. These figures are extremes, probably £50 can be quite comfortably spent, but so much depends on what one wants to do, and how one does it. For example, a certain firm, noted for good value, quoted the writers 27s. 6d. for a special transformer. By buying the iron stampings and wire, the transformer was made with 9s. worth of material in two hours.



Where only a small room is available as a laboratory this arrangement will be found suitable.

The Location of the Laboratory

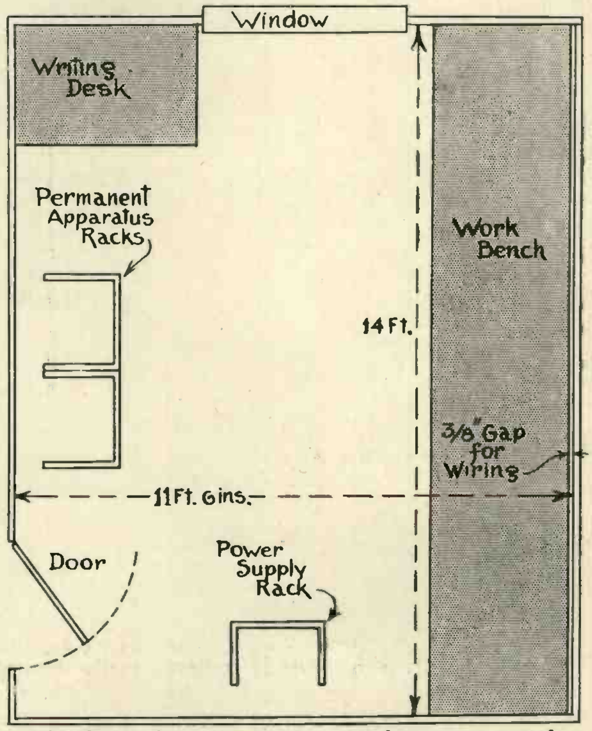
The first question which arises when taking up experimental work of any kind, is—where shall one experiment? It is almost a necessity to have somewhere where the gear can be left rigged. Nothing is more disheartening than to have to tidy up and put one's things away. The serious experimenter must have a room, however small, to himself. This is definitely difficult to a large number of us in these days of small modern houses. Many a bedroom is used to experiment and to sleep in, while a minor war rages with the female members of the household over the impossibility of "doing the room." It is really strange how women, on the whole, abhor their men-folk's hobbies, and wherever possible condemn all such efforts to continual discouragement.

To those who are in the position to say "I will have a room," and can take their choice, let us consider what makes for the best. Upstair rooms are to be avoided if possible, for various reasons. A long lead to "earth" is never to be recommended, while the effective height of an aerial is usually decreased if a radio receiver is situated upstairs. On the other hand for the reception of 4·7 metre band, it is a decided advantage to have the receiver on the top of a building, a point which should not be overlooked; even though, as far as the public are concerned, it is not yet used for any form of broadcasting, it will definitely be used for television in the not too distant future.

Another disadvantage in being upstairs, however, is that such noises as hammering and the running of motors will resound throughout most houses. The ease with which a room may be darkened is a consideration to the television experimenter. We are, apparently, a long way from a picture which will be bright enough to be viewed in anything but rather subdued light, or darkness, and it is remarkable how hard it is to quickly and neatly block out light from even a small window. For this purpose, a wooden frame or shutter is the only satisfactory solution, and it must be well made. The usual blind or curtain is generally useless.

Size and Shape

Now let us consider the shape of a proposed experimenter's room. Long and narrow is preferable to square, unless the room is larger than the average. In all optical work connected with projection, length in one direction is generally a necessity. The writers have a friend—a communication engineer—whose home equipment is fitted out in a long pas-



Plan showing the convenient arrangement of an average room for television experiment.

THE AMATEUR'S LABORATORY

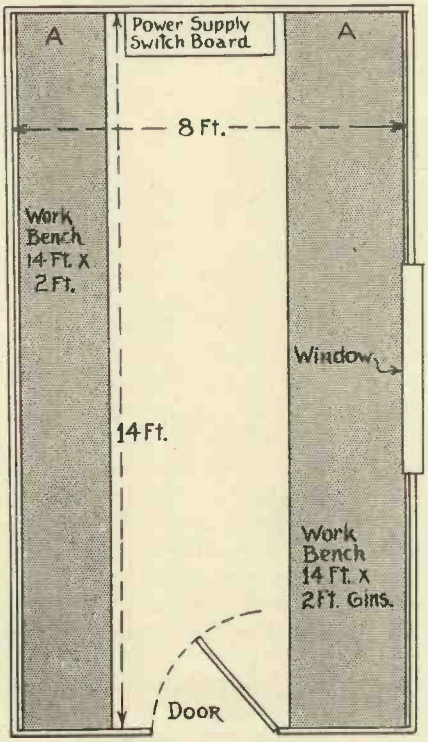
sage some 20 ft. by 5 ft., most elaborate apparatus being set out on a bench only 2 ft. 6 in. wide. When considering a suitable place, do not forget the garage might have possibilities, though probably cold in winter, and perhaps damp for sensitive electrical devices. No doubt, the best of all, however, is to have one of the garden sheds, generally made in so many sections. These are ideal, and considering their many advantages, not too dear—ranging from £8 to £15, including the floor. Such buildings have everything in their favour. The amateur experimenter can do what he likes in it. Fix things anywhere to the walls, make considerable noise without disturbing anyone, probably be completely free from interference produced by domestic electrical appliances, and electromagnetic fields of the average house electric wiring, while his testing apparatus will not be so inclined to interfere with the domestic radio receiver.

The Bench, etc.

Having decided on some place to experiment in, it is well to consider what furnishing will be required. Rooms vary so much in shape that it is impossible to lay down any definite plan. A bench the length of the greatest dimension of the room will be necessary. The height from the floor should be such that the experimenter should just be able to rest his elbow on it standing upright, his arm being kept to his side. Such a height will be most suitable for working standing up. A wide bench is not necessary, and is often space wasted, as it is not convenient to stretch over to the back of a bench more than three feet wide: the writers find 2 ft. 6 in. wide is generally ample. The space under the bench should have at least one shelf as wide as the bench, about two feet from the ground. Put up as many shelves round the room as possible—they never come amiss, though one end wall should be kept clear for the erection of a screen for experiments in projector work. The drawings show various suggested lay-outs for different conditions.

Current Supply

The next general consideration is that of the necessary electricity supply to operate various apparatus. A.C. mains are undoubtedly best, in-



The arrangement for an outdoor laboratory utilising a shed about 14 ft. by 8 ft. The walls AA should be left clear for projection screens.

asmuch as they are more flexible. To those who have no supply mains, the subject of electricity supply is rather serious, especially if the generation of a television signal is being considered. While the L.T. battery can be taken to a charging station, an H.T. accumulator cannot be satisfactorily transported. In such cases, H.T. should be generated from a rotary converter, which has an output of 12 volts—600 volt output, or a trembler outfit such as is used in automobile radio receivers can be used.

One must here clearly state unless one has electricity mains available or a dynamo and engine, the problem of a supply of "juice" is a knotty one, as television requires considerably more power than audio reception, and an experimenter who has no mains must have at least a 150-watt supply, preferably 500, for anything but the simplest receiving apparatus. Public mains should definitely be fitted with high-frequency filters at the point of entry to the premises.

The following power supplies will be required in a completely equipped laboratory.

1. 4 volts, 7 amperes, for valve heating of reception apparatus.
2. 12 volts, 8-10 amperes, for projection lamp.
3. 500-600 volts, 120 milliamperes, for neon or Kerr-cell reception.
4. 1,000 volts, 5-10 milliampere, for cathode-ray tube.
5. 1.5-2.5 volts, 2 amperes, for cathode tube filament heating.
6. For generation of television signal 1 and 2 as above in duplicate.
7. 300 volts, 50 milliamperes.

Many extra L.T. and H.T. will be required of somewhat less wattage for operating such things as valve voltmeters, oscillators, etc., also about 30 watts for each driving motor, receiver or transmitter.

(*To be continued.*)

Isochronism and Synchronism

As some readers may not be familiar with the real meanings of isochronism and synchronism, it may be well to define them.

Two mechanisms may be in isochronism and yet not be in synchronism.

When two machines are said to be running in isochronism, what is meant is that they are running at the same speed, but are out of step, just as two men's feet may be out of step although both are moving at the same speed and the feet of both strike the ground at the same instant. A similar case is that of two clocks which are both keeping perfect time, although the hands of one might point to 2.30 and the hands of the other to 3 o'clock. Isochronism has been achieved in both cases, but for synchronism to be achieved the two men would have to be "in step," and the hands of both clocks would have to indicate exactly the same hour.

CATHODE-RAY TELEVISION PICTORIALLY EXPLAINED

The pictures below should suffice to show the beginner the fundamental principles upon which cathode-ray television is based. Simple explanations are given with the pictures and they will be found to serve as an introduction to the more detailed articles which appear in this journal from time to time.

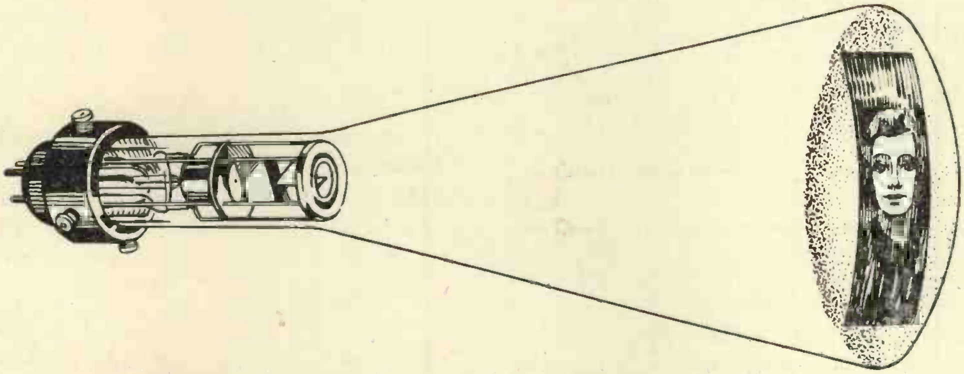


FIG. 1.—A TELEVISION PICTURE ON THE END OF THE CATHODE-RAY TUBE.

The picture is produced by the movement of a beam of electrons across the surface of the chemically coated screen at the end of the tube. The movement of the electrons is controlled by two electrical circuits, and the picture signal from the receiver serves to control the intensity of the beam. The chemical compound glows with a green fluorescence where the electrons strike the screen and this fluorescence renders the picture easily visible in the dark at a distance of 10 feet. The average size of picture is 7 cm. by 4 cm., and it requires no lens to magnify it.

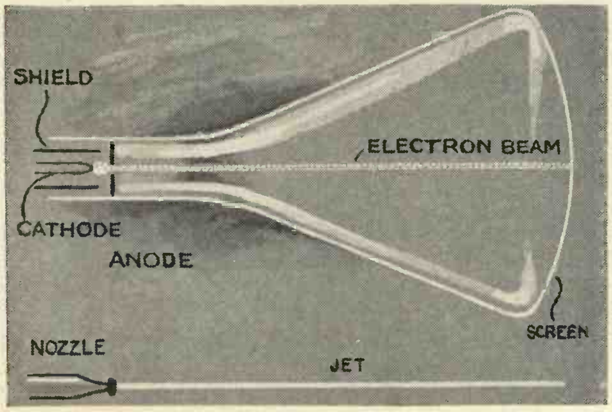


FIG. 2.—HOW THE BEAM OF ELECTRONS IS PRODUCED.

The electrons are produced from a cathode at the back of the tube in a similar manner to the electron stream in an ordinary power valve. The shield and the anode serve to control the stream and direct it up the tube in a narrow jet. The action is very similar to the production of a narrow jet of water from a nozzle, as seen below.

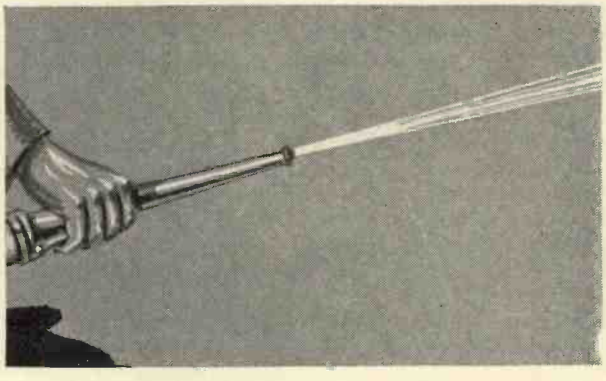


FIG. 3.—HOW THE BEAM IS MOVED.

If, while the jet of water is issuing from the nozzle, the nozzle is moved, the end of the jet can be made to trace a pattern on the wall where it strikes. The same action takes place in the cathode-ray tube, but the movement is caused by a pair of electrodes, called deflector plates, placed in the path of the beam. These plates can be seen in Fig. 1, arranged in two pairs above the anode. One pair moves the beam in a horizontal plane and the other pair in the vertical plane.

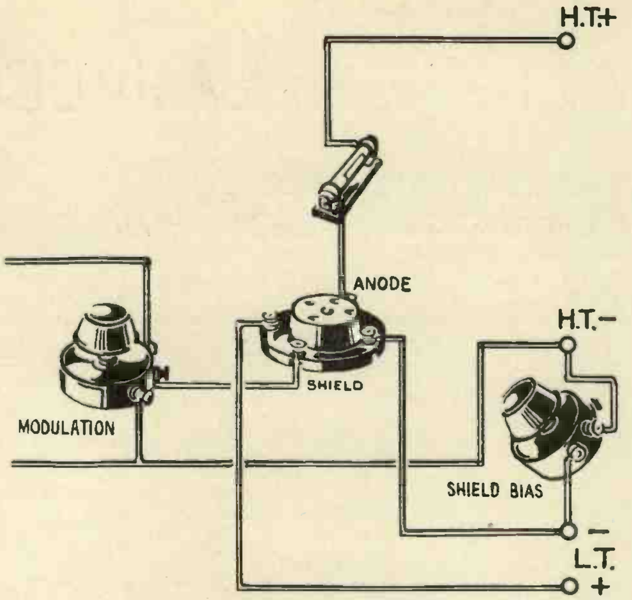


FIG. 4.—THE CIRCUIT FOR PRODUCING THE ELECTRONS.

This is practically the same as the circuit for supplying an ordinary power valve, but the voltage applied to the anode is much higher. The bias applied to the shield of the tube is from a resistance in the H.T. —ve lead (" auto-bias resistance "). The picture signal is applied to the shield of the tube from a potentiometer (marked " modulation ") and alters the intensity of the beam by varying the bias applied to the shield.

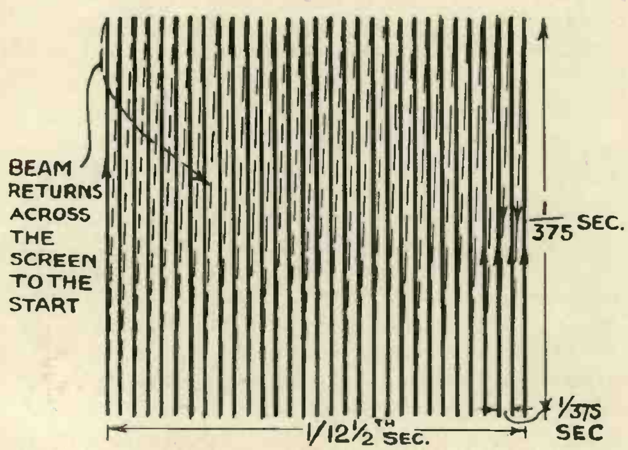


FIG. 6.—THE ACTUAL PATH OF THE BEAM ACROSS THE SCREEN.

Two of the circuits shown in Fig. 5 are required to form a 30-line screen—one to move the beam upwards at the rate of 375 times per second, and the other to move it sideways at the rate of 12½ times per second. Actually the beam describes a zig-zag path, but the return of the vertical movement is so rapid when the condenser discharges that it is not visible to the eye. The screen therefore appears as a series of 30 vertical lines. It is possible to obtain any number of lines in the screen by altering the rate at which the beam moves, and the circuit of Fig. 5 will serve for 180-line transmission with a slight alteration.

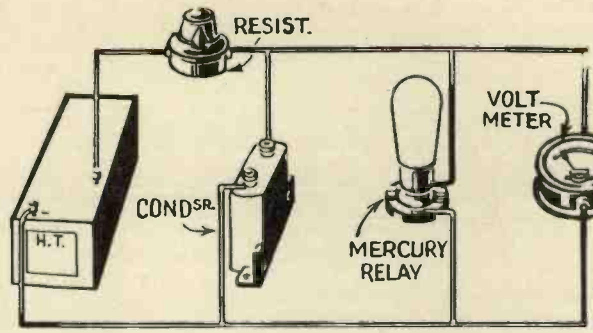


FIG. 5.—THE CIRCUIT FOR MOVING THE BEAM.

This is made up by connecting a resistance and condenser across an H.T. battery. As the condenser charges, the voltage, shown by a meter connected across it, steadily rises. At a certain point the mercury relay discharges the condenser, which then charges all over again. The varying voltage produced by this means is applied to the deflector plates of the tube and causes the beam to move slowly across the screen, returning to its original position when the condenser discharges. The speed of movement of the beam is controlled by the resistance in the circuit.

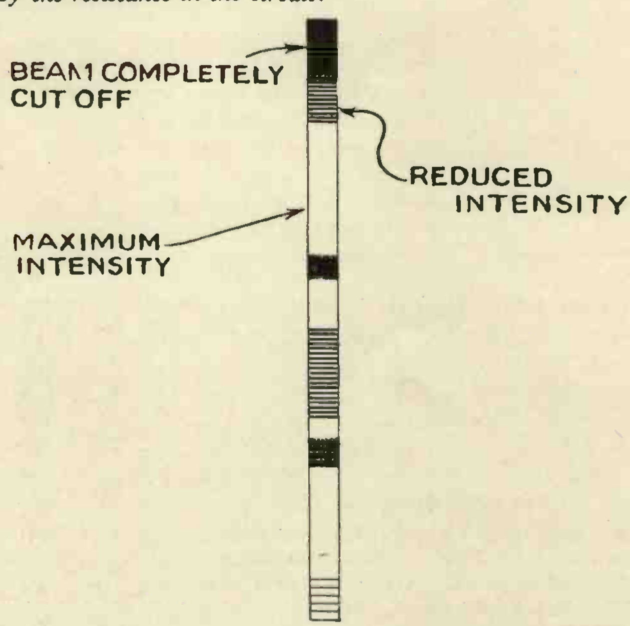


FIG. 7.—WHAT PART OF THE TELEVISION SCREEN LOOKS LIKE.

