Vol. 3 AUGUST 1930 No. 30 SIXPENCE MONTHLY

TELEVISION

COMPETITION

Win a "TELEVISOR"

See page 236

"Television To-day and To-morrow"

SOME PRESS OPINIONS

DAILY NEWS

"Many secrets of the apparatus used are revealed in detail for the first time in this book, together with full technical information about the system, put in simple language specially for the wireless amateur."

ELECTRICAL TIMES

"This book is of very considerable general interest. It sets out very clearly the outstanding developments and achievements in the evolution of television broadcasting."

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"The book is neither dull nor formidable for the non-technical reader; in addition to the diagrams, this book is excellently illustrated by almost fifty photographic plates."

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"The illustrations are good, well chosen and interesting, while the diagrams and sketches are numerous and clear. It is well worth careful perusal by anyone interested in this entertaining subject."

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"It is essentially a book for the person who knows little or nothing about television, and is so simply written, so free from those technical terms which often mar a book otherwise good, that even the most untechnically minded of us are able to understand it."

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By SYDNEY A. MOSELEY
and H. J. BARTON CHAPPLE, B.Sc.(Hons.), A.M.I.E.E.

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Table of Principal Contents

The Competition Story

(*For full details turn to page* 236)

When visiting friends or relations the first thing you do on arriving at the house is to . . (1) . . ; this is not a very complicated procedure, but really very simple. After a short delay the door is opened and behold you perceive a most charming . . (2) . . Of course, you go through the usual formalities of presenting your . . (3) . ., another brief pause ensues, you are then asked to enter the house. You do so, and will be received by your host with a most vigorous . . (4) . . When you have recovered from this treatment you may be requested to remove your . . (5) . . ; of course, you may not be wearing one at the moment; however, you will have to leave it in the safe custody of the maid. Your host at this stage will invite you to join him in the library, where you will find several other guests, who are looking at a very large portrait of . . (6) . . After the necessary introductions have taken place, you may be invited to partake of a little refreshment. You will probably be offered a . . (7) . ., but being more or less under the doctor's orders, you ask for a glass of . . (8) . . Your request evokes a roar of laughter, and your fellow guests may offer you several alternatives; someone may offer you a . . (9) . . or some . . (10) . . You will probably accept the . .(11). . and attack it in the usual manner. When you are feeling more settled, and at ease, your host will suggest that you join them at . .(12). ., but being rather poor at this sort of recreation, you politely refuse, with the excuse of having an urgent appointment at . .(13). . You ask your host if you may use his . .(14). ., and after a very annoying and strenuous time with this object you prepare to take your leave. But on entering the hall you have the misfortune to stand on . .(15). . Of course, when this poor chap has his tail squashed he always sets up a terrific squeal, which is heard by this gentleman . .(16). ., who happens to be passing at that moment and who, thinking a murder is being done, makes the necessary inquiries. Having explained very much to his entire satisfaction, he agrees to let the matter drop. After the confusion you adjust your . .(17). . put on your . .(18). . and, thanking your host for his hospitality, you bid him good-night.

Name..

Address..

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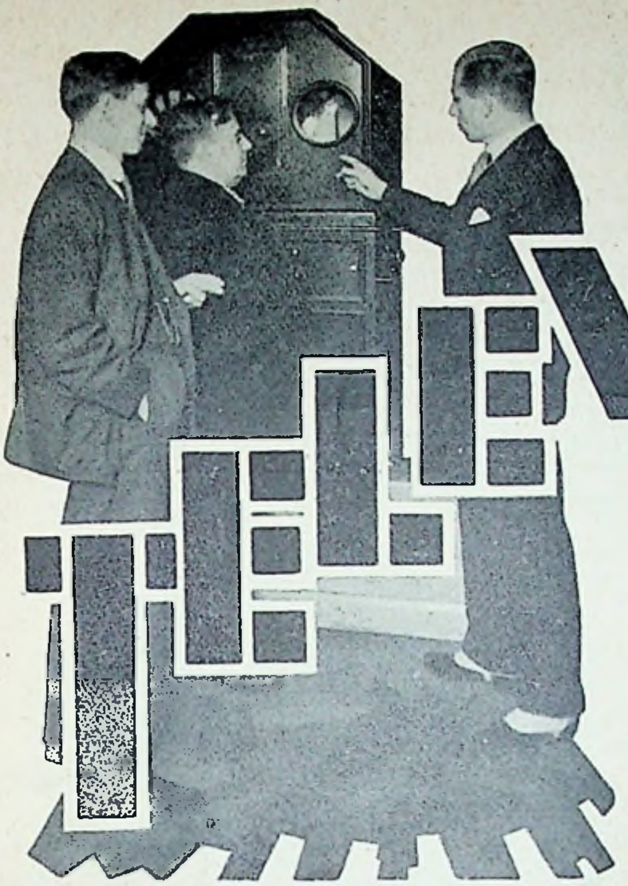

TELEVISION

THE
OFFICIAL ORGAN OF
THE TELEVISION SOCIETY

SYDNEY A. MOSELEY, *Managing Editor.*

Consultants { C. TIERNEY, D.Sc., F.R.M.S.
W. J. JARRARD, B.Sc., A.R.C.S., A.I.C.

VOL. III] AUGUST 1930 [No. 30

EVENTS OF THE MONTH

THE past has been an eventful month as this issue of the TELEVISION Magazine will show. But first of all we desire to draw our readers' attention to an interesting competition, details of which appear in this issue. During the recent transmission of the play many thousands of our readers, who are not yet in possession of "Televisors," were enabled to look-in at various parts of the country by courtesy of dealers, who offered special facilities in their showrooms, and they have written us reports, a few of which appear on another page.

The competition, which many no doubt will peruse at the seaside, will enable readers not only to enjoy an interesting novelty, but to become the possessor of a "Televisor." We suggest that after reading this article they should immediately turn to the competition and learn all about it!

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Two events of the month. The successful broadcast of the first television play is dealt with at length by Mr. Lance Sieveking and ourselves. Another article of importance to which we direct special attention tells of the big development of television on the screen.

Our Special Correspondent deals in this article with the technical side of this remarkable development, while we ourselves in our monthly causerie refer to another epoch-making development arising out of the demonstration which was held at the Baird premises.

Indeed, these events are a just answer to those critics who have alleged that television is standing still. This allegation was never farther off the mark.

By the time the year is out those enthusiasts who have followed the interesting course of television history will be congratulating themselves on the steadfastness of their faith.

Win a "Televisor"

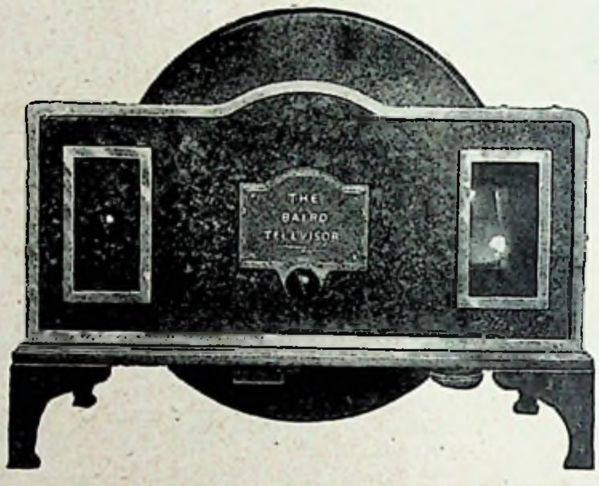
An Interesting Competition to be Broadcast this Month

AN advertisement in the *Radio Times* recently gave a comprehensive list of wireless dealers who are demonstrating television to the public. In the first television play which was broadcast recently from the Baird studios, in conjunction with the B.B.C., many thousands of people who are not in possession of wireless sets were able to look-in and see the actual characters, their expressions and actions. Hitherto, the radio actor, remembering that his audience does not see him, has had to rely on the intonation of his voice alone. To-day all that is changed, and the actor may supplement his voice by gesture, expression, and deportment.

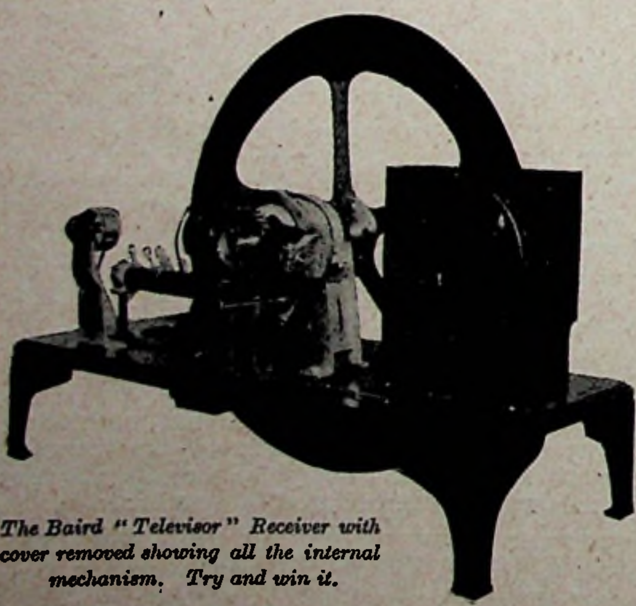
In order to give those readers who have not yet a "Televisor" an opportunity of winning one, the following simple competition has been devised and will be broadcast from the Baird studios on Tuesday, August 12th.

What you have to do

On the 12th day of this month during the television broadcast at approximately 11.10 a.m. you will hear the story, printed on page 234, read slowly. Have with you your copy of the story and follow closely. You will notice a lengthy pause when every blank space occurs. During these pauses an object, action or person representing the missing word will be televised.



This is the 25 guinea "Televisor" which you can win in this simple competition.



The Baird "Televisor" Receiver with cover removed showing all the internal mechanism. Try and win it.

The following is an example:—You will hear the announcer say:

"This . . . . . . does not suit me."

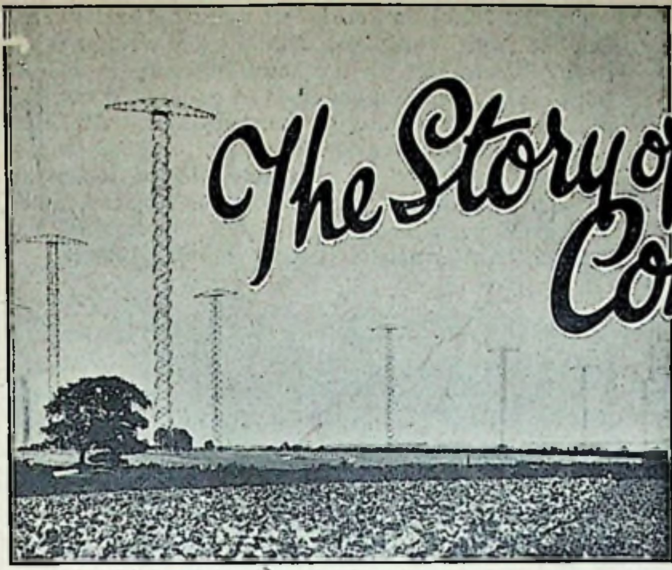
During the pause you will see a hat televised, so your missing word would be *hat*. Your sentence would then read:

This *hat* does not suit me.

Cut out the story with its numbered blank spaces and write in block letters a *numbered* list of these eighteen objects, actions or persons. Attach this list to the story, write in block letters your name and address in the space provided and post to:—

"COMPETITION,"
Television Press, Limited,
505, Cecil Chambers,
London, W.C.2.

The competitor who sends the first correct solution to be opened will be presented with a Baird "Televisor."



The Story of Electrical Communications

by

Lt. Col. CHETWODE CRAWLEY, M.I.E.E.
(*Chief Inspector of Wireless Telegraphy, G.P.O.*).

PART XVII.

*P*ICTURES

OUR story draws to a close. We have traced the development of electrical communication by means of symbols and of speech, and we propose in this article to take a glance at electrical communication by pictures, which led up to electrical communication by sight, that is, television.

In communication, speed and accuracy are the two great essentials, and television will be incomparably more speedy and accurate than telegraphy or telephony. It will thus, when fully developed, be by far the greatest advance of all in the field of electrical communication.

Television provides for instant communication, compared with the considerable time taken in communicating by telegraphy or telephony. Picture telegraphy, of course, holds great possibilities in this direction of hastening the speed. On April 3rd last, for instance, the front page of a Californian newspaper was sent by wireless by picture telegraphy 2,500 miles across the United States. It was reprinted and read on the Atlantic seaboard within three hours of its leaving the presses in San Francisco. In this experiment the paper used was only 8 inches wide, and to complete the page three strips had to be recorded and pasted together, so that with improved apparatus the time could be considerably shortened.

Early Experiments.

Experiments in the electrical transmission of pictures and writing began in the early days of telegraphy. Bain, of England, invented a chemical recorder in 1842. Improved forms soon appeared, and in 1862 Caselli, of France, opened a service between Paris and Amiens for the transmission of drawings. This service continued in operation for several years. At the sending end, a cylinder, with a sheet of tinfoil wrapped round it, was revolved, and a needle traced out the drawing spirally with special ink. At the receiving end, a cylinder revolved in synchronism with the transmitting cylinder. The receiving cylinder was wrapped round with chemically prepared paper, and a needle traced out the drawing. The whole thing was crude and gave crude results, but the general idea bore a striking family resemblance to the latest types of picture telegraphy.

The possibility of commercial picture telegraphy became apparent ten years later when it was found that selenium was sensitive to light rays, and at that time Graham Bell experimented with picture transmission when he was grappling with the problem of sound transmission as described in an earlier article. A host of experimenters were soon at work, all using very similar arrangements, with the notable exception of Campbell Swinton in England, and Rosing in Russia. These two struck out a new line by employing a cathode ray system of transmission in 1907, an idea which it is claimed by some may still bear fruit in the development of television.

This year, 1907, may indeed be taken as the year when picture telegraphy became a practical proposition, and the first successful system employed was due to Korn of Germany. It would be wearisome to trace out the developments from that time to the present day. They consisted of details, not of principles, and it will be of more interest to summarise the principles at the root of all systems of picture telegraphy than to attempt a summary of the details of development.

General Principles.

The first essential is some means of translating the light and shade of a picture into corresponding variations of electric current; the second essential is a medium between the sending and receiving station capable of transmitting this varying current without distortion; and the third essential is some means of retranslating the variations of electric current into light and shade so as to make up, at the receiving end, a replica of the picture at the sending end.

A picture may be divided up into a great number of parts so that each part is of nearly uniform brightness, then the brightness, so to speak, of each part can be transmitted in the form of an electric current, the strength of which depends on the degree of brightness. The greater the number of parts into which the picture is divided, the better will be the reproduction at the receiving end, but the greater will be the time occupied in the transmission.

At the sending end, the picture is wound round a cylinder which, while rotating uniformly, moves along slowly in the direction of its axis. A spot of light is made to scan the picture in fine, closely packed parallel lines, and this light, passing through the picture, or in some systems being reflected from it, falls on a photo-electric cell. The spot of light activates the cell, which translates the variations in the intensity of the light, caused by the relative brightness of the parts of the picture, into electrical variations which are transmitted through the medium, that is, along a wire or through the ether of space, to the receiving end. At the receiving end, the process is reversed, the variations in current producing variations of light, which act on a photographic film wrapped round a cylinder, which rotates in synchronism with the cylinder at the sending end.

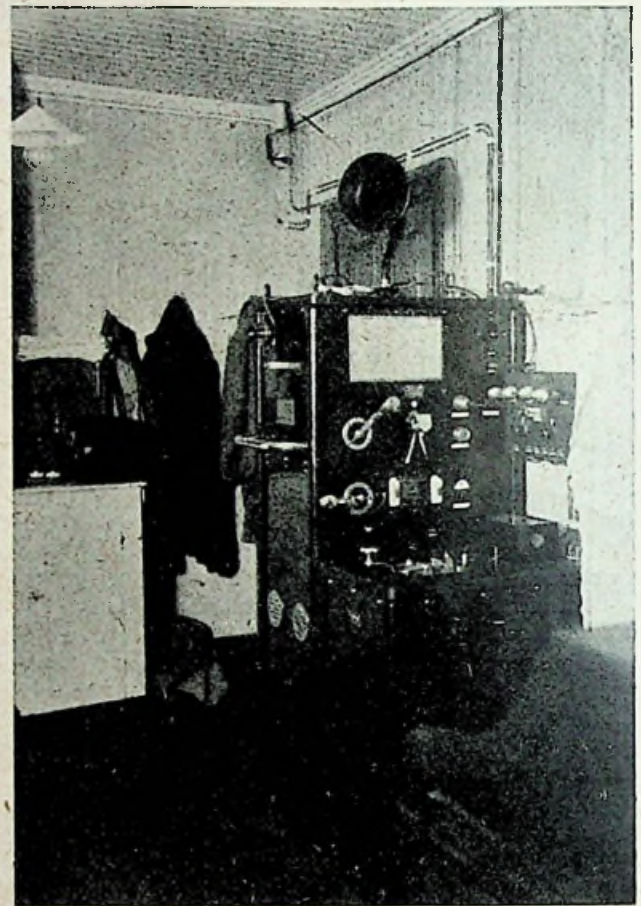
Various methods for obtaining this synchronism are employed in the different systems.

Commercial Development.

The Siemens-Karolus system, which is now in use commercially between this country and the Continent, obtains synchronism by using at each end exactly similar tuning-forks, an arrangement which obviates the necessity of the synchronising signal used in some other systems.

The speed at which pictures can be transmitted in line working depends largely on the type of line, an overhead telephone line, or lightly loaded cable, being the most suitable arrangement. When the ether of space is used as the medium, that is in the case of wireless transmission, the problem becomes more complicated, due to jamming, fading and atmospherics, but several systems now in operation give satisfactory results; for example, the Marconi Company's transatlantic wireless picture service, which has been in successful operation for several years. This company is now arranging for a similar service between the beam wireless stations in England and South Africa.

On the transatlantic circuit a 5 by 7 inch picture can be sent complete, including developing and drying operations at the receiving end, in half an hour. The minimum charge is 48 dollars (£9 12s. 6d.), and the size of picture, or sheet of other matter, that can be sent for this fee is about 23 square inches. The value of this service for facsimiles of documents, as well as drawings and pictures, is obvious, and it has even been used for the transmission of such unlikely matter as the finger-prints of criminals.



