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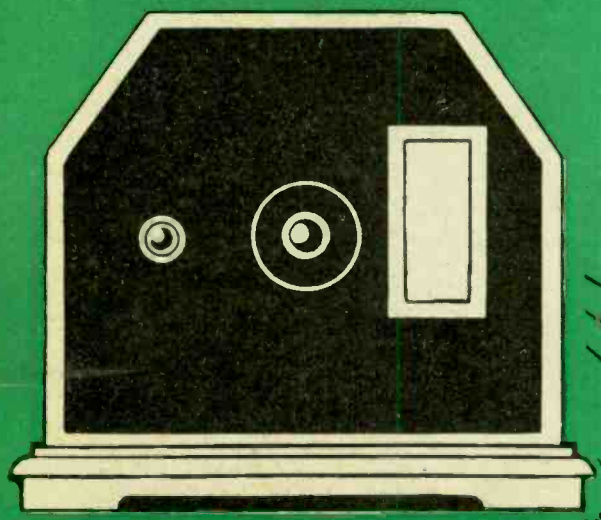

FEBRUARY, 1933

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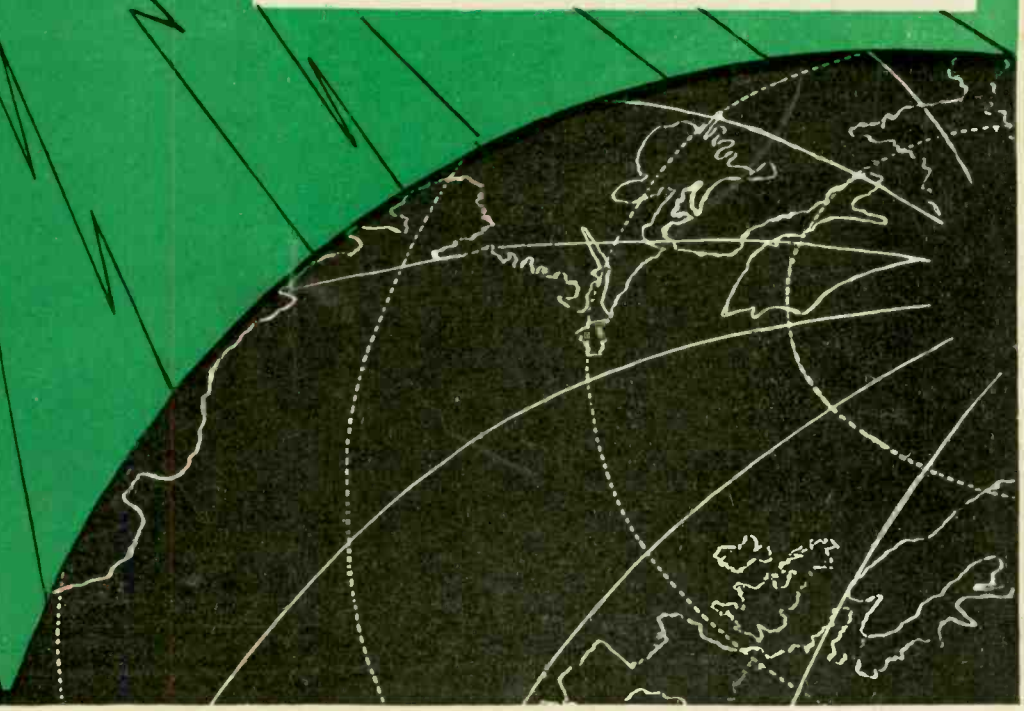

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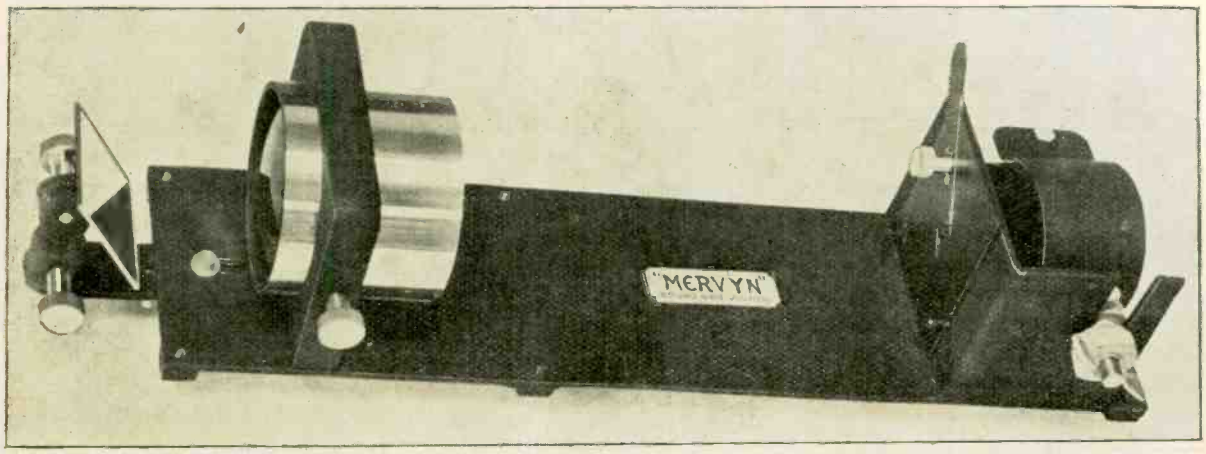

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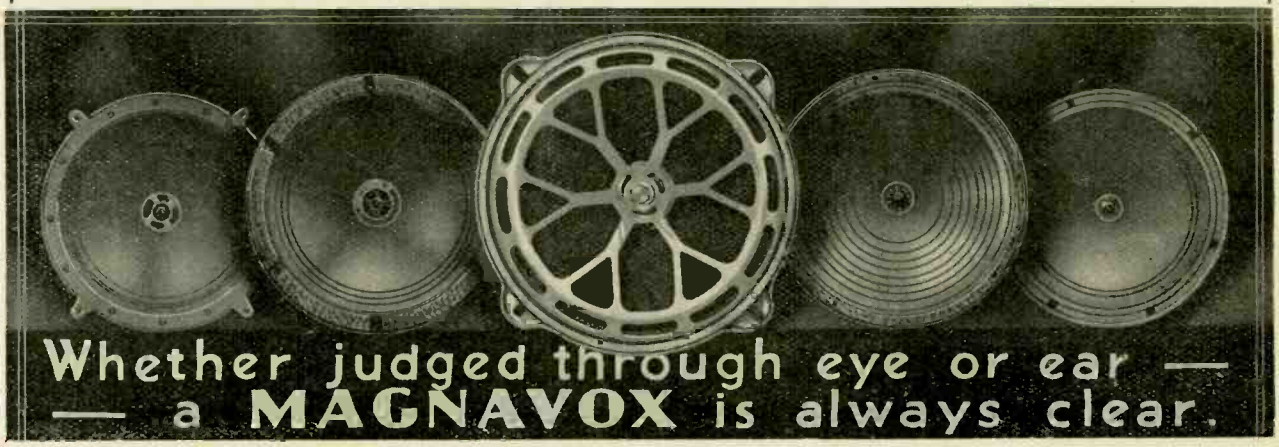

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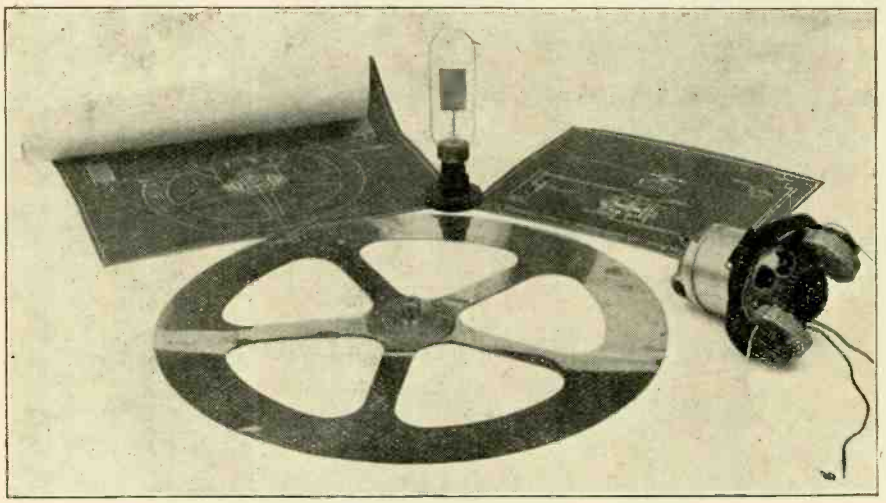

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Notes of the Month

WE are interested to note that the B.B.C. engineers have inspected the television system on which Electrical and Musical Industries, Ltd., better known as H.M.V., have been working for some while. It is reported that a 200 line picture is produced on ultra-short waves which give, of course, a much clearer image than is obtained on the present wave-length. The B.B.C. are continuing their experiments with television on the 7-metre transmitter at Broadcasting House, and no doubt the H.M.V. engineers have their eye on the future in concentrating their efforts on short-wave apparatus. Meanwhile the Baird Company is experimenting with a cathode ray tube, which is used at the receiving end in conjunction with the present mechanical transmitter. This interesting development is described on another page.

* * * * *

Two readers report that they successfully picked up a television transmission from Leningrad on the same evening. Both, curiously enough, live in the same neighbourhood and were unaware that the other had received the programme. The Russians apparently lack the resources of Mr. Robb and his colleagues at the B.B.C. The pictures were "stills" and consisted of posters, portraits of Stalin, and "a man with folded arms." The images were, however, quite distinct, although inverted. Leningrad uses vertical scanning, with 30 lines and 12.5 frames per second. We should be interested to hear from any other lookers who have picked up this station.

* * * * *

Among our national institutions, *Punch* can claim a very high place, with the result that to be noticed in its columns amounts to proof of national status. Television has achieved this distinction. We reproduced a cartoon not long ago showing a doctor confronted with a "close-up" of his patient's tongue on a screen, and last month another television sketch appeared. This time the victim was an "amateur scientist," who was shown resisting the invitation of a bachelor friend to join him on a night out. The caption read: "Sorry I can't join you, old man. My wife has gone to her mother's and I promised to sit at this television transmitter every night until she returns"! The difficulties which may arise when every telephone is fitted with television have often been foreseen, but we think the hen-pecked husband is a "new one" in this connection. As usual, *Punch* is to be congratulated on being well abreast of the times.

* * * * *

In view of the rather undignified controversy as to whether certain artistes shall be allowed to broadcast, it is pleasant to read of the wholehearted support of at least one great actress for radio. We should not expect Madame Delysia to express things by halves, and after her first experience in the television studio she said that she "felt like a moth before the candle, fascinated by that red light. I couldn't take my eyes away from it." As Delysia stepped into a taxi outside Broadcasting House her last remark was that she "wanted to come again." We hope that her wish will soon be realised.

* * * * *

The suitability of the puppet show for television was discussed in these columns a few months ago. Since then puppets have been included in the B.B.C. programmes. Although some lookers thought the dolls too small to be suitable, Mr. A. R. Philpott who staged the show is convinced of the possibilities for his art. He writes to say that, after the try-out of his legitimate set, painted black and white for the occasion, he has been busy making a special television outfit and stage. Mr. Philpott has had a large experience of children and shares our view that television should be included in the Children's Hour.

Picture Shape in Television

By H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E.

I AM repeatedly coming across cases where confusion seems to exist as to the "shape" of the picture obtained by television. This is a very important side of the problem of reception, as a failure to appreciate certain fundamental details will evidence itself in an image which, in effect, is mechanically distorted. No matter how perfect the marking out and punching of the apertures in a disc, the care taken will be completely nullified unless the constructor is

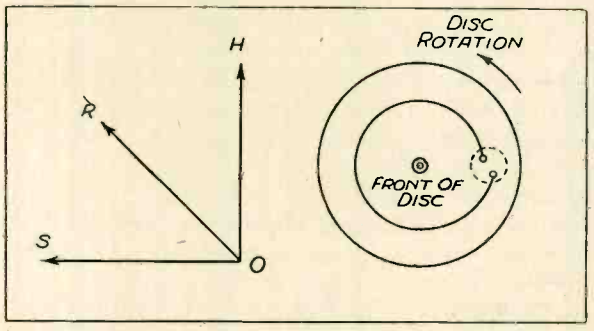


Fig. 1. *(Left) Direction of scanning. (Right) Disc rotation.*

quite familiar with the methods which must be adopted in calculating hole size.

In many cases I find that the amateur arbitrarily decides that the actual picture width on his disc shall be one inch. He then divides this by thirty, since there are thirty holes in the disc used to receive the transmissions now being sent out by the B.B.C. Having drawn his radii so that individually they subtend an angle of twelve degrees at the disc centre, he proceeds to mark off the aperture positions so that the distance of each from the disc centre is progressively reduced by one-thirtieth of an inch on neighbouring radii.

This is quite a mistake, for several other factors have to be taken into account, and a definite relationship exists between each dimension according to the ratio of the picture, that is, length to breadth or height to breadth, the number of holes to be employed and the diameter of the disc.

It is with the object of clearing up this confusion that I have been prompted to write this article, which may also be of use to those who have recently addressed questions on the point through the TELEVISION Enquiry Service. Unfortunately the science of television is young and there is at present no uniformity of standard in the various types of transmisions, but it is to be hoped that in the future this difficulty will be cleared up to the satisfaction of all. In the meantime the facts have to be faced.

First of all let us take the case of the B.B.C. transmissions which are sent out according to the Baird standards. The direction of scanning is vertical, being remembered as follows:—Hole movement from bottom to top and strip movement from right to left. This is shown in Fig. 1 (left). OH indicates hole movement, and OS strip movement. Memorising the direction OR will therefore ensure that readers get these two points correct.

The direction of rotation of the disc is anti-clockwise when facing the front, while the single-turn spiral on which the holes are marked is clockwise towards the centre, as in Fig. 1 (right). The neon lamp is mounted on the right hand side of the disc at the back, the centre of the neon glow area being on a horizontal line from the centre O as shown diagrammatically by the small dotted circle.

Having got these points clear in mind let us turn attention more to disc details. In Fig. 2 (left) I have shown the first hole of the spiral of apertures at Q and the last hole at R. If the radial lines PR and QS were continued till they intersect, then the angle subtended with the thirty hole Baird standard we are considering would be twelve degrees, that is 360° divided by 30.

What now is regarded as the "height" of the picture for the area bounded by the radial lines PR and QS and the two arcs PQ and RS really represents the resultant light area, which is exposed by our disc when scanning the glowing neon. The correct height of the picture is not the *arc* PQ but the *chord* PQ. It is measured on the circle marked out by the outer edge of the first hole. For the width of the picture we take the radial distance PR, that is the radial difference between the outer edge of the first hole and the inner edge of the thirtieth or last hole.

No doubt from time to time readers have seen it mentioned that the ratio of height to breadth in a Baird television image is $\frac{7}{3}$. This is correct, and from our previous reasoning and still

referring to Fig. 2 (left) we have the following simple equation established:

$$\frac{\text{Chord PQ}}{\text{PR}} = \frac{7}{3}$$

All these points have to be committed to memory or recorded in an accessible notebook before any attempt can be made to find the size of the disc hole. Comes now the simple calculation for determining this last mentioned point and we now refer to Fig. 2 (bottom). Here we have our picture area PQRS with the radial lines continued so that they intersect at O. We require first of all to know the length of the chord PQ which we will call h, the height of the picture.

Let r be the length of the radius to the outer edge of the first hole, that is OQ, then since the triangle OPT is a right-angled one and PT is half PQ we have by simple trigonometry that

$$h = 2r \sin 6°$$
$$= .20906\, r$$

Now let w be the width of our picture, that is RP, and from our first equation we have

$$\frac{h}{w} = \frac{7}{3} = \frac{.20906\, r}{w}$$

Furthermore if each disc aperture is to be a square hole, and since there are thirty of them, it is only simple arithmetic to determine the size. From our last equation we have

$$w = \frac{3}{7} \times .20906\, r$$
$$= .08959\, r$$

Therefore, each hole must be one thirtieth of this, or .002986r.

To take a case in point a very popular disc size is ten inches external diameter. If we start the first hole half-an-inch inside the outer edge then r =9.5 and in consequence we have

h = 1.986 inches.
w = 0.851 inch
Hole size = 0.0284 inch

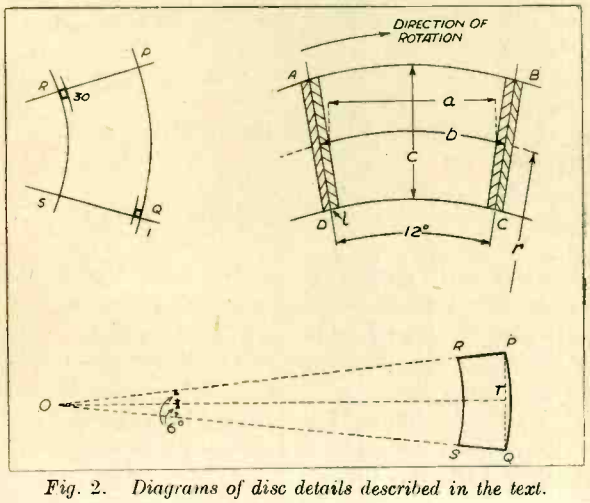


Fig. 2. Diagrams of disc details described in the text.