While the beam is travelling across the screen the signa from the receiver alters the intensity of the fluorescent spot to produce the light and dark shades. The dark part of the line is caused by cutting the beam off completely and in the light portions the bias applied to the shield of the tube is reduced to intensify the beam and brighten the fluorescence.

RECENT DEVELOPMENTS

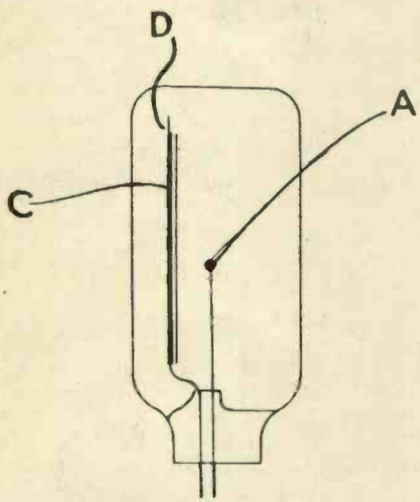
A RECORD OF PATENTS AND PROGRESS
Specially Compiled for this Journal

Cathode-Ray tubes
(Patent No. 411,955.)

The cathode, which is intended to produce a ray of constant strength suitable for the reception of television signals by intensity modulation, consists of a small ring filled with barium oxide and carried at the end of a metal rod. Covering the latter are two sleeves of insulating material which support and protect the heating-wire. The whole assembly is compact and rigid.—(*K. Schlesinger.*)

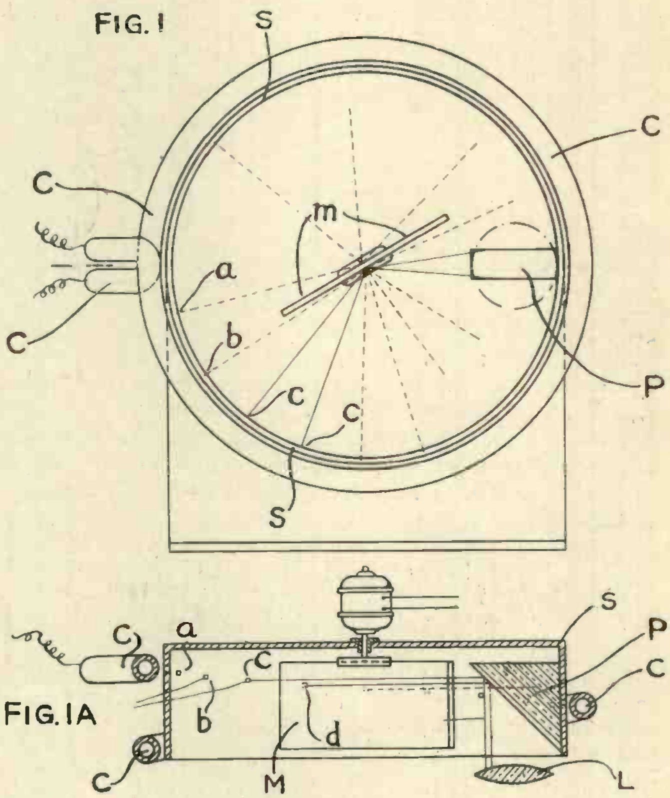
Glow Lamps
(Patent No. 412,024.)

A gas-filled lamp, suitable for receiving television signals, consists of a rod anode A and a cathode C, in



A glow lamp with part of the cathode coated with a substance having a lower extinction potential than the rest of the cathode. Patent No. 412,024.

the shape of a plate, and covered on one side with a layer of enamel or mica. In order to ensure a rapid restart of the main discharge, after extinction, the upper part D of the cathode is formed with a small projection which is coated with barium or cæsium. This has a much lower "extinction" potential than the remainder of the cathode, and therefore serves to maintain a small residual discharge, even when the main glow has disappeared, which "triggers" the lamp as soon as the applied voltage again rises above the striking point.—(*Soc. des Lamps Fotos.*)



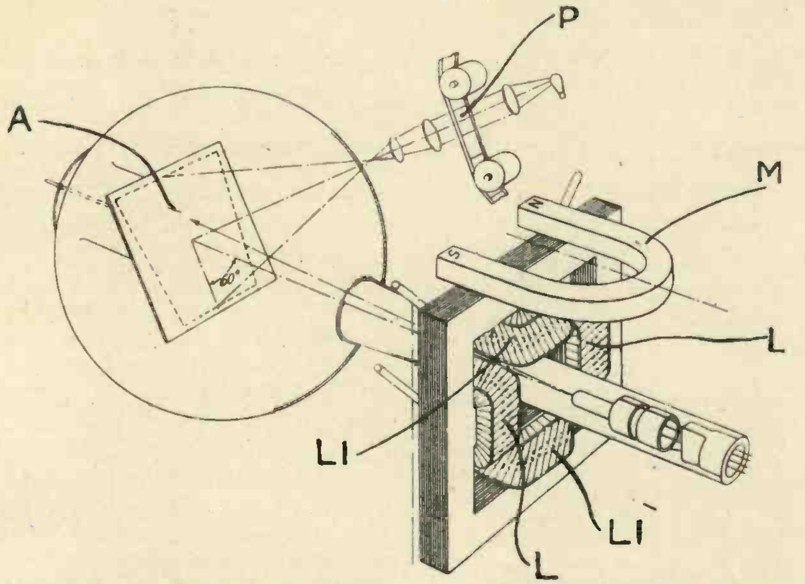
An apparatus for the decomposition and composition of pictures with a fixed decomposition or composition device and a rotating mirror which projects the picture on to this device. Patent No. 412,026.

Mirror Scanners
(Patent No. 412,026.)

A rotating drum S, shown in elevation in Fig. 1 and in plan in Fig. 1A, is driven by a motor D inside the spiral coils C of a long neon tube, which follows the line of scanning-apertures marked a, b, c, etc., and forms the source of light. Inside the drum is a mirror M, which is fixed to the axis of the drum and rotates with it. Light passing through the holes a, b, c, etc., falls on to the mirror M and is reflected by it on to a prism P mounted on the inside wall of the drum. This reflects the rays through a lens L on to the screen.—(*I. M. K. Syndicate, Ltd.*)

The "Iconoscope" Transmitter
(Patent No. 412,092.)

In the "Iconoscope" system of television, the picture to be transmitted is projected on to the special "mosaic-cell" anode A of a cathode-ray tube. Simultaneously the image is scanned by the electron stream inside the tube, and the various light-and-shade values of the picture are thus converted into current impulses by the group of photo-electric cells forming the "mosaic" anode. As shown in the drawing the picture to be transmitted is projected from a film P outside the glass bulb on to the anode A, whilst at the same time the electron stream is sprayed across it by the scanning coils L, L1. It is clear that under these conditions the plane of the anode must be tilted, relatively to the path of the electron stream, in order to allow the picture from the film P to be projected on to its surface. Under ordinary circumstances this would give rise to a distorted image, but a special compensating field is applied to the stream from a magnet M, which has the effect of converting the keystone-shaped scanning area (shown in dotted lines) into a true rectangle as projected on to the plane of the anode. —(*Marconi's Wireless Telegraph Co.*)



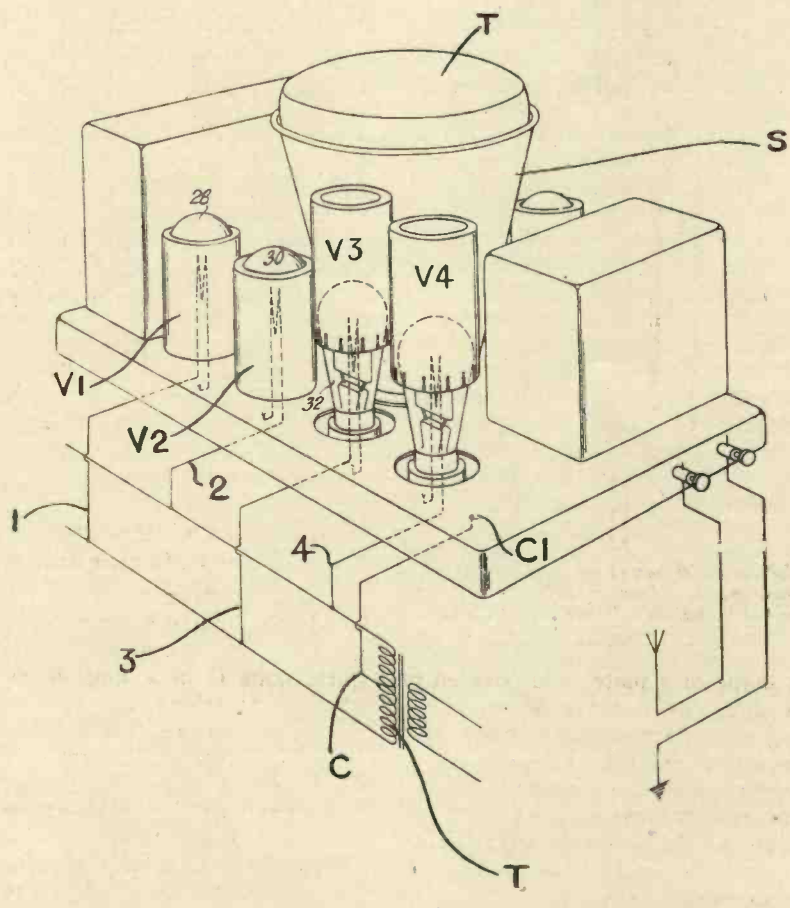
Arrangement of cathode-ray tube with means of eliminating "keystone" distortion. Patent No. 412,092.

Television Transmitters
(Patent No. 412,126.)

A method of automatic volume control is applied to the transmitter so as to keep the percentage modulation constant for films or pictures of varying brightness or high "light-and-shade" contrast. Two special control valves are suitably biased so that impulses above and below the average output from the photo-electric cells are separately rectified. The resulting D.C. voltage is then applied to the grid of a variable-mu valve which is inserted before the main amplifier in order to regulate the "gain" according to the type of film being transmitted.—(*Fernseh A.-G.*)

Receiving Sets
(Patent No. 412,435.)

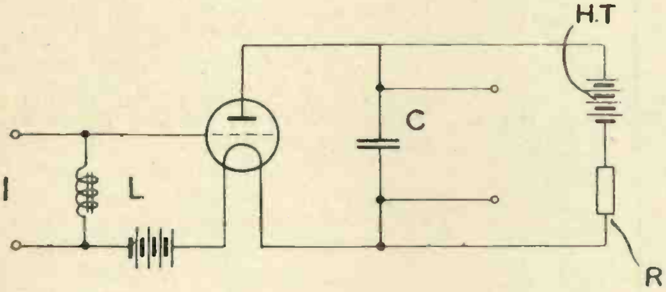
The figure shows a complete television receiver, including a cathode-ray tube T with its conical supporting shield S, and a number of amplifier valves V1, V2, V3, V4, encased in the usual screening cans, all mounted on a metal chassis. It is found in practice that when all the valve heating-filaments are "earthed" on to the chassis (which is génerally done in order to minimise regeneration) there is a tendency for L.F. currents at the frequency of the A.C. mains supply to be induced in the metal chassis. These act to distort the scanning "pattern" on the viewing-screen of the tube, and may also interfere with the sound signals accompanying the picture programme. The invention is designed to overcome both these defects. The A.C. supply transformer T is centre-tapped at C and connected to the chassis at C1. One end of the secondary winding is then connected through leads 1, 3, with the heaters of valves V1, V3, whilst the other end is connected through leads 2, 4, with valves V2, V4. In this way the two groups of amplifiers are energised in phase-opposition and any interferring currents are accordingly balanced out.—(*Marconi's Wireless Telegraph Co., Ltd.*)



A wireless receiver with means for energising the valve filaments in groups with alternating current energy of opposite phase. Patent No. 412,435.

"Saw-toothed" Oscillators
(Patent No. 412,833.)

The figure shows a "spill-over" circuit for generating the saw-toothed oscillations used for scanning in a cathode-ray receiver. The voltage generated must be such as to give a comparatively slow traverse of the cathode-ray in one direction followed by a quick return. The condenser C is charged up from a source of voltage H.T. through a resistance R, and is discharged through a thyratron glow-discharge tube controlled by a frequency applied to the input terminals I. The latter are shunted by an iron-cored choke L, which is saturated for the greater part of each cycle of the input frequency. A sharp impulse is, however, applied to the grid at the moment the current passes through zero. The impulse renders the tube V conductive and so allows the condenser C to be rapidly discharged, thus giving the desired quick-return to the scanning beam. The control frequency applied to the terminals I may be derived from a motor-driven alternator, a tuning-fork vibrator, or a photo-electric cell energised by a beam of light.—(*Telefunken Co.*)



A spillover or relaxation oscillator generator. Patent No. 412,833

Summary of Other Patents

(Patent No. 412,117.)

Light-sensitive cells provided with filters of different actinic transparency.—(*A. Dresler.*)

(Patent No. 412,813.)

Improvements in cathode-ray television receivers of the kind in which the picture to be transmitted is projected upon a photo-sensitive anode and is then scanned by the electron beam.—(*Marconi's Wireless Telegraph Co., Ltd.*)

(Patent No. 412,941.)

Increasing the power and efficiency of television synchronising-devices of the electro-magnetic type.—(*J. L. Baird, J. C. Wilson and Baird Television, Ltd.*)

(Patent No. 413,129.)

System for televising both the picture and sound tracings on a cinema "talkie" film.—(*B. Freund.*)

(Patent No. 413,178.)

Improvements designed to increase the rapidity with which an outdoor scene can be televised from a photographic record of the event.—(*Fernsen Akt.*)

PITFALLS THE INVENTOR MUST AVOID

In television there is at the present time probably more scope for research work and improvement than in any other science. Once a person has developed an invention and is convinced of its practicability and usefulness the rest he may perhaps consider an easy matter. Actually, however, the marketing of an invention is one of the most difficult problems which the inventor has to face, and it is no exaggeration to say that probably eighty per cent. of the work involved in making a success of an invention is in the commercialisation of it.

From an idea to a working model is a big step; but the step from the working model to the marketable commodity is often even bigger; and even when the marketable commodity has been produced there remains the work of bringing it before the notice of the public.

The inventor should realise that in most cases it is impossible for he himself to handle his invention single-handed through all these stages, if success is to be achieved. He must either sell the idea for what it will fetch as a vendable patent, or work on it himself until he has succeeded in developing a saleable article.

Usually an inventor will find that the market value of a mere idea is simply nothing, even if it is patented. A patent, unless backed by some sort of demonstration, or by some sort of working apparatus is one of the most unsaleable commodities in existence; and the very action of offering his device for sale may prove his undoing. The parties to whom the patent is offered may sieze upon the underlying idea, and may themselves utilise it while avoiding the actual claims covered by his patent specification.

The inventor's best plan is to develop his invention to the stage where he can show results; then, if he can, to interest a financial syndicate, first taking care that his own interests are safeguarded by professional advice.

From a commercial point of view the publication of all details is most inadvisable, and the premature publication of any facts which would assist rival concerns should be carefully avoided.

Publicity is unavoidable when patents are published, but it should be borne in mind that any information divulged prior to the lodging of the patent, even further details not given in the patent specication, amounts simply to the giving away of valuable property.

Persistence of Vision

Persistence of vision is all-important for the practice of television, and this property of " the lag of the retina " has long been recognised.

In 1550 Cardanus described the zoetrope, and more recently Plateau's phanakistoscope and Stamfer's stroboscopic disc have been utilised to demonstrate the phenomenon. By means of such apparatus it can be very clearly shown that the impression of one image remains till the next image takes its place.

To-day we exploit the principles of these instruments in the cinematograph and the televisor.

THE CATHODE-RAY TUBE HAS MANY USES

The applications of the Cathode Ray Tube to modern research are innumerable, and in this article G. Parr describes some of the little-known effects which can be observed. Owners of C.R. Tubes will find some suggestions for individual experiments with their own apparatus.

IT is not long before the owner of a cathode-ray tube appreciates that he can apply it to other purposes than receiving television images. The field of application which is available is very wide.

First there is the checking of distortion in the receiver—an easy matter with existing time-base equipment. The vertical deflector plates are disconnected from the time-base, leaving the horizontal traverse connected, and on starting up the tube and time-base unit a horizontal timing axis will be drawn on the screen, ready to record any waveform applied to the vertical plates. If the time-base is set for 12½-cycle horizontal speed it will probably be necessary to speed it up slightly, which can be done by decreasing the capacity of the charging condenser in the time-base.

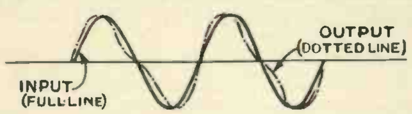


Fig. 1.—Effect of distortion in amplifier, shown by alteration in waveform.

Checking Distortion

For checking audio-frequency distortion a steady note from an oscillator or from a constant-frequency record is applied to the L.F. stages and the vertical deflector plates are connected to each stage in turn, either across the transformer secondary, or across the grid leak. The voltage across these points will not be high, so the sensitivity of the tube should be increased to the utmost by lowering the anode voltage. With 500 volts on the tube the sensitivity should be sufficient to give a well-defined wave-form with a deflecting potential of 15-20 volts.

The leads from the set to the deflector plates may introduce instability if they are long and it is preferable to have them screened. As an example of distortion observable in L.F. amplifiers, the curves of Fig. 1 show the effect of over-bias on the valve. These were drawn by placing a piece of tracing cloth on the screen of the cathode-ray tube and pencilling in the wave-form. It may be found that the wave does not remain steady enough to enable a sketch or tracing to be made, but it can easily be held on the screen by "locking" the time-base to the applied potential in the same way that the time-base is synchronised to the television signal. The diagram of Fig. 2 shows the alterations necessary in the standard double time-base circuit to enable wave-forms to be drawn on the screen.

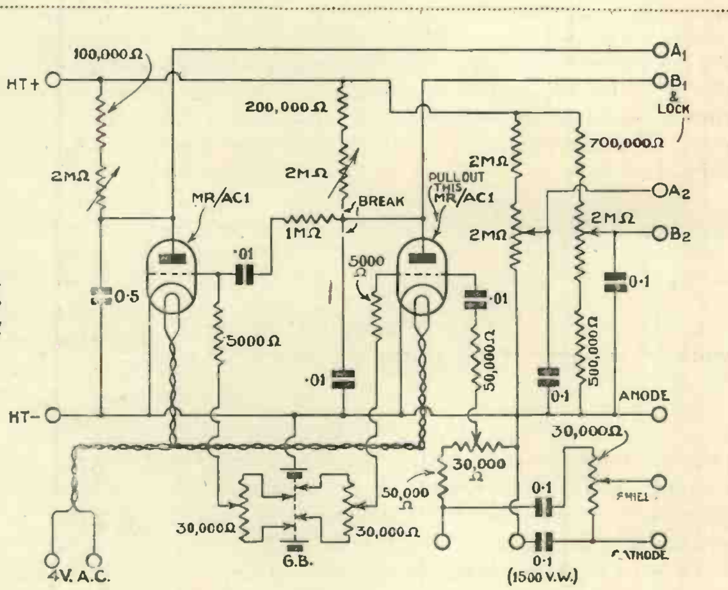


Fig. 2.—Alterations to double time base for recording wave forms.

