

Von Mihaly's apparatus for transmitting directly from living objects. A lens is used as in photography and the resulting projected image is explored by the usual disc arrangement

While the first dashing announcements of television and its wonders have left many radio-minded folks in a state of temporary collapse a great deal of work is being done by the more serious investigators. There remain a great group of scientists who believe the problems can be solved. There are a number of large corporations here and abroad which are backing this view with the tremendous financial investment television experimentation involves. They hope some day to reap a rich harvest. No doubt they will, if not through television as we are aiming at it today, through some by-product of the art developed from television research.

In the accompanying review we have a direct comparison of two European systems, written by a man who has witnessed demonstrations of both and who should be in a position to judge them.

# Television Abroad

*A Comparison of the BAIRD and the  
VON MIHALY Systems*

By Dr. Ing. Walter Reisser

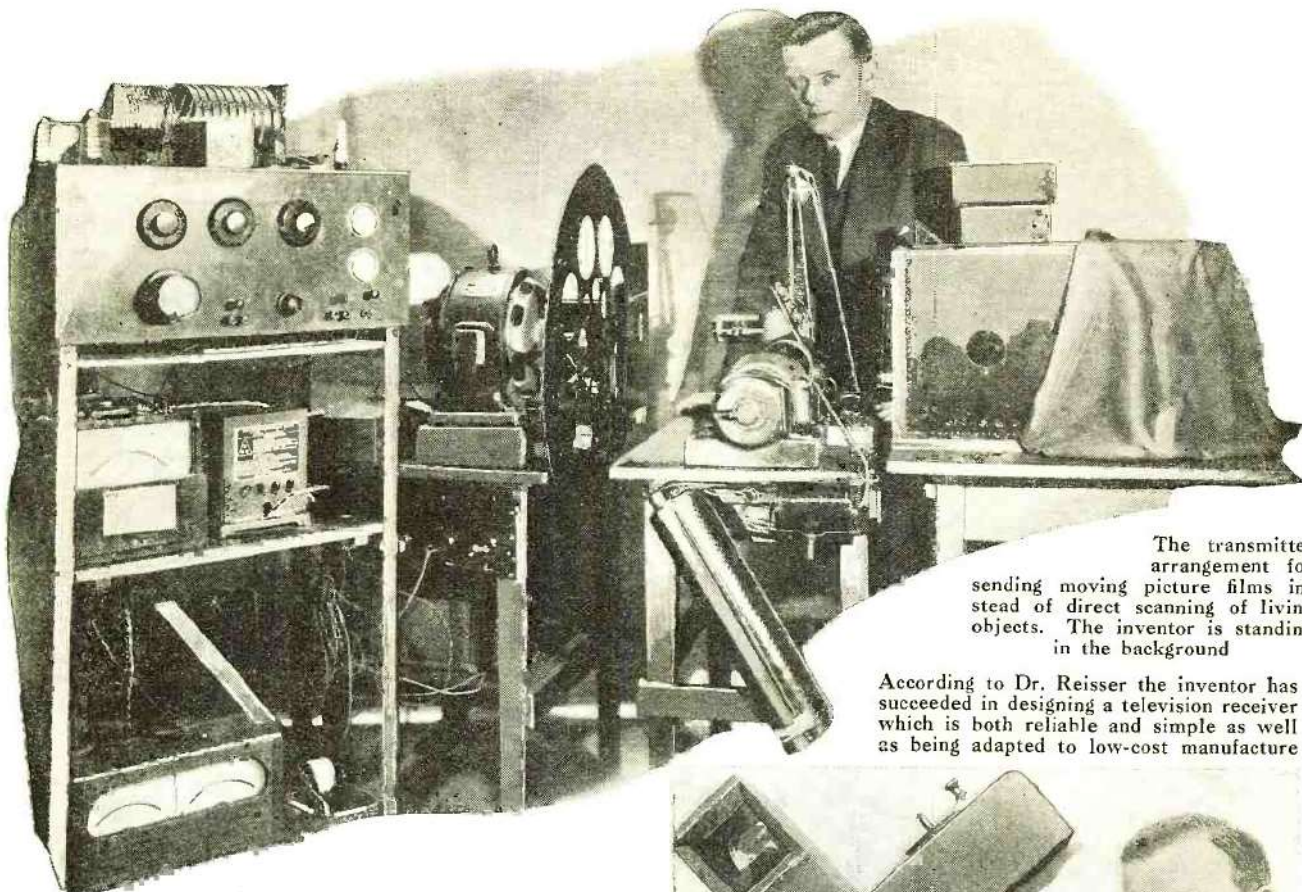
*Chief Engineer, Government Broadcasting Company (Reich-Rundfunk Gesellschaft, Berlin)*