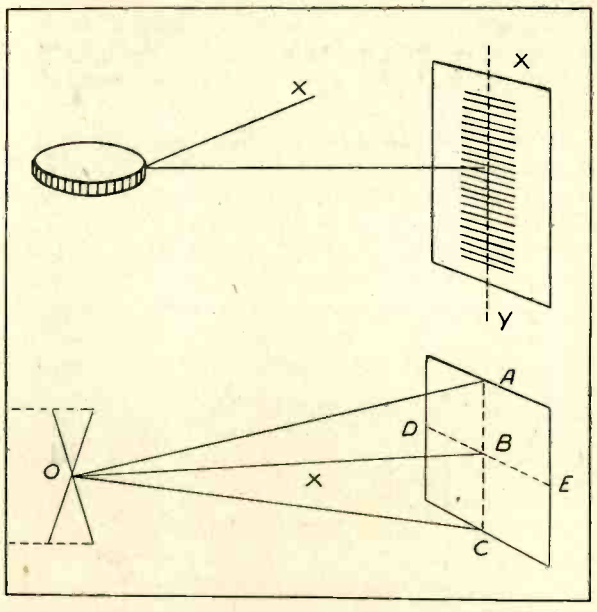


Fig. 3. Diagrams to assist in the adjustment of mirrors on the drum.

Of course if any constructor desires to fix the width of his picture to start with, then it is a very simple matter to use the derived equations and work backwards, but in any case the various steps in the derivation which I have purposely dealt with at length to save any future misunderstanding, will no doubt clear up many of the difficulties which amateurs have encountered in their work. A disc *properly made* from this data will at least be free from mechanical distortion, and that will leave the user free to study the electrical effects.

Several months ago I described in these columns details concerning the thirty-hole German television transmissions, but in order to make this review of the question quite complete and enable those inclined to pick up these German images on the proper type of disc, I think it advisable to show where the differences exist between the English and German standards. First of all, while the B.B.C. transmissions are based on vertical scanning in an anti-clockwise direction, the German transmissions are designed for horizontal scanning in a clockwise direction. Any image received in this country is therefore not only turned through 90 degrees but is reversed. Furthermore, since the English picture ratio is 7 to 3 and the German ratio 4 to 3 the resultant images when seen on a standard English disc are distorted.

In arriving at the relationships which exist between disc dimensions and picture shape, certain departures from the method just described have to be made. A reference to Fig. 2 (right) will help to make this clear.

First of all, although the rotation of the scanning disc is in the reverse direction to this country, the scanning of the images is such that the apertures of the receiving disc as seen from the front by the "looker" traverse the neon light field ABCD so that they start from the left at the top line and finish at the right on the bottom line. In addition there is a definite mark off of one hole at each side of the picture field in order to provide a synchronising signal. According to German reckoning the true image ratio of Fig. 2 (right) is

$$\frac{a}{c} = \frac{4}{3}$$

The total mean breadth, however, is really equivalent to 42 square holes, and this corresponds to the dimension shown as b. With these points to guide us we have the following equations at our service from which any calculations can be made.

The total number of horizontal light strips in one image is 30. Hence if l is the width of one square aperture then the height of the picture is given by $c = 30\ l$.

The width $b = a + 2\ l$ while the average radius can be stated as

$$r = \frac{30\ b}{2\pi}$$

Therefore $b = \dfrac{2\pi r}{30} = 42\ l$

The dimension which is generally decided by the constructor himself is the mean radius r and then it is quite a simple matter to calculate the the other quantities from the equations we have just derived.

Now just a word in conclusion concerning the adjusting of the mirrors on a drum so that the spacing between them is such that they produce a light field of the correct ratio. Apparently one or two readers failed to understand thoroughly my remarks in TELEVISION last November.

In Fig. 3 (top), we have a spot of light focussed from a suitable source—an old galvanometer lamp was suggested—so that when this light is reflected from a mirror it falls on a vertical screen say of thick drawing paper mounted on a board. Now the screen should be of sufficient size to receive two spots of light due to reflections on two adjacent mirrors of the drum when the beam from the lamp is passing over the point between them. Also it must be noted that the teeth holding these mirrors are exactly at right angles to the drum surface and the distance between these spots on the screen should be measured carefully. If the reader is not sure of the mirrors being at right angles he can take an average between three or four pairs approximately correct. Then calculate three sevenths of this distance (this is to take account of the 7 by 3 ratio picture used) and measure it along the line XY of Fig. 3. Finally, divide this measured distance into thirty equal divisions numbering them 1 to 30 from the top. It is now an easy matter to adjust the position of each mirror in the manner outlined on page 329 of the November issue, and you will have a resultant light field conforming to the English standard. For the mathematically inclined it will be useful to give a small calculation which will prove useful when dealing with mirror drums. In Fig. 3 (bottom), suppose the two lines crossing at the point O on the left of the diagram represent the first and last mirrors on a drum periphery having n mirrors. Let Θ be the angle subtended between the two mirrors and assume the perspective rectangle on the right of the diagram is the total area of light traced out by the n mirrors when the drum rotates.

The "breadth" of the picture area, that is AC, which we will call b as in our first calculation for the Baird standard disc, then becomes

$$b = 2\ x\ \Theta$$

where x is the distance OB.

For the height of the picture area we have the length DE, and calling this h (as before) and assuming n mirrors as originally stated we have

$$h = 2\ x\ \tan \frac{2\pi}{n}$$

With the English ratio picture we have

$$h = \frac{7}{3}\ b$$

Therefore

$$2\ x\ \tan \frac{2\pi}{n} = \frac{7}{3} \times 2\ \Theta\ x$$

Hence

$$\Theta = \frac{3}{7} \tan \frac{2\pi}{n}$$

For an approximation we can say

$$\Theta = \frac{3}{7} \times \frac{2\pi}{n}$$

and if n is thirty to suit the B.B.C. transmissions then

$$\Theta = \frac{3}{7} \times \frac{360}{30} = \frac{36}{7} = 5 \text{ degrees (approx.)}$$

Readers will gather from this that the angle between the first and last mirrors for a mirror drum of the Baird standard is therefore only slightly more than five degrees. Since the angle between individual mirrors is one thirtieth of this, it will be appreciated that the construction of a correct drum calls for very great care and skill in workmanship.

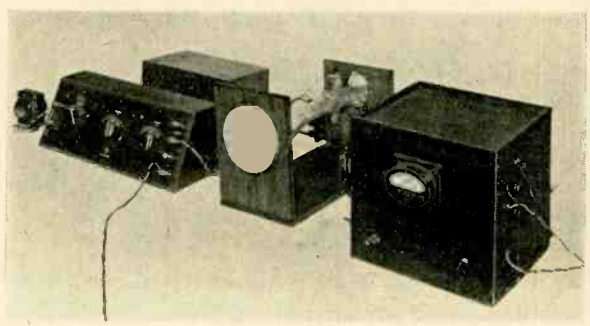
New Research on Cathode Rays

By a Special Correspondent

QUITE recently the cathode ray tube has been brought into considerable prominence in the field of television research. Great claims have been made on its behalf and its protagonists go so far as to say that mechanical methods must give place to it. That may be so, but it must not be forgotten that the use of the cathode ray oscillograph for television purposes is by no means new. It was in fact embodied in one of the earliest television systems proposed, namely, that of Boris Rosing who patented such a system as far back as 1907.

Realising that if the cathode ray tube could be made to function in a properly controlled manner it would provide another medium for presenting television, the Baird Company has carried out an extensive experimental investigation into the subject. In all the experiments a mechanical transmitter was used, the cathode ray tube being employed only at the receiving end. As a matter of fact, except for the transmission of transparencies, that is, films, slides, etc., very little success seems to have attended the attempts made to use the cathode ray tube as a transmitting device.

There are two main problems that arise in connection with cathode ray tubes. First of all, the ray must be made to scan the fluorescent screen in a manner exactly similar to that of the more usual and better understood light spot. Secondly, the intensity of this ray has to be varied according to the degrees of brightness



The cathode ray tube connected to the apparatus.

of the various elements of the resulting image, that is to say, it has to be modulated.

Dealing with the first problem, in order to receive the standard type of transmission now being sent out by the B.B.C., it is necessary to use two "saw tooth" oscillators with frequencies of 375 and 12.5 cycles per second respectively. "Saw tooth" oscillations are produced quite easily in several ways. For example, it is possible to use oscillating neon tubes, but the synchronising of these scanning frequencies then becomes a matter of some difficulty and calls for very delicate apparatus. Again, use can be

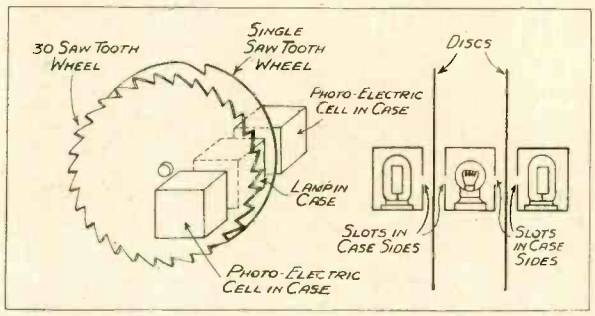


Diagram of apparatus showing "saw tooth" discs.

made of standard 50-cycle A.C. mains, but here it is essential that the frequency be absolutely accurate and this is not always so.

In the laboratory experiments undertaken, a very suitable source of scanning potentials was obtained by securing two discs on the shaft of a small motor which had been fitted with the ordinary cogged wheel synchronising gear. One disc had thirty "saw tooth" cuts on its periphery, while the other disc was so constructed that its edge formed one "saw tooth." Two photo-electric cells arranged behind respective slots received light which was interrupted by the teeth on the edge of each disc in the manner shown in the diagram and the photo-electric currents when amplified were fed to the deflecting plates on the cathode ray tube.

The problem of modulating the cathode ray is equally difficult. The brightness of the spot on the fluorescent screen can be varied either by changing the velocity of the electrons forming the ray or by controlling the number of electrons which form the ray. The difficulty with the first method is that the extent to which the ray is deflected depends on its velocity as well as the intensity of the deflecting. Therefore, instead of obtaining even scanning, entirely controlled by the scanning potentials, the momentary position of impingment of the ray also depends on its velocity. This was overcome in the case under review by superimposing the picture signal on to the scanning oscillations, so that when the velocity of the ray was reduced the scanning

potential was also reduced in order to counteract the deflectional error otherwise introduced.

In order to experiment with modulation by the method of varying the number of electrons in the cathode ray, an interesting tube was built up in the laboratories. In addition to the usual electrodes, other electrodes have been introduced within the glass.

In its journey from cathode to accelerator the ray has to pass between a pair of small electrodes, and by means of a potential applied between the electrodes, the ray can be deflected so that instead of passing through the aperture in the accelerator some of the ray is intercepted. By superimposing the picture signals on to these plates the ray is then modulated. The second pair of small electrodes work in the opposite manner in order to "straighten out" the deflected ray after it has passed through the accelerator, while a charged cylinder also helps in this process of centralisation.

Although some very good results have been obtained from these experiments, the apparatus still appears to be far too critical to be of much commercial value up to the present. The mechanical system undoubtedly gives better results, while having the advantage of being comparatively simple in operation. This description must not be taken as representing the Baird Co.'s present cathode ray work but explains certain past research and is all that can be disclosed at present.

Our Questionnaire

The enthusiastic response to the questionnaire published in last month's issue suggests that there is more interest in television in the Midlands and North of England than in the south or west, or even in London. Twenty-five per cent. of the replies are, however, from London and the suburbs. The following analysis of the answers forms an interesting summary of the current interest in television throughout the country.

The number of people who see each copy of TELEVISION is on an average four, although some copies are read by as many as eight or ten "lookers." (The correspondent whose answer to this question is "none," seems to be wasting his subscription!)

Technical and constructional articles are the most popular, and the "enthusiast" series is appreciated by almost all readers. News from abroad, however, and "Spectator's" monthly review of the B.B.C. programmes also have their following. A number of readers are primarily interested in accounts of the latest progress in the design of receivers and transmitters. All the replies show an interest in radio construction, although many readers amplify their answer to this question by stating that their interest is confined to radio construction which has a direct bearing on television.

Sound and Vision

All readers possessing vision apparatus look-in to the B.B.C. programmes, many to every programme and few on less than two nights a week. The opinion that television is proving a boon to the radio manufacturers, for the reason that a second radio receiver is required, has been discounted by certain critics who suggest that a good many people were content to receive the vision signals only, thus using one set for the purpose. It was this that prompted our question "Do you receive sound as well as vision?" and the answers show that all our correspondents receive both. In most households three to four people look-in, on an average. Head and shoulder scenes are best received, although a small proportion of lookers have found semi-extended views more satisfactory.

To the question, "What appeals to you most in the programmes?" nearly thirty per cent. think dancing the most suitable medium, while a large proportion votes for character sketches, acrobatic turns and light comedians. It is clear that plenty of movement is essential.

As far as receiving apparatus is concerned, sixty per cent. use mains receivers, twenty per cent. battery, and the remainder both. A small proportion of readers have no sets at present, but are busy constructing them. About half the replies state that scanning discs are used, but many of those who are not at present using mirror drums are already constructing them. Only three per cent. of our readers are not familiar with circuit diagrams, technical terms, etc., which confirms the view that television appeals to the most advanced section of the radio public, this again being an important indication for the radio manufacturer.

Most readers have found difficulty in replying to the last question, "Which is the best programme so far?" but the choice seems to lie between Dick Whittington, Delysia and St. Andrew's Night. Judging from many replies, reception seems to have been consistently good during the last week in December. As an entertainment December 28 was a popular programme, while the Spanish night also seems to have been widely appreciated. The Editor wishes to thank all those who responded to this inquiry, which provides further evidence of the whole-hearted co-operation by which the success of TELEVISION has been achieved.

A Controversy and its Outcome

By John Benn

WHEN Benn Brothers, Ltd., acquired TELEVISION last June, their early connection with the science was recalled by reprinting the first article which Mr. Baird had contributed to *Discovery* in April, 1925. He was at that time seeking financial support to develop his invention and shortly afterwards, on taking over the editorship of *Discovery*, I began to follow the fortunes of this enterprising Scotsman with keen interest. From time to time I was invited to see demonstrations in the experimental stage and to record my impressions in that journal, which was among the first to take television seriously.

The other evening I happened to refer to some past volumes and I felt a certain curiosity in re-reading these notes in the light of subsequent events. For example, optimistic comments had aroused the scorn of a well-known F.R.S., who was at considerable pains to prove that television by the scanning method was incapable of any progress! This lead to a controversy which may be of interest to readers of TELEVISION, and particularly to anyone who is still inclined to be sceptical about the future.

New Ideas

Nearly every invention that has become common-place to-day was at one time regarded with scepticism. Most people are conservative when faced with new ideas and this certainly proved to be the case as regards television, even on the part of "experts." But before describing the controversy into which I was drawn, let me recall how I first came to be interested in television.

Early in 1926 I introduced a monthly section devoted to radio, which was still a comparatively new field for the general public. In some comments on the short-wave telegraphic service inaugurated that year with the Dominions, it is noted that "Mr. Marconi confidently expects that the system can be utilised for broadcasting and even for such new applications as television."

The first radio telephone service was opened between London and New York in January, 1927 and just twelve months later this was followed by the first transmission of a television image across the Atlantic. This remarkable achievement was a convincing proof of the potentialities of television, and it was soon possible to report further progress.

To begin with, I find a note welcoming the appearance of TELEVISION, but regretting that the first of a series of articles on future developments should be devoted to television in warfare. "Probably," I commented, "few discoveries are made which do not have undesirable as well as useful applications, but Mr. Baird himself has publicly expressed the hope that other peaceful uses may be found for his invention. In making this criticism we are not overlooking the argument that every additional horror should serve to make war less readily undertaken, but this, in our opinion, is closely related to the fallacy that preparation for war is the best defence against it." The reference to Mr. Baird's views related to noctovision, which had just been successfully achieved.

"Darkness," he said, "the great cloak for military operations, will no longer give so much security, but it is to be hoped that other uses may be found in peace for this latest development of televison. The fact that infra-red rays possess great fog penetrating powers opens up possibilities for their use in connection with commercial navigation."

In the following autumn the B.B.C. gave the first public transmission of wireless pictures by the Fultograph process from the Daventry 5 XX station, to see whether there was a demand for the broadcasting of sporting and other topical photographs. The official statement was accompanied by a reminder that the process must not be confused with television—"a warning by no means superfluous in view of the recklessness with which even the leading newspapers continue to confuse these terms." The B.B.C. went on to say, in view of "current rumours," that it had "not so far been approached with a television apparatus of so practical a nature as to make television possible on a service basis." Presumably the current rumours concerned Mr. Baird's statement to the Press that his company was "quite ready" to begin television broadcasting.

A Report from America

At about this time a demonstration was reported from America by the General Electric Company, which televised a play over a distance of eight miles. This prompted Mr. A. A. Campbell Swinton, F.R.S., to write to *Discovery* questioning the basic principles of the scanning method

of television and his article in November, 1928, may be said to have represented the views of "opposition" at that date.

As a basis for comparison Mr. Swinton examined the elements required to reproduce a newspaper photograph, pointing out that "the number of dots of which the picture is composed is very large, as, for instance in a recent one in the *Times* depicting the Eton and Harrow match, measuring about 16 inches by 10 inches in size, the grains or dots amounted to over a quarter of a million, or about 1,500 to the square inch." On the other hand, in the best television pictures so far obtained, the "light bands employed do not exceed about 50 in number, and if we make the reasonable assumption that these are each divided up individually into 50 parts, the total number of elements we have wherewith to construct the whole picture only amounts to 2,500 in all. Now with so small a number, obviously only the simplest of very small pictures can be constructed, and seeing that each has to be registered 16 times per second, we have a total of 40,000 to be dealt with per second, which is about as much as the present mechanical factors can manage."