Photographic Records

The study of wave-form in general is a most fascinating subject. The oscillograph has enabled a detailed study to be made of the characteristics of speech sounds, showing the minute variations introduced into vowel sounds by the influence of dialect. Fig. 3 is the vowel sound "e" recorded photographically on a moving plate by means of a standard tube. Photographic recording requires elaborate auxiliary apparatus if a moving film or plate is used, but successful photographs can be taken of a stationary wave on the screen if a fast plate is used with one or two seconds exposure.

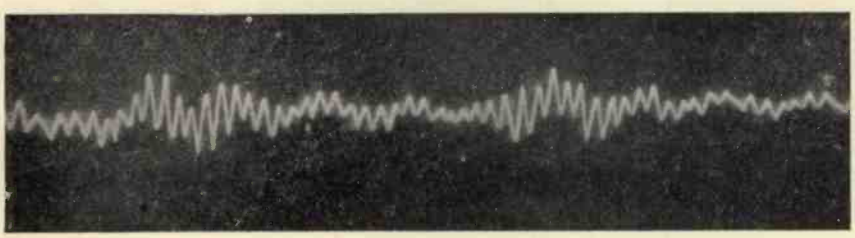


Fig. 3.—Sound record of vowel "e" recorded by microphone and moving film.

An ordinary copying camera can be focused on the end of the tube, or a plain convex lens can be mounted in a holder to focus the wave on to a ground glass plate which is afterwards replaced by the dark slide.

Turning to other applications of the tube, the characteristics of valves can be drawn on the screen under actual working conditions. The circuit of Fig. 4 shows a typical arrangement for obtaining the anode current-grid volts curve with a 50-cycle wave applied to the grid of the valve. The vertical plates of the tube are applied across the load resistance in the anode circuit, while the horizontal plates produce a deflection proportional to the applied grid voltage. Variations in the load resistance and in the bias can be investigated by this circuit.

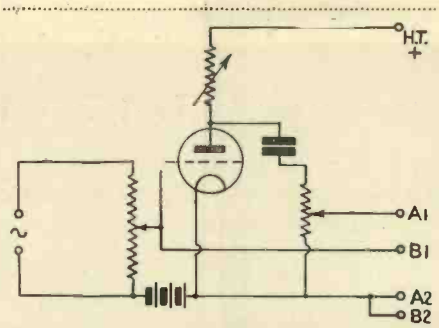


Fig. 4.—Connections for observing valve curves under working conditions.


Fig. 6.—Waves of explosion pressures obtained by the crystal device. These waves are read from right to left.

In mechanical engineering, the tube has been used to determine the conditions under which explosions take place! The force of impact of the explosion is translated into electrical impulses by a piezo-electric crystal mounted in the wall of the explosion chamber, and the resulting potential applied to the cathode-ray tube. Fig. 5 shows a crystal mounted to form a "pressure gauge" and Fig. 6 shows two wave-forms obtained, one from the cylinder of an internal combustion engine and the other from a gas explosion in an enclosed vessel. It is probable that the design of petrol engines will be considerably helped by the accurate picture of what is happening instantaneously in the cylinder, obtained by this means.

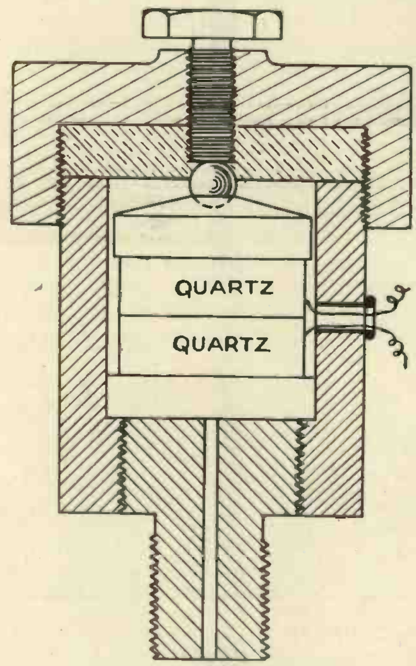


Fig. 5.—Crystal "pressure-gauge" for recording explosion pressures as used by Tokyo Institute.

Without a linear time deflection of the beam, the cathode-ray tube can be made to indicate power absorbed in circuits, and phase differences between two potentials. For this purpose the two pairs of plates are connected across the two potentials to be compared. If they are in phase the beam will move diagonally across the screen in a straight line, but if they differ in frequency or in phase the beam will trace a close loop on the screen of varying complexity.

These closed loops, or "Lissajous" figures, as they are called, can be made to give a variety of pretty patterns in the hands of the experimenter, the only requirements for producing them being a pair of L.F. oscillators capable of variation in frequency independently of each other. Fig. 7 shows some Lissajous figures obtained from an oscillatory valve circuit, and from a pair of oscillators deliberately adjusted to give a distorted wave. The number of loops in the figure is a measure of the ratio of the frequencies of the waves, or in some cases indicates the harmonics present.

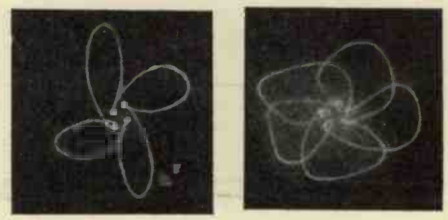


Fig. 7.—Two pretty patterns obtained by oscillatory circuits connected to the deflector plates.

We have received from the Dubilier Condenser Co., Ltd., a copy of their latest list of condensers and resistances. A large amount of data concerning these components is presented and the information will be of particular interest to all users. The facts are set out in a concise manner enabling quick reference to be obtained. Copies of the booklet will be sent free on request and mention of this journal.

Television for the Amateur Constructor, by H. J. Barton-Chapple, Wh. Sch., B.Sc. First revised edition (Sir Isaac Pitman & Sons, Ltd.).

The first edition of this book was devoted principally to the construction of the disc visor and the associated wireless apparatus and although it was published only a little more than eighteen months ago progress for the amateur constructor has been so rapid that it did not meet present-day needs. The second edition has been completely revised and includes general information regarding disc and mirror-drum systems and also an explanation of cathode-ray methods. Practical instructions are given for the construction of mirror-drum and disc machines and details of suitable receivers and amplifiers. The amateur constructor will find in this book a wealth of information of particular value to him. The price is 12s. 6d.

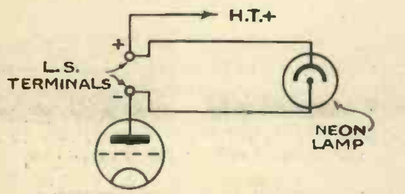
The Television Society.

The first meeting of the 1934-35 session will be held on October 10, at 7 p.m., at University College, Gower Street, W.C.2, when a paper will be read by Mr. E. H. Traub, entitled: "Television at the 1934 Berlin Radio Exhibition," illustrated by lantern slides. Readers of TELEVISION are cordially invited. Tickets on application to J. J. Denton, hon. sec., Television Society, 25 Lisburne Road, N.W.3.

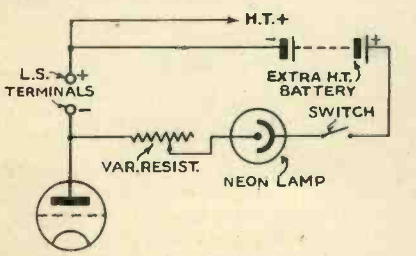
LIGHTING THE NEON

A COMPREHENSIVE SERIES OF CIRCUITS

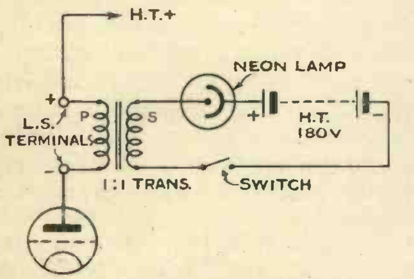
As large numbers of requests are constantly being received for circuits showing methods of connecting the neon lamp to the wireless set, we have thought it desirable to give a comprehensive series which will cover practically every type of receiver.



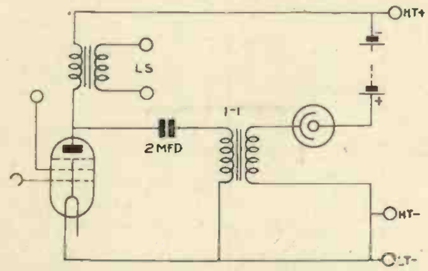
If you want to modulate your neon, this is the simplest circuit that will give good results. You want a high anode voltage, otherwise the circuit is straightforward.



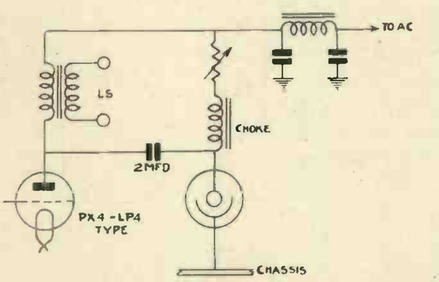
Better definition is obtained if the voltage applied to to the neon is varied by means of a resistance. The additional battery in this case should be large enough to cause the neon lamp to strike with the resistance only half in circuit.



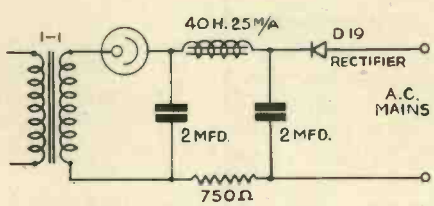
If you have two receivers and can spare one for television, this circuit can be recommended. Simply take off the loudspeaker and connect the neon lamp as indicated. The transformer primary connections should be reversed if the pictures are reversed.



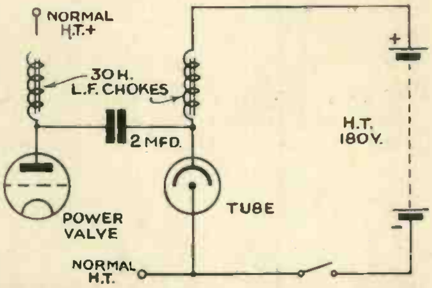
If you are troubled with reverse pictures, this circuit is worth considering. The images can be reversed by altering the transformer connections. The extra battery should be about 100 volts.



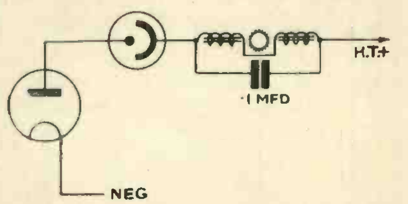
This is a circuit that can be used with the mains receiver. If the applied voltage is too high, the definition will suffer. This can be overcome by the use of the variable resistance.



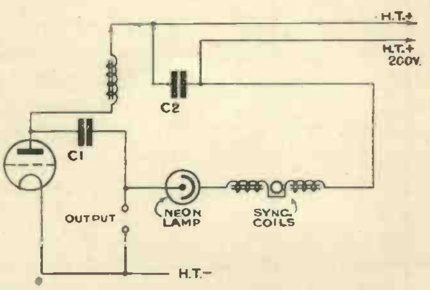
It is an expensive hobby running a neon lamp from dry batteries, so if you have mains laid on use a metal rectifier of the half-type wave. Don't forget the small resistance in series with one side of the supply.



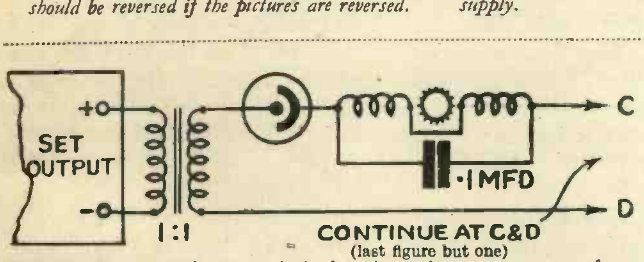
If you use a commercial receiver where the connections are difficult to get at, this is the circuit to use. The output from the power valve is fed to the neon lamp through a large fixed condenser. An extra battery is required to bring the voltage up to over 180 volts.



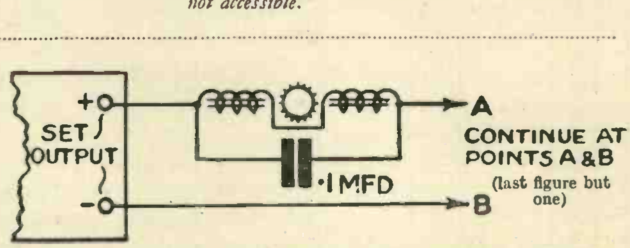
A simple circuit that will keep your pictures steady. The synchronising gear is quite standard and consists of two synchronising coils and a phonic wheel.



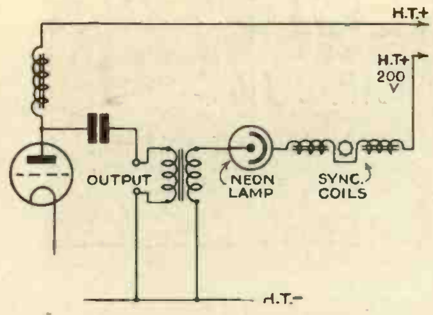
This is a simple circuit which makes use of a pair of synchronising coils. It is better for use with commercial sets when the internal connections are not accessible.



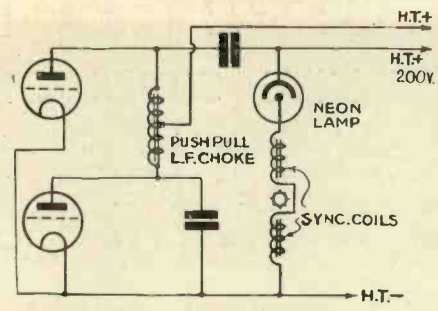
With this circuit simply remove the loudspeaker and connect a 1:1 transformer across the output terminals. In this way the circuit is suitable for home built or commerical receivers.



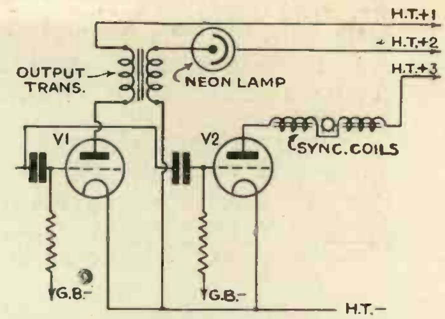
This simple synchronising circuit should be used in connection with the last figure but one and connected as indicated. It is again a simple arrangement that will keep your pictures steady.



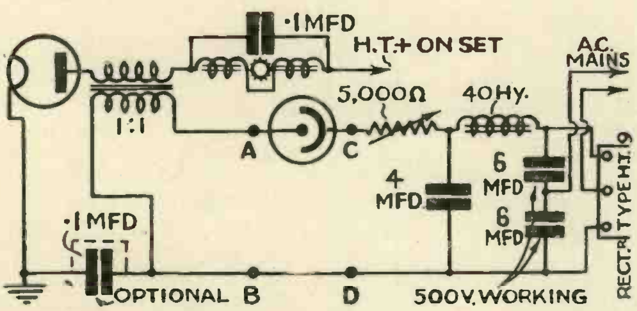
If you have over 200 volts available and can get at the anode circuit of the power valve, the neon can be modulated through a 1 : 1 transformer. The neon lamp is in series with the synchronising coils and the high-tension.



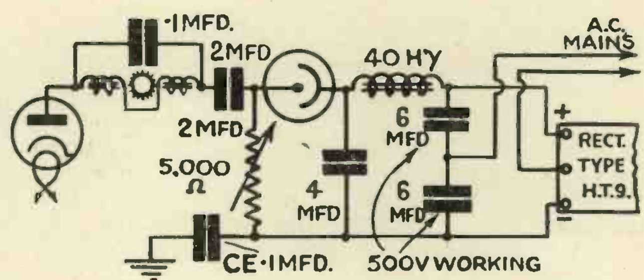
If you have push-pull output a tapped low-frequency choke can be used instead of a transformer. Notice how the synchronising coils are connected in series with the neon lamp and the H.T. side of the high-tension battery.



To obtain the maximum efficiency from synchronising coils you should make use of a special synchronising valve. With this circuit pictures can be held steady for quite long periods and will greatly increase the entertainment value of the television gear.



Over 300 volts can be obtained from this power pack so the output is enough to feed both the neon and the output valve. The usual variable resistance is included to improve the definition from the neon lamp.



This is a simple arrangement in that there is no transformer and the potentiometer is across the supply instead of in series with the neon lamp. With the synchronising coils in series with the anode of the output valve the pictures are kept very steady.

PHOTO-VOLTAIC CELLS

The photo-voltaic effect, also known as the Becquerel effect, consists in the production of an electromotive force when the light sensitive element is illuminated.

Until recently, the Becquerel effect was observed mainly with the electrolytic type of cell, that is, an electrolyte consisting of certain chemicals in solution in which was placed two electrodes. Upon exposing one or other of the electrodes or the electrolyte to an illumination an electromotive force was created between the electrodes which could be measured by a sensitive meter.

A simple cell can be made up by immersing two copper electrodes coated with cuprous oxide, in an electrolyte of almost any nature. The electromotive force created between the two electrodes and the electrolyte will be equal and opposite and therefore no P.D. will be produced. However, if one of the electrodes is illuminated, an extra voltage is created, which may be measured.

A further effect was observed by W. W. Coblentz in 1927 that crystals of molybdenite gave rise to a potential difference upon illumination.

Recent experiments carried out on the Becquerel effect have evolved the photo-electric property of metal to metal oxide films. This is principally attributed to B. Lange.

Two great advantages are obtained with these new types of photo-electric cells. Firstly, atmospheric conditions are in no way detrimental to the efficiency of operation—thus the need for evacuation and protective glass bulbs is no longer present. Secondly, there is no electrolyte to decompose with a consequent reduction in sensitivity. Also no polarising voltage is required and finally the output is sufficient to operate a reasonably sensitive galvanometer.

The manufacture of these oxide cells is interesting. A pure copper strip is heated electrically for 20 hours or more in an atmosphere of oxygen; this results in the copper strip being coated with cuprous oxide and a surface layer of cupric oxide. The cupric oxide is then dissolved off in aqua-regia, leaving the thin layer of cuprous oxide.

The strip is then cut up into smaller pieces and the oxide surface coated by cathodic sputtering with a monatomic layer of gold.

