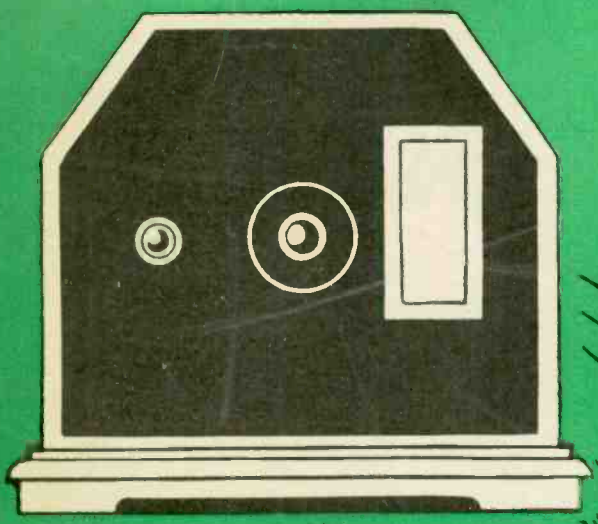
LATEST B.B.C. REPORTS

TELEVISION



NOVEMBER, 1932

Foreign Programmes : Special Time-table

More about the Mirror-Drum

A New Use for Old Valves

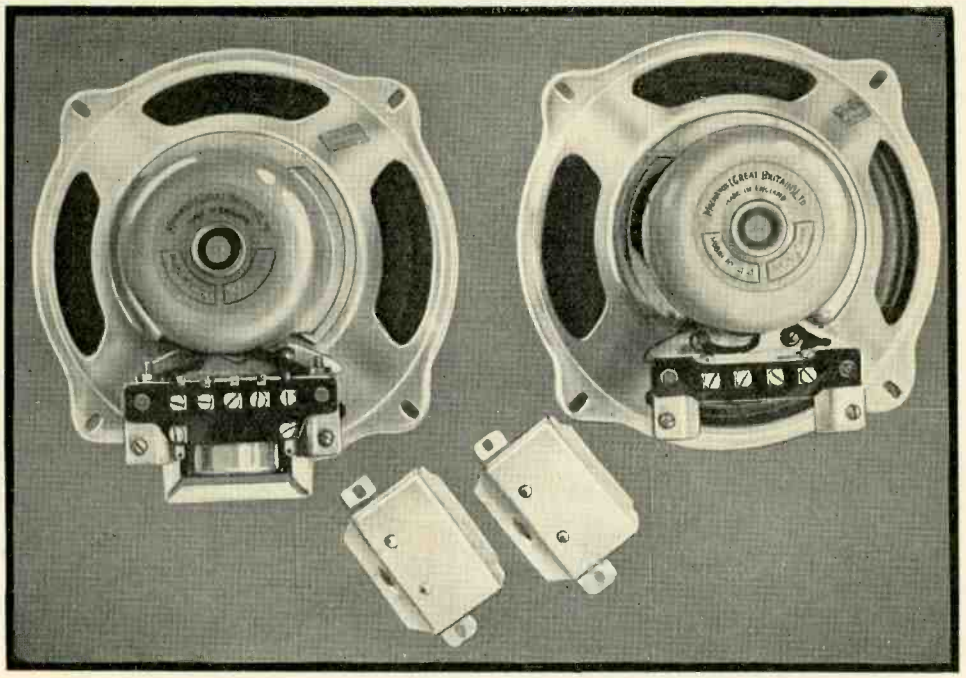
Television and the Theatre

Vol. 5 No. 57

1/- NET.

THE FIRST TELEVISION JOURNAL IN THE WORLD

Why we recommend Dual-compensated Speakers



for first-class reproduction

The very high quality of reproduction and the decided advantages enjoyed by using Magnavox Dual-compensated Speakers are acknowledged on all hands.

The underlying principles are not so generally understood. All speech coil impedances are relatively small at low frequencies, except for a marked rise at fundamental resonance. If, then, we connect in parallel the speech coils of two speakers of slightly different fundamental resonances each coil, in turn, offers a path of comparatively low impedance at the resonant frequency of the other, resulting in more uniform impedance and response.

There are also mechanical acoustic advantages, as will be explained in forthcoming advertisements.

Dual-compensated Speakers are supplied each fitted with 2,500 ohms field coils and hum neutralising coils. The required transformer must be stated when ordering. Type 20500 is for a single power valve, Type 20503 is centre tapped and is for a single pentode, using the whole primary, or two power valves in push-pull.

Two Dual-compensated Moving Coil Speakers, D.C. 144, Cone Diameters 7 inches, Overall Depths 4¼ inches, Baffle Hole Diameters 6½ inches.

INCLUSIVE PRICE
Complete with Transformer **£3 - 12 - 6**

MAGNAVOX

MAGNAVOX (Great Britain), Ltd., 89 Kingsway, London, W. C.2.

Telegrams :
Benbrolish Fleet
London

TELEVISION

Telephone :
City 0244
(10 lines)

Proprietors : BENN BROTHERS LTD.

Established 1880

Editorial, Advertisement and Publishing Offices :
Bouverie House, Fleet Street, London, E.C.4
(*Closed on Saturdays*)

SUBSCRIPTION RATES
13/6 PER ANNUM, POST FREE.
9/9 SIX MONTHS, POST FREE.
AMERICAN RATES
$4.50 PER ANNUM, POST FREE.
$2.25 SIX MONTHS, POST FREE.

MSS. AND OTHER MATERIAL FOR EDITORIAL CONSIDERATION SHOULD BE ACCOMPANIED BY A STAMPED ADDRESSED ENVELOPE, AND SHOULD PREFERABLY BE TYPEWRITTEN.

Contents November 1932

Index to Advertisements

TELEVISION

The First Television Journal in the World

Publishers: BENN BROTHERS, LTD. *Technical Editor:* H. J. BARTON CHAPPLE, WH.SCH., B.SC.
Offices: BOUVERIE HOUSE, FLEET STREET, LONDON, E.C.4

VOL. V. NO. 57] NOVEMBER 1932 [1S. NET

Notes of the Month

THIS month we publish a first article by Mr. G. W. Walton, the Lancashire engineer who claims to have developed an entirely new system of television. Scophony Ltd., the company with which he is working, are anxious to avoid premature claims and will not yet disclose any information. It is clear, however, that the inventor hopes to overcome the limitations of scanning, which he regards as the chief difficulty in existing methods. Another hint is given in the statement that the problems of television must be tackled as a whole if a perfect system is to be evolved. Mr. Walton takes the cinema picture as the standard to be aimed at for television and proceeds to discuss the problem on the basis of the 35 mm. film. From this standpoint the difficulties seem to be very great, but fortunately excellent images can be obtained with the present method of transmission, which is far less exacting for practical purposes. This should be kept clearly in mind in reading Mr. Walton's interesting discussion.

* * * * *

Other inventors are making headway with television, and it is a sign of the times that the first prize at the International Exhibition of Inventions last month was awarded for television. The apparatus consists of a camera and projector, in which the image from the camera lens is rotated by a prism, the resultant television image being produced by a number of circular or spiral lines. It appears that the patent was applied for over four years ago, and there could be no better illustration of the lag that often occurs between the original research and its practical application. We hope to hear more of Mr. de Wet's invention shortly.

* * * * *

It is reported that a hotel in New York is being "wired for television," in order to provide its patrons with this latest means of entertainment. Radio is, of course, already installed in many hotels and "apartment houses," each room being fitted with a loud speaker operated from a central receiver. It is not long ago that the Pennsylvania achieved fame with its bath to every bedroom, since adopted by all the big hotels, and television will become equally commonplace. We are reminded of an Englishman on his first visit to America who asked the price of a room without a bathroom; it was a luxury he could hardly afford. "We have 2,000 rooms," replied the manager, "and 2,000 baths —*you can't escape 'em* !"

* * * * *

On another page we give a list of the American television stations, and also a table of the weekly broadcasts now being given from Berlin and Rome. Some of our correspondents have described how they are successfully looking-in to these European stations, and readers on the Continent are in turn picking-up the B.B.C. programmes. Television is once more proving that science knows no frontiers. A correspondent sends us this month a photograph from Riga—even Latvia is taking to television.

* * * * *

Readers are making the most of our technical enquiry service but we should like to hear more about the programmes themselves—for example, which of the B.B.C. artists are most popular and which type of scene comes through best on the receiving screen. The programmes of the past month have again shown that the B.B.C. are sparing no effort in their desire to explore the possibilities of television. Reports from "lookers" not only afford encouragement but are of the utmost practical assistance to those in charge of the programmes. So write to TELEVISION to-day!

Last Month's Programmes

By "Spectator"

THE chief novelty in the past month has been an exhibition of palmistry by Miss Nell St. John Montague, who is distinguished for having provided the first programme to receive general recognition from correspondents. Counting heads is not always a fair test and, as comparisons are sometimes disastrous, the B.B.C. prefers not to publish figures of its post; but it is only fair to this lady to make it known that her performance evoked a volume of mail at Portland Place that would have been gratifying to the producer of a popular revue.

Superstition

Superstition is always with us. Who would not foretell the future if they could—and it is not necessary to be a serious student of chiromancy to wish to learn how to read a hand. If part of Miss Montague's success must be attributed to these factors, a great deal of credit must be given to the method and manner in which she presented her subject. Using a charcoal pencil, she sketched on white paper the outline of an ordinary hand and then, explaining each line as she progressed, she drew in bold definition lines of life, fate, head and travel. Next she took an unusual palm and showed the markings of suicide, murder, fame, and danger from air, fire and water. Each hand could be clearly read in the receiver in the projection room, and the interest was so keen in the studio that when Miss Montague finished, everyone was gazing at his palm. Seizing Eustace Robb by the left wrist, the seer then gave an impromptu reading of the producer's palm, and we applauded when we learned that he was to overcome difficulties for five years!

Clairvoyance is a delicate topic, and while this demonstration was entertaining and informative, I confess to surprise that it was permitted. The producer feels that the response vindicates its inclusion, and I am glad to find in the incident fresh evidence that he is to be given a free hand. It would be a mistake to fetter these new television productions with conventions that have grown up around the ordinary programme. In any case, an art that has survived for five thousand years and still thrives over the greater part of the East, is worthy of at least a cursory study, and Miss Montague is an authority on the subject. After the transmission she told me that she was reared in an atmosphere of superstition, in one of the Central provinces of India, of which her father was then governor, and that her mother came of Scottish highland stock which had a reputation for claivoyance extending over hundreds of years. Sceptics claim that the size of the "mountain of Venus" is determined by the muscular development of the ball of the thumb. I am putting this to the test by means of a course of thumb twiddling exercises, but to date can record no improvement. Miss Montague will be seen and heard again.

Writers often liken television to the cinema in its early development, and as both forms of entertainment appeal to the eye, a resemblance does exist; but the introduction of the talkies seems in one respect to provide a closer parallel. Vision was already established when sound was added to the cinema. In the case of television, sound is already established and it is vision that is being added. Am I mistaken, or do I now hear the same people who said that sound was not needed in the cinema, moaning that broadcasting is enough without vision?

More Receivers Wanted

It is a misfortune that a crystal set cannot bring television to the home. Lookers would increase by hundreds overnight as listeners did in 1923, if the humble, cheap and efficient cats whisker could throw an image upon a screen. The apparatus for receiving television programmes is somewhat formidable and many listeners must be without vision because they are unwilling to purchase and operate an additional wireless receiver. It is a shame that so much enterprise should be frustrated by the inability of listeners to become lookers, and as I have sat in the studio watching auditions, rehearsals and transmissions, I have pondered this problem of reception, and now in a diffident, artless way throw a suggestion to the experts.

Receivers in wireless exchanges carry broadcast programmes into sixty thousand homes. In return for one or two shillings per week a subscriber to a relay service is provided with a loudspeaker which he plugs into a socket whenever he wants to listen, and in many areas alternative programmes are on tap. Programmes are carried by telephone line from the receiver at the Central Exchange to the listener's homes. Is there any reason why television should not be relayed in this way? Listeners attached to these

" Vladimir flung Vanda out of the picture once or twice."

wireless exchanges would probably become lookers if facilities were offered. I am told that relaying of television is practicable but not simple by this means. It might be worth investigation. People will hire when they will not buy.

Irving Berlin, who called on Henry Hall at Broadcasting House and was most impressed with all he saw, said they had nothing like it in the States. Hall naturally took Berlin to see Studio BB and gave a demonstration. Standing before the screen he sang one of Irving's songs and he was moved by the chorus to try a step dance. In the flickering light he kicked over the microphone, which cracked. Asked when he was going to televise, Henry, who is not accustomed to stage performance, said he disliked the make-up which is rather forbidding; and for those who prefer not to use it a blue lamp is placed in the projector. The blue light is less vivid than the white arc and as a result the image is not so well-defined. For this reason, it is rarely used.

Ventriloquists

I have always been partial to ventriloquists and even without vision they always raise a laugh. Coram is one of the best and his " Disorderly Room " sketch is really funny. Music-hall patrons would not have recognised Jerry, his dummy, if they had seen his television debut. His face was livid and his mouth was black. A good effect was contrived when Ralph Coram and his wife faded out of the picture on a tandem cycle at the end of " Daisy Bell."

Guelda Waller and Vera McConochie were chosen to televise from a photograph taken in their old-world costume in which they sang nursery rhymes and songs of another era very prettily. The see-saw on which they sat for " Margery-Daw " was produced at short notice by a resourceful official who now looks after these things. He said a little job like that was easy, ask him for something difficult next time! I thought the puppets were a little too small to be really effective. Their faces are only about four inches in diameter, which accounts for the relative lack of detail. It is surprising that so much was seen. The props—especially the magic tower—were seen well, and the gollywog behaved just as a full-sized gollywog should. The speech was a little thick at times.

Meduria sang " A Peanut Vendor " with great verve and danced the Rumba on the Spanish-Mexican night, but Val Rosing suffered from having a bad cold. His make-up was good; though fair, he looked a Mexican, and his voice was well-suited to his songs. Val is going on the concert platform where his father, Vladimir Rosing, had a distinguished career. We must now look forward to seeing his successor as dance band vocalist, Les Allen, who also plays the saxophone,

Camaraderie in the Studio

Fred Douglas was seen without a black face in a programme with Nat Lewis, fat and hearty, and Betty Burke, a blithe dancer. These three separate acts were blended into one in rehearsal. Fred and Nat appeared together in one scene, and Betty joined Fred in a cockney dance for his number, " Lambeth Walk." This camaraderie is good to watch. All the time artists in the television studio are helping each other out. They are always ready to change costume and play in character with another act at the suggestion of the producer. No sign here of jealousy or striving for effect at the expense of other turns. Eustace Robb must be complimented upon the friendly informal atmosphere that prevails.

Vladimir flung Vanda out of the picture once or twice in their acrobatic dance, but it was not his fault that he was too quick for the man handling the projector. Vanda looked sweet and managed her crinoline to the manner born, but her acrobatic dance was the biggest thrill.

Mary, the performing ape, ambled about as apes do. Did you detect the deception? We are seeing a lot of animal life, and I hear that a greyhound may be here soon, in which case an expert will explain the winning points.

The " Party " was a slight disappointment. At times the fun seemed to be a little forced. Namara came in costume from the theatre and

as her dress was suitable she just had to sing "Carmen." Having extravagant gestures she televises well. Betty Pollock is a competent mimic; her make-up as Gracie Fields was best. Namara wore a mantilla for her bolero and her Cuban costume was graceful in the rumba.

The Newells

The projection light plays queer tricks. Elsa Newell's red dress looked pale in the receiver, blue appears as black and the filmy black tulle —or was it chiffon?—used by Betty Burke for her dance was so transparent that it was barely visible. The dancer was seen to great advantage. Bill and Elsa Newell have some saucy patter. They form one of the best light song and cross-talk double acts on the radio to-day. They gave an effortless, finished performance that looked as well as it sounded. Bill said that he wrote most of the patter himself, so there should be good original material here for future shows, and both he and Elsa know how to make the best of their clothes.

Dell and Dene in the same programme were a surprising pair. Nan Dell has walked for a mile and a half on her toes. I believe it now that I have seen her hop round that studio, and Jerry Dene, besides this remarkable toe dancing, can get a tune out of almost anything from a wine glass to a saw. Melodious stuff, too, don't you think?

Jass, of Jass and Jessie, kicks like a real pony. Ever since my first pantomime, I have loved a human horse.

The introduction of a second figure in Max Templeton's shadow play complicates the picture and I prefer to concentrate on a single object until images improve.

Short gaps have occasionally appeared in the programmes for which no apology has been made. I am no stickler for etiquette in presentation detail, but listeners have become accustomed to expect an apology or mention of any short break that may occur in regular programmes, and I think that lookers should be treated with the same courtesy.

A Stage Effect

During the month the producer has taken a stage effect to finish several turns. Instead of stepping back from close-up to extended position and fading out, artists, after backing to the extended screen have then walked forward to a close-up and following a curtsey or bow have slid out of the picture. This "curtain" is more impressive and serves to implant the artists' features in the memory.

Acoustical balance is not yet perfect, but I can see no way out of this problem with the existing facilities. The accident when Henry Hall kicked over the microphone by catching his foot in the cable demonstrates the difficulty. The microphone used is of the Western Electric condenser pattern and is housed in metal torpedo-like casing, from which it derives its nickname of "the bomb." The Western Electric instrument is an omnidirectional, good, all-purpose microphone that has been chosen for its robust qualities, but no condenser apparatus can resist a knock-out blow. It is awkward to move the microphone while a performance is in progress, and so it is necessary to compromise by placing the instrument before projection in such a position in the studio that it will give adequate reproduction of sound throughout the scene, whether the performers are in close-up, intermediate, or extended positions, dancing or stationary.