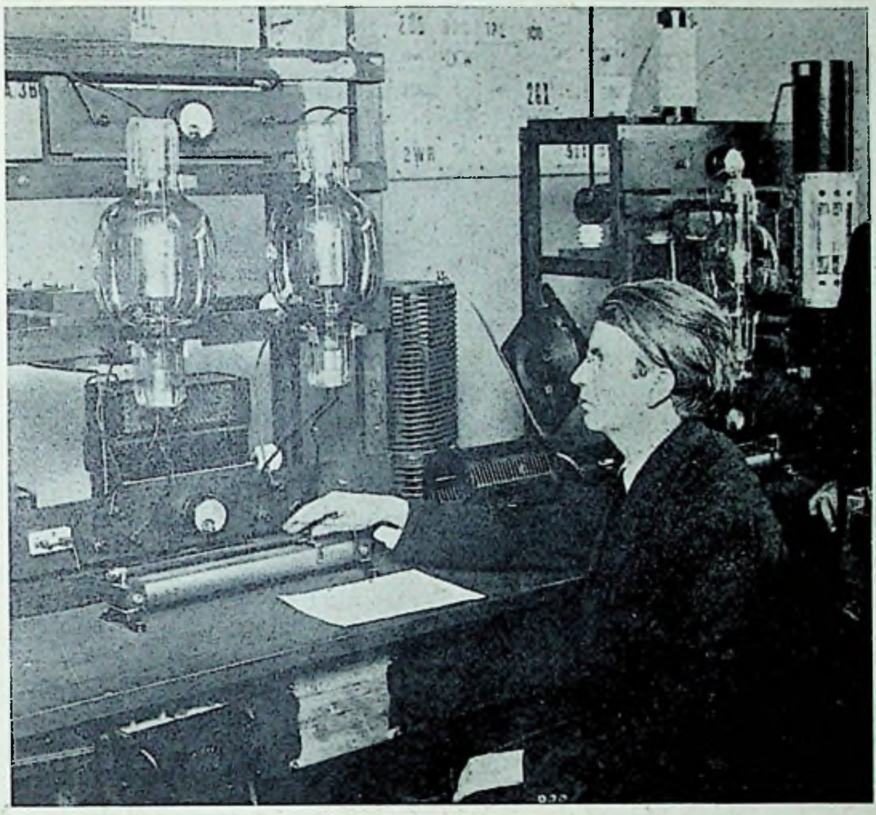
Marconi 500 watt telegraph-telephone set working on 410 metres (with adaptor unit for 600 metre wave working) installed at Prince Olaf Harbour, South Georgia, the most southerly wireless telephone station in the world.

In the United States, picture telegraphy over land lines is becoming quite popular, and recently a New York firm sent out 300 picture telegrams of the latest feminine fashions all over the country, and, incidentally, received over 200 orders by return.

France was the pioneer of commercial picture telegraphy in Europe, and was followed by Germany and England. Several newspaper services have been in operation for some years in this and other countries, but the *Scotsman* was able to announce in August, 1928, that it was then the only newspaper in the world that owned and operated its own picture telegraph system. Incidentally the same newspaper was the first in this country to have a private telegraph wire.

The principal systems now in use are the Belin, the Bell, and the Siemens-Karolus. The Belin system is used extensively in France and is used on a service between Pekin and Mukden in China. The Bell system has a service in America between New York, Boston, Atlanta, Cleveland, Chicago, St. Louis, San Francisco and Los Angeles. The Siemens-Karolus system is used between this country and the Continent, and for a service between Berlin, Frankfort-on-Main, Copenhagen, Vienna and Stockholm.

On January 7th this year the Post Office opened a commercial line service between London and Berlin. This was the first commercial picture telegraph service established between this country and the Continent. Normally a picture handed in at Berlin is delivered to an addressee in London within two hours. The charge is 2½d. per square centimetre, with a minimum of £1 for 96 square centimetres (about 15 square inches). The maximum size is 450 square centimetres (about 70 square inches), for which the charge is £4 13s. 9d. Similar services have since been opened with other places in Europe.



An illustration of great historical interest. Mr. Baird is shown seated at the controls of the transmitting station from which television signals were successfully sent across the Atlantic in February, 1928.

Television.

We have seen that the discovery of the light sensitiveness of selenium paved the way to the development of picture telegraphy, but it really did little towards television as the response in sensitivity was much too slow. Various attempts were indeed made to obtain television, but the apparatus was very cumbersome, and the results bore little resemblance to true television. It was not until a totally new type of light sensitive cell, called a photo-electric cell, was produced that television entered the realm of possibility as a commercial proposition.

It would be superfluous in this journal to make any attempt at tracing the development of television, but no apology is needed for repeating once again the outstanding landmarks of achievement.

On January 27th, 1926, Mr. J. L. Baird gave the first demonstration of true television ever given, and the apparatus which he used can now be seen in the South Kensington Museum. Previous to that time no one had achieved more than the transmission of silhouettes. This is a fact of which there is no doubt, and of which this country may justly be proud.

On February 8th, 1928, Mr. Baird transmitted the image of a man by television, by means of wireless waves, from London to New York. This was, and still is, the longest distance covered by television. A little later he transmitted successfully by television from London to the s.s. *Berengaria* in mid-Atlantic.

On March 5th, 1929, Mr. Baird gave in London, before the Postmaster-General, the first public demonstration of television by wireless with a self-synchronised receiver, simultaneously with speech by wireless.

Mr. Baird was also the first to demonstrate noctovision and phonovision. Noctovision consists of the transmission of the image of an object which is in darkness, and phonovision consists of the recording of the sound of an image. These first, and later, demonstrations have been dealt with fully in the pages of this journal.

There have been, and there still are, many prominent experimenters in television in other countries, but it is unnecessary to touch on their work here, as it is already well known to readers of TELEVISION.

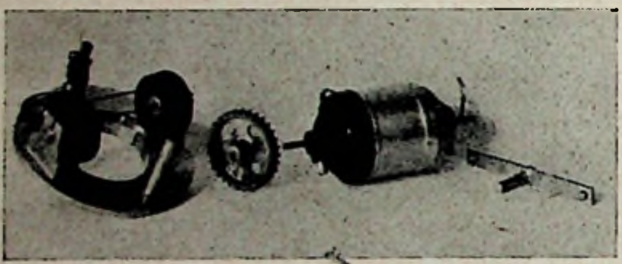
No series of articles on electrical communication could, however, be concluded, even in this journal, without some mention of television and of the one name which will ever be connected with it, John Logie Baird, of Scotland.

Television for the Beginner

PART VIII

By *John W. Woodford*

TOWARDS the end of the previous instalment in this series I introduced the question of synchronism, and pointed out the difference which must be borne in mind when dealing with this as against isochronism. I am afraid these two terms are used rather loosely on many occasions in so far that isochronism is taken to mean synchronism, but it is to be hoped that readers will now at least be able to identify the separate conditions, bearing in mind the simple illustrations which were cited.



Parts of the Baird synchronising mechanism shown dismantled from the motor.

No commercially practicable television scheme can be put into operation unless we can ensure this question of equal speeds taking place, and while, in addition, it would be a distinct advantage to bring about automatically the "phasing" of the image, the knob manipulation which the individual is called upon to do himself to fulfil this condition is so easy that no difficulty can arise.

Several Schemes Suggested

In the logical development of television it is only reasonable to suppose that many schemes have been devised to bring about automatic synchronism. Perhaps one of the first was to use alternating current synchronous motors, and, under limited conditions, this is quite successful. What are the limitations, however? Why, both the receiver and transmitter motors must be run from the same main's supply, and a moment's reflection will show how restricted is the area over which reliable results can be achieved. In London alone, for example, there are several different supply companies with varying voltages and frequencies, without taking into account the fact that direct current is used in many of the localities.

Another proposal which has been put forward—this from America—is the transmission of a special synchronising signal of definite frequency, and tune both the receiver and the transmitter mechanisms to this.

Apart from the practical difficulties and the enormous power that would be required, we are faced with the necessity of providing an extra communicating channel to bring the scheme to fruition.

This is, therefore, a retrograde step, for two channels are already required, one for sound and one for vision, and any addition to this would meet with strong opposition in an already congested ether.

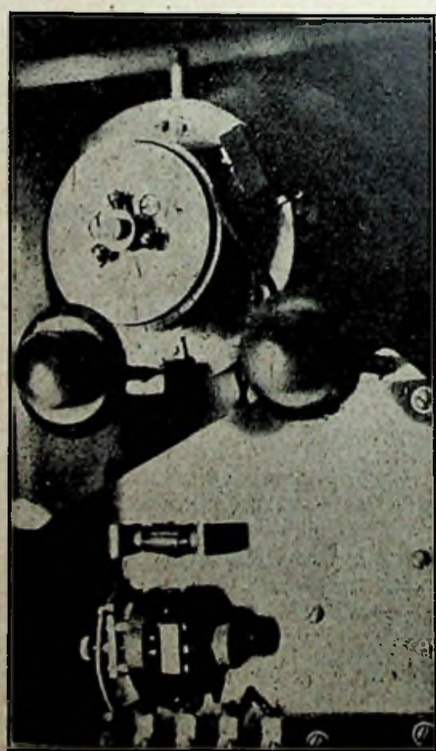
Patient Research Work

On top of this proposal we have the extremely complex and expensive efforts made to obtain synchronism by using oscillating valves, tuning forks, oscillating crystals, etc. The alternating currents generated by these devices must be amplified considerably before being used to supply power to the

* * *

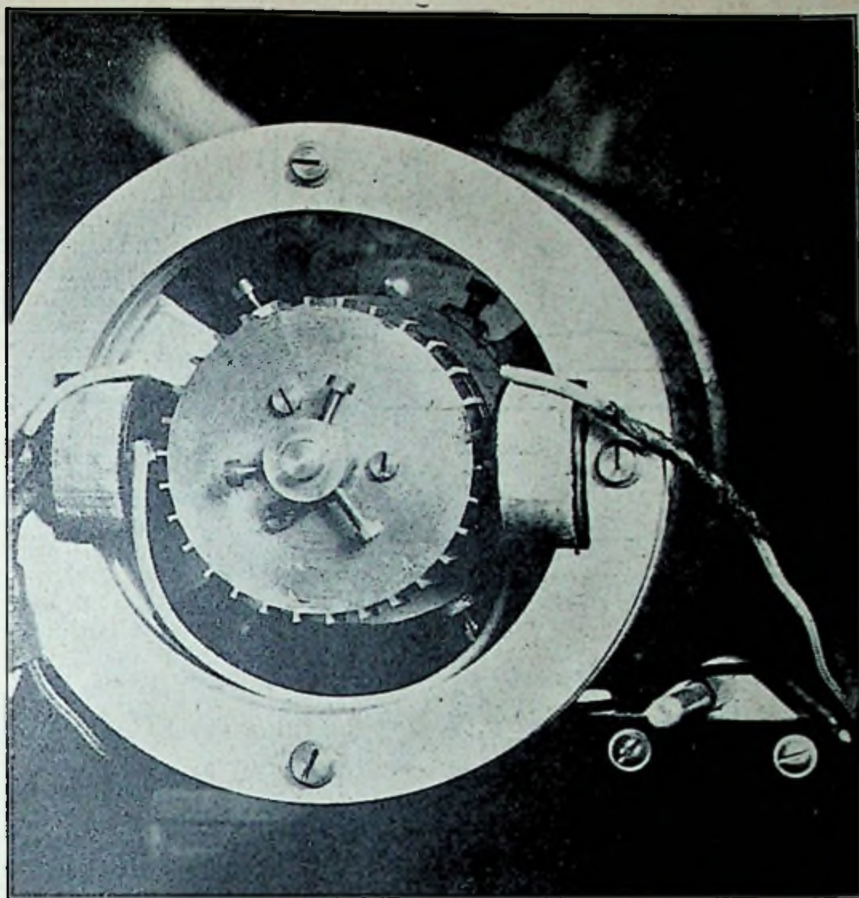
Here we have depicted the relay and commutator used in the earlier automatic synchronising system employed by Baird.

* * *



synchronous motors. Within the confines of a laboratory or under expert supervision these ideas would work, but for the general public they are out of the question. Something simple and inexpensive had to be devised to bring television within the scope of the ordinary domestic user.

This was accomplished by Mr. Baird and his engineers after months of patient research work, and was shown in operation for the first time at the September, 1928, Radio Exhibition in London. No separate synchronising signal was sent out, but the picture itself was made to provide the necessary impulses required to keep the receiver in a state of isochronism with the transmitter. For this to occur it is logical to assume that there is some component part of the television signal which varies exactly in accordance with the transmitter disc and is uninfluenced by the type of scene or subject which is being televised.



One of the first models of the cog-wheel mechanism. Note how this has been improved upon in the commercial "Televisor."

Recall the Process

Just recall the elements of the process, a spot of light moving from the bottom to the top of the scanned area to create a narrow light strip, and a sequence of thirty strips built up, side by side, in this way owing to the orientation of the holes in the exploring disc. It is the fundamental component of the actual strip sequence which is employed, for this is unvarying, assuming a constant speed for the transmitter motor. This signal, with a well-defined beginning and ending and, of course, an intervening period, occurs 375 times per second. This is based on the standard 12½ pictures per second which is used in this country.

* * *

Fig. 1.

The narrow black band used for synchronising occurs at the top of the spotlight sweep.

* * *

A black band is artificially introduced into the scanned area by means of the "gate," which we discussed when dealing with the transmitter. In simple language this means that at the top of its sweep the spot-light is masked out and there is a momentary period of darkness and thus no light is reflected on to the photo-electric cells. Thus the narrow black band, approximately equal in depth to the light-spot produced by the disc hole, is brought into being somewhat as illustrated in Fig. 1. It marks the boundary between consecutive pictures, and if you look carefully into a Baird machine you can notice it in the image aperture.

It should be quite obvious that by this simple means a definite signal, depending entirely upon the transmitter mechanism, is introduced into the normal picture signal. The receiver mechanism must, therefore, in some way be made to respond to this, and by so doing the condition of isochronism will be established.

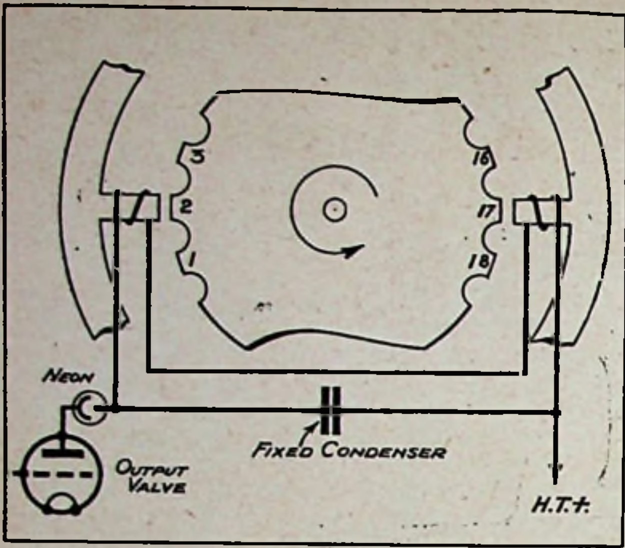


Fig. 2.—Showing how the cogged wheel synchronising mechanism may be connected in series with the neon and output valve.

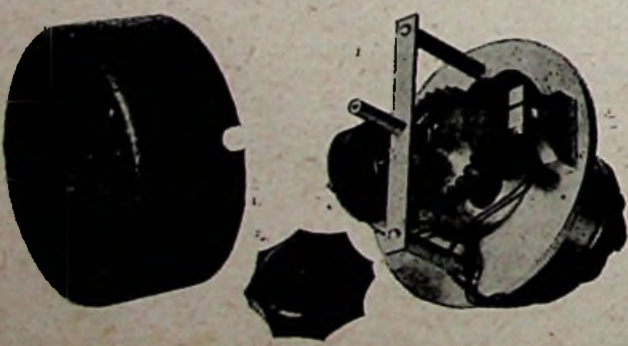
The System Explained

The first automatic synchronising system used by Baird employed what he termed the relay method, and, although most ingenious, it had several drawbacks both mechanically and electrically. Constant adjustment was necessary, while bad hunting, that is, a swinging of the picture about a mean position, occurred.

It has now been superseded by the cog wheel device or magnetic toothed wheel synchroniser, which in practice has proved far more effective.

A study of the accompanying illustrations will enable the reader to follow exactly the construction of the apparatus. Two small electro-magnets are so mounted on a metal ring that they are diametrically opposite to one another. This framework, in turn, is secured to the carcase of the small driving motor. A cogged wheel made up from mild steel laminations is held on the motor shaft by grub screws and is so positioned that it can rotate exactly between the pole faces.

Only a very minute clearance is allowed between the poles and teeth, whose facet areas are identical. Furthermore, it should be noted that the wheel teeth are separated by gaps four times wider than the tooth width.



With the cover removed we here see the magnetic toothed wheel synchroniser.

Not a Phonic Wheel

Unfortunately this device, which, in operation, is purely a correcting mechanism, is often confused with a phonic wheel. Now the phonic wheel is really a simple form of synchronous motor with teeth equal in width to the gaps, and must be driven by a current of approximately sinusoidal wave-form. There is no *drive* in the Baird mechanism, but merely a braking effect. For accurate working a tooth and pole face should be exactly opposite to one another when the scanning hole is just cut in halves by the bottom edge of the black band shown in Fig. 1.

Fig. 2 illustrates how the mechanism is connected in circuit with the neon lamp, both the neon and coils being shown in series. The coils can be fed separately to the neon if desired, but this will in no way affect the working parts which I want to describe. The action is rather intricate, so that to explain it in simple language it is felt advisable to leave this over until the next instalment.

Television Society Notes

Members met on the afternoons of July 16th and 19th, the dates appointed for the summer meetings. On each occasion the full number of members allowed duly arrived, and the visits to the Central Telegraph Office will have happy memories for all concerned.

Mr. E. Phillips (Fellow, and member of Council) acted as principal guide, and was ably assisted by Mr. W. T. Rowe (Associate), who conducted the party over the various rooms devoted to telephony and telegraphy, including wireless, while Mr. Phillips held the other portion of the party in the room devoted to picture telegraphy.

All were particularly interested in the transmitter and receiver with controlling switchboard utilised in the transmission and reception of telegraphed photographs and prints.

The lecturette and demonstrations given by Mr. Phillips were closely followed, and the many telegraphed pictures exhibited critically inspected.

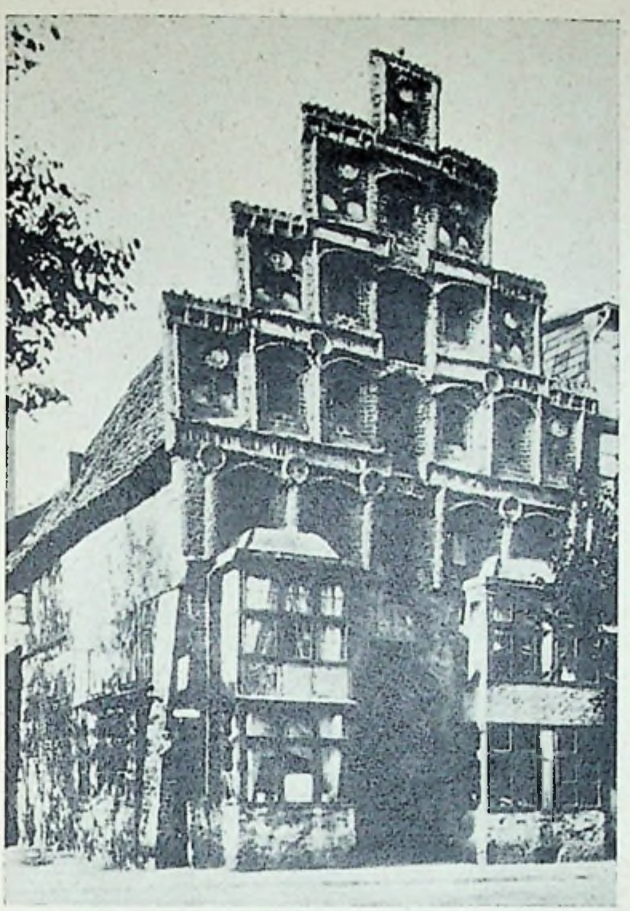
After the visits members able to stay met for tea, and so ended a most enjoyable outing.