To give an idea of what the newspapers called "wonderfully successful television," Mr. Swinton proceeded to comment on the American concern which had "made a pretence—one can call it nothing else—of transmitting a play by television." A play containing only two characters had been selected and (he added indignantly!) "what was actually transmitted and received on a screen only four inches square were images of only the heads and shoulders of the two performers." What this critic expected of this initial experiment he did not bother to explain, but concluded by ridiculing the fact that in the past two years "only a single facsimile of a portrait transmitted by television" had been published, this being "supposed to represent a man's face but can only, with some degree of imagination, be recognised as such."

Exposing a Fallacy

The fallacy of comparing still photographs and television images was not difficult to expose, and I remember arguing at the Athenæum with Mr. Swinton on the distinction which he seemed incapable of recognising and certainly would not admit. An editorial note published with the article explained that *Discovery* could not entirely agree with its contributor's pessimistic comparison with other forms of pictorial reproduction. "The two ideas are by no means comparable," I wrote. "The chief object of television must be to convey a transient impression through the medium of the eye. Other forms of reproduction are by their nature permanent records."

This view was supported in a letter from Mr. V. E. Pullin, the director of Radiological Research at Woolwich, who pointed out that television should convey, over great distances, "a vivid mental impression . . . it must be the instantaneous transmission of a transient scene, for example the changing expression on a human face, without the interposition of photographic films, plates or developing materials. If these conditions are to be fulfilled, then obviously the transmission must be extraordinarily rapid." Mr. Pullin stated that television had apparently yielded the required result and although still far from perfect, "the achievement is in a class by itself and must be judged by comparison with results which satisfy similar conditions."

Cathode Rays

In fairness to the late Mr. Campbell Swinton, who was a very sincere critic of television, it must be added that he thought the solution would be provided by cathode rays. Until some such method was available "whereby the present limitations of mechanical methods may be eliminated," he concluded, "it is scarcely open to much doubt that the promised televising of extensive scenes, such as a cricket match at Lord's or the race for the Derby, will remain impossible of achievement." The writer did not, unfortunately, live long enough to see the Derby televised by this same "mechanical" method, but I cannot help wondering how he would have reacted to this final blow to his views.

In the same issue (November, 1928) I gave some impressions of a visit to the Baird studios, at which I had been invited to see the latest demonstration. "The blurred facial image of a year ago," I reported, "has now given way to a fairly distinct picture, and the gold-rimmed spectacles of the sitter were clearly seen on the receiver as the head moved from side to side. Furthermore, in place of the battery of high-powered lamps to which the sitter was exposed before, a single beam of light now suffices for illumination."

Referring to the "flickering" of the image, however, I said that if this disturbance could not be removed, "the day when larger scenes can be transmitted is evidently a long way off." No doubt this factor was one cause for the failure at that time to satisfy the authorities that a trial through a B.B.C. broadcasting station was yet justified.

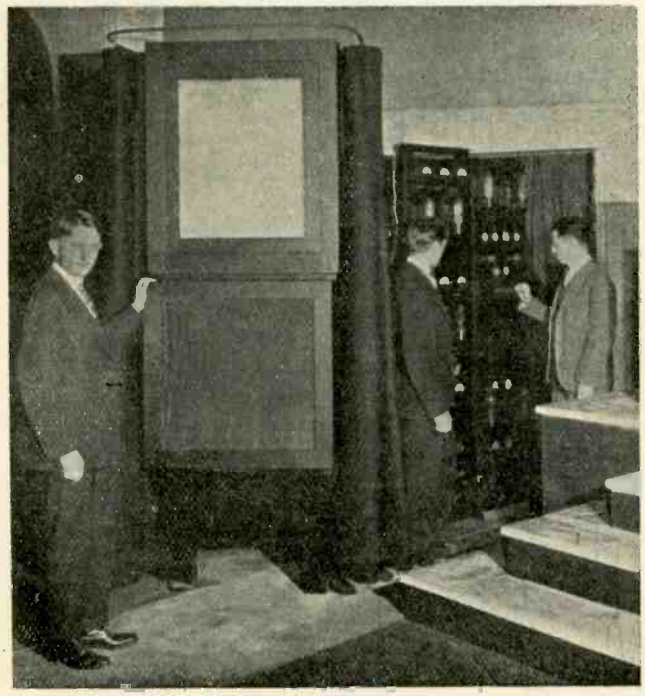
Fortunately further improvements were made in the apparatus and the "flickering" was gradually reduced to neglible proportions, with

the result that ten months later, on September 30, 1929, the first B.B.C. experimental transmission was given from 2 LO between 11 and 11 a.m. Mr. Baird again wrote for *Discovery*, but whereas in 1925 he had had to explain what the word television meant—it was so new to readers—he was now able to head his article "Television Enters Public Life."

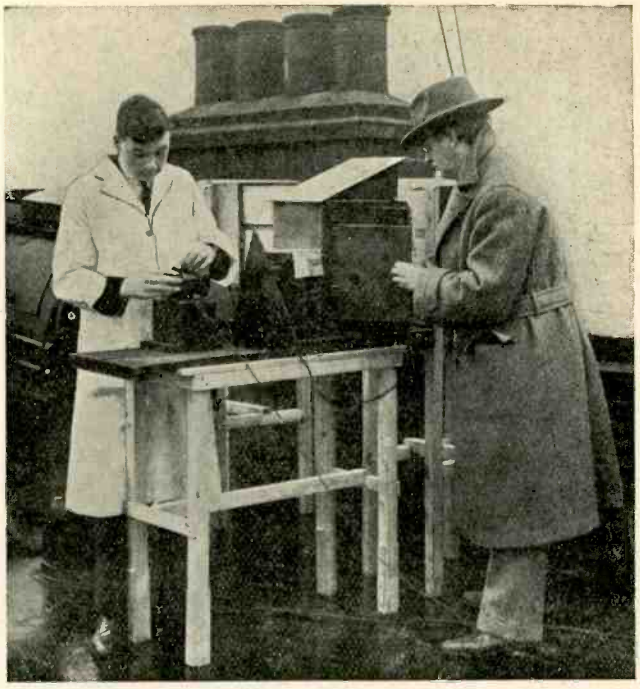
He stated that only one wave-length would be available till the completion of the Brookman's Park Station, so that in the meantime speech and vision could only be transmitted alternately. The person to be televised would first say a few words and then be switched over to television for his image to be sent out through the ether. But with the public broadcasting of television now in operation, he concluded proudly, "the general public will have an opportunity of participating in the development of this new branch of science."

The achievement, in contrast with the incredibly humble beginnings of 1925, appealed strongly to my imagination, and in an editorial report I attempted to sum up the progress which had led up to this first public transmission.

"Unlike certain successful people," I wrote, "Mr. Baird is still a man of few words. Readers of his first article will recall the concise description with which the historic achievement of 'seeing by wireless' was penned. Not only did Mr. Baird begin by acknowledging his debt



One of the first television screens used in America, where a television "play" caused an interesting controversy referred to in this article.



Another early incident—Mr. Baird testing the first "Noctovisor" on the roof of his laboratory in London.

to previous investigators of television, but he concluded by emphasising the very crude nature of his first results. As the article appeared at the time when he was endeavouring to secure financial support for the invention, this characteristic was all the more commendable. To-day, after a long struggle with technical problems and even greater difficulty in obtaining official recognition, the same modesty is still observed in what he writes."

I went on to describe the new B.C.C. transmissions at work, after watching one of the first broadcasts. (October 10, 1929.) "It can be said at once," I reported, "that the image received by wireless to-day compares in standard with the results transmitted over a wire a year ago." The television images travelled by telephone wire to Savoy Hill and were thence broadcast; I was watching the programme on a receiver in the Baird Laboratories, after it had been picked up by wireless.

After the broadcast was over, the transmitter was connected up by wire to the receiver, and the artist (previously observed by wireless) was televised direct from one room to another. Then followed a display of photographs and printed matter. "Picture after picture of well known people was transmitted in this way and considerable detail observed. A year ago attention was attracted by the use of the "Televisor" for observing a newspaper poster . . . comparatively small print can now be seen . . .

Boxing matches have been televised in the laboratory, although public transmission for some time to come will probably be confined to objects of head and shoulder size."

Almost exactly three years after writing this report I was again watching an historic television programme, but on this occasion at the new B.B.C. headquarters. As I saw the artists inaugurating the television service from Broadcasting House on August 22, 1932, it seemed scarcely possible to realise the progress of three years and almost incredible to reflect that it was only seven years since the first television apparatus was described in *Discovery* as an "unimpressive erection of old sugar boxes" with an electrical wiring that was "a nightmare cobweb of improvisations."

With this final recollection, I shall conclude without daring to make any prophecy as to the possibilities of television in 1935 . . . or 1945. As the rustic said when he first saw a zebra at the circus, "There *ain't* no such animal!"

A Television Competition

The television competition organised by *Popular Wireless* resulted in a large number of entries which indicate the growing enthusiasm among lookers. This journal states that the suggestions made by thousands of entrants provide sufficient foundation for advancing definite opinions as to what the public expects from television.

In analysing the entries, our contemporary states that the word "variety" occurred more than any other. There were many pleas for juggling, ventriloquists, dancing and conjuring turns; and this corresponds with the views expressed by a reader of TELEVISION in our correspondence columns. The results of the competition thus suggest that the most popular use for television is likely to be variety and vaudeville entertainment.

A number of competitors asked for news presented in the form of "topical budgets," pointing out that these are popular features in the cinema. Instructional transmissions were requested by hundreds of entrants who asked for illustrated talks describing hobbies, handicrafts and domestic matters. Demonstrations of physical training and first aid were also suggested, and a popular proposal was the transmission of outdoor sports events, following the success of the Derby broadcast last year. Animated cartoons, such as Mickey Mouse of Cinema fame were suitable subjects in the opinion of many lookers.

Those who regard television purely as a medium for entertainment may be surprised to know that there were many supporters of exclusively educational transmissions. *Popular Wireless* points out that the ratio of amusement to education in the entries was two to one. Thousands of competitors demanded talks on "how it works." Very few wanted to see famous people, and "an infinitesimal number expressed the desire to have the faces of politicians inflicted upon them." On the other hand, the works of Big Ben and "behind the scenes" at Broadcasting House were repeatedly asked for.

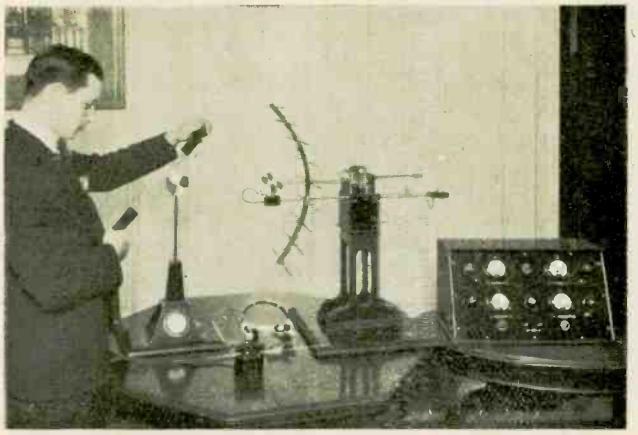
Micro-Wave Apparatus

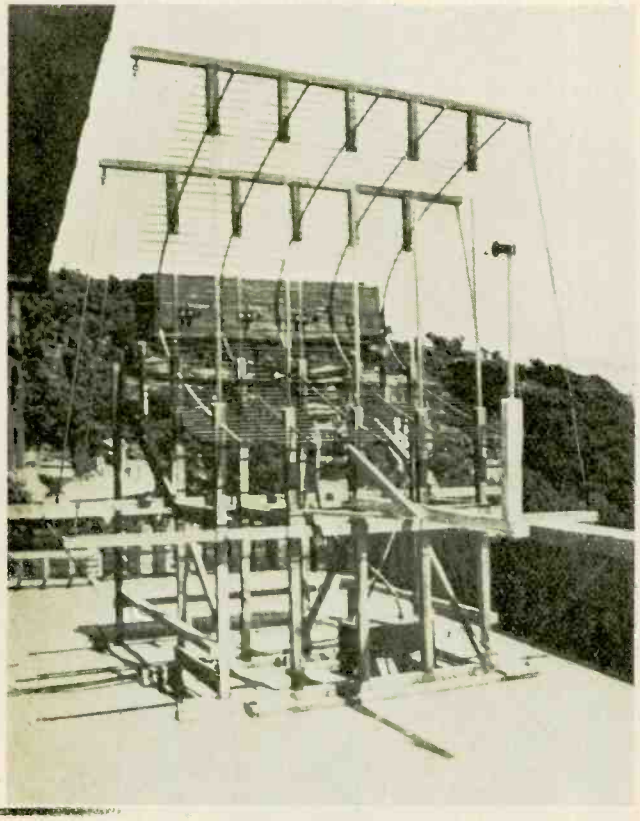
Last month we published a summary of the paper read by Marchese Marconi to the Royal Institution, in which the inventor described the latest experiments with ultra-short waves. We are now able to publish some photographs of the apparatus used, which appear on the facing page. The applications of micro-waves to television are being explored. The transmitting and receiving apparatus was exhibited by the Marconi Wireless Telegraph Co., Ltd., at the annual exhibition of the Physical Society in London. By means of the apparatus the generation and propagation of waves of the order of 50 cms. were demonstrated. The transmitter, which is of the novel design incorporates two valves operating in parallel, and is provided with a parabolic reflector which limits the radiation to a narrow beam. This transmitter is of a similar though simpler type to that used in the recent demonstrations in Italy. The receiver is of a simple type, comprising a crystal detector and a tuned aerial, signals being received on a pair of telephones. Another Marconi exhibit demonstrated light beam telephony. With the apparatus shown telephony can be received over distances of a few hundred yards up to two or three miles. A sodium glow discharge tube is placed at the focus of a parabolic mirror which is provided with a searchlight mounting and sighting telescope. The tube is modulated by a small power valve, across the grid and filament of which speech currents are applied. The receiver consists of a pick-up lens, photo cell and L.F. amplifier. The diaphragm at the focus of the lens is provided with an adjustable aperture in order that the photo cell may receive a maximum of modulated light and a minimum of scattered or extraneous light.

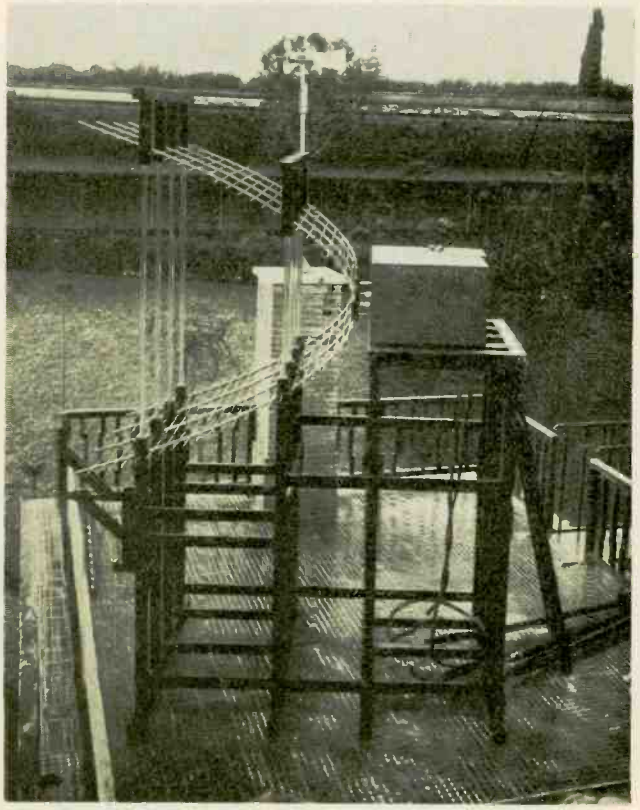
Portable picture apparatus was also shown for reproducing at a distance line drawings over a suitable landline or wireless circuit. The message to be transmitted is written in pencil on a specially prepared message form. The apparatus has been suitably designed for use on board aircraft and for general mobile work.

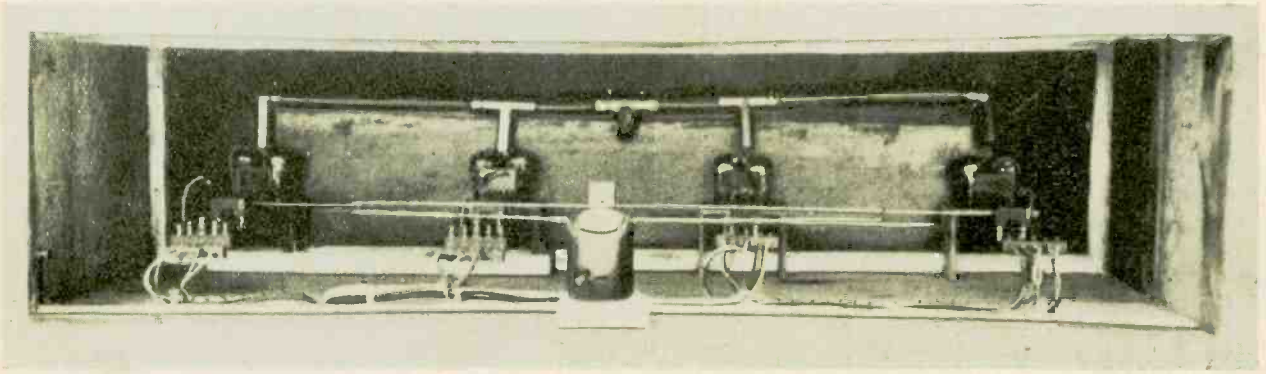
Experiments with Micro-Waves

(Right) The apparatus exhibited by the Marconi Co. at the Physical Exhibition. (Below left) Experimental transmitter. (Right) Herring-bone reflector. (Bottom) The arrangement of four transmitter units and five reflector units. The exhibit at the Physical Society's Exhibition is described on the facing page, and the Marchese Marconi's address to the Royal Institution was published last month.