The finished cell is therefore a metal base as one electrode, a layer of cuprous oxide and then a transparent layer of gold as the other electrode. If a connection is made to these two electrodes from a galvanometer and the gold surface illuminated, a measurable current will flow.

The colour sensitivity of these copper-oxide cells ranges from 600 to 1,300 millimicrons, therefore making them extremely suitable for the measurement and deduction of red and infra-red radiation.

REVIEWS OF THE PROGRAMMES AND RECEPTION REPORTS

LOOKERS will gain in two ways from the changes which occur in the second week in October. Programmes will be extended from half-an-hour to forty-five minutes and the day-time transmissions will be given on Saturday afternoons, when experimenters who are at work during the week are free to attend to their visors.

Tuesday and Friday transmissions are to stop and from the second week in October, programmes will be broadcast on Wednesday evenings from eleven to eleven-forty-five and on Saturday afternoons from four-thirty to five-fifteen. London National will continue to broadcast "vision," and it is now certain that this station will be kept in service for several months at least. As at present, "sound" will be received from Midland Regional, which will remove from Daventry to Droitwich some time during the winter. The power of Midland Regional will be raised from 25 to 50 kilowatts when the service is transferred; but, as a lower medium wavelength is likely to be used after this change, lookers in London, which is further away from the new station, may get a weaker signal in their "sound" receivers.

B.B.C. Policy

No change in B.B.C. policy to television is implied in the extension of thirty-line programmes. Transmissions timed for eleven o'clock at night have been liable to start late, owing to over-running by the main evening aural programmes. It is impossible to guarantee that transmitters will always be ready for television at eleven sharp, especially when the previous programme is coming from an opera house or other place outside the studios.

If any transmission makes a late start in future, it will not be necessary to cut the programme to bits, as the producer will have an extra quarter of an hour in his schedule.

* * *

Gloria, the blonde mannequin, was standing close to the lens in the flickering shaft of light. " I feel as though I had just had an anæsthetic," she cried to Dawn, who was waiting with the other girls in the shadows while the picture was being focused. Four of London's famous mannequins had come to the studio to show the season's latest modes. The staircase was placed across the studio in the distant position and the beam picked out each model as she descended the steps. On reaching the floor, the mannequins turned and walked slowly towards the lens. In this way the dresses were seen from every angle. Gowns, coats and hats had all been chosen with an eye to their effect when seen by television. Colours were always contrasted, and in a display of coats, Dawn wore black velvet and pink feathers, Gwen a white garment with a black collar, while Irene showed ermine and silver fox, and Gloria a bob-tail coat. Much envy must have been caused among feminine lookers and I am glad that another engagement kept my wife from our visor that morning.

* * *

We have already seen the Eight Step Sisters and the Jackson Girls, and now Rosalind Wade and her Radiolympia Girls are appearing in the programmes. This troupe has the advantage in Rosalind Wade of a leader who is a remarkable solo dancer. She takes part in a programme which is reminiscent of the show staged at Olympia, where Tessa Deane, Bertha Willmott and John Rorke also appeared. They are singing the popular songs of other days which have made the " Old Music Halls " successful on the air and, judging by a rehearsal, this production should be well worth watching. Seeing the artists in costume greatly enhances this type of programme. It is impossible to focus eight dancers at once, but by swinging the scanner from side to side, an impression is transmitted which would be impossible if fewer dancers were around.

* * *

Even a holiday could not keep the producer away from television. Attracted by early reports of demonstrations at the German Radio Exhibition, Eustace Robb packed a grip and flew to Berlin, where he was soon among the television experts. After visiting the exhibition and the broadcasting headquarters, he took another aeroplane for Nuremburg to watch

Gavin Gordon as an officer in the early 19th century singing arias from La Dame Blanche.

Hitler's Saar demonstration, but not before he had made contact with representatives of the many firms developing systems of television in that country.

Several other Englishmen interested in television have recently returned from Berlin, and from their accounts there is no doubt that the German Government is offering every encouragement to television research. On all suitable occasions Chancellor Hitler has used broadcasting to further his cause. The microphone is present at all his demonstrations, and loudspeakers at home, in public halls, cafés and hotels enable the nation to take part in his triumphs, but mass participation would obviously be more effective if the impressive spectacle which always accompanies the oracle could be relayed with the sound. While the sale of visors for use in a million homes is probably the main objective of manufacturers in Britain, the display of pictures on huge screens in public places may be the first requirement in Germany. Television may therefore develop on different lines in the two countries.

A system of distribution which would be far too costly for home use might be practicable for mass looking, and a report from Berlin states that German engineers are experimenting with a special insulated high-frequency cable capable of transmitting television signals long distances without distortion. Such a cable could be laid underground, but the cost might exceed five hundred pounds per mile!

* * *

For three weeks, while Eustace Robb has been abroad, programmes have been directed by Jean Bartlett, the assistant producer, and although no ambitious production has been attempted, programmes have sustained the usual high standard of variety and finish. Eby Namash, the young Hungarian singer, was seen again after a long absence from the studio. From experience in cabaret she has acquired an intimate style which suits the medium, and an expressive face and jet black hair help her to make an excellent picture. Dudley Rolph, a juvenile lead in several recent broadcast productions, and Freddie Carpenter and Reita Nugent made up a lively bill which was supported by Sydney Jerome's Quinet. I like to hear a band; a piano becomes monotonous however well it is played.

Gavin Gordon as Basilio in the Barber of Seville.

* * *

D. R. Campbell, senior engineer in the team which operates the television equipment at 16 Portland Place, had some rough luck last month when a fire at his home in North London destroyed his experimental apparatus. The loss of gear assembled over a period of years is a severe setback to a keen experimenter and every looker with a workshop of his own will know what a disaster such an occurrence must be to a man who has spent years in television research. D. R. Campbell was formerly with the Baird Company and he joined the staff at Broadcasting House when the B.B.C. started a television service more than two years ago. Since the transfer to 16 Portland Place, he has been responsible for maintaining the "works" in the new studio and ignorant and inquisitive visitors have reason to be grateful for his patient explanation of points which must often be obvious to the initiated. I hope that he will not be discouraged by the destruction of his equipment at home and fully expect to hear that has has started again on returning from holiday.

For the Diary

Friday, September 28, in the morning: Lydia Kyasht, famous Russian dancer, making her first appearance in the television studio; Katherine Arkandy, soprano; and Gavin Gordon, bass.

Tuesday, October 2, at night: See, as well as hear, for the first time, Greta Keller, radio star of two continents, with Victor Leopold, a tap dancer, in the same programme.

Spectator

The Postmaster-General's Committee

Readers will be interested to know that summaries of the questionnaire put out by this journal, the opinions of well-known authorities and all the correspondence relating to television broadcasts received since January of the present year have been submitted to the Postmaster-General's Committee for its consideration.

We venture to say that the information thus provided will be of particular value in indicating public opinion. As readers who have followed the matter in recent issues will be aware, a very strong case is made out for the continuance of, and increased facilities for, low and medium definition television.

No official information has been given regarding the Committee's deliberations but it is understood that all the demonstrations which the Committee proposed to see have now been witnessed and that most of the evidence has been obtained. It would appear, therefore, that the work which now remains to be done is consideration of the information already obtained. How long this will take can only be a matter of pure speculation but there is a general hope that the Committee's findings will be available about November.

A private Teleprinter Service has now been installed between the London office and the Chippenham works of the Westinghouse Brake & Saxby Signal Co., Ltd. The installation at each end includes, of course, a Westinghouse metal rectifier, which is a standard part of A.C. teleprinter equipment.

HOW FAR HAS GERMANY PROGRESSED?

This article by Ernest H. Traub is a most complete analysis of television progress in Germany as revealed at the Berlin Radio Exhibition.

AS in previous years a special section of the Berlin Radio Exhibition was devoted to television.

This television section has now become so important that a whole hall is devoted to these exhibits. Many remarkable television inventions have been shown here for the first time in the past, and this year's exhibition was not lacking in remarkable improvements in the pictures themselves though perhaps less progress has been made on entirely new lines.

Televising the opening of the German Radio Exhibition.

The television exhibits are under the auspices of the German Post Office which as is well known has its own television research laboratory. In addition to the Post Office the following firms exhibited: Telefunken, Fernseh Loewe, Tekade of Nurnberg, Manfred Von Ardenne, and the German Broadcasting Company.

Taking the stands of the various exhibitors in turn, we shall start with the Post Office exhibit. On this stand three big cathode-ray receivers were shown. Two of these were showing pictures from the Post Office's own cinema transmitter, and the third was working from the Berlin 7-metre transmitter on 180-lines at 25 pictures per second. The size of the picture was about 8 in. by 10 in. and the colour almost sepia. The tubes were remarkably big, and too heavy to support in a standard socket; they were suspended in cradles. These receivers were, however, purely demonstration types and made no pretence to being home receivers.

Telefunken gave a splendid exhibit; two receivers were shown, one giving a very small picture and a bigger one giving an image about 8 in. by 10 in. As regards detail, colour and contrast, these pictures were probably the best in the show this year. The colour was absolutely black and white, and it is believed that this is the first time that this has been achieved in a cathode-ray receiver. The general pictorial impression was extraordinarily realistic, due to the very carefully chosen films that were transmitted, mostly topical and outdoor scenes, white clothed figures and white horses, etc., being shown, the only difficulty with the image as such was very intense flicker so that it was rather tiring to watch it for any great length of time. The receivers (there were three) were mounted in special booths or in a complete cabinet. The complete cabinet contains a cathode-ray tube showing a picture about 5 in. by 6 in., a superhet receiver for vision, and a three valve reflex circuit for the reception of sound. The vision superhet consisted of 1 H.F. stage, a combined detector and oscillator followed by four I.F. stages, the total number of valves in that particular circuit being seven. Altogether, including time bases, 13 valves are used, not including rectifiers.

It will therefore be seen that these receivers are hardly yet commercial and Telefunken in their Press statement admitted that they were as yet too expensive to put on the market on a big scale.

Tekade ultra-short wave chassis using a five valve circuit, octode 3 I.F. triodes and double diode triode detector.

The Tekade 180-line transmitter and amplifier.

The transmitter used was interesting as a special type of projector was incorporated which gives much greater accuracy in running than the ordinary cinema projector. H.F. carrier frequency amplifiers were used and the actual carrier frequency could be seen in the picture. Thus the picture was really and truly composed of dots along each line.

[Photo courtesy Telefunken

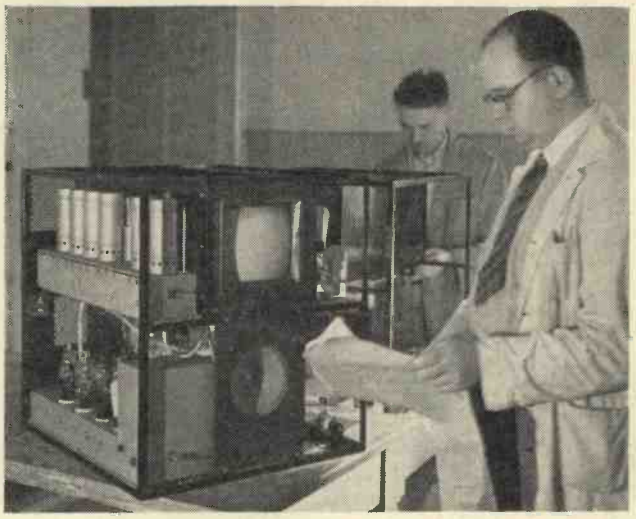
The Telefunken 180-line cathode-ray receiver.

Telefunken again showed Professor Karolus's big screen projection system. This is a four channel system, each channel conveying 24 lines, thus giving a 96-line picture. Substantially the same apparatus was shown last year when films were transmitted. This year, however, living subjects were transmitted by means of a floodlight transmitter. Three powerful lamps were used to illuminate the subject the heat being rather unpleasant. The receiver used a four-electrode Kerr-cell in conjunction with a mirror drum. The brightness was 20 lux and the detail when viewed at sufficient distance was very good. The image size was one metre square.

A ten thousand element lamp screen was to have been shown but was not ready in time. Each line has its own transmission channel there being 100 channels. Each channel has a nine valve amplifier so that a total of 900 valves is used in the system. The image size is two metres square. This will no doubt be seen in improved form next year.

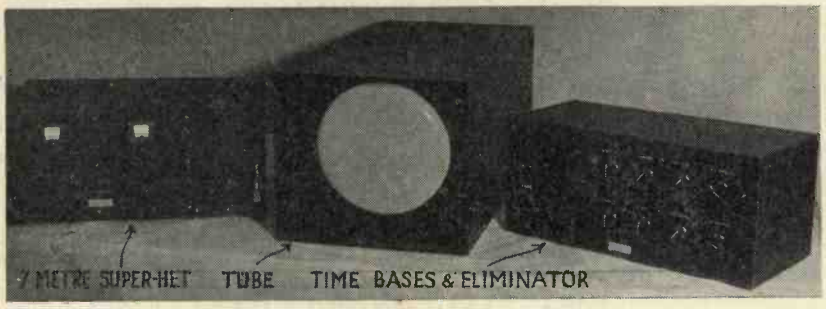
Fernseh A.-G.

This firm showed several items of extreme interest. Firstly, a 180-line spot light transmitter was shown working, the image being seen on a cathode-ray receiver near by. The transmitter, which is a magnificent piece of work, consists of a specially developed type of arc lamp which has twice the brightness of the most powerful arcs now in existence. The current consumption is 150 amps. A 4-spiral scanning disc running at 6,000 r.p.m. in vacuo; a vacuum pump is a permanent part of the transmitter. The disc and motor are totally enclosed to insure silent and vibrationless running. A shutter disc, driven by a separate motor, is used to cover up the three spirals that are not being used at any one moment. The diameter of the disc is 3 ft. The subject was situated in a totally enclosed booth the walls of which were painted zinc white. The use of this allows three times more light to be reflected on to the photo cells. Special giant cells of very high sensitivity were used. This transmitter was specially built to the order of the German Broadcasting Co. who will install this for experimental television transmissions on 180-lines. The detail was very pleasing.



The chassis of the Telefunken cathode-ray receiver.

On another stand this company demonstrated their giant cathode-ray tube. This is far and away the biggest tube that has yet been shown anywhere. The screen diameter is about 16 in. and the picture size was 10 in. by 12 in. The images were excellent especially as regards detail. The colour was greyish sepia. The tube, however, was over 3 ft. in length and protruded through a hole in the wall into an adjoining room. This receiver was fed from a film transmitter behind the stand. This transmitter, which was illustrated last month, is also a wonderful engineering job. It was also made specially for the German Broadcasting Co. Special devices are incorporated to enable announcements to be faded into the programmes whilst films are being changed, etc.



The Ardenne cathode-ray receiving equipment.

The intermediate film projection receiver was again demonstrated, this year, however, using 180 lines. The results, although improved since last year, are still far from satisfactory as regards detail and modulation. Although this method seems the ideal one to overcome the optical difficulties associated with big screen projection, the difficulties in other directions are very great and it will probably take some considerable time before this system is perfected.

Tekade

Ninety-, 120- and 180-line mirror screws were demonstrated on this stand. The first two were shown from the firm's own transmitter and were working in conjunction with a Kerr cell. The images were remark-

The Telefunken cathode-ray cabinet receiver for the home.

ably good as regards detail and colour and compared very favourably with the higher definition cathode-ray tubes. The 180-line screws with neon lamps as light source were occasionally demonstrated on radio reception from the Berlin transmitter. Although some difficulty was experi-

The Tekade small cathode-ray receiver.

enced in picking up the signal in the hall the images were at times very good.

A departure was this year made from the ordinary type of mirror screw, the present screws being known as spherical mirror screws. The laminations are not polished plain surfaces but concave mirror surfaces. This form of construction has the advantage that the distance from the lamp to the screw and the viewing distance are reduced.

Another interesting feature on this stand was a kit of parts for an ultra-short wave superhet specially designed for 180-line television reception between 6 and 8 metres. This kit is actually for sale at the price of R.M.150 with valves. The circuit consists of an octode frequency changer followed by three triodes as I.F. amplifiers and a double diode as second detector. Band pass filters are incorporated adjusted to 500 kc. band-width. This receiver will no doubt be available to English amateurs in due course.

Loewe

In order to show that this firm had reached the manufacturing stage they demonstrated four receivers side by side, all showing the same picture. The receivers were fully described in TELEVISION last month and therefore do not need any further technical description. The results were very pleasing and ultra-short-wave reception was also occasionally demonstrated. The receiver is fairly easy to handle and it was the only one shown at Berlin which approached a commercial proposition. The sale price to the public has now definitely been fixed at R.M. 700 complete, but it is not yet on sale. The credit must go to Loewe for having won this stage of the television race. The mirror screw was not shown in commercial receiver form and the other cathode-ray pictures, although some were a little better and bigger in size, were definitely uncommercial. It thus seems as if those receivers demonstrated by Telefunken and Fernseh represent something better than will be available to the public. This is definitely bad policy and misleading. The only criticism that I dare make with a Loewe receiver is the rather small size of picture, but it *is* a commercial proposition as regards detail, simplicity and price and that is, after all, what counts for the moment until such time when a better projection receiver is available.

Many competitors, especially those from abroad, were hovering round the Loewe stand in search of technical details.

Von Ardenne

Manfred von Ardenne showed his new high-vacuum cathode-ray tube, the images being picked up by radio from the Berlin transmitter. Although this form of tube undoubtedly represents a big advance on his older tubes it did not come up to the standards of the commercial tubes. The colour was reddish and the well-known handkerchief effect was noticeable. The detail, however, was good. The radio receivers and time bases were shown on the stand and could be inspected. In fairness it should be said that Ardenne relied on the Berlin transmitter as his only means of demonstration and this let him down rather badly as there was not sufficient time to adjust the transmitter for optimum performance.

The tube shown is on sale at the price of R.M.310 and it is capable of giving a picture 18 by 24 cms.

German Broadcasting Co.

An intermediate film transmitter

[Photo courtesy Telefunken.

Dr. Schröter, research manager of the Telefunken Co.

mounted in a van was demonstrated in the grounds of the Exhibition. The complete equipment was made by the Fernseh A.-G. It consists of a special cine camera mounted on the roof of the van. Inside the van are the various developing and washing tanks, a film transmitter and amplifiers. A check receiver is also incorporated as well as the necessary cables and water supply arrangements. The van was demonstrated daily; the public was photographed by the camera and one then had an opportunity of going into a tent where a receiver was installed (Loewe) and one could see oneself on the television screen walking around the grounds. This is, of course, a very amusing experience and the public liked it very much. The reproduction on the receiver was extremely good and lifelike and one could recognise oneself and one's friends infallibly. This van is intended to be used for outside broadcasts of sporting events and political meetings. The connecting link between the van and the main studios will be a special high-frequency cable.