It is hoped that a more detailed description of these visits will appear in the next issue.

Members will be interested to know that the Television Society is now duly incorporated, the certificate from the Board of Trade being dated July 12th, 1930.

Intending members can obtain full conditions of membership by applying to the hon. joint secretaries, 4, Duke Street, Adelphi, London, W.C.2.

J. Denton, A.M.I.E.E.,
W. G. W. Mitchell, B.Sc.,
Joint Hon. Secretaries.



The Picture Telegraph

By *E. Phillips.*

THE transmission of pictures and printed or written matter in facsimile by wire requires apparatus refined to a high degree of precision. The results of transmission are scrutinised closely by the recipients, and should be able to withstand such scrutiny in a satisfactory manner. The methods used produce results which satisfy these requirements.

Of the systems in use at present the three best known are the "Siemens-Karolus-Telefunken," designed by Professor Karolus in Germany in conjunction with the Siemens and Telefunken Companies; the "Belin," designed by Monsieur Belin in France, and the "Bell," designed by the Bell Telephone Company in America. The principal difference between these systems lies in the method of transforming the received electrical signals into terms of light. The Siemens-Karolus uses the "Kerr Cell" between Nicol prisms. The "Belin" uses an Oscillograph, and the "Bell" uses a "Light-Valve." Each system produces good results.

The prints shown at the exhibition of the Television Society in April were the product of the "Siemens-Karolus" system. This system is used for the Picture Transmission Service arranged by the Post Office between Great Britain and Germany and Denmark. Many of the prints shown had been transmitted over long lengths of line. The lines are mainly loaded underground telephone cables, with repeaters at intervals. The excellence of the results was generally remarked upon.

The translation of light into terms of electricity is performed by the "photo-electric cell" in all systems. A carrier current of the required frequency is imposed upon the line, either by the use of an interruptor disc, similar to that used for "Baird Television," or by an oscillating valve system. The "Siemens-Karolus" and "Belin" systems use the interruptor disc. The "Bell" uses the oscillating valve. For the loading mainly used in telephone cables a frequency of 1,300 cycles per second is suitable.

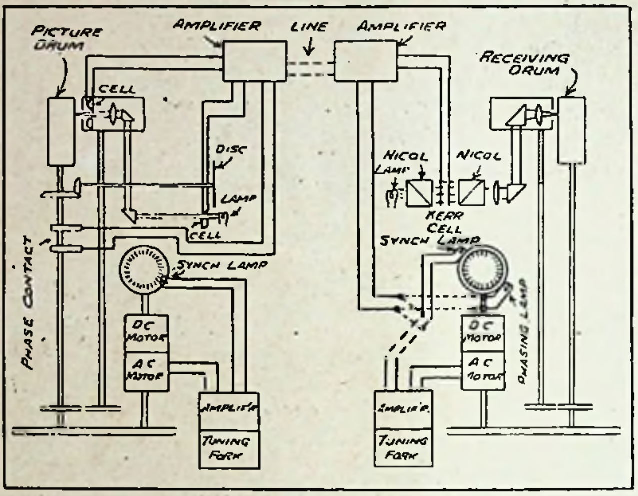
The light which illuminates the picture for transmission is provided by a spot-light lamp. After passing through the interruptor disc, the light is directed by means of lenses as a bright spot on to the surface of the picture from which it is reflected on to the photo-electric cell. The apparatus is so arranged that the spot will travel in a fine spiral over the surface of the picture. The picture is clipped to a drum, which is revolved by a geared electric motor.

In the "Siemens-Karolus" system the drum has a circumference of 28 c.m., and a depth of 18 c.m. Other systems use smaller sizes. The drum revolves on a vertical axis. The optical system, through which the light spot passes on to the surface of the picture, consists of prism, lens, and photo-cell. The last-named is in annular form and the light passes through the centre. The system is mounted on a shaft on which is cut a screw thread. The shaft is revolved by gearing with the same motor that revolves the drum shaft. The optical system therefore moves up or down the shaft at a steady rate. The pitch of the screw is such that the light spot "explores" the surface of the picture to the extent of five lines to the millimetre. This gives "fine grain." Coarser grain of 4 and 3 lines to the millimetre can be arranged by changing the gearing. "Fine grain" permits of the reproduction of the finest detail, as may be seen from the illustration of the lace-bordered handkerchief.

The methods of driving and synchronisation vary. The system the use of which is extending most widely at present is the "Siemens-Karolus," and a description of the driving and synchronising method is given. The main drive is by D.C. motor and an A.C. motor is mounted on the same shaft. This is driven by a tuning-fork enclosed in a thermostatic chamber. The temperature is kept constant automatically, and the rate of vibration of the fork is therefore constant. The fork-current is led to the A.C. motor, and also to a Neon lamp above a stroboscopic disc. The disc is geared to the main axle, and the speed of the D.C. motor is adjusted by a rheostat until the lines on the disc appear stationary. The motor speed is then constant, any variation being corrected by the A.C. motor. To obtain synchronism between two stations, one station transmits its fork-current over the line to the other, which disconnects its Neon lamp from its own fork and connects the lamp to the incoming currents. It then adjusts its own fork-capacity until the stroboscopic disc shows no sign of "creeping." When so adjusted the variation at the end of a 20-minute transmission does not exceed 0·04 inch. The total traverse of the light over the sending or receiving drum is 813 feet, so that the variation is negligible.

It is also necessary to put the two stations in "phase" with each other, and so ensure that transmission and reception shall commence at the same relative points on the two drums. A "phasing" signal is sent out by the transmitting station once every revolution of the drum axle. At the receiving station a Neon lamp is mounted on the axle with the stroboscopic disc. The "phasing" current is led to this lamp, and flashes it once each revolution. The flash should occur under a shield at the front of the disc, and the rotor of the A.C. motor can be rotated by a handle until this position is reached. When "phase" has been obtained the phasing signals are cut out, and transmission of the picture current commenced. No synchronising or phasing signal is sent during the transmission of a picture. The "phase" is checked before commencement of the next picture and the synchronism remains constant.

The translation of the incoming electrical impulses into terms of light for impression upon the photographic film is effected in the "Siemens-Karolus" system by a "Kerr Cell," placed between Nicol prisms. These are crystals of Iceland spar which have been cut along a plane which is perpendicular to the optical axis of the crystal. The cut surfaces are polished, and then cemented together with Canada balsam. This has a refractive index of 1·53. When



The schematic diagram of the Siemens-Karolus-Telefunken picture transmission system.

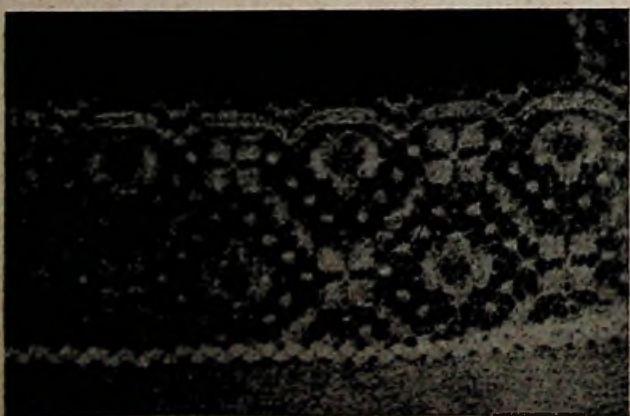
light is admitted along the optical axis of the crystal it is split into two rays, an ordinary ray, with refractive index 1·65, and an extraordinary ray, index 1·48. The ordinary ray falls on the Canada balsam at such an angle that it suffers total internal reflection and is lost. The extraordinary ray passes through and is plane-polarized.

The two Nicol prisms in the receiving apparatus are arranged to polarize light in different directions. The light admitted into the first Nicol, the polarizer, passes through a small aperture into the "Kerr Cell," and on emergence falls upon the second Nicol, termed the analyser, which normally prohibits further passage.

This "Kerr Cell" consists of a small condenser immersed in a solution of nitro-benzole. When a voltage is put across the terminals of the condenser, the plane of polarization of the beam of light passing through the cell is rotated to a greater or less degree. The light is now incident upon the analysing prism in such a manner that a greater or less amount can pass through. A voltage of 700 volts across the terminals of the "Kerr Cell" will cause a rotation of the incident ray through 90°. This is equivalent to the light passing through the polarizer. After passing through the analyser the ray is directed by lenses as a bright spot on the surface of the photographic film placed on the receiving drum.

Variations in the sent currents caused by the variations of light and shade in the picture on the sending drum are received over the line, and after amplification are passed to the "Kerr Cell." A maximum of 700 volts for white sent is placed across the cell, and the received currents vary from this value downwards. The characteristics of the "Kerr Cell" require, for tone

(*Continued on page* 247.)



Notice the extremely fine detail which is reproduced when the "fine grain" gearing is in operation.

*E*nemies—and *F*riends—of *B*ritish *T*elevision

By Sydney A. Moseley

YOU would think that at this late hour our small but noisy band of British patriots who do their level best to impede the progress of British television would have retired with as much grace as they could muster from the field of controversy.

A few of the genuine critics recanted before it was too late. The most persistent of them was the most open and frankest of them all—A. A. Campbell Swinton.

Readers of this magazine will remember that Mr. Swinton, who had evolved some ideas of his own regarding television, refused to believe in the truth about Mr. Baird's television until shortly before his death when he wrote a remarkable letter to *The Times*, which deserves quotation :

"I recently went to see an exhibition of Baird television at the offices of the British Broadcasting Corporation. The television was very successful, and I was easily able to recognise a moving picture of the Prince of Wales."

* * *

In this connection I cannot help recalling the amusing manner in which Sir John Reith told me of how he had heard about this extraordinary *volte-face*.

"I was reading in the quietude of my club," he said, "television being the last thing I was thinking about, when a form towered over me, the owner saying in a tense, mysterious voice : 'I have been converted . . . . . .I have been converted. . . . . .' "

Sir John looked up and saw it was Campbell Swinton. He imagined that the conversion was a religious one ; but it appears that the well-known scientific investigator had been given a demonstration of Baird Television at Savoy Hill during one of the morning transmissions, and—well, had seen what he had so long doubted. He saw at once that he had been wrong in his rather severe strictures, and did not hesitate to say so. Let that remain a credit to the memory of a worthy disputant. Incidentally, those who imagine the Director-General of the B.B.C. to be austere and without a sense of humour should have heard the delightful manner in which he recounted this episode.

There are opponents of television of a very different calibre, however. Some are merely disappointed experimenters. Others are so vain and thin-skinned that they are unable to admit they are wrong, even in the light of experience. There are a few who are employed by foreign interests. They are paid spies, even as there are military and naval spies employed by all countries, including Great Britain. By spoken and written propaganda they seek to advance the interests of their foreign masters by misrepresenting British interests. There are others, whose support can only be purchased. If necessary, I can be more explicit about these matters.

* * *

During the summer months, when things in the radio trade are inclined to slacken, it has been found expedient by the Baird Company to curtail the number of their staff. This, as one knows, has been occurring all over the country. It is purely a matter of economics. I sincerely sympathise with certain members of the Baird staff in their disappointment in thus finding themselves not only unemployed but debarred from close association with so enthralling an occupation as television. But they must not blame television. The science has not changed if their position unfortunately has.

* * *

To go back to Campbell Swinton. There is another man who has not been afraid to alter his views. He is Captain E. H. Robinson, a notable writer on wireless topics.

When television was in the early stage of development Captain Robinson did not hesitate to point out the difficulties and limitations. Since then he has followed the course of recent happenings very closely, and does not hesitate to acclaim himself an adherent where once before he was cold, if not hostile.

I am printing some of the interesting notes Captain Robinson has sent out to the members of his wireless circle.

I recommend my readers to turn to them on page 260.

* * *

The position regarding my old friend Captain Eckersley is, to say the least, intriguing.

Here is a man who, once upon a time, by virtue of his official position at the B.B.C., had an opportunity of helping along a sister science. He not only refused to do so, but by his spoken and written word ridiculed the great invention. With his departure from the B.B.C. he was no longer, as they say, " in the news " ; he had become an ordinary private individual.

* * *

With the circumstances of his departure from the B.B.C. I have no concern, but I desire to know in a matter of public interest what his position is at the moment. I gather that for a time he acted in the capacity of an adviser for the B.B.C., for which he received a fee. But I was under the impression that his direct association with the B.B.C. had definitely ceased, and that Noel Ashbridge had, in point of fact, become Chief Engineer of the B.B.C.—as indeed he is. Wherefore, I was surprised, when I have had occasion to visit the B.B.C. twice lately, to find Captain Eckersley there as large as life! During the transmission of the first television play, "The Man with the Flower in his Mouth," I understand that Captain Eckersley was present, and tried to justify his past opinions about television.

That is just my complaint against this type of person. He can never withdraw. He will endeavour to maintain his opinions in face of fresh evidence. To withdraw, we know, requires a certain amount of moral courage, and as we have seen there have been prominent men who have not been lacking in this quality so far as television is concerned.

* * *

Captain Eckersley stated in the hearing of a friend of mine after the transmission at Savoy Hill that " television had made no progress," and he stated this gleefully. But here again I ask, as I have asked before now—how can Captain Eckersley know what is really going on in the world of television ? His interests in the Gramophone (or any other) Company may reasonably justify him in expressing views about the state of affairs in those big concerns.

But how can he know what is happening in the Baird laboratories ? Critics such as he scorned the very idea of being able to recognise a living image through the "Televisor" not so very long ago.

And here the late Chief Engineer's own prominent colleagues have, on their own volition, after testing out television, put over a play where different characters appear, and where, of course, unless complete recognition of the actor by the audience were established it would be utterly futile and foolish to have done so.

* * *

I have before now quoted the competent views of the wireless experts in the popular press against these diehards, and I will merely content myself with referring him to the views expressed by *The Times* and other journals about the production of the first television play.

* * *

As an additional example of the entire ignorance in which Captain Eckersley expresses his opinions on such an important matter, I might merely add that he can have known nothing about the big screen which was shown on the roof of the Baird premises at the moment he was looking into the small commercial "Televisor."

This big screen must stagger Captain Eckersley in his self-satisfied mood, for not only is it of large dimensions, but it is of such brilliance that a big audience can see the picture twenty, thirty or more feet back.

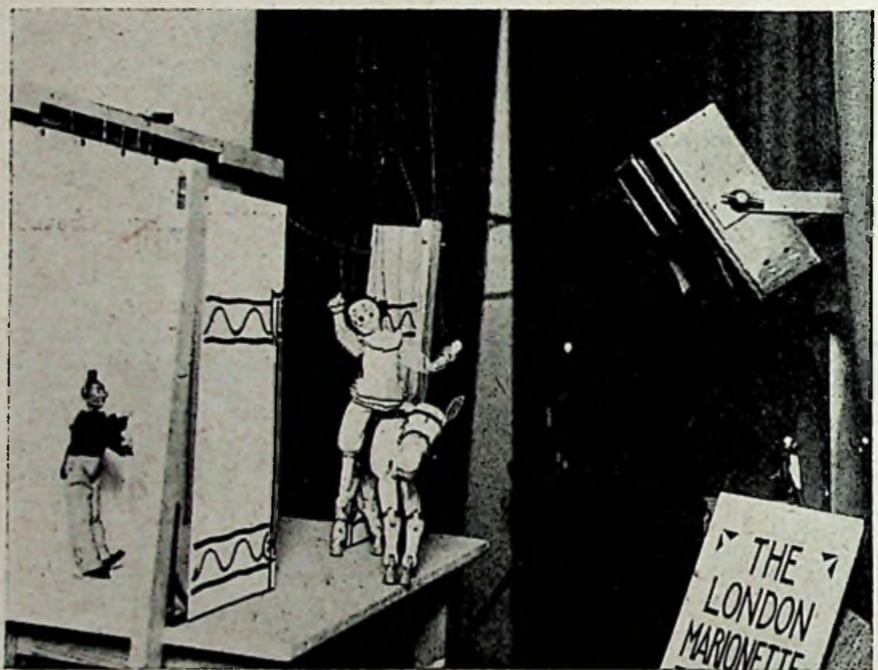
Indeed, television has made *sufficient progress as to warrant Sir Oswald Stoll booking the screen for at least a fortnight for daily performances at the Coliseum.*

Here, again, let me hasten to write what I wrote about the small " Televisor " a year or so ago when the Eckersleys were saying it was impossible.

The screen is by no means perfect, but it is an extraordinary advance—a step in the right direction.

* * *

I am still interested to receive letters from the trade who have taken up television so enthusiastically.



The London Marionettes have been a feature of the television programmes on several occasions. Special arrangements had to be made to adapt the "turn" to television purposes and this glimpse of the studio shows a stage in the process.

I have quoted some of the letters that have been sent to me. They have been so numerous that I can only refer to a selection, but I hope in time to cover as much of the ground raised by correspondents as possible.

With regard to the transmission of the first television play, a note reaches me from Mr. L. Leaman of West Ealing, who says: "With regard to the play transmission, we would wish to compliment you on the excellent results obtained. Every detail showed up clearly and distinctly. Our audience was most enthusiastic, and came from as far as Richmond in response to the notice in the *Radio Times*. The transmission was greatly enlivened by the addition of music."

My correspondent refers to other transmissions which he has picked up, with excellent results.

Portrait in bronze of Mr. C. R. V. Nevinson, by Barney Seale. This famous artist painted the "scenes" for the first television play.

And again, here comes "Uncle Tom" with a letter to "Uncle Sydney." He reports results from the North, where "weather conditions could not possibly have been worse. We had a loudspeaker on both stations five minutes before the transmission commenced and bursts of thunder threatened to make reception hopeless."

Amusing to relate, "Uncle Tom" first of all took the background for distortion. This is what he says: "For two minutes or so after the commencement I was confronted with a lovely black and white chequer-board screen, and I thought I was picking up some 'lovely' distortion. To my relief, however, the curtain parted and the play commenced. The scenes were, of course, at such a distance, only moderately discernible, but when we were treated to the faces of the actors these came through wonderfully for daylight reception, considering the atmospheric conditions, which were truly deplorable. The speech and music, particularly speech, was coming in so badly, owing to atmospherics, that it was practically inaudible; the music was very little better, and, to put it plainly, not fit to listen to—yet the picture was really quite good under the circumstances. Once again, "Uncle Sydney," I have to point out to you that, under identical receiving conditions, the picture was far more satisfactory than the speech and music—another success, I say, for the young science as against the old."

