Seeing by Wireless at Last!

HOW IT IS DONE

By WATSON DAVIS

In this special article an account of the latest experiments in wireless vision in America is presented to British readers. The results as detailed in the article speak for themselves, and although there is room for much improvement, one thing is clear, it is possible to see by wireless

WHEN I talked to C. Francis Jenkins over the telephone and he asked me to come up to his laboratory, I was not surprised and startled that he and I could talk over a copper wire. Telephoning is a common performance. Even the nightly radio voices in the ether are no longer the marvel they were a mere two years ago.

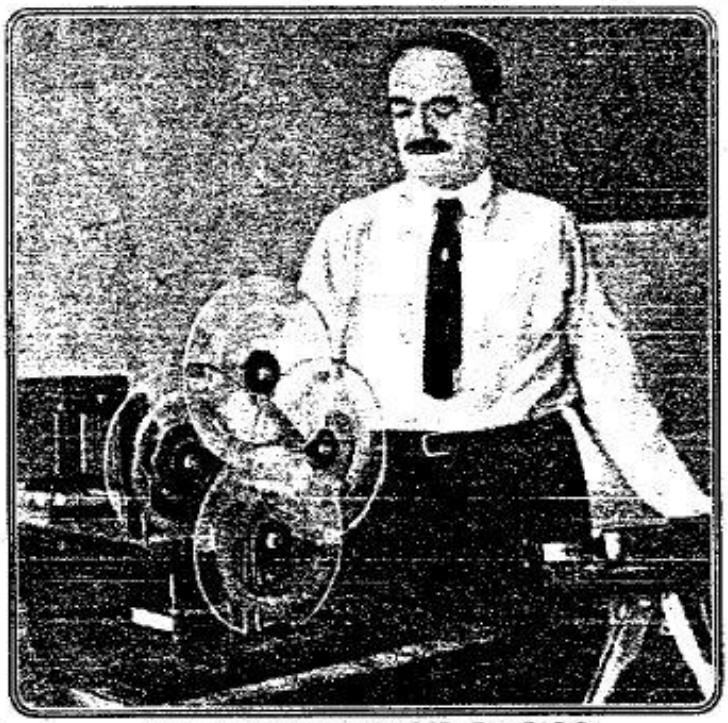
But when Mr. Jenkins asked me to watch a screen in his laboratory which was shut off from the rest of the room, and when I *saw* him wave his hand to me, although my back was turned to him, it was unusual.

I was seeing by wireless!

But Mr. Jenkins has done unusual and unprecedented things before. Every ordinary motion-picture projector contains a vital principle invented by him. Readers of WIRELESS REVIEW know also that he has within the last year made it possible to send diagrams, messages written in Chinese characters, and even photographs by wire and radio.

Sending and receiving sets for transmitting still pictures by radio were in his laboratory, and it was plain that this apparatus for radio vision, a new assembly of discs, motors, lenses and lights, was related to the more finished and mature equipment that has been successful in sending pictures and diagrams through thin air.

In reply to my hardly pronounced "How?" Mr. Jenkins showed how he had made the movement of his fingers and hand visible by radio. The apparatus seemed extremely simple, certainly no more complex than the telephone when Bell first operated it. A magic-lantern, the same as thousands in ordinary use, was projecting its shaft of light through a disc that revolved at high speed. The light fell on an opening in a rectangular box, supported much like a small camera on a heavy tripod placed half-way across the room. From the black box on the tripod wires ran to a radio transmitting set that was heavily screened to keep stray and troublesome electric currents from getting in the way. When a wave of the hand was to be transmitted, Mr. Jenkins simply inserted his fingers into the space where the lantern slide-holder of the ordinary stereopticon is placed.



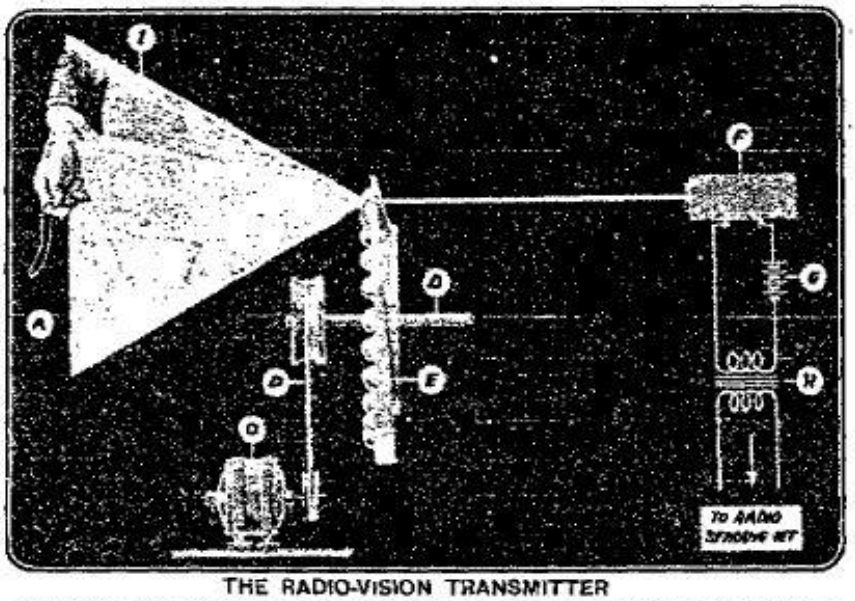
THE FIRST MAN TO SEE BY RADIO

Mr. C. Francis Jenkins, of Washington, D.C., has to his credit several important contributions to the production of motion pictures as well as to radio. His most recent invention combines these fields in the "television apparatus" described in this article.