Conclusions

The general impression is one of feverish activity to attain the desired results; it appears that no expense is being spared and no stone left unturned. Great technical progress has been made on the transmitting side and a great deal of research on ultra-short waves has been done. It seems that at the moment the weakest link in the chain is the receiver. There is still the need for a simple system that will give a big high-definition picture at a low price. This is definitely lacking. The firms concerned are aware of this and we shall no doubt see very interesting developments along those lines next year.

THE LENS IN PICTURE PROJECTION

A very instructive experiment for demonstrating the action of a lens in picture projection can be carried out as follows: Take a double convex lens of as great a diameter as possible and arrange it in a darkened room to project an image of a small electric lamp (of the flash-lamp type) or other light source on to a screen. Arrange that the size of the image is approximately equal to that of the object.

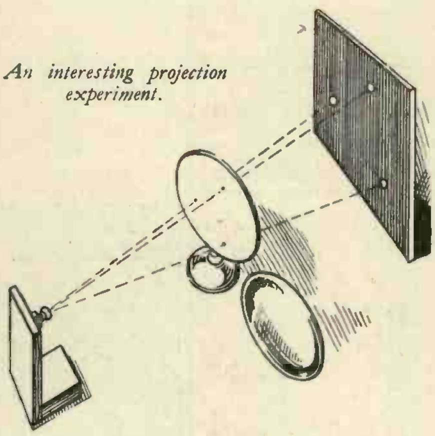
Now remove the lens and in its place put a stretched sheet of tinfoil, and with a stout pin prick a hole in the foil. An inverted image of the lamp will appear on the screen. Prick a second hole, when a similar image to the first, but on a different part of the screen, will make its appearance. Prick a dozen or more holes and with each an image will be produced, each, of course, in the continuation of the straight line joining the object and the aperture producing it. Note that if two apertures are made fairly close together the corresponding images on the screen more or less overlap one another.

Next, without disturbing the perforated tinfoil, slide the lens slowly back into its original position.

As this is done and the rays passing through the various apertures are picked up by the lens, one by one, the corresponding images on the screen will fall together in the most striking way, until, finally, when the lens comes to its final postion covering all the apertures, only one central image will be found on the screen.

Proceed now to prick more holes until the whole of the tinfoil in front of the lens has been removed. Nothing further happens except that the single image becomes brighter and brighter.

An interesting projection experiment.



This experiment shows us then, that one of the primary functions of a lens is to allow of the use of a large aperture with its great light-collecting properties for image producing purposes.

The Reflecting Power of Polished Surfaces

Loss of light always takes place with reflection. A highly polished surface will reflect three-quarters of the incident light; regular reflection only occurs when the reflecting surface is smoothed to within one-eighth of the wavelength of the incident beam.

Reflecting power varies with different materials and depends on the angle at which the light is reflected. A matt surface of lamp-black will easily reflect light at a grazing angle of reflection. Bright sodium has the highest reflecting power known, the calculated figure being as high as 99.7 per cent.

Selective reflection occurs from different materials—thus gold reflects red light more strongly than green light, and according to the wavelength of the received light the reflecting power will vary. Silver reflects, when highly polished, 95 per sent. at one wavelength, and as little as only 4.2 per cent. at a shorter wavelength of incident light.

Below are shown the percentage reflecting powers of different materials.

Wave-length of light.	540 $\mu\mu$	600 $\mu\mu$	700 $\mu\mu$
Silver	90.5	92.6	94.6
Nickel	59	65	69
Copper	37	72	83
Dold	33	84	92
Silver glass mirror ..	79–85	81–88	84–89
Mercury glass mirror ..	73	70	73

Television in Australia

Dr. McDowall (4 CM), Observatory Tower, Brisbane, has been granted permission by the Federal Government to broadcast television programmes, and has been allotted a special wavelength of 136 metres. Dr. McDowall states that his experimental work has reached a practical stage and that pleasing results have been obtained. So far, his television programmes have consisted of old silent films, which, with synchronised music, were being successfully received.

WE NEED MEDIUM-DEFINITION TRANSMISSIONS

If we neglect the possibilities of medium-definition television, says **J. H. Reyner,** *we shall be doing the art a great disservice.*

DURING my recent visit to the German Radio Exhibition in Berlin I was particularly impressed by the exhibit of the Te-ka-de people. In a hall devoted almost entirely to 180-line cathode-ray equipment, the 90-line mirror-screw receiver shown by this firm provided much food for thought.

The picture was brilliant and clearly visible twenty feet away, while the definition was so good that at first I mistook it for another form of the 180-line reception. The standard of definition throughout the television hall was remarkably good—about equivalent to that of a home cinema—and this 90-line picture was not far behind.

I found on inquiry that this firm—the only one showing a mechanical system, apart from the very elaborate continuous film system of the Fernseh A.-G.—were hoping to convince the German Post Office of the need for a medium-definition system, *in addition* to the high-definition transmissions, their proposal being to radiate such programmes on 200 metres.

This argument seems to me to be very sound. Certainly the demonstrations given in Berlin were convincing. Personally I found the mirror screw a little troublesome, for, as is well known, it is necessary to be directly in front of the screw or the image will appear out of frame, but this criticism only applies to the particular system of reception, and not to the form of transmission.

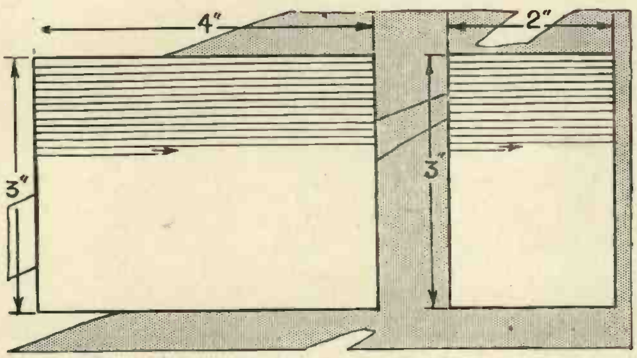


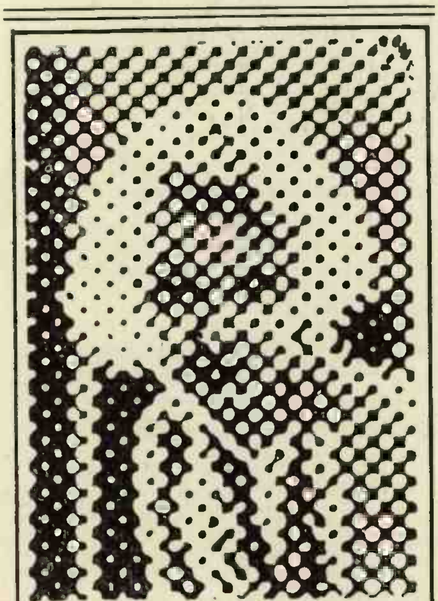
Fig. 1. *A* 180-*line picture with a* 4-*to*-3 *ratio contains* 43,600 *picture elements. Half the normal picture with* 2-*to*-3 *ratio and* 90 *lines contains* 5,450 *elements.*

Consider briefly the limitations of the high-definition system. The enormous frequency band required necessitates the use of ultra-short waves for the transmission. Ordinary short waves cannot be used because of the fading which is experienced, so that recourse is had to wavelengths below ten metres.

Limitations of Ultra-short Waves

Ten-metre technique is not understood by the majority of users or even designers. The waves behave rather like light and are liable to be reflected from buildings in the neighbourhood of the receiver. But, more serious than all this is the limited range. The service area is about 50 miles *irrespective of the power.*

The range, in fact, is limited by the curvature of the earth, for the waves will not " hang on " as will the longer waves, and there is no reflection from the Heaviside layer. The waves are too short to be reflected and go straight through. The only way of increasing the range is to locate the transmitter at a considerable height, but such methods are hardly applicable to ordinary everyday transmissions. This means that any programme service to cover the country involves the erection of a large number of special transmitters at suitable points.



An interesting study in definition. If this picture is viewed at an ordinary distance it is almost meaningless; viewed at a distance of six feet or so the characteristics are quite clear.

Medium-wave Transmissions

The alternative to all this is a medium or low-definition system radiated on a normal wavelength but with a limited frequency band so that the transmission does not absorb a disproportionately large share of the ether. Let us see what can be done in this direction.

A 180-line picture with a 4/3 ratio as shown in Fig. 1 contains 43,600 picture elements. With 25 pictures per second the frequency band required, estimated on the usual basis, would be nearly 550 kilocycles. The Te-ka-de proposition is to use half the normal picture, giving a 2/3 ratio (which is still quite a convenient shape) and to use 90-line scanning, horizontal as before. This would involve 5,450 elements.

The frequency band required depends on the number of pictures per second and for a medium-definition transmission 25 pictures per second are not really necessary. I shall return to this point later, but we will assume for the present that $12\frac{1}{2}$ pictures per second will suffice. Under these conditions the frequency band needed for the 90-line system is 34 kc.

Even this sounds a little formidable but it is not so utterly impracticable as 550 kc. Moreover, we know from experience that the present 30-line B.B.C. transmissions theoretically require a band of 13 kc., whereas tolerably good detail is obtained on close ups with a band width of less than half this figure. On this basis we could reckon that good 90-line pictures could be radiated within three normal broadcasting channels.

Such a transmission would have a considerable range. It would, no doubt, be subject to fading at the longer distances but this would constitute no more serious a defect than with speech broadcasting. It would provide a service *at a reasonable cost* which would have good entertainment value and it would popularise television if it were put out at a reasonable time of day.

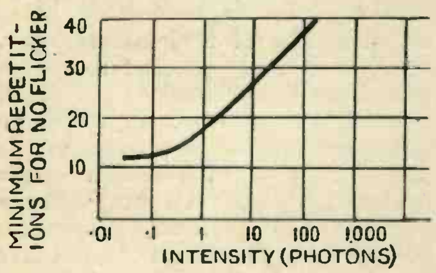


Fig. 2. Curve showing relation of picture brightness to flicker.

The usual argument against low-definition television is that the public will be so disappointed with the results that they will react violently against any form of television. The pictures I saw in Germany render any such argument ludicrous. In fact, the comments of the general public were distinctly favourable.

Perhaps the most important advantage of all is the stimulus which such a service would give to research generally. Few manufacturers can afford to spend money on television when there is little market for their goods. There would be no question of bad faith, for the service would be there giving good entertainment while the manufacturers were continually seeking improvements.

Some Suggestions

Let us consider just a few of the possibilities. The fundamental need of television to-day is a means of reducing the frequency band. One way of doing this is to reduce the number of pictures per second. Now flicker is dependent on the brilliance of the picture as is shown in Fig. 2. The minimum frequency for no flicker is $12\frac{1}{2}$ and this is satisfactory for small illuminations. The illumination of a small disc receiver with neon lamp is something under one photon* but the sort of brilliance which would be tolerable in an ordinary room is about 5 photons.

Reference to the figure shows that this needs a repetition frequency of 20 to 25 per second and if we make the pictures much brighter a still higher rate will be needed, unless we find some means of artificially increasing the flicker speed at the receiving end. On the face of it the idea seems impracticable. So do a good many ideas which ultimately come to fruition.

Reducing Scanning Lines

Another line of attack is in reducing the number of scanning lines *in any one second*. One method of achieving this has been suggested by Walton (of Scophony fame) and Sanabria in Chicago. This is to use a disc or drum which does not scan each line in turn but one in every two or three. For instance, we might scan lines 1, 4, 7 and so on the first time, lines 2, 5, 8, etc., the next time and lines 3, 6, 9, etc., the third time, making a thirty line scanning do the work of ninety.

Normally such a disc would have to run three times as fast unless some device such as a fluorescent screen were used to assist the visual persistence of the eye. In the case just quoted the afterglow would have to be of the order of 0.2 second which would be too long for rapidly moving objects but might be practicable for normal subjects.

There is still another method—one which has the advantage of having been tried and proved. This is the use of single sideband transmission. A carrier wave modulated to a frequency of 10 kc. covers a band of 10 kc. *on each side* of the carrier frequency with normal methods. With the single sideband method the frequency spread would be only 10 kc.

* A photon is the illumination of the retina with a pupil aperture of one square mm. by an object having an intensity of one candle per square metre.

Single sideband working involves the use of special receiving circuits and the adoption of the system for broadcast telephony is thus hardly feasible owing to the number of receiving sets already in existence. With a new art like television this argument does not apply and it would be quite a possible arrangement to radiate this medium definition programme on a single sideband system.

These excursions of fancy may, and probably will, call forth numerous protests as to their impracticability.

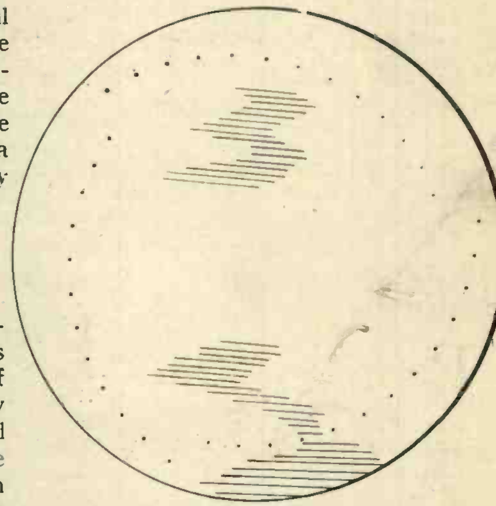


Fig. 3. The triple-spiral disc.

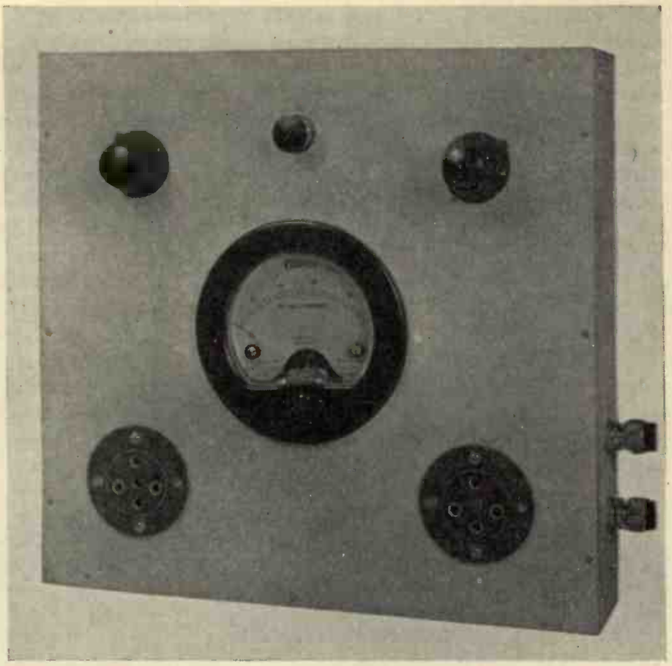
They do not affect the main argument which is that medium-definition television can provide a good programme service without heavy expense. The receiving equipment required is not expensive and the stimulus to television would be enormous. The movements of the German Post Office will be watched with interest. No doubt the Postmaster General's Committee is taking these factors into account.

Practical Television Handbook, by B. Bennett. This is a small handbook of 16 pages with paper covers. It has been written essentially for the beginner. Television principles are simply and briefly explained and details are given of the construction and operation of a disc machine. The matter mostly relates to the disc type of receiver but brief details are given of the mirror drum. The price is 1s. 2d., post paid, and it is published by the Bennett Television Co., of Station Road, Redhill, Surrey. Every purchaser of this handbook will be eligible to enter the simple competition for free television apparatus.

BUILDING A HIGHLY-SENSITIVE VALVE VOLTMETER

By S. Rutherford Wilkins.

Here is a description of a highly-sensitive valve voltmeter suitable for use on both audio and high-frequency voltages. The experimenter will find it a particularly useful instrument.



A photograph of the valve voltmeter described in the accompanying article.

RECENTLY I described a simple slide-back valve voltmeter which was used for measuring peak A.C. voltages. It great advantage was that it required no initial calibration. This type of valve voltmeter has one great disadvantage, however—the bias voltage potentiometer has to be reset for each reading. This makes such an instrument practically useless for determining the extent of varying voltages such as would be obtained if the instrument were used for the purpose of an output meter.

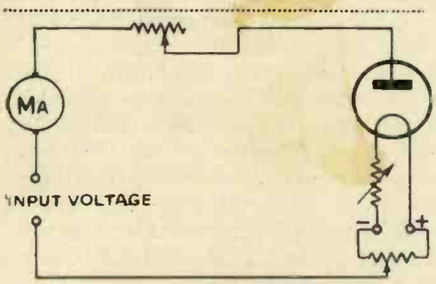


Fig. 1.—Circuit of simple diode valve voltmeter.

For this type of work it is better to have a direct reading instrument. Such an instrument would consist of an anode-bend or grid rectifier with a suitable range meter in its anode circuit, the latter being preferably fitted with a blank scale. In the case of the anode-bend type of meter the valve is first biased nearly to cut-off point. The rise in current is then noted and marked off on the blank scale when various value of alternating voltage within the range of the instrument are applied to the input terminals.

A simple valve voltmeter of this description is shown in Fig. 1. A meter of this description is rather useful where great accuracy is not of primary importance, but where a wide range is required. For a sinusoidal input voltage, the deflection of the microammeter is practically proportional to the value of the applied voltage.

The calibration of such an instrument can be carried out by means of a known sinusoidal voltage, or if necessary, with voltages taken from a direct-current source. In the latter case, however, the calibration of the instrument is not directly proportional to the applied voltage.

If alternating voltage is used to calibrate the instrument it is only really necessary to have one known source of voltage, of a value approaching the maximum range of the valve voltmeter. This is because a roughly linear scale law exists, and if the relation between scale length and applied voltage is found for any one value of voltage, a similar law exists throughout the whole range of the instrument.

The simple diode valve voltmeter just described is not extremely sensitive. A more useful instrument is the Moullin type valve voltmeter, a simple circuit of which is shown by Fig. 2. This instrument uses a triode working along the curved part of its grid-voltage plate-current characteristic. Since the plate and grid voltages are obtained from the voltage drop across the filament and the filament rheostat, the only external source of voltage that is necessary is a six-volt filament accumulator. The one-microfarad condenser serves to by-pass the alternating current component of the plate current. The meter is calibrated in effective volts and for normal medium impedance valves the range is usually between ½ to 1½-2 volts.

