



Radio Uses NO ETHER WAVES

By WALTER W. MASSIE

The author, whose portrait appears at the left, is one of America's earliest and best known radio pioneers. He has never accepted the conventional ether-wave theory of radio. In this article he explains an alternative theory—a theory which assumes that radio is propagated along the magnetic field of the earth.

SCIENTIFIC theories and traditions are a good deal like religious creeds. It is heresy for the ordinary scientist to depart from them.

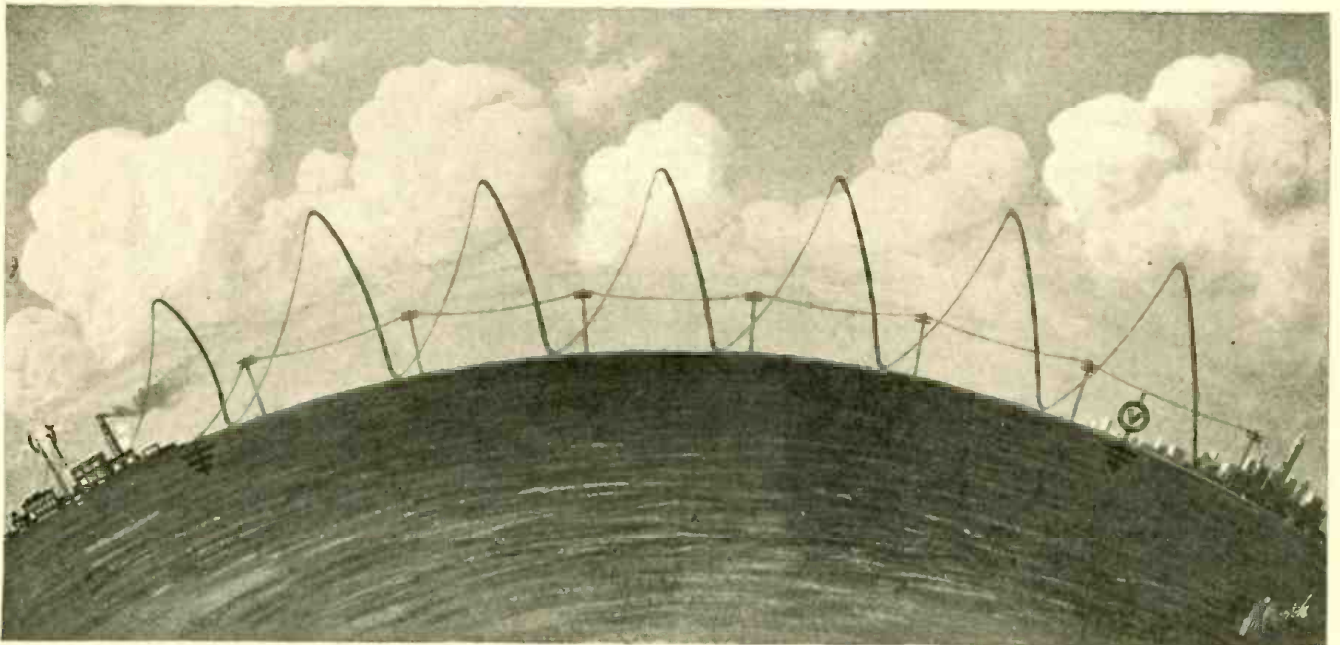
This fact was strongly impressed upon me twenty-five years ago when I could not accept the prevalent theory that wireless was propagated by free Hertzian waves. During my work of more than a quarter of a century on the subject of wireless I have found it best to stay down upon the earth and have been able to explain all radio phenomena with the magnetic wave theory.

When the theory was advanced that wireless was propagated by free Hertzian waves, traveling in straight lines like light I could not accept that theory. The early results obtained did not seem to support it and as far as I was concerned it took a lot of explaining to show how signals could travel around the globe.

In my home I set up a small transmitter automatically operated by a clock to give signals at short intervals. Carrying a microphonic receiver around the house to test the signal strength at different distances from the transmitter,

I found that the signal strength was strongest near a lighting fixture, regardless of the distance from the transmitter. There was no doubt the wireless waves were following the conductors provided by the lighting installation.