Placing the Microphone

The task of placing the "mike" is further complicated by the need for a good acoustical balance on the piano or other instrument that accompanies the performance. By means of a movable stand and cable, mobility is secured, as with the familiar standard lamp and flex in domestic use. But this arrangement is far from ideal, and I wonder whether the use of two or more microphones, suspended from the ceiling, would not improve matters? Engineers employed

Miss Montague, the palmist, provided the chief novelty in last month's programmes from Broadcasting House.

on outside broadcasting meet the same problems in theatres from which excerpts are occasionally relayed. The technical difficulty of getting good acoustical quality is one of the reasons why these relays are now heard so seldom. The experience of outside broadcast engineers in theatres might be valuable to the television people. Perhaps they could be consulted.

November Programmes

Scotsmen may like to note that the highland fling and other Scottish items will be given on St. Andrew's night, November 30. Gasson, the human bird, will also be seen this month while Nina Devitt and Jack Browning, Louie Freear and Lauri Devine are all appearing again. Penelope Spencer is to dance to Lord Berners' "Funeral March for a Rich Aunt" and the composer has been asked to come to the studio and accompany on the piano. A play, "Posters," is being specially written by Val Gielgud and Holt Marvel. The characters are three men and one girl, and the authors tell me that their play will employ every device of the medium discovered to date. Late November or early December should see its first performance. As previously, the B.B.C. programmes will be broadcast this month every Monday, Tuesday, Wednesday and Friday from 11 to 11.30 p.m. Vision is transmitted from Brookman's Park on 261.3 metres, and the accompanying sound is transmitted from Daventry on 398.9 metres.

By the time these notes appear in print, a mannequin parade will have have been seen by television for the first time. Reville is the enterprising firm of modistes, and I hope to deal with this programme in the next issue.

Reports from Readers

Reports commenting on the B.B.C. programmes which continue to reach the Editor regularly, show that the public for this latest branch of broadcasting is steadily growing as a result of the regular transmissions from Brookman's Park. Letters have already arrived from sixty different towns and cities in England, Wales, Scotland, Ireland, the Channel Isles, Holland, France and Germany. That there are many lookers in the Midlands is shown by letters from Rugby, York, Coventry, Derby and Sheffield, and in Birmingham alone TELEVISION has eight correspondents.

The prize of a free subscription for the best comments on the October programmes is awarded to Mr. T. Payne, of North Gosforth, Newcastle, who was last month's "runner-up." He writes:

"The Spanish programme on October 12, both from a television and entertainment point of view was immensely successful. Although I have been receiving television for over two years, Mr. Val Rosing's image last evening was the finest I have yet received. Every expression that he used whilst singing so delightfully was almost (if I may use such a daring expression) *perfectly* received. I am hoping that Mr. Rosing will be broadcasting again very soon. In fact, I should like to see the whole programme repeated in its entirety.

It is surprising that so much was seen of the puppets, considering their size.

"The ladies doing Spanish dances were seen remarkably well, and the details of what appeared to be most beautiful dresses came out very distinctly. I saw every step of the dance done with the tambourine, and at the conclusion when each artiste advance to take the usual curtain they were all distinctly seen, including the lady with the tambourine who came on after the pianist had finished, the pianist having to commence his music again for her curtain.

"In spite of very bad atmospheric conditions on the following evening, when reception of speech and music was rendered difficult from all stations, my television reception was very good. The lady who did a monologue was seen very clearly, especially when doing a certain amount of business with the telephone. The dancers also came through distinctly, although the black and white floor of the studio was not seen, presumably because they were dancing on a mat.

"A gentleman who did singing and whistling also came through well. What appeared to be his paper tearing, however, was the only item of the programme that was not seen distinctly. When the artistes took their curtains at the finish of the programme they were all seen very well."

"On October 20 the cartoonist's image was the nearest approach to a photograph I have ever seen on television. His black jacket, collar and tie and white handkerchief, also his features stood out very clearly. I cannot imagine this picture being seen any better in London. His cartoons and caricatures were each and all seen with won-

derful clearness, the transmission, fortunately, not suffering from fading which is generally very prevalent."

From Scotland

The resumption of television transmissions under the auspices of the B.B.C. has revived interest amongst enthusiasts in the north, and a number of sets are now in operation in Scotland. Mr. W. S. Mowat, of 8, Tullos Circle, Aberdeen, reports that, from his own experience remarkable progress has obviously been made at the transmitting end, and that, provided good clear signals are obtained, excellent detail is now available.

" During the past month, both here and in Stonehaven where my friend Mr. Thow is operating one of the early units designed by Richardson, the results have been consistently satisfactory. On October 5 the ventriloquist was received fairly well. Both he and the dummy were dressed in military (or bandsman's uniform) with white belt and white neck cord. The head and shoulder item of the artist giving impersonations was practically as good as a newspaper print, and the large hat which she put on occupied most of the picture. On the previous night we had a huge monkey doing some extraordinary tricks. It made marks with a crayon on a white board which were easily distinguishable. The lady in charge came over very well.

" The dancing turns (full length at times) came over very well—possibly the best in this range was the ' Nippy ' doing her ' duster dance.' The two full dressed gentlemen, complete with top hats, were seen very well also. The black and white floor is an improvement to the dancing items. Mr. J. A. Mollison was not received very well. The reason, I believe, was the expanse of white front and tie. He glanced down to his right hand, obviously reading his notes, and then we were given the impression that he was a bearded gentleman. Mrs. Mollison came in from his right, but fading was very pronounced at this point. The exits of the artists are generally very good, as they come up from the back in turn and make their bow.

" During October the London Regional station has shown a decided improvement so far as fading is concerned, and practically all the television transmissions have come through well. This week I have been concentrating on the vision side, and have not had Midland tuned in to the sound. I believe it would greatly assist ' lookers ' if they could get some idea of the amount of real detail available say, in the adjoining room of B.B. studio. For example, on October 14 the clown with the cone shaped hat was received very well indeed (possibly the best we have had). His loose fitting print blouse was clearly seen, and when his arms only were seen coming in from the right, as he was tearing long strips of paper, the detail was really good. The lady with the black spotted scarf thrown over her right shoulder was also good; again the five black spots were clearly visible on the scarf. The two dancing girls were best when the one standing up was playing a banjo and the other appeared to be kneeling at her left side. When both were dancing they went out of the picture frequently.

" One of the best items during the week was the gentleman with the silk hat, grey trousers, black coat about three sizes too large, with the exception of sleeves which were so short as to show about four inches of white shirt sleeve. The only item which we could not follow was on October 10. It appeared to be some miniature on a turn-table like little dolls.

" On October 13 I changed over my disc and got the German long-wave station. After the usual pause the dancing film came on. The three couples were seen very clearly, and the close-up demonstrations of the tango, foxtrot and waltz came through remarkably well. The braid down the side of the gentleman's trousers was visible. They had Mickey Mouse and the gymnastic film on again."

Mr. "Al." Smith, the famous Democrat, was televised during the American Election campaign a few weeks ago.

The Problems of Television

Limitations of Scanning

By G. W. Walton

In our July issue, reference was made to what is claimed by Scophony, Ltd., to be an " entirely new system " of television. Particulars are not yet available but its inventor, Mr. G. W. Walton, indicated his approach to the subject in a recent lecture to British Kinematograph Society, here reproduced by special permission. Editorial comment appears on page 319.

TELEVISION involves a number of problems, namely, the picture itself, scanning, synchronisation, transmission and reception, photo-electric cells, amplifiers, light efficiency of receiving apparatus, light source and light control. Previously experimenters have unfortunately concentrated too much on one of these problems, usually scanning, instead of attempting to obtain a whole solution. It may appear surprising to some that the picture is a problem, and I should like to deal with this completely, but at present it is only possible to mention parts of this problem when necessary in explaining the remaining problems. Pictures have not been studied nearly so much as they ought to be, for most of the serious difficulties in television lie in the picture itself, and a proper understanding of it will point the way to satisfactory solutions.

The Picture

In order that we shall have some starting point in dealing with the problems of television, what is required in results must be ascertained. For this purpose the picture on the screen in normal cinema projection from 35 mm. film can be considered as completely satisfactory, but this must be defined in television language.

Every picture is built up of a large number of small areas of light of equal diameter, which we will call the picture elements. In a picture on a cinema film, the picture element is obviously the " minimum circle of confusion " of the lens, which with a good lens is about 1/500th of an inch. The projector also has a lens having a similar circle of confusion, and there are mechanical inaccuracies such as the register of successive " frames " which, for this discussion, can be taken as equal to the lens inaccuracy. In the projected picture these three inaccuracies are additive, so that its picture element diameter is relatively three times greater than that of the film picture. If the projected picture is .75 x 1 inch in size (*i.e.*, the film picture) then the element diameter is 3/500ths of an inch, and is roughly a circular disc which may be in any position in the picture.

In television, due to scanning, the picture is divided into parallel strips of equal width, and so its element diameter is equal to the width of a strip. In this case, however, the element is roughly rectangular, and in one direction, across the strips, the position of an element can be changed only in definite jumps of one element diameter or an integral multiple thereof. In the other direction, along the length of a strip, an element may have any position.

The television picture therefore has a limitation not present in the cinema picture, and so for equal definition the element diameter of the television picture must be smaller than that of the cinema picture. Without giving any further reasons for it, if as above the cinema picture element diameter is 1/125th of the vertical dimension of the picture, then the television picture element diameter must be about 1/200th of the same dimension, *i.e.*, the picture should have 200 strips. If the picture has a ratio of 2 to 3 (instead of 3 to 4, as in a cinema picture) each strip would be 300 element diameters long, but it is better to consider the picture element as a rectangle of the 2 to 3 form, so that there would be only 200 elements in one strip, or, rather, that the element area is 1/40,000th of the picture area.

In order that the television picture shall appear as a continuous whole, the complete picture must appear 25 times per second.

It is now possible to specify the limits of inaccuracy in a television picture, and this can be expressed in terms of the picture element diameter. No element should be displaced by mechanical, synchronising, or electrical inaccuracies by more than a half of the element minimum diameter in either transmitter or receiver, which gives an overall tolerance of one element (*minimum*) diameter. This is a very liberal tolerance between adjacent elements and should certainly not be exceeded, otherwise the quality of the picture will be greatly impaired by the production of disjointed details.

Scanning Devices

It is possible now to deal with the problem of scanning, which is a process of disintegrating a picture so that it can be transmitted element by element as a succession of electrical impulses, by

means of which light at the receiver is varied and reconstructed as a reproduction of the original picture by a similar process of scanning. This is the most simple method of dealing with the picture, but there are multiple scanning methods most of which can be understood from a consideration of single scanning.

Inventors have paid a considerable amount of attention to scanning devices, too much, indeed, and naturally quite a number have been evolved, which can be divided into the following types: apertured with or without lenses in the apertures, mirror, prismatic, electro-optical and cathode ray devices.

The Nipkow Disc

The best-known apertured device is also the oldest scanning device, the Nipkow disc, which consists of a disc having a spiral of apertures, *i.e.*, having an angular and radial displacement between successive apertures. The picture scanned has a width equal to the angular displacement between two adjacent apertures, and a height equal to the radial distance between the outermost and innermost apertures of the spiral. As the disc rotates the apertures pass over the picture in arcuate paths, scanning it in successive strips. To obtain the tolerance of picture element position previously given, each aperture must be accurately positioned angularly to within plus or minus 5.4 seconds, and radially within plus or minus .25 of the aperture radial size. For cinema film picture size the disc would be 5 ft. 6 in. in diameter, and would have 200 apertures each .0037 inch diameter radially, the radial position accurate within plus or minus .001 inch and angularly with plus or minus 5.4 seconds, and the area of the apertures must be equal within 10 per cent. which means that the aperture diameter must be accurate within plus or minus .00005 inch approximately. This is rather a tall order.

As such a disc rotates (at 1500 r.p.m.) it has a tendency to collect dust in the apertures, reducing the effective aperture erratically, thereby producing incorrect shade values in the reconstructed picture.

Such a disc is generally satisfactory as a transmitter, but at the receiver as each aperture is only 1/60,000th of the picture area, and only one aperture is operative at any instant, the brilliancy of the average reconstructed picture can only be 1/120,000th of the brilliancy of the source of light. This can be improved by increasing the size of the apertures and fitting lenses into them but unfortunately for the perfection of picture now being discussed, each lens must be a highly corrected anastigmat, and even with the largest lens the light passed must be less than 25 per cent. of the useful light from the source. Such a lens disc dare not be considered, its cost would be prohibitive, the weight very great, dynamic stability terrible unless it had a double spiral of lenses (*i.e.*, 400 lenses) in a disc about 12 ft. in diameter, and the energy to synchronise and drive it would be very great.

Other apertured devices are apertured drums and slotted discs and drums, but all have much the same disadvantages and limitations.

In the mirror type of scanning device, the Weiler drum is one of the best known. In the example of picture given it would have 200 mirrors arranged around the periphery of a wheel with successively different angles of inclination to the axis of rotation, as well as the angular displacement due to their arrangement around the wheel. For example, if each mirror is 1 x 1 cm., the wheel would be 25 inches in diameter, the mirrors must be of metal, such as stainless steel, to prevent double images, and both angular displacements of each mirror accurate within plus or minus 5.4 seconds (or .0065 mm. in 1 cm. length). As a mass production job, I do not think any engineer would like to tackle it.

Oscillating Mirrors

The best form of scanning device is an oscillating mirror; some systems use two oscillating on axes at right angles to each other, others use one mirror having a double motion, one of which is slow, the other fast, in our example 12.5 and 2,500 oscillations per second. Another system uses a mirror fixed on a string passing through its centre so that it can rock in all directions at a certain frequency, and it is energised with a "rotating" magnetic field such as is obtained with a two-phase squirrel cage induction motor, which makes the mirror rock to a certain maximum angle during an inactive scanning interval, and during the scanning interval the amplitude of the rock dies away logarithmically, so producing a spiral form of scanning. In our example the rotating magnetic field or rather the peculiar rotary rocking of the mirror would be at a rate of 1,250 per second, or 75,000 r.p.m., also a tall order.

Oscillating mirror devices depend on their motions to produce the picture and so they have no mechanical tolerances, but synchronisation and phase are very important as is also the amplitude of swing which should be rigidly fixed so that considerable changes of energy produce no change of picture size.

Prismatic devices take several forms; one system consists of two overlapping bevelled edge discs, the angle of bevel changing continuously around the disc in one revolution; others have pairs of prisms rotating in the same or opposite directions. Two prisms rotating at equal speeds

in opposite directions are equivalent to a mirror oscillating on one axis, and so two pairs can accomplish scanning, in one pair each prism rotating at 1,500 r.p.m., and in the other pair at 300,000 r.p.m.! This is rather impracticable.

The light efficiency of mirror and prismatic devices is good particularly with a single mirror system, but the high speeds required for a good picture are a serious drawback.

The electro-optical type is represented by an arrangement by Von Bronk and consists of two laminated blocks of oscillating quartz crystals, one block having its laminations at right angles to those of the other block, electric conductors in the form of metal plates being arranged between the laminae. The two blocks are placed between two crossed light polarising prisms, so that no light passes through the system when the laminated blocks are not energised electrically. In each block each lamina is of a different length to oscillate at an individual frequency, so that when one lamina of each block is oscillating, light passes through from one element of the picture. The laminae of each block are successively oscillated, in one block at a high rate of succession, in the other at a low rate, in our example 1,500,000 and 5,000 changes of applied electrical frequencies per second. This is also a very tall order, and the brilliancy of the reproduced picture cannot be more than 1/120,000th of that of the light source.

In the cathode ray device, the chief advantage claimed is that there is no inertia in the scanning device, but this is a serious disadvantage in synchronisation and phasing particularly when synchronising and picture signals are transmitted over the same channel. In this type of device a cathode ray pencil is deflected over a screen (fluorescent in a receiver) by electric or magnetic means, in our example in one direction at a frequency of 12.5 per second and in a direction at right angles at a frequency of 2,500 per second. The amplitude of deflection is dependent on the strength of the deflecting potential or current which can change erratically in practice to considerable amounts. Without discussing cathode ray transmitters, of which there are many types, all equally poor, the chief limitation is in the receiver where the light available from the fluorescent screen is small; even with high powers it is not sufficient to project a home size cinema picture.

Synchronisation

In a system of television using scanning it is necessary to have some form of synchronisation and phasing of the transmitting and receiving scanning devices. Synchronising systems and methods can be divided into two classes, those for rotating devices and those for oscillating devices.

With rotating scanning devices some kind of motor drive is required, the commonest being a series wound D.C. (or A.C.) motor. This motor has a speed-load characteristic which decreases greatly with increasing load, and therefore is very good where an additional synchronising device, such as the phonic wheel of La Cour or some other synchronous motor, is used, particularly at the receiver.

Stability

For the transmitter a shunt wound D.C. or an induction A.C. motor is good, for the speed remains almost constant with wide variations of load, the speed decreasing slightly with increased load. When used with an additional synchronising device (at receiver or transmitter) it is more stable than the series type of motor, but if the synchronising device applies synchronising power in a short interval, it has a tendency to change its speed as greatly as the series motor for a short time, though it quickly returns to the correct speed.

The differentially wound D.C. motor to give really constant speed, or the synchronous A.C. motor, is most suitable for a transmitter; and a synchronous motor of small power rigidly coupled to a rotating scanning device (which is driven by a series of D.C. or A.C., shunt D.C., or induction A.C. motor) is a good means of obtaining synchronisation provided hunting effects are heavily damped out.

Rotating devices are exceedingly difficult to synchronise and phase unless a large control current is available, because they have no natural frequency of their own, and this also applies to cathode ray scanning. On the other hand oscillating devices such as oscillograph mirrors may be tuned to the frequency of a control current, so that the latter may be small and can change greatly in strength without seriously disturbing synchronisation or phase.