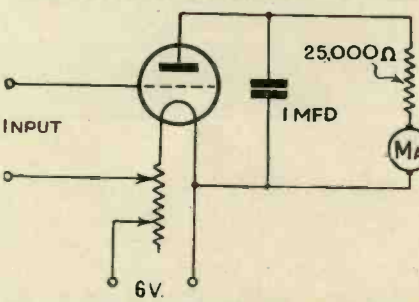


Fig. 2.—Circuit of Moullin type valve voltmeter

The calibration of such an instrument with an external alternating current source is quite a simple matter when you have an alternating-current voltmeter available. When no such instrument of reasonable accuracy is to hand, however, the best means of obtaining the calibration voltage is from a mains transformer and potential divider. With low-range valve voltmeters the 4-volt winding of a fairly good mains transformer would provide an excellent source of voltage and, provided that no great accuracy is required, a fairly accurately calibrated linearly wound 50,000-ohm potentiometer will serve as a potential divider.

The various voltmeters just described, although extremely useful for some purposes, would not be of much use for the minute voltages met with in high-frequency measurements owing to their fairly low sensitivity. Various devices can be used for increasing the sensitivity of a valve voltmeter, one of which is shown by Fig. 3. This consists of an arrangement whereby the standing current of the valve is eliminated from the indicating meter, the latter only being used to show minute changes in current due to the voltage applied. This arrangement allows the use of a very sensitive measuring instrument which would in all probability be damaged if it had to carry the initial current of the rectifying valve. By this means minute changes of the applied voltage can be easily shown on the indicating meter.

This arrangement is rather unsuitable for valve voltmeters which are intended for a variety of uses, owing to the ease with which the very sensitive microammeters which are used for indicating purposes can be damaged.

Additional sensitivity can be gained also by using a screen-grid valve instead of an ordinary triode. With such a scheme, however, the screen and plate voltages are rather critical and the instrument tends to lose its calibration easily.

Fig. 4 shows a simple arrangement for constructing a valve voltmeter of very high sensitivity suitable for use as a sensitive voltmeter on both audio and high-frequency voltages. An additional amplifying valve is used after the triode valve voltmeter with the meter in the anode circuit of the amplifying stage. The theory of the arrangement is that small changes in plate current of the valve voltmeter can be made to provide relatively large changes of grid voltage for the amplifying valve. This will result in an equally large change of anode current shown on the indicating meter. The beauty of this arrangement is that it is not really necessary to use an expensive instrument for indicating purposes, as a milliammeter will usually be quite sensitive enough if the latter has a fairly low range. One of the snags of this type of instrument is that quite a number of batteries are necessary to provide the various anode and grid voltages. If the valve voltmeter together with its batteries are connected up in the same cabinet, however, it will form a portable instrument of great utility which will find many uses in the experimenter's laboratory.

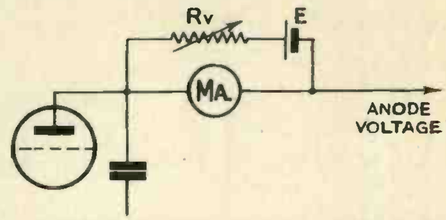
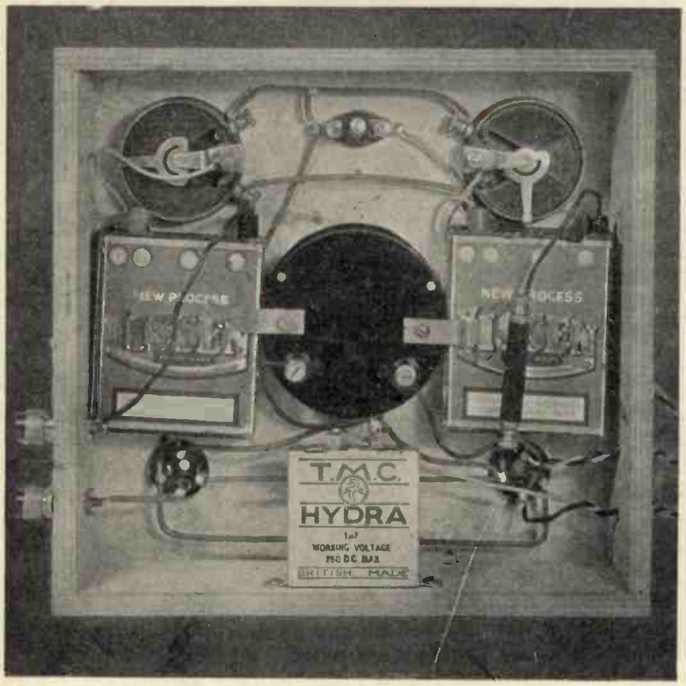


Fig. 3.—Circuit showing a method of increasing the sensitivity of a valve voltmeter.

The valve V_1 which functions as the actual valve voltmeter, is a valve of high slope and fairly high magnification (HL type). It is biased back to act as an anode-bend rectifier. The anode voltage for this stage is provided by a battery of about 45 volts (A). A higher voltage than this is really unnecessary, as the valve is biased to the lower bend of its characteristic for efficient plate rectification. Coupled to this stage is an amplifying stage which comprises the valve V_2 and its necessary coupling resistance R. A suitable valve for V_2 is one of medium impedance and fairly high slope. I used a Marconi LP2 which

(*Continued on page* 470)



The construction of the meter is quite simple, as this photograph of the underside of the panel shows.

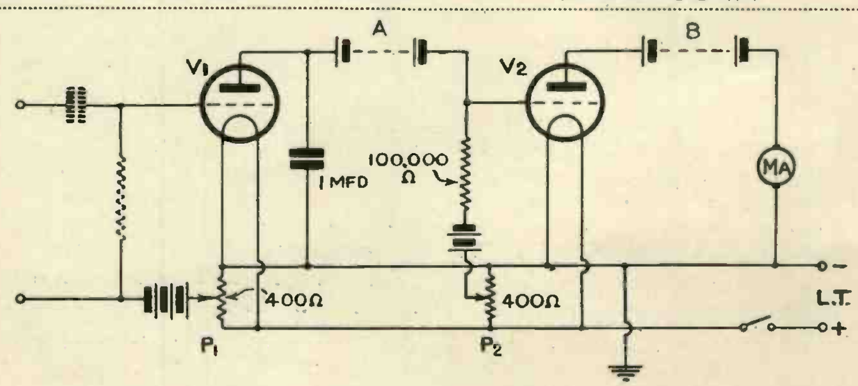


Fig. 4.—The circuit of the highly sensitive valve voltmeter described.

TELEVISION— AND THE NEW VALVES

Of late several types of new valves have been introduced which will simplify the problems of vision receiver design. This article, by **Kenneth Jowers**, *explains how these valves may be used to best advantage.*

EVERY television enthusiast knows that to obtain good pictures the radio set must be able to give almost perfect quality, be free from interference and to receive the programmes without fading.

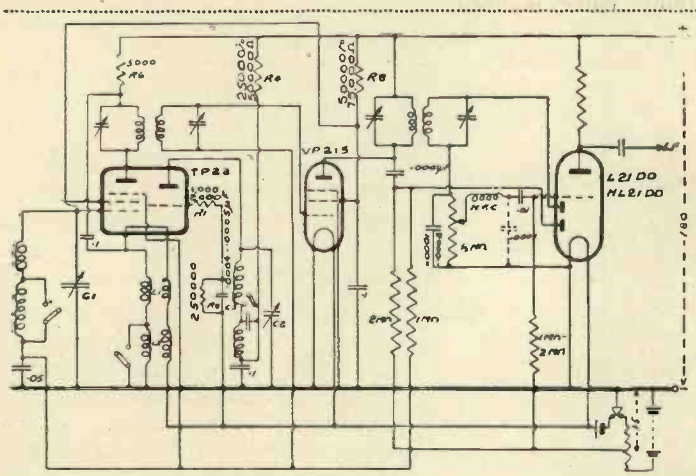


Fig. 1.—This is a good circuit that uses a double diode triode valve for rectification, low-frequency amplification, and provides automatic volume control.

The freedom from fading applies in particular to the listeners over a 100 miles or so from the London National transmitter. So that amateurs can make receivers fulfilling these requirements the various valve makers have, during the past few months, introduced new valves that almost do the job for you.

Automatic volume control instead of being an almost unknown quantity is now familiar to most constructors although many of them do not realise just how the idea can be embodied in their own particular set.

The Marconi-Osram, Mullard, and Mazda companies, to mention just a few, have brought out double-diode-triodes that in addition to giving distortionless rectification provide a simple means of obtaining automatic volume control and actually give more volume than simple triode or tetrode detectors. These valves are made for battery as well as mains operation.

A typical circuit is shown in Fig. 1 which gives a D.D.T. circuit with automatic volume control. The first part of the circuit can be ignored for the moment as this is for a pentagrid frequency-changer.

If you look into the matter you will see that by using a D.D.T. valve you actually have another low-frequency amplifying stage. This is to make up for the low output of the diode-detector.

Most of you know that the biggest trouble with a super-het is second channel interference and uneven oscillation due to inefficient coupling between the oscillator and detector circuits. This cannot be overcome with any circuit that requires external or coil coupling owing to the efficiency of the coils varying at different frequencies.

To overcome this trouble a system has been arranged so that the required coupling is carried out within the valve, actually mixing the electron streams of two separate anode circuits. The Heptode valve that can be obtained from all our leading valve makers is specially made for this purpose and has five grids in addition to the normal filament and anode.

The five grids are oscillator control grid, oscillator anode (actually grid construction), inner screen grid, signal grid—variable base—and outer screen grid. Two of these, the inner and outer screen grids, are connected internally so that the valve has the usual seven-pin base.

Take a look at Figs. 2 and 3. Fig. 2 shows the construction of the Marconi-Osram X21, the latest heptode available to the home constructor. Remember the detector grid connection is at the top of the valve.

The Heptode

The circuit in Fig. 3 shows how the heptode is connected in a conventional superhet. Standard coils can be used, but be advised and use the coils designed around the valve and made by Varley and Colvern.

With this circuit, owing to the fact that the electron streams from the two valve units do not vary, constant coupling is obtained. Boiled down this means that oscillation will be almost constant over all wavebands.

A variation of this arrangement is given in Fig. 1 where we show how to use the Mazda triode-pentode (TP22). This circuit was evolved by the makers of the valve and is actually the nucleus of a fine super-het.

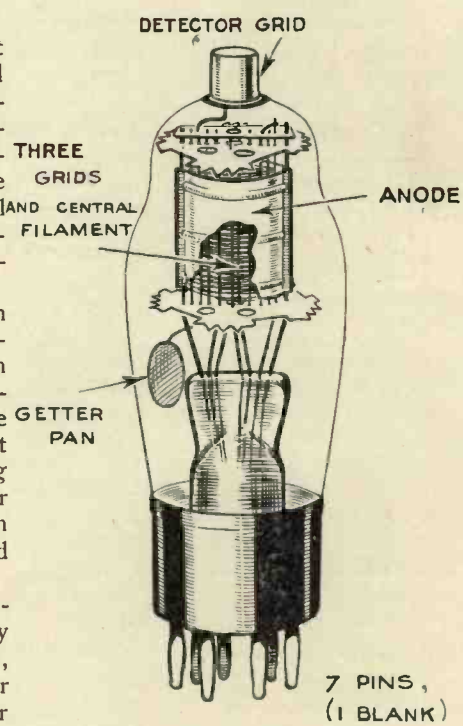


Fig. 2.—You can see from this sketch just how a battery heptode is constructed. It has a seven-pin base, but don't forget that the grid connection to the detector section is at the top of the bulb.

All you have to do is to connect an amplifier after the second detector.

The Ostar-Ganz people have a pentagrid that runs directly from the mains either D.C. or A.C. without any mains transformer. A circuit that will give the best from their pentagrid is shown in Fig. 4. This circuit can be added to any standard super-het and the improvement is enormous.

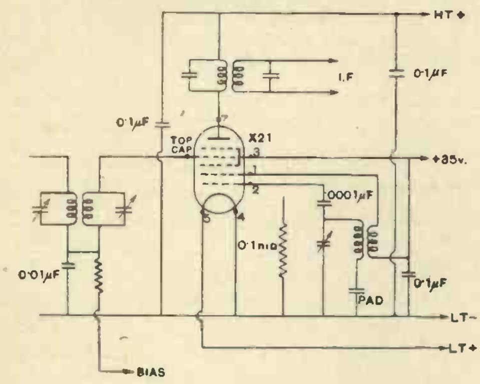


Fig. 3.—This is a good circuit in which to use your battery heptode. Varley make special coils for the X21.

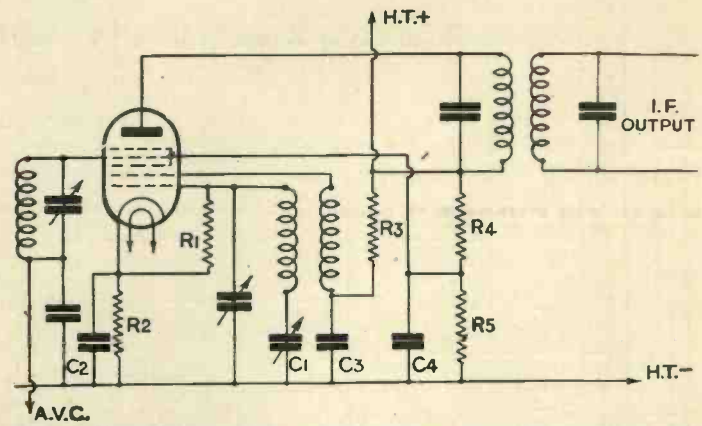


Fig. 4.—You can do away with a mains transformer and use this circuit on either A.C. or D.C. mains, providing you have an Ostar-Ganz high voltage pentagrid.

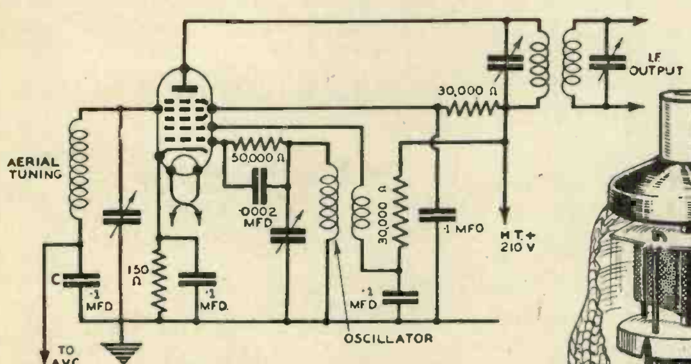


Fig. 6.—Cossors have developed this special circuit for use with their mains pentagrid. It can be added to almost any conventional super-het.

If you have a powerful low-frequency side to your receiver it will not be advisable to use a double-diode-triode as you will get distortion. In such circumstances use a double-diode. This valve is very helpful for it can be used in any circuit to give full automatic volume control and really distortionless detection. The very thing you want for television.

Mullards make a valve of this kind with a special side contact base. In Fig. 5 you will see how the Ostar-Ganz double-diode is made. This valve again works directly from the mains.

Cossors have developed a very fine pentagrid (41MPG) which is amongst the best in its class, particularly if you use their circuit. This is shown in Fig. 6 and is quite straightforward and complete with values so you can go ahead and try it.

This valve may look awesome, but try to remember that it is really only a plain triode and a screen-grid valve in the same bulb, so it is not really anything to worry about.

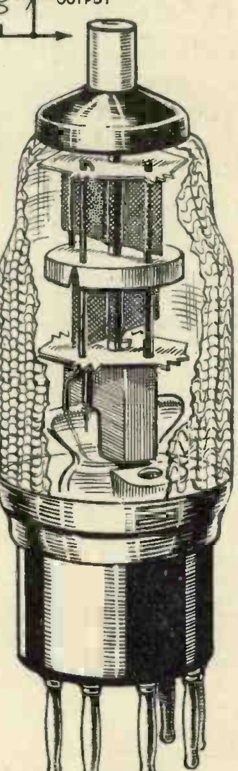


Fig. 5.—Talking about double diode triodes, this is the way the Ostar Ganz people make their version of this valve. You can see that the diodes are carefully screened from one another.

If you have mains available you have no need to worry about getting enough output to modulate your neon or whatever you have. Even the D.C. user is well off when compared with those thousands without mains at all for you can use a pair of pentodes and get three or four watts without any trouble.

It is agreed that for good television pictures at least two watts undistorted is required. Mullards have just brought out the PM22C, a battery-operated pentode which under optimum working conditions will give 1,000 milliwatts. A pair of these valves in parallel or push-pull will give well over two watts with reasonable economy in current.

The other valve makers have valves of a similar type, as for example the Cossor 220PT or Mazda Pen 220A both of which will give 1,000 milliwatts with 150 volts high-tension.

Class-B amplification is not much good for television, but have you tried the new Marconi-Osram QP21 valve? This will give 1,100 milliwatts without any driver stage, so the output from a double-diode-triode or triode detector will fully load it. It is a valve which all battery users should have a look at, for a pair in parallel would give enough output to modulate the most obstinate neon lamp.

One of the cheapest ways of getting D.C. volts from A.C. mains is to use an Ostar-Ganz full-wave valve rectifier. These valves have high potential filaments. All you have to do is to connect the supply across the filament pins and take the output

(*Continued on page 466.*)

COMPLETING AND OPERATING THE AMATEUR TRANSMITTER

Complete instructions for the construction of an amateur mirror-drum transmitter and the associated amplifier were given in the two preceding issues of TELEVISION. This article gives details of the final assembly and notes on its operation.

IN a preceding article describing the construction of the optical side of the transmitter, the shield for enclosing the lamp was omitted for the sake of simplicity, and those wishing to make a screen at this stage will find the following design very satisfactory whilst also being simple to construct.

Two pieces of 20 s.w.g. aluminium are required measuring 3 in. by 15 in. These two pieces are then drilled in the positions marked in Fig. 1 and a 1-in. hole drilled in one piece at the position marked X. From this same piece of metal the area shown shaded should also be removed, this being to enable the shield to clear the lens runner. This sheet of metal can now be bent up. Considerable care should be taken at this stage of the construction as otherwise the shield will allow a considerable amount of light to escape in unwanted directions.

In this section of the screen the bends M and N can be made at a distance of 1½ in. from the line drawn through A, whilst in the other sheet these distances should each be increased by the thickness of the metal.

In the case of the bottom bends, the distances KL and OP should be ½ in. whereas on the second piece of metal both these distances should be increased by a length equal to twice the thickness of the aluminium used. This latter piece of metal can now be dropped over the first piece as shown in the diagram, and a 4 B.A. nut and bolt put through the hole A.

The completed screen should then be finished dull black inside and out, and screwed down to the baseboard.

