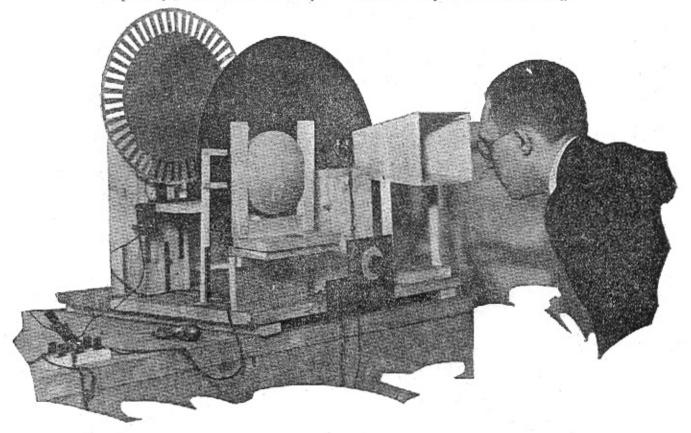
MARCH 1928

### How to make a Simple Televisor

Specially described and tested for Television" by our Technical Staff.



AMATEURS must have read the numerous accounts of the demonstrations given of television during the past two years, but although much has been published on this work nothing whatsoever appears to have been done to give practical assistance to the amateur in carrying out research work in his own home. This at first seems surprising, as the very large part played by the amateur in the development of wireless is well known and appreciated.

Television, however, is a much more complex subject than wireless, and requires a knowledge of science which is not usually within the grasp of the man in the street. The subject, however, has been greatly developed within the past two years, and in the South Kensington Museum, open to the view of the public, is a quite simple apparatus with which "television" of shadows was first achieved.

There would seem to be no outstanding reason why the ordinary amateur should not build for himself a similar device and enjoy the unparalleled pleasure of exploring for himself this new branch of science. There is always something infinitely fascinating in exploring a completely novel field, and we propose to give in this article constructional details which will enable the amateur to build for himself a simple machine which will show the transmission of outlines in a crude form.

In subsequent issues we shall publish further devices and improvements, and also assist in any way we can amateur constructors in solving and elucidating the problems which they are bound to meet.

The mechanical part of the apparatus consists essentially of a simple disc perforated by two spiral sets of holes. We have purposely reduced the device to its simplest possible form, and in this first machine the same disc will be used both for transmitting and receiving, so that there will be no synchronising problems to deal with. Synchronising devices will be dealt with in a subsequent issue.

We will begin by giving the details of this disc. Cardboard may be used and forms a fairly satisfactory medium, and one very easy to handle. It may be obtained from any stationer's, and should, preferably, have one side covered in black. considerable latitude in the thickness of card, but it must be sufficiently substantial to give rigidity. The first step is to cut from this card a circle 20 inches in diameter. then mark off eleven circles, the first with a radius of q inches, the second with a radius of 848 inches, and so on until the final one with a radius of 714 inches. The circumference must then be divided up into twenty equal segments and radii drawn. Where the radii intersect these circles the squares are cut, as shown in diagram, Fig. 1.

In place of cardboard thin sheet metal, such as tin-plate, may be used. A very suitable tin-plate is the material known as Taggart. This is almost as thin as paper, being, in

of mechanical skill and Fig. 1. labour.

fact, the same material out of which biscuit tins and similar light tinware is made. It is very easily handled, and can readily be cut with an ordinary pair of scissors. It is sold in sheets of 22 inches by 30 inches. Any ironmonger will supply these.

A heavier grade of tin may, of course, be used, but it is not so easily handled.

In marking off the circles the proper instrument to use is a large protractor, but this may not be available, in which case a strip of

cardboard II inches long by 2 inches wide may be employed. This is used in a similar way to a draftsman's trammels. With the point of a pair of dividers pierce the cardboard at one end and place on the tin as shown in the sketch, Fig. 1.

Using the point of the dividers as a pivot, mark off the radii along the card, and at the end of each radius pierce a hole with another pair of divi-Then using the cardboard as a link swing a circle round on the tinplate, this being repeated for each radius.

Where thick tin is used it may be more convenient to drill the holes in place of cutting them with a chisel or knife. Round holes must then, of course,

be used. A round hole does not give such good results as a square hole, but if it is desired to get the best results the circular hole can be filed square with a rat-tailed file.