* * *

"Uncle Tom" finishes up by saying that the local interest was tremendous. Many hundreds of people applied to "look-in" to the transmission, but unfortunately these could not be accommodated.

* * *

I have not space to quote any more interesting letters, but I must refer to one from Mr. David J. Smith, of Messrs. Geo. Kenning (Chesterfield) Ltd.: "We thought it might be of interest to you to know that about 130 people, including a class of school children, witnessed the play."

* * *

Mr. Alfred S. Reeve tells me in a private letter that he was present in a house six miles north of Newcastle and saw the play transmission. Although the atmospherics were terrible, the play came through clearly enough. "The actor with the flower mopping his brow, or passing his hand over it, was plainly visible."

* * *

And now turn to the competition page and win a "Televisor."

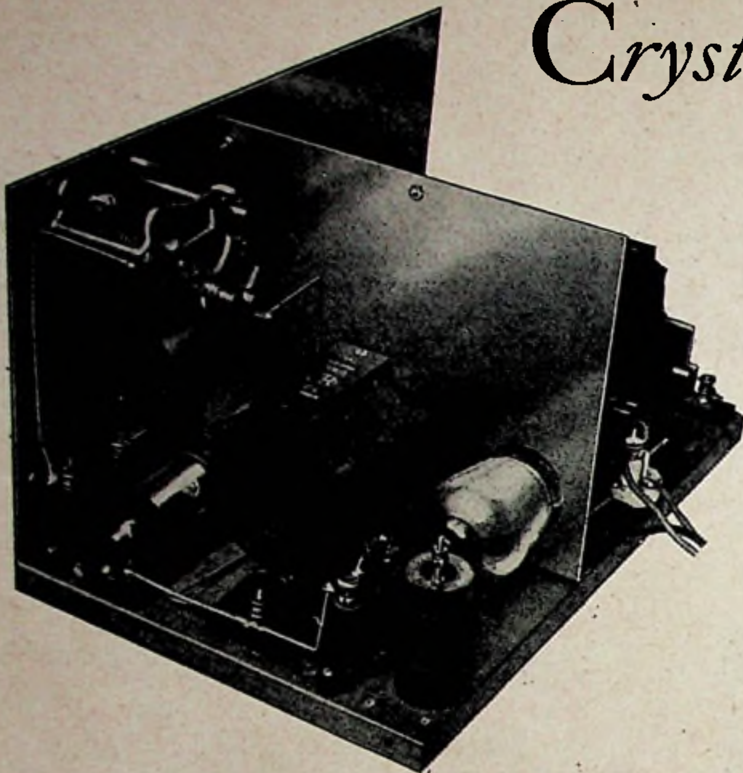
The Picture Telegraph

(Concluded from page 244).

pictures, a "priming effect" of approximately one-quarter of the total current sent. This is provided at the sending end by an additional photo-cell placed so as to receive a regular proportion of the light from the sender lamp, and so provide the regular current required. The "Kerr Cell" then acts as an inertialess translator of received signals. The photographic film is afterwards developed and printed in the usual way.

The photo cell used is potassium on copper, sensitised, and is a good all-round cell. Its threshhold is in the red, and the peak is in the blue range of the spectrum, with a minor peak in the yellow, these being the general characteristics for sensitised potassium. The current generated for white is 4 micro-amperes.

Specimens of the work done are shown in the illustrations. Photographic tones are reproduced with fine gradation, handwriting, typewriting or print is faithfully reproduced. Pencil sketches or writing also reproduce well. The prints are indistinguishable from photographs taken by the camera direct.



Crystal and Diode Detectors for Television

By *William J. Richardson*

I POINTED out in my short note last month that the detector stage of a wireless receiving set which is to be used for television purposes has a very important bearing on the resultant images. Naturally this point has been emphasised in the columns of TELEVISION by various writers, particularly Mr. H. J. Barton Chapple, but it will make our analysis more complete if we deal briefly with the two popular detector methods.

Fig. 1 gives the bare details of the connections for grid leak working where the signal currents are rectified first and then undergo magnification in the valve itself before being passed on to the low-frequency amplifier. Unfortunately, although this method of detection is quite satisfactory for use in wireless sets receiving the sound broadcasts, it does not give very good television images.

Possible Improvements

With strong signals the grid circuit is very liable to choke while the presence of the grid condenser often brings about frequency distortion. I have found when working with this method that improvements can be effected by lowering the value of the grid condenser and grid leak from the usual ·0003 mfd. and 2 megohm values or adjusting carefully both the grid and the plate voltages. That is why the potentiometer shown in Fig. 1*B* proves a very useful refinement under these conditions.

If stages of resistance capacity coupling are used after a grid leak detector then either two or four valves are necessary for a positive picture. The two stages are generally incapable of giving sufficient strength to produce a good picture, while the four stages tend to "overcook" the neon. This is another reason which makes the grid leak detector generally unsuitable for television work and although my first television images were obtained with the grid leak arrangement I soon found that anode bend working was better.

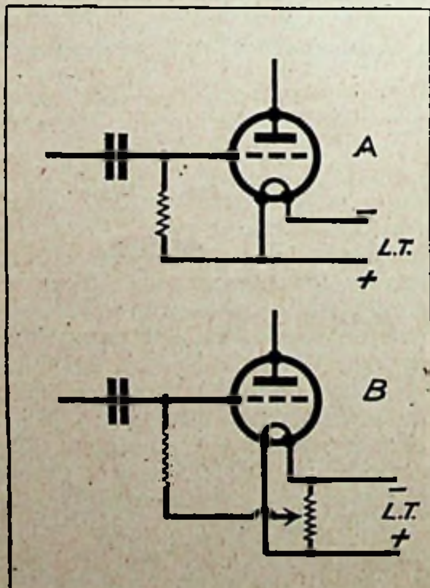
An Anode Bend Detector

I have shown in Fig. 2 one of the best ways for connecting this up and one of the big advantages of

* * *

Fig. 1. Two satisfactory methods for connecting up the grid leak detector valve.

* * *



this method lies in the fact that by properly adjusting both grid bias and high tension voltages, very strong input signals can be handled without any trace of distortion. Note that the high frequency impulses are amplified in the valve itself before undergoing rectification in the anode or plate circuit, so that the scheme is entirely different from that of the previous method.

For many months I have used the anode bend detector and been rewarded with first rate television images, especially when coupled with the low-frequency amplifier which I described in TELEVISION about six months ago. The true experimenter is seldom contented with his results for long, however, and I must confess that I am no exception to this ingrained characteristic.

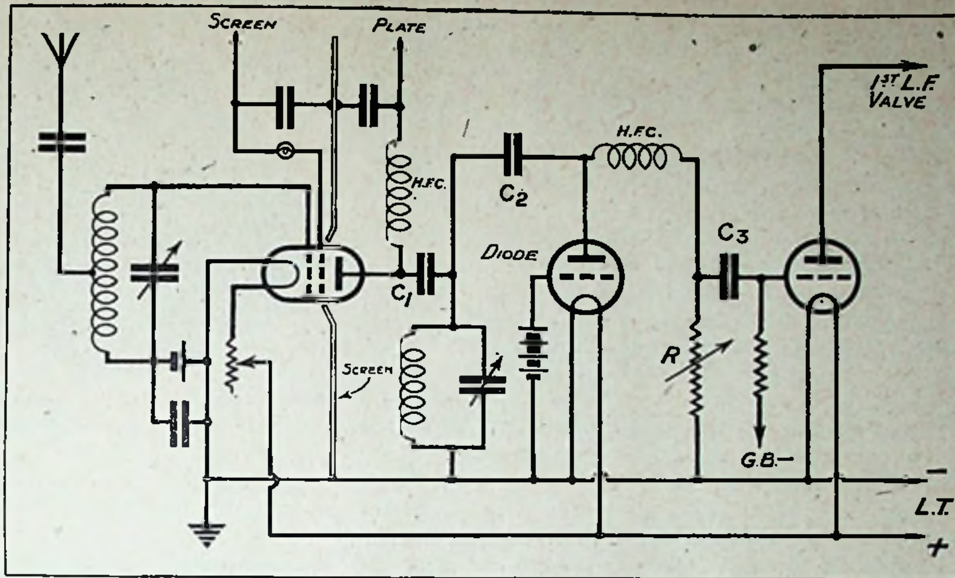


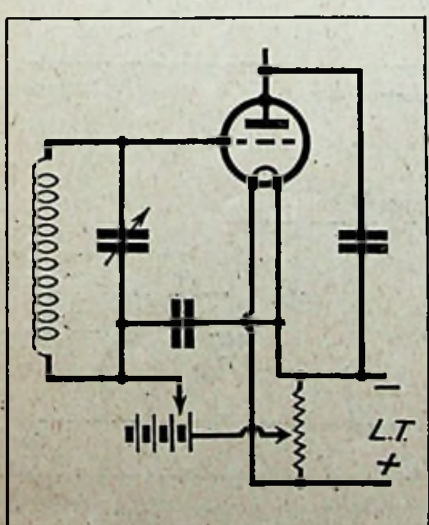
Fig. 3.—Details of the diode detector circuit which have given such good results.

Features of the Diode

Wasn't there any other form of detector which could be pressed into service to still further improve the images ? Casting my mind back on earlier wireless experiments I recalled the old diode and then remembered a modification which I think was dubbed the " Kirkifier " after Mr. H. L. Kirke of the B.B.C. engineering staff.

The ordinary diode or two electrode valve has an anode current/anode volts characteristic curve which obeys a non-linear law and is thus not wholly satisfactory. In the diode arrangement which I have indicated in Fig. 3, however, the valve is made to obey a linear law and thus gives absolutely distortionless reproduction.

If you refer to the anode current/anode volts characteristic of any three electrode valve it will be seen that the slope of the curve varies considerably with grid voltage. Not only does this slope, and therefore the impedance, vary, but the curvature of the slope also varies. If, therefore, a three electrode valve is used as a two electrode valve, varying the voltage on the grid will vary the impedance of the valve and the straightness or otherwise of its characteristic.



* * *

Fig. 2. This diagram shows the elements of an anode bend detector.

* * *

A Grid Priming Voltage

In the Fig. 3 circuit one has a control of the grid priming voltage and generally this is so chosen that the impedance is a minimum and the characteristic can be made straight over the range of voltages used.

Generally it is found that a high impedance valve has the most suitable characteristic with a grid priming voltage of about twelve positive. In the course of my tests I found an LS5B admirably adapted for the purpose and the positive grid voltage was obtained via a 16-volt G.B. battery. The drawback to the diode lies in its inherent insensitiveness and in consequence it requires a strong signal input. One must also bear in mind that the valve is a passenger in the sense that no amplification is derived from it.

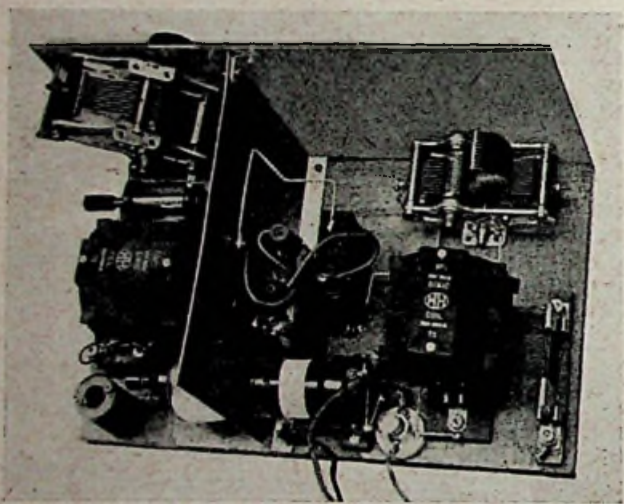
To overcome this effect a stage of screened grid amplification precedes the diode and as will be seen from Fig. 3 this is arranged in the form of a choke feed tuned grid.

Circuit Details

The mica fixed condensers C_1 and C_2 are ·001 mfd. capacity, while the two high-frequency chokes must be of differing characteristics. For experimental working I found it best to make the resistance R variable and a universal power Clarostat giving a resistance range of zero to 100,000 ohms functioned splendidly in the set. C_3 forms the ·1 mfd. coupling condenser of the three stage resistance capacity coupled amplifier that I mentioned earlier and which, according to reports, I am pleased to say has found a large number of users as a result of the constructional details given in the March, 1930, issue.

The operation of the circuit is quite straightforward, for apart from the normal tuning controls it is necessary only to adjust the grid priming voltage and the value of R. I found in practice that the variation of R within certain limits provided an excellent volume control and enabled me to adjust the signal input to the low-frequency amplifier so that the neon gave a first-class image.

I can thoroughly recommend the scheme to all readers, it being my firm conviction that the images I obtained with this apparatus were superior to



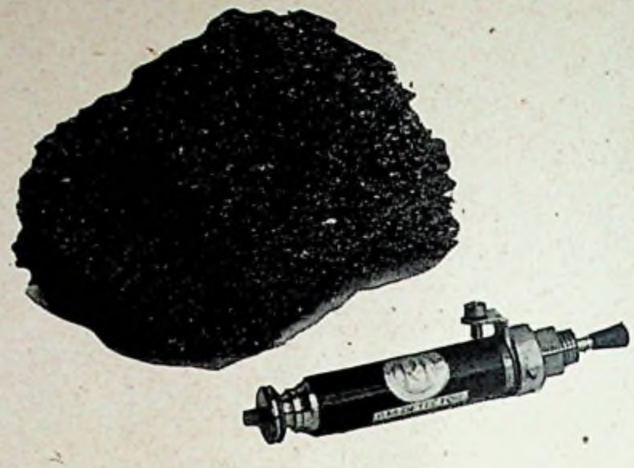
A view of the experimental receiver which was made up for the crystal detector experiments.

those secured with anode bend working, while the control was much smoother.

Now the Crystal

In spite of the noticeable improvements, my mind still ruminated on this problem of rectification. Since one appeared to be working backwards, what more natural than to substitute crystal rectification for the diode. Even in these enlightened days of distortionless reproduction there are still many wireless fans who are most emphatic in stating that there is nothing to beat the old-fashioned crystal for purity.

I resolved to put it to the test for television, the alterations from the diode arrangement being quite simple. The unit which I employed is illustrated in two of the accompanying photographs, the crystal being quite visible. That shown is a Burndept,



A sample of a modern crystal detector with a large carborundum crystal in the background.

several years old, but I used others including an R.I. permanent crystal with equally effective results.

The skeleton diagram of Fig. 4 gave about the best results, C_1 and C_2 being of ·001 mfd. capacity as in the diode, although it is advisable to try the effect of different capacities for C_2. The crystal was placed at the high potential end of the tuned circuit for when C_3 and the crystal were reversed, results were inferior.

Wonderful Results

Using this circuit I was rewarded with some wonderful images, indeed I think I am right in saying that they are the best I have ever seen. The whole "screen" was clear and image detail of the highest order. When the choke feed arrangement was replaced by a straight tuned anode the results were not comparable to the original scheme, so the Fig. 4 circuit was used for most of the time. It is important to note that the crystal and "catswhisker" must be the right way round otherwise a negative image will appear in the "Televisor" and tests must be made to ascertain which is the correct way round for this unique little rectifier.

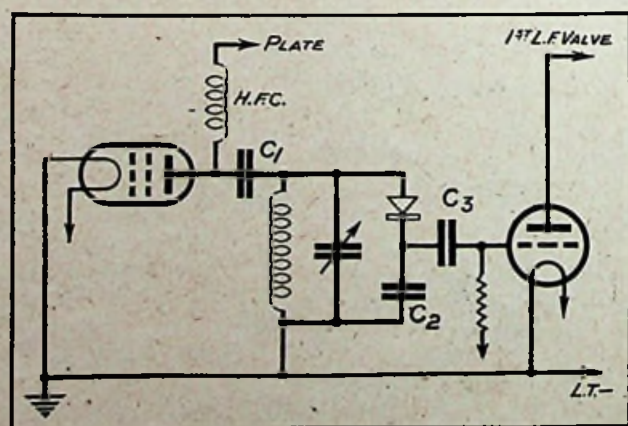


Fig. 4.—Showing how the crystal was connected up when receiving television images.

Baird Studio Topics

By *Harold Bradly*, Studio Director

"WHAT a weird experience!" I have heard these same words used time and again. These, and "I was nonplussed!" are only two of the many expressions uttered by bewildered artistes who have just completed a test. For every artiste who looks out from your "Televisor" has had to undergo the ordeal of a test, and there is no denying that to some it does represent an ordeal.

Take an ordinary audition, held at any theatre prior to a musical production. There is an atmosphere of nerves everywhere. Most artistes are quite used to such things, but always there is that nervous tension which seems to pervade the whole building. A name is called, an artiste hands his or her music to the pianist, then walks on to the stage. A song is sung or a dance performed before the manager who is usually seated somewhere in the stalls. He either calls for them at the conclusion of their turn or says nothing. In the latter case the unfortunate artiste realises that this is not their lucky day.

Now with the advent of television these auditions take on a more exacting aspect, for not only has the artiste to go through a similar procedure, but on top of that you have the dimly-lit Baird studio, a screen, a studio chair, and the flickering spot-light projected from the control room through an aperture in the wall. The whole thing has an air of mystery.

Then, prior to the test, a full explanation of the technique is given, all of which the artiste must bear in mind if a successful test is to be made.

An Audition Described

Imagine, therefore, what a strain is imposed upon these temperamental people, and it is only by giving them a few words of encouragement that their fears are somewhat allayed. There is no doubt that the atmosphere of the whole procedure is not without its terrors.

This is really unfortunate, because in consequence of this one can see quite plainly that artistes are often not doing justice to their talents. It would not be without interest, perhaps, if I describe here the nature of the proceedings during an audition at the Baird studio.

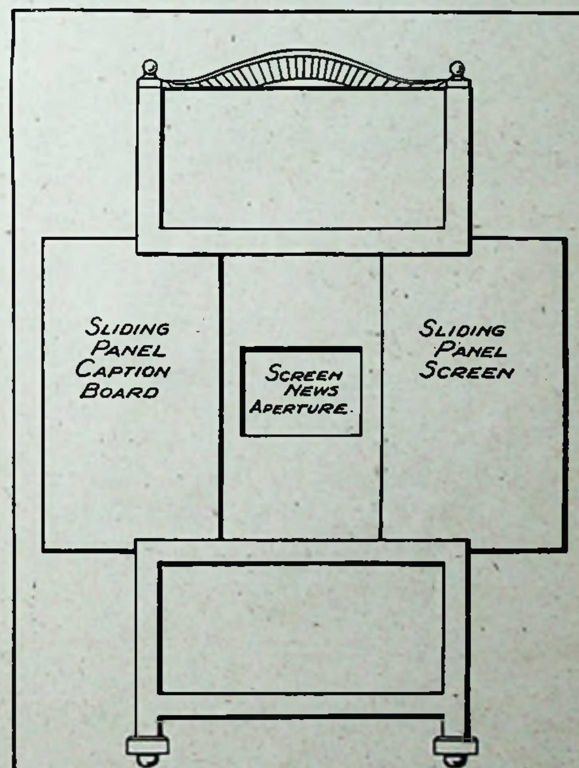
The artiste is first escorted to a dressing-room where hats and coats are discarded, and any necessary attention to the hair, etc., is given. From here they pay their first visit to the studio, and hand their music to the accompanist for a preliminary rehearsal.