Last Month's Programmes

By "Spectator."

JANUARY is a lively month for the young. It is the party month, and some good parties in Studio BB have made the season remarkable even to those who find the autumn better suited to their temperament.

In their different ways I specially commend the Albert Hall programme; the pantomime "Dick Whittington"; and the delightfully varied, more serious and sophisticated programme given on January 9th. About this last effort, the image of Gavin Gordon kneeling before the sheet and the tones of his Prayer for Russia haunt me yet. How this Slav stuff sears the susceptible soul! Russia has been responsible for more genuine British hysteria than any country since the war; but it is not her politics, it is her melancholia that gets me every time.

An Old Time Concert

The producer, who always makes a good picture—features score—craved indulgence for an anachronism when introducing dancing in an old-time concert at the Albert Hall. Any anachronism is excusable that introduces Penelope Spencer, who appeared on this occasion first in an Aubrey Beardsley impression with lots of arm movement to Ravel's "Jeaux d'eau," and then in a big bustle dress and a little pork-pie hat with ostrich feathers of the 'eighties. Faithful to the last detail, this dress had been copied from a contemporary illustration in *Punch*.

It was a thrilling moment when Ina Souez swept into the picture in her huge bustle dress with a train. She was impersonating Christine Nilsson and the scene was her farewell concert in the Albert Hall of 1888. The dress was a replica of Christine's but the voice and the grace were Ina's. First she gave us the "Jewel Song" from "Faust," then "La Luna Immobile," and we gave her a bouquet of white flowers edged with black lace. With stately grace she bent her wasp-like waist to take the flowers. "I can barely breathe," she whispered under cover of our applause. We clapped once more and, thus encouraged, she sang again, "There Is a Shadow," which was "specially composed for me by Balfe," and "Angels Ever Bright and Fair," which had received five encores at the original farewell concert. A surreptitious visit to the floral decorator's room having been productive at the close of the concert, imposing bouquets of flowers and evergreens were showered upon the ladies in the true Albert Hall tradition.

Ina Souez is both a singer and an actress of talent, and as Christine Nilsson she made an attractive and convincing picture. I have it from a quarter I respect that the line of the bodice, small waist, outstretched hands, fair wig and black aigrette, were severally and altogether as they should and would have been in 1888. Echo was added to her voice and, as you noticed she sang first to one side and then to the other as a singer must who wishes to embrace the whole audience at the Albert Hall. As I have written before, it is little things that count, and if an effect misses the mark it is not the fault of the producer, who goes to infinite pains to complete an illusion. There was nothing lacking this evening.

Robert Easton has a remarkable voice and was a good choice for the rôle of Signor Foli, great basso-profundo of the period. In this case make-up presented a problem. Foli was famous for

Ina Souez who appeared as Christine Nilsson

his voice and not his features. What was his colouring? Opinion differed, but Willie Clarkson remembered. He knew him. "Black flowing wig and moustache, that's what you want," said Willie, "and I have them." So Robert Easton was made up as Signor Foli. "A little more black round the lips, please Mr. Easton," advised the producer in the dressing room. "Really! My wife says my mouth is too big already!"

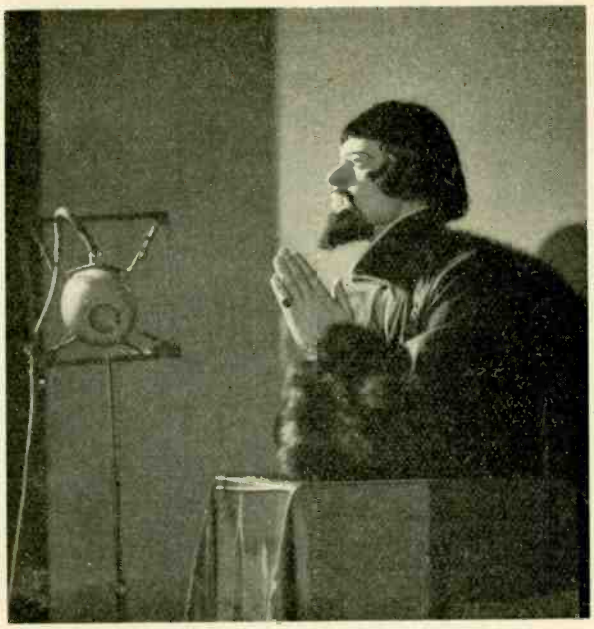
Robert is six feet one and a half inches in height, and it is one of the limitations of the existing accommodation that a tall figure cannot be televised erect in close-up. Robert sang, sitting on a chair, and it reflects great credit that his performance was convincing in this position. His song, "An Auld Irish Wheel," had been copied specially from archives at the British Museum, and was sung in the old-fashioned style with the music held in both hands at arm's length.

I had the experience of watching this programme in rehearsal in the new receiver placed in an engineer's room away from the studio. The screen in this model is sixteen by six inches and the larger image makes a big difference. Here is something to convert the sceptic. A taste of the new makes one impatient of the old, which is the way of progress, and until these machines become available, I advise the B.B.C. to keep this piece of apparatus in the dark.

The "Scenery"

Television has introduced a new art-form, in the shape of cards that are used for scenery, bearing black and white drawings of the Albert Hall and the Mansion House, and special messages, captions and billing in black letters on a white ground. These cards are rather crude at present, but capable of development and fascinating because they are new. Robb is continually experimenting. One day he may be asked to advertise the *Radio Times* this way. The cover of TELEVISION might make a better picture. Placards and show-cards in fancy lettering have been tried and discarded, plain bold block letters are really clearest. In the first programme this year Violina danced to her own accompaniment on the violin, a clever feat; and Helen Alston made herself look a guy, a hard task.

A second performance was given during January of the pantomime first televised on Boxing Day. The producer must be congratulated on his decision to repeat a successful programme and a clever cast upon a performance that conveyed perfectly the spirit of an entertainment that is singularly and beautifully British. The characters were traditional. We had Dick, and Alice, Cook and a Cat, an Eastern



Gavin Gordon who sang "The Prayer for Russia"

dancer and fairies and a magnificent Rajah. A long and, no doubt, expensive cast, but this pantomime was a special effort and was well worth the cost. Harry Bidgood's quartet provided cheerful music and a jolly time was had by all. The show was a triumph of compression, eleven numbers being sung in half-an-hour, yet the *tempo* seemed to me to be right. I have always felt that our stage pantomimes could be improved by pruning, and if I had a free hand it is the spectacular scenes that would be cut.

Property rats were specially made by Willie Clarkson for "Dick Whittington" and scenery and sub-titles were painted on cards for the production. In view of the effort entailed, it was galling for the producer and others to read in a Birmingham newspaper that in the first television pantomime "all we got was a couple of principals and the cat." We who were there know better and it would be interesting to know what other lookers saw.

When the O'Farrell Sisters appeared again it was a pleasant change to miss the black and white squares of the flooring. A tap dancing mat was laid over the floor for this accomplished pair of tappers, who also sang some syncopated numbers. Stella Scott gave us banjo solos, and Crooning Sam coon songs and patter in the same programme, which was enhanced by Sydney Jerome's snappy syncopated accompaniment.

An enquiring mind is a sign of intelligence and often one is caught pondering deeply about accepted things. Is St. Paul's a thing of beauty? Is the British parliamentary system failing? Are all the hours well spent in making up for television? Sometimes the answer comes at once,

other times one has to wait. When John Rorke appeared as a clown, his face was one mass of thick vivid paint and in a full close-up it shone in greater detail in the receiver than any image I have seen before or since. The inference is clear, the more paint the better the picture. Now that question is settled so quickly I dare say I shall have to wait for a decision about St. Paul's and the parliamentary system.

The position of the artist in the trouble between the B.B.C. and music-hall interests has been watched with some misgiving by all concerned in developing television programmes. Naturally, the producer looks to the music-hall to provide a proportion of his acts which may be seen and heard in the studio as on the stage. So far, difficulties have not arisen and it is hoped that the storm may be weathered, because, taking the long view, the interests of two parts of a whole must be complementary, and both the B.B.C. and the G.T.C. are parts of one great and flourishing industry, the entertainment business.

I am pleased to record that up-to-date co-operation has been the key-note of the relations of studio BB and the music-hall. As an instance, note the case of Max and Harry Nesbitt, who were appearing at the Shepherd's Bush Empire for the week in which they were also to televise. The management of the theatre kindly arranged to alter the order of their bill on the night when Max and Harry were booked to come to the studio. Congratulations to all parties and particularly to Max and Harry for their entertaining turn.

The Picture Goes "Tishy"

One day at rehearsal a man blowing a big deep saxophone caused the picture to go "tishy." This phenomenon excited the engineers momentarily, but they soon recovered their balance and explained that the very low frequency of the saxophone was affecting the light. I may have been wrong in supposing that the light was also affecting the saxophone; but there was antipathy somewhere, and I felt quite relieved when the instrument left the studio.

Of the programme on January 9, to which I have already referred, I would add that Raymonde Collignon made a pretty picture in her Victorian flounced crinoline, which was emphasised for television and for the naked eye by the additional loops of black lace draped over the pink skirt.

Pink is an awkward colour before the projector, and Robb has added to other accomplishments a knowledge of dress on which he has frequently to advise. In this aspect of his work he is ably assisted by Jean Bartlett, who rehearsed and produced several programmes in the early days of

The cast of the "Dick Whittington" programme

the month while the producer took a few days' rest, following weeks of continuous duty extending through the Christmas holiday. In one case an artist arrived in a totally unsuitable dress of pale pink, but the producer was not to be beaten and, after a brief search, produced from his store a length of sequined material from which he made up a bodice that fitted over the pink frock. In the end the dress, with the addition of panels to the skirt, made quite an acceptable picture.

Algeranoff is an agile dancer who takes enormous leaps and I liked his costume as a jester, which provides the contrast that is needed in the studio. Gavin Gordon, who sang the "Prayer for Russia," from Mussorgsky's "Kovantchina," had another fine moment as Mephistopheles, in which character he gave "Serenade" and "Song of the Flea," from Berlioz' "Faust." Welcome to George Mozart, an old-timer who gains from being seen as well as heard. His opening number, "Don't Sing a Song About Mother," always raises a laugh, and then there were the impersonations with comic hats. Funny business.

Every year the bright young things of the B.B.C. give a staff revue and sooner or later some of the material finds its way into a broadcast programme. This is inevitable, because several authors and composers who contribute are talented. This year a number from the staff show has been seen and heard. It is "Wien," burlesque Viennese song written by Denis Freeman to music by Mark Lubbock. Our thanks are due to Colleen Clifford for a clever interpretation of a good number.

Austin, Collins and Annette formed a bright song and dance act that was specially arranged for television in this way: Austin first appeared singing to his banjulele, then stepped out of focus

and sang off-stage while Annette was shown dancing; Annette faded out and Collins stepped into the picture and was joined by Austin, who returned to take part in a duet. Slick and entertaining. Veronica is a high kicker. Two thousand continuous kicks is her record, but one hundred were sufficient in the studio to assure me that a dancer would have to be very good indeed to beat her at this game. The *tempo* of the piano increased rapidly as she neared her century, excitement ran high and the announcer who was counting began to lose his breath.

Marcel de Haes sang a series of old French songs dating from the thirteenth to the eighteenth century, including the Cantatille which was written for Madame Pompadour, and in the same programme Cleo Nordi gave an infernal dance, for which she dressed in a black wig and a straw skirt that was picked out in bands of black material. Her fierce bold movements were well suited to the medium and a trio added pep to the musical accompaniment. I have always favoured the use of as many instrumentalists as the purse and the accommodation permit. Let us have quartets and trios whenever possible please. The piano is a lovely piece, but it can be heard too often.

Reports from Readers

The prize of a year's free subscription, which is offered for the best reader's report received by TELEVISION, is awarded this month to two readers—Mr. J. D. Percy and Mr. L. B. Friedman, whose interesting letters are reproduced on page 64.

Reporting on the January programmes, Mr. H. H. Awcock, of 296 Essex Road, London, N.1, notes a great improvement in extended view transmissions. He asks whether this is the result of a different placing of the cells. "Until just recently I noticed that when an artist retired from a close-up to a full-length view, the reception faded almost completely at the semi-extended stage. This is not so pronounced now."

Mr. Awcock is anxious to see another outside transmission, and suggests that the cup final would be a suitable subject. He would also like the television programmes to be at an earlier hour, and asks "why we must stick to the London National transmitter, which often plays funny jokes on our pictures! When fading comes along, bang goes the synchronisation and with it the picture. The London Regional has already proved its worth." This reader suggests that an adequate tuning and phasing signal would be an advantage to lookers.

Writing from Oxted, Surrey, another reader states that one of the fascinations of television is the variable quality of the results. "A perfect image is always hoped for and the moment of its achievement never fails to thrill the looker. Sometimes a good picture is obtained at the outset, on other evenings the precious half-hour begins to run away rapidly before the moment arrives.

" For this reason the producer's usual practice of beginning the programme with a head and shoulders item is most helpful, as it affords time to adjust the vision receiver before the more ambitious items are presented. Looking-in to the well-known soprano Olive Groves, after reading " Spectator's " opinion that she is the most popular soprano on the radio to-day, I was disappointed with her performance by television. Possibly this was due to a faulty image, but compared with Gustave Ferrari in the same programme the impression was poor. Singing French songs, he came through very well.

" Cleo Nordi's dances were an attractive item, though she appeared to be dressed mainly in white and there was not sufficient contrast with the background. I am inclined to agree with the correspondent in the last issue who said that too much foreground is inclined to detract from the figure of the dancer. It would also be helpful if each item could be announced, as in the radio programmes, as the order of the items published in the papers is not always followed. The producer must be congratulated on the excellent transmissions recently, and every looker will wish him even greater success in 1933."

Mr. Tom Payne, of St. Andrews' Buildings, Gallowgate, Newcastle-on-Tyne, is among the keenest of lookers, and rarely misses a programme. He writes that quite by accident he recently played the part of eavesdropper on what appeared to be an experimental test on the B.B.C. transmitter.

Mr. Payne has found that the quality of reception has improved consistently during the month. "I would like," he writes, "to congratulate all concerned on the excellence of the Albert Hall programme. Penelope Spencer who danced in the costume of the 'eighties was seen excellently. Then followed the printed announcements, and the "scenery" representing the Albert Hall. Robert Easton, impersonating Signor Foli, appeared in a semi-extended view, and the music which he held at arm's length was well seen. The Russian programme was seen only fairly well, but on the following evening, George Mozart, the old-time music hall comedian, was a complete success."

Here and There

Derby Chamber of Trade has decided to include television demonstrations in an exhibition to be held from February 1 to 11.

* * * * *

The National Broadcasting Company of America is constructing a new television studio on the eighty-fifth floor of the Empire State Building, New York.

* * * * *

Television is now being employed to defeat smugglers into Germany. Apparatus comprising invisible rays and selenium cells has been installed at regular intervals along the frontier.

* * * * *

The London Electric Wire Co. and Smiths, Ltd., of Church Road, Leyton, London, E.10, announce that, as from January 1, they have reduced the price of Lewcondensers, type O and W, from 2s. to 1s. 6d.

* * * * *

At the last meeting of the Television Society, Mr. E. H. Traub described the television system perfected by Baron Manfred von Ardenne, which is claimed to give an image five to ten times as bright as that obtained by other cathode-ray methods. The meeting is reported on another page.

* * * * *

Two television problems have been solved in America, writes our United States correspondent, by the use of waves ranging from 3 to 9 metres. Fading, both slow and fast, as well as "ghost" pictures are eliminated when the transmission is carried out with these waves. Up to a range of 25 miles reception is remarkably clear and distinct.

* * * * *

In its annual report Baird Television, Ltd., announces that provision has been made for obtaining further working capital to ensure commercial production and marketing. The balance of £53,730 shown by the profit and loss account, and representing expenditure during the year, has been transferred to the general development account, after deducting gross trading receipts and other credits.

* * * * *

The transmission of art pictures, introduced by Lord Lee of Fareham, was one of the most successful items in the television programmes last November. It was followed on January 23 by a similar show when several rare pieces from the "Queen Elizabeth" Exhibition at Grosvenor House were televised to accompany a talk by Lord David Cecil. The King has lent five pictures from the royal collection.

* * * * *

Herr Albert Ahronheim, the German expert who is experimenting with colour television, has arrived in the United States with the object of perfecting his system.

* * * * *

Mr. A. E. Bowell, of 1, Brook Street, Western Road, Oxford, and Mr. L. Drammer, of 33, Stoke Road, Shelton, Stoke-onTrent, would be glad to get into touch with other television enthusiasts who happen to be in the same district.