If you are using cardboard there is a to warp tendency which makes the Divide into use of tin 10 equal parts. orother metal preferable. In place of tin an aluminium plate gives a more satisfactory disc, and can be recommended in preference, although, of course, in cutting it entails a greater amount

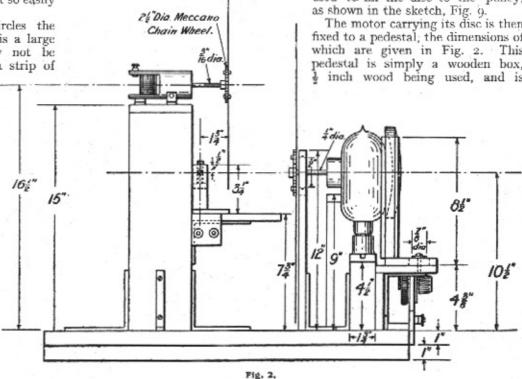
The marking off of the disc is done as follows: First of all, using either a sufficiently large protractor, a pair of trammels or, if you have not any of these, a piece of cardboard as previously described, mark off a circle

with a 10-inch radius, then with the same centre mark off a second circle with a radius of 9 inches, then a third circle as shown in the drawing, and so on until you come to the tenth circle with a radius of 71 inches. Now divide the circumference of your disc into twenty parts. To do this you will require a large pair of dividers. First of all draw two diameters at right angles to each other, thus dividing the disc into four equal parts, then divide each of these four equal parts into five equal sections, using your dividers to do this, or, of course, you may divide the disc by using a protractor and drawing radii at angles of 360 degrees divided by 20, that is 18 degrees.

You will now have your disc divided into twenty segments, and at the point where the radii cut the concentric circles square holes should be cut, as shown in the sketch, Fig. 1; or, of course, as previously stated, round holes may be used. The centre of the disc must be bored with a hole to fix on the spindle of the driving motor.

Any simple little 4-volt motor may be used. In the actual model which we are describing the motor used was obtained from Messrs. Bond, of Euston Road, London, its spindle being 3 inch in diameter. Meccano pulley was used for fixing. Three bolts (3 inch diameter) were used to fix the disc to the pulley,

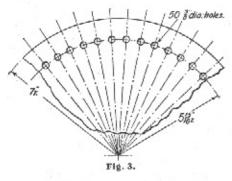
The motor carrying its disc is then fixed to a pedestal; the dimensions of which are given in Fig. 2. This pedestal is simply a wooden box, inch wood being used, and is



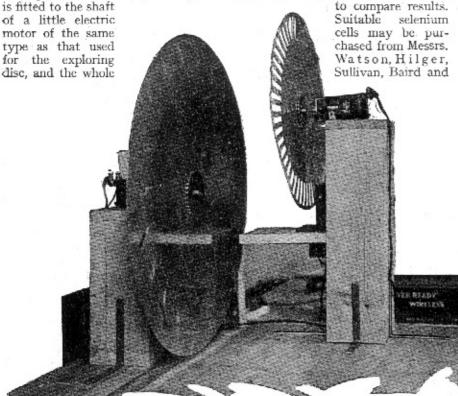
TELEVISION MARCH 1928

attached to a baseboard made of the same material.

We have now a revolving disc suitably mounted, and this constitutes the first and most essential part of our "televisor."



The next step is to construct our light interrupter disc. The light interrupter disc is 10 inches in diameter, and has fifty holes arranged round its circumference, the holes and spaces between being equal. Two alternative constructions of this disc are shown in Figs. 3 and 4. To make the disc the most suitable material is thin tin, but aluminium may be used, and makes a more rigid job, although it is not perhaps so easy to handle. This second disc



Side Elevation of Apparatus, showing Arrangement of Spirally Perforated Disc.

is mounted upon another pedestal, as shown in sketches, Figs. 2 and 3. We come now to what may be

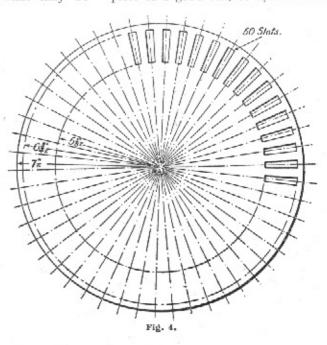
considered the heart of the whole apparatus, that is the selenium cell, and this is a snag which has destroyed the hopes of many amateurs who started along the road towards television.

In another part of this journal an account appears upon "How to make a Selenium Cell." But some readers may not wish to go to this trouble, and while it is highly advisable for those who are taking up the study of television to construct their own cells, it may be preferable to buy at least one

commercial cell to enable results to be achieved without delay. Experimenters may then commence to construct their own cells, having by them the standard article with which

to compare results.

Tatlock, and a number of other firms. The amateur should not grudge the price of a good cell, as apart from



the apparatus being described at present, these cells will be of the greatest use in future experiments, the same applying to the little motors, reflectors and lamps which he will also be called

upon to purchase.