IN assessing the value of a Television process, and especially of the possibilities of its technical exploitations, it is not sufficient to consider it alone as such, but it must be considered in conjunction with the whole technology with which it will have, most probably, to operate. In the following, therefore, the process is considered first of itself and then in its relation to broadcasting, which it will probably exclusively effect.

First of all, generally speaking, what does television set out to accomplish? Its object is to render visible, at the moment of their occurrences, motion-comprising events, at distances only limited by the range of the means of transference applied; in other words, to increase the range of vision to an extent beyond that

obtained by the aid of the best telescopes, unhindered by intervening objects of all kinds, such as walls, mountains, dense fogs, etc. Electric waves form such a means of transference, which are also applied in a large degree for the distant reproduction of sounds. It must thus finally be demonstrated under what conditions the electric wave is capable of solving the above problem.

Broadly stated, the problem runs: taking a pictorial impression, converting this into electrical oscillations suitable for modulating a broadcast transmitter, conveying the modulated high frequency to the receiving station, and converting back into optical impressions which, taken together reconstruct the picture at the transmitter.



The transmitter arrangement for sending moving picture films instead of direct scanning of living objects. The inventor is standing in the background

According to Dr. Reisser the inventor has succeeded in designing a television receiver which is both reliable and simple as well as being adapted to low-cost manufacture



What method has von Mihaly adopted for this purpose? First of all, he does not start, up to the present, with the object itself in motion, but from a cinematographic film. This appears so far desirable in that, in my opinion, it is not only an intermediate step on the way to actual television, but it will, also certainly later on find an important application in the introduction of such processes into broadcasting. There are a large number of events which cannot be transmitted at the moment of occurrence for reasons of time and on other grounds.

Fundamentally, the same problems have here to be solved as in actual direct television, only with the difference that with the film the intensity of the available illumination can be increased to almost any desired degree, so that during the developmental stages a number of difficulties can be avoided, for the overcoming of which, however, the theoretical foundations appear to have been laid.

Von Mihaly utilizes, for breaking up the pictures to be transmitted, the so-called Nipkow discs. These are discs carrying spirally-arranged holes by means of which, on rotating the disc, the picture is utilized in a similar way by nearly all new television processes, and appears to represent the most promising method of reaching a wide circle of television receivers. The mirror wheel, used for example with the "Karolus" system, is too costly to allow of its being incorporated in a popular receiver. Baird also, who is to my knowledge the only serious competitor of Mihaly's, uses the Nipkow disc.

Such a disc is inserted in the path of

the light rays, which, passing from the picture to be submitted, are led to a photo-electric cell. The latter has the property of changing its resistance according to the intensity of the light which impinges upon it, so that a more intense illumination corresponds to a stronger current, and a less intense illumination to a weaker current. This conversion of variations of optical intensity into variations of electric current forms the essence of the transmitter. The photo-electric cell must not only cause the greatest possible difference in current, when the illumination changes from light to dark (intense to weak), but must be able to follow the necessarily very rapid variations without lag. An experiment shown to me by Herr von Mihaly demonstrated that the sensitiveness to light variations of the cell used is quite good, on account of a special switching arrangement. It may be concluded, from demonstrations which have since taken place, that the behavior of the cell is throughout favorable even at the high frequencies necessary for the transmission of pictures.

The difficulty of passing from films to directly moving objects is, ultimately, a question of amplifier technique, of which, however, von Mihaly is, in my opinion, eminently qualified.

