The Radio Science

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THE youngest of all our sciences—the science of radio—now less than thirty years old, has perhaps made greater strides than any other branch of physics in the history of the world. When we consider that less than thirty years ago, the word wireless had not been invented, and if we look closely about us today, and see what great changes have been wrought by the young giant, we are struck with wonderment and awe, but when we contemplate the wonders of the new art, we as a rule pay little attention to the whole.

Most people, particularly in these days of radio broadcast, are wont to think that when the word radio is mentioned, it means nothing but a concert or a speech broadcasted by radio telephony, or perhaps a message flung into space by radio telegraphy. To the scientist, however, these two branches of radio are today the least important. It is true that new achievements are being evolved every day in radio telegraphy and radio telephony, but the fundamentals of these two branches remain roughly the same. The waves which our broadcasting stations are sending out today are not much different from those of Marconi's early days, with the exception that Marconi used the so-called damped or interrupted waves, whereas we now use the undamped, or continuous waves. The broadcast feature is only a stunt or variation of something that has been known for over a decade. We could have had broadcast entertainments ten years ago, but no one had thought of doing it.

Poulsen invented the first radio telephone in 1902, but it never came into practical use by the public at large. While interesting to the general public, radio telephony holds little to interest the scientist because there are few features in it that have not been well known for many years. There are, however, other phases that are today of great interest to the scientist, and which will be of the greatest interest to the public, once it takes hold of the ideas and sees its possibilities.

We have, for instance, a distinct branch in radio termed radio-telemechanics. This art embraces all subjects where objects are caused to move without the use of wires or other connected means, by radio waves. We have thus the radio controlled automobile that is steered from a distance, and the United States Navy even has experimented with the radio controlled battleship not so long ago when one of the big ships was started, steered and stopped in a well defined manner in the open ocean. It is possible and entirely feasible today to send ships across large bodies of water such as lakes, and even oceans, without a human soul on board. All controls, whether it be the rudder, propeller, or steering device, are regulated by radio. It is possible to thus steer a ship clearly across the ocean in as safe a manner as if the captain and crew were aboard for protection. The ship will send out hourly signals by which its path can be plotted by the shore observer for the entire route. In order to avoid collisions, fog horns can be sounded every five minutes for the entire trip, because no means have yet been found to tell by apparatus the existence of a fog on the distant ocean. For that reason the fog horn would sound in broad daylight as well. These, of course, are only suggestions of what can be done. In war time the art of radio-telemechanics is of tremendous importance.

Future wars will be fought not with men but with machines. Ships and airplanes will be sent out without crews, while battleships will bombard the enemy fleet by radio if necessary. The course and maneuvers of the battleship will be guided from a distant airplane. The airplane observer could plot, for instance, the location of the enemy fleet, and charge the firing range of his own ships, while we can send radio guided airplanes over the enemy fleet, or over the enemy territory and drop bombs at will, all by radio.[1] The more horrible such an idea becomes, the better, for the reason that if war comes to a stage where it is too terrible, there will be no more wars. It will be the best insurance against war.

One of the latter day inventions in radio is the exploration of the earth by means of radio waves. A new branch in radio has lately been created—the art of radio prospecting. In Germany, where coal mines are becoming more and more depleted, new veins are found by means of radio waves. These are sent underground, and by means of certain instruments it is possible for observers to note when the sounds received in their receivers are not of the usual intensity, and by means of charts and other devices the location of the coal veins can be readily ascertained. The soundings, therefore, are made entirely by radio waves. Of late, in Italy the same thing has been done in prospecting for ores. By means of super-sensitive vacuum tubes and certain condenser arrangements, radio waves affected by mineral deposits are received thru the ground, and it

[1] Joseph P. Kennedy, Jr., the oldest brother of John F. Kennedy, was killed in World War II attempting just such a maneuver. Operation Aphrodite called for a pilot to fly a B-17 Flying Fortress packed with explosives close to a bombing site and parachute away from the craft before it was remotely piloted *into* the target using radio control and two television cameras mounted on the dashboard. In the case of Kennedy's plane, the explosives detonated prematurely. Ed Grabianowski, "The Secret Drone Mission that Killed Joseph Kennedy Jr.," *io9*, February 21, 2013, http://io9.com/5985733/the-secret-drone-mission-that-killed-joseph-kennedy-jr.

becomes a simple matter to locate new mines. It is even possible to correctly judge the depth of the mineral deposits by means of radio waves. This branch of radio bids fair to become an exceedingly important one. It will not only be useful in locating hidden mineral deposits, but buried treasures as well. It will no doubt be used also to locate sunen ships in the ocean when the time comes. At the present moment, it is almost impossible to accurately determine the position of a sunken ship. Radio will prove a great boon here, because the ship can then be found with absolute accuracy.

It may come as a surprise to most people that radio waves are material. Once upon a time there was a theory that radio waves were nothing but an electro-magnetic disturbance in the ether. We are slowly but surely coming away from this. We are leaving behind us the ether, which we do not find necessary any longer. On the other hand, recent discoveries tend to prove that radio waves are just as material as an ocean wave. Because we cannot see a radio wave does not prove that it is non-material, and its weight may be so small that to express it in figures would stagger the imagination, but it certainly is material, the same as a light wave is material. This is not theorizing but stating facts as we understand them today.

From sending out radio waves as we do today, the next step naturally will be sending out power by radio, long predicted by Tesla and other investigators. When we look at the sun and think how many billions of horse-power are sent out every second, by means of light waves, we have no reason to refuse belief that radio waves do likewise, once we knew the key to the problem. There will be much less loss in energy when we send out radio waves, because when we use no conductor there is no resistance, such as exists in ordinary conductors. Of course, we have not today succeeded in developing the transmission of power, but we already do know that radio waves sent out by means of a few dry cells, and a spark coil, may travel all around the earth and further. We know this because as we increase the sensitivity of our receiving apparatus our receiving range becomes greater and greater. Thus, for instance, in recent tests, we have seen where amateur stations operated by less than one kilowatt were heard clearly in Europe where to cover the same distance, the commercial radio companies use over 1,000 kilowatts.

If radio waves are material, the next logical step naturally would be sending materials by radio, a not at all impossible prediction. As we come to understand our electronic world to a higher degree, we know that a piece of copper and a piece of bread are identically the same substance in every way except that the electrons and nuclei are grouped differently. It is then not impossible to predict that once we have the key, we can send a carload of coal across the ocean by radio if we so desire. We are still a long way off from the solution of such a problem, but we are getting nearer to it. We are already doing this same thing in laboratory experiments, where X-rays are used, which rays are particles of matter and which are shot out into space, passing easily thru walls or iron doors as if these did not exist.