The selenium cell, of whatever type he decides upon, is fixed behind the disc and in line with the perforations and slots, as shown in sketches, Figs. 2 and 5. The next item then is the lamp. A projection type lamp, such as an Osram 400 watt, is suitable, or an ordinary 100-watt lamp may be used. Behind the lamp is the reflector. This is a Mangin mirror 6 inches in diameter, and can be purchased from any kinematograph or optical suppliers. The object of this mirror is to concentrate the light of the lamp upon the cell. In operation the light from the lamp is focussed upon the holes in the disc, so that an image of the lamp

> Now for the first test of the apparatus. The first thing to do is to find if the cell is functioning properly, and this requires a three-valve low frequency amplifier. Any good

> three-valve amplifier will serve

filament falls upon the cell.

the purpose.

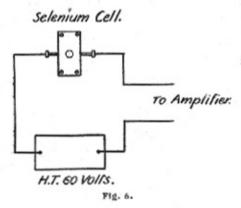
There are on the market a number of ex-army mark 4 three-valve amplifiers which can be purchased very cheaply,

and these are quite suitable. The circuit of the cell is shown in Fig. 6 and the motor circuits in Fig. 7.

The arrangement of the cell fixing is shown in Fig 8. The voltage required for the cell varies from 20 to 100 volts, depending upon the type used. It is safest to start with a voltage of not more than 20, as there is a danger of burning out the cells if too high a voltage is used. The makers will give you what they consider a safe maximum voltage, and this should not be exceeded.

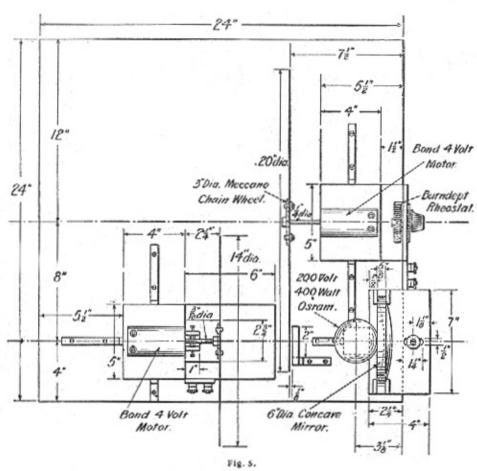
Having connected the cell as shown in the diagram (Fig. 6), start up the motor driving the radially-perforated disc; see that the light from the lamp is coming through one or other of the perforations of the spirally-perforated disc and is falling on the cell. If now a pair of headphones is connected to the output of the amplifier a clear note should be heard, this note being caused by the interrupted light falling upon the cell. When a hand is interposed between the light and the cell the note should immediately stop.

If you find that this is the case then we can proceed to the next step. If you cannot get a clear note from the amplifier then there is a fault either in the cell or in the amplifier itself. If the cell is a



purchased one there is not much likelihood of it being faulty, and it would be as well to make sure that the amplifier is in order.

Once having got the sound we have to amplify it sufficiently to give a fairly brilliant light in a Neon tube. An ordinary Neon tube of the Osglim type may be used. These can be purchased from any electrician at the cost of a few shillings. They have in the base a little coil of resistance wire, and it is advisable to remove this or to purchase an



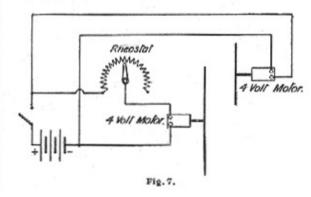
Osglim from which the resistance has been omitted. Such lamps can be obtained from the makers, Messrs. The G.E.C. It is, however, not essential that the resistance should be removed, the only difference being that the results are somewhat brighter with no resistance.

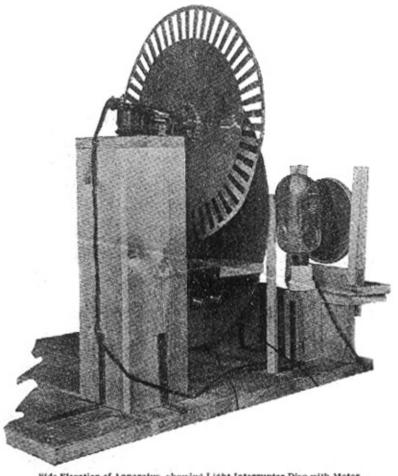
To amplify the current sufficiently to light these Osglim lamps two more stages of amplification will probably be necessary. An ordinary transformer coupling may be used, but difficulty will probably be experienced in preventing "howling." The easiest way to overcome this ten-

dency is by spacing the valves widely apart. The final valve, which should be of the transmitting type (for example, a Mullard 040), must be kept well away from the input of the first valve, a distance of 4 or 5 feet being advisable, or shielding may be resorted to. The potential on the final valve must be high; the higher the potential, of

course, the brighter the Neon tube. As much as 500 to 700 volts may be necessary on the circuit shown to give a bright image.