* * * * *

German engineers made a film of an open-air scene and broadcast it by television less than thirty seconds later. Instead of winding up the exposed film, the spool is fed into a developing and fixing tank. From the tank the spool passes to the transmitter while still wet.

* * * * *

Last month we printed an extract from Chaucer, discovered by Mr. H. W. Fowler, in which the poet showed that he was familiar with television. Mr. W. Snow now calls our attention to the fact that Chaucer was anticipated by Virgil, and quotes this passage from Aeneid IV: "Illum absens absentem, auditque videtque," which may be rendered: "Although far away, he is seen as well as heard."

* * * * *

In a lecture on "Cathode-ray Oscillography" at the exhibition of the Physical Society, Mr. R. A. Watson Watt dealt with the applications of the oscillograph to television. He demonstrated the varied colours produced by the "electron pencil" when writing on different fluorescent materials deposited in the cathode-ray tube, an "heraldic" screen showing green, blue-violet, red and slate-blue responses in its four quarters.

* * * * *

Mr. Watt showed how the blue traces disappeared the instant the electron pencil passed on, while the green trace faded only quite slowly and the red was still more persistent. A small amount of such persistence would eliminate flicker from television pictures. He showed what he believed to be the first public demonstration in this country of the optical projection of the oscillographic image with a 20-fold magnification on to a screen some 2 ft. square. This demonstration was of importance in relation to home television reception.

News from Abroad

From our Own Correspondents

The United States

Twenty years ago it was the simplest thing in the world to start an argument whenever two or more radio fans got together, by asking whether galena or silicon made the best rectifier for wireless reception. To-day an argument that will be conducted even more heatedly may be started by asking whether the scanning disc or the cathode ray tube is the best method for reproducing television images. Only time will furnish the correct answer, but it is interesting to note some of the facts of the case. Mr. Paul G. Weiller, writing in *The New York Sun*, has something to say about this subject.

"From a fairly large acquaintance among technical men," writes Mr. Weiller, "I have not been able to locate one who has seen a tolerable picture on a cathode ray tube, except those who attended the RCA demonstration a few months ago. I do not claim that no one has ever seen a picture on a cathode ray tube. The stunt has been accomplished by several experimenters here and abroad, but it is still a stunt. All information available indicates that the cathode ray scanner must remain in the laboratories for several years to come before it can be incorporated in a receiver for the home. On the other hand, I have examined several outfits with mechanical scanning which give quite pleasing pictures on a screen a foot square. No great skill is required to operate them.

Stable Scanning

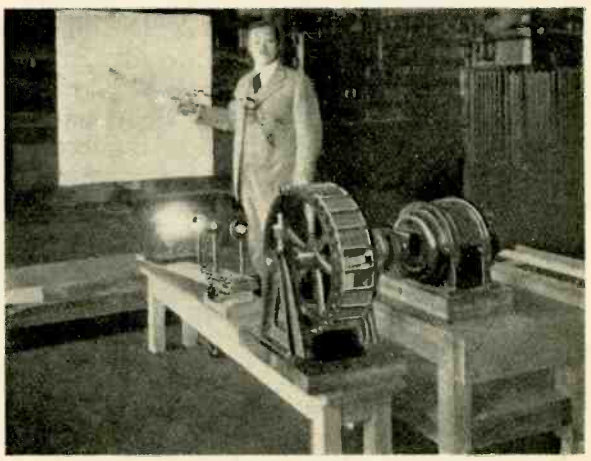
"It is quite true that the cathode ray has no appreciable inertia and that scanning at any speed even up to frequencies of one million is possible—theoretically. But providing stable scanning frequencies is another story. These scanning frequencies are not sine waves. Plotted on paper, they look like saw teeth. Such oscillations are readily obtainable only with the use of gas or vapour tubes. Unfortunately, gas tubes are always somewhat erratic. Consequently, our scanning lines keep wandering. Synchronisation of scanning oscillators (two are necessary for each tube) is also a difficult problem. To these must be added difficulties with the tube itself.

"On the other hand, with the mechanical 60-line scanner, satisfactory pictures can be obtained easily. Synchronisation offers no difficulty where the transmitter and receiver are on the same power line. Where this is not the case, synchronisation may be obtained from the frame frequency. It has been said that unwieldy disc dimensions are necessary to obtain sufficient light. That is not correct. I have seen sufficient light with 18-inch discs and a good lamp combined with proper amplifier.

High Frequencies

"It is claimed that the cathode ray tube can be operated with 420 lines. Perhaps it can. That corresponds to a maximum signal frequency of over 3,000 kilocycles. Does anyone hope to modulate a transmitter with 3,000 kilocycles in the near future? Does anyone hope to build an amplifier with a fair response curve over the 3,000 kilo-cycle band at a price anyone would be willing to pay? I doubt it. So far none of our receivers reproduces even all the details that can be obtained with 60 lines. Amplifiers for more than 60 lines are difficult to design. So are transmitters. We shall be bound to 60 lines for quite a while, and 120 lines will certainly carry us over a goodly number of years."

While we may not all agree with what Mr. Weiller has to say, it must be granted that the scanning disc reproducer is simple to build and that it will give respectable results, all things considered. It has its drawbacks and disadvantages but it works. Even in the hands of the layman it gives pictures, and with a comparatively simple outlay of apparatus. It is undoubtedly open to vast improvement, which is becoming more



Dr. Alexanderson, the well-known American engineer, with his latest mirror-drum device.

European Television Time-Table.

Station.	Wave, metres.	Power, kW.	Scanning Lines.	Frames per sec.	Object.	Time. C.E.T.
Berlin-Witzleben	419	1.5	30	12.5	Films	Mondays and Thursdays, 9-10 a.m.
Konigs-Wusterhausen	1,635	60	30	12.5	,,	Tuesdays, 9-10 a.m.; Thursdays, 1.45-2.45 a.m.; Saturdays, 8.50-9.25 a.m.
Berlin-Witzleben (ultra-short waves)	7.0	4	90	25	,,	Daily (except Sunday), 10-11 a.m. and 2-3 p.m.
Rome	80	—	60	20	Films and Scenes	Tuesdays and Fridays, 11.30-12 midnight.

The German stations transmit horizontal pictures of 3 × 4 cms.

noticeable in America every day. The possibilities of the scanning disc have by no means been exhausted. Your correspondent is looking forward to a demonstration in the United States of a 120 line scanner that is reported to be a "knockout." As soon as details are available, they will be presented to readers of TELEVISION.

France

Recent demonstrations of television in Paris were extremely successful and drew a large number of visitors to the Grand Palais. This was the first occasion on which a demonstration had been arranged for the public. Five television receiving machines working simultaneously, were installed, and M. Barthelémy, chief engineer of the television laboratory of La Compagnie des Compteurs, was in charge, giving information and advice to amateurs. Vision was transmitted from the Montrouge studio, on the outskirts of Paris, on a wavelength of 220 metres, sound being on 330 metres.

Thirty lines were used in scanning, with a disc rotation of 16.5 revolutions per second. The image was horizontal and of the "cinema" type. The rotation of the disc was in the opposite direction to that of the Baird process. Synchronization was effected by means of a system of electrical distribution, and a special motor which, exactly followed the phase of the electric current, that is, a synchronous motor, was used. The image remained remarkably stable throughout the demonstration, exploration being made by means of a Nipkow disc and a luminous neon lamp. Although the disc was small, the image obtained was of post card size; this was due to the use of two magnifying lenses. The apparatus was of midget size. The loudspeaker was replaced by a lens in which the image was seen. The regulation was extremely simple and might have been managed by anyone.

Another model exhibited involved the use of a mirror drum and a powerful "crater" tube, producing a projection image of 30 x 40 cms.; this could be seen from a distance of 15 metres. The synchronisation was again effected by using synchronous motors. The distance between the transmitter and the receiver was several kilometres. Well-known singers, music hall artists and clowns were televised. Only the heads and shoulders of the artists could, however, be seen, but the short films which were shown could be seen quite clearly. The clarity of the images was equal to that of the London transmissions, but the process lent itself particularly to the transmission of films. The remarkable detail obtained in the images transmitted by the Barthelémy process is due to the type of scanning aperture adopted. Instead of being square, the apertures are hexagonal and are longer vertically than horizontally.

I hear that M. Barthelémy is at present experimenting with 60 scanning lines, which makes the image four times as distinct. My own experiments have shown that the 30-line images transmitted from Montrouge are as satisfactory as those transmitted from London but are more easily synchronised. This remark only applies, of course, to the Paris district itself, where the system of electrical distribution is connected in parallel lines and where fading is insignificant, specially in the evening. But at 100 kilometres from Paris the problem becomes complicated.

Growing Enthusiasm

At an exhibition at the Palais Berlitz, we recently saw the new Baird "Televisor," which is really remarkable. The image was very distinct and almost perfect. It compared favourably with a cinematograph projection in the clarity of the image. These two demonstrations, in fact, mark the commencement of practical television in France. Enthusiasm has increased among amateurs who were already keen in a country where no official transmissions were provided.

The Television Society

Two Successful Meetings

As briefly reported in TELEVISION last month, the December meeting of the Television Society took the form of a members' "practical evening," and proved a most successful experiment. The chair was taken by Mr. H. H. Hope, who opened the meeting by reading a "foreword" prepared by Mr. S. Goldstein. In this the author indicated the desirability of securing adequate information before proceeding to construction. He also mentioned the facilities for reference to technical journals available at the Patents Office Library and stressed the value of the journal, TELEVISION, in keeping members abreast of the latest developments.

Mr. R. W. Corkling read a paper on mirror drums and their construction, giving details relating to a ten-inch, thirty-mirror drum, made and exhibited by himself at the last exhibition of the society.

Having discussed dimensions relating to the drum centre or hub, the drum body, and spring platforms for the mirrors, he then gave instructions for building the drum, and concluded by tabulating the minimum drum diameter relating to thirty mirrors and their maximum lengths.

He also exhibited a drum casting having milled planes for seating mirrors and adjustments, also a mirror drum made by Mr. Lance.

Mr. T. M. C. Lance described some experiments he had made with gas discharge tubes for use with receiving sets. He first showed characteristic curves of the G.E.C. Flat Plate neon tube, such as is used with Nipkow disc receivers. These curves showed the voltage and light from the tube for different currents and it was noticed that the light output was proportional to the current down to the point where the discharge glow became patchy. This is the lowest limit of current because if the tube were modulated below this point the picture would be badly distorted.

Testing Valves

He then showed how he had tested various valves with one of the tubes with a view to finding the most efficient arrangement. An Osram PX25 was found to match the tube perfectly. With 400 volts on tube and valve in series 84 per cent. light modulation was obtained with a grid voltage of six. This meant that only a small magnification of the signal was required. He showed similar tests for a discharge tube suitable for mirror drum projection which gives white light of high intensity. This was the Osram D1 tube, and the PX4 was the most suitable valve. A much higher starting voltage (600) was required with this arrangement.

A short demonstration-talk on "Faithful Amplification at Audio Frequencies" was given by Mr. A. H. Bennett, M.I.E.E., who shewed a three-stage push-pull amplifier, resistance capacity coupled throughout incorporating an arrangement to obtain the necessary phase shift without the use of a transformer. Visual indication was given by means of a cathode ray oscillograph that the wave form was practically unchanged when amplified several hundred times. The oscillograph, together with a variable frequency oscillator were standard models, provided by the courtesy of Messrs. Edison & Swan.

Amplification

The speaker gave a brief resumé of the reason why he preferred push-pull to straight amplification and emphasised that it was essential for television purposes that there should be no lag of the higher frequencies relative to the lower ones, such as must occur in circuits containing inductance. Among the reasons for favouring push pull were the following:—The cancelling out of even harmonics and imperfections of smoothing in anode supply volts; only moderate size condensers are required for the decoupling, which is imperative if frequencies of less than fifty cycles are to be faithfully amplified; larger output can be obtained for a given H.T. voltage.

Speaking on the subject of Acoustics, Mr. Bennett said he did not agree with the generally accepted idea that 5 or 6 per cent. distortion was admissible for good aural reproduction of music. It was pointed out that it was very important that manufacturers' figures should be closely adhered to if the best results were to be obtained. The valves used were Mazda A.C.2/HL.AC/P and P.P.30250. The condensers were T.C.C. dry electrolytic, except the valve coupling condensers which were T.C.C., H.V. paper. The anode, grid bias, and decoupling resistances were Dubillier metallised type.

Questions regarding image reception of B.B.C. transmissions were answered by Mr. D. C. Birkenshaw, B.A., and Mr. T. H. Bridgewater, and were received with much appreciation.

Mr. R. A. Hill exhibited and described a mirror screw of his own make, and was afterwards bombarded with questions which were dealt with by aid of the blackboard.

The chairman, in closing the proceedings, congratulated all on the success of the meeting and said that now is the time for new members to enter the Society.

At the January meeting Mr. E. H. Traub read a paper on "A New Television System." The chair was taken by Dr. Tierney. The lecturer described an entirely new scanning system by Thun, and its practical perfection by Manfred von Ardenne. This is a cathode ray television system, and embodies means by which "the intensity of the actual ray is constant, but the speed of the movement of the ray across the screen varies. Thus when the ray travels slowly we get the effect of greater lighter than when the ray moves quickly. All the effects of light and shade are therefore represented by varying speeds in the movement of the scanning ray.

Scanning Speed

Transmission and reception by this variable speed system can only be accomplished by inertia-less cathode rays, as mechanical systems cannot handle the high speeds necessary. Calculation shows that the speed must be capable of changing from one hundred metres per second to one thousand metres per second in the space of one hundred-thousandth of a second. Manfred von Ardenne has devised a practical method for accomplishing this, and the receiver was stated to be of very simple construction. At the transmitter, it is necessary "to modulate the scaning speed in accordance with the intensity variations of the picture current at the photocell amplifier." Lantern slides illustrated the apparatus, designed by von Ardenne and constructed with the aid of Loewe Radio, for the transmission of films by the new variable speed method, and for their reception.

Mr. Traub said that this system has been shown to be capable of giving images of a quality, size and intensity sufficient to meet the most critical demands of the home-viewer. They are achieved with apparatus requiring only an ultra-short wave receiver, a two-way tone filter and a cathode ray tube of suitable design, with a mains unit.

The next meeting will be held at University College, Gower Street, at 7 p.m. on February 8 when a paper will be read by Mr. Z. H. Harris, of the G. E. C. Research Laboratories, on "Gas Discharge Tubes, and Their Application to Television. Application forms for membership can be had on application to Hon. Secretary (Members) Television Society, 25, Lisburne Road, Hampstead, N.W.3.

Sight and Sound on One Wave

In a recent issue of TELEVISION, Mr. A. P. Peck described the transmissions of sight and sound on one wave in America. Mr. F. Wood, of 7, Queen's Road, London, E.16, now sends us the following details of an invention recently patented by him:

"The invention has actually a smaller side-band or frequency relating to the full scan of the picture or view.

"According to the present invention, the sound impulses are converted into light impulses which are used as part of the scene to be televised. The resulting reconstituted image at the receiving end is screened so that the light and shade corresponding to the sound are not seen by the observer, but actuate a photo-electric cell to reproduce the sound by means of a suitable amplifier.

"In a further method of carrying out the invention, the sound picked up by a microphone is, after suitable amplification, caused to modulate the light output of a neon lamp which is so disposed with respect to the scanning disc that the neon lamp light is scanned at the beginning of each scanning line. At the receiver end a photo-electric cell or the like is similarly arranged with respect to the reconstituting disc. A mirror drum may be used, in which case the modulated sound light and the image light may be reflected by different parts of the mirror drum and thus reflected to different photo-electric cells. Suitable screening is provided and a suitable arrangement of this mirror drum is provided at the receiving end to separate the sound and vision.

"It will be seen that by means of the invention a simple method of transmitting sound and vision on the one wavelength is provided, thereby avoiding the necessity of one wavelength for sound signals, and one for vision signals, as heretofore."

Television and the Talkies

The possible effect of television on the talkies was recently discussed by a prominent member of the trade in an interview with the *South Wales Echo*. He foresaw the march of television in conjunction with the talkies, but suggested that if millions of home vision sets became available in the near future, they would kill the talkies. He mentioned the fact that in Radio City, where there are regular television transmissions, "not even the wealth of a Rockefeller has been able to save the theatre which has closed down as a result of the television and cinema competition."

Letters to the Editor

TWO-WAY TELEVISION.

To the Editor of TELEVISION.

SIR,—I note that you publish this month a reply by the Secretary of the Post Office to my letter in your November issue. It appears that a misconception exists as to the point of that letter; the Secretary has inferred that private enterprise alone should be the motive-force behind the installation of duplex television links between the larger towns of the country, whereas State development and design of equipment are surely essential before this public utility service can be inaugurated.

The use of " private " circuits for the transmission of public telegrams by any new process, even more rapid than the Creed undulator, would not be tolerated by the authorities, for it would be a flagrant violation of the Post Office " intelligence transference " monopoly. Similarly, for a firm by private enterprise to set up town-to-town duplex television services, entailing the erection of public kiosks and of control and censoring organisation, for fixed charges by circuit mileage and duration of (pre-arranged) visual conversations would constitute just as undesirable a state of affairs.

Again it is stated that Tariff E circuits would *prima facie* be technically suitable for renters desiring to conduct experiments in television, whereas *prima facie* they would not; the equivalent line-speed of a circuit of this class it is noted is not less than 2,400 cycles per second, while television transmissions require, for even limited reproduction fidelity, at least 7,500 cycles channel width.

