ENGINEERING

Pictures by Radio?

Simple Receivers for Facsimile Transmission Plus Development of Now Unused Waves Hold Promise

By ROBERT D. POTTER

BULLETS from an assassin's gun kill King Alexander of Yugoslavia. Pictures taken by alert news photographers at the scene of the crime, in France, appear the next day in American newspapers, thanks to radio and wire transmission of facsimiles. A miracle—Yes! But only the forerunner of things to come in picture transmission.

New receivers for unscrambling radio waves which carry the pictures, and even new types of radio waves never before utilized commercially, offer the possibilities for an attractive future in the field of radio facsimile transmission.

When that day comes—and it is not far ahead—present systems of transmission may seem as antiquated as the model T Ford does to its current offspring and its competitors. There is more than an even chance that by the new developments in the field of facsimile transmission single pictures may be received at such speed that they will come to "life" and become television in a practical sense.

Miracle that it is, radio facsimile transmission of pictures works best—at present—across oceans where it cuts days to hours in bringing a picture to a receiving newspaper. Yet the hours of time still required consist of more than 99 per cent. details of transmission and receiving and only a brief instant in actual transit. Radio waves, remember, travel 186,000 miles a second.

Scrambled Jig-Saw

The present arrangement is like dropping a completed jig-saw puzzle from the Washington Monument. It comes apart at impact with the ground and must be reassembled. The time of transmission from top to ground is but a small fraction of the time for the complete job.

Picture a Washington Monument so tall that it takes days to walk down it and one sees the gain in time by the present "breaking-up" arrangement. For the real monument it is faster, everyone will agree, to carry the puzzle down intact.

The present arrangement of facsimile transmission, by this picture, is useful for very "long monuments," equivalent to the width of the Atlantic Ocean. For the situation in the United States it is but little faster, if any, to break up a picture into radio signals and reassemble it at the receiving end; not, at least, when great cities like New York and Chicago are but a little more than three hours apart by airplane.

What lies ahead for facsimile transmission may be just as great an improvement over the present systems as the latter are over picture transmission via ocean vessels across the Atlantic. If present methods cut days to hours, future devices should cut hours to minutes and seconds. Already pictures have been transmitted experimentally in five minutes which would require over an hour by the present facsimile transmitting systems. And the end is not yet in sight.

More Than a Hope

Thus the future holds more than a hope that a time will come when radio facsimile transmission will serve as useful a place in American news photo distribution as present facsimile systems occupy in the trans-oceanic field. And every newspaper, however small, could enjoy the benefits of the new methods. Already facsimile receivers are available which might cost only $20 or $30 if placed in production on a commercial, instead of an experimental, basis. But more of that shortly.

Facsimile equipment today is not selling for $30, but many times that amount. It is an intricate combination of photography, electrical engineering and radio development.

See what happens in a radio station when an important picture, such as the Morro Castle disaster or the assassination of King Alexander, is about to be transmitted across the ocean by wireless.

A tiny, brilliant pin-point of light plays back and forth across the photograph which has been wrapped around a slowly moving cylinder and moves with it. Closely adjacent to the light source is a small photoelectric cell.

AN EARLY PRINT

This lovely lady is pictured by carbon copy reception process while it was still in the experimental stage.

Where the light beam strikes the blacks in the photograph little light is reflected and picked up by the photocell. Where white or light grays occur, the reflection is stronger. Thus, as the picture is "scanned" bit by bit, the photocell generates an electric current whose strength is a measure of the blackness or whiteness of each section of the picture.

The changing photocell current is, of course, most minute but nearby amplifiers "pep it up" enormously until it is capable of changing or modulating the signal being sent out by the transmission aerial. This puts the picture "on the air" and flashes it to its destination in a fraction of a second.

Now jump over to the receiving station. In essence the receiving process is transmission in reverse. The incoming picture signal is weak, and first must be amplified millions of times. A home radio receiving set does the same thing. Instead of worrying about making pictures, however, it produces oscillations in a loudspeaker.

The picture receiver consists of a rotating cylinder turning at the same prearranged speed as that of the transmitting station. On its surface is an unexposed photographic film. Again a point of light scans its surface with an

intensity changing as the incoming signal modulation varies. Remember those variations mean degrees of black and white and the in-between grays.

Gradually, as the film turns, the entire surface is exposed to the pin point of light and when developed in a dark room resembles closely the original "master" picture. The whole process of exposing the film bit by bit and developing it must, naturally, be carried out in darkness.

So that the operator will know what is going on, however, a crude auxiliary system produces a rough replica of the picture by spraying ink from a small nozzle onto paper. The thickness and blackness of the applied ink is varied with the incoming signal. This novel monitor device operates in daylight and, in substance, the ink spray takes the place of the light beam exposing the photographic film in the sealed, darkened apparatus.