It will, of course, be obvious that other systems of amplification may equally well be used, and there lies here an excellent field for the experimenter. We have purposely shown a perfectly straight method of amplification, but the number of valves and the quantity of H.T. might possibly be reduced by using other and more powerful circuit arrangements.





Side Elevation of Apparatus, showing Light Interrupter Disc with Motor, Projection Lump and Mirror.

#### Announcement

Readers are reminded that the construction of any television apparatus, as described in the issues of this Magazine constitutes an infringement of the Baird patents and renders the infringer liable to legal proceedings unless he is the possessor of the constructors' sub-licence that may be obtained in accordance with the offer herein contained on page 42.

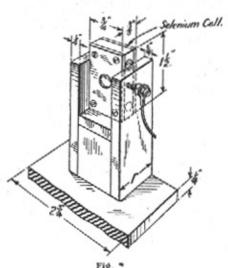
#### APPLICATION FORM.

In accordance with the offer contained on page 42 of the issue of "Television" for March, 1928,

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(description) hereby apply to Television Press, Limited, for the issue to me of a Constructor's Sub-LICENCE and agree to be bound by the provisions of such sub-licence.

. Having got the Neon tube to obey the light impulses we have finished the first part of our "televisor," and the most difficult part. The remaining constructional details to enable us to show an image will be given in the next issue. The present



article is the first of the series describing television in its very simplest form. Articles in subsequent issues will be published, using this first elementary "televisor" as a basis for further improvements and devices, always having the object in view to

make each step progressive and as cheap as possible. With this in view an endeavour will be made to incorporate, in the next televisor to be described, all parts purchased for the first set, so that the expense incurred may be looked upon as an investment of permanent value.

If any questions arise in the construction of this apparatus we shall be very pleased to answer any queries, which should be sent to the "Queries Department," enclosing a coupon cut from the current issue.

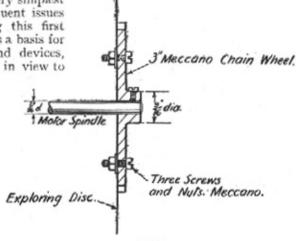


Fig. 9.

Full size Blue prints of the Discs may be obtained on application to the Editor, price 2/-.



It is proposed in this issue to give hints on the operation of the "Televisor" described in last month's issue, but before doing so certain improvements, mainly in the optical system, will be described and explained. In another article in this issue a specially developed amplifier is described which enables the H.T. voltage required to be reduced to 250.

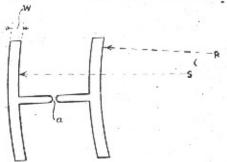
As originally designed, the optical system consisted simply of a concave mirror placed behind a 400 watt projector lamp at such a distance that an image of its filament was reflected on to the selenium cell.

Now the main disadvantage of this method is that the ordinary cheap concave mirror is not perfect, and consequently the image of the filament formed by those rays which pass through a given aperture in the spiral disc is not in the same position as the image formed by rays passing through any of the other apertures. Hence if the spiral disc be slowly rotated the image of the filament will be seen to wander within quite wide limits across the face of the cell, and, in addition, there will be noticed a fleeting and less brilliant image whose motion is in a vertical direction. This latter is formed in the same way as the image produced by a pinhole camera, the pinhole" in this case being one or other of the square apertures in the spiral disc.

#### New Optical System.

This difficulty may be largely overcome by using a pair of exactly similar converging lenses, either plano- or bi-convex. One of these is placed between the projector lamp and spiral disc so that the filament is at its principal focus, while the other is placed behind the spiral disc so as to focus the image of the filament on to the cell. The arrangement is shown diagrammatically in Figure 1, and it will be found to be very much better than a concave mirror. The lenses should be four to five inches in diameter and should have a focal length of about seven inches.

Another point which will require attention is the provision of some suitable screening for the projector lamp, as the light is very brilliant,



How the stencil is prepared. The radii S and R start from a common centre.

and in addition to being very trying to the eyes, it will mask the dim light of the neon tube. Any simple contrivance of box form made from sheet tin or cardboard is suitable, but if the latter is used plenty of space must be allowed, because a great deal of heat is radiated from the lamp. In any case some ventilation is advisable as a protection to the lens.