To say that there are no recognised standards for television is not in accordance with fact, for authoritative pronouncements on the range of frequencies necessary for any given degree of fidelity in a television reproduction have appeared in publications quite available to the public. It is to be stressed that in this country a system employing thirty-strip analysis and a picture ratio of 2.4 to 1 scanned 12.5 times per second is extant and has been accepted as standard. As the Secretary points out, many circuits are rented by private concerns for their own purposes, and the cost of lines for these purposes is certainly not prohibitive; it is to be noted however, that for television the requirements are considerably greater: either multi-channel systems must be used with correspondingly high rental charges, or else a single channel, corrected for amplitude and phase-delay over a very much wider range of frequencies; in this case, presumably, the charge would, as he says, have to be specially assessed, and would certainly be very much higher than that for a circuit under Tariff E.

The present position is to be compared with that extant while the Post Office were experimenting with various automatic telephone systems; they must have worked in co-operation with the sponsors of the Strowger system for some time before our first exchanges were built, unless they waited to see the success of American installations first. It is to be stressed that there was not the slightest demand in this country for an automatic telephone service.

The question appears to be whether the Post Office authorities are going to lag behind other countries in duplex television development and finally adopt one or other of the systems possibly available in some years' time, or are going to put the public in a position to see and hear correspondents (at recognised centres and by arrangement at first), in the shortest possible time for the good of the State. A special technique is being developed elsewhere to deal with the complicated mathematical treatment of line correction problems including two-way repeater design and I am sure that the Post Office engineers are better fitted to take charge of this section of the development than are the engineers of private concerns who must be trained practically *ab initio*.

The application of known systems for the reduction of frequency band (such as the artificial Döppler effect, and skewing the spectrum in the frequency-time plane) to duplex television, I maintain, belongs properly to a line-engineering department which, in this country, is State-controlled; that the Post Office is fully alive to all sorts of problems connected with speech and still-picture transmission is amply evidenced by the range of work undertaken at Dollis Hill: surely therefore it is merely lack of realisation of the possibility of co-operation with existing British television concerns to inaugurate this new public service that has so far prevented further development of duplex television. After all, it need not be felt that any interest taken in this development must be an unremunerative one, for the return would be measured in hard cash.

Yours, etc.,

J. C. WILSON.

Linden, Elm Drive,
North Harrow.

LOOKING-IN TO RUSSIA

To the Editor of TELEVISION.

SIR,—With a view to encouraging television "ether searchers," I am writing to record that strong clear images were received here on January 1st from Leningrad, Russia. The time was roughly 10.45 p.m. and probably the station had been transmitting vision for some time before it was picked up. The number of apertures was 30 and the speed about 750 r.p.m., giving the British Standard 12.5 pictures per second. Owing to the transmitting scanner revolving in the opposite direction to my receiver the images were inverted.

The pictures were "stills" and looked like posters. The best one was of a man with folded arms at a semi-extended view. The wavelength of Leningrad is published as being 825m. The station was shut down about 11 p.m. by a lady announcer. These images were really clear and distinct although, of course, not quite up to the standard of the television images now being transmitted from the London National.

I have written to the Leningrad Station for confirmation and schedules of transmissions and when these are received I think I may claim to be the first to receive Russian television pictures in England. The receiver was a 2 variable mu H.F. anode bend detector (no reaction) and 3 L.F. driving a standard Baird "Televisor."

Yours faithfully,

JAMES D. PERCY.

548 Finchley Road,
London, N.W.11.

To the Editor of TELEVISION.

SIR,—No doubt it will interest your readers to learn that on January 1 I succeeded in receiving a television transmission from Russia. The transmission started at approximately 10.10 p.m. G.M.T. and finished at about 10.32 p.m. The transmitting station was Leningrad, RV 53, transmitting on a wavelength of 857.1 m. (350 Kc.), listed at 100 kW. Due to the power and wavelength used, I had no difficulty in receiving it. The transmission consisted of: the call sign of the station $\frac{PB}{53}$ appearing in big letters that filled the whole screen, and portraits of Stalin, Voroshiloff and Kirov. Apparently this station uses the German standards but vertical scanning (30 lines and 12.5 frames per second).

In apparatus set for the reception of the B.B.C. transmissions, the image will appear reversed and turned through 180 deg., and therefore, for correct reception the direction of rotation should be changed to clockwise and the disc reversed. The quality of reception compared partly very favourably with the B.B.C. transmission and I would advise anybody in possession of a receiving apparatus to try for this station. The receiver used consists of one stage H.F. (screened grid), anode bend detector and 3 stage R.C. coupled L.F. stages, giving a positive picture.

The next transmission was announced to take place on January 6th. In this connection, may I claim to be the first in Great Britain to have received a television transmission from Russia?

Yours faithfully,

LEOPOLD B. FRIEDMAN.

54 Woodstock Road,
Golders Green.

SUGGESTIONS FOR THE B.B.C. PROGRAMMES.

To the Editor of TELEVISION.

SIR,—I am keenly interested in television, especially from the point of view of the programmes, as originally I was assistant director of programmes of the B.B.C., and later director of the Plymouth station when there was a suggestion of its being made a regional station. I should like to propose one or two additions to your magazine; First, that the times of television transmissions abroad should be published, with any additional information that may be available. Secondly, that the B.B.C. should be persuaded to extend the period allotted to the transmissions; half an hour is too short for experimenters. I would also suggest that television programmes at regular intervals should be relayed to and re-radiated from additional regional transmitters, such as Scottish regional, London regional and North national. This would prove of great assistance to many regional lookers. Finally, I suggest the inclusion of additional types of artists in the programmes, such as acrobats, jugglers, ventriloquists, and conjurors. These items would be excellent for television, though unsuitable for ordinary broadcasting.

Yours faithfully,

B. WALLICH.

St. Ives, Cornwall.

(A copy of the table of European television transmissions, published in the November issue of this journal, has been sent to Captain Wallich.—Ed.)

REFLECTING VALUES OF LIGHT.

To the Editor of TELEVISION.

SIR,— I have recently carried out some experiments on the reflecting values of light and its divergent rays as applied to television. When a beam of light passes through a prism it is, of

course, refracted and resolved into divergent rays which compose the spectrum. The divergent rays, or colours, have a definite mechanical pressure relative to the light source. In other words, each colour of the spectrum has a percentage of the mechanical pressure of light.

The lighting of the studio screen and objects depends to a large extent upon the colours and materials of the scene to be televised, that is, upon the percentage of light and quality reflected by them. My experiments have shown that the proportions of light reflected are as follows: (A mirror, not a perfect reflector, equals 92.75). White, 70.5; light orange 55.0; light green, 47.0; light yellow, 40.5; dark blue, 30.0; dark yellow, 20.0; light red, 16.3; dark green, 10.12; dark blue, 6.5; black card, 4.72; black serge, 1.3; black velvet, 0.45; perfect reflector, 100; absolute black, nil.

Yours faithfully,
FRANK WOOD.

7, Queen's Road,
Tidal Basin, London, E.16.

"SELF-CENTRED" TELEVISION.

To the Editor of TELEVISION.

SIR,—Mr. De Wet's article in your December issue has left me in perplexity as to the advantages of his system of image scansion. He says: "— It seems that attempts have been made in many places to use the mirror drum, polygonal prism, mirror screw, lens drum, vibrating mirrors and other arrangements abandoned by motion-picture engineers long ago; because each of these methods introduces an optical error initially which becomes intolerable after magnification." It does not really appear to matter what degree of success these mechanisms had in cinematography—if they were experimented with in this application at all—but it is difficult to imagine where any appreciable optical error is introduced in any modern scanning system in use, providing that the lenses or mirrors are accurately ground together, with careful design and construction of the apparatus.

Again, it should be possible to construct an aperture disc to give an almost exactly correct occasion for spot light work, taking into account the divergence of the light rays. Mr. De Wet condemns this piece of apparatus, however. It rather appears that the slot apertures reported to be used in his apparatus might possess all the shortcomings of a Nipkow disc, and may have a scanning area which does not remain constant.

With my very scant knowledge of Mr. De Wet's apparatus, I would sum up the advantages he claims as follows:—

Simple mechanism—A mirror drum or screw, consisting of one rotating element appears simpler.

Free camera movement—This applies to practically any system in use.

Image centrally analysed—No real advantage is apparent.

Uniform exposure and mask—The same should apply to any good system if masking was applied.

Any size of projection—To the best of my knowledge, this is applicable to any system except cathode ray types providing sufficient illumination is obtainable.

No up and down sway—Sway in an image is caused by bad synchronism of the scanning mechanisms. If this occurs in Mr. De Wet's apparatus, it would presumably be distorted or destroyed.

Frail lens—If this refers to the "line effect" in images, this is a real advantage.

Infinite scansion—If this is intended to imply infinite detail, this is quite impossible, at least, in any spot scanning system.

Black and white or colour—This seems to be adaptable to any system other than cathode ray types.

Photographic record at will—This should be possible to develop with most systems, using transparent film.

Yours faithfully,
ALBERT E. BOARDMAN.

16 Shrubland Road,
London, E.8.

SHORT-WAVE TELEVISION.

To the Editor of TELEVISION.

SIR,—I have been successful in generating and receiving waves down to 25 centimetres wavelength. I now wish to transmit television images across Portsmouth on waves of 100, 50 and 25 centimetres length but lack one essential. Could I appeal to any of your readers who may have a phonovision record they could lend me for the test? I will look after it and return it as soon as tests are completed.

Yours faithfully,
ALBERT PARSONS.

Radio Department,
The Municipal College,
Portsmouth.

When Ina Souez, the singer, was televised at Broadcasting House recently she wore a reproduction of the dress worn by Christine Nilsson at her farewell concert in 1888.

From My Notebook

By the Technical Editor

Television at the I.E.E.

It is surprising how one continually comes into contact with tangible evidence of the way in which television is broadening its appeal and giving food for thought to both technical and non-technical minds. On January 9, I was invited to open a discussion on television at an informal meeting of the Institution of Electrical Engineers. Needless to say, I was gratified to find such a large number present. The seating accommodation proving inadequate, several had to stand.

As is usual at these meetings, the advanced technician rubbed shoulders with the man who openly admitted that his knowledge of the subject was negligible, but he was willing to learn. In an opening address timed for half an hour, I dealt with the subject in the form of expressions of personal opinion on various aspects giving emphasis to such items as simple analogies to demonstrate the principles of working. I then laid particular emphasis on the fact that the whole technique had altered now that extended scenes are possible.

Strip Scanning

This gave a lead to the driving of another nail in the coffin of the dot theory, and I endeavoured to point out how the early theorists proved so *conclusively* by this means that a television transmission of the type and scope now embraced by the B.B.C. was absolutely impossible using the sideband normally allotted for medium wave broadcasts. By emphasising that strip scanning is used almost universally for television purposes, I endeavoured still further to convince those present that there was no analogy between a newspaper illustration made up by dots and a television image made up from light strips. From here a migration was made to the wireless receiver used for television reception and how current practice for aural reception needs but little modification for television working, synchronisation and finally cathode ray working.

Interesting Discussion

The subsequent discussion in which from fifteen to twenty people present participated, lasted for about an hour and was most interesting and it then took me about three quarters of an hour to reply in order to the points raised. It was really surprising to find how differing were the opinions of those who spoke and the confusion that exists as to what television attempts to portray in its present stage of development. For example one speaker went to great lengths to describe how it was necessary to use 400 lines to transmit a six inch picture in picture telegraphy and suggested that *at least* this number was necessary to reproduce any television image with minimum acceptable clarity.

What seems to be forgotten is that television primarily is not for the purpose of giving any form of permanent record but merely a transitionary effect and the illusion of continual movement, so that the senses react and follow the actions just the same as if watching a play or film. When it is remembered that the extent of the scene scanned and transmitted direct in any extended working is several *feet* square, it will be appreciated that the analogy fails to be adequate.

Then we had various opinions as to standards of quality, but after all, as was pointed out subsequently, we do not go to a radio engineer or expert musician to learn whether our own wireless set is functioning satisfactorily. The user himself is the best judge of that, and as long as he satisfies his own tastes that is all that matters.

In any case we can rest assured that television, especially in this country, is in no way standing still, and during the course of this year we can expect developments which will still further bring about far-reaching improvements.

Short Wave Technique

It was the band of wireless amateurs who really established the undisputable fact that long distance communication with short waves and small powers was possible, although it was contrary to accepted theory at the time. World communication is now maintained on short waves while the recent inauguration of the broadcast Empire service has served to draw attention once more to S.W.

Information on the subject is not readily obtainable and I was therefore, glad to obtain a copy of "Short Wave Wireless Communication," by Ladner and Stoner (Chapman and Hall, 15s.). The authors, both "graduates" of Marconi's Wireless Telegraph Co., Ltd., have a very sound grasp of their subject and in the 350 pages deal fully with the short waves in their various aspects. The ultra short waves have not been forgotten although it is hoped that in a subsequent edition

more space will be devoted to this important section.

As television demands the maximum sideband for its most successful working the "shorts and ultra shorts" are being freely "tipped" as providing the best solution for an adequate service. In consequence, readers should take steps to familiarise themselves with the theory and practice and both the novice and the radio engineer will find this book a valuable help. There is a good index while the 200 diagrams are well drawn and materially assist the reader in grasping the text. A book well worth adding to your library.

Electrical Communication

Having pleasant memories of a course of radio instruction under one of my college professors, Dr. E. Mallett, I fully expected that a book written by him would be very thorough in its treatment. "Telegraphy and Telephony" (including wireless communication) by E. Mallett (Chapman and Hall, 21s.) proved that my expectations were correct. Its 400 odd pages form an excellent textbook in the science and art of the electrical communication of intelligence.

A third of the book is devoted to the radio side and will enable the reader to understand better the fundamental facts if he studies the pages with the care they merit. My only criticism is that the author has not mentioned television, and I take issue with him if he does not regard television as now being a most important section of the electrical communication of intelligence. That, however, is a sin of omission and I cannot find any real sins of commission for the book has obviously been compiled with great care and is undoubtedly based on the author's extensive teaching work for I can recognise some of the material as being identical with my own college notes. A book that will be a very good investment for the student and serious minded reader.

The Baird Grid Cell

When the first model of the Baird "Televisor" was shown a few months ago and described in the Press, only rather scant details were available concerning its mode of operation especially in relation to the new Baird Grid Cell. During the intervening period some intensive research work and investigation has been going on with the result that an entirely new light has been thrown on its performance. Bearing in mind the description given on page 223 of the August, 1932 issue, there are one or two amendments that now become necessary and I am pleased to be able to pass these on to readers.

First of all it is now correct practice to regard a beam of light as consisting of transverse vibrations in all directions at right angles to the direction of propagation. The action of a nicol prism is to select the component of all these vibrations lying in the direction of a given line, fixed with respect to the prism. If no cell were interposed and the second prism were set to pass only components in a direction at right angles to that of the components passed by the first, the net result would be that no light would get through the combination.

The new Baird grid cell, consisting principally of a set of thin interleaved electrodes immersed in a liquid called nitro benzine, has the effect of distorting the line of vibration passing through the first prism into an ellipse, of eccentricity progressively changing as the voltage between alternate leaves is increased, passing through a circle and eventually becoming a line of vibration at right angles to the initial direction. Accordingly a progressively increasing component is available for passage through the other prism.

This particular cell has minute inertia, and the variations of light passing through the combination are practically proportional over a definite range to the corresponding voltage variations, due to an applied signal. Furthermore it has the very important advantage that it will work at voltages such as are available in any reputable wireless set especially, if mains driven.

By applying the received television signals to this cell, therefore, the amount of light passing out of the second nicol prism is proportional to the magnitude of the signal strength. In this way at the receiving end it is possible to obtain a light variation which is proportional to the reflected light picked up at the transmitting end when exploring the subject being televised. When used in conjunction with a revolving mirror drum suitably proportioned and running in synchronism with the transmitter mechanism a black and white image can be built up on a translucent screen with very great brilliancy.

Synchronising Experiments

Mr. Winston Jones, of Solihull, Birmingham, informs us that for some time he has been endeavouring to devise some improvement in the Baird synchronising system, but with only small success so far. "One point occurs to me," he writes, "which I have not heard suggested. Why not have four electro-magnets arranged nearly in square formation about the toothed wheel, and so increase the accelerating or retarding effect?

"I have not had a chance to try out this idea up to the present, but perhaps some other reader has experimented in this direction."

Talks on Television—III.

Photo-Electric Cells

By J. J. Denton

(*Hon. Secretary of the Television Society*)

"SEEING by Electric Telegraphy," formed the subject of a leading article in the *Telegraph Journal* of May 1, 1880, and is interesting because it refers to a "mystery box" or sealed packet deposited by the inventor of the telephone. Mention is also made of a letter claiming credit for having "solved the question of seeing by electricity" which was circulated by scientific gentlemen, stating that "whatever may be the means by which Professor Bell affects the object he may have in view, that object has already been worked out."

The editor then discussed the principles involved, indicating that "it is necessary that a series of impressions, infinite in variety, be produced upon the retina in an almost immeasurably slow space of time, and, practically all at the same instant." He then writes that "to do this through a single wire by electrical means is a difficult problem; but that it will eventually be done by means of a single wire is we think an undoubted fact."

Students of television to-day recognise that this "undoubted fact" has been realised. The most recent method placed before us is that whereby variable speed scanning, by aid of the rapidly deflected stream of electrons, actually permits "seeing by electricity" by aid of a single wire. Even the prospect of radio vision, was probably beyond our friendly editor's imagination.