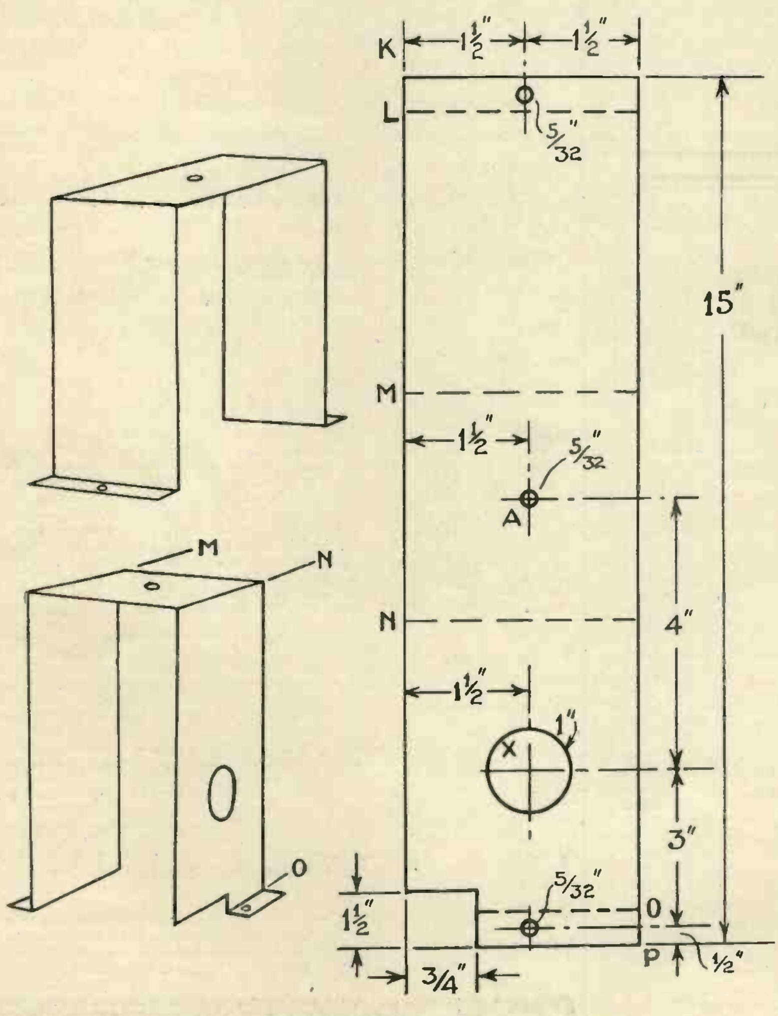


Fig. 1. Details of shield for enclosing the lamp.

The Synchronising Frame

The construction of the " frame " used to provide the synchronising signal is perfectly straighforward, most of the details being apparent from Fig. 2.

A piece of 20 s.w.g. aluminium measuring 12 in. by 12 in. is required. After marking out the positions of the holes and bends, the metal should be drilled. The main bends can now be made and the small fixing flanges bent over. Two pieces of metal should now be prepared to the dimensions shown at B in Fig. 2. These plates are slotted so that the slots register with the holes above and below the aperture on the main frame and are fixed by means of small nuts and bolts, a spring washer being provided so that the plates can be readily adjusted. The object of these plates is to intercept a short part of the travel of the scanning spot so that for approximately 1/6th of the total time taken by the spot to scan one line, no light falls on the image.

The effect of this is to give a strong note having a peaky wave form at a frequency dependent on the number of scanning lines per second, nominally 375. This strong signal is fed on to phonic wheel of the mirror drum or disc receiver, and on to the grid of the 375 cycles thyratron in the case of a cathode-ray receiver. If difficulty is experienced with synchronising the two plates can be slid towards one another so as to increase

(*Continued on page* 466)

the length of time during which each line is intercepted.

The complete frame can be mounted on the baseboard of the transmitter immediately behind the plane mirror, and the two photo-electric cells can conveniently be mounted one on either side of the actual aperture. This aluminium screen should also be finished dull black all over.

For scanning pictures approximately postcard size it will be found convenient to construct a vertical wooden frame at the extreme end of the main baseboard remote from the projector lamp and for the purposes of initial adjustments a piece of matt white paper can be fixed on the frame.

The lamp should be connected to the necessary 6 v. accumulator and the position of the aperture and condensing lens adjusted until the aperture is at the focus of this lens. It will be found easier to appreciate the method of adjustment if the aluminium synchronising screen and plane mirror are removed so that the spot of light can be seen at the bottom of the white paper at the end of the baseboard without the complication of reflecting surfaces confusing the operator.

Final Adjustments

During the initial focusing the adjustable aperture is best left fairly widely opened. The objective lens is slowly moved up and down the runner until a sharply defined square spot of light is shown on the focusing screen. If a halo is seen around the main spot, the second mask should be moved between the first aperture and the objective lens until a position is found at which the halo disappears.

The plane mirror can now be placed in the path of the beam so that the light is thrown on to the mirror drum, and the angle of the stationary mirror is adjusted until the light reflected from the drum passes through the synchronising mask. If the mirror drum is now run up to speed it will be seen that each line slightly overlaps his neighbour, and with the drum running, the adjustable mask should be closed up until it is just possible to discern a black line between each white scanning line.

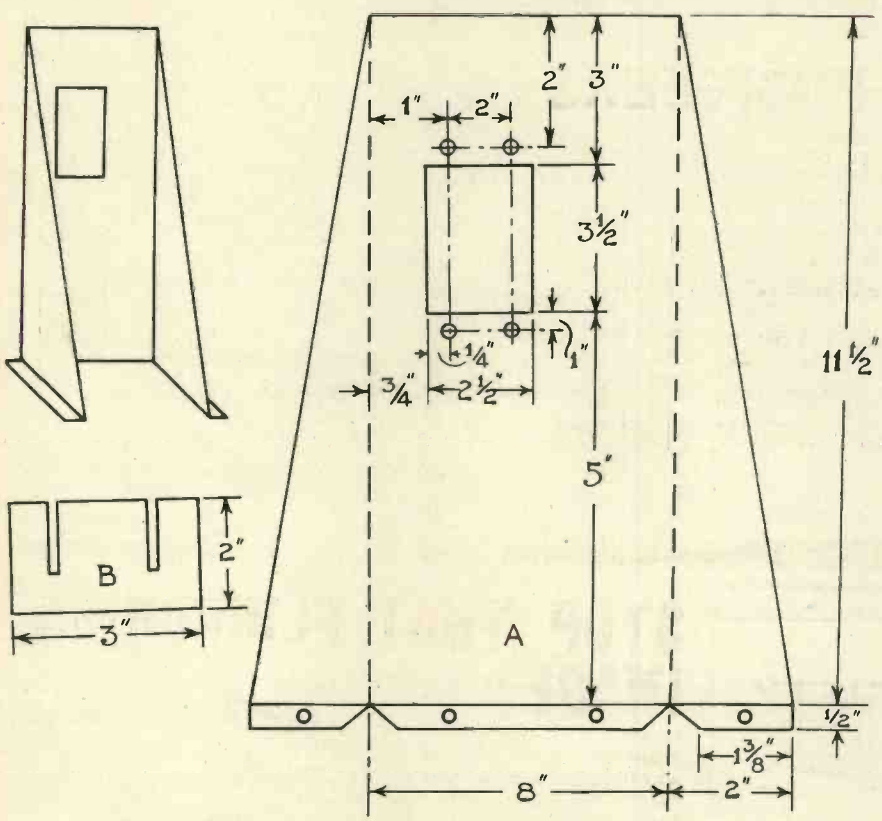


Fig. 2. Particulars of frame for providing the synchronising signal.

If it is desired to use images nearing postcard size, two photo cells will be required for satisfactory pictures, one can be mounted either side of the hole in the synchronising mask. The cells should be connected in parallel and can then be coupled up to the amplifier. If the apparatus is used near any A.C. lines the wiring will probably have to be screened, but it should be remembered that any screening on the input leads must be of very low capacity or picture details will suffer. Whilst a definite voltage for polarising the photo cells cannot be given as individual cells vary in their requirements, approximately 90 volts is satisfactory with most cells.

Picture Detail

Having reached this stage the transmitter should give pictures having considerable detail and a little experimental work with the size of aperture and the position of the condensing and objective lenses will be all that is necessary to complete the constructional work. As made on an open baseboard in the manner described, it is essential to run the transmitter in a darkened room, but by enclosing the whole in a light tight box measuring 2 ft. 6 in. long and 9 in. wide by 14 in. high it can, of course, be used in ordinary light.

"Television and the New Valves"

(*Continued from page 462.*)

from the grid and anode to the smoothing circuit. In this way an output of 280 volts at 60 milliamperes is obtained from 250 volt mains.

Several Tungsram valve rectifiers will give 400 volts from 200-volt mains without a mains transformer by voltage doubling, the very thing for a large amplifier and when cost is important.

If you live on the fringe of the service area of your station and want just a little more pep try replacing your screen-grid valves with high-frequency pentodes. These valves, which give colossal stage gains can be had with four-pin bases so that no alteration to the receiving set will be necessary. This applies to mains as well as battery users.

There is plenty of scope at the moment, so just look around and make quite sure that your receiver is capable of giving good pictures before you blame the transmissions or your television gear.

Correspondence

Correspondence is invited. The Editor does not necessarily agree with views expressed by readers which are published on this page.

Definition :: Bottled Programmes :: This Matter of Definition A Research Laboratory Destroyed by Fire.

Definition

SIR,

My letter on the subject of scanning lines, which you published a few months ago, has brought no response from your readers or the Cossor Co.

I think that there ought to be a clear definition of "equivalent number of lines" when comparing systems. I don't feel satisfied when I read that thirty lines with the A system are as good as ninety in the B system.

Perhaps Mr. Wilson could go into the matter, as he is interested in paradoxes?

S. GOLDSTEIN (London, N.).

* * *

Bottled Programmes

SIR,

I have noted the controversy over the times of "Television broadcasts" and agree that these are most inconvenient, for both experimenter and listener. Doubtless it is in the interests of all to arrange some scheme to put out these transmissions at more convenient hours. With this in mind, I propose the following: That the reflected light from the subject scanned be photographed on to a narrow strip of film; the strip could also be punctuated at the termination of each line or scan for purposes of synchronising. When the strip is re-run between a suitable light source and photo-cell (which can be now much closer together) the impulse could be arranged to be much greater than when fed into the transmitter in the usual way.

CHAS. E. MILES (London, S.W.).

* * *

"This Matter of Definition"

SIR,

Although the American pictures in the September issue representing the amount of definition in 120-line pictures are interesting, they are also highly misleading.

They fully confirm the conclusions of Mr. Traub. For example, take the view of a football match. The actual football pitch accounts for only 60 lines of the image, the rest consisting of spectators, and far distant scenery. This is, of course, typically American to waste 120 lines in order to achieve 60 lines worth of result. The actual width of the knot of players is only 20 lines (vertically). If the scene were actually televised, the players would, of course, be concentrated on, and we should have six times the detail shown.

This applies to the stage scene shown, in which the essential detail is contained in 60-80 lines vertically, according to the entertainment value of the "torpedo-like objects."

This invalidates the conclusions of our American friend. The other pictures are not so "mad" from a common-sense point of view, although Miss Greta Garbo could have been done justice if the ratio had been the other way about. The television set of the future might easily have an interchangeable picture ratio, a suggestion that I present to Mr. Baird. For a cathode-ray receiver a simple commutator will do the trick.

In any case purely dissecting an image does not give a good idea of the actual television image. For are not all the results thus obtained unanimous in proving that 30-line images are useless? By the way, I am not disagreeing with the general conclusions that Mr. Wenstrom has reached. These are sensible. I am merely pointing out the uselessness of using n lines to produce $\frac{n}{2}$ lines worth of result, which is, as I have said, a peculiar idiosyncrasy of American scientists.

O. J. RUSSELL (Norwich).

* * *

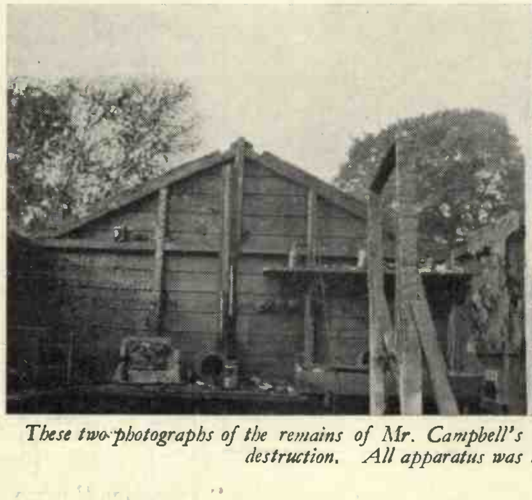
A B.B.C. Television Engineer's Laboratory Destroyed by Fire

SIR,

Your readers may be interested in the photographs of the remains of my private laboratory which was destroyed by fire recently. The fire was first noticed by neighbours at 8.15 a.m.

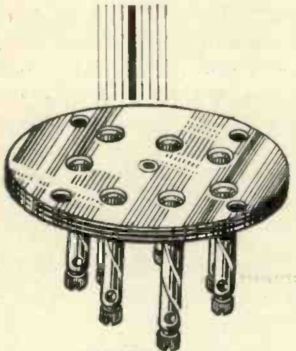
The cause of the fire, appears to have been an H.T. eliminator which had been on all night charging H.T. accumulators. It is interesting to note that the circuits had six fuses. The fire was practically out by the time the fire brigade arrived, thanks to the help of neighbours with two garden hoses. Among the many things destroyed were a test meter panel (containing seven precision meters), power switch board and meter, two valve voltmeters, rack of apparatus comprising beat oscillator, supersonic oscillator, bridge measuring apparatus, amplifiers, photo-cell photometer, standard light source and light interrupter, film projector, three cameras, and photographic enlarger, three mains eliminators, numerous

(*Continued on page* 470.)



These two photographs of the remains of Mr. Campbell's laboratory show how complete was the destruction. All apparatus was totally ruined.

HOW MANY LINES?



Every additional line to the Clix range of perfect contact components has a definite duty to perform. Each is designed to add to simplicity and efficiency in the construction and operation of Television or Radio apparatus.

The majority of readers of "Television" know all about the Clix Chassis-Mounting Valveholders and their excellence of design. Contributors of constructional articles for the technical press invariably specify Clix.

DO YOU KNOW HOW MANY CLIX LINES THERE ARE?

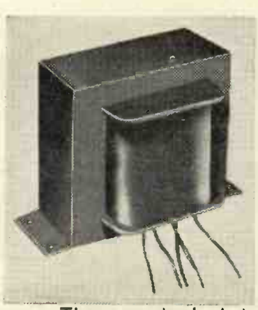
It is a simple matter to secure that valuable information. There is a two-colour Folder (Ref. "T") fully illustrated. A copy will be sent you free on request.

CLIX SPECIFIED for the TELEVISION TRANSMITTER
Described in September issue.

LECTRO LINX LTD.

79a, Rochester Row, London, S.W.1.

HYPER-ACCURATE TELEVISION TRANSFORMERS



Always use Sifam Television Transformers. They possess that micrometer accuracy which Television demands. Their standard of winding is higher than for normal radio purposes, and *they adhere strictly to their rated output.*
Wherever accuracy coupled with thorough-going reliability is called for, Sifam Transformers are the complete answer. Insist upon them. They are backed by a peerless reputation for technical excellence and consistency of performance. And they cost no more.
Any transformer made to specification within 3 days. Send for lists.

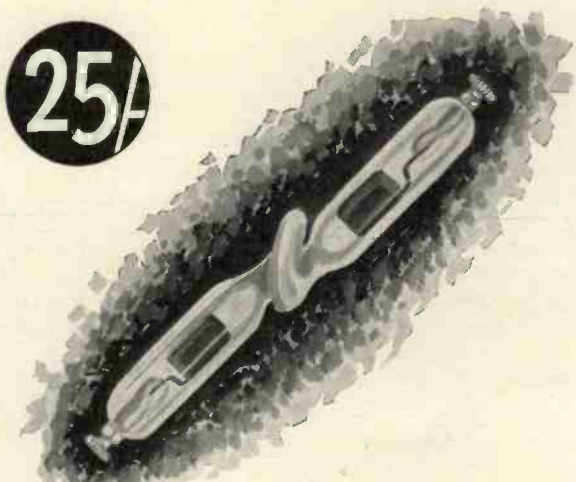
Sifam Electrical Instrument Co., Ltd.
York Works, Browning Street, London, S.E.17

SIFAM

Manufacturers of Transformers and Metres.

THE Ti LAMP FOR TELEVISION

25/-



THE MOST BRILLIANT TELEVISION LAMP YET PRODUCED

(1) Can project a picture on a screen **through a disc.**

(2) Can be used for viewing both direct and **by projection.**

(3) Can be used in conjunction with a reflecting mirror, giving **more light** on the picture plane.

(4) Provides **three** tubes of light at the price of **one.**

(5) Gives **three** times the light for **once** times the power consumption.

(6) Is adaptable to **all** modulated lamp television systems.

Obtainable from all good wholesale and retail distributors complete with full technical information and range of circuit diagrams.

TELEVISION INSTRUMENTS LIMITED
323, CITY ROAD, LONDON, E.C.1
Telephone: **Clerkenwell 4494.**

"Correspondence"

(Continued from page 468.)

accumulators, and many reference books. An experimental photographic recording device, which was to have been the basis of a lecture to the Television Society in December, about three thousand feet of unexposed film, over three thousand photographic negatives on film, many of them the only records of television images and general development, and a thirty-line television transmitter were also destroyed.

D. R. Campbell (Wembley).

[Mr. Campbell has charge of the projection apparatus in the television studio at Broadcasting House. Formerly he was with the Baird Co. in charge of transmissions and went to America on behalf of that company in 1929. On his return he was responsible for the installation of the television apparatus at Broadcasting House, and he joined the B.B.C. in 1932.—Ed.]

"Screen Pictures with a Disc Receiver"

(Continued from page 430.)

4-in. condenser lens to 6-in. condenser lens .... 3 in.
6-in. condenser lens to screen 4 in.

The most suitable position for the reflector behind the lamp can be found by experiment.

The operation of the disc projector is just as simple as the operation of the ordinary disc machine, once the correct position of the lenses have been found. The object should be to get as bright and well-defined spot on the screen as possible and then note that when the disc is set running the scanning spot starts in the bottom right-hand corner and travels upwards, each successive line moving to the left.

A series of circuit diagrams which cover practically every class of wireless receiver is shown on other pages in this issue and readers are referred to these for the method of connecting the lamp to the set.

"Building a Valve Voltmeter"

(Continued from page 460.)

was excellent for the job. With this valve a suitable value for the coupling resistance R was 100,000 ohms. P_1 and P_2 are ordinary 400-ohm potentiometers for making adjustments to bias.

The value of the second H.T. Battery B is not at all critical, any value between 45 and 60 volts usually being found suitable.