The Englishman Baird is at the moment ahead of Mihaly in so far as he starts with directly moving objects. For this purpose, however, he uses a procedure which, in my opinion, has no great practical value. That is to say he places the person to be seen (the view obtainable extends only to the head and shoulders by this procedure) in a room which is either completely dark or illuminated only feebly with red light, and then explores him with a wandering beam of light, produced by a fairly complicated arrangement of rotating lenses. (See Dinsdal's "Television.") One or two heads can be transmitted in this way. According as this beam of light traverses a light or dark portion of the object, more or less light is reflected, and this, corresponding in intensity with the illuminating power of the point to be transmitted, acts upon a series of photo-electric cells arranged opposite to the object. A Nipkow disc is not used in this transmitter.

On my visit to Baird in London in

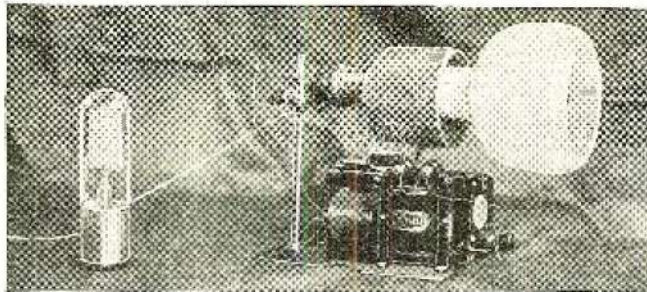
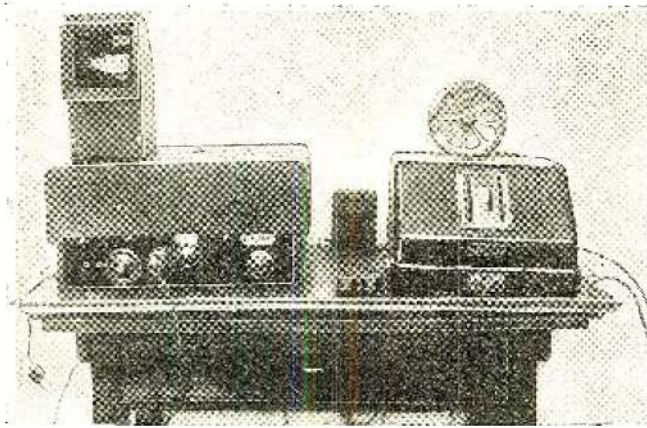
December of last year, a boxing match was indeed shown to see, transmitted by means of another receiver, which was stated to be capable of transmitting from an illuminated room. In contrast to the other demonstrations, however, the acoustic effects were not transmitted simultaneously on the one hand, and on the other hand he declined to show me the transmitting room. I am therefore in doubt as to whether the transmission was made from actual objects or whether the original was really a film.

In comparing Mihaly's and Baird's processes, it must not be forgotten that Baird uses a considerably greater number of points in the picture than does Mihaly, who based his arrangements from the start on the circumstances attending broadcast waves. Further, Baird's transmission took place over wires, whilst Mihaly's was carried out by wireless through the Berlin-Witzleben transmitter. Also, last but not least, Baird has had fairly considerable means available for some years, whilst Mihaly has had relative freedom of movement for only a short half year.

On enquiry, Herr von Mihaly informed me that he had since solved the problem of transmitting directly from living objects. For this purpose an objective is used as in photography, and the picture projected by this explored by the usual disc arrangement. As a preliminary arrangement, there is said to be still required an extraordinarily high degree of illumination of the object to be transmitted, corresponding approximately to that used in cinematography. Such strong illuminations, however, soon becomes unpleasant, and experiments are at present in progress with the object of reducing the necessary intensity of illumination, so that it should already be possible to make exposures in well-lighted rooms. Such a procedure has the advantage over the above-described Baird procedure, which takes place in a dark room, that on the one hand the free movement of the object to be transmitted is unhindered, and on the other hand that it is naturally more pleasant to work in an illuminated room than in a dark one.

Further, Mihaly has, according to his statement, already developed a daylight-exposure process which he claims to have rendered independent of variations of the intensity of the sun's light by means of an automatically operating photo-electric cell.