There is next an introduction to the studio chair, a description of which I will give. It is a compact adjustable piece of furniture which can be raised or lowered according to the height of the individual. The seat revolves on a swivel, and this enables the artiste to make a simple entrance or exit, preventing any interference with the photo-electric cells. There is a back rest, too, which is also adjustable, thus affording adequate support for the subject.

Then a few points are given with regard to voice volume and the necessity of keeping within the radius of the spot-light are explained, and the test begins.

If an artiste is nervous I naturally make all possible allowances, and occasionally ask for another song to be sung in order to try and create a little confidence; but if this nervousness is still apparent, then, unless an artiste's work is obviously suitable, there is no alternative but to bid them a polite "good morning."

On the other hand, if a successful test is made the fortunate one is engaged, and returns home with that pioneer feeling as one of the early television artistes, for which they have every right to be proud.



The back screen now in use at the Baird studio. It is padded with felt and then covered with white linen, thus preventing sound vibrations.

THE FOURTEE

By *Lanc*

Lance Sieveking, D.S.C., joint producer of the first Television Play.

The first Television Play was transmitted on 14th July from the Baird Studio at 133, Long Acre. "The Man with the Flower in his Mouth," by Luigi Pirandello.

The Man - - - - EARLE GREY.
A Customer - LIONEL MILLARD.
The Woman - GLADYS YOUNG.

Scenery by C. R. W. NEVINSON.

Adapted and produced by Lance Sieveking (B.B.C.) and Sydney A. Moseley (Baird Television).

WHEN I think how one used to go along a dusty road on a motor cycle in 1912 and '13, to a field, and there stand with a group of oddly-assorted, rather unplaceable people, I am forcibly made to compare it in my mind with what happened on the afternoon of the 14th of July, 1930. The field, all those years ago, was just rough grass, and on one side of it a small and rather insecure-looking tarpaulin had been rigged up. We enthusiasts talked among ourselves, and flicked cigarette ash about. Every now and then someone held up a handkerchief to judge the strength and direction of the breeze. Soon a flap was drawn up from the side of the tarpaulin, and out came three or four men, laboriously wheeling something that looked like a gigantic daddy-longlegs, with translucent wings spread out. We gathered round, examining the thin fabric of which it was made, and commenting eagerly upon the cunning way in which the piano wire was twisted about the bottoms and tops of the struts. We nodded sagely over the bicycle wheels underneath, and gingerly felt the edge of the propellor.

"Contact!" said the pilot, grasping the little joy-stick, and thrusting his elevator backwards and forwards. We noted how he tested also the ailerons. He adjusted his golf cap on back to front and, fixing his cigarette firmly to his upper lip, prepared for the jerk.

The engine started. The men at the wing tips let go, and away it went, bumpty-bumpty-bump, across the field. We held our breath. It rose, *it undoubtedly rose*. Now it was down again. Again it rose. Up,

No. 1.

NTH *of* JULY, 1930

Sieveking

up, ten feet, fifteen feet. It sank abruptly. It was approaching a tree. We held our breath. It sank beyond the tree. We turned to each other. Someone began to run, and then we were all running. . . . .

The 14th of July is celebrated in France in connection with a revolution. The 14th of July, 1930, had its revolution too, and I wonder how many people who stood and looked at that flickering picture, and heard those voices which now boomed, now scraped, now rattled, realised just the import, the significance, of the thing they were witnessing. There was just a group of them, all sorts of people. Some sat in rooms, and were shown the first play produced by television by means of the little commercial sets which Baird Television Ltd., have put on the market. Others, a few friends of mine, and some more who were interested, just in the same way as those men were interested in the early flying machine, came up in a great open lift, on to the windy roof of the Baird building. Here had been erected a long tunnel made of tarpaulin.

No. 3.

No. 2.

We scrambled inside, and stood about a little awkwardly. The late comers flashed into our darkness from the blinding sunlight outside. The wind blew, the tarpaulin rattled, shafts of sunlight shot across our vision.

And then, on a cue given by telephone to Savoy Hill, the first television play began. From first to last the audience never stirred or made a sound. I think there was something in all their minds, which gave them the ability to see beyond that which their physical eyes and ears were receiving, something which does come upon groups of people sometimes, and which is called prophetic. At the end of the long tunnel, where it narrowed, the big screen leaped into life. It had only been tried a few times before, and we none of us quite knew what to expect. But it held from first to last that oddly-assorted audience, standing or crouching as best they could, and certainly it was not only the work of Pirandello, nor the acting —though it was very good acting—of the cast, nor the production which had unified all the little bits of the play—which held them. No, it was something more. . . . .

The problem to be faced in setting out to produce a play within the mechanical limitations at present imposed was a problem which needed all the patience and ingenuity we could bring to it, but here we had the sound judgment of Mr. Gielgud, the productions director, who chose what proved to be a most suitable play. The fading board, which was described in the July number of TELEVISION, was scrapped, as it

No. 4.

was impossible to use it, since, whether raised, lowered, or done anything else with, it merely put out the rhythm of the synchronisers; also, no matter what design in black and white was painted upon it, the photo-electric cells, in some way rather like a nervous horse, shied at it, and sent the picture skidding wildly in all directions. So a new one was made, which slid backwards and forwards along a groove in a firm trestle. It was thus enabled to enter the picture along a horizontal line, and to remain firm when it had completely arrived there. By this means it followed the example of the electric impulses, which also pass across the picture horizontally. The chess-board design painted on it in black and white was found to be the best relationship of black and white for the purpose, disturbing the photo-electric cells hardly at all.

You will see it in one of the pictures; on the left you will observe the handle with which it is pushed in and withdrawn. The bottom row of squares are worn away by continual friction in the groove.

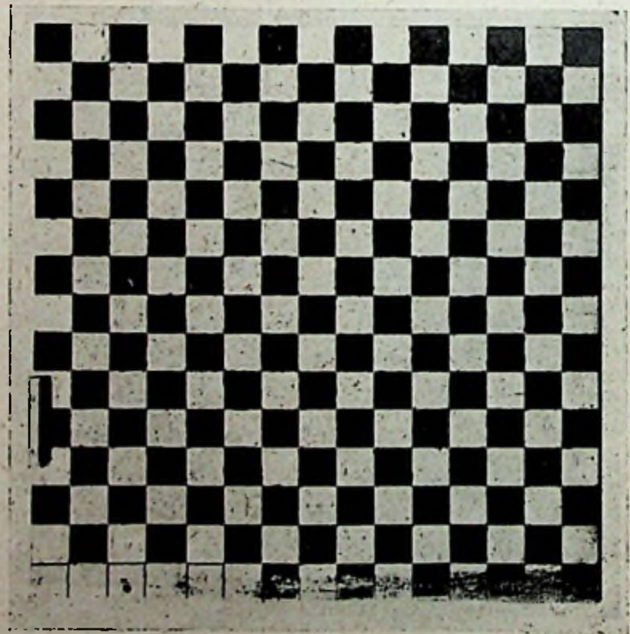
The other four pictures are reproductions of the four scenes, or "sets," which were specially painted for "The Man with the Flower in his Mouth," by Mr. C. R. W. Nevinson, the famous artist. He was asked to do it because he is one of the few living artists of any importance who is really interested in the developments of the modern world. There are quite a number of artists whose technique and manner is, in the true sense, modern, but for the most part they fear the actual objects which go to make up modern life, and concern themselves entirely with things which belong to all ages—the human figure, and the natural landscape. Mr. Nevinson, however, is keenly interested in introducing into his paintings designs which are significant of the modern world—aeroplanes, motor cars, trams, wireless masts, battle-ships, skyscrapers, and so on. It was not surprising, therefore, that he consented to attempt to make scenery for the new medium of television, without cavilling at the limitations of simplicity which it imposed.

The four scenes he painted specially for the first television play were:—

1. Conductor's score and café tables.
2. The dark street outside the café.
3. The table at which the Man is sitting; with glass, etc.
4. Close-up of tumbler into which he stares.

A great deal more might be written about the make-up of the actors' faces, their limitation of gesture, and voice; and all the effects—music, train, traffic, and so on. But I will conclude by recording the feats of understanding and efficiency performed both in front of the transmitter and also in the little darkened room beyond its scope. Mr. Earle Grey, Mr. Lionel Millard and Miss Gladys Young gave a fine performance. Miss Mary Eversley, as announcer and stage manager, executed feats of such difficult dexterity, with the help of her assistants, that it was nothing short of astonishing when, at the end of the play, not even the minutest mistake had been made. Mr. Freeman conducted the music and effects with his usual sure touch.

At the end, Mr. Baird, Mr. Gielgud, Mr. Moseley and I looked at each other in silence.



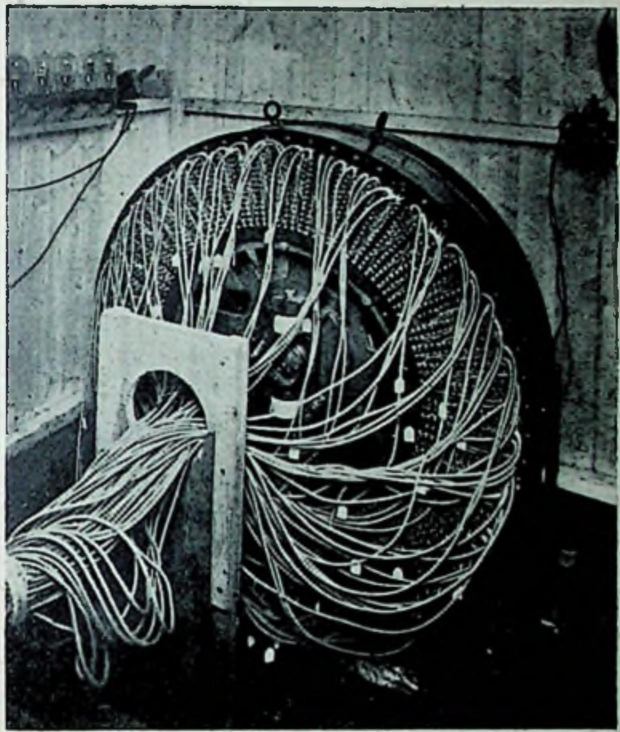
The sliding fading board which was moved to and fro by the handle on the left.

A Startling Development in Screen Television

From OUR SPECIAL CORRESPONDENT

ON July 1st I was privileged, in company with a number of other press representatives, to witness a demonstration of an entirely novel development of television. For years now the television interests of the world have devoted a great deal of research and vast sums of money in the endeavour to produce television images of sufficient size to be shown to large audiences, and it is very gratifying to know that British research, under the direction of Mr. J. L. Baird, is so far ahead in this direction. On the roof of the Baird Laboratories in Long Acre we were shown a large screen approximately 2 ft. by 5 ft., on which we saw living images of extraordinary brilliance and clarity. I should say that the brightness of the screen was quite comparable to that of the cinema, and the various parts of the image varied from intense white, through shades of sepia, to dead black.

A very entertaining programme was put on, lasting for about thirty minutes. Mr. Sydney A. Moseley



The intricate nature of the selector and commutator mechanism and wiring are revealed in this photograph.

An illustration of the apparatus as installed in the Baird Laboratories.

opened the proceedings with a short speech, and we were then able to see and hear those popular television artistes, Miss Lulu Stanley, Miss Pearl Green and Mr. Ben Lawes in characteristic songs and sketches. Mr. Baird had previously stressed the point that what we were seeing was just the nucleus of a very much larger screen, which was to have quite ten times the scope of the present one; but, nevertheless, the demonstration was extraordinarily attractive and entertaining.

Details of the Apparatus

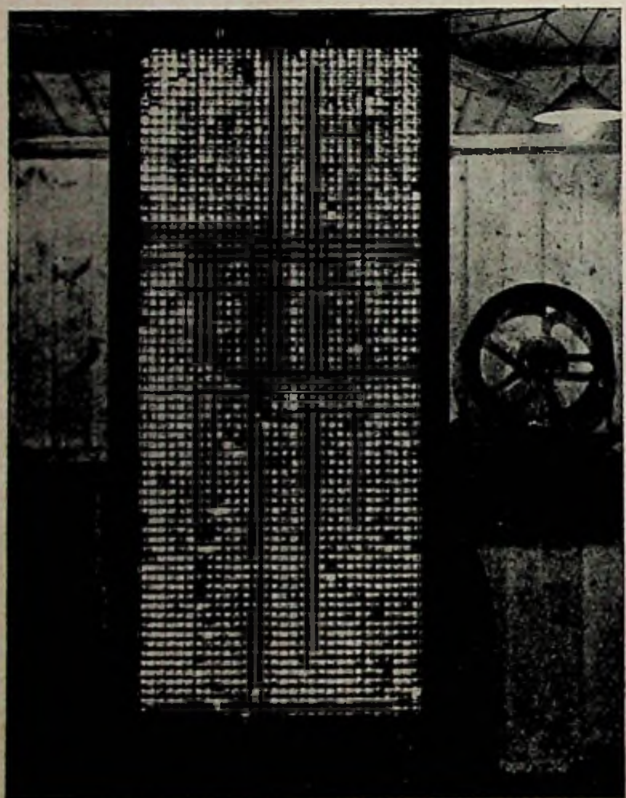
After the demonstration we were able to inspect the apparatus, which was described to us in detail by Mr. Baird. The screen consists of a ground glass sheet, behind which is a honeycomb containing 2,100 compartments, and each compartment has a tiny metal filament lamp, which is connected to one segment of a commutator made up of 2,100 segments.

As the selector brush of the commutator revolves each lamp is lit up in turn, so that the whole of the screen is " scanned " in one revolution of the selector. As the selector revolves at 750 r.p.m. it will be seen that *over 25,000 contacts are made every second.*

The standard television signal is amplified and the output from nine D.O. 60 valves is fed to each lamp in turn, and as each lamp will light up to a brilliance determined by the amount of current flowing at that moment a picture is built up on the screen when the selector brush is in synchronism with the disc at the transmitting end. Synchronism is obtained with a synchronising gear differing from the standard Baird toothed wheel synchroniser in size only.

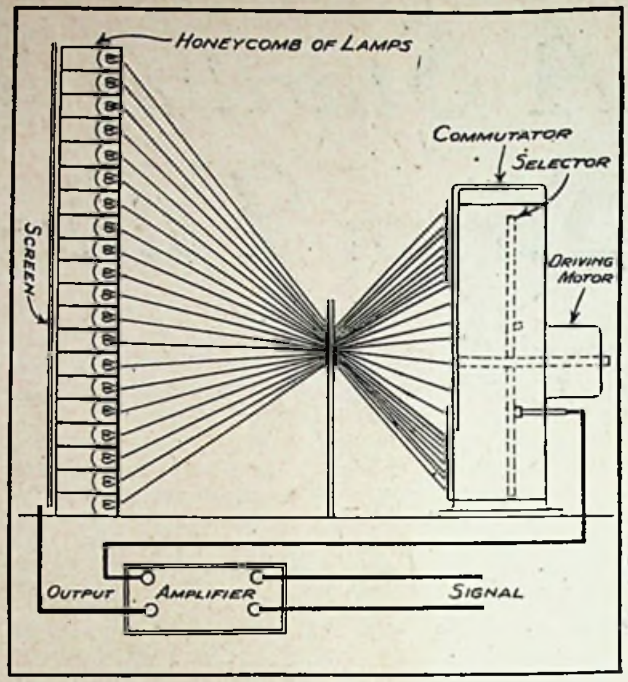
Distinct Advantages

This new system of screen television has two great advantages over any previous efforts insomuch that



A " close-up " of the screen showing the small metal filament lamps in their honeycomb compartments.

by choice of lamps any brilliancy can be obtained, and that flicker is greatly eliminated, due to the fact that the lamps are not instantaneous in their action but continue to glow for a short time after the selector brush has passed their respective segments. Lack of light and excessive flicker, which is very noticeable in large pictures, have been the main obstacles that television engineers have had to overcome in the development of screen television, and Mr. Baird has now every hope of producing a screen comparable in size and scope with that of the modern cinema.



A rough schematic diagram of the wiring between commutator and screen.

A New Field

This prospect opens out a new field for the cinema. In the cinema theatre of the future we shall see events of the day at the instant they are occurring. In addition, it will be possible to feed a number of cinemas from one master studio, from which they will obtain not only events which are happening at the time, but also films which can be televised in just the same way as ordinary scenes. In this manner the present system of distributing films to cinemas may become obsolete.

Television in the Cinema

PUBLIC DEMONSTRATION

Read what *The Times* special Wireless Correspondent has to say on this wonderful advance.

(*Reprinted from " The Times," dated 16th July,* 1930.)

" ARRANGEMENTS have been made for a demonstration of television in the cinema to form part of the programme of the Coliseum in the week beginning July 28th and onwards, as was announced in *The Times* yesterday. The demonstration will consist of the recent developments of Baird's system of television, whereby an image can be seen by a large number of persons simultaneously. One of the chief disadvantages of the home television sets which are now on the market is the comparatively small size of the reproduced image, which makes it impossible for more than two or three observers to be accommodated simultaneously. This has led Mr. J. L. Baird, the inventor of the Baird 'Televisor,' to concentrate recently on the problem of increasing the size and brilliance of the reproduction so that any number of onlookers can see the televised images at great distances. The relative importance of this problem of 'television in the theatre' compared with the more familiar problem of 'television in the home' has already been emphasised in these columns, mention being made of the fact that the large performance factor of safety necessary in home 'Televisors' could be dispensed with in the case of cinema or theatre television because in the latter case any complicated apparatus could be worked by experts.

Conveying a Message

The new type of reproduction, which is based on a device patented seven years ago by Mr. Baird, emphasises in a striking way one of the essential elements of all methods of picture transmission in that the object to be televised is to be regarded as made up of a large number of elements of equal size. The television 'eye' can be said to scan each element in turn, running over the whole of the object about twelve times a second. Corresponding to each element in the object there is an appropriate element in the image, the brightness of which is controlled by an electrical impulse passing from transmitter to receiver. For each element scanned an electrical impulse must be transmitted, conveying the 'message' whether the element is light or dark.