The object of the whirling disc and stereopticon, Mr. Jenkins told me, was to impress the shadow of the moving fingers and hand, portion by portion, upon the light-sensitive cell that was contained in the camera-like black box on the tripod. How this is done will be explained later. But the result is that the variations in light that this cell receives are translated into variations in electric current, just as the variations in sound that enter the telephone transmitter leave the wires as variations in electric current. The shadow of the moving fingers, now in

the form of varying electric current, was fed into the radio transmitting set and handled in exactly the same way as hundreds of jazz concerts are broadcast.

The receiving aerial in the case of this demonstration was only a few feet away from the sending aerial on the roof of the Jenkins laboratory, but for a short distance that wave of a hand went through the ether in the form of radio waves. After being picked up by the receiving radio set, these impulses were changed back into an electric current and sent to the radio-vision receiving set.



THE RADIO-VISION TRANSMITTER

The light I, from an object, A, is focused one strip at a time through lenses on the rotating disc E, on to the light-sensitive cell, F. Electric current from the battery G is modulated by the light and sent out by radio in the usual way.

This receiving apparatus consisted of just four essentials—a lamp that changed electric-current variations into light variations, a whirling disc similar to the one in the transmitter, a lens, and a picture-receiving screen.

An Optical Trick

Radio vision is as much a matter of optics as electricity, and since light and electricity are both members of the big family of ether waves, differing only in length, there is no reason why they should not collaborate.

Yet there is no question but that the radio part of radio vision plays second fiddle to the whirling disc. These rings of lenses make radio vision possible. They take the wave of the hand and impress it portion by portion on the light-sensitive cell; they take the rapidly fluctuating light and change it into a moving picture.

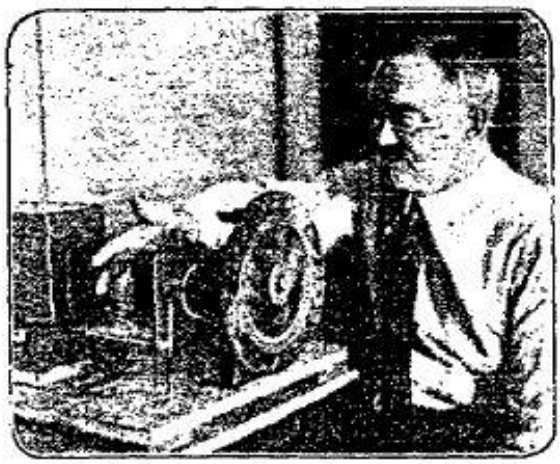
The human eye is easily pleased and slurs over minute imperfections. All of the half-tone illustrations in our newspapers are nothing but areas of coarse dots, sixty to the inch, that our eyes obligingly turn into pleasing pictures. That is a very useful optical trick, and it is used by Mr. Jenkins in sending still pictures by radio and also in his process of radio vision.

Again, speed can be used to fool the eye. Getting fooled is not always unpleasant, because it allows us to enjoy motion pictures. In the theatres, sixteen photographs appear on the screen each second, and that is speedy enough to make it seem to our eyes that the motion is in the objects in the pictures, not in the pictures themselves. And this optical illusion is used by Mr. Jenkins in radio vision.

Lines, not dots, as in the half-tone, very close together, are the structure of both pictures and vision by radio. These lines of light are swept across the progressing picture by the whirling discs. Light is the paint and the whirling disc is the brush in radio pictures and vision.

In the Jenkins apparatus for transmitting still pictures, the whirling disc has a prism curled around its circumference. Prismatic lenses, as almost all of us have observed, have a way of persuading light to deviate from its straight path. The discs used in transmitting still pictures by radio are made entirely of glass, and the prismatic lens is ground on the circumference. This is, however, the equivalent of many lenses, since it is of varying thickness. And this causes a beam of light, projected through it while it revolves, to be swept from one side to the other.