The operation of the voltmeter is as simple as its construction. The bias on the first value is chosen so that its plate current falls to practically zero, minute adjustments being made on the potentiometer P_1. The bias on V_2 is then adjusted together with the potentiometer P_2 until the milliammeter registers its full scale deflection of 1 milliamp.

When an alternating voltage is applied to the input terminals of the instrument, the current in the indicating meter will drop, the drop in current depending on the amount of voltage present.

The sensitivity will depend on the choice of valves and voltage, but with the values mentioned, no trouble should be found in measuring a tenth of a volt A.C.

If the dotted input condenser is used this instrument can also be used to determine alternating voltages with a superimposed D.C. voltage. The condenser is necessary to prevent the D.C. voltage from reaching the grid of the valve and thus upsetting the working conditions of the valve voltmeter.

As in the slide-back meter, a chassis construction is employed only this time I used metallised wood for my chassis.

As will be seen from the photograph a symmetrical lay-out is obtained with the indicating meter in the centre of the panel. The latter need not be extremely expensive—any fairly good moving-coil instrument will do. The Ferranti 0-1 milliammeter is a good example of an excellent meter at a reasonable price.

If it is desired to make this valve voltmeter even more sensitive, a microammeter can be used instead of a milliammeter, and the excess standing current backed off by the method shown in Fig. 3. By this means, I have been able to make an instrument of this class sensitive to voltages of the order of 50 millivolts.

Our Policy
"The Development of Television."

The Problem of Vision

Up to the present no physical concept has been apportioned for the faculty spoken of as "the gift of sight." We do not understand the behaviour of that delicate transparent membrane which forms the image screen, and organ of vision, called the retina, the function of which is to televise the details of the image to the brain. The microscope reveals that the retina is made of a number of layers consisting of light-sensitive cells and fluids, mixed up with nerve filaments, leading to nerve cells and nerve fibres which extend to the brain.

Light which has passed through the lens system of the eye, falls on the layer of nerve fibres, which varies in thickness at different parts of the retina, and consists of filaments that radiate from the half million nerve fibres that make up the optic nerve trunk, which latter continues to the brain.

Visual impulses do not appear to begin until the light has penetrated most of the retinal layers and reached the two types of cells known as the rods and cones, and when any of these are destroyed corresponding dark spots appear in the field of vision. The inner limbs of the cones under the action of light become shorter, and elongate in the darkness.

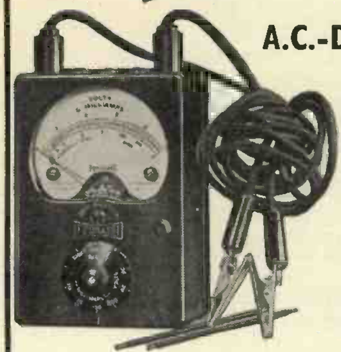
It is not possible to say which are the more important, rods or cones, as rods are absent from the eyes of some seeing animals, and the cones are absent from others. The outer limbs of the rods are tinged with a fluid pigment known as visual purple, and light may effect chemical changes here which are important to vision. Yet some animals see that have no visual purple in their eyes.

The following paragraph, which was taken from a recent issue of the *Radio News*, is of interest: —

Will Television be a Future War Spy?

"LONDON. Aerial and naval warfare of the future, including television to spy out the movements of the troops, etc., was recently demonstrated to the British War Office, with the Baird television installed there.

FERRANTI



A.C.-D.C. CIRCUIT TESTER

for the measurement of

A.C. VOLTAGE
D.C. VOLTAGE
D.C. MILLIAMPS AND RESISTANCE

Price £5 : 15 : 0

Complete with External Resistance to give voltage ranges up to 600 volts.

An 0.5 mfd. plug-in Condenser Unit can be supplied (Price 5/-) to enable the instrument to be used directly to measure output voltages.

RANGES.

A.C. Volts.	A.C. Milliamps.	D.C. Volts.	D.C. Milliamps.	Resistance.
0-15	0-1	0-3	0-1	0-50,000 ohms self-contained and up to 30 megohms with external 600 volt supply.
0-150		0-15	0-7.5	
0-300		0-150	0-30	
0-450		0-300	0-150	
0-600		0-450	0-750	
		0-600		

Write for Leaflet Wa 529.

FERRANTI LTD., HOLLINWOOD, LANCS.
London: Bush House, Aldwych, W.C.2.

FREE !

Send a copy of TELEVISION *to your friend*

In order that anyone you know who is interested in television but is not yet a reader of the only publication entirely devoted to this subject —"TELEVISION," a complimentary copy will be sent to him gratis and post free, if you will kindly send your request on a postcard, giving both your own and your friend's address and attach the special coupon below.

To the Publisher, "Television," 58-61 Fetter Lane, E.C.4.

ATTACH THIS COUPON TO YOUR POSTCARD

TELEVISION COUPON 10/34.

NEGATIVE TO POSITIVE

PICTURE AT WILL

The television experimenter is often faced with the problem of converting his pictures from negative to positive. There are several ways of doing this, but they all take time to carry out, and even then you will still be faced with the problem of overload distortion, always apparent when a triode detector is used.

The use of the new WX6 Westector, however, enables you to overcome both difficulties.

It is an H.F. metal rectifier designed for linear detection, requires neither H.T. nor L.T., and used as directed, it cannot overload ; it cannot give harmonic or phase distortion, and it cannot deteriorate or break down.

No matter what your set, you can be sure of a definite positive picture with a Westector as the detector. The Westector should be mounted in a grid leak holder. Then, if your test picture happens to be negative, just pull out the Westector, reverse it, and your picture will be 100 per cent. positive ; remaining so, until further experiments may alter it.

Write TO-DAY for our booklet "ANOTHER TELEVISION PROBLEM SOLVED" which shows with theoretical circuits how easy it is to convert to metal detection.

The Westinghouse Brake & Saxby Signal Co., Ltd., 82, York Road, Kings Cross, London, N.1.

Half-wave, maximum input voltage : 36 volt peak carrier, maximum current output 0.12 milliamps.

WX6 WESTECTOR

7/6

There is news in the "Television" advertisements

THE BEGINNINGS OF TELEVISION

The idea of the possibility of television was first conceived when the light-sensitive properties of selenium were discovered sixty years ago. Selenium, of course, is a metal, the electrical resistance of which varies when light falls upon it. The discovery of these properties was made quite accidentally in 1873 at the Atlantic cable terminal station at Valentia.

After this discovery various experimenters had constructed selenium "cells," and it was immediately suggested that these cells would make it possible to see by telegraphy. Within the next few years many scientists described systems to accomplish this remarkable feat, and it was confidently asserted that vision over the telephone line would be an accomplished fact very shortly.

The problem of television was to break up the image into many thousands of unit areas, convey these "pieces" to the receiver and re-assemble them on the receiving screen in a fraction of a second. It was realised that it would be necessary to make a complete traversal of the screen in about one-tenth of a second so that the images are seen instantaneously owing to persistence of vision effect.

Photo-Electric Effect

In 1888 another method of turning light into electricity was discovered, and what are called " photo-electric cells " were constructed and used as an alternative to the sluggish selenium cell. These early photo-electric cells also proved insufficiently sensitive to the very small amount of light that is reflected from the scene or object.

The invention of the thermionic valve by Fleming, and the development of the three-electrode valve appeared to give a means of amplifying the weakest currents to any degree, but even the magnification possible in this way was insufficient. It was clearly evident that the main stumbling-block was the light-sensitive device.

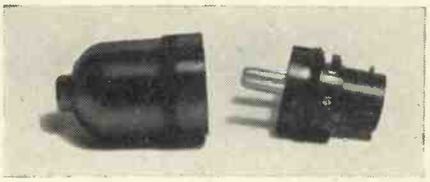
Among the early experimenters in the field of television may be mentioned Rignoux and Fournier, Szczepanik, Rosing, Belin; but there were a host of others. All these workers attacked the problem in their own particular manner, and although success eluded them in early days they laid foundations which were, no doubt, of value in later experiments.

By 1923 several scientists had advanced towards television to the extent of sending *shadows*, and this was taken as a hopeful sign. This feat was achieved by Jenkins and Moore, U.S.A.; Holweck and Belin, France; and Baird, England. The difference between sending mere shadows and sending the living image with all gradations of light and shade is, however, very great, and in view of the long years of fruitless experiments it was said that many years would pass before a living image of the human face would be transmitted and recognised at the receiving end.

However, in January, 1926, Baird gave before members of the Royal Institution the first demonstration of true television in the world, sending the images of faces from one room to another. The results were, naturally, quite crude, and there was much room for refinement and improvement, but, still, it *was* television, and was recognised as a most remarkable achievement.

A Handy, Two-way Plug Adaptor

The photograph shows a novel type of plug adaptor which will be found particularly useful by the television amateur. As will be clear from the picture this is a combined lamp adaptor and wall plug. The wiring once having been made need not be altered and the changeover from lamp adaptor to wall plug is made by unscrewing the cover and reversing the body. This handy device is a new Clix speciality and retails at 1s. 3d.



The Clix 2-way Plug Adaptor.

"John L. Baird—The Man"

(*Continued from page* 439.)

did not make any difference to Mr. Baird—always that same quiet air of conviction; and even in later years when he demonstrated the precision apparatus which was installed in Long Acre there was never any display of pride of accomplishment. At the recent demonstration of the Baird high-definition system there was still observable that impression of conviction of still more progress that will be made, though it may be that results now have exceeded his wildest dreams of those very early days.

Televisual Films and Cinemas, Box 4241, G.P.O., Sydney, Australia, are desirous of getting into touch with British manufacturers of television apparatus with a view to obtaining a sole agency in that country. Thirty-line apparatus is particularly required.

We have received from the Radio Resistor Co., Ltd., a copy of a new technical booklet on the Erie high-resistance products. The booklet contains a large amount of technical data relating to the use of resistors which has not previously been available to the public. The booklet will be sent free on request and mention of this journal providing a 1½d. stamp is sent to cover postage. The address is 1 Golden Square, Piccadilly, London, W.1.

The National Model C.R.O. cathode-ray oscilloscope is entirely self-contained, with its own power and built-in control devices. This instrument provides an instantaneous graphic picture of the actual operating conditions in transmitting circuits. The cathode-ray tube employed is the new R.C.A. 3-inch diameter type 906. No linear sweep device is provided, as it has been found more desirable to use an audio signal from the transmitter for this purpose. The resulting " trapezoid pattern " may be interpreted more readily, and the percentage of accumulation more easily calculated than with the linear sweep. However, a linear sweep may be added at any time it is found necessary for special work.

Constructors' Circle

Additional Members

Mr. F. A. Middleton, 59 Sundial Avenue, South Norwood Hill, S.E.25; E. C. Thomas, 15 Carlyle Road, Easton, Bristol, 5; B. Daley, Chop-Sticks, Pennystone Road, Bispham, Blackpool; A. E. Moore, 108 Doncaster Road, Leicester; N. Lockley, 17 Formosa Drive, Fazakerley, Liverpool; N. Greig, Haslemere, Glenville Road, Rustington, Sussex; T. J. Hindley, 22 Blenheim Road, Wood Green, N.22; E. F. Gray, 19 Watkin Street, Nottingham; A. Beattie, Main Street, Ballymoney, Co. Antrim; F. C. H. Dyer, 35 Peterborough Road, S.W.6; G. W. Young, France Lynch, near Stroud, Glos.; R. A. Lampitt, 237 Coalway Road, Wolverhampton, Staffs; R. Croft, Oakmead, Mountfield, near Robertsbridge, Sussex; Dr. W. Campbell-Mackie, Metchley Lodge, Metchley Lane, Harborne, Birmingham; F. C. Coleman, Hamdon House, Stoke-under-Ham, Somerset; J. E. Adamson, 3 Anlaby Park Road, Hull; N. Bevan, 6 Grosvenor Road, Westcliff, Essex; T. Lock, 31 Lintott Avenue, Kemptown, Brighton; J. W. Allen, 16 Dauncy Buildings, Webber Row, Waterloo Road, S.E.1; H. M. Fairs, 158a Pinner Road, North Harrow.

INDEX TO ADVERTISERS

THE CONSTRUCTORS' CIRCLE

Application for Membership

To be filled in and sent with a *stamped envelope for reply* to the Editor, "Television," 58-61, Fetter Lane, London, E.C.4.

(1) I already subscribe to your journal at the address below.

(2) I have placed a regular order for TELEVISION with my booksellers, Messrs..........

* ....

....

and desire to be enrolled as a member of the TELEVISION "Constructors' Circle."

Please send membership badge *free of charge* to

Name (in block letters) ....

Address ....

....

*Strike out lines not applicable.

"TELEVISION" COUPON

FOR FREE INQUIRY SERVICE

Name ____________________

Address ____________________

October, 1934.

MISCELLANEOUS ADVERTISEMENTS

The charge for advertisements in these columns is 12 words or less 2/-, and 2d. for every additional word. All advertisements must be accompanied by remittance. Cheques and Postal Orders should be made payable to Bernard Jones Publications Ltd., and crossed, and should reach this office not later than the 15th of the month previous to date of issue.

ANSWERS TO QUERIES

An expert service is available to assist readers who experience difficulties in the construction, operation and maintenance of television apparatus or associated wireless receivers and amplifiers.

The following rules should be observed:

Please write clearly giving all essential particulars.

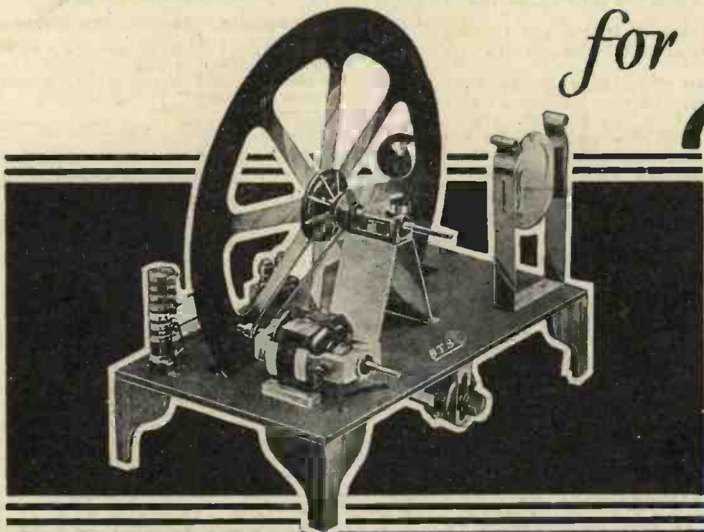
A stamped, addressed envelope and also the coupon on the last page must accompany all queries. Not more than two questions should be sent at any time.

Reply will be made by post.

Queries should be addressed to the Query Department, TELEVISION, 58-61, Fetter Lane, London, E.C.4.

B.T.S. INDIRECT DRIVE DISC TELEVISION RECEIVER

for Efficiency



If required with *B.T.S.* **Synchronising Gear** 27/6 extra

84/-

COMPLETE KIT for HOME ASSEMBLY

TELELUX

FOR BRIGHTER PICTURES

Provisional Patent No. 15269

6'6

Invented to *perfect* Disc Television.

TELELUX is the latest Television patent. The special opaque external coating eliminates 'glare' and 'bee-hive' lines. Bright, clear and well-defined images result from the concentration of light by a special light collecting medium, and the special treatment of the aperture itself. Designed for use with 16" and 20" discs, TELELUX lights at 180 volts, and operates with only 18 m/a passing through it.

Obtainable from all Dealers, if any difficulty send direct.

B.T.S. COMPONENTS

B.T.S. TELEVISION MOTOR

Runs with perfect precision. Heavy cast aluminium frame ensures freedom from mechanical vibration and absence of noise. Ball bearings provide even running. Suitable for both 16 in. and 20 in. Scanning Discs. Cat. No. M/1 Universal A.C. or D.C. Mains, 200-240 volts, A.C. 40-60 cycles. Cat. No. M/2 6-volt Battery Type. Price **35/-**

B.T.S. SYNCHRONISING GEAR KIT

Perfect synchronisation, with floating images reduced to a minimum. Expertly designed and constructed. Quickly and easily assembled. For mounting on either end of B.T.S. Universal Motor.

In carton with assembly instructions. Cat. No. S/8. Complete Kit. **27/6**

● *AS SPECIFIED in this month's issue :*

	£	s.	d.
B.T.S. 6" Diam. Plano Convex Lens, 17" fc. ...	1	5	0
B.T.S. 4" Diam. Bi-Convex Lens, 12 fc. ...		6	6
B.T.S. 1" Diam. Projection Lens, 1½" fc. ...		8	6
B.T.S. 1½" diam. Condenser Lens, 2" fc. ...		8	6
B.T.S. 2" Concave Mirror		12	6
B.T.S. Projection Cabinet (Parts, with 3 Lens Holders)		10	6

The *B.T.S.* **DISC TELEVISION KIT** comprises EVERY PART for instant assembly. Including *B.T.S.* Universal Ball-bearing Television Motor for either Mains or Battery operation as required ; controlling resistances; laminated and ready-assembled chassis with all component fixing holes marked. Stroboscope 16 in. Scanning disc and stand ; lens and lensholder ; improved type TELELUX Neon Lamp and Holder. **FULL-SIZE BLUEPRINT WITH ASSEMBLY, WIRING AND OPERATING INSTRUCTIONS WITH EVERY KIT.**

TYPE K12 for A.C. (40-60 cycles) and D.C. Mains **84/-**

TYPE K13 for 6-volt Battery **78/-**

B.T.S.

● *MANUFACTURERS of TELEVISION APPARATUS* ●

BRITISH TELEVISION SUPPLIES, LTD. BUSH HOUSE, LONDON, W.C.2

Telephone : TEMPLE BAR 0134. *Telegrams : TELEVIEW, BUSH, LONDON*

Wholesale Stockists Frank Riddiough & Son, Simes St., Westgate, Bradford. J. Dyson & Co., Godwin St., Bradford. Samuel Gratrix Jnr. & Bros., Ltd., Alport Works, Quay St., Deansgate, Manchester. Boynton's & Co., Ltd., 65-8 Stafford St., Birmingham. Nottingham Radio Supplies, Ltd., Sherwood Buildings, Sherwood St., Nottingham. T. Beadle & Co., Ltd., 3, 4 & 5, Castle St., Hull. Avenue Trading Co., 241, Park Road, Aston, Birmingham, 6.

Wholesale Distributors of the new T.I. Television Lamp

Printed in Great Britain for the Proprietors and Publishers, BERNARD JONES PUBLICATIONS, LTD., 58-61 Fetter Lane, London, E.C.4, by THE PRESS AT COOMBELANDS, LTD., Addlestone, Surrey. Sole Agents for South Africa: CENTRAL NEWS AGENCY, LTD. Sole Agents for Australia and New Zealand: GORDON AND GOTCH (AUSTRALASIA), LTD