The control current for maintaining synchronisation and phase is in some systems obtained from local generators at each station, but this is most unsatisfactory in television. Methods using A.C. mains have also been proposed, but the continual changing of the strength and phase of such currents renders this very troublesome. Another method uses a control current obtained from the picture currents themselves, but this is also not all that could be desired. A better method consists of a local oscillating device controlled by a frequency obtained from the picture currents.

All these methods are troublesome with good pictures and the best method is to transmit a control alternating current from transmitter to receiver. (*To be continued.*)

Constructing a Mirror Drum

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

LAST month a method was shown for building up a mirror carrier which could be made to function as a mirror drum scanner, to be used in conjunction with a modulated light source for building up a television image by projecting it on to a translucent screen.

Referring once more to the question of the clip, it is essential to position each one correctly on its own carrier arm, a good soldered joint round the arm edges holding it rigidly in place. If preferred, before soldering these clips or mirror carriers in place, the four "edges" or projections can be bent at right angles to the carrier bottom, each bend being made very carefully in a vice or with pliers.

Coming now to the mirrors, thirty in number in the case under review, these should be of "polished plate silvered." Each one is $\frac{5}{8}$ inch long by $\frac{3}{8}$ inch wide and $\frac{3}{64}$ inch thick. Any good glass warehouse will supply these to order, and obviously for the best results good quality glass must be used. To allow for possible breakages, either in mounting or subsequently, it is a wise plan to obtain a few spares, say half-a-dozen at the same time. It is so inconvenient if one or two of the mirrors smash and there are no replacements available.

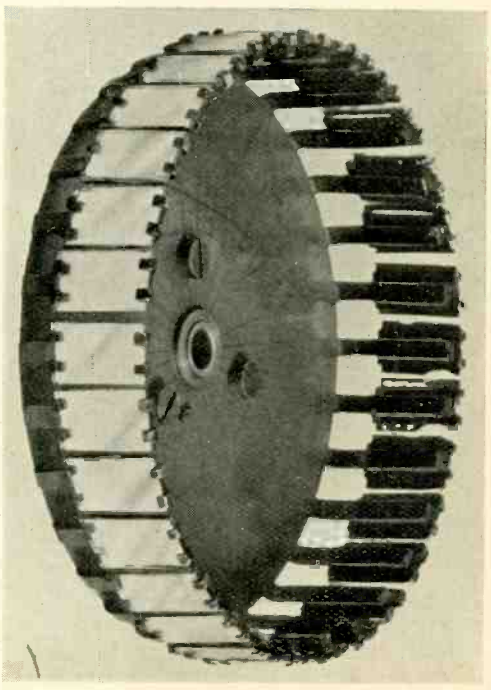
Exercise the greatest care in bending over the four edges or clip projections so that they grip the mirror firmly in place, as shown in Fig. 5 (c) last month and the photograph here reproduced. Care and patience are essential in this job. See that the long edge of each mirror is parallel with the carrier arm, which is in turn parallel with the axis of the main carrier. A boss must be fitted to the drum but this is quite a simple matter, the hole size depending on the diameter of the motor shaft on which the drum is to be mounted. In any case the diagram shown as Fig. 1 is quite self-explanatory for this section of the work, the mirror carriers being omitted for clarity. Three screws will be sufficient for holding the boss firmly in place against the drum side.

Construction is now complete and the next point that arises is the setting or canting of each individual mirror so that the drum produces a perfect light strip field. Here again considerable care is called for and it is of little use to adopt a trial and error method or the results will leave much to be desired.

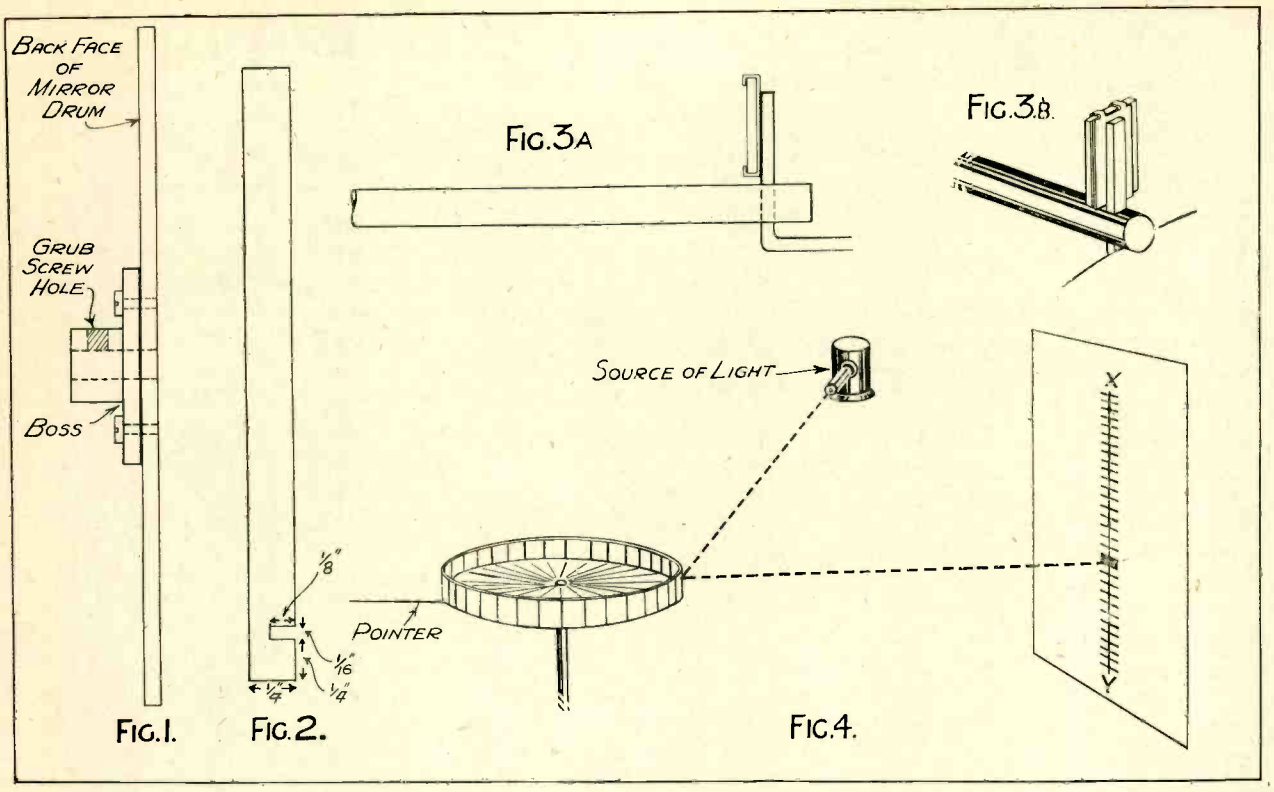
First of all, then, how are we to adjust each carrier arm? A pair of strong pliers will do the work but it is much better to make up a special tool for the job. This is illustrated in Fig 2, and consists of a steel rod about four to six inches long with a slot cut by a file at one end as shown, the slot should be made just a fraction over $\frac{1}{16}$th inch wide and $\frac{1}{8}$th inch deep.

This will now act as a lever by passing the end of the mirror carrier arm into the slot of the rod. The rod can be bent in the plane of the drum side or at right angles to the drum side, and in this way adjust the mirror to any position that may be desired. Fig. 3 (a and b) shows an edge-on view of this scheme and also a drawing in perspective, only one mirror carrier being indicated to avoid confusing the reader. In this way the mirror carrier is bent beyond the elastic limit of the metal until the mirror is set at the particular cant or pitch required.

Having seen how it is possible to adjust each mirror position we must now consider the final task, namely, that of adjusting one to the other to give the explored light field. One scheme for doing this is shown in Fig. 4. Mount the drum on the end of a vertical rod so that it can be turned round in a horizontal plane, the other end of the rod being gripped in a vice. Drill a



The completed drum with mirrors in position.



Constructional details shown in these diagrams are described in the text.

very small hole right through the centre of the rod at right angles to its main axis, and pass through this a steel pointer (say a long, thin knitting needle) so that it is held rigidly with reference to the rod. (If available, of course, the turntable of a dividing head is a much better mount for the drum, but failing this the scheme suggested will suffice).

Now focus a spot of light from a suitable source (an old galvanometer lamp will do admirably for this), so that when this light is reflected from a mirror it falls on to a vertical screen, say of thick drawing paper mounted on a board. It is best to arrange for the spot of reflected light on the screen to be square.

A centre line XY is marked down the screen so as to be parallel with the axis of the drum. Assuming that the finite size of the reflected light spot is one inch, then 30 one-inch divisions must be marked off on the line XY as shown. Starting from the top these will be numbered one to thirty if we are setting a thirty mirrored drum.

Now fix the drum rigidly so that one of its radii previously scribed on the metal surface when marking out the " teeth " lies along the pointer. Switch on the light so that its beam is central on one mirror and reflects a spot of the predetermined dimension on the screen. The tooth holding this mirror should be exactly at right angles to the drum surface and the screen so placed that the spot of light reflected comes just on the division marked No. 15 on XY (see Fig. 4).

Slacken the nuts holding the drum rigid and move it round carefully through 12 degrees to the next scribed radii; let this lie along the pointer. Tighten the nuts so that the drum is rigid once more and with the spot of light reflected on the screen, grip the tooth or mirror arm by means of the tool (as shown in Fig. 3), and very gently bend this so that the spot of light is positioned exactly on the line XY, but coincides with the division marked 14. Rotate the drum through another 12 degrees and repeat as before, each mirror in turn being lined up to its appropriate cross-line until No. 1 is reached. The next mirror must then be set to coincide with No. 30 line, then the next with No. 29 line and so on until we come back to our starting point of No. 15.

The drum may then be removed and is ready for use in any form of mirror drum receiver which the reader is desirous of using. In some cases the drum may require readjustment after a lapse of time, but this is quite easily carried out in the manner just indicated.

As soon as any suitable light source is on sale, then steps will be taken to evolve a complete receiver design for readers. Next month, however, other types of mirror drums will be discussed and in this way the scope of our readers' activities will be broadened.

News from Abroad

From our Own Correspondents

The United States

NEW YORK, *October* 3.

UNDOUBTEDLY one of the most interesting and most discussed phases of television is the transmission of scenes that are "picked up" out-of-doors. A new "camera" for this work has recently been developed here by engineers of the De Forest Radio Company. In this equipment, the well-known flying spot has been eliminated because of its obvious draw-backs. Instead, the scene to be televised is focussed through a high-grade lens on to the revolving scanning disc, behind which is a sensitive photo-cell which feeds into a six-stage resistance coupled amplifier and then to the main amplifier of the transmitter. The apparatus is so mounted that the lens can be raised, lowered, or swung from one side to the other so that moving objects can be followed, or panorama effects obtained.

In front of the scanning disc is a neon tube through which part of the modulated current is fed. A shadow-box arrangement permits the operator to view the image formed behind the disc, by this tube, and thus monitor the out-going programme. There is also provided an adjustment for the lens so that the operator may train his "camera" on an object only a few feet away, or on one several hundred feet distant or on any subject in between. The entire equipment, including all the necessary battery equipment, can be mounted on a small motor truck for mobility.

Cathode-Ray Tubes

Cathode-ray tubes for experimental television installations are now available in the United States from the Globe Television and Phone Corp., New York. It has often been predicted that the cathode-ray tube will be the practical successor to the scanning disc as we now know it; in any event, low-powered cathode-ray tubes available to anyone open a fascinating field for amateur research.

The smallest of these tubes is about the size and shape of a power tube such as used in some receivers, and has a five-prong base. Within is the cathode "gun" which sprays electrons against the fluorescent screen on the inside of the bulb's rounded top. There is also a single set of deflection plates which, for every volt impressed upon them, will deflect the electron stream one tenth of a millimetre. The filament is rated at 0.5 to 1 volts and 5 amperes. The electronic stream is created by a potential of 250 to 500 volts.

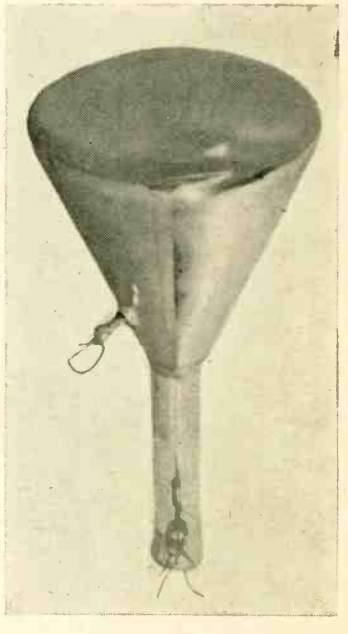
Then there are three others also with deflecting plates, but funnel shaped as shown. The 3-inch screen size has the same characteristics as the smaller one, but because of enhanced sensitivity brought about by mechanical refinements, the deflection of the ray beam is increased to 0.5 millimetre per impressed volt. The 5-inch size displaces the beam 1.0 millimetre per volt, with the same filament voltage and current as before, but with a potential of 400 to 1,000 volts for creating the electron stream. The 9-inch tube has the same general characteristics as the 5-inch type, but the beam displacement is increased to 2.0 millimetres per impressed volt.

In another design, the deflecting plates are replaced by deflecting coils placed on the outside of the bulb, and the efficiency is increased by an auxiliary silver anode for focussing and increasing the intensity of the light emitted.

Over Thirty Stations

Although television in the United States has a long way to go before it can be considered as a reliable method of communication, there are now over 30 stations in more or less regular operation. Several of these are linked with regular sound broadcasting stations and are sending out their

* * * *



One of the cathode ray tubes for experimental television sets now available in the United States. The photograph shows the general design for the 3in., 5in., and 9in. sizes.

* * * *

images simultaneously with the sound programmes. The following table shows the distribution of vision stations and may be of interest to English readers for the general information which it gives.

Call Letters.	Power in Watts.	Company.	Location.	Scanning Lines.
1,600 TO 1,700 KILOCYCLES.				
W2XR (1)	500	Radio Pictures, Inc.	Long Island City	60
W1XAV (2)	1,000	Shortwave & Television Co.	Boston, Mass.	60
2,000 TO 2,100 KILOCYCLES.				
W3XK	5,000	Jenkins Laboratories	Wheaton, Md.	60
W2XAP (3)	5,000	Jenkins Television Corp.	Washington	60
W2XCD	5,000	Deforest Radio Co.	Passaic, N.J.	60
W9XAO (4)	500	Western Television Corp.	Chicago	60
W6XAH	1,000	Pioneer Mercantile Co.	Bakersfield, Cal.	60
W9XK	100	Iowa State University	Iowa City, Iowa	60
W8XAM	1,000	Sparks-Withington Co.	Jackson, Mich.	?
2,100 TO 2,200 KILOCYCLES.				
W3XAK	5,000	National Broadcasting Co.	Portable	?
W2XBS	5,000	National Broadcasting Co.	New York City	60
W3XAD	500	RCA-Victor Co.	Camden, N.J.	60
W8XAN	1,000	Sparks-Withington Co.	Jackson, Mich.	?
W2XCW	20,000	General Electric Co.	Schenectady	?
W8XAV	20,000	Westinghouse Elec. & Mfg. Co.	Pittsburgh	?
W6XS (5)	500	Don Lee Broadcasting Corp.	Gardena, Cal.	?
W9XAB (6)	2,500	National Broadcasting Co.	Chicago	60
W9XO	100	Kansas State Agri. College	Manhattan, Kan.	60
2,750 TO 2,850 KILOCYCLES.				
——	1,000	Sparks-Withington Co.	Jackson, Mich.	?
W9XG	1,500	Purdue University	W. Lafayette, Ind.	60
W2XAB (7)	500	Atlantic Broadcasting Co.	New York City	60
W3XE	1,500	Phila. Storage Battery Co.	Philadelphia, Pa.	120
W9XAA (8)	500	Chicago Federation of Labor	Chicago, Ill.	60
43,000-46,000, 48,500-50,300 AND 60,000-80,000 KILOCYCLES.				
W1OXG	500	De Forest Radio Co.	Portable	?
W9XD (9)	500	The Journal Co.	Milwaukee, Wis.	?
W3XAD	2,000	RCA-Victor Co., Inc.	Camden, N.J.	?
W2XBT	750	National Broadcasting Co.	Portable	?
W1XG	30	Shortwave & Television Co.	Portable	?
W2XR	1,000	Radio Pictures	Long Island City	?
W2XF	5,000	National Broadcasting Co.	New York City	120
W2XDS	2,000	Jenkins Television Co.	Portable	?
W6XAO	150	Don Lee Broadcasting System	Los Angeles, Cal.	?
W3XK	1,000	Jenkins Laboratories	Wheaton, Md.	?
W3XE	1,500	Phila. Storage Battery Co.	Philadelphia	?
——	1,000	Sparks-Withington Co.	Jackson, Mich.	?

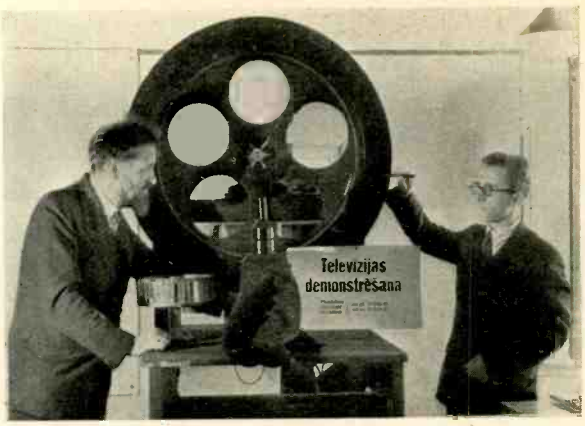
(1) In connection with sound station W2XAR, New York.
(2) In connection with sound station W1XAU, Boston.
(3) In connection with sound station W2XJ, in Washington, D.C.
(4) In connection with sound station W1BO, Chicago.
(5) In connection with sound station KHJ, Los Angeles.
(6) In connection with sound station WMAQ, Chicago.
(7) In connection with sound station W2XAB, in New York.
(8) In connection with sound station WCFL, Chicago.
(9) In connection with sound station WTMJ, Cleveland.