This leading article also refers to the effect of light on the resistance of selenium, and a later issue of the same journal (May 15, 1880) reports a paper given by Professor Minchin, on the subject of "Photo-Electricity," and describes experiments on a light sensitive silver cell. Students will find inspiration in looking up this period, when pioneer workers and prominent physicists excited themselves in newly found phenomena, and sought its applications.

The Photo-Electric Cell

Television has developed alongside with the development of the photo-electric cell, the latest form of which, is a bulb with the light sensitive material deposited all round the inner wall of the bulb, so that it can respond to reflected light from all directions. The light sensitive material is caesium, and is so thinly deposited, that the wall of the tube is transparent. The results are as one would expect when all this sensitive area responds to incident light.

Students will be interested in repeating an experiment due to Hallwachs, whose research led to the development of the photo-electric cell. Clean a piece of sheet zinc with the aid of sand-paper and attach it to a simple electroscope. Charge the apparatus negatively, then illuminate the zinc by aid of an arc light, or burning magnesium ribbon. The electroscope at once discharges. Repeat, charging positively and the electroscope is unaffected. Loss of electrons by the clean surface of the zinc in the presence of light accounts for the falling leaf or leaves of the electroscope.

Some Experiments

Teachers may interest a class by connecting to a terminal of a reflecting galvanometer, a wire connected to a piece of brass gauze, and to the other terminal the positive end of a high tension battery. To the negative end of the battery connect a lead attached to the cleaned zinc sheet, which should be adjacent to the gauze but not in contact. On illuminating the zinc, through the holes of the gauze by light rich in ultra-violet rays, the galvanometer will indicate current due to emitted electrons being directed across the air gap, which close the circuit of the battery and galvanometer.

Many instructive experiments may be performed by aid of the very cheap potassium photo-electric cells at present on the second-hand market. Substitute one of these potassium cells in place of the zinc and gauze, and by long leads from the galvanometer expose the cell to the sky. The varying character of cloud shadows will at once be evidenced by the galvanometer. Clouds that appear dense may scarcely affect the readings, yet a cloud scarcely visible may absorb ultra-violet rays and cause a large drop in the galvanometer readings.

The photo-electric cell made the transmission of television signals possible, and is universally used in one form or another for all systems no matter what form of scanning is adopted, even though the light sensitive material may not be enclosed in individual cells. The most sensitive

and suitable material at present used is the alkaline metal caesium.

For the B.B.C. television transmissions, boxes of four cells are distributed about the television studio, these boxes are on adjustable stands and are easily placed to receive the reflected scanning beam from the subjects undergoing transmission. By watching the image on the monitor instrument, more or less cells may be mixed from the control board, or revised adjustments of the cell boxes ordered, and so effect the production of satisfactory outgoing image signals.

The curve of sensitivity of the caesium cell is much the same order as the curve of visibility by the eye, but is shifted towards the infra-red end of the spectrum. Yet in spite of its great sensitivity much more is desired for television work, in order that the ideal of scanning the image focussed by a photographic lens may be achieved.

The frequency response of the photo-electric cell and its amplifier determines the detail of the image; this also is governed by the wave-length sensitivity of the cell. The frequency characteristics of the photo-cell amplifier must be linear up to the highest frequency required. It is important also to consider the ratio of signal strength to ground noise. The image signal must be much greater than the noise produced by electrons moving up and down the resistance and other parts of the cell circuit. Frequency troubles may be compensated for but even this increases ground noise.

Simple experiments with photo-electric cells always arouse interest. By aid of a direct vision projection spectroscope, photocells and their varying characteristics may be demonstrated. Make a patent plate glass box and divide it into three triangular cells, by cementing inside the box glass plates. Fill the three cells with cinnamic ether, and so obtain three liquid prisms. Now make a lantern slide in the form of a narrow slit, and project the spectrum so obtained by aid of the lantern, so that various portions of the spectrum may fall on the selected photo-electric cell. Then by aid of the reflecting galvanometer in circuit with the cell and a high tension battery, deflections of the galvanometer will indicate response to wavelengths of the spectrum, screens of paper ebonite, and Chance's glass will cut off the luminous rays for comparison of the response to ultra-violet or infra-red radiation.

Image Signals

To obtain an image signal, rotate a scanning disc so that the light of a bunched filament lamp may pass through the apertures of the disc on to the photo-cell in circuit with high tension battery and 1 : 1 transformer, the secondary of which is connected to an amplifier and loud speaker. A vision of the glow lamp may be seen by placing a beehive neon lamp behind the disc so that it may be viewed through the holes of the rotating disc, the neon lamp now being substituted in the circuit in place of the loudspeaker.

With simple apparatus the keen experimentalist will soon become familiar with essentials, and many further experiments will suggest themselves. The many applications of photocells to industrial purposes have been made possible by the addition of a one valve amplifier and a relay for closing a local circuit in which is placed the operating device which can be made to respond to the varying light energies that affect the photocell. Owing to the need of response to rapidly varying frequencies, relays as above referred to prove unsuitable for television.

Distributing Energy

Television depends on energy distribution at the source, that is from the scene to the photocells. With studio lighting and its average of 20,000 foot candles, ample energy may reach the cells, also by the high candle power of spot scanning, whether directly as in film transmission, or by reflection as in normal practice. But for daylight transmission of outdoor scenes, the varying quality of natural illumination has to be contended with.

Average daylight may be taken as about 2,000 foot candles, summer light 4,000 foot candles, and light in December less than 1,000 foot candles. Add to this consideration, varying atmospheric conditions, fog, rain and cloud effects, besides the usual wavelength variations of sunlight, and it will be realised how needful is the further development of the photo-cell, alike in extent of area of the light sensitive material, and its increased sensitivity—without damping its frequency response. Possibly the combination of the valve with the photo-electric cell, which is said to give an increased output, and the deposit of the light sensitive material on the entire inner surface of the thermionic and photo-ionic container may promise further advance. The improved brilliance of the light spot obtained by the bombardment of the cathode rays on the fluorescent screen makes it practical to transmit films by allowing this light to pentrate the film on to the photocell.

Much is expected from the new scanning method and the rapid production of the film to aid the further advance of television.

Mr. J. J. Denton's lectures on television, which commenced in the autumn, have resumed at the Borough Polytechnic, Borough Road, London, S.E.1, on Thursday evenings at 8 p.m. Further particulars may be obtained at the Polytechnic.

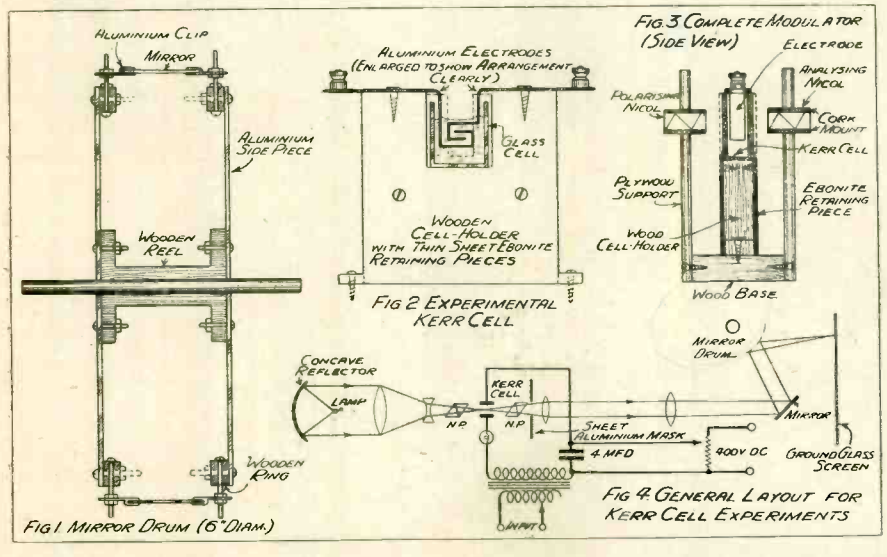
The Enthusiast Sees it Through

THE increase in correspondence which we are receiving is remarkable proof of the extension of interest which the B.B.C. television transmissions are bringing about. One thing that does strike us most forcibly is the eagerness of our readers to pass on hints to fellow enthusiasts. During the coming year we shall look forward to receiving many more reports from our readers for inclusion in this series.

Overcoming a Youthful Handicap

Although still at school Mr. F. E. F. Voss of Ridgecroft, King's Road, Berkhamstead, Herts, has written to describe how he and two friends, Mr. R. Hill and Mr. F. H. Woodridge, took steps to surmount the difficulties associated with "study versus hobbies." Waiting for the holidays must prove somewhat irksome but we wish them every success in their efforts. Mr. Voss writes:

"Although we started experimenting towards the end of 1931, being handicapped by the fact that we were still at school, we only obtained our first recognisable pictures on September 7, 1932. The first disc we made was in cardboard, but as soon as we tried it we found that it had a tendency to warp and wobble when rotating so we therefore decided to make another in zinc. Although we were fortunate in having the use of a 60-watt fan motor, the disc proved too heavy; we did not discover this till later as the neon which we had on the fifty cycle mains for stroboscopic purposes only, glowed fifty times a second and not a hundred as we thought it was doing. This prevented us from getting any successful pictures, as of course the motor was only running



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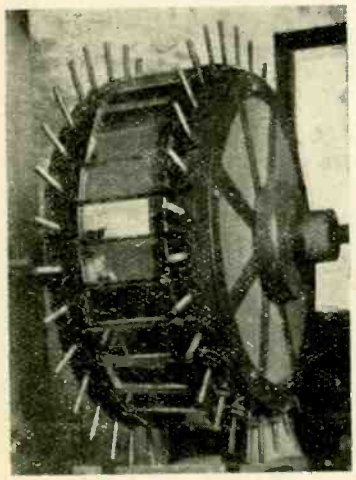
Diagrams of the apparatus constructed by Mr. Gilbert, whose experiments with both scanning disc and mirror drum are here described.

* * *

at half speed. Moreover our neon was at that time either a bee-hive type or a letter neon, and we had no biassing voltage across it. At this point school intervened, as we were away for most of the Easter holidays, matters were practically at a standstill until the Summer holidays. Even then various circumstances prevented us from any further experimenting until after the Show at Olympia.

" Our first vision set had been a Phillips 1-v-1, but this was replaced by a home-built set, originally designed as a 4-valve set with two R.C.C. stages run partly off the mains. We immediately altered this to a 3-valve set with a Band-pass filter and an S.G. stage, with a parallel-fed Ferranti A.F.3. coupling a power-grid detector to a PX4. The set was run entirely off the mains.

" In our spare time during the term, an aluminium disc had been marked out very carefully with several home-made jigs, the holes



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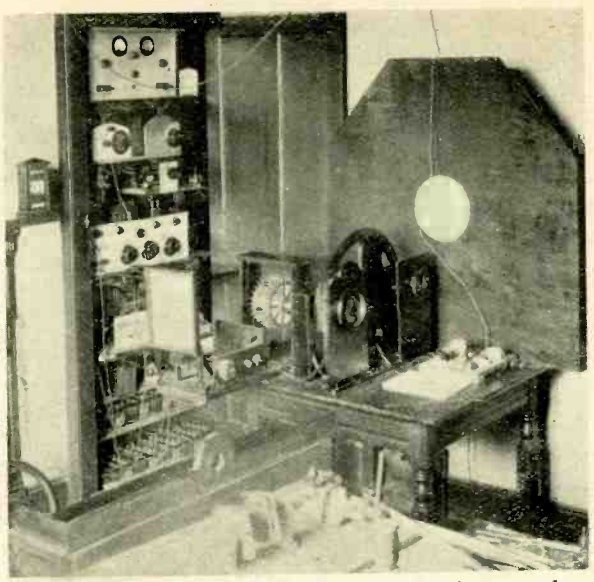
Photograph of the mirror drum constructed by Mr. Gilbert.

* * *

being punched out with the sharp end of a rat-tailed file. A friendly radio-dealer lent us a Baird neon and with this much more satisfactory equipment, we succeeded in receiving quite good pictures on the night of September 7. No synchronising gear was fitted, but a fair degree of control was effected by means of rheostats. The remaining fortnight of our holidays was spent in trying various schemes for synchronising, and in increasing the peak-separation of the Band-pass filter.

" We also changed the output circuit from transformer to a choke filter system similar to a choke modulation circuit, thus running the PX4. and the neon off the same eliminator. These alterations considerably improved the pictures, and now we have to wait till next holidays unless the B.B.C. can give television broadcasts on Saturday nights."



Notice the positioning of the front screen with reference to the mirror drum

Mr. A. H. Gilbert, of 1, Leopold Road, Wimbledon, S.W.19, is evidently a very keen experimenter for in a letter to us he shows how he has used both disc and mirror drum receivers and also been successful in picking up the ultra-short television transmissions. With the diagrams and photographs he enclosed we are sure our readers will be able to gain a considerable amount of useful information. Mr. Gilbert writes:

" In order to gain some idea of the sort of picture quality available (as television had not previously been seen) a simple disc receiver was first made up. A home-made aluminium disc was adjusted to give a fairly accurate scanning-field by the homely method of pasting on pieces of paper by trial and error, and was mounted on a cheap ex-fan motor. Quite good results were and are obtained from this arrangement, using a fully-loaded L.S.6.A. in the output stage. When giving demonstrations, a second neon is placed on the opposite side of the disc to enable the operator to maintain accurate synchronism while friends have an uninterrupted view of the main picture. A series resistance is inserted to prevent waste of power.

" Attention was then turned to the Kerr-cell-mirror-drum projector. A mirror-drum was made up at a cost of about three shillings, using selected pieces of a sixpenny looking-glass, some old condenser vanes, a discarded wire-reel, sheet aluminium, and some nuts and bolts. The construction is indicated in the rough diagrams enclosed.

" The Kerr cells used have been of various designs, but Fig 2 shows one that is convenient for experimental purposes, and has the

advantage of simple construction. The cell itself was made up from pieces of glass cemented together and strengthened with bent aluminium corner-pieces. The electrodes were cut from old condenser vanes. They must be accurately flat and smooth and correctly spaced, or trouble will be had with arcing over on peak voltages. Rigidity is likewise important for the same reason. The cheapest Nicol prisms obtainable were used (16/-) and though small, are reasonably satisfactory. The present experimental layout is shown in Fig. 4. The lenses are all of the junk-shop variety at from 2d. to a shilling each. The output transformer must be carefully constructed, as secondary peak voltages of over 2,000 may be necessary with simple cells of this type. The ratio depends on the output valve and on the spacing of the Kerr cell electrodes, and must be found by trial. The experimental one at present in use has a tapped primary, giving a variable step-up. Coloured spots (due to over-stressing of the Nitro-benzine) will appear on the screen and indicate when the maximum voltage is being exceeded.

" The light-source is still a problem. The 36-watt motor head-lamp bulb at present in use is insufficiently bright and has an unsuitable filament shape. Moderately good pictures have been received with this apparatus, but it is purely experimental and work is still in progress.

" Finally, some notes on seven-metre reception. A simple super-heterodyne adapter has been made, the circuit being quite standard covering 5-8 metres. There is only one secret on these frequencies—put an H.F. choke in every lead from the set except the aerial. Fifty turns of thin wire carefully spaced is quite sufficient and will not affect the intermediate frequency. Signals from Broadcasting House are very strong here at 8 miles. A number of television tests have been put out by the B.B.C. on 7.75 metres, and some of these have been very well received.

" It is interesting to note that that bugbear of the ultra-shorts, car ignition interference, does not have nearly such a devastating effect on vision as on sound. The prospects for television on these frequencies appear to be remarkably good."

A Cure for Fading

Mr. E. H. Ware, of " The Beeches," Woodbury, near Exeter, has sent a very interesting account of the scheme he has tried to overcome the trouble of fading. This will undoubtedly have a special appeal to those enthusiasts residing some distance from the London National Station.

In the course of his letter Mr. Ware says:

" Some time ago I promised to furnish a report of my latest experiments in television. I regret the delay but shall be forwarding this very shortly now. In the meantime I believe that your readers may be interesed in a development arising out of these experiments, and I am therefore enclosing a short account of this.

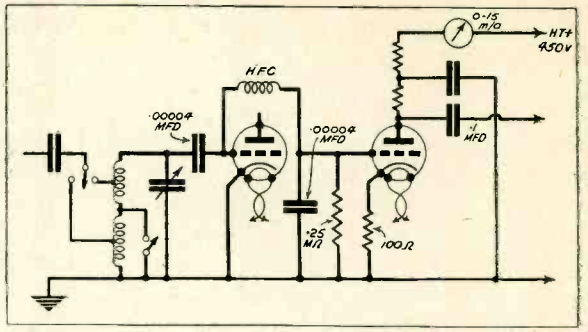


Diagram of the detector portion in the set described.

" I do not claim that my circuit is original. In fact, it is so simple that it seems exceedingly unlikely that I am the first to use it. The fundamental circuit to which I have applied it is almost identical with Mr. Barton Chapple's Tele-radio receiver.

" As those enthusiasts in the North, Midland and South Western districts have good cause to know, fading is one of the biggest bugbears the television experimenter has to face to-day. My home is in the heart of Devonshire, where terrible fading is experienced on the London National transmission as soon as darkness sets in. Excellent vision results were obtained on the old morning transmissions, but with the change-over last August to the new times results were very disappointing indeed. It was at once realised that no improvement would be obtained until at any rate a partial cure for this trouble was found.