An additional refinement would be to substitute for the stencil holder (the holder for the object whose shadow is to be transmitted) described in last month's issue a "Bulldog" paper clip screwed by one arm to a wooden upright. This enables the stencil to be adjusted in position so that the best results may be obtained.

This concludes the suggested improvements to the original design, so that a few practical hints on operation may now be given.

#### Cutting the Stencils.

When considering objects the shadows of which are to be transmitted, simple stencils which the amateur can cut himself out of thin cardboard are perhaps the best with which to commence experiments. A very useful and instructive one is the letter H, and the cutting of such a stencil will be described in some detail.

As each of the square apertures in the spiral disc moves on a circular path, the limbs of the H will be curved in corresponding arcs, so the stencil must be cut accordingly (see Figure 2). Thin card or copper foil is suitable, and the material can be cut with a sharp penknife. It should preferably be coated with dead black celluloid paint after cutting. It is desirable to leave a small strengthening web in the centre of the horizontal crossbar of the H, as shown at a, Figure 2.

#### Correcting Image Reversal.

While on the subject of stencils, it should be mentioned that the image formed by this simple televisor may be described as a "focussing screen" image. That is to say, like the image seen on a camera focussing screen, it is upside down. Now, in the transmission of the shadow of the H stencil this defect will obviously not be very apparent; but the amateur should bear this fact in mind when constructing on the same principle stencils for the letters T, E, F, G, etc. The experimenter

may perhaps care to try the effect of focussing the received image on to a ground-glass screen by means of a converging lens. The resulting image will then be erect, but brilliance will be lost.

#### Working Adjustments.

Having made the stencil, it should now be adjusted in its holder, the projector lamp being switched on so that the shadow is thrown on to the spiral disc. The latter is then slowly rotated by hand and the passage of the square apertures over the shadow observed; the outermost aperture should trace exactly the outer vertical limb of the H, and the stencil should be adjusted until this is the case. When this has been achieved the innermost aperture should trace over the inner vertical limb, while the remaining light apertures should pass over the horizontal limb one by one, if the stencil has been cut accurately and the light beam is truly parallel.

The interruptor disc should then be started, and about 30-50 volts switched on in series with the sclenium cell. The filaments of the amplifier should then be switched on. Switch off the projector lamp and adjust the filament rheostats so that the amplifier does not oscillate. Oscillation is indicated by the neon tube, which will suddenly light up very brilliantly. Should this occur the last valve should be switched off, or it may be seriously damaged. The other filaments must be reduced in brilliancy before again switching on the last valve.

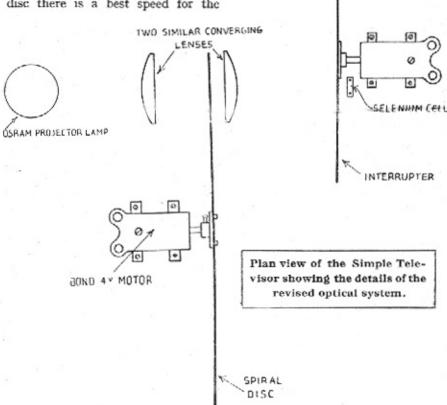
#### Focussing the Projector Lamp.

Having stabilised the amplifier, the description of which appears elsewhere in this issue, switch on the projector lamp and see that the image of the filament remains on the cell during the whole time of illumination of both the vertical limbs. While this is the case the neon tube should light up, but should remain dark when no light is falling on the cell. Once this condition is attained the motor driving the spiral disc should be switched on, and the speed adjusted by the rheostat until the image of the H is formed clearly and distinctly when the neon tube is looked at through the spiral disc.

It is necessary for the interruptor disc to be run very fast so that the picture has as fine a "grain" as possible. This will be more readily grasped if the stencil is removed and the appearance of the bright field of view at the receiving end is examined while the spiral disc is being speeded up. The faster the latter is run in relation to the speed of the interruptor the more will the field of view resemble a chessboard arrangement, and this can only be counteracted (i.e., so that the field is uniformly bright) by increasing the speed of the interruptor.

On the other hand, the faster the spiral disc is run the greater will be the number of complete pictures transmitted per second. That is to say, there will be less flicker. Thus, for a given speed of the interruptor disc there is a best speed for the image of the letter H. It will be observed to shift in the direction of rotation of the spiral disc to quite a noticeable extent, often as much as half an inch, while at the same time it broadens out.