Germany

BERLIN, *October 17.*

The event of the month was the first meeting of the German Television Society here on October 13. All those interested and engaged in television research work in Berlin were there, including Ministerialdirektor Kruckow of the German Post Office, German television's official friend, Professor Schröter of Telefunken, Dr. Schubert of the Fernseh A.-G., Dr. Schlesinger of Radio-Loewe, as well as other television experimenters, such as von Mihaly and von Ardenne.

Dr. Kirschstein, of the German Post Office laboratories, gave members an interesting account of the television exhibits at the Berlin radio exhibition. It was interesting that he as a neutral expert placed the cathode-ray tube picture shown by Telefunken at the head of the list, this being closely followed by the mirror-screw receivers of Fernseh A.-G. and by " Tekade " of Nürnberg. Dr. Kirschstein told us that he pins his faith to



Television apparatus constructed by the post office engineers in Riga, Latvia.

the mirror screw receiver at the moment. A discussion then followed during which Herr Krucko revealed that one of the P.O. engineers was shortly leaving for England on an official visit to report on British television. I understand that members of the German Television Society will be given an account of his visit at a later meeting. It will be interesting to hear what this neutral scientist will say.

The Berlin 4 Kw ultra short-wave transmitter is still regularly transmitting television from 10-11 a.m. CET, and I understand that these transmissions may shortly be augmented by further television broadcasts between 14.00 and 15.00 CET and 21.00-22.00 CET, daily except Sundays. The wavelength used is exactly 7.0 metres. The same transmitter now sends out broadcasting of sound three times a week. Berlin-Witzleben, which at present still transmits a 30-line picture (German horizontal scanning), will probably discontinue these transmissions, but the long-wave television broadcasts sent out by Königs Wusterhausen will be continued so as not to disappoint experimenters having the old 30-line receiving apparatus.

On the whole, activity in television research has started again in Germany, Telefunken and Radio-Loewe retaining the cathode-ray tube receiver, whereas Fernseh A.-G. are devoting more attention to the transmitting end at present, although they have work in hand for mirror-screw and cathode-ray tube receivers. Tekade of Nürnberg are also working on cathode-ray tube receivers and specialise in the mirror screw.

Readers may wonder at the German reluctance to start public television. But they have definitely given up all thought of broadcasting a 30-line picture and consider the 90 lines at present in use as the minimum. Later they intend going on to 120-lines. Now these frequencies can only be broadcast on a short or ultra-short wave, and therefore they intend waiting until sufficient ultra short-wave adaptors are in use; these will be

European Television Time-Table.

Station.	Wave, mm.	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
Königs-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.

marketed in Germany the moment the Post Office gives its approval to ultra-short waves, to ensure a public for the television broadcasts.

I was privileged to witness a reception of the ultra-short wave television broadcast at the Telefunken laboratories the other day, and I must say that at long last the cathode-ray tube receiver is definitely there and is all-mains driven too. (Distance transmitter-receiver 6 kw). The German engineers are still dissatisfied and do not consider their present splendid pictures good enough. Let us hope they will start out soon and risk it; after all the B.B.C. has started with a very much less perfect picture.

France

The growing interest in television here is reflected in the September issue of *La Nature*, which is largely devoted to television, and contains some interesting comments by the leading French experts. "Television," this journal states, "has now become a practical proposition thanks to the combined progress of wireless, cinematography and acoustics, and to the efforts of an army of inventors. It is impossible to exaggerate the importance of the results, and the way in which the pioneers have overcome the apparently insurmountable obstacles that barred their way makes their progress even more surprising."

M. R. Barthelémy is among the pioneers of television in France, and his best known contribution to the science is probably the method of electro-mechanical synchronisation for which he is responsible. A representative of *La Nature* visited M. Barthelémy in his laboratory at Montrouge, where regular television transmissions are now taking place. Important results, he said, had been obtained at the laboratory during the past eighteen months, in the course of which at least two hundred demonstrations had been given. The stability obtained was such that during a transmission lasting for several hours it had not been found necessary to alter the timing of the image phase at the receiving end. Faces have been seen very clearly, and the transmission of animated sketches has also been satisfactory. M. Barthelémy forecasts important developments in television transmissions from his studio. The results, he said, fully justified more frequent transmissions, but the system itself must first be perfected, and they had not really yet had time to organise regular programmes. "Such an organisation would, of course, need to be meticulously thought out beforehand and would require careful handling. It would not be easy to retain the interest of spectators for several hours each day, for this would call for innumerable different scenes. We have not the resources of a theatre which can repeat the same show for three months! But we have already obtained the stability of the image and its necessary brightness on the screen—two important steps. Our immediate aim is to be able to transmit scenes containing a number of people: then the public will probably begin to appreciate television. The progress made so far is immense; we have increased the number of images per second, and the number of lines per image, while the band of frequencies transmitted has become more and more extended."

Cathode Rays

M. P. Brenot, one of the leading personalities in the wireless industry, is not quite so enthusiastic. He does not think that television at present offers sufficient interest to the general public, as the images are restricted to a comparatively small screen. M. A. Dauvillier, who still supports cathode rays, thinks that television will develop either by means of this system or not at all.

Meanwhile, amateur enthusiasts continue to make headway with their experiments and as reported in TELEVISION last month, satisfactory reception of the new B.B.C. programmes from Brookman's Park is being obtained in Paris and elsewhere on receivers of the scanning-disc type.

A Rival to the Theatre?

By Orrin E. Dunlap, Jr., B.Sc.

In these final extracts from "The Outlook for Television," reproduced by special arrangement with Harper and Brothers, New York, the author discusses the future of the theatre, the cinema, and other entertainments which are likely to be influenced by this fascinating science.

WHAT effect will television have on the theatre? Will the public go to the movies if they can see the films and news reels flash on screens amid the comfortable atmosphere of their home? Will they go to the theatre to view a stage performance or to an auditorium to see and hear the opera?

The stage, screen and opera will endure. The leaders in radio are of this opinion else they would not plan great theatres for the actors and opera stars in Radio City. The theatre, the cinema and the opera will probably be more spectacular in this new setting. They will be part of television. All will go hand in hand. No matter how elaborate the radio show, it will not keep people away from the theatre, where the entertainers are seen in person untouched, unblemished by the elements that may attack them on their flight through space. Television could probably begin successfully in the home as a more or less peep-show, but in the theatre, if it is to play a part there, it must compete with the motion picture.

When the theatre complained of a dearth of material; when playwrights said they had used up all the stories and plots of generations past, along came the motion picture to work them all over again. And when the silent films exhausted the dramatic themes, the talkies arrived at the opportune moment. And the old stories were still good. Now Hollywood says it is running out of ideas for screen adaptation. This looks like a sign that another step in the evolution of entertainment is not so far away. Television may be next to give the ancient themes a new avenue of escape and the actors further opportunities.

Greater Triumphs

The old material will be freshened, old ideas and love stories as old as the hills will be dressed up to amuse many millions over and over again. Everything that has been adapted successfully to the celluloid reel will find television a medium for greater triumphs. Television and the movies are destined to be related. There is a wedding of these two arts in the offing. Camera men, continuity writers, directors, actors, dialogue specialists, studio fashion stylists, decorators, swarms of artisans, carpenters, authors, painters, orators, scenic experts, musicians, electricians and mobs of extras comprise a small portion of the army that will hear the call of television inviting them to the "Hollywood of the Air" to participate in a great revival of all that has gone before on the silver screen.

New Thrills in the Cinema

The blood hounds that chased Eliza across the ice blocks in many a small-town opera house, and then across the movie screen, featuring *Uncle Tom's Cabin*, will do that same thing over again for the television audience. Ben Hur, who lived on the stage, raced in his chariot across the silent screen only to have his name blaze in brighter lights on Broadway when the sound picture brought him back, will race again in a television thriller, in a spectacle of nation-wide scope. The covered wagon will lumber through space as it did across the plains in the pioneer days. *The Birth of a Nation* and all the great pictures of the past will be seen again by television.

Television will be a good thing for the film business. Already the projectors of teleopticons, as they might be called, are handling reels of pictures instead of attempting to televise directly in studios or out-of-doors. It is more likely that dramas, comedies and geographic scenes will be photographed and prepared in advance of the broadcast on reels, which will be distributed to the stations in much the same way as electrical transcriptions or records are furnished the broadcasters. Television from film will be more perfect than direct photography, because mistakes can be corrected before the reels are completed. Much of the television show will be prepared in studios and presented as are the talking pictures.

Theatres may find it necessary to subscribe for a wire service that will bring them television news scenes, so that the audience can follow the events as they take place. There may be special television auditoriums that will feature the "world series" baseball games, the best stage productions, outstanding football games, cham-

pionship bouts, international and national news events, boat races and hockey games.

However, there is much to be done in scientific research before a television picture is equal in size and clarity to the motion picture. Furthermore, it is one thing to televise a filmed studio performance adapted to broadcasting, and a much different proposition to televise an outdoor event alive with activity such as a football game. It is a rather difficult job to follow the gridiron contest on a movie screen and much more so to follow the plays as might be reproduced by any of the current television systems.

Looking in on Sport

It will be many a year before the Harvard-Yale game is played with no spectators in attendance because they are all at home looking in. As long as the game is played there will always be the football crowd that prefers to be on the scene rather than at the screen. And so it will be with other sports events.

Some one remarked that to hear a prize fight by radio is like staying at home to look at a best girl's picture, or to watch her in a home motion picture instead of being with her. The picture or film is a mere substitute. The enthusiast for football will not surrender the trip to the playing field for a motion picture by television. The " world series " fan will continue to go through the turnstiles. The theatregoer will continue to pay homage to the box office. Television will supplement. It will not supplant. Everyone cannot crowd into a football enclosure, into a Radio City theatre, so what will it matter if the same scene travels across the countryside by television? It merely gives added millions an opportunity to enjoy the performance, but the man who pays admission sees it first-hand.

Broadcasting did not destroy the stage and motion picture as some predicted it would. They saw radio as a great monster threatening to claw the theatre and the screen. Now some see television as the monster grown up and more ferocious. But it is away down the road of the future so far as the theatre is concerned, and when it approaches it may not be as dangerous as it looks, because of its co-operative and supplementary features which will open new opportunities for all concerned.

" The motion picture industry need experience no alarm over the impending advent of television," said David Sarnoff, president of the Radio Corporation of America. " The transmission of sight by radio will benefit not only the radio industry; it will also provide a welcome stimulant, a pleasant tonic to all the entertainment arts. There will be no conflict between television in the home and motion pictures in the theatre. Each is a separate and distinct service, Television in the home will not displace the motion picture in the theatre. Granting that we can develop 26,000,000 potential theatres in the homes of America, public theatres will continue to operate because people will go there in response to the instinct for group emotions and to see artists in the flesh. These are human demands which television in the home cannot satisfy.

" Television, when it arrives as a factor in the field of entertainment, will give new wings to the talents of creative and interpretative genius. It will furnish a new and greater outlet for artistic expression. All this will stimulate and further advance the art of motion picture production. The potential audience of television in its ultimate development may reasonably be expected to be limited only by the population of the earth.

" Special types of distribution networks, new forms of stagecraft and a development of studio equipment and technique will be required. With these must come a new and greater service of broadcasting, of both sight and sound. A new world of educational and cultural opportunities will be opened to the home. New forms of artistry will be encouraged and developed. Variety and more variety will be the demand of the day. The ear might be content with the oft-repeated song; the eye would be impatient with the twice-repeated scene. The service will demand, therefore, a constant succession of personalities, a vast array of talent, a tremendous store of material, a great variety of scene and background."

Television and Music

Leaders in music attest to the fact that radio has given the masses a new appreciation of music. Some are wondering what the effect of television will be on the vast audience that has learned to enjoy good music without seeing the musicians and conductors.

Willem Van Hoogstraten, conductor of the New York Philharmonic Symphony Orchestra, was asked at a dinner in New York if he expects television to aid in the development of appreciation for classical and symphonic music that is broadcast. " My answer is no," said Van Hoogstraten. " Television may revolutionise other forms of radio entertainment but it cannot be expected to create a devoted interest in the higher forms of musical composition, because sight of the artists and their instruments invariably dulls the appreciation of the sounds created, even if the auditor is highly skilled in the art of listening.

" The ears alone should be permitted to

generate one's impression. When a person sees the musical performer sight usually takes away something from his ability to hear and assimilate the tonal shadings of good music, which, after all, is something for the ears. A higher plane of musical appreciation by listeners in general should be reached without seeing by radio, even assuming that television were perfect. All this is my personal point of view. I can understand that others may want to see the artists. However, the listener who sees not but hears completely, although the players or their images are before his eyes, gets the most out of the musical score. Television in itself is a great mechanical-electrical achievement but I cannot see it as an aid in the true appreciation of music.

" Appreciation of music is the great thing to be sought," contnued Van Hoogstraten. " But first one must learn how to listen. Those attending a concert should not depend too much on the eyes. Do not look at the conductor and the musicians, or the individual artists on the stage, and you will begin to hear things never heard before. If one must hear and not see, to get the most out of music, is not broadcasting of sound the ideal medium of conveying the works of the great masters to everyone?

" I realise that many people like to see orchestras and conductors, but the heart of the matter, I believe, is that it steals attention from the music. Conductors do not stand on the platform for people to look at; they are there to convey to the men of the orchestra that which the composer had in mind when the music was written, as conceived by the leader. I am much in favour of building halls in which the conductor and the orchestra would not be seen by the audience. The lights should be soft, and not shine in the eyes. The foreground should be of soft colours. One might go even further and in an inconspicuous way, use lighting effects which change softly and slowly to suit the mood of the music."

A sports event at an American University. "As long as games are played there will always be a crowd which prefers to be on the scene rather than at the screen."

There are instances in music where television will be a boon. Take for example, the opera. The broadcasters agree that they can do justice only to certain arias and acts. That is why they are not anxious to broadcast complete opera performances from the stage. The audience must see as well as hear opera to enjoy it thoroughly. That is why television is expected to stir a renewed interest in appreciation of this class of music.

"There may be special television auditoriums that will feature the 'world series' baseball games . . . ." An artist's impression of the national game in America.

" One must see and hear the opera to get the fullest appreciation," said Rosa Ponselle, soprano of the Metropolitan Opera Company. " I believe we are rapidly approaching the day when radio and the opera will be entirely reconciled by the addition of television to sound programs. When that comes it will be a great day for operatic appreciation, but I am uncertain as to whether such broadcasting will keep people away from the seats before the footlights or cause them to gather in greater numbers. We shall see. It seems that radio is awaiting television to give the theatrical part of opera the wings now enjoyed by sound."

It is natural that the universal question " What effect will television have on sound broadcasting? " is on the tongue of all who are interested in it whether from an artistic or a financial standpoint. The entertainers have reason to wonder what they must do to adapt themselves to the new medium. The station owners wonder what will become of the millions they have invested in equipment. The listeners wonder if their receivers will be obsolete. The answer is that television is destined to revolutionise the art of broadcasting.

All stage stars are not screen successes. Stars in the silent cinema often ceased to twinkle when the talkies were introduced. New requirements had to be met. New talent was discovered. So it will be in television. All broadcast stars

should not expect to win new triumphs when radio is given eyes that enable the audience to see. They may be delightful and serene on the wings of sound alone but that does not mean that that the eye will be pleased with them too. Some will captivate both eye and ear. They will be the stars of television. The entertainer who can please the eye need not worry so much about the ear. But the one who can please the ear and not the eye had better watch out.

Generally speaking, humourists have failed in broadcasting. Their jokes have usually fallen flat. The comedian needs to be seen in action. His antics and gestures, facial expressions and make-up do more to put him across. Television will give the comedian a new day—more opportunities and greater audience than radio ever did with sound alone. Radio vision will help the world to have more laughs. The clowns will have their innings.

In the beginning probably the regular broadcasting stations will be employed to handle the sound part of the programme while short waves carry the images. Eventually, the sound portion of the programme may be moved to the ultra-short wave realm too. That would mean new equipment.

Here is one reason why television cannot be developed overnight. Let us suppose that the regular broadcast band from 200 to 550 meters is to be utilised for sound, and short waves for the scenery. It means two transmitters and two receiving sets. As research progresses it is discovered that the ultra-short waves are ideal for both sound and sight, more economical and more efficient from a scientific standpoint. Then the transmitting stations would have to be scrapped and so would all the receiving sets.

If there were 600 transmitters and 10,000,000 television receiving sets the manufacturers would think awhile before disturbing such a vast investment. So it is far the best to determine in the beginning what waves are most suited for television and build on that foundation, rather than develop on an uncertain basis and later be afraid to change to a more efficient system, because of the tremendous investment that would be disturbed.

Waiting for Developments

A Washingtonian once remarked to a Chicago station owner, one of the pioneers in that city, that he could have bought a 500-watt station in Indiana six years ago for 1,000 dollars and could have made "a barrel of money." "I wonder if you would have," remarked the Chicago broadcaster. "We rushed in here in the beginning and it didn't cost much to buy the equipment. But we have spent thousands and thousands of dollars since in development and replacement of antique apparatus. We have made money but would be far ahead of the game if we had waited until broadcasting became stabilised and then bought a station. It would have cost less. So you cannot look at this broadcasting business from an original cost basis. That is why many of the pioneers are forgotten. The man who takes them over after the development is more less complete makes the money. We have learned our lesson in this rapidly changing field of radio. We are watchfully waiting for television. We will let the others rush in at the start, and when we think it is ready we will enter the race, fresh and ready to profit by their mistakes and experiences."

