Short Electromagnetic Waves of Wave-length up to 82 Microns.

UP to the present date, short electromagnetic waves have been generated only by the method of the Hertz vibrator. This method offers very serious difficulties when we try to produce electromagnetic waves of the smallest possible length, as the vibrator burns out very soon, so that the amount of the energy and the length of the waves produced do not remain constant, and also as the length of the waves decreases slowly, if the dimensions of the vibrator are diminished, when we approach the region of the very shortest waves. The experiments of many investigators who have tried to fill the interval between the short electromagnetic waves of Lebedew and the long heat-waves of Rubens, have proved how difficult it is to obtain the shortest electromagnetic waves by the Hertz method, and have shown the necessity of finding a new method.

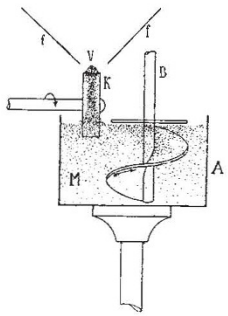

FIG. 1.—Paste radiator.

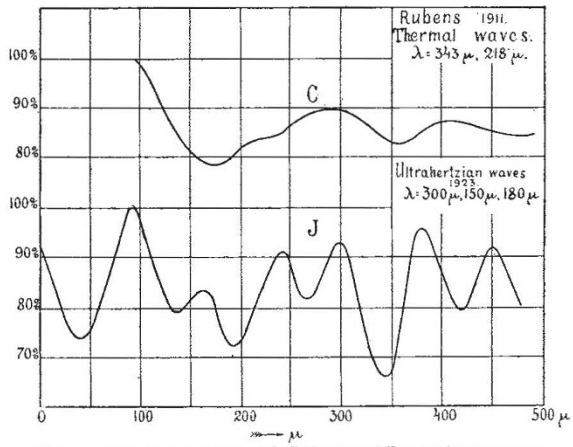

FIG. 2.—Interference curves: C, Rubens and Baeyer heat-waves; T, electromagnetic waves, obtained by the author.

Ten years ago Prof. W. Arkadiew had hinted at a new method of producing short electromagnetic waves. In order to increase the energy of short electromagnetic waves, it is necessary to substitute for the single Hertz vibrator a number of small vibrators. To avoid the burning out of the vibrators it is necessary to change them frequently.

I have now completed the construction of such a type of wave generator. The receptacle A (Fig. 1) is filled with a mixture of brass or aluminium filings and viscous mineral oil. This mixture is agitated by a constantly working mixer B and gets into the state of a uniform pap-like paste—the "vibratory substance." By a small rotating wheel K, made of carbolite, this vibratory substance is taken out of the receptacle and covers the wheel in the form of a sticky tyre. The wires, ff, convey the high-tension current from the induction coil in such a way that the discharge takes place through the vibratory substance in the tyre on the wheel at V. As the investigation has shown, such a source of radiation—a "paste radiator"—sends out short electromagnetic waves of various lengths, depending mostly upon the size of the metallic grains. The different wave-lengths in the present case are also due to the not very precise sifting of the filings taken for the vibratory substance.

To detect the waves, thermo-elements of seven different types were used. The measurement of the wave-lengths was carried out by the method of Boltzmann mirrors. In Fig. 2 are shown the interference curves of the Rubens and Baeyer heat-waves (curve C) radiating from the quartz lamp, and the electromagnetic ultra-Hertz waves (curve J) which were obtained by the writer from a paste radiator in the same region of the spectrum of the electromagnetic waves. An harmonic analysis of the interference curves obtained at various conditions of the experiment has shown that the length of the waves from the new source is as follows: $\lambda = 50, 48, 40, 24, 20, 13, 12, 8, 6{\cdot}7, 6, 4{\cdot}8, 4{\cdot}4, 2{\cdot}8, 2{\cdot}6, 1{\cdot}8, 1{\cdot}2, 0{\cdot}9, 0{\cdot}8, 0{\cdot}55, 0{\cdot}45, 0{\cdot}35, 0{\cdot}30, 0{\cdot}28, 0{\cdot}225, 0{\cdot}20, 0{\cdot}18, 0{\cdot}15, 0{\cdot}129, 0{\cdot}082$ mm.

In this way, the waves radiated by the paste radiator lie between the short electromagnetic waves of Nichols and Tear on one side, and the Rubens heat-waves on the other, and so fill the interval that has hitherto existed in the scale of the electromagnetic waves (Fig. 3).

Of special interest is the circumstance that the waves sent out by the paste radiator possess considerable energy, which is proved by the possibility of using measuring instruments of ordinary sensibility. These waves are the results of independent electric oscillations in very small vibrators, and are not overtones of a vibrator or resonator, as has usually been the case in experiments of investigators studying this question. The source of radiation due to the essence of the paste vibrator approaches the sources of radiation of heat and light waves: it forms the transition from the radiation of an individual Hertz vibrator to the total radiation of an aggregation of molecules in a heated body.

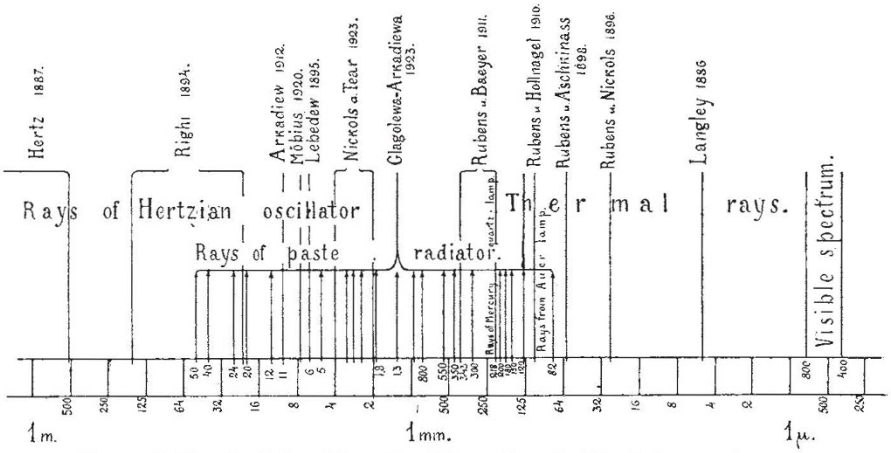

FIG. 3.—Position of radiation of the paste radiator on the scale of the electromagnetic waves.

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