In Mr. Baird's new apparatus the receiving screen is broken up into as many as 2,100 elements, each of which consists of a cubicle in which is situated a small metal filament lamp such as is used in pocket electric torches. The front of the cells is covered with a sheet of ground glass. Each of these little lamps is connected to a separate bar of a gigantic commutator, which switches on only one lamp at a time, and, as the contact of the commutator revolves, each of the little lamps is switched on in succession. The contact switches on and off the whole of the 2,100 lamps in one-twelfth of a second.

Operation

In operation the incoming television signal is first of all amplified, and this powerful current is then fed to the revolving commutator, which switches it to every lamp in turn. The current is strong at a bright part of the picture and weak at a dim part, so that the little lamps are bright or dark accordingly, and the picture is built up of a mosaic of bright and dark lamps. This device differs from any other television device previously shown, in that the lamps are not instantaneous in their action; they remain alight for quite a considerable time, and it is on this fact that, to a great extent, the success of the new device depends, great brilliancy and reduced flickering being easily attained.

The screen demonstrated recently on the roof of the Baird Laboratories in Long Acre has been specially designed to receive the standard Baird transmissions now being sent out through the B.B.C. station at Brookman's Park, and, as these transmissions are limited by broadcasting regulations to a certain amount of detail, the screen has only a limited number of lamps. There is nothing, however, to prevent a screen of any desired magnitude from being built for the use of the cinema and transmissions of greater detail supplied by means of land lines. When standing quite close to the screen the coarseness of the scale is so marked that the image is quite unrecognisable, but at a distance of about 150 feet the picture seen compares very favourably with that obtained with the normal 'Televisor.' "

Positive and Negative Images

By *H. J. Barton Chapple*,

Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

WHEN we switch on a wireless receiver and listen to an enjoyable programme of varied fare provided by the B.B.C. our mind seldom gives way to ruminations on " how it works." The broadcasting of sound has become such a normal part of our daily life that time has helped to deaden somewhat the enthusiasm and keenness with which we tackled the early experiments in our efforts to achieve working results. Do not misunderstand me. I am not trying to infer that wireless broadcasting is not a wonderful achievement, and that there are not problems which still require solving.

A New Desire

Apart, however, from the inevitable difficulty of endeavouring to provide fare to satisfy all tastes, sound broadcasting, as we now know it, has lost some of its thrill, and we are prone to accept its presence without troubling to delve into its intricacies. The appearance of television on the horizon, however, even though the broadcasts made by the B.B.C. are dubbed experimental, has awakened the pioneering spirit, and we are turning to our wireless sets with a newer outlook on life, a desire to fathom to the very core all that this wonderful science can offer us in its unbounded possibilities.

Theory and practice have had to be " rubbed up," and this alone is a redeeming feature for, having once seen a demonstration of television, there is the desire to know more about the apparatus and how it functions. Much has been written on the principles involved, and I propose in this article to single out just one section which so often proves puzzling but to which little attention appears to have been directed.

A Question of Current Direction

I refer to the question of positive and negative images. It has been pointed out by other authors that the glow on the neon lamp plate, which forms the screen on which the image is seen, is directly proportional to the current strength. In other words, if the current increases the glow is intensified, while if it decreases a dimming takes place. The output current from the wireless set tuned to the vision wavelength is proportional to the television signals which we know are brought about at the transmitting end by the conversion process undertaken by the photo-electric cells.

If at any one instant more light is reflected from the televised subject the current should increase at the receiving end, and conversely decrease when less light is reflected. This increase or decrease, however, must perforce be a factor of the wireless set itself, and in consequence the functioning of the different stages in the receiver must be understood intelligently to see what bearing they have on the ultimate image.

The Detector Stage

Take the detector stage, for example. An anode bend rectifier works in such a manner that when the signals are passing the mean anode current increases, whereas in grid leak rectification the mean anode current falls under similar circumstances. If we had

Have you ever seen a negative image of this character on your vision screen?

two sets identical, except that one had an anode bend detector and one a grid leak detector, we should possibly notice no difference in reception as far as loud-speaker reproduction was concerned when they were tuned-in to the same broadcast. But what would happen if tuned-in to a television broadcast ?

Obviously, the images would differ, for where one showed high lights the other would indicate a shadow. They would bear the same relationship to one another as a photograph does to the negative from which it is printed. This is portrayed clearly in the two accompanying illustrations, and steps must be taken to rectify matters or the whole reception will be spoilt.

Low Frequency Couplings

This state of affairs does not begin and end with the detector stage. There are other parts of the set which govern current direction and can upset similarly the working of the vision apparatus.

It is seldom appreciated that if you have a receiver in which the first low frequency stage is resistance capacity coupled, and the second stage transformer coupled, the signal on the plate of the detector valve is then in the opposite direction from that on the plate of the output valve at the same instant. On the other hand, should both low frequency stages be transformer coupled then the signal is in the same direction.

This reversal of current direction is important for, as I mentioned earlier, it will change our image from positive to negative. Now with the normal transmissions sent out by the Baird Company an anode bend detector, followed by three stages of resistance capacity coupling, will ensure a positive picture, and should the reader get a negative then he is provided with one of several alternatives to rectify matters.

Putting Matters Right

A low frequency stage of resistance capacity coupling must be added or subtracted, whichever is the more expedient, or the type of detector changed. If an L.F. transformer is present in the set then the change from positive to negative is brought about simply by reversing *either* the primary or secondary connections, but not both.

These expedients will no doubt satisfy the majority of cases, but in the course of my own investigations I have come across other factors, which have produced negative images, and which were rather puzzling at first until proper tests were made to elucidate the causes.

One instance was a receiver employing a neutralised stage of high frequency. Through some chance this had been adjusted so that it was over-neutralised, with the result that the grid potential was reversed and a negative picture produced ; when brought back to the condition of true neutralised stability all was well.

Curious Cases

A similar sort of thing happened in the case of an anode bend detector valve provided with a semi-variable condenser bypass between anode and filament. The effects of removing the high frequency choke in the plate circuit were being tried together with the removal of this bypass condenser. Under certain conditions, when the choke was out and the condenser removed, a negative image was secured, and this could be attributed to a reversal of grid voltage and a consequent alteration of plate current direction. Two other cases can also be cited.

One was an anode bend detector with an entirely

Compare this photographic print with the plate from which it was taken, shown on the preceding page.

wrong arrangement of negative grid bias and plate voltage. This resulted in rectification taking place at the top bend of the valve characteristic instead of at the bottom, and, of course, current direction was again reversed and a negative image produced. Finally, I had the experience of a run-down 6-volt accumulator feeding the valve filaments bringing about the same effect.

The latter cases are no doubt of rarer occurrence, but indicate that care and forethought must be applied if the elucidation of negative image faults are to be of a satisfactory character. Keep uppermost the point of correct current direction and how the system works and all will be plain sailing.

Extracts from the Wireless Notes

Published by CAPT. E. H. ROBINSON

THE new art of television is of such great importance that I make no apology for devoting the greater part of this "news letter" to my experiences of a "Televisor" very kindly lent to me for experimental purposes by Baird Television, Limited.

I have made no secret of my opinions on the subject of television. I think that the Baird people have been ill-advised in some of their moves in the past. I also think that there should be much greater facilities for experiment than there are. There are, without doubt, a large number of folk who are only too anxious to take up television reception, just as there were a goodly number of us who delighted in the reception of wireless signals in the days when the transmission of speech was a rarity. This difference there is, though. We could receive something at any hour of the day or night, even if it was only coded morse that could not be translated into anything that had a meaning. The television experimenter is confined to three and a half hours a week, two and a half hours of which are at times when hardly anyone who is not professionally engaged in wireless in some way or another can receive the transmissions. This is an absurdity which must be remedied if any considerable advance in the art is to be made.

The transmission of television requires apparatus so complicated in detail, though simple in principle, that it is beyond the resources of the amateur. It must be carried out by someone with financial backing; and financial backing means that it must be a commercial undertaking. The Baird Company has to make money if it is to carry on with its experimental work. It can only make money in two ways. One is by obtaining contracts to put up transmitting apparatus or leasing the rights in its patents for such apparatus; the other is by selling receiving apparatus or by leasing its patent rights in such apparatus. It has put on the market a television receiver costing 25 guineas, which, in association with a good receiver, makes real television in the home possible.

The image which can be received at present is small. It has to be magnified slightly to make it appear a reasonable size. It can only be viewed in comfort by a few persons. It is best suited to the reception of the head and shoulders of persons singing and speaking. Most of the transmissions are of this type; but in the month I have been using the "Televisor" we have had, besides the head and shoulders pictures, an excellent marionette show and a good conjuring performance.

Anyone you can say you know you can recognise on the "Televisor," and anyone you have seen by television you will easily recognise again. After I had been working television reception for two or three days I called at the Baird Studio and instantly recognised the announcer, though my reception had not, up to then, been particularly good.

The Baird synchronising system is a real triumph of simplicity. It is absolutely independent of anything but the pictures being transmitted and makes use of the interval between one trace of the scanning hole and the next. I have not the space to give a full description of the apparatus employed, but it certainly works remarkably well, the images holding almost dead steady during the whole of the transmission. There is occasionally a slight up and down rocking, which I attribute to slight changes in the supply voltage from the mains. I happen to be supplied from a small transformer, and when cooking apparatus is switched on from the mains there is always a slight drop in voltage. The transmissions which I have received at midnight have always been remarkably steady. Those who have any knowledge of television will realise that synchronising is one of the most difficult parts of the whole subject, since, if the two discs, in transmitter and receiver, are not running absolutely in step, there is bound to be displacement of the image. If there is no synchrony at all the image is received as a mass of whirling dots.

To see as well as hear performers is very fascinating and with more extended television programmes, not of necessity on the broadcast band, I think that the Baird apparatus has made out a good case for itself. In its present form it is, as I have said, somewhat limited in its programme application; but even in its present state it has a very decided entertainment and educational value. The whole future of the art depends on more programme time so that it may be popularised and so that programmes may be developed.

Everyone who sees the "Televisor" at work is amazed at the definition and clarity of the image, and all express the greatest interest and amazement. I am reminded of the early days of speech transmission, when I used to invite friends to hear what could be done. In those days it was only the experimental nature of the programmes that held a number back from acquiring the necessary apparatus for reception. I feel sure that television will go forward by leaps and bounds directly some means is found of giving two or three hours programme every night. I hope that before next winter I shall be in a position to tell my readers that this has been done.

How the First Television Play was Received

By the *Managing Editor.*

SINCE writing my usual article on another page I have received many messages, letters and telegrams from all over the country concerning the reception of the first television play. The following is a varied selection :

ALEC A. KEEN, 48, Broad Street, Chesham, Bucks.

" After looking at and listening to the play ' The Man with a Flower in His Mouth,' transmitted by Messrs. Baird and the B.B.C. this afternoon, I feel I must congratulate them on such a wonderful success.

I saw the play from beginning to end, but I am afraid that we—that is, friends who were with me and myself—paid very little attention to the speech, being more interested in the acting which was excellent, the hand movements being particularly good.

I had difficulty in distinguishing the scenery, but I think this was due more to the trouble I experienced to-day in ' holding ' the picture, synchronism being very erratic, than anything else. My motor is mains driven and the voltage fluctuates badly in the daytime owing to factory motors being fed from the same mains. On the midnight transmissions synchronism is everything that can be desired.

Why the chequered or ' draught-board ' fading screen or board ? This, in my opinion, rather interrupted the ' atmosphere ' and smooth continuity of the play.

The ' make-up ' on the faces of the players made their features more prominent, and was an improvement on the ordinary transmissions. I noticed that the picture or image became much clearer towards the end of the play.

I should imagine that Mr. Sieveking—whom I recognised by pictures of him in TELEVISION—had not 'made-up' his face, as I noticed a distinct difference between the 'contrast' of his features and that of the players. Why did Mr. Sieveking show us his profile only ?

On the whole a great success and I hope the forerunner of many more such plays."

An illustration marking a milestone in Baird Television. "The Man" (seated), Earle Grey, "The Customer," Lionel Millard, and "A Woman," Gladys Young, are shown in their make-up. Notice also the scenic effects on the stand, at the back, and the four photo-electric cells.

W. A. A. PAGE, Unthank Rd., Norwich.

" With reference to the play broadcast yesterday afternoon, we were provided with a very interesting entertainment and we hope you will continue the idea.

May we be allowed to make a few suggestions in order to assist you. The scenery provided came out very well, but for some reason Mr. Van Gielgud's head was situated in the middle of the synchronising strip and only his mouth and eyes were visible. It appears that you use a mechanical device for obtaining this synchronising strip and its position is not always to be relied on. Cannot you use a red or black strip on your background so that its position is apparent, and place the sitter accordingly? This synchronising strip at times has a definite time lag and spreads into the top part of the picture; for this reason it appears to us to be mechanically operated, as opposed to line effects due in the picture itself which show no trace of time lag, and are, of course, electrically obtained.

Another point which, perhaps, deserves attention is the microphone used and the noise in the studio. The microphone gives the impression of one employed about 1923, but this may be due to vibration or the surrounding noise, which is not unlike a spark transmitter at times. It cannot surely be the disc motor, as these can be made to run absolutely silently. Neither should it be the brush gear, as no doubt this is totally enclosed. In fact it is puzzling to know what it can be.

I hope you will not be offended by these criticisms and suggestions which are given without any idea of the apparatus used or the surroundings. I merely give some idea of the improvement we should like at this end.

I should very much like, when at some future date I am in London, to see your studio and plant as I am quite ignorant about television."

H. R. Jeakings, Mill Street, Bedford.

"Congratulations on the first play by television. It was received here in Bedford splendidly. During the whole of the transmission every movement of the artists could be easily followed. Both the close-ups and extended view of the images were very good, also scenery and various other subjects.

We were pleased to notice that during the close-ups and the extended view the image never once went out of focus, as is so often the case with ordinary transmissions.

We experienced some trouble with synchronising when the changes of scenery, &c., were taking place, and we should be interested to know if any other 'telegazer' experienced the same trouble.

We hope we are going to see more transmissions on the same lines as the above, as one gets more scope for experimenting than with the eternal soprano and tenor, who, but for the movements of their mouths, are as still as dummies.

We suggest that a competition along the lines of the B.B.C. in the early days of broadcasting would be interesting and instructive. For instance, we would suggest that a number of ordinary everyday articles should be televised and that we, at the other end, should be asked to describe them in our reports.

Since writing the above we have received the morning transmission (Tuesday, 15th), and we must say that it was the best and clearest pictures we have yet received, the two young ladies being exceptionally good—the one playing the piccolo and the other a concertina and 'uke.' Not only were the faces good, but the strings on the 'uke,' the keys on the piccolo and the folds on the concertina could be quite easily made out. We are very pleased with the way the transmissions are improving and we feel sure that before long it will be a feature in every home.

Wishing you all every success."

[In view of our competition, the suggestions of Mr. Jeakings are remarkable. Is this a case of telepathy?—Ed.]

H. H. Lassman, 427 & 429, Barking Road, East Ham.

"I am very pleased to inform you that the first television play was a huge success. The play was well thought out and directed in a wonderful manner. I should, however, have liked the lady to have screamed to make it more exciting.

We had a large crowd here to see the play and all were delighted with the clearness of the transmission."

2

1

3

Look out for these artists on your Television screen during August.

1. *Miss ETHEL DAIMLER, a singer of light songs who possesses a good television face.*
2. *MAX and HARRY NESBITT, who need no introduction to listeners-in, but lookers-in will be able to appreciate the facial value of these inimitable entertainers.*
3. *Miss DORIS GILMORE can put over a monologue in first-rate fashion.*
4. *Miss REGINA WEST. This artiste is a charming singer of light songs.*
5. *PAULINE AND DIANA, two clever people who play a varied number of instruments.*
6. *Both lookers-in and listeners-in will welcome the next appearance of Mr. LOUIS GODOWSKY, the brilliant violinist.*

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6

Reproduction and Amplification in Television Receivers

By *Dr. Fritz Schröter*

(Concluded from July issue)

THE reproduction of a movement of the original in both co-ordinates can be graphically ascertained analogously to the foregoing remarks. The distortion of movement can be deduced in the form of a path curve for each surface element of the figure. A complicated mathematical theory of these distortions for arbitrarily selected paths, initial positions and phases in relation to the scanning device is waived here, because such a theory only comprises the purely geometrical conditions but permits of no declarations regarding the physical, physiological and psychological attendant phenomena, which, according to experience, exercise a very important influence on the resulting picture impression.

Vertical Scanning Best.

2. *Conclusions from* 1: With the very small number of surface elements into which the picture is broken up (in view of the permissible frequency band width) it appears necessary for the transmission of moving scenes to take into consideration the aforesketched laws of the co-ordinate distortion, in order not to make the reproduction in the receiver worse by effects which have nothing to do with the limitation of the picture point number in itself. More or less unconsciously this necessity has hitherto been followed. Almost all apparatus with coarse screens, especially those serving for the rendering visible at a distance of a living human countenance, work in such manner that the running direction of the scanning apertures is parallel to the long axis of the sight oval (see Figs. 13 and 14).

In this connection only the vertical movements ($\|v_1$) can produce distortions in the sense of Fig. 17, in that all cross lines in the displacement phases are reproduced distorted; such movements occur, however, as a rule, more rarely and slowly than the natural horizontal head turnings which are unaccompanied towards the top by any distortion of form. Therefore one obtains with vertical scanning a greater pictorial surface over which alterations of position can be reproduced without distortion.

Apparatus with a large number of scanning lines (which naturally entails the transmission of a wider frequency band) is independent in respect of the direction of v_1 relatively to the movements of the original, as in them the values of v_1 turn out greater, for the co-ordinate distortion (obliquity), to be understood in the sense of Fig. 17, can be proportionally set down as $l\,c_1/v_1$; therefore, for c_1 remaining the same, which is given unaltered by the natural movement of the object of transmission, it will become smaller as the scanning aperture moves faster along the line, in order to turn the increased line of surface elements to account in I/n's.

If these reflections are followed, the question arises whether there is any sense in applying increased picture frequencies (n) or line numbers (k) and accordingly increased running speeds ($v_1 = n\,k\,l$) of the scanning apertures in conjunction with proportionally enlarged expansion (f) of the same in the scanning direction, in such manner that the maximum frequency $v_1/2f$ to be transmitted remains unaltered; the quotient c_1/v_1, however, is lessened with the object of ensuring less movement distortion. That is to say, the previous square aperture shall now be made rectangular, the longer side of which lies parallel to the scanning direction.

An objection against this could be caused by the relation between longitudinal and transverse sharpness mentioned under 1, 2. Its decisive ratio value should, however, be displaced for moving pictures, perhaps even considerably. In this connection it is quite conceivable that the co-ordinate distortions of all transverse lines in accordance with Fig. 17 make the sharpness of contours as determined by $T = f/v_1$ for stationary objects, illusory as regards its importance for the quality of the distant picture, that it therefore

At present the Germans favour horizontal scanning as can be seen from this photograph taken at the 1929 German Radio Exhibition. Two television receivers will be noticed with their horizontal apertures and also a subject being televised.