In addition it will be noticed that whereas, at slow speeds, the upper and lower edges of the horizontal limb were sharp and well defined they now shade off gradually, while the whole broadens out considerably to



spiral disc. This best speed is a compromise between the two extreme conditions—a fine grain and a complete absence of flicker.

There is also a further consideration which limits the speed of both the spiral disc and the interruptor, and that is the lag of the selenium cell. This can be easily demonstrated. Keeping the frequency of interruption constant, speed up the spiral disc and watch the horizontal limb of the

perhaps more than twice its original width.

It is impossible in a single article to deal with all the possibilities of this little machine, or with all the experiments that can be performed with it. Enough has been said, however, to show the enormous scope there is for the amateur experimenter to modify or to improve the apparatus in accordance with the indications resulting from his own research.

Full size Blue Prints of the discs described in our last issue are still available, price 2/-; post free.



Last month we concluded our description of a simple televisor, which consisted of a transmitter and receiver combined, so that in consequence problems of synchronisation were not involved.

It is now proposed to show how, by building a separate receiving machine and by slightly modifying the original apparatus to form the transmitter, simple shadowgraphs may be transmitted over any distance. Two leads of twin flex form the sole connection between the two machines (one to carry the shadowgraph signals and one to carry the synchronising current), as the amateur would hardly care to go to the trouble and expense of fitting up a wireless transmitter and receiver for the purpose of transmitting the signals by wireless.

#### The Method Employed.

The method to be employed is briefly this: Instead of placing the neon tube behind the same spiral disc that is used for analysing the image, it is now going to be placed behind a second disc which may be situated at any desired distance away from the transmitter. Now, however, in order to see an image we must ensure that this second disc revolves at exactly the same speed as the first disc and continues to do so. In other words, the second disc must revolve in synchronism with the first disc.

One method of obtaining synchronism would be to control the motor driving the second disc with a fine control rheostat until the two discs were exactly in step. This is a very simple method, but constant readjustment is called for; the slightest variation will upset the received image.

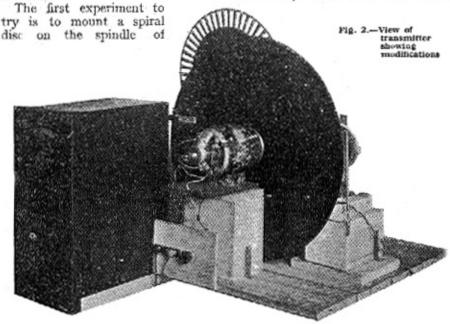
The method which will be described here consists in using to drive each of the spiral discs a D.C. motor coupled to a small A.C. generator. In the apparatus to be described two 200 w. W/T Newton motor-alternators were used, as these happened to be available, but any small motor-alternators would be equally suitable.

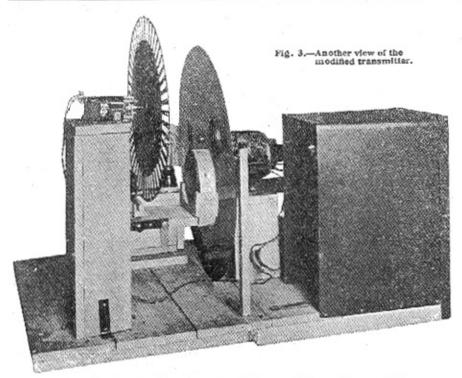
If Newton motor-alternators are used the connections will have to be traced out as the generator and D.C. motor are combined and housed in one aluminium shell. The field current for the A.C. side must be supplied between the centre carbon brush at one end of the spindle, and the frame. Field and armature connections are easily traced and the insertion of a 2 ohm variable resistance in the armature circuit will enable the speed to be controlled. A 6-volt accumulator will supply ample current for the purpose. The A.C. output comes from the two vacant plug holes in the ebonite block screwed to the side of the machine.

each alternator and connect the A.C. sides together, putting a small 3:5-volt flash lamp bulb in the circuit (see Fig. 1). A single-pole knife switch should also be arranged so that the small bulb can be short-circuited. Now supply about 6 volts (derived from the accumulators used to drive the D.C. motors) to the A.C. fields and set the motors going. Leave the shorting switch open and watch the small bulb. It will be seen to be flickering.

#### Synchronism Adjustments.

Now adjust the speed of one of the motors by varying the series armature resistance until a speed is reached when the bulb flickers at as slow a rate as possible; it should remain out for three or four seconds. While it is out close the knife switch, shorting the bulb. The two motors will now remain exactly in step, provided the original adjustment was sufficiently close and the knife





switch was closed at the correct instant.

If the two motors are observed both to slow down on shorting the bulb, this indicates that they are not synchronising, and the switch should again be opened and the adjustments repeated more carefully until success is achieved.