Flickering has been reduced to the minimum by special shaping of the holes (in the discs) at



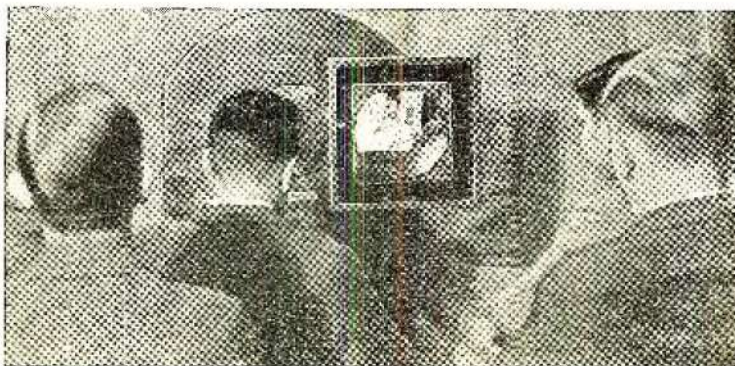
The upper illustration shows, at the left a television receiver, and at the right, a sound receiver, while the illustration immediately below is of the "super-frequency" lamp which, according to description is considerably more efficient than the average

the transmitting and receiving stations.

For the comprehensive broadcasting of television, the production of the receivers is of course of the utmost importance. These machines must not only be so cheaply manufacturable as to be available to the majority of radio listeners, but must be throughout reliable and simple in operation. Von Mihaly appears, in my opinion, to have fulfilled these conditions very well.

The condition of greatest possible cheapness is fulfilled in that no special motor is necessary, the Nipkow disc of the receiver being operated by a fully balanced, horizontal, point-supported "phonic wheel." This has the advantage

A demonstration with the large receiver. If this illustration is to be taken at face value, the received image is both larger and brighter than what television enthusiasts in this country have been accustomed to



of being considerably cheaper than the usual shunt-wound motor. The latter costs about 26-marks, whilst the phonic wheel can be produced for about M. 6.-. As, apart from the very slight friction at the point of suspension, only air resistances has to be overcome, 5 milliamperes are sufficient to maintain the phonic wheel in rotation; i. e., approximately the current produced by the broadcast receiver. In contrast to this, Baird, who uses a special motor, requires in addition a local synchronizing arrangement, with which the effect of variations in temperature can become noticeable. During visits to England and demonstrations of the Baird procedure it was in fact determined that frequent readjustment of the synchronization was necessary. As it is not sufficient merely to maintain synchronous rotation, but also to maintain the arrangement in phase, the latter being only possible by variation of the rate of rotation, the procedure is not very simple. The phonic wheel, on the other hand, when once brought into phase (which is effected by manual operation) remains permanently in phase, so that the necessity for further readjustment is eliminated.

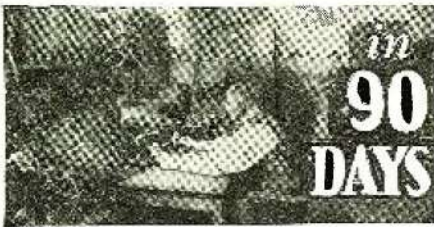
In Mihaly's latest procedure, the synchronization problem is solved in the most ingenious manner. That is to say, the synchronization impulses are superimposed on the actual picture impulses in such a way that the actual picture is not distorted, and no special transmission channel is required for these synchronization impulses. Herr von Mihaly even indicated the possibility of transmitting speech on the same wave as the picture and synchronization by utilizing the other sidebands of the carrier wave. This at present, however, is still theory, and in addition, slight alterations to the transmitter would be necessary.

An important part of the receiver is the glow lamp (vacuum tube) necessary for illuminating the picture field. This is produced in conjunction with the scientific laboratories of the Osram Company. The lamp is so constructed that it can be operated with a few *milli-amperes*, instead of requiring excessive power. Baird uses therefore under all conditions a power amplifier, whilst the power required for operating Mihaly's lamp is that generated in an ordinary receiving set giving weak loud-speaker reception.

At present, Mihaly uses lamps filled with neon or argon, which give a reddish light. Lamps filled with helium, and giving a white

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light have, however, already been prepared, but have the disadvantage, as compared with the other fillings, of lack of permanency. If, however, a black-and-white picture is desired, it can be obtained, with the above disadvantage.