Looking Ahead

It was M. H. Aylesworth who pointed to the immediate application of television as the visual presentation of the broadcast artist. He contends that the public may look forward to an early television supplement to the regular sound broadcast programmes, in which speaker, singer or musician will appear on the home television screen as purely optional features. In other words, he believes that the sound program will be received in the same manner as it is to-day. However, if the home be equipped with a television receiver, it will be possible to tune in the animated portrait of the performer. That this feature will prove highly attractive, no one will deny.

There are certain to be new uses for television. Just as the artistic mind of the past has capitalised on the limitations of silent movies and blind broadcasting, so will the artistic mind evolve an entirely new mode of expression to be handled by the television vehicle. It is already predicted that a variation of the futuristic art, with its symbolic abbreviation whereby a few lines and masses effectively tell an intricate story, may come to the aid of television in its early stages when detail must be sparingly used.

(*Continued from page* 337).

microphonic valve holders for the first two valves. The "anti-microphonic" valve holders on the market are quite useless for this particular purpose and the writer has found that the only satisfactory method was to suspend the valves by means of thin strips of elastic, making connections direct to the valve legs with thin stranded wire coiled like a spring so as not to transmit vibration.

Good quality grid leaks, condensers, and wire-wound anode resistances are advisable as the cheaper grades are inclined to be very noisy.

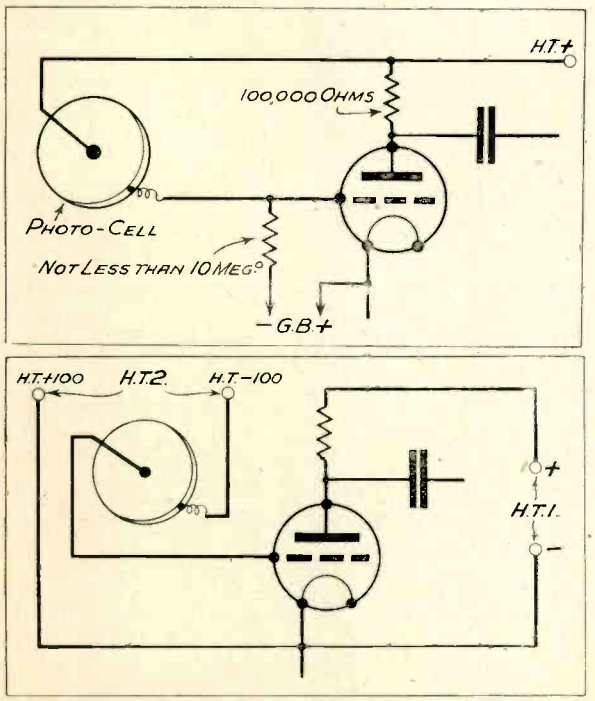
Many interesting experiments can be made with these cells, and they cost nothing to construct for every wireless experimenter has a burnt-out valve among his scrap parts.

A New Use for Old Valves

By D. B. McCarthy

WHILE conducting some experiments with a brilliant lamp it was noticed that when the beam fell on an A.C. amplifier the character of the faint A.C. hum in the loud speaker changed. In order to find out exactly what part of the amplifier was affected in this peculiar manner, the light was concentrated upon various components in turn. It was found that when the light fell on either the first or second valve this " change of hum " effect was noticed.

It was surmised that the effect was caused by the light falling on the magnesium deposit inside the glass thereby emitting electrons attracted to the anode, hence causing changes in current. In order to prove this theory various burnt out valves were connected-up as shown in the diagram, using a piece of tin foil fixed to the glass for a cathode connection. The results were remarkable. The old valves worked just like photo cells, quite an appreciable " plop " could be heard as the beam of light crossed the valve, only three stages of R.C. amplification being used in this experiment. The exciter lamp was a small C.A.V. motor head lamp with a parabolic reflector, using a 18 watt 6/7 volt bulb run off a small transformer.



(Above) Method of coupling cell to first stage amplifier. (Below) An alternative method, which is more sensitive but requires two H.T. batteries; no grid leak is used.

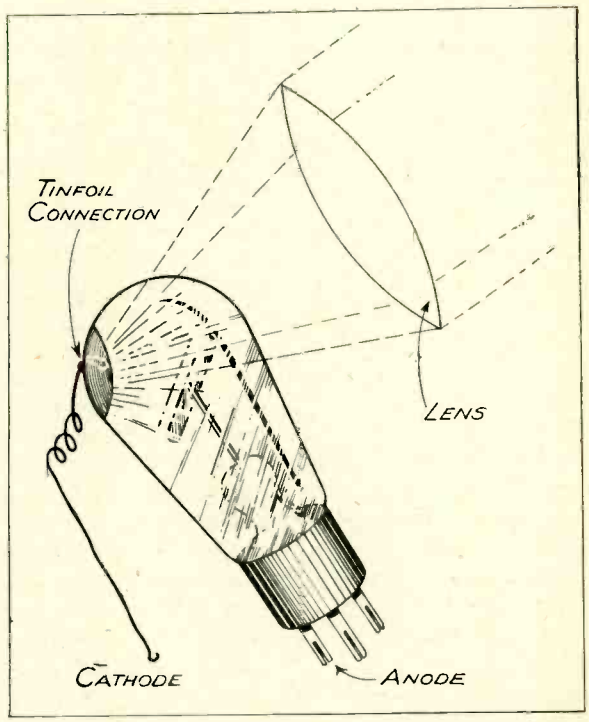


Diagram showing the light being directed from the lens to the valve.

Photo-cells made in this way do not, of course, compare with modern photo-electric cells, but since they have a very high resistance, a great deal depends on the method of coupling, also since there is a very good vacuum in the valve the higher the voltage on the anode the better, for there is no fear of " flashing over " as is experienced with ordinary photo-cells.

It is advisable to choose a valve having a magnesium deposit on one side of the glass only, and to construct a special totally screened two stage R.C. battery amplifier, having the valve to be used as a photo-cell also enclosed in the same case leaving a hole to admit the light. The output from this amplifier may be connected to a more powerful A.C. amplifier. By adopting this method of total screening a very high resistance may be used for coupling the photo-cell to the grid of the first valve, and greater sensitivity is thereby obtained.

The insulation is very important and an improvement might be effected by housing the amplifier in an airtight case having some calcium phosphate or other chemical to absorb moisture.

A very material point is to have really anti-

(Concluded on page 336, col. 2)

Talks on Television

By J. J. Denton.

Hon. Secretary of the Television Society.

This is the first of a series of articles to be contributed by Mr. Denton for the benefit of those who are new to television. The author here deals with the first principles involved and briefly reviews the historical facts. Later developments will be described in further articles.

IT is of interest to the student of television to note that this new branch of applied physics has developed from the application of principles relating for the most part to outside physical phenomena, whose measurable effects were so small that they scarcely merited mention in the average text book. The action of light on materials has long been a fascinating branch of study, but mostly of interest only to the food, photographic, and dye chemist. Electrical data made possible the production of the light sensitive selenium cell, which proved useless for practical television, but whilst it acted as a kind of " will o' the wisp," it undoubtedly existed as an incentive to television research, leading to the development of instruments favourable to television inventions.

Persistence of vision being partially understood led to many interesting " toys," many of which may now be seen and operated in the Science Museum, South Kensington. Finality, in the application of " visual inertia " to scientific instruments, was supposed to have been reached in the kinematograph. For television reception

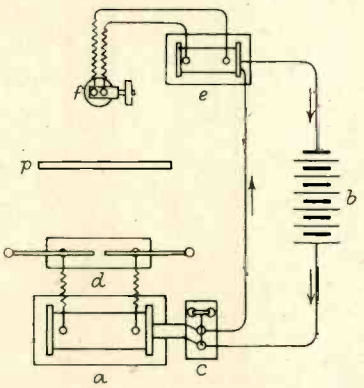


Fig. 1. Hertz's diagram, reproduced from his book "Electric Waves."

we depend on this " lag of the retina " and find interest in the study of all known devices that will demonstrate the " retention of vision " in order that we may evolve the ideal television receiver.

Vacuum tubes, of both high and low exhaust excited interest as scientific " toys," but the recent discovery of neon and helium, and their luminous properties, stimulated research to meet the needs of industrial advance, so that the glow discharge tube is now a familiar spectacle. Before this, the positive column and the negative glow of the vacuum tube had little or no application. Now the neon tube or glow lamp helps the television experimentalist, and its design is based on what was considered " outside phenomena."

Electrostatic Strain

The effect of electrostatic strain on dielectrics first investigated by Quincke and Rontgen, and afterwards satisfactorily demonstrated by Professor Kerr, of Glasgow, was long regarded as a microscopic effect and only referred to as a matter of interest. To-day the Kerr effect invites the serious attention of the student, as it indicates the underlying principle of the modern light valve, which is proving itself successful in large screen television demonstrations and in the new home "televisor." The development of the photo-electric cell has proceeded from phenomena that only engaged the attention of the advanced student. The phenomena itself was indeed " outside " not only from the routine of general physics, but from the work of its own investigator.

Hertz was concerned with testing and confirming the fundamental hypothesis of the Faraday-Maxwell theory of light, and succeeded in founding its establishment by discovering the nature of electro-magnetic radiations, and demonstrating the existence of electro-magnetic waves, since so universally evidenced by broadcasting. The waves he observed and measured were generated by spark discharges, and during the course of his experiments, he observed that the light of the spark at an adjacent spark gap, aided the discharge of a spark in a neighbouring spark gap. Note diagram Fig. 1.

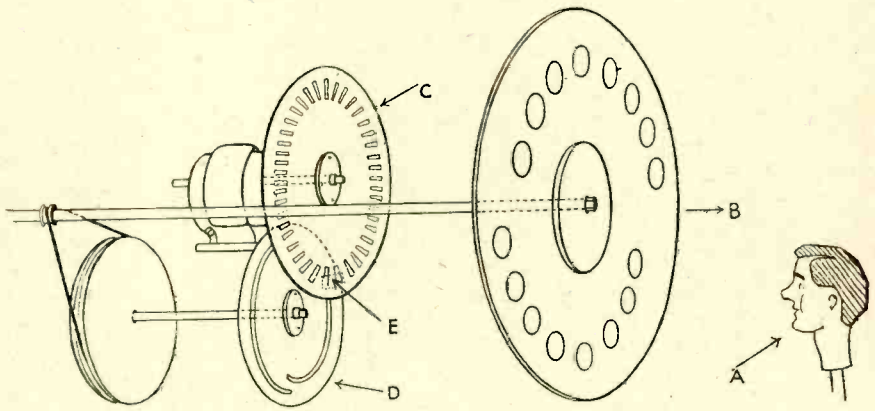
By placing a plate of metal or glass and other substance between the distant spark gaps, the action ceased. On investigating by aid of a prism he found that action resulted even beyond the violet end of the visible spectrums, and that he obtained the best results when magnesium light, or the electric arc was used. He therefore

stated, "that light of the active spark must be regarded as the prime cause of the action that proceeds from it." Such was the beginning of the study of the so called "class phenomena" known as "photo electrics" which led to the invention of the photo-electric cell.

* * * *

Fig. 2. The Scanning Device with the first model television transmitter made by Mr. Baird now on view in the Science Museum.

* * * *



Were it not for the development of the instrument resulting from the studies of the very minute effects that interests only the more advanced students of physics, resulting in the production of the photo electric cell, the light valve, and the thermionic valve, television could not have advanced, or have made a profitable field for the student.

In these notes consideration will be given to the essential principles that have made television possible, and the trend of present day research making for improvements, with details of all instruments involved. Quantitative statements must be made, and experiments suggested, in order to enforce the understanding of fundamentals. In these days of mass production the function of the tool or instrument is for the most part considered.

Too often the physical laws applied are ignored even by the operator or experimentalist, who at times of breakdown or failure suffers accordingly. The wise student therefore aims to become conscious of fundamentals, which at all times become the true capital of the student and inventor alike, and is undoubtedly the unseen foundation of genius. Attention to elementary principles is therefore all important if applications are to be sensed.

In the study of television we are at once attracted to various branches of physics, particularly electricity, light and optics, and mechanics, in connection with which the application of mathematics will be serviceable. Electrolytic chemistry is helpful, and some knowledge of the eye itself, desirable. Students will therefore develop an urge, and keenness for these subjects alongside with their pursuit of wireless developments, in order to establish an intelligence for television advance.

Photo-telegraphy having developed on somewhat similar lines will be of interest, it always being remembered that time may be fully allowed for building up the photo-telegraphic record, whereas in television the completed scene observed at the receiver must fully evidence itself before the eye within the time lag of the retina. No branch of the study of light may be neglected. Without light television would be impossible. The scene to be transmitted must be illuminated by the visible or invisible rays of the spectrum, and the received signals transformed to luminous variations in order to satisfy the eye.

For illuminating the scene we may employ the ultra-violet, luminous, or infra-red portions of the spectrum, which rays may be reflected by mirrors, deflected by prisms, and focussed by lenses or pinholes for optical purposes in the design of the transmitter or receiver. The process may be considered the same whether by daylight or artificial lighting.

Unit of intensity of light = 1 standard candle.

Standard candles are sperm candles $\frac{7}{8}$ in. diameter, 6 to the lb. burning at the rate of 120 grains per hour.

Unit of illumination = 1 ft. candle. (Illumination at one ft. from source of one candle).

Unit of light flux = light from one candle-power in unit solid angle.

Unit of flux = lumen.

Unit of brightness = candles per unit area.

Römer in 1676 determined the velocity of light to be 186,000 miles per second.

(The first attempt was made by Galileo, whose method was afterwards satisfactorily employed by Fizeau.) It is now known that all wave motions of the ether travel at the same rate, whether generated as light, heat, or wireless radiations.

Television refers to the process by which scenes or subjects illuminated may be made

visible at a distance by electrical means, in such a way that all movements, actions, etc., if any, may be seen at practically the time of happening. The scene or subject to be transmitted must be explored or scanned in such a way that the reflected or transmitted light may affect a light sensitive device capable of transforming the varying light values into electrical signals which can be conducted or radiated as a train of signals.

The purpose and methods of scanning are unique to television and telephotography. The scanning device exhibited with the first model television transmitter, made by Mr. Baird and now on exhibition at the Science Museum, South Kensington, consists of lenses mounted in spiral formation, as shown in the accompanying diagram, which is a copy of the label attached to the exhibit (Fig. 2). The rotating lenses served to focus portions of the scene on to the light sensitive device he then used.

At the receiving end, a disc scanning device consisting of a spiral of holes, explored the flickering light of a small Neon lamp of the beehive type, which flickering resulted from the imposed incoming signals. A necessary condition for success depends on the maintenance of the same speed and phase, of both rotating scanning discs. This we shall further note under the heading of synchronising.

Student experimentalists desiring to begin practical testing might build the shadowgraph machine described in TELEVISION for May, 1928, and make the selenium cell by aid of the ordinary electric flat iron, which may be set up as a simple melting and annealing furnace as illustrated and described, also in that number of TELEVISION, which also gives full instruction for making selenium cells.

An interesting television testing and demonstration instrument was exhibited at the last Physical and Optical Exhibition, by The Television Society. It was designed and made by Captain R. Wilson and Mr. A. A. Waters, who demonstrated the model working throughout the period of the exhibition. This educational model, had the transmitting and scanning discs mounted on one rotating shaft. The discs had triple scanning spirals, with holes square in section and of the order of 0.015 to 0.016 in., the picture ratio being 4:4. One photo electric cell with amplifier served for the transmission of signals and a neon lamp operated at the receiver.

Dates to Remember

1564 GALILEO. Vision at a distance, by invention of a lens system.

1676 ROMER. Determined the velocity of light.

1442 NEWTON. Observes spectrum by aid of prism. He indicated that matter cannot act where it is not, which called for a theory of action and reaction with distance.

1771-81 CAVENDISH. Investigated electrostatic effects across space, filled with air, glass, etc., and indicated inductive capacity of some dielectrics. His researches remained unpublished till September, 1879.

1817 BERGELIUS discovers Selenium.

1845 to 1870 FARADAY discovers principles underlying construction of condenser and transformers.

1853 KELVIN states laws relating to H.F. circuits.

1862 ABBE CASELLI. Develops chem. recording method of Picture Telegraphy.

1867 JAMES CLERK MAXWELL. Papers on Electromagnetic Radiation.

1873 EDISON improves Picture telegraphic method.

1873 MAY observes light sensitive properties of Selenium.

1877 SENLECQ brought out Telectroscope (Tracing image on ground glass screen using selenium points).

1879 GRAHAM BELL invents the photophone.

1880 AYRTON and PERRY, also Prof. Kerr, publish proposed television systems.
LL. B. ATKINSON proposes a television system using crossed nicols. Apparatus now in South Kensington Mueum.

1881 SHELFORD BIDWELL proposes Telephotography method using Se.

1884 NIPKOW suggests requirements for Television, using spiral disc.

1887 HERTZ discovers electromagnetic waves and later 1888 photo electric phenomena.

1891 MINCHIN uses Se. for Stellar Photography.

1894 LODGE. Demonstrations of circuit tuning before the Royal Society.

1895 MARCONI began wireless experiments in Italy.

1904 FLEMING invents Thermionic Valve.

1901 ERNEST RUHMER (died 1913) experiments with Se. to obtain Television and obtained shadowgraphs.

1906 RIGMOUX and FOURIER demonstrated 64 Se. cells, and shutters in imitation of the eve.

1907-8 SZCZPANICK proposes vibration mirror svstem for television.
ROSING and CAMPBELL SWINTON propose using Cathode Rays for Television.

1923 BAIRD, in England, and JENKINS and ALEXANDERSON, in U.S.A., demonstrate Television Shadographs.

1926 BAIRD demonstrated true Television before members of the Royal Institute.

1927 BELL Telephone Laboratories give first Television demonstration outside Engand.

Letters to the Editor

DEVELOPING AN IDEA.

To the Editor of TELEVISION.

Sir,—If I may, I should like to add a few words to my letter which you published in your October issue.