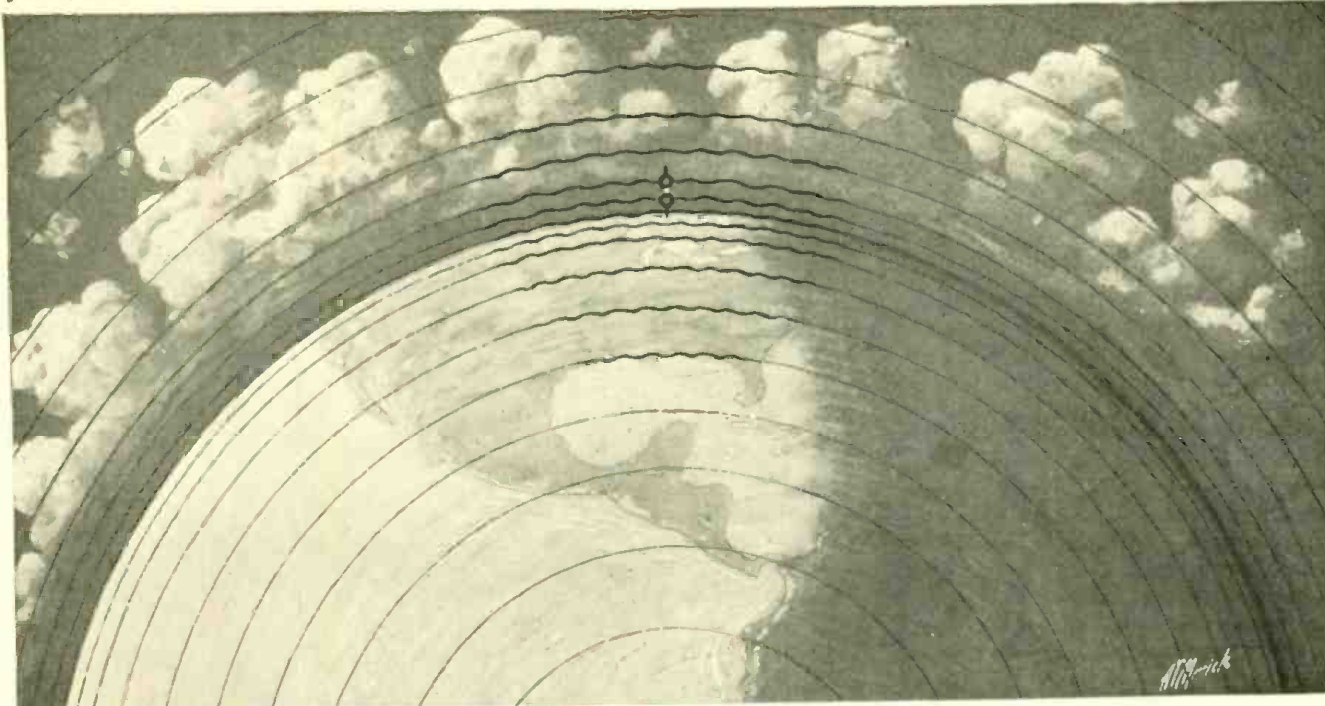
With a "filings" coherer and a bell for a receiver and a buzzer for a transmitter I began experimenting and found that the buzzer would ring the bell a foot away from the coherer. But if a wire of any length was stretched out with one end near the coherer, the buzzer would ring the bell when operated at any point



From a drawing made for POPULAR RADIO by Arthur Merrick

HOW THE MASSIE THEORY COULD BE TESTED

The telegraph line, grounded at both ends, is set up between the transmitting station and the receiving one. A voltmeter inserted in this line registers the potential of the earth currents. This potential will correspond, Mr. Massie believes, with the perfection of radio transmission between the two stations.



From a drawing made for POPULAR RADIO by Arthur Merrick

RADIO IS CARRIED BY THE EARTH'S MAGNETIC FIELD

According to the Massie theory the lines of force of the magnetic field run parallel to the earth's surface. They are disturbed by a radio transmitter, as is indicated in this drawing, by the crinkles in the magnetic lines. These disturbances are propagated along the lines of magnetic force, thus producing the radio phenomena.

along this artificial ground. There was no doubt that the wireless waves followed the conductor. I then formed my grounded magnetic wave theory and in the book* of which I was co-author, I set forth my theory as follows:

"Wireless signals are a wave motion in, or disturbance of, the magnetic forces of the earth, and are propagated through this magnetic field, following the curvature of the earth, just as a tidal wave would follow the surface of the ocean. Practice indicates that the nodal points of the waves are at, or near, the earth's surface."