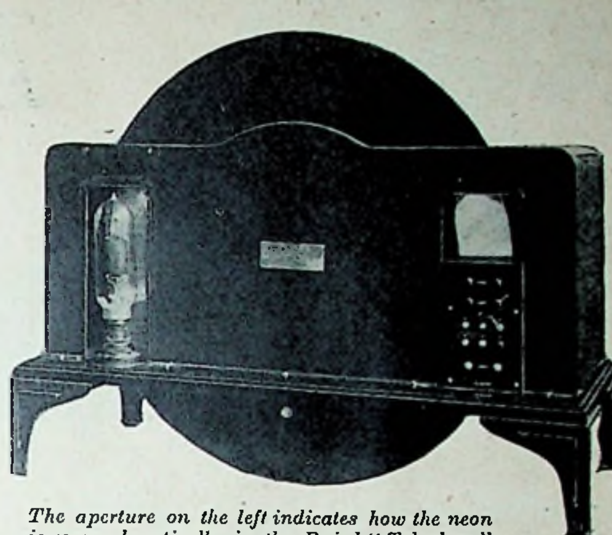
does not depend on f being as small as possible; whereas it might be of use to obtain a minimum of movement distortion by making values of c_1/v_1 as low as possible. In this connection further experiments must clear up the optical conditions.

In respect to the action of the movement distortion reference may be made to the so-called "line jump scanning," which aims at a lessening of the flickering with a physiological basis. Instead of a continuous, constant scanning (lines 1, 2, 3, . . . etc.), there have been proposed, for example, the series 1, 3, 5, . . . ($K-1$, 2, 4, 6 . . . K (Case I) or 1, K, 2 ($K-1$), 3, ($K-2$), 4, ($K-3$) . . . (Case II). During the movement of a smooth edge, which stands transversely to the direction of v_1 and is displaced parallel to itself, the receiver now shows in Case I a markedly frayed contour of zigzag obliquity as in Fig. 17; whilst in Case II there is seen a broken limiting line in the centre of the picture height. The discordance of the co-ordinates is therefore decidedly worse in the transition as compared with continuous scanning, such as a disc in accordance with Fig. 1 provides, and the application of the line jump accordingly appears less useful for moving transmissions than for rigid pictures.

3. *Physical, physiological and psychological factors.* Experience has taught, as opposed to all previous assumptions, that the reproduction of moving representations acts more satisfactorily than that of stationary objects for the same screen (*i.e.*, number of scanning lines). This is partly attributable to the fact that in the visual following of displacements in the picture field the perception of the line structure, which in the case of stationary bright-dark-distribution forces itself on the perception, comes into the background of consciousness. In this connection physiological and psychological factors should have something to say: the permanent accommodation movements of the eye and the combination of the surface elements changing in accordance with position and brightness, by the sense of vision which is busy with the mental grasping of what is seen, make the rigid localisation of the heterodyned (übergelagerten, "overlaid") line screen impossible.

A further purely psychological interpretation of the favourable action of moving pictures is the following: we perceive plainly the coarse screening of a configuration, invariable as to place and time, of various light-intensive surface elements, as soon as our axis of view is adjusted in a fixed position relatively thereto. The dullness (want of sharpness) of a movable object is received on the other hand by the apparatus of sense as a "natural" sight-impression, because, on the basis of our knowledge, the accommodation and the clear perception of individual phases are excluded thereby by nature. Calling on our long experience, we combine the transitory light effects reproduced in the field of vision by a psychological act all the more completely and satisfactorily into the complete picture if the object concerned is extremely familiar to us.

Therefore, for present-day apparatus, the living features and mimical alterations of the human countenance constitute the most valuable subject for transmission, which, for 1000 to 2000 quadratically defined surface elements, can deliver a high degree of recognisability. If thereby, moreover, the fundamental fact that the quality of the distant picture steadily increases with the fineness of the screen,



The aperture on the left indicates how the neon is scanned vertically in the Baird "Televisor."

remains entirely unaffected, the discovery of the practical utilisability of a relatively smaller number of picture points represents an important result, especially for wireless with its modulation band width limited to 9,000 cycles. We must be clear, however, that illusion and power of supplementation play an important rôle in this connection, and that these factors will leave us in the lurch if unsuitable objects are transmitted.

Amongst the physical effects which determine the sharpness of reproduction there are two which are plain. (1) The alteration of the transition period T by the movement component of the object in the line direction. (2) The stroboscopic composition of transmissions following one another. Contours which are displaced with the speed c_1 relatively to the scanning, appear sharper than in repose, as the operating time of the scanning aperture is reduced to $T_1=\frac{f}{v_1+c_1}$. This, of course, assumes that the correspondingly increased fundamental frequency $\frac{v_1+c_1}{2f}$ reaches the receiver. Inversely, for the displacement in the same sense with v_1 we get the operating time $T_2=\frac{f}{v_1-c_1}$; the edge zone of the bright-dark transition must now become fainter therefore than in the case of repose. That these two effects for reciprocating motions are not balanced, is due to the psychological after-effect of the object once plainly seen.

If, however, the frequency permeability of the electric cable is limited in such manner that the oscillation $\frac{v_1+c_1}{2f}$ acts on the receiver in a consider-

(*Continued on page* 272)

The Enthusiast Sees it Through

THE advent of summer with its call to the open air makes its presence felt in all those activities which by their very nature necessitate time spent in the home. Television falls within this category, and to those of our readers who are already on holiday, or contemplating departure at an early date, we extend best wishes for an enjoyable time.

There is something so fascinating about television, however, that the enthusiast cannot break away from his natural habits to be up and doing, and we welcome the reports that have reached us this month and look forward to a continuation of this personal contact with our readers. Our columns are at your disposal, and we take the keenest delight in reading of your exploits.

Using Two Valves

Mr. J. E. Coram, of "Greenfields," Canvey Island, Essex, has been using home-made apparatus and, as he is a reasonable distance from the transmitter, he is quite satisfied with his results so far, but naturally he hopes to improve. Like many others, he employs a neon of the ordinary beehive type and, in the course of his remarks, says:—

"I have been receiving very fine results with home-made apparatus, except that I cannot get the half-tones. Hair, eyes, and mouth, and sometimes the nose, and beard, if any, come out strong, provided I use no more than (roughly) 210 volts. If I use more I lose the mouth and eyes, and, eventually, if I employ 300 volts I lose everything.

"I find lately that results are much better with only two valves (detector and power) straight with Reinartz reaction, Tungsram valves."

May we suggest to Mr. Coram that he will no doubt find an improvement if he develops a circuit in which no reaction is necessary, for from his symptoms it appears that distortion is creeping in and reaction must be eschewed as far as possible.

Results in Austria

In reporting his progress in Austria, Mr. J. Sliskovic pointed out an error which unfortunately crept into our June issue. A photograph was published of Mr. Sliskovic and his home-made television apparatus, but the name was wrongly given as Mr. Mossig. We apologise for this mistake and include the photograph again, correctly captioned.

It appears from his letter that the vision signals now being sent on the longer wave of 356 metres are on an average of satisfactory strength with little fading. In spite of this, however, better results were secured on the 261 metre wavelength. The moving news bulletin or telelogography can be read, but the sound is not quite up to standard on 261 metres. Apparently the images of persons can be more easily distinguished when seen in profile.

We trust our correspondent will continue with his good work, and keep in touch with us to report progress.

Suggestions from Scotland

In writing to us again from Scotland, Mr. A. H. Mason, of 30, Marlborough Road, Cathcart, Glasgow, puts forward a further plea for television facilities in the North. Undoubtedly this is of great importance, and we join with our reader in hoping that there will be the minimum of delay in this matter. Continuing his letter, Mr. Mason offers one or two suggestions concerning which our readers may have something to say.

"I notice that many of your correspondents are using straightforward sets for vision reception with ordinary L.F. transformers. From my limited knowledge of television I should say that the frequencies involved in building up a picture are often supersonic, and it would be interesting if manufacturers were to publish amplification curves of their transformers up to, say, 20,000 cycles.

"I have no trouble in receiving the 'frames' (the low-frequency signal), but often can only see a faint outline of a face on a bright background, and this I attribute to insufficient amplification of the higher frequencies.

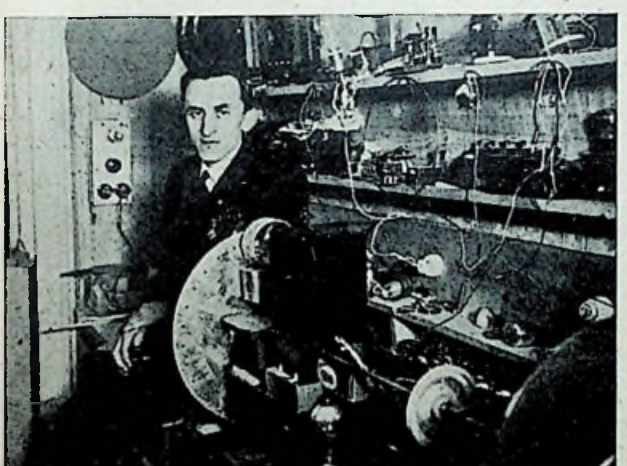
"In the July issue of this journal Mr. John W. Woodford states that 'the intensity of the neon glow is directly proportional to the current strength.' Unfortunately in my case the glow is confined to the top part of the plate when small currents are passing, and it seems to me that the light will thus be more localised and not proportionately dimmer to the decrease in current strength. This will tend to give better detail of the upper parts of images, and may account for another Scottish reader not getting good results on the lower parts of a face. Perhaps readers will enlighten me!

"How can one be television-minded when one is 400 miles from Brookmans Park and working under such bad radio conditions as are prevalent now? Fifty-metre transmissions may help in daytime, but they will certainly be of little use at night when 'skip-distance' steps in. When, oh when is Scotland to have its own transmitter?"

An Aberdeen Achievement

"Everyone up here is tremendously enthusiastic," this from Mr. J. N. Piper, of 118, Union Street, Aberdeen, makes good reading. Undoubtedly he is working under extreme difficulties, but this only makes Mr. Piper all the keener to achieve the best possible results. Below we print extracts from his communication:—

"It will be gratifying to you to learn that last night splendid results were obtained with the television transmissions.



The interest in Austria is typified by this photograph of Mr. J. Sliskovic with his home-made television apparatus.

"The picture was 'held' for fully twenty-five minutes after the first five.

"The pictures were quite clearly defined, but at times distorted by atmospherics or other disturbances. I am right in the heart of Aberdeen and I would imagine that this speaks quite a lot. I intend arranging public demonstrations as soon as results are a 'matter of fact.' Wishing you every success."

Guernsey to the Fore with Television

Mr. F. T. Bennett, of Contree Mansell, Guernsey, is making television history in Guernsey. He has achieved some wonderful results in the Channel Islands, and demonstrated to notabilities and press alike. We extend our hearty congratulations to Mr. Bennett, and trust that his success in the future will be even more remarkable. In the course of some of his letters he says:—

"You will no doubt be interested to read the report of the reception of the television transmission in the local press, copies of which I have sent you under separate cover, and that Lady Ruthven, the wife of the Lieut. Governor, was an interested spectator.

"Possibly you will also like to have my views on this and the results we have so far received over here. Dealing first with Monday's results, my impression was that the making-up had been overdone, results were very hard and half-tones seemed to be lacking, compared with the results received on the following morning, Tuesday, July 15th, when the half-tones were very good indeed. I think that this particular morning is the best we have yet seen. One difficulty appears to be always present, and that is to get the object or person into focus and the lighting in the correct position.

"Invariably when the subject is changed just at one particular point as they move into position almost every detail can be seen, but as they approach the lighting the face appears rather 'ghostly,' and the further they get away from it the face goes black and looks like an under-exposed photograph.

"One point I should like to compliment the Baird Company on this particular transmission was the absolute steadiness right through. Once I set the speed right at 3.30 o'clock, it was not necessary to touch any of the 'Televisor' controls right through the performance. Very little movement indeed was noticeable. This, I think, is rather different from what sometimes happens during the normal morning broadcasts."

Extract from the Guernsey Evening Press, dated 15th July, 1930.

"A very important new development of wireless occurred at 3.30 yesterday afternoon when a party of five sat in Mr. F. T. Bennett's wireless studio, Mansell Street, and witnessed the reception of the first television play production.

"The party consisted of Lady Ruthven, Mrs. W. L. R. Dugmore, two pressmen, and Mr. Bennett.

"The play was produced in London, and was entitled 'The Man with the Flower in his Mouth,' written by Luigi Pirandello.

"It was much like attending a lilliputian 'talkie.' The picture was small, but there was vivacity of movement and expression on the part of the two actors, and the curtain, a check one, came along the stage very clearly and was well defined. The whole performance was quite interesting, and, indeed, fascinating, since speech was reproduced with the acting."

Selectivity *and* Modulation Response

PART I

By R. S. Spreadbury

IN a recent article I gave a brief description of experiments proving the non-existence of sidebands in modulated carrier frequencies. In the present series I propose to explain that defects attributed to sidebands are in reality due to conditions in the tuning circuits of the receiver, and to suggest ways in which the difficulties involved may be overcome.

A super-selective circuit of conventional design fails to reproduce the higher musical notes in their true proportions, since responding or induced oscillations in oscillatory circuits take time to build up and die out, and are unable to follow such rapid variations of amplitude in the received oscillations. A graph showing the circuit response to an instantaneous application and withdrawal of an unmodulated frequency is shown in Fig. 1*a*, the response curves being

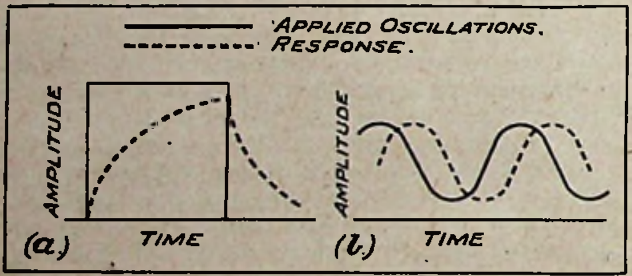


Fig. 1.—Response curves obtained under certain definite conditions.

logarithmic. The modulation response of an oscillatory circuit to a modulated carrier frequency is shown in Fig. 1*b*, a reference to which will make it clear that the response amplitude does not attain its full value, and that the response oscillations lag behind the applied oscillations. An increase in the modulating frequency results in a decrease in the amplitude and an increase in the lag of the response.

A Real Problem

A receiver designed to give distortionless reproduction without interference necessitates the inclusion of a tuning circuit having a quick initial response or increment, a large damping factor or decrement, and great selectivity. Selectivity, however, has always been considered synonymous with slight increment and decrement, so the problem to be solved is a real one.

There are three classes of circuits known to the writer, by means of which a certain band of frequencies can be selected, these being: — First, circuits incorporating some kind of electrically controlled mechanical vibrator, such as a quartz crystal; secondly, filter circuits; and, lastly, oscillatory circuits. Examining these classes, the quartz crystal is the only mechanical vibrator at present known which responds to radio frequencies. Such a crystal has good selectivity and good modulation response, but its inclusion in any but experimental receivers is precluded, as no means have yet been devised for conveniently varying its tuned frequency. Filter circuits have an absolute modulation response but their selectivity and sensitivity are poor. They are sometimes invaluable in research work, however, so the description of a good circuit will not be amiss. There are two filters in the circuit (Fig. 2*a*), each feeding a separate valve. The frequency responses of the filters, *A* and *B*, are given in Fig. 2*b*, where *A* gives the greatest response at the required frequency (*x*), whilst *B* gives the lowest response at this frequency. The centre tapped reaction coil, *R*, applies reaction from the two anode circuits in opposition, while the output derives its energy from the anode of the "*A*" circuit only. Reaction is positive within a small range of frequencies approximating to *x*, but outside this range the reaction is negative. The frequency response at the output (Fig. 2*c*) is as good as many of the older oscillatory circuits were.

A simple oscillatory circuit may have good selectivity, or good modulation response, but not the two

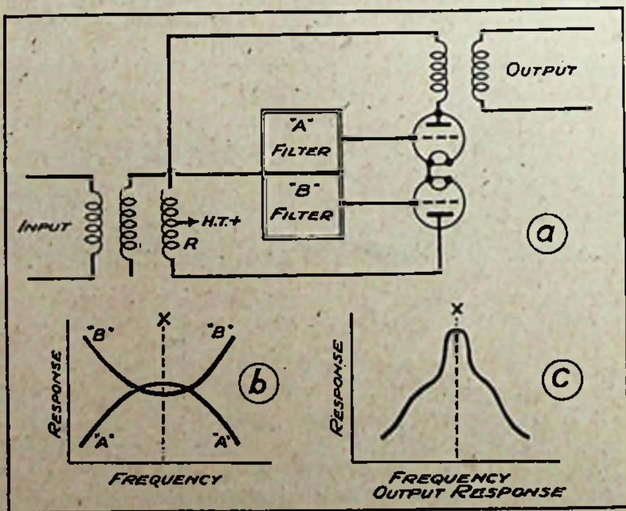


Fig. 2.—A suggested filter circuit together with the frequency responses of the filters.

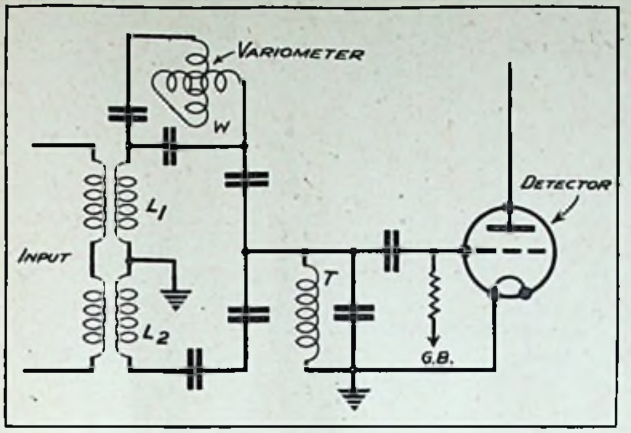


Fig. 3.—Circuits can be designed for neutralising and accepting the unwanted and wanted frequencies respectively.

together, since the one varies inversely as the other. A method which at first sight appears to combine good selectivity with good modulation response is to connect a number of highly damped oscillatory circuits in cascade, as it is well known that the cascade arrangement increases selectivity, whilst the individual circuits possess a good modulation response. It will be found, on test, that the high notes are suppressed, and this result has actually been quoted as evidence of the existence of sidebands. The explanation is that no oscillatory circuit has an absolute response to any frequency, and the response lag, however slight in the first stage, increases with each successive stage of the cascaded circuits, and the amplitude decreases proportionately.