At the time of writing this system was merely a bare idea, but after some further thought I have been able to bring it down to something more practical. Assuming that the light rays from the object have been transformed into musical notes as already explained, it only remains to reconvert them into light in order to obtain a television image. This could be done by arranging each sympathetic string over a narrow slit which is cut in the sounding board. Under the board is placed a source of light. As the string vibrates a portion of the slit will be exposed, allowing light to pass through in direct proportion to the amplitude of vibration. The resultant light rays from each string are, by means of an optical system projected to their respective positions on the receiving screen.

I also suggested that there might be an electrical parallel. It has occurred to me that if the Selenium cells were fed with electrical impulses of different frequences; one might, by using a filter apparatus, be able to separate each set of impulses and so obtain the desired image.

Yours faithfully,
W. P. OWEN.

37, Hollingbourne Road,
London, S.E.24.

TELEVISION AND THE POST OFFICE.

To the Editor of TELEVISION.

Sir,—In a recent issue, reference was made to a prominent American electrical concern which has displayed considerable activity, in connection with the application of television to the telephone system. This concern owns or directly controls a very large proportion of the channels of communication in the United States, and is in an unrivalled position to exploit new systems.

Its confidence that there is a similar field for exploitation in Great Britain is shown by the assiduity with which it is filing and prosecuting applications for Letters Patent here. This concern has in the last year or so made several applications, of which the subject-matter comprises a wealth of detail of an intrinsically practical nature, and I judge that apparatus represented by these specifications is already in use elsewhere.

In particular British Patents No. 286262 (Dr. Ives and Electrical Research Products Inc.) and No. 297152 (communicated by Bell Telephone Laboratories) would indicate that the television circuits are to be run through the ordinary telephone exchanges.

It may be that our Post Office authorities have already commenced researches into the possibility of applying two-way television to fixed-office telephones over long-distance routes, but have they availed themselves of the specialised knowledge and experience of those experts who are already engaged in the commercial exploitation of radio television? It is plain that experiments on the part of private companies are curtailed by the heavy rent charges made by the Post Office for long-distance circuits. Has not the time now come for active co-operation by all public and private organisations in the further development of a system which will certainly provide an important national service in the next few years?

An analogous case may be found in the comparatively recently inaugurated Post Office telephone service across the Atlantic, from which the Treasury has derived no inconsiderable income, after a certain amount of outlay on specialised research. I suggest that if anything approaching the same sum were devoted to the furtherance of two-way television, there would possibly be an even greater return.

I am, Sir,

Your obedient servant,
J. C. WILSON.

"Linden," Elm Drive.
North Harrow.

FROM A READER IN SWITZERLAND

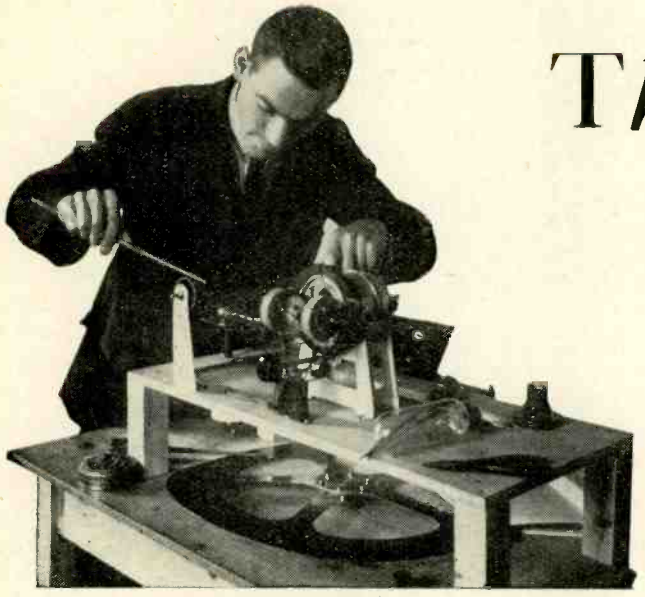
To the Editor of TELEVISION

Sir,—In reply to your request in the October issue for a word to correspond with "listener," I suggest the word "sighter," to apply to those who look in at the receiving end.

I have been a subscriber to your journal since the first number, and it has always given me great pleasure to receive and read TELEVISION.

Yours faithfully,
G. MILLS.

Coppet Vaud,
Switzerland.



The Enthusiast Sees it Through

AS we anticipated, the new B.B.C. transmissions at night, coupled with the darker evenings, have encouraged many of our past contributors to send further notes concerning their experiences with television reception. All have a measure of praise for the efforts of the B.B.C. on the transmitting side, and those in the north are naturally hoping that they will be served with transmissions a little nearer home. This is a factor to which we are sure the B.B.C. is giving very careful consideration.

Still Enthusiastic

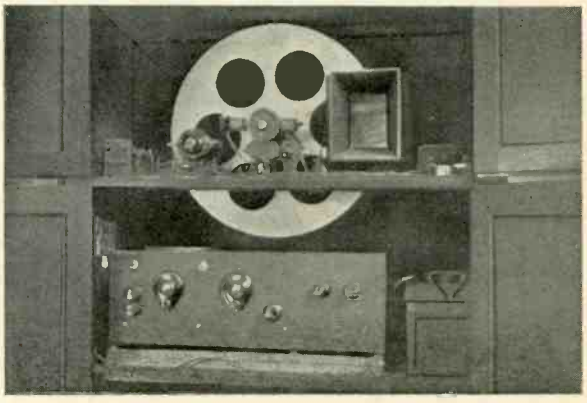
From the detailed descriptions furnished by Mr. C. W. Gilderdale of "Hartside," New Earswick, York, it is clear that this reader is obtaining very good results. In an interesting letter he describes his activities and records his impressions of the received images:—

"I am afraid that owing to pressure of business I have not had time for much experimenting since I wrote to TELEVISION last. I may say, however, that I am just as keen as ever. The dropping of the midnight transmissions put a stop to my work as I was never able to look-in during the day. In any case my set was not powerful enough, with only one screened-grid valve to bring in Brookman's Park in the daylight at sufficient strength.

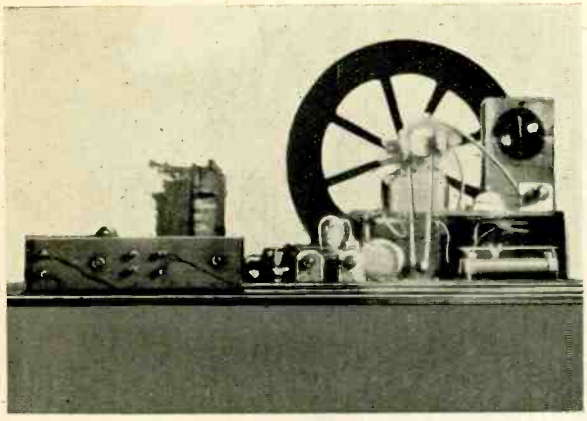
"I spent some of this waiting period, however, in fitting my wireless set, eliminator and vision receiver into a cabinet and I enclose the only photos I have of the arrangement. Unfortunately the lower shelf containing the large eliminator was missed when taking the photos and I have not had an opportunity of photographing the full set since.

"You will see from the photo that I am still using a home-made disc, belt driven from a small motor. I have mounted a stroboscope on the far side of the disc, and by the aid of a small mirror on the back of the cabinet and a beehive neon lit from the mains, I can run up the disc to 750 r.p.m. The only other modifications made have been the fitting of a reaction coil and condenser, as on bad nights it is necessary to have a little reaction, although I always try to manage without it, if at all possible.

"I have built an eliminator for the grid bias using a metal rectifier, as although only about 20 volts is required for television, I need over 100 when using my loudspeaker. I have arranged suitable switching arrangements so that after tuning in the television signal on the loud speaker I can switch over quickly to the flat plate neon.



Mr. C. W. Gilderdale's vision receiver



The apparatus described by Mr. Anderson overleaf

"Since the new B.B.C. evening broadcasts I have been able to start up again. I find that I get 261 metres better than I did 356, although at York we suffer from bad and rapid fading and also jamming from foreign stations. I am still only working with one screened grid valve and am anxiously awaiting the completion of the new tele-radio design employing two stages of screened grid which you are describing in TELEVISION. I am anxious to know whether I shall be able to use any of the components I have already. By the description so far I doubt whether this will be possible.

"Now with regard to results, although I have been away from York a good deal, I have had some excellent images. The opening night was very good. I find I could easily recognise the artists seen from their photograph which appeared on page 245 of the September issue of TELEVISION. Further I could recognise Mollison from his photo in the Press. I find the head and shoulder figures the clearest as you would expect, but as I have no set for sound reproduction I think long stretches of these head and shoulders become a little tedious to watch.

Transmission of Dancing

"The full figures with movement are good, and the latest idea of the introduction of animals is distinctly interesting and adds greatly to the entertainment value. The dancing comes over usually very well indeed, and it is possible to see the black and white floor and the shadows on the wall behind the dancers as well as all their movements very clearly. As to the future I have on order a Baird disc as my present one is not one of the graduated type, and a Baird motor and synchronising gear, and I hope when these are fitted I shall get even better results.

"My greatest difficulty is fading; at one time the signal is so strong that the picture is 'over cooked' and I am afraid to tone it down for fear that next minute it will fade out completely. This fading also upsets the synchronising gear. Incidentally, I have often noticed when the picture is running away fairly quickly my stroboscope shows that my disc is running absolutely true to 750 r.p.m.

"I took the opportunity of seeing the Marconi demonstration given to the British Association at York. I saw the visible message transmissions from Chelmsford, and a head and shoulder picture of a man transmitted from an adjoining room. This picture was about 8 in. by 10in. and was fairly clear but not as detailed as one would wish.

"May I wish TELEVISION the best of luck in its efforts to get a transmission from the North Regional station."

Making Progress

That his enthusiasm has not waned but increased is the message contained in the letter of Mr. Gordon E. Carden, of 13, Athelston Road, Folkestone. He explains how he is working on mirror drum apparatus and promises further information at a later date.

"My enthusiasm has not waned but greatly increased since I last gave details of my experiments with television reception. All my disc type apparatus has long been discarded, in favour of the mirror drum projection system. I have already received images with a crudely assembled arrangement, 7 in. x 3 in. on a ground glass screen, using a crater neon. I will not go into details at the moment but will give you full information at an early date.

"I am now experimenting with an improved system of synchronising which will, providing everything turns out as expected, enable any small receiver which gives images, to keep the disc or drum in perfect synchronism with the transmitter. I have great faith in this new device, but am rather handicapped for want of apparatus, etc., as most experimenters are.

"Nevertheless, it has got to be done and I shall see that it is. At a later date I intend to try out a method of increasing the detail of images without increase of side band.

"To get back to 'our' magazine, I must thank the proprietors for the up-to-date news and technical information given therein and also for the way in which they have fought for transmissions."

Clear and Detailed Images

Although a certain amount of fading has been experienced by Mr. S. Hancox of 6, Murdock Grove, Alexandra Road, Handsworth, Birmingham, he has been successful in obtaining good images. He says:—

"It is six months now since I last wrote to

you, so I think it is about time I let you know how I am getting on. In my last letter I explained my trouble of poor detail in the image. Since then I have obtained two LS5A valves of which I use one for output and one for synchronising. Results were very good, the image being clear and fine in detail, although the transmissions from the London National exhibit fading at the moment. I have also experimented with a mirror drum."

In Real Earnest

In furnishing us with a diagram of his receiver Mr. E. Anderson of Kenmore House, Wilmslow, Cheshire, tells us how, after a certain amount of experimenting with wooden discs, he took up television in earnest in April of this year and now gets good images. In the course of his letter he says:

"I have been experimenting in a small way for some time with wooden discs and small Meccano motors. At the beginning of April I began to start in real earnest by getting a one-sixteenth horse power B.T.H. motor. I then made a synchroniser which works moderately well but the P.650 with only one watt output is very small. I have now got a P.P.S/400 which I hope will be better.

"In August I made an eliminator to give 700 volts at quarter ampere. I put the neon in the circuit of the AC/Pen as shown in the diagram. The photograph shows the pentode and the eliminator. The mains here are very unsteady but I can usually manage to hold the picture fairly well with a thirty ohm vernier resistance on the motor.

"Now a word or two about the pictures. The first transmission on August the 22nd was fairly good then the weather became bad with static and general 'mush.' On September 5 the strings on Peggy Cochrane's violin were plain. On September 13 and 14 the pictures were really very good; the stripes on men's trousers were quite clear."

At Southsea

Mr. H. E. Christie of 94, Suffolk Road, Southsea, is a frequent contributor to the 'Enthusiast' columns and is at present working on a mirror drum receiver, details of which he hopes to furnish at a later date.

"I am glad to report," he writes, "that I have made full use of the new television programmes. I am quite sure all readers of TELEVI-

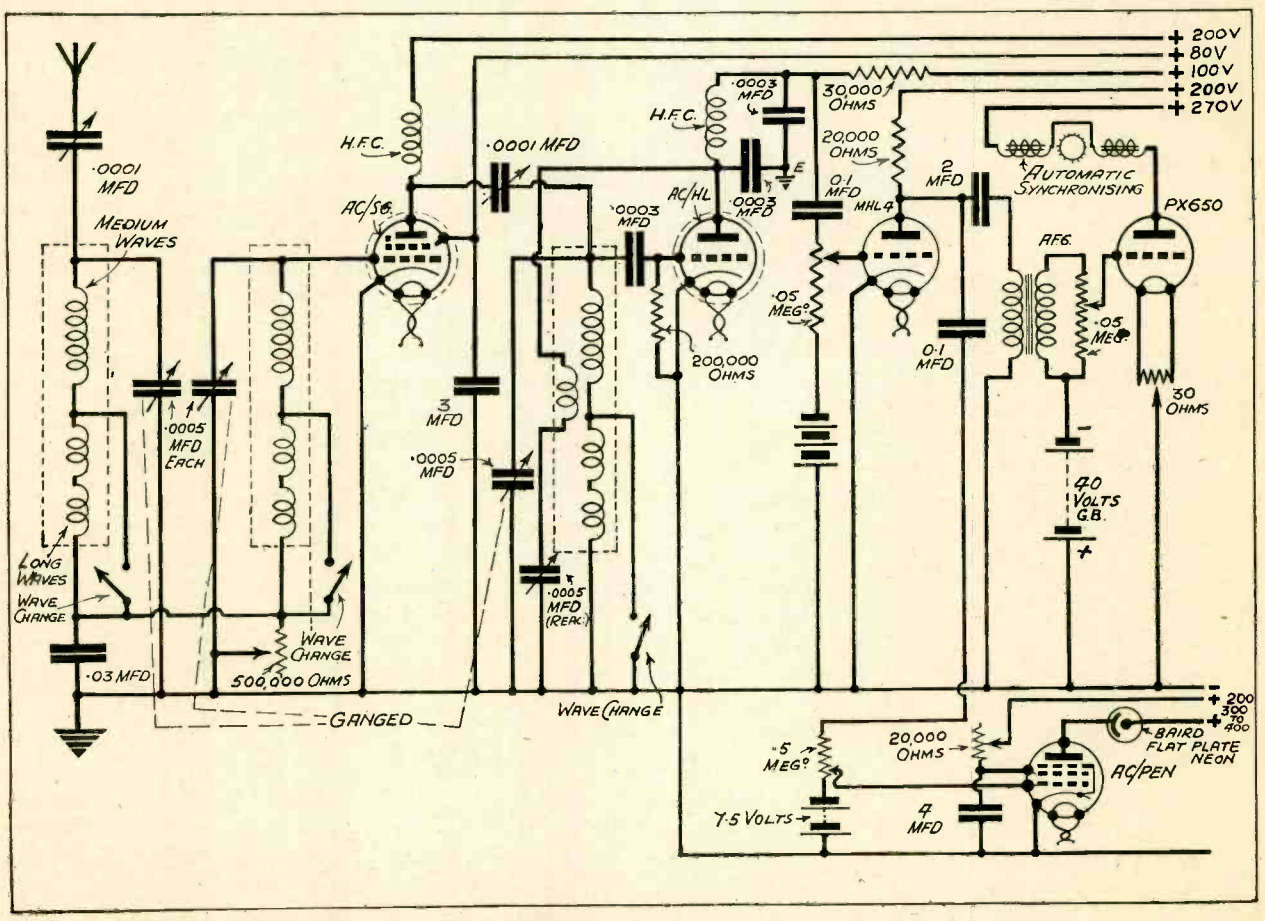


Diagram of the receiver described by Mr. Anderson

SION will agree that much thanks is due to you for the better transmissions which we are now getting. Here in Southsea, vision on 261 metres is difficult to receive. However, do not record this as a grouse, things have got to be improved until it is perfect. At the moment I am still running on the old 30 hole disc and given a good night can produce a very good picture. I have a mirror drum in the workshop at present and if I am successful in placing nicol prisms, lenses, etc., etc. I will write you full details with photographs of the apparatus. Many thanks for the improved television and the extra 'half hours,' not one of which is missed."

Unusual Synchronising

Mr. P. F. Carmichael, of Gartocharn, Dumbarton, sends us a detailed description of rather an unusual method of synchronising which we are sure will be of interest to our readers. In many districts the question of holding the image steady is an acute one and any new ideas on the subject are always welcome. He says:—

"A short time ago a rather unusual method for hand synchronising occurred to me. The model I set up worked to a certain extent only, since the parts used and the rough and ready construction were not satisfactory. The idea was to abolish, if possible, the hunting which takes place between the time the speed is first seen to alter and when the image is again framed after correction. When the speed of a synchronised image increases, say, the image rises so that the resistance or brake effect must be increased until the speed is *slower* than normal in order to reframe the image, after which the control is decreased a little to normalise the speed.