Having got the two discs revolving exactly in step the main difficulties are at an end. The connecting lead between the alternators may be of any desired length, and the flash lamp bulb and shorting switch may be conveniently mounted near the receiving apparatus.

#### Connections from Amplifier to Neon Tubes.

All that now remains to be done is to transfer the output leads from the amplifier to a neon tube which will be placed behind the receiving disc. This is most conveniently done by having a double-pole double-throw knife switch arranged so that the output from the amplifier may be thrown at will either to the neon tube on the transmitting machine or to the distant neon tube behind the receiving disc. This is for convenience, so that the amplifier may be adjusted by throwing over to the neon tube behind the disc at the transmitter, and then throwing the switch over so that the distant neon tube is illuminated, when the image should come through perfectly.

The amplifier and neon tube connections are the same as described in our last two issues.

#### Structural Alteration to Original Machine.

(See Figs. 2 and 3.)

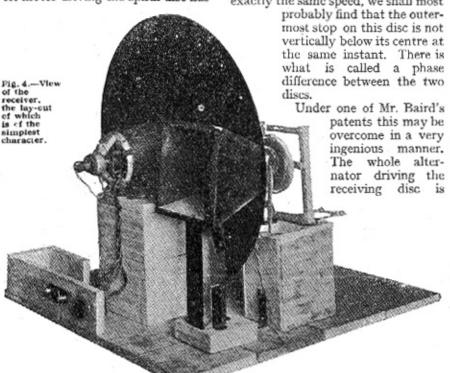
As will be seen from the photo, the original pedestal supporting the fourvolt motor driving the spiral disc has been reduced in height to 8 in., and a Newton motor-alternator mounted thereon, carrying the original spiral disc on its spindle. The addition of a double-pole double-throw knife switch from amplifier output to neon tube completes the list of alterations, the interruptor disc and motor, sclenium cell, projector lamp, etc., being retained intact.

#### Receiving Machine.

Obtain or make another spiral disc exactly similar to that at the transmitting end and mount it on the spindle of another similar motoralternator. Prepare a wooden baseboard about 18 in. by 24 in. and mount the alternator and its attached disc on a pedestal (about 8 in. high) fastened to the baseboard.

There now arises a point to which the amateur may care to devote some attention. While it is possible to get the two discs revolving at exactly the same speed, there is no guarantee at all that corresponding parts of the two discs will, at any given instant, be in corresponding positions.

To make this clearer, consider either of the two stops on the transmitting disc furthest from its centre. At some instant one of these stops will be vertically below the centre of the disc. Now, if we turn our attention to the receiving disc, running at exactly the same speed, we shall most



mounted so that its body may be rotated through any angle, and if this be done slowly, say, by means of a handle operating through worm gearing, it will be found that the phase difference can be corrected without upsetting the synchronism. Obviously the use of a jerky or rapid motion will put the discs out of step. The effect on the received image of this "phase difference" is to displace it sideways to left or right, so that it is part in, part out of the field of view.

The effect is similar in many respects to the corresponding effect sometimes seen in a cinematograph theatre where a black bar appears across the screen. Above this bar a portion of the picture appears, and below it another part of the picture is seen. The only difference is that in this case the displacement of the image is in a vertical direction instead of sideways.

In the machine shown in Figs. 4 and 5 this phase-correcting refinement has been omitted for the sake of simplicity, but the amateur who cares to try it should find no difficulty in designing a simple arrangement to suit his own motor-alternator.

In the photo there will also be seen a neon tube on a pedestal, behind which is placed a 4-in. concave mirror, and in front of which is a ground-glass or ground gelatine screen. This neon tube is connected at will through the D.P.D.T. knife switch previously mentioned to the output of the amplifier.

This completes the receiving set, which will be seen to be a comparatively simple piece of apparatus.

#### General Remarks.

The experimenter will soon find that the simplest way to get his discs synchronised is to watch the image at the receiving machine, the flash lamp bulb being shorted, before any trouble is taken to get the discs properly synchronised. It will then be noticed that the received image, instead of being stationary, is in motion either in an upward or downward direction. If the image moves in the direction of rotation of the receiving disc the latter is going too fast, so that more resistance is needed in the armature circuit of the driving motor.

If, however, the motion of the image is opposite to the motion of the

disc, the latter must be speeded up by cutting out some of the armature resistance. In this manner it will be found quite easy to adjust the armature resistance until the image is perfectly steady, and the synchronising current will then control the speed so that the discs always remain perfectly in step.

