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 halfway 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 stroboscope of the ordinary stereopticon is placed.

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, on the light-sensitive screen 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

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 disc. 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 cut 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 disc 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

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.

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 slips over minute imperfections. All of the half-tone illustrations in our newspapers are nothing but arrays of coarse dots, sixty to the inch, that our eyes obligingly run into phasing 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.

The simple apparatus that threads 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 six
teenth of a
second. Prismatic
discs that produce
only one picture
are obviously
too slow.

So Mr. Jenkins has
devised a new form of disc, which contains lenses that
combine the power of covering the picture vertically and horizontally. In the apparatus that
he demonstrated, the disc was so made as to produce
each 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-eight
lens. For all lenses the convex portion was
the same. Thus in this compound lens both hori
zontal 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-fourty-eight 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 possi
bilities that
the method holds.

In another
important
way, the
radio-vision
apparatus
differs from the
radio
pictures out
lit. 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 simplic
ity 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 experi
mental apparatus devised by Mr. Jenkins gives prom
ise of 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.