Suppose, however, that the motor is first connected to a smooth-faced flywheel on an extended shaft to allow a light scanning disc, with three light rubber-faced rollers running free, let in at the places shown, to be placed next to it (free sliding fit). Another flat and rigid disc is fitted (also sliding free) next to the scanning disc. This extra disc is connected to the shaft from the speed control knob by means of an extended spur wheel and chain as shown. With the extra wheel stationary (as is usual), the flywheel, rotated at 1500 r.p.m. will cause the scanning disc to turn at 750 r.p.m. owing to the differential effect of the rollers in contact with the extra control disc and flywheel, since

$$\text{Scanned speed} = \frac{\text{Controlled} + \text{flywheel.}}{2}$$

"It can be arranged, therefore, that the increasing of the resistance also turns the control wheel against the spin, which action immediately reduces the speed of the scanning disc in proportion to the rate at which the control is turned, *as well as* counteracting the cause of the increase of speed, *i.e.*, the increase of freeness or higher current value, etc. in the system. Thus the speed can be kept constant when the resistance or braking is corrected. In brief, it is a combined synchronism, or rather isochronism-control, and phase control.

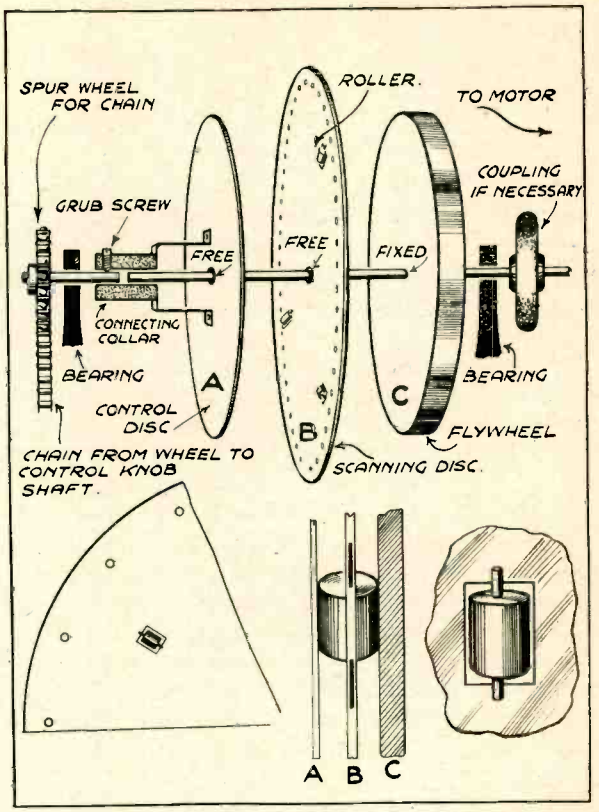


Diagram of Mr. Carmichael's method of synchonising

"If such an arrangement was well constructed mechanically, it might perhaps be useful where automatic synchronising was impossible due to type of receiver used or absence of synchronism signal in certain transmissions, *i.e.*, where one is dependent on synchronous motors received outside local mains system. I hope to be able to look into the programmes later on in the winter, since the hours are certainly more suitable though the point of transmission is hardly right for Scotland."

In the *Manchester Evening News*, Mr. Alan Hunter suggests that in the North there would be more amateur participation in television if Daventry were to send out the vision signals and all the regionals on the medium waves could simultaneously send out the accompanying sound. The advantage would be that only one vision apparatus would be required for transmitting, and the only technical difficulty Mr. Hunter foresees is the carrying of the vision signals over the land line to Daventry.

From My Notebook

By the Technical Editor

Television at the Inventions Exhibition

As a rule the lot of an inventor is not an easy one. Filled with enthusiasm as to the new device he has evolved he is often met with countless rebuffs when it comes to the question of commercialisation. Speaking broadly the steps in the process of evolution for the production of a new piece of apparatus generally can be classified under three distinct heads. First of all the original inventor or investigator makes his discovery and draws up plans of his proposals. The next step is that a worker in an industrial research institution recognises the possibility of utilising the discovery and carries out a further investigation to ascertain its practicability. The final stage is when a development worker takes the matter in hand and as a result of this third investigation an actual product is elaborated, embodying the principles evolved by the two predecessors.

It happens frequently that the proposed apparatus, as submitted to this third party, is fragile, inefficient, unreliable and expensive, its utilisation being unwarranted or even impossible until various practical problems have been solved. The function of the third class of worker who renders the apparatus suitable for manufacture in the shops and for acceptance in the commercial field is therefore a most important one, but it is often overlooked. These and many other thoughts ruminated through my mind when I paid a visit to the International Exhibition of Inventions, held at the Central Hall, Westminster, quite recently.

Gold Medal

From the point of view of TELEVISION'S readers the most interesting was, of course, the exhibit of Mr. F. de Wet who showed his television camera and projector and was awarded the gold medal in this connection. With this apparatus, which unfortunately was not working, I gathered that the image obtained from the camera lens was rotated by a prism, a selection of a strip of the image being secured by means of a fixed slot, and another moving relatively to it. The resultant television image is produced by a number of circular or spiral lines, but it was impossible to ascertain exactly how these fitted in one with the other. The problem that worried me was the destruction of the image when the system was only slightly out of synchronism. The model on view looked most ingenious and well constructed, being built up from a patent specification applied for over four years ago.

A New Television Film

I had a most interesting experience the other day, for I paid a visit to the Gaumont studios at Shepherds Bush to assist in the making of a short film explaining how television transmissions were effected by the Baird process. The painstaking care exercised by the film producers in getting the smallest detail just right was a revelation to me, and what good customers are these film people to the electricity supply companies, for in any one set brilliant lights are used everywhere.

Mr. Baird introduced the film which, by the way, is being shewn on the Gaumont Sound Mirror, and described the latest television receiver and then in addition to an explanation of the transmitting side (one of my functions as " voices off ") an actual television transmission complete with artiste and so on is shown. I have seen the completed film at a private demonstration and can well recommend readers to look out for it at their local cinemas if they would like to see just " how it is done."

Broadcasting House

I had another delightful experience the other day when I made a visit to Broadcasting House, and saw everything that could be seen. The whole building is certainly one of which the B.B.C. both technically and architecturally can feel proud. All the studios, which by the way number twenty-two, are grouped on the various floors in a central tower and " insulated " from all external noise. Artificial heating, lighting and ventilation is provided and every precaution taken in the case of the latter to restrict the passage of sound in the conduits. This is done mainly by baffles while thermostatic controls maintain the temperature at the current level. I learnt a lot about the different reverberation periods arranged for artificially in different studios and in addition, found it most curious to speak in a " dead " studio, that is, one in which there is no echo.

All the decorations have been carried out in the most modern style and very lavishly, the two listening rooms for the press and privileged visitors being a case in point. The effects studio,

concert hall, control room and of course the television studio all had their special appeal and after a tour lasting nearly two and-a-half hours, I felt that in Broadcasting House, Great Britain has a headquarters for its broadcasting of the very first magnitude.

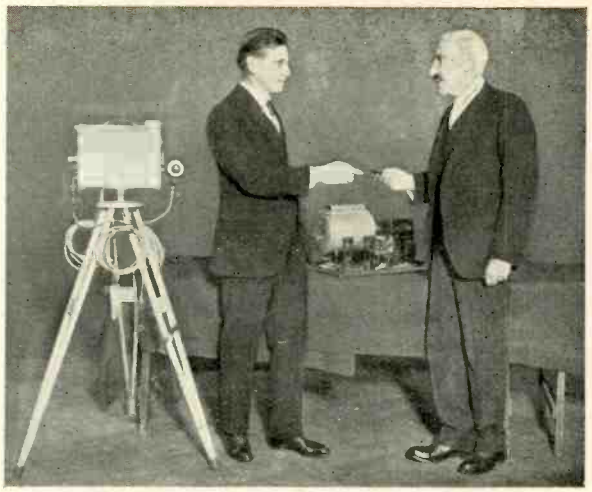
The New Irish Station

More and more high powered stations seems to be the trend of things at the moment as far as radio is concerned. Many people look upon this as a mixed blessing, especially those who own sets which do not fall within the category of suitable selectivity.

Listeners in Great Britain should soon be able to hear the new Irish station which is being erected at Athlone, and as this station will have an unmodulated aerial energy of 60 kilowatts, with modulation up to 80 per cent., it will rank from the outset among the more powerful broadcasting installations in Europe. Arrangements have also been made whereby the power of the transmitter can be doubled at a later date. The transmitter can be adjusted to work on any wavelength between 300 and 550 metres, and is expected to operate on a wavelength of 413 metres, which is at present used by the Dublin broadcasting station.

In accordance with current practice in the design of broadcasting transmitters, low power modulation is employed, while the frequency of the emissions is controlled by an oscillating quartz crystal drive, thermostatically controlled. This ensures great constancy of the transmitted wavelength, an essential condition in view of the present crowded state of the ether in the broadcasting wave band. With a frequency characteristic giving a practically straight line between 30 and 10,000 cycles, and employing the most

Mr. Rupert Harvey, the popular television artist, depicts his alarming sensations on appearing before the transmitter.



Mr. F. de Wet (left) who is exhibiting at the Inventions Exhibition, receiving the gold medal from Lord Askwith for his television camera here described.

modern speech input apparatus, the new station should afford the highest quality reproduction of speech and music.

The transmitting apparatus consists of six totally enclosed units constructed of aluminium panels with glass fronts. The aluminium panels, which are sprayed with grey cellulose lacquer, are framed in polished aluminium borders giving a distinctive appearance to the transmitter. A control table of similar finish, placed in front of the units, is provided for the control of the transmitter circuits. Each of the six transmitting units forms an independent link in the progressive series of operations which, starting from the constant frequency drive, terminates in the delivery of the modulated energy to the aerial system.

A Visit to Nottingham

I paid a visit to Nottingham recently where I had the pleasure of addressing the members of the Rotary Club, following their usual weekly luncheon. A very large company was present and from the questions put to me at the end of my address it is safe to say that the many leading business men present were fully alive to the developments arising from television progress. It is only by the dissemination of the true facts that we can hope still further to expedite the science, for misconception can do an enormous amount of harm to pioneer work.

While in Nottingham I learned that a very heated controversy is occupying the minds of those of its citizens who enjoy the benefits accruing from sound radio reception. This centres round the question of whether trolley buses cause interference, and I was afforded an opportunity of voicing my personal opinion on the matter. The day was altogether a most enjoyable one and finished up with meeting the radio convoy at

Leicester where it stayed overnight en route for the Manchester Wireless Exhibition.

"The True Road to Radio"

As I have pointed out repeatedly in these columns the ethics of true radio reproduction unfortunately are very often misunderstood. Any means therefore wherby knowledge on this subject can be added to should not be overlooked by the amateur constructor and experimenter who places a high premium on that much used but much abused term "quality." I was therefore very pleased to see that Messrs. Ferranti, Ltd., have produced yet a fourth edition of "The True Road to Radio." It has been brought right up-to-date and the few slight inaccuracies present in the previous edition have been rectified. The book is compiled in a most comprehensive manner and from cover to cover is full of useful or original information compiled in an easily digestible manner.

I can thoroughly recommend the publication to all television readers. It is obtainable through the usual channels or failing that the Publicity Department of Messrs. Ferranti, Ltd., Holmwood, Lancs, will despatch a copy post free on receipt of a 5s. remittance.

The Television Society

First Autumn Meeting

THE opening meeting of the fifth session was held at University College, London, on October 12. Before a large gathering two papers were read, "Television at the 1932 Berlin Radio Exhibition," by Mr. Ernest H. Traub and "An Improved Method of Electrostatic Light Modulation," by Mr. L. M. Myers, B.Sc., of the Wilson Laboratories. The first paper was read in the absence of the author by Mr. W. G. W. Mitchell, B.Sc. (lecture secretary).

Under the auspices of the German Post Office almost an entire hall was given up to television exhibits, and demonstrations, and Mr. Traub described in detail the working apparatus exhibited by the R.P.Z. (German Post Office), Telefunken, Tekade, Fernseh A.G., Loewe and the Henrich Hertz Institute for wave propagation. During the lecture an abstract in the form of a printed chart was distributed, indicating the scanner employed, the light source, the number of lines, points, and images per second, the ratio and size with remarks on detail and flicker, also the channel used and the method of synchronising. The chart showed that 90 scanning lines are for the most part employed in Germany although Telefunken uses only 48 lines with their mirror drum and Kerr cell demonstrations, and Fernseh A.G. use both the disc method and the mirror screw, in conjunction with the new sodium lamp, demonstrated with 120 lines. Details of this new lamp and its working conditions are also given in the paper, as well as a description of several types and sizes of the mirror screw. Photographs and descriptions of these new instruments have appeared in the August and September issue of TELEVISION.

Mr. Traub's paper described the cathode ray demonstration given by Telefunken, and Loewe Radio, which are stated to have been excellent, distortion being entirely absent, the size of the image being 9 x 12 cms. Particulars were also given of the new ultra short wave transmitter working in conjunction with the short wave aerial on top of the 450 feet high tower, the highest point in Berlin, from which reception is expected in a radius of 50 miles.

Mr. Myers' paper which followed was illustrated by lantern polariscope and lecture table experiments, also with coloured charts and diagrams. The lecturer dealt with the application of polarised light for modulation purposes and proposed a new method, which dispenses entirely with the Nicol rhomb as a polarizer, which itself absorbs 50 per cent. of the available incident light. The first part of the paper therefore considered the limitations of the Nicol prism as a polariser. Chromatic effects were dealt with more or less theoretically, confirming the results obtained by the H.M.V. engineers, as given in a previous paper before the Institution of Electrical Engineers.

Polarisation experiments shewn on the screen demonstrated, first that the retardation set up by stressed nitro-benzine between the two components of the plane polarised light which traversed the liquid, resulted, when different stresses were applied, in interference phenomena, and the increase in stress was represented in demonstrating the effects by increased thickness in a selenite wedge. Red interference bands were obtained, then blue interference bands, and finally the interference bands as produced by natural light. Thus the effect of increasing the stress in the nitrobenzine was shewn on the screen as the

effects produced by increased thickness of the wedge. From darkness, the Nicols being crossed, the field lit up to maximum brilliance, then followed in this order, brown, carmine, violet, indigo, blue, green, etc . It was pointed out by means of this demonstration that there was no other transition from darkness to maximum brilliant white in the whole range of stresses other than at the initial stress.

This point was also illustrated by rotating a disc upon which was painted the interference bands of all colours in the spectrum. Further, the first transition from darkness to maximum brilliance was obtained by stressing a piece of glass between the two nicol prisms set to extinction. It was made apparent therefore in view of these experiments, that the present methods of utilising the Kerr effect were greatly wanting in efficiency.

A Novel Method

Mr. Myers therefore suggested a somewhat novel method of polarising light in which both the ordinary and extraordinary rays could be used. In normal circumstances it is not possible to do this, as the author demonstrated, for when the analyser was set to extinguish the one ray, the other was copiously transmitted. However, by the piece of apparatus exhibited it was possible to extinguish both ordinary and extraordinary rays at the same time. The intensity of the two rays when most profusely transmitted was four times the intensity of the normal unpolarised light. This is always the case with interference phenomena; the intensity of maximum brilliance is four times the intensity of normal brilliance which makes up for the want of light in the dark interference bands. Thus by this interference method the light spot could be produced four times as brilliant as the spot focussed without first being polarised.

It was clearly shewn that the aperture forming the light spot, which scans the field, was indeed illuminated by both the ordinary and the extraordinary rays simultaneously, and that this spot had four times the brilliance of the present Kerr cell light spot. In actual methods, for television purposes, a forty ampere arc is employed and the candle power of the light, which is capable of modulation, is 1,500, as against a candle power of 300 of the mercury argon modulating light valves shown at the Berlin exhibition.

The next meeting of the Society will be held on Wednesday, November 9, also at University College, when a lecture on polarised light will be given by Professor F. J. Cheshire, C.B.E. Further particulars, and conditions of membership can be had from the hon. secretary, Mr. J. J. Denton, 25, Lisburne Road, N.W.3.

Points from the Press

A central organisation, known as the Institute of Amateur Cinematographers, Ltd., has been established to promote the general advance of the science, including television systems and sound or film processes.

* * * *

According to the *Talking Machine*, the first British-made sets for the Philco Radio and Television Corporation were completed recently, and production is now going forward at the works of Standard Telephones and Cables, Ltd.

* * * *

At a meeting of the Catford and District Radio and Television Society, Mr. H. S. Ryland, the chairman, recently demonstrated a radio-gramophone employing a light sensitive cell and a beam of light, the intensity of which was controlled by the needle movement.

* * * *

M. Dussaud, of Geneva, has sent to the French Academy of Science a paper in which he claims to have devised a new system of television. It is based on the principle of registering images electrically on gramophone records, and reproducing them by means of television apparatus. Experiments have been carried out at Geneva University.

* * * *

A series of television demonstrations has been arranged by the *Manchester Evening Chronicle* in conjunction with Mr. A. E. Kay, of Rochdale, and Messrs. Tutills, Ltd., of Manchester. The transmitting studio is in an upper room at Messrs. Tutills' premises, and the performances are seen on a screen of 14 in. by 6 in. on the first floor. Owing to the time at which they take place it is not possible to transmit the B.B.C. programmes. The apparatus has been constructed by Mr. Kay, and experts who have seen the demonstrations are satisfied with the detail obtained on the screen. * * * *

The fact that Messrs. E. K. Cole, Ltd., radio manufacturers, of Southend, have spent thousands of pounds on television research is revealed by Mr. W. S. Verrells, the managing director. "One day soon," said Mr. Verrells in an interview, "we shall be making a 'home amusement cabinet' containing everything radio, television and a gramophone." The progress of this firm has been remarkable. Eight years ago Mr. Verrells and Mr. Cole were working in a small room at the back of a confectioner's shop. In 1925, with a capital of £50, a workshop was opened and five workpeople engaged. To-day the capital of the firm is £400,000, the factory covers 175,000 sq. ft., and 3,000 hands are employed.