" Although not primarily used for this, the system of automatic volume control which has lately become popular in the better-class American sets, has valuable properties in minimizing the effects of fading. Now there is an old fallacy, still current in some quarters, that automatic volume control (generally called A.V.C. for short) is not permissible in sets designed for really high quality, as it will level up the soft passages, and tone-down the loud ones, thus eliminating all " expression " from speech or music. This, of course, is not so, as the control is operated by the strength of the carrier wave, and not by the strength of the modulation superimposed on the carrier frequency.

" The principle of A.V.C. is quite simple. The steady rectified current present in the detector anode circuit is separated from the low-frequency component, and fed back to bias the grids of the preceding H.F. valves. Thus any decrease in strength of the carrier wave, such as

that caused by fading, is immediately followed by a decrease in the amount of negative bias applied to the H.F. valves, thus increasing the sensitivity of the H.F. amplifier, and tending to keep the strength of the signal passed on to the L.F. stages constant. Conversely, any increase in strength causes a decrease in sensitivity, again tending to maintain a constant output. By choosing suitable values in the A.V.C. circuit, the output can be maintained absolutely steady, unless the signal disappears completely or almost so. Obviously, for the control to work effectively, the set must be sufficiently sensitive to bring in the required station at considerably more volume than is normally required.

" Turning to the practical side, there are two methods by which A.V.C. may be achieved. The first is to use an extra valve, virtually a second detector in parallel with the normal detector, with the anode circuit connected through a filler network back to the grids of the H.F. valves. The second method is to make the normal detector (generally a diode) perform the work direct. Those interested are referred to recent articles in the " Wireless World " for more detailed information. (Aug. 12, Sept. 23 and 30, 1932).

" Unquestionably, the most satisfactory detector for television is one form or other of the diode circuit. H. L. Kirke's version is in use in the writer's vision set,and the detector portion is shewn in Fig. 1. The problem then was to devise a system of A.V.C. which would hold the London National transmission steady, without having to re-build the set, or make any serious alterations. Fig. 2 shews in skeleton form how this was finally accomplished. It will be seen that the only alteration made was to fit a potentiometer in place of the grid-leak R. The filter resistances R_1, R_2, and R_3 were then added, and the grids of the H.F. valves isolated from earth by means of the condensers C_1 and C_2.

" The rectified signal sets up a voltage across R which can be measured by noting the drop in anode current of the first L.F. valve. (If R_4 is made 100 ohms, a signal of one volt on the grid will cause a one milliamp drop in anode current.) This voltage is tapped off by the slider of the potentiometer, separated from the L.F. Impulses by means of the high resistance R_3, and fed back to the grids of the H.F. valves through the decoupling resistances R_1 and R_2. By adjusting R, the A.V.C. can be set to pass any desired strength of signal to the detector, further control of volume being obtained on a manual control later in the set in the normal way. In the writer's case, the London National transmitter gives rectified current varying between 7 and 0 m.a., i.e. on overload and a complete fade-out. When receiving television the slider of R is set to give a rectified current of $1\frac{1}{2}$ m.a., sufficient to ensure linear detection. Thus any fade which would ordinarily cause the rectified current to vary between $1\frac{1}{2}$ and 7 m.a. will have no effect on the vision, the only fade which will now cause trouble being such a severe one that the rectified current falls below $1\frac{1}{2}$ m.a., which is comparatively infrequent, and usually of only momentary duration.

" This system of A.V.C. has effected a tremendous improvement in the writer's results and readers should find it equally effective in other parts of the country. It must be pointed out, however, that if selective fading is present (usually this is not nearly so common as the ordinary fade) while the A.V.C. will keep the picture steady, it will inevitably become seriously distorted for the duration of the fade, though synchronisation will be maintained."

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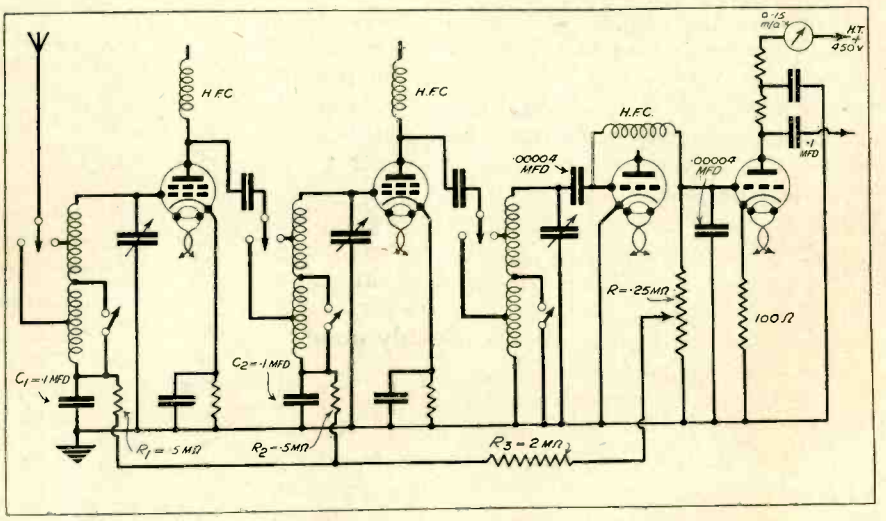

Fig. 2. Skeleton diagram showing the system of A.V.C. designed to hold steady the transmission from the London National Station.

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A More Compact Mirror Drum?

By A. Everett, M.A., F.T.S.

THE volume of a drum or cylinder varies as the product of its length by the square of its radius. Hence, if the radius be diminished and the length increased in the same proportion, the volume will diminish in that proportion. The area of the curved surface, however, remains unaltered. These facts suggest that space could be saved by replacing the single drum of any form of vision apparatus by two or more coaxial drums of smaller radius in contact. Thus instead of a single tier of mirrors, there would be two or more parallel tiers (*not* a spiral). The beam of light falling on the mirrors would have to be widened sufficiently in the direction parallel to the axle to fall on all the drums.

Removing Alternate Mirrors

If alternate mirrors be removed from an ordinary mirror drum, then in the screen picture alternate strips will be left blank. Without altering the size of the mirrors, suppose the radius of the drum to shrink until the remaining mirrors meet and fill the circumference. This will not affect the screen image. The blank strips may now be filled in by means of a second and similar drum, suitably adjusted, placed in contact with the first on the same axle, but displaced by half a mirror-breadth round the axle relatively to the first drum, so that the centres of the mirrors on either drum are in line with the joins of those on the other. If the light consisted of a parallel beam at right angles to the axle, the two small drums could be exactly alike; but since it is convergent, the mirrors on the additional drum will need to have their tilts to the axis of rotation suitably adjusted. These tilts will not be quite the same as those of the mirrors supposed removed from the original single drum, owing to the different position of the drum on the axle.

If the reduction of radius were not carried so far as to make the mirrors meet on the circumference, then the mirrors might be made longer tangentially, thus enabling them to receive a larger beam.

Suggested Advantages

The above reasoning can be extended. If n be the total number of mirrors, and $n = km$, then the single drum of radius r with n mirrors might be replaced by k adjacent drums each carrying m mirrors. (If R_n, R_m, be the radii of the circumcircles of two regular polygons of m and n sides, the length of side being the same in each, then

$$\frac{R_n}{R_m} = \frac{\sin\frac{\pi}{m}}{\sin\frac{\pi}{n}} = \frac{n}{m} = k,$$

approximately, when n and m are large.)

Each drum would be adjusted to trace on the screen a different series of m strips at regular intervals. For example:—the 1st drum may trace 1st, $(k+1)$th, $(2k+1)$th, &c. strips; the 2nd drum may trace 2nd, $(k+2)$th, $(2k+2)$th, &c. strips; the kth drum may trace kth, $2k$th, $3k$th, &c. nth strips, but other orders are possible.

Other advantages of the proposed method, in addition to space-saving, are reduced tangential velocity owing to the smaller radius, and facility for secrecy, since by turning any component drum round the axis through a given angle, the relative chronological order of the strips of different series can be changed. On the other hand, the need for a wider beam of light from the source is a serious disadvantage.

The B.B.C. Year Book

Discussing the television transmissions from Broadcasting House, the B.B.C. Year Book for 1933 explains that the present tendency in experimental programmes is to look for artists, acts, human and otherwise, that fall outside the scope of ordinary broadcasts. Special make-up—dead-white ground, blue tips and blue-shaded eyes—is necessary to give the black and white effect that televises most successfully. For this reason television auditions are longer than most, seldom occupying less than an hour. The Year Book states that every opportunity of improving technique is being taken: future progress must depend on this.

In an article on "Television in 1932," Mr. J. L. Baird reviews the events of the Year. The inventor believes that one of the largest fields for television lies in the cinema of the future. The television screen, he says, "is now approaching the perfection necessary to give full entertainment value apart from the curiosity attraction."

Reports on Apparatus Tested

The Technical Editor of TELEVISION *will be pleased to receive apparatus, components, etc., from manufacturers for test and if found suitable, for review in these columns.*

Controlling Tone

Readers of TELEVISION appreciate only too well the value of good reproduction, and in an effort to achieve this, every avenue should be explored. It is very often found in ultra-selective sets that the higher frequencies are missing with the result that the "timbre" of musical reproduction is missing. Then again with pick-up working the low notes may be missing, and furthermore irrespective of the set's performance the final test comes with the loud-speaker and this may be "found wanting."

One of the best ways of meeting these contingencies is to make use of some form of tone control and in this connection we have recently been testing a Multitone transformer working in conjunction with a graded potentiometer, both of which are marketed by Multitone Electric Co., Ltd. We were agreeably surprised at the improvement which this combined device effected. Merely by turning the graded potentiometer knob it was possible to alter the character of the response curve very materially. At one end of the movement the high notes predominated and at the other the low notes.

It was possible therefore to find intermediate settings which produced a most natural rendering of speech or music and the performance proved outstandingly good. The primary inductance of the 4 to 1 component tested varied from about 50 to 25 Henries as the current through the primary winding increased from zero to 6 milliamperes. Very complete instructions for connecting this transformer in the set are given and we can thoroughly recommend it to our readers. Furthermore, those readers who prefer to use transformer coupling in the set employed for the reception of television signals will be able to carry out a number of experiments in changing the quality of their image.

Magnavox Moving Coil Speaker

It is, of course, common knowledge that mains-energised moving coil loud speakers are in general more sensitive and capable of handling larger input powers than the permanent magnet type. While this does not always hold good the tests which we have just completed with the D.C.142 "Magna" moving coil speaker manufactured by Magnavox (Great Britain) Ltd., have shown the undoubted advantage brought about by the increased field strength which is one of the distinguishing features of the "Magna" series.

The speaker has a $8\frac{3}{4}$ in. cone and a field coil having a resistance of 2,500 ohms. It is suitable for 100-200 volts, the current consumption being 40-80 mA. Since in the tests we made, A.C. mains happened to be available the field supply was rectified in the manner suggested by the makers. A Westinghouse H.T.8 rectifier was used together with a 1,000 volt test 4-mfd condenser and the scheme proved most efficient. Only a slight trace of mains hum could be heard when no signals were passed to the speech coil, but not enough in any way to mar reproduction.

The speaker is most robust in construction and undoubtedly the high grade workmanship contributes in no small measure to the excellence

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The Magnavox moving coil speaker, which is suitable for 100-200 *volts.*

* * *

of its overall performance. There is a carefully designed magnetic circuit incorporated with no stinting in the use of either copper or iron with the result that there is colour and character in the reproduced speech and music. The speaker should be mounted in a suitable sized baffle, about 2ft. 6in. square for a minimum.

Sensitivity was most marked while the power handling capacity was more than ample for any domestic purpose. No undesirable resonances could be traced while the base was in no way "boomy," and music came through in a most colourful manner. With speech there could not be traced any slurring of the sibilants. It will be seen, therefore, that this speaker marketed at £3 5s. is a high-class instrument and where readers are desirous of obtaining a mains-energised model the D.C.142 will bear the closest inspection.

New A.C. Mains Superheterodyne

This new G. E. C. receiver, fitted in a first class walnut cabinet and equipped with an automatic station index, is simple to control. The wavelength range of the set is: medium waves, 200/550 metres; long waves, 900/2,000 metres; and it is designed for use on mains of 100/150 and 200/250 volts (at all frequencies between 40

and 80 cycles). Its consumption is 70 watts, and the undistorted output of the set is approximately 2½ watts A.C.

So far as the circuit is concerned the first valve is coupled to the aerial by a tuned pre-selector in the form of a band-pass filter. Rectification takes place in the anode of the H.F. valve, at which point the oscillator feed is also injected. A single stage of intermediate frequency amplification follows. This employs a variably-mu screen grid valve, and incorporates two band-pass units accurately adjusted, thus ensuring a high degree of selectivity.

The second detector is of the screen grid variety, and is resistance-capacity coupled to the power pentode output valve. Decoupling and smoothing are generous, and have ensured quiet operation. Intermediate frequency amplification is carried out at a frequency of approximately 107 kilocycles.

There are three operating controls situated on the front of the receiver. That at the left hand is a volume control (and an " on/off " switch) which varies the input to the aerial band-pass filter simultaneously with an adjustment of the bias of the variable-mu screen grid intermediate stage. At the centre of the panel is the main tuning control which actuates a triple gang tuning condenser, and at the right is the range switch which automatically adjusts the station index according to the setting of the range switch contacts.

Sockets are provided for external aerial and earth, for external loud speaker, and gramophone pick-up as well as for mains aerial, while the receiver is equipped with a mains energised moving coil loud speaker. Only a short aerial is needed for average reception purposes (a good earth should be employed), but the provision made for a mains aerial will, in favourable circumstances, be found satisfactory. The set is priced at 26 guineas and represents remarkably good value for the money.

Sifam Test Prods

To be able to take measurements of voltage and current *inside* a set while it is working is a very valuable asset, especially when making any adjustments to meet the refinements so often pointed out in connection with television reception. The pair of Sifam test prods which we have just had an opportunity of examining are admirably suited for this purpose. They are 8½ inches long and have a small "handle" just over an inch in length. The remainder consists of a brass rod covered with a good insulating tubing ⅛ inch in diameter. The prods terminate in sharp metallic points and owing to their length and flexibility it is possible to make excellent metallic contact in the most awkward of places inside the set. The handles have distinguishing red and black colourings with metal sockets at the top to make contact with the instrument leads. Altogether a most handy and efficient addition to the experimentor's kit.

Free Inquiry Service

We may draw the attention of new readers to our free inquiry service. Every experimenter in taking up television is faced at some time or another with a technical problem on which advice is required. In view of the increasing interest in this science and the need for making technical information widely available TELEVISION has arranged to answer questions without charge. Inquiries should be stated as concisely as possible and written on one side of the paper only, and *must be accompanied by the coupon* which appears on another page.

Television Amplifiers

Commenting on the article in the January issue on " A Direct Coupled L.F. Television Amplifier, Mr. J. Potts, of Hyde, Cheshire, suggests that the voltage of 700 might prove dangerous in a household where anyone might switch on the vision apparatus." If it were possible to decide on a common power unit, say 500 volts at 120 M.A., it would save a great deal of expense, and at the same time bring the apparatus more in line with the present radio receivers. I do not by any means under-rate the value of the amplifier described; it is clearly a great improvement on R.-C. coupling, and should be used wherever possible."

A Larger Image

The answers to our questionnaire suggest that there is more enthusiasm for television in the North of England and the Midlands than in London and the South. This is confirmed by a special correspondent of the *Manchester City News* in an article on the progress of television in that city. Among the pioneers are Messrs. Franks, who were convinced of the possibilities of television seven years ago, when "Baird first startled the country with his experiments." This firm staged the first public demonstration of television in Manchester and has given much practical assistance to enthusiasts in that city.

The *City News* correspondent is anxious to see a larger image, and suggests that there will be more interest among experimenters when this step becomes possible.

MISCELLANEOUS ANNOUNCEMENTS

At the request of many of our readers, the rates for announcements in this column have been considerably reduced.

Readers wishing to dispose of second-hand apparatus, components books, etc., are now invited to make use of this advertisement section at the prepaid rate of **1d. PER WORD (MINIMUM 36 WORDS).**

Announcements should be written on one side of the paper only, and must be accompanied by a postal order made payable to Benn Brothers, Ltd., 154, Fleet Street, E.C.4.

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MIRROR Drums, Component parts for Home Construction. Scanning Discs, Motors, etc.—JOHN SALTER (Established 1896) Experimental and Radio Engineer, 13, Featherstone Buildings, High Holborn, London, W.C.1. Telephone—Chancery 7408.

BAIRD Neon Lamp, 12/6. H.T. eliminator, 200/250 A.C. output 150 v. 20 m.a. with valve, 21/-. Brown's A2 phones, 6/-; valves, 2/-; stamp for list.—8, Exchange Mansions, Golders Green Road, N.W.11.

A. DOSSETT, Commercial Artist and Draughtsman for all technical diagrams, illustrations and layouts.—HAZLITT HOUSE, Southampton Buildings, Chancery Lane, London. Holborn 8638.

PHOTO-ELECTRIC Cells, potassium type K.2. As used in television, burglar alarms, talkies, etc. Guaranteed, 12/6 each, postage 6d. extra.—J. E. COOK, 20, Lady Somerset Road, London, N.W.5.

FOR SALE—Complete Baird Televisor Kit, in perfect condition, £7.—Apply 47, St. Anne's Road. Phone: Harrow 1612.

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