Then if the receiving set has been fitted with an adjustment for "phasing," as explained above, this may be used to bring the picture to the centre of the field of view. If no special adjustment has been fitted for the purpose, the entire carcase of the motor-alternator will have to be slowly and steadily rotated by hand. To facilitate this adjustment the top of the pedestal supporting the motor-alternator may be shaped like a cradle, so that the cylindrical carcase of the motor can rest in it and be turned freely.

#### Suggestions for Research.

While the above method of synchronisation with the spiral discs mounted directly on the spindles of the motor-alternators is quite satisfactory, it is really somewhat easier to obtain perfect synchronism with

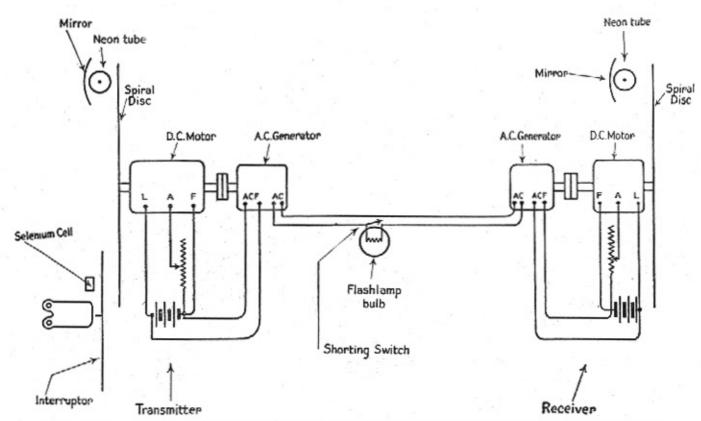
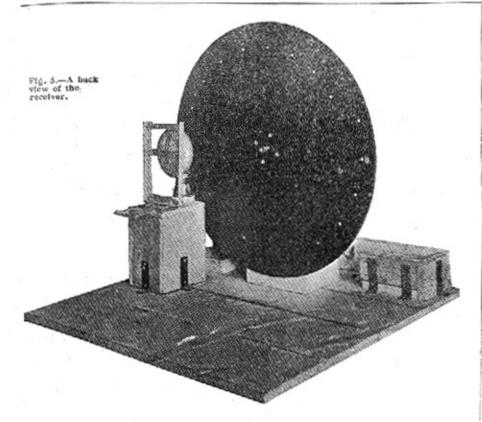


Fig. 1.—Diagrammatic sketch of arrangement of transmitter and receiver. Projector lamp, optical system, and a nutifier have been omitted for the sake of clearness.



complete absence of hunting (a peculiar up and-down swing of the image) by making the alternators run at higher speeds. The present arrangements limit their speed to about 120 r.p.m., because the best all-round speed for the discs is determined by the fact that about 240 images per minute will be found to be the most convenient number to transmit.

Certainly 400 pictures per minute should not be exceeded, or difficulties will be encountered, due to the lag of the selenium cell. Note that two images are transmitted per revolution of the disc, there being two spiral sets of holes in each disc. An obvious refinement is some simple system of gearing made up from "Meccano" parts, of 3 or 4 to 1 ratio.

Again, the amateur may wish to increase the detail in the received image. This may be done by having only one spiral of holes in each disc. For a given width of picture this will double the detail obtainable. Two discs made on this plan will well repay the trouble of making them, as much more complicated shadowgraphs may be transmitted with their aid. It will also be found that the problem of synchronism will be easier of solution, for the discs can be run at twice their former speed.

#### Announcement

With reference to Condition (2) of the Baird Television Constructor's Sub-Licences granted to readers of this journal by Television Press or by the Television Society, the Editor takes pleasure in announcing that the Baird Television Development Co. has signified its agreement to the apparatus described and illustrated in the foregoing article being included in such licences, and holders thereof may therefore construct and use this apparatus in accordance with the terms of such Sub-Licence.

# review that became a TRIBUTE



"Celestion" Model C.12, the subject of this striking testimony.

The following review of "Celestion" from "POPULAR WIRELESS" is of particular importance to listeners, coming as it does from a foremost radio journal:—

"We found Celestion model C.r2 perfectly satisfactory on each of the several sets with which it was tested, ranging from two valves to a multivalver of the super kind."

"It is some time since we have experienced so much pleasure during a loud speaker test and we have no hesitation in saying that we consider this 'Celestion' a long way ahead of its class. Those of our readers who have the opportunity should endeavour to hear it in operation. We are sure they will agree with us when we say it is a revelation in what sound design and construction mean to such an instrument."

P.W.31/3/28.

Write for illustrated folder and also for new Gramophone Pick-up leaflet.

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