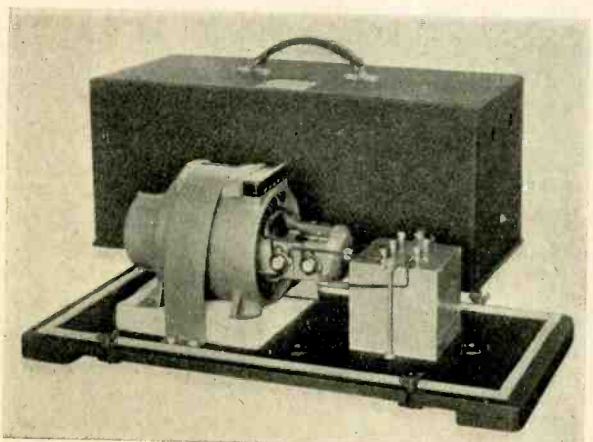
Reports on Apparatus Tested

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.*

Rotax Rotary Transformer

THE problems of readers who have only D.C. mains in the home have been dealt with from time to time, and it has been suggested that one of the best solutions is the use of a rotary transformer. We therefore welcomed the opportunity of thoroughly testing out a Rotax type HFA rotary transformer which is rated for a 100 volts D.C. input and an output of 85 watts, at 230 volts, 50 cycles. The machine was supplied complete with an anti-interference unit and sound-proof cover, the cost being £16 for the machine, £2 for the unit and £3 for the cover. The machine consists of an armature, having two independent windings, which runs in a magnetic field. Ball-bearings are employed and it was noticed that it was extremely silent in operation, the armature being dynamically balanced to prevent vibration.

First of all the machine was given an efficiency test, and from readings taken the figure worked out to be 50 per cent. which compares most favourably with the maker's figure of 55 per cent. The machine was run for two hours with a 20 per cent. overload; and at the end of that period the temperature rise was quite normal while not the slightest trace of distress was evident under these abnormal conditions. A very stringent test was then made to see if any interference could be detected. The machine was run within two feet of a sensitive three-valve all-mains wireless set, the output from the rotary transformer being adjusted to feed the set to supply the necessary input A.C. power. A common earth was used and ordinary flex leads, purposely run together.



The "M.—L." rotary transformer with anti-interference unit.

On switching on and working the set as usual, not the slightest trace of hum was evident, even when the ear was placed close to the speaker. Furthermore no interference would be noticed such as often happens with an inefficient machine due very largely to sparking at the brushes.

In every way this Rotax model proved a delight to handle and provided the maker's simple instructions are followed the purchaser can place every confidence in the product. We can thoroughly recommend it as ideal for all D.C. to A.C. conversions.

New Low Consumption Pentode

The latest new valve to be put on the market by the Mullard Wireless Service Co. is known as type PM 22A and is a low consumption two-volt pentode. This valve has been designed for use in portable receivers and other sets where economy in battery consumption is of prime importance, a working voltage of 100 volts H.T. being quite satisfactory.

According to the makers the valve's data is as follows:—

Filament voltage	2.0V
Filament current	0.2A
Max. anode voltage	150V
Max. aux. grid voltage	150V
Recommended load	15,000 ohms
Mutual conductance at anode volts 100, auxiliary grid volts 100 and zero grid volts	2.5 mA/V
Price	17/6

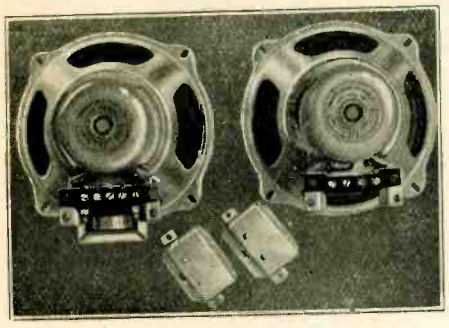
In the single sample we tested we were able to substantiate these figures within quite narrow limits. With a G.B. of 3 volts negative and an H.T. of 100 volts the anode current was found to be approximately 4.5 milliamps while at 4.5 volts G.B. and 150 volts H.T. the corresponding current was 9.5 milliamps approximately. Readers will see therefore that the consumption of the P.M. 22A does not exceed that of a normal two-volt power valve, while of course there is the added advantage of a much greater sensitivity. A welcome addition to the Mullard range.

Dual Compensated Loud Speaker

Much interest is being taken in the question of dual-speaker working, although in many cases it is being confused with that combination we had in the early days of wireless, namely, a horn and cone speaker working from the one set. We therefore welcomed the opportunity of testing out the Magnavox team which consists of a pair of dual compensated moving coil speakers, mains

energised type D.C.144 complete with hum neutralising coils and input transformer.

The speakers were mounted on a single baffle-board quite close together (the makers state that the centres must not be more than 10 inches apart) and the field coils connected in series as the makers diagram so as to be fed from 200 volt D.C. mains. A good quality wireless set operated



The Magnavox dual-compensated loud speaker.

the speakers, which had their speech coils in parallel, a pentode output valve being first of all employed. The reality of the reproduction was most noticeable the twin speakers together producing a stereoscopic effect.

Each speech coil has a slightly different fundamental resonance and each coil in turn offers a path of comparatively low impedance at the resonant frequency of the other. A more uniform response is thus obtained and it was found by test that there was no noticeable over-emphasis in any part of the musical register. The bass was rich while at the other end of the scale we had a freedom from shrillness. Furthermore speech was clear and naturally crisp (no slurred s's).

When tried later on a powerful amplifier nearly seven watts were handled without any signs of distress or overloading, and the maker's figure of 10 watts would appear to be quite correct. Sensitivity was normal and our general impression of the whole scheme is that it is one which merits the earnest consideration of all readers desiring the best type of reproduction in the home. The inclusive price with transformer is £3 12s. 6d.

Sample Mirrors

We have received from the Mervyn Sound and Vision Co., Ltd., several sample mirrors cut to the size to suit the mirror drum which is described in this issue. A very careful examination and test showed that these samples are in every way most suitable for the work. They are very accurately cut to size with a " clean and smooth " back surface, a point which is so often overlooked with this type of product. Furthermore, from the optical point of view they appear most satisfactory, distortion in a reflected image being very difficult to detect and in most cases quite absent. We can therefore recommend these mirrors with every confidence to our readers.

"V.S.2" Variable Mu Valve

It will be unnecessary to deal again in detail with the advantages associated with variable mu valves and we were glad to note that the G.E.C. have developed a new valve for this class to be known as the V.S.2.

According to the maker's rating, the valve has the following characteristics:—

Filament volts	2.0 max.
Filament current	0.1 amp.
Anode volts.	150 max.
Screen volts	70 max.
Mutual conductance	1.25 ma/volt

(measured at E.a-150, Esg-70, Eg-0).

Mutual conductance 0.05 ma/volt approx. (measured at Eg-9).

Price 16/6

These figures were substantiated within narrow workable limits and it was noticed that the V.S.2 has a mutual conductance sufficiently high to provide very good sensitivity when used as a screen grid single stage H.F. amplifier, but not too high to introduce instability if used in a two stage amplifier, under which condition the principal benefit of the " variable mu " valve is felt.

The requirements in the way of grid bias are moderate, a 9-volt battery sufficing to reduce the slope to 0.05 ma/volt, while a 15 volt battery will reduce the volume of signals to practically zero. The variable grid bias may conveniently be obtained by the use of a 50,000 ohm. potentiometer connected directly across the grid battery and open circuited when the set is not in use.

Free Enquiry Service

May we 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. The Editor cannot at the moment undertake to supply circuit diagrams, blue prints, etc., in this free service, but will welcome inquiries on every aspect of television.

THE FOLLOWING DEALERS ARE WILLING TO DEMONSTRATE TELEVISION

"TELEVISORS" ● KIT SETS ● COMPONENTS

AMERSFOORT (HOLLAND)	WILLEN VAN LOON	Stationstraat 32B
BAGSHOT	LINDFIELDS GARAGE	Surrey
BEDFORD	JEAKINGS & SON	Mill Street
BEDWORTH	T. H. RUSSELL	Tram Terminus, Coventry Rd.
BEXLEY HEATH	J. SPENCER (LONDON) LTD.	127 The Broadway
BICESTER	LAMBOURNE BROS.	47 Market Square
BIRMINGHAM	C. WEBB LTD.	41 Carrs Lane
BIRMINGHAM	SHANNON & CAPENER	13 Aston Road North
BISHOPS STORTFORD	H. R. MOORE LTD.	Northgate End
BOURNEMOUTH	J. E. BEALE LTD.	Hants
BRACKNELL	DRAKE & MOUNT LTD.	Berks
BRAINTREE	COX'S GARAGE	Rayne Road
BRIDGEND	WRIGHT & ASHWORTH	Kings Bldgs., Adair Street
BURTON-ON-TRENT	RADIO & CY-KAR MART	Cross Street
CAERPHILLY	L. PRITCHARD	73 Princes Avenue
CHALVEY	J. D. HALLIDAY	Nr. Slough
CHESTERFIELD	G. KENNINGTON (CHESTERFIELD) LTD.	Victor Lane
CHIPPERFIELD	A. C. GEORGE	The Common
COLCHESTER	SHROSBURY & BAKEWELL CO., LTD.	73 Crouch Street
COULSDON	THE "VIC" WIRELESS STORES	21 Chipstead Valley Road
COVENTRY	MAX. A. BUCH	143 Lower Ford Street
COVENTRY	PARKER'S RADIO SERVICES	3 Holyhead Road
DARLINGTON	C. SHARP	321 North Street
DEAL	G. CLOUT	Electrical Engrs.
DEWSBURY	BICKERS LTD.	The Galleries
DOVER	DOVER RADIO STORES	4 Townwall Street
EASTBOURNE	A. BODKIN & CO., LTD.	11 Cornfield Road
EASTBOURNE	OWEN H. RELLY	"Gavinwood," Willingdon
ERDINGTON	STANLEY'S RADIO	191 High Street
FELIXSTOWE	L. E. PULFORD	141 Hamilton Road
FOLKESTONE	BOBBY & CO., LTD.	48 Sandgate Road
GERRARDS CROSS	R. F. CHIPPS	6 Oak End Way
GODALMING	H. J. CHALLEN	12 Church Street
GRAYS (ESSEX)	GRAYS WIRELESS CO. (H. W. FRANKLIN)	Clarence Road
KIRKCALDY	GIBB & WATSON	270 High Street
LEIGHTON BUZZARD	GRIFFIN BROS.	11 High Street
LLANDUDNO	EVANS & EVANS	29 Mostyn Ave., Craig-y-Don
LONDON :		
BATTERSEA	E. F. KELLY	5 Park Road
BAYSWATER	HOPE, NORMAN & CO.	85 Westbourne Grove
BRIXTON	QUIN & AXTENS	Brixton Road
BROMLEY	UNIVERSAL ENGINEERS	1 Chatterton Road
CLAPHAM COMMON	DEMPSEY & CO.	69 South Side
CRICKLEWOOD BROADWAY	HARDEN & CO.	99 Cricklewood Broadway
EALING	KEEN WIRELESS CO.	1 Dare Road
EALING (WEST)	L. LEAMAN	97 Northfield Avenue
EARLSFIELD	H. HOLLIER & SONS	422 Garratt Lane
EAST BARNET	EAST BARNET WIRELESS STORES	3 Park Parade
EDGWARE	A. ALDERTON	8 Bank Parade, High Street
EDGWARE	J. F. WISSON	2 Cheapside, Deans Lane
FULHAM PALACE ROAD	"ECONOMIC"	24 Fulham Palace Road
HAMMERSMITH	W. H. OATES	195 Hammersmith Road
HOLLOWAY	JONES BROS. (HOLLOWAY) LTD.	Holloway Road
HOUNSLOW	SANDERS ELECTRIC & RADIO SUPPLIES	119 Staines Road
KINGSTON	BENTALLS LTD.	Surrey
KNIGHTSBRIDGE	BROMPTON RADIO CO.	20 Brompton Arcade
KNIGHSTBRIDGE	HARRODS LTD.	S.W.
MUSWELL HILL	VICTOR RADIO SERVICES	8 Firs Parade
NEW BOND STREET	KEITH PROWSE LTD.	159 New Bond Street
OXFORD STREET	SELFRIDGE & CO., LTD.	W.1
PECKHAM	HAVIL RADIO	30 High Street
PIMLICO	F. DOVE & SONS	77 Pimlico Road
WEST NORWOOD	E. SHELDRICK	493 Norwood Road
WIGMORE STREET, W.	WIGMORE RADIO SERVICE	36/38 Wigmore Street
WOOD GREEN	DISTRICT SUPPLIES LTD.	43 High Road
LUTON	R. J. STEARN & CO.	7 Manchester Street
NEWCASTLE	PAYNE & HORNSBY LTD.	7 St. Andrew's Buildings
NEW MALDEN (SURREY)	ACORN SERVICE STATION LTD.	Kingston By-pass Road
NORWICH	E. A. PRIEST & CO.	28 St. George's Road
PERRY BAR	WELLINGTON RADIO & ELECTRICAL DEPOT	303 Birchfield Road
PLYMOUTH	W. H. AXWORTHY & CO.	106 Tavistock Road
RAMSGATE	J. CARMAN	65 King Street
RAMSGATE	E. COVENEY & SONS	20 Belle Vue Road
ROCHDALE	BANNISTER & FITTON	27 Milnrow Road
ROCHESTER	A. F. SMITH & SONS, LTD.	215 High Street
SLOUGH	G. CASE & SONS	2, Grove Parade, High Street
STAINES	V. & D. KEALE	Kingston Road
TONBRIDGE	A. T. LANGTON	High Street
WALLINGTON	W. BELDING	9 The Parade, 320 Stafford Rd.
WALLINGTON	BULLOUGH BROS.	34E Woodcote Road
WEST BYFLEET	A. LONG	1 Byfleet Corner
WEST DRAYTON	SPRATLEY BROS.	Station Road
WITLEY (SURREY)	G. WOOTON	Northfields
WORTHING	E. LAMB	Franklin Road, Durrington

● GIVE YOUR LOCAL DEALER A CALL TODAY ●

MISCELLANEOUS ANNOUNCEMENTS

Readers wishing to sell secondhand apparatus and components, books, etc., are invited to make use of this advertisement section at the rate of 3d. per word (minimum, 36 words).

Announcements should be written on one side of the paper only, and accompanied by a postal order made payable to Benn Brothers, Ltd.

BALLBEARING Electric Motors, extra long spindle ideal for synchroniser, high grade absolutely best value 35/-. Motor variable fixed resistance 7/6, Knob adjusters 2/6, Phonic wheel 4/-, Poles, yoke, assembly 15/-, Square hole Scanning Disc 12/6, Synchronisers, framing controls, Neons, Lenses, everything for television, lowest prices.

Secondhand Bargains, Motors reconditioned 13/6, double ended 18/6, Mains transformers (425 h.t. for Vissionette 21.-), eliminators chokes condensers etc. send requirements. Seen by appointment—A.C.R. 47, Gerrard Street, Piccadilly.

THE owner of BRITISH PATENTS numbers 364231 and 364232 offers licenses for short periods without charge to substantial firms wishing to experiment. The patents concern *spiral mirrors* and *spiral mirror drums* for scanning.—Apply E. WOTTON, SOLICITOR, RAMSGATE.

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.

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

BACK issues of TELEVISION from No. 1 can be obtained at the published price from the publishers, 154, Fleet Street, London, E.C.4.

L. LEAMAN

97, NORTHFIELD AVENUE

WEST EALING, LONDON, W.13

For Radio and Television

DEMONSTRATIONS DURING TELEVISION TRANSMISSIONS

Baird Components Supplied

PHONE: EALING 5394 (MEMBER, TELEVISION SOCIETY)

"MERVYN" Kit of Parts for the Mirror Drum

Described in this issue by MR. H. J. BARTON CHAPPLE

This Kit comprises three sections any of which can be purchased separately.

Supporting disc with accurately made spokes, bent as specified. Made of brass with centre bush. - - **7/6**

Set of 30 special pressed mirror clips with spoke recess made from thin gauge brass - - - - **7/6**

30 light spot tested special mirrors size 5/8" × 3/8" × 3/64" as specified - **8/6**

"MERVYN" can also supply the following :—

Adjustable Mask - -	6/-	Nitro Benzine per bottle	1/-
Universal Angle Mirror Stand - - - -	7/6	Nicol Prisms 10 m/m each	30/-
		Achromatic Lens - -	15/6
Ground Glass Screen 10" × 6" - - -	2/6	Pair Condenser Lenses -	15/-

Send all orders to :—

THE MERVYN SOUND & VISION CO., LTD.

60, Craven Park Road, Harlesden, N. W. 10

Telephone : HOL 6332.

"THE ELECTRICIAN"

The oldest Weekly Illustrated Journal of Electrical Engineering, Industry, Science and Finance

Established 1861 Price **6d.** weekly

WILL KEEP YOU FULLY INFORMED

of the progress of this great science in all its aspects, including radio.

Write for a specimen copy to the Publisher,

BOUVERIE HOUSE, FLEET STREET, LONDON, E.C.4

"TELEVISION" COUPON

FOR FREE INQUIRY SERVICE

Name .....

Address .....

Enclose with this coupon a stamped addressed envelope.

Readers writing from abroad should use the Universal Stamp Coupon, obtainable from most post offices.

November, 1932

Printed by THE PRESS AT COOMBELANDS, LTD., London and Addlestone, and published by the Proprietors, BENN BROTHERS, LTD., Bouverie House, Fleet Street, London, E.C.4. Registered for transmission by Canadian Magazine Post. Entered as Second Class Matter, March 15, 1929, at the Post Office at Boston, Mass., under the Act of March 3, 1879 (Sec. 397, P.L. and R.)