R. C. A.-Victor in its research laboratories at Camden, N. J., has realized the device just described was not perfect, or the ultimate in picture transmission. Progress in the art has been steady. Charles J. Young, one of their research engineers, has just perfected a new form of facsimile receiver which is a step toward the $30 receivers previously mentioned.

Young Mr. Young—son of Owen D. Young—has improved the photographic receiver by the substitution of the principle of making carbon copies on a typewriter for the photographic prints.

Compare the time and cost of making a carbon copy and a photoprint and the reader will realize why the former brings in the important low cost and speed angle.

Externally the carbon copy receiver looks little different from the photographic device. No method yet seems to be able to get away from the rotating cylinder idea.

In Engineer Young's method, however, there is no photographic film being exposed piece by piece by a light spot. Instead, the rotating cylinders simply have a paper "sandwich" fixed to their surface consisting of two sheets of white paper with a carbon sheet between them.

Instead of a fluctuating light beam varied by the incoming picture signal, a helical stylus presses against the top white sheet of paper in varying amounts. Where the radio signal says, in effect, "here is black" the stylus presses heavily against the paper and the carbon and thus transfers a black mark to the bottom sheet. Where the signal says, "here is white or light gray," the pressure on the stylus is removed or reduced and the carbon wax is transferred lightly or not at all to the bottom sheet. The carbon copy method removes at one stroke all need for photographic development of the picture, all need for an auxiliary monitor sprayed ink apparatus and the need for light beams for exposing the film. Mr. Young's device may not be the final form of facsimile receivers but it is relatively simple and cheap to operate. More important, it marks the rapid progress of an art that is gaining momentum so fast that the investor in present equipment might well await future development to avoid the installation of what tomorrow may be obsolete equipment.

SIMPLIFIED FACSIMILE RECORDER

C. J. Young, son of famous Owen D. Young, is demonstrating his device which eventually may sell for about thirty dollars.

Develop Microwaves

Coupled with Mr. Young's receiver as typifying progress in radio picture transmission is the development of the micro-radio waves for commercial use. Microwaves, as they are called for short, are the smallest radio waves which science has yet been able to produce with vacuum tube equipment.

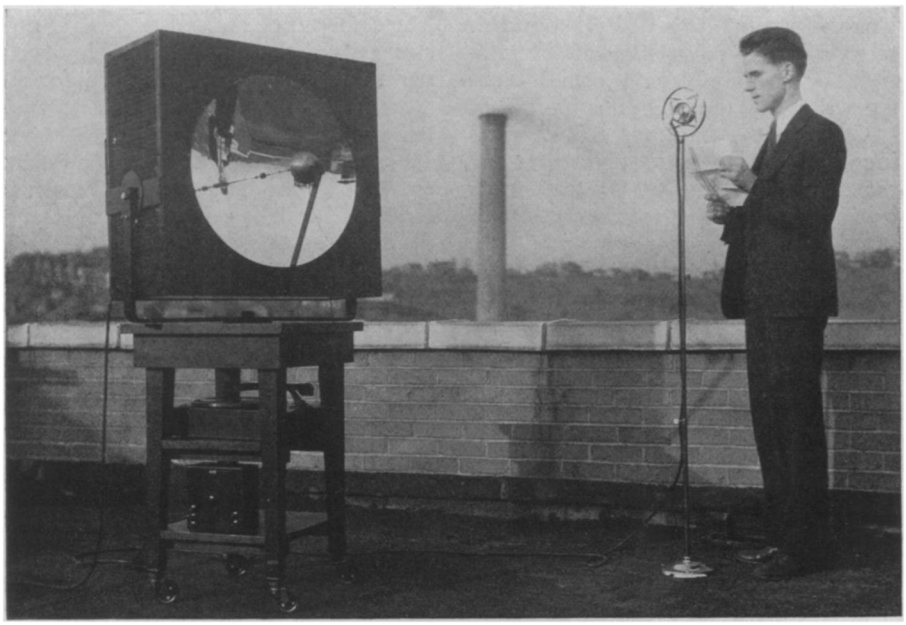
Where the radio waves for sound broadcasting are hundreds of meters long—thousands of feet from crest to crest—microwaves are measured in inches. They are far shorter than the so-called shortwaves used by radio amateurs, measuring fifty or seventy feet in length.

Strangest characteristic of micro-radio waves is their property of being able to be focused like light with strongly directional effect. When transmitted they can be sent in a nearly parallel beam by suitable reflecting "mirrors." A concentration of intensity at a distant point is thus possible. Ordinary broadcast radio waves are sent out in all directions. Much of their energy is wasted. Where thousands of watts of power is sent out only a few thousandths of one watt is received in your home set.