Two of these discs are used to project the photograph upon the transmitting light-sensitive cell in Jenkins' pictures by radio apparatus. One disc covers the picture in one direction while the other covers it at right angles to the first, and one of these discs operates many times faster than the other, so

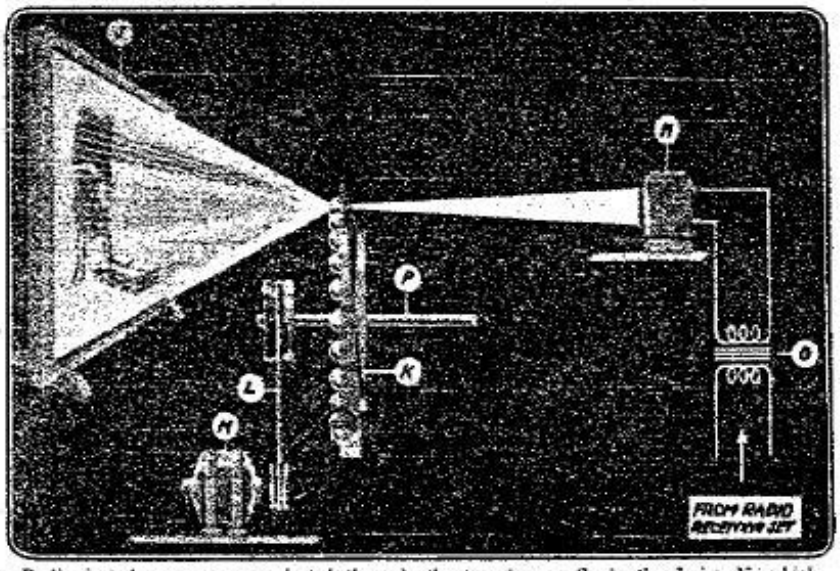


The simple apparatus that sends a wave of the hand by wireless.

that the effect, in both sending and receiving, is the drawing of lines across the picture very close to each other. In sending still pictures, this operation takes about a minute.

The Forty-eight Lenses

To transmit motion, the sending must be speeded up so that at least sixteen pictures are transmitted each second instead of one picture, in several minutes. Compared with this, ordinary motion pictures, such as we see in theatres, are comparatively simple. At the movies whole photographs are projected on the screen all at once, and they are thrown on and taken off so rapidly that the eye cannot detect the separate projections, but blends them together into continuous motion of the objects in the picture. In radio vision the picture is projected on the screen portion by portion, but to produce the effect of motion or actual vision a complete picture must be built up every sixteenth of a second. Prismatic discs that produce only one picture a minute are obviously too slow.



Radio impulses are communicated through the transformer O, to the device N, which reconverts them into pulses of light. These pulses, passing through the lenses on the rotating disc K, produce an image of the original object on the screen J.

So Mr. Jenkins has devised a new form of disc, which contains lenses that combine the function of covering the picture vertically and horizontally. In the apparatus that he demonstrated, the disc was so made as to produce one complete picture with each revolution. It contained forty-eight lenses in all. Each of these was, in effect, a combination of a rather flat convex lens and a prismatic lens. The lenses varied by having the prismatic part thick on one edge for the first lens, and then gradually changing their angles until the thickness was on the other edge for the last or forty-eighth lens. For all lenses the convex portion was the same. Thus in this compound lens both horizontal and vertical motion of the light was obtained. The forty-eight lenses forming a prism of varying angles shifted the scene once horizontally, while each convex lens by its vertical motion swept the scene over the light-sensitive cell in one-forty-eighth the time of the horizontal shift. Thus each scene was impressed on the cell as forty-eight horizontal lines spaced close together. The speed necessary for the production of continuous motion in the radio-vision receiving apparatus was sixteen revolutions a second, or 960 r.p.m.

Exactly the reverse process takes place in the radio vision receiver. The dismembered scene enters the lamp of the receiver as a fluctuating current, strong where the light of the transmitted scene was strong, weak where it was weak. Faithfully the lamp reproduces light, and the whirling disc with its dual-lenses sweeps the scene on the screen just as its twin in the transmitter swept it on the light-sensitive cell.

It is a shadowy wave of the hand or movement of the fingers that is produced. A picture composed of only a few horizontal lines, varying in light intensity along their lengths, cannot be expected to be very distinct or detailed.

But even shadowy motion, such as was produced, was a demonstration of the important possibilities that the method holds. Increase the number of lenses that produce each picture to several hundred and the detail will come.

In another important way, the radio-vision apparatus differs from the radio-pictures outfit. The light source in the receiver must vary quickly with variations in the incoming current.

In the Near Future

The question of synchronism, of keeping the discs of the transmitting and receiving sets running exactly together, Mr. Jenkins says, is a simpler problem in radio vision that in radio transmission of pictures. In the experimental set that was demonstrated, discs of both the transmitting and receiving sets were driven from the same motor for the sake of simplicity in operation.

The transmission of pantomime by radio has been accomplished. There is no reason why the receiver should not have been in New York rather than in Washington next to the radio-vision transmitting set.

The perfection of the invention has not yet reached the point where actual scenes in all their lights and shadows can be reproduced or motion pictures distributed to the hearth and home. But the experimental apparatus devised by Mr. Jenkins gives promise eventually of our being able to see in New York at nine o'clock in the morning what "will occur" the same afternoon at two o'clock in London.