Present-day receivers include tuning circuits which are very efficient in accepting a required frequency, but only by-pass unwanted frequencies indifferently. There may be some who refute this, yet reception on any night when atmospherics are prevalent will supply all the evidence required. On the other hand, a wavetrap is much more effective in rejecting a certain

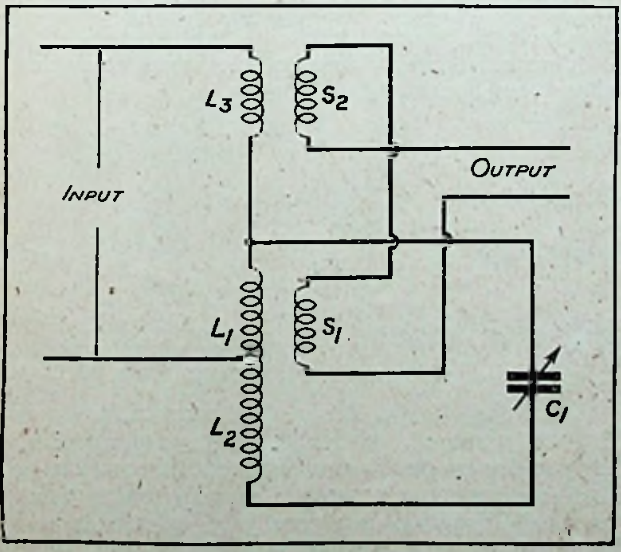


Fig. 4.—Here the oscillatory circuit acts both as a tuning circuit and as a wavetrap.

frequency and accepting all other frequencies. Now a circuit can be designed in which unwanted frequencies are definitely neutralised, but the required frequency is accepted, by deneutralising with a wavetrap. One form of this circuit is shown in Fig. 3, in which oscillations are induced in two coils, *L*1 and *L*2, and applied to the tuning circuit *T* in opposition, thus cancelling each other, except at the required frequency, when the wavetrap *W* becomes operative, allowing one phase of the oscillations to affect the tuning circuit. Thus greater selectivity is attained with a given modulation response, the decrement portion of the modulation response, in fact, being improved also. The problem of interference from atmospherics and nearby electrical machinery is also solved.

A Partial Solution

A circuit similar in principle is shown in Fig. 4, the one oscillatory circuit acting as a tuning circuit and also as a wavetrap. The circuit, however, can only be included in voltage-operated receivers, where the

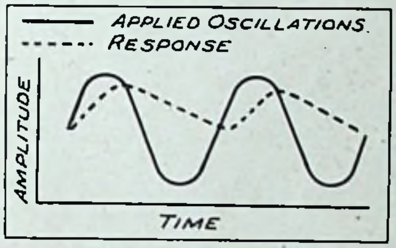


Fig. 5.—A further analysis of modulation response.

current taken from the output is negligible. The output is not taken from the tuning circuit, but from a secondary circuit, *S*1, *S*2. Unwanted frequencies in *L*1 and L3 induce opposing oscillations in *S*1 and *S*2. At the required frequency, the tuned circuit, *L*1, *L*2, *C*1, oscillates, and induces an increased voltage in *S*1, at the same time, acting as a wavetrap, it reduces the current in *L*3 and the induced voltage in *S*2. On test, the circuit appears to give the required conditions at only one particular setting of the condenser dial, the reason for which has not yet been fully investigated.

It is known that reaction increases both selectivity and sensitivity, but has an adverse effect on modulation response. If this modulation response be analysed it will be discovered that the increment is greatly improved, and the decrease in the modulation response is due entirely to an abnormal reduction in the decrement, a reference to Fig. 5 making this clear. If the decrement can be increased, so as to have a value equal to the increment, the resultant circuit will be an advance in the right direction. A circuit giving such decrement, by applying an entirely novel reaction principle, and incorporating the neutralising-wavetrap system of tuning, will be described in the next part of this series. On test, this receiver has reproduced undistorted, intelligible speech from any station whose heterodyne whistle could be heard, and should prove especially interesting to those wishing to receive television transmissions from a distance.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents. Correspondence should be addressed to the Editor, TELEVISION, *505, Cecil Chambers, Strand, W.C.2, and must be accompanied by the writer's name and address.*

SIDEBANDS CHAMPIONED AGAIN.

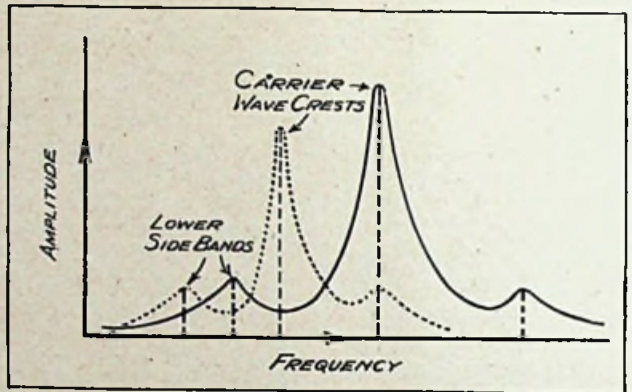
To the Editor of TELEVISION.

DEAR SIR,—Mr. Spreadbury, in his reply to his critics in the July number of TELEVISION, although he reaffirms his principles, does not appear to answer many of my criticisms. Perhaps you will permit me to discuss his statements in order.

In the first place Mr. Spreadbury questions whether an expression of the form $A\cos.pt(1+M\cos.qt)$ can adequately represent an amplitude modulated carrier wave. The question is not strictly pertinent, for, although the expression is often used to represent some property of electro-magnetic waves, it actually represents not the wave itself, but the electro-motive force induced by that wave in the receiving aerial. This aspect of the expression neither ascribes particular properties to, nor assumes any particular knowledge of, the wave: it merely states that the induced E.M.F. is of modulated sinusoidal form. Ample experimental evidence is extant to justify this last supposition. Expressions of the above form, moreover, are applicable to signals which are not of sinusoidal form, since by virtue of Fourier's theorem any complex periodic modulated signal can be represented by the sum $\Sigma A\cos.pt(1+M\cos.qt)$.

In his second paragraph Mr. Spreadbury desires an explanation of the unimpeded reception of two simultaneous transmissions, the sidebands of which overlap. Such an explanation is surely very obvious. It will be seen on examining a resonance curve, such as that in my last letter, that between the resonance crests of the carrier-wave and the sidebands there are well-defined troughs. If the carrier-wave crest of one transmission fall upon one of the troughs of the other transmission, and if the receiving circuit be tuned to the carrier frequency, then the interference will be slight and may, under certain conditions, be negligible. The diagram should make this clear. Of course, if the carrier-wave crest of one transmission be superimposed on one of the sideband crests of the other transmission interference will occur, but unless the depth of modulation be great, it may not be very marked even then.

Concerning the response of a slightly damped circuit to "non-existant frequencies," I presume from the words "impulses of one micro-second duration" that the exciting signals are of complex (non-sinusoidal) character. This is scarcely a fair test for the circuit, since the complex signal can be resolved by Fourier's series into its fundamental and a sequence of harmonics. The fundamental will have the natural frequency of the impulse (one kilo-cycle per second) and the harmonics will have frequencies which are integral multiples of this. Because of the smallness of the damping factor, the resonance amplitude of the response to the lower harmonics will be comparable with the resonance amplitude of the response to the fundamental. The harmonics have quite as much reality in their effect upon the receiver as have sidebands, so that the circuit is not exactly responding to "non-existing frequencies." If the damping factor be augmented by increasing the resistance in the circuit, the resonance amplitude of the harmonics will decrease and may become negligible compared with the resonance amplitude of the fundamental.



The diagram submitted by Mr. Jones to lend weight to his arguments.

Mr. Spreadbury's statement that the sidebands will vanish if a sufficiently damped circuit is used is probably correct, but then the formation of a receiver negligibly affected by sidebands is not disputed. The fact still remains that most receivers which have a sufficiently small damping co-efficient to resonate sharply are sensitive to sidebands.

Yours faithfully,
MERLIN S. JONES.

Morlais House, 229, Chepstow Road,
Newport, Mon.

July 10th, 1930.

INTERESTING NEWS FROM CANADA.

To the Editor of TELEVISION.

DEAR SIR,—Might I take this opportunity to say how very much I value and enjoy your magazine? As you are no doubt aware, practical reception and transmission work over here is really very "flat" and conditions do not encourage one to try and build up a decent receiver. About the only station transmitting on regular schedule is the Jenkins

Laboratory at 1519 Connecticut Avenue, Washington, D.C., U.S.A., with "radio-movie" silhouettes for two hours every evening, except Sundays. This station, on its 103-metre assignment, comes through here with tremendous volume (except when one of our local B.C. stations having a giant fifth harmonic is on the air blotting out the television signals), which, in spite of short-wave variations, selective fading, and other unmentionable things, enables me to receive quite good pictures. I am using a special short-wave receiver I built, highly shielded screen-grid, grid circuit detector and screen-grid, R.F. amplifier with the necessary R.C. A.F. stages and power output giving me 1½ watts of "supposedly" undistorted output, this latter tube, with the neon in series, with the plate circuit working entirely from the 110 v. 25-cycle lighting mains. I am using a hum feed-back system to give me pure effective D.C. in my plate circuit, and it is very satisfactory indeed. I have great fun with my receiver endeavouring to listen to 5SW. Some nights I can put them on the loud-speaker, but most nights it is hard to even hear their carrier.

I am looking forward to an enlarged and possibly more frequent TELEVISION, as a month seems a long time to have to wait for the next copy to arrive.

Thanking you for all the good things you have given us thus far.

Yours faithfully,

ROLAND J. PRICE.

299, Waverley Road,
Toronto, Ontario, Canada.

VIEWER OR TELESEER?

To the Editor of TELEVISION.

DEAR SIR,—With regard to the various suggestions put forward by correspondents for a name, I would like to suggest "Viewer," or perhaps "Teleseer," to coin a word.

Perhaps some of your correspondents may be interested in these suggestions.

Yours faithfully,

L. HEMSHELL.

134, Cowick Road, Tooting, S.W.17.
July 1st, 1930.

AMERICA TALKS ON THE SIDEBAND THEORY.

To the Editor of TELEVISION.

DEAR SIR,—For some time I have been watching with interest the discussion on the sideband theory. The letter by Mr. Bailey challenges reply that I cannot resist.

Mr. Bailey's complaint is that Mr. Spreadbury needs to go to such extremes to prove the non-existence of sidebands. In this he is perfectly right. If the sidebands exist, they may be tuned-in without difficulty, exactly as if sent from three separate stations.

One of the chief difficulties of all such experiments is the elaborate precautions necessary to insure the sending out of a truly theoretical sine wave, modulated only in volume and not the least in frequency. Furthermore, harmonics and their attendant distortion of wave shape nearly always enter to prevent the experiment from performing according to the clauses 1 to 7 inclusive of Mr. Bailey's letter.

The writer has invented a system of modulation that can cause no effect on the carrier wave other than volume modulation. With this device it is possible to secure a modulation frequency of 26 kc. with a selectivity of 4 kc., while in addition it is impossible to tune the signal at any other point outside of the 4 kc. selectivity band, and yet the receiver when highly damped to receive the theoretical sidebands due to 26 kc. responds as if there were sidebands present. Repeated attempts to receive the sidebands independently of the carrier have failed even with over 100 per cent. modulation and powerful signal strength. I might add further, that when the usual methods of modulation are employed there are humps in the approximate regions where the sidebands should be, but these humps never have the amplitude called for by the degree of modulation, and, more important still, the wave meter when set to the sideband region, denoted by the humps in the response curve, *always shows modulation*, which shows conclusively that the phenomena is not due to the theoretical sideband, but to phenomena entirely within the tuner—too complex to be described here, but sufficiently denoted as periodic partial resonance.

The thorn in the side of the sideband theorists is the fact that the sidebands cannot be tuned-in as separate entities by a selective tuner, just as if each came from a separate station. The fault of the sideband theorists is that they take the components of the modulated wave and try to make them *real*, when they have obtained them purely from *mathematical* transformation. Mr. Bailey asks us to point out the clause with which we disagree. We can only reply that if the regular station is replaced by three stations each broadcasting one of the components of clause (4) he will NOT get their resultant by clause (1).

The reason is the difference between theory and practice. In practice there is a geometrical displacement between the three aerials which introduces the reactance of space between aerials, and the resultant selectivity of the three aerials will hardly be the same as the selectivity of the regular station aerial. Again, the heterodyning between the two sidebands will give a double audio frequency note in addition to the regular modulation frequency note; that is, if middle C be struck, its octave will also be given off, and no amount of phasing and timing the waves relatively will remove the octave. Three stations can be selected with ease, but the sidebands of a pure sine wave modulated only in volume have never been separately detected in full amplitude called for by the degree of modulation, and free of all modulation.

The modulation is taken out by the resonance hysteresis of the receiver. The lag in the building up and dying out of resonance with changes in amplitude of the signal is the cause of this hysteresis. This can be calculated by the ordinary methods for the alternating current circuit in an unsteady state, where the unsteadiness is that due to a sine form of variation in amplitude. The simpler method, however, is to first resolve the wave into its THEORETICAL COMPONENTS, and consider the effect of the selectivity on these IMAGINARY separate wave trains which are unmodulated and therefore as easily calculated as the simple alternating current circuit. The suppression so obtained is the same as if calculated directly from the REAL PHYSICAL PHENOMENA, but in itself is, nevertheless, *imaginary*.

That this is true may as well be accepted from reason as from the merciless fact that the sidebands, pure and unmodulated, have never yet been tuned in, and thus have no experimental confirmation. Mr. Bailey can hardly consistently disagree since the very premise of his first clause is that the one expression is the component of the other. Both cannot be true of the same phenomena at one and the same time. Either a single frequency modulated only in volume, or else three separate component waves, are being sent out. One has to be a fact; the other a fiction. One is obtained on paper and has no experimental confirmation. The other is obtained by actual practice and undoubtedly is the actual physical phenomena, as anyone can soon demonstrate to himself with a few moments at a pendulum.

There can be no other conclusion than that the sidebands are mere components and that sideband cutting is the mere *component theory* of suppression as compared with the theory of suppression by the REAL phenomena of resonance hysteresis. If we let the suppression be the time honoured cat, then the sideband theory is one method of skinning it, while the hysteresis theory is another method of skinning it. There is no reason other than pure ignorance why there should be any quarrel between the sideband theorist and the hysteresis theorist. The hysteresis theorist has the facts and a lot of troublesome, cumbersome mathematical equations on his side. The sideband theorist has the *components* of the real phenomena, and comparatively simple analytical methods on his side. Either method gives the same results in the end; but the one is *physical* and the other *mathematical*. In this respect a single fact sinks the whole shipload of argument to the contrary. That little fact is that to date no sideband has ever been tuned in. The more precise the experiment, the more this is true.

Yours faithfully,

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Reproduction and Amplification in Television Receivers

(*Concluded from page* 265).

ably more damped state than the repose frequency $\frac{v_1}{2f}$, then any movement of the object will obviously cause the reproduction to be poorer. The amount of this influence cannot be considerable, however, for slow displacements, especially as we know how much more satisfactorily the impression of the movement is reproduced in the distant picture than that of repose. Sometimes the reproduced detail of the lines which in the scanning direction are narrower than the aperture f is explained from a certain summation of the sight-impressions over several individual pictures.

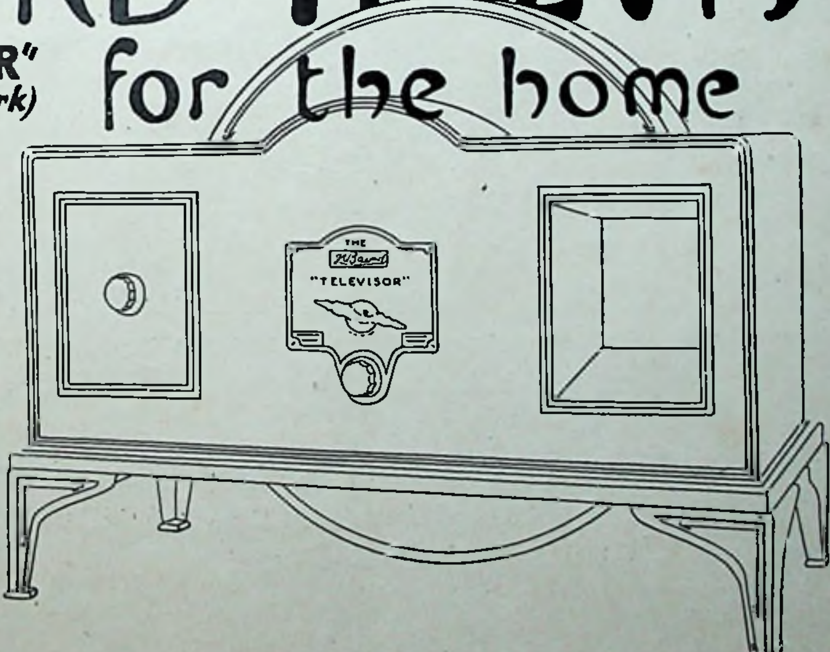
The influence of the grid biassing shown in Fig. 9 will be disregarded in the following, that is, linear transmission of all amplitudes would be assumed. If the strip thickness is $< f$, then no complete darkening of the photo-cell takes place in the scanning. Therefore, in the receiver there must arise objectively a faded and, according to Fig. 6, widened distant picture of the line, the maximum blackening of which is of smaller amount than in the original. If one imagines several such brightness curves superimposed on one another by the persistence of vision, then within a zone of unaltered width an amplified brightness contrast between edges and centre would result. This hypothesis could make comprehensible the "visibility" of fine strips or lines, which in reality are not transmitted at all as an optical picture.

For the good reproduction of the human countenance the characteristic cross lines (eyebrows, nose, mouth) are especially important. From the foregoing reflections, therefore, the advantage of a scanning directed vertically to the course of these lines is again evident. It yields by indicating light fluctuations a localisation of the contours even in the case of considerable fineness of the original line. The sensitiveness of the eye for brightness differences thereby makes possible the inference of the position from the zones of sharpest brightness alterations, and indeed all the more exactly as the original persists in the direction parallel to the light point path. In the transverse direction the frequency transitions take place in jumps. The stroboscopic individual phases of a moving limiting line therefore appear sharp. It is therefore advisable to place the movements in this co-ordinate.

The improvement of definition sometimes claimed by small relative displacements from picture to picture as they arise owing to oscillations or vibrations seems unjustified. A simple graphic consideration shows that in this connection the contrast obtainable by the super-position of several portrayals (which can be defined by the quotient)

$$\frac{\text{Height of the resulting blackening maximum}}{\text{Breadth of the fading zone}}$$

never reaches the value possible by complete covering of the individual pictures. If the original itself is in movement, of course those phases of the reproduction may appear sharper in which the oscillation is opposed to the running direction of the aperture or light spot.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SIR OSWALD STOLL, who has always been such a staunch supporter of Britain and of everything British, has arranged with the Baird Company to allot a part of the programme at each performance at the London Coliseum, commencing on Monday, 28th July, to demonstrations of this marvel of science, the transmission of Television on to a screen.

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There will be three demonstrations daily, at approximately 3 p.m., 6 p.m. and 9 p.m., commencing on Monday, 28th July

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