Limited Range

The light-like properties of microwaves are at once useful and a handicap. Marconi, "father" of wireless, employs the directional effect of microwaves in his radio fog beacon for ships entering a harbor "blind." By receiving an accurately directed beam the ship's captain can take bearings even though he can not see the shore or familiar landmarks.

On the handicap side, the optical properties of microwaves mean that their range of usefulness on the earth is limited by the distance of the horizon. From a tall skyscraper like those of New York fifty or sixty miles transmission is the maximum distance possible. Scien-



BROADCASTING ON ULTRA-SHORT WAVES

G. R. Kilgore, research engineer of Westinghouse Company, broadcasting on radio waves only a little over 3 inches in length. In the microphone the voice is turned into electric impulses which are sent into space at the focus of the mirror. The mirror sends out the signal as a parallel beam. A similar mirror receiver several miles away picks up the message.

tists of the Radio Corporation of America working on the problem of microwave transmission will get around this difficulty by having "booster" stations every sixty miles in a country-wide network linking the large cities.

While booster stations will involve expenditures of large amounts of money for equipment, the development will be worthwhile because of freedom from static. Static on audible broadcast means a blurring of the speech. In facsimile transmission it means a smudging of the picture or original message. The received facsimile sent through static may be like a letter written in ink and then smeared before drying. Only on microwaves, where static does not occur, can facsimile transmission be accomplished with 100 per cent. success all the time.

Present radio transmission yields pictures which, if taken in the home town of the newspaper, would seldom be printed. They are blurred, tend to be smudgy and lack detail. They are used because of their great news interest and to some extent because of their novelty at the present time. Everyone, publishers, photographers and reading public alike wish to have them better. Greatest of the advantages which micro-radio waves will bring to facsimile transmission is an increase of detail in the resulting picture.

Microwaves should bring as big an improvement in radio pictures as a fine magazine photoengraving screen does compared to a very coarse fifty-line screen. The little dots characteristic of the latter disappear in fine photoengraving because the dots, while still existent, are so close together the eye cannot resolve them.

One could become lost in the technical radio details proving that increased detail is an accompaniment of the use of shorter and shorter radio waves as the carriers of the picture signals. But suffice it to say that for a picture split up into 50 sections per inch up and down and across, a radio band of frequencies equal to 50 times 50, or 2,500 cycles is required. And the result is coarse; equivalent to a rough 50 line photoengraving screen.

For better detail at ordinary radio wavelengths the facsimile channels would be so broad there would be little else "on the air." Broadcasting on the longer wavelengths for sound is crowded enough without trying to contemplate the mixture which would result if facsimile transmission with its much wider "bands" came into being on those same wavelengths.

Fortunately, because the frequency separation spreads out rapidly as one goes to short microwaves, broad bands can be obtained and yet crowding avoided. In television where the transmission bands need to be even wider, microwaves appear to be an absolute necessity.

Compared to the broadcast radio waves, the short waves of the amateurs are the "great open spaces." Microwaves, in turn, would be a "wilderness." No one, however, likes to go into a wilderness. It is an uncharted, unmapped sort of place. Pioneer work is necessary whether the wilderness is a new country or a new radio region.

Microwave facsimile transmission is so encouraging to the radio engineers because it is a wholesome sign of progress in the wilderness.

But out of the wilderness are coming prophets. Their prophecies are more than wish fulfillment. Hard-won scientific discoveries and new techniques are behind them. The promised days of still more progress are not now too far ahead.

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ASTRONOMY

Year's First Comet And Unidentified Object Seen

A NEW object in the heavens, discovered by a British amateur astronomer, has been reported to the astronomical world through the International Astronomical Union bureau.

It may be an asteriod or a comet. Although it is tenth magnitude and too faint to be seen with the unaided eye, it is located in the constellation of Taurus, the bull, west of the bright star Aldebaran in the evening sky.

Discovered on Jan. 6 by Geoffrey Francis Kellaway, who lives in the Somerset county of England, the new object was confirmed by Dr. A. C. C. Crommelin before being reported. It will be known as the Kellaway object. The object has no tail but does have a bright center or nucleus.

The astronomical coordinates at discovery were right ascension 4 hour 25 minutes 24 seconds and declination north 16 degrees 11 minutes and the daily motion is in right ascension plus two minutes 8 seconds and in declination plus one minute.

A comet, discovered from Union Observatory at Johannesburg, South Africa, by Astronomer E. L. Johnson, is the first of the new year.

But it is not visible from the northern hemisphere, and even south of the