This theory which I began testing as far back as 1902 and which the work of other investors indicated was the correct theory, I thought had been universally accepted. But the theories now being advanced to explain fading indicate radio scientists are getting back into the air again. Fading can be explained by my theory of grounded magnetic waves and can be definitely settled by certain corporations or by the Federal government which has experimental use of telephone or telegraph lines.

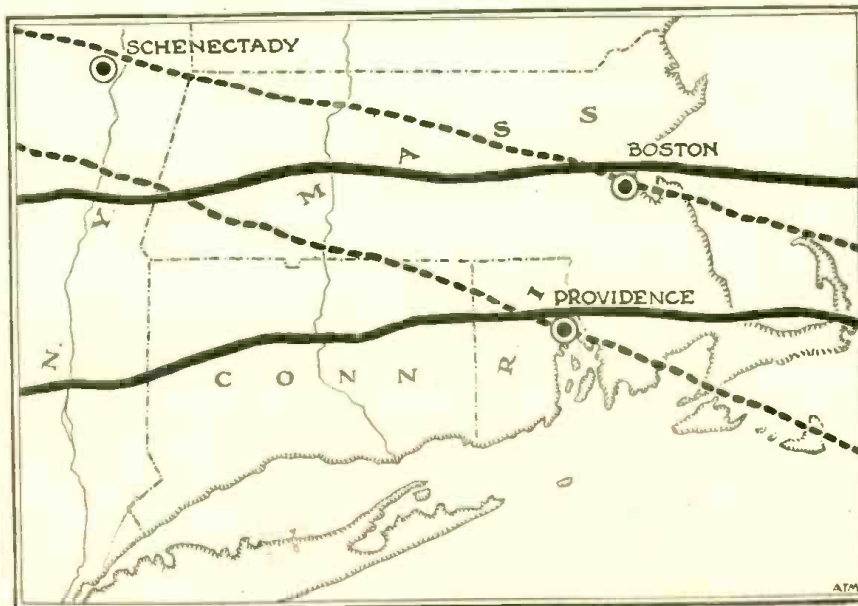
We know there are earth currents, that they vary in strength and that they travel in paths of least resistance. Charts have been made to show the earth current paths.

Every telegraph operator has to contend with these earth currents. If one end of a long telegraph or telephone line

is grounded and the other end tested for voltage it is found at times the potential impressed by the earth currents alone may run into hundreds of volts. As a matter of fact in the operation of long distance telegraph lines it is necessary to watch the earth currents with a great deal of care and adjust accordingly the

current fed into the line from the batteries.

One day in the fall of 1903 when I was installing a wireless station at Point Judith, R. I., the telegraph companies reported the earth currents exceptionally strong. At the same time it was noticed that the wireless reception was



HOW EARTH CURRENTS AFFECT RADIO

When the paths of the earth currents follow the heavy lines western stations will be received well at Boston and Providence. If the direction of the earth currents shifts to that of the dotted lines, Schenectady will be exceptionally strong at Boston. Radio moves best along the lines then being followed by the earth currents.

* "Wireless Telegraphy and Telephony," published 1908.

extraordinarily good, indicating there is a direct connection between earth currents and radio reception.

The stronger the earth currents, the stronger the resultant magnetic field and the greater the distance the radio waves will travel and the greater the strength of signals at the receiver. Earth currents are constantly varying in strength and follow paths according to the conductivity of the earth's strata. When we have compiled enough data on these earth currents, I believe we will have an explanation of practically every radio problem not yet satisfactorily solved.

Of one thing I am certain; it has been demonstrated to my satisfaction, time and again during the past twenty-six years, that there is a very definite relation between the signal strength and transmission distance and the strength of the earth currents. I feel certain that radio waves travel greater distances when following along the earth-current paths. This by itself explains some of the peculiarities of radio reception.

On land, due to the almost constant change that is taking place in the conductivity of the earth-current paths, more current may be traveling at a given time in one path and at another time in another path. These currents vary not only from day to day but also from path

to path. There is nothing about them that seems fixed.

Now let us suppose that on one night the earth currents in the most direct path between the broadcasting station and the receiving station are exceptionally strong, that this path has less resistance than any other path between the two stations. We would then expect to have great signal strength and exceptionally good reception. There is reason to believe this is actually the case.