On account of the horizontal arrangement of the Nipkow disc, it is necessary, for comfortable reception, to use a periscope. The arrangement is so carried out by Mihaly that the room need not be darkened throughout.

By special arrangement of holes (in the disc) in the receiver, the variations in modulation occasioned by the transmitted picture are brought to complete expression, that is, a better delineation is obtained, without having to increase the frequency.

The operation of Mihaly's receiver is very simple. If it is desired to go over from broadcast reception to television, a change-over switch is operated which transfers the output of the receiver from the loud speaker to the television. The switch connects up the glowlamp at the same time, the latter operating at 120-180 volts. The phonic wheel is then started up by hand and brought to synchronization, the latter being easily effected by oral observation of the interference waves produced. Synchronism being obtained, the disc is brought into correct phase by operating the phase-corrector knob—that is, the picture is brought into correct position. Once adjusted, the receiver requires no further attention.

Another arrangement of Mihaly's should be pointed out, by means of which ordinary film photographs can be transmitted. If it is desired simply to project a film of any kind, it would be difficult with distant views to make all the details sufficiently clear at the receiver. In this case the technician operating the transmitter is able by moving the light-receiving apparatus to and fro, or sidewise, to bring that portion of the picture to projection on which it is desired to focus attention, remaining incidentals being neglected, so that everything can be followed with certainty under all circumstances. The arrangement is so constructed that the objective always comes into the correct focal position for the sharp delineation of the picture.

Now it is naturally of great interest to see how far a satisfactory picture transmission is possible on broadcast waves which can only have a definite higher

limit of frequency numbers, in order that stations operating on neighbouring waves shall not be distorted, that is to say on broadcast waves with permissible width of sidebands. As already stated, Mihaly has constructed his apparatus from the start according to conditions laid down by the Imperial Post Office. He was therefore bound to produce the best possible pictures inside the prescribed frequency limits. Baird, on the other hand, uses a high number of picture points, which definitely cannot be permissible for ordinary broadcast transmitters. Whether his pictures will have sufficient detail when the transmission is limited to the prescribed frequencies, remains to be demonstrated. It is, of course, to be understood that with the possibility of going over to higher frequencies, more detail can be obtained.

This, however, cannot happen in the range of ordinary broadcasting, and so far is only possible in the region of the short waves. These however, have a number of disadvantages with regard to broadcasting, which at present cannot be overcome. As, however, it is not clear that later on it will be necessary to tread this particular route to increase the number of picture points with corresponding increase in detail, the greatest attention should be paid to short-wave transmission and reception with reference to television. The optical and electrical arrangements of the television transmitters and receivers will certainly allow of a considerable increase in frequency.

With regard to the present state of Mihaly's process, it can be said that the first laboratory-stage difficulties have been overcome, and that attention can now be paid to the construction of popular receiving sets. The fundamentals are firmly established, and slight improvements in the nature of other arrangements of perforations and the like can be made in each apparatus by changing the Nipkow disc (cost about M. 2.—) at any time. The fact that the public shows an extraordinarily keen interest in television may justify the immediate production of such a receiver.

Summarising, it can be stated that the way suggested by Herr von Mihaly appears clear throughout, as the requirements of such a procedure, outlined in the foregoing, appear already to have been very largely fulfilled by Herr von Mihaly.

## Television Field Tests Under Way

CERTAIN television broadcasting interests are making field surveys in a quiet but effective manner, according to J. E. Smith, president, National Radio Institute of Washington, D. C. This marks the laying of a solid foundation; for in television, more than in sound broadcasting, it is essential to begin with clean signals. The television image is especially susceptible of distortion from excessive regeneration.

"I am pleased to note," states Mr.

Smith, "that television broadcasters are not making the mistake of the pioneer sound broadcasters. With the experience of the latter taken very much to heart, sight broadcasters are going about determining just how much territory they can cover reliably under the average run of conditions. They are making no wild claims as to their coverage, but, rather, are apparently going to confine their marketing efforts only in territories positively covered by good television signals."