Suppose, however, that on the following night something has happened to make the strength of the current in this path almost equal to that flowing between the stations by more circuitous paths. The waves that come together after traveling over different paths might not be exactly in place. As a matter of fact those in one path might be lagging behind or leading the others by just the right amount as to counteract each other and there would be no signal at all at the receiver. If the waves from the two paths were slightly out of phase, they would periodically re-enforce and then counteract each other and the signal strength would build up and then fade away.

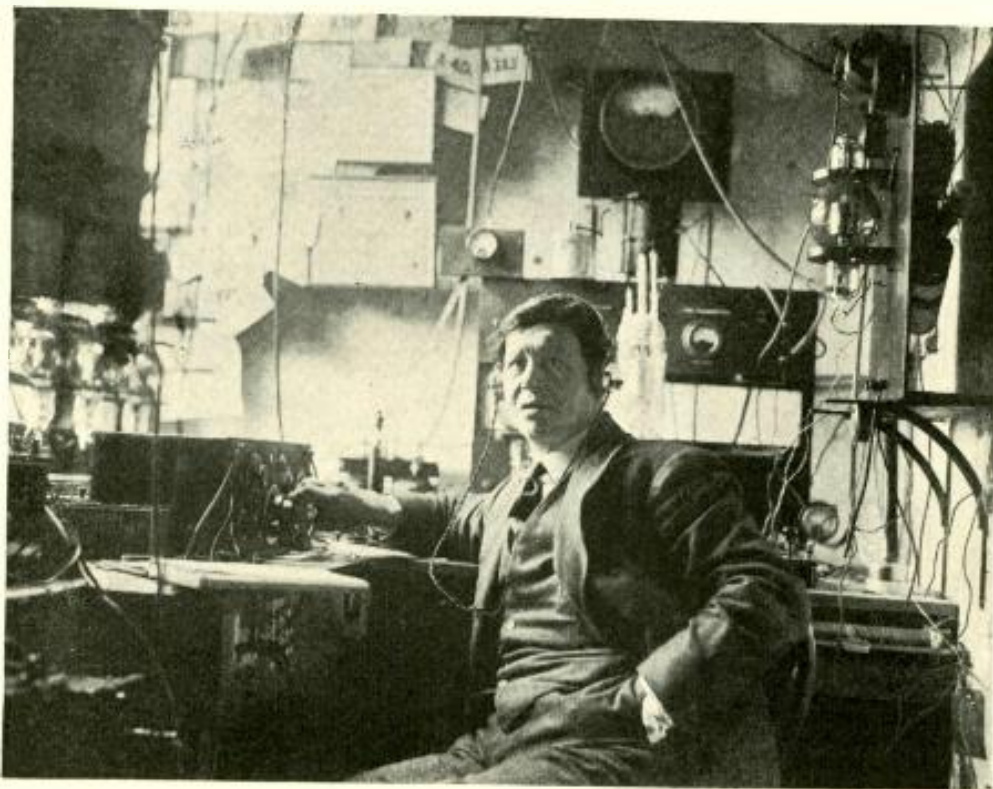
Under these conditions, fading would ordinarily be most pronounced on the most distant stations and less pronounced on those stations nearest the

receiver. However, on account of the peculiarities of earth currents and their paths and the great number of things that may affect these currents and their paths this could not be adopted as a universal rule.

I am not trying to advance a proved theory; I am merely submitting an idea that I believe is worth careful thought and extensive investigation. It is obvious that the simple experiments I conducted to satisfy myself that radio waves are really grounded magnetic waves would not suffice to demonstrate that fading is caused by earth currents. Much more study must be given to earth currents than has ever been given before. A vast amount of data we do not now possess must be compiled.

It will require extensive research over a wide area to establish this idea as a theory. I believe, however, that work along this line is along the right line, and that it is possible to establish positive proof of my claims.

Therefore, I pass along the idea with the hope that it will be taken seriously by enough investigators to enable us, during the next few years, to gain the knowledge of earth currents and their relation to radio that is necessary to establish it as a proved theory—a theory that will show in a sound and satisfactory manner the cause of fading.



ENGLAND'S BEST-KNOWN "HAM"

Thousands of American amateurs are familiar with the signals of Mr. Gerald Marcuse (2 NM). Here is the radio shack from which they come at Caterham, Surrey, England. Mr. Marcuse's receiving apparatus is shown at the left of the picture, while just to the right of his head may be seen the huge quartz tube used in many recent transmissions.