
NOTES AND DISCUSSION

Franklin's Discovery of the Electron

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IN celebrating the anniversary of the discovery of the electron, it is a mistake to concentrate attention solely on J. J. Thomson's paper of 1897. I do not in any way underestimate the importance of that paper in bringing about general acceptance of the electron theory of matter, through the evidence presented in it for the existence of a charged particle of *mass* about 1/1000 the mass of the hydrogen atom. However, to this particle Thomson gave the name "corpuscle," rather than electron, doubtless because the word "electron" had already been assigned by G. Johnstone Stoney to the hypothetical *atom of electricity*, that is, of electric charge, whether that charge is positive or negative. The existence of this atom of charge, or of the atomic constitution of electricity, was asserted with great clarity by Benjamin Franklin because of experiments begun in 1747, so that 1947 is both the 200th anniversary of Benjamin Franklin's discovery of the existence of an atom of electric charge and the 50th anniversary of J. J. Thomson's proof of the existence of a charged particle whose mass, as he then phrased it, was about 1/1000 that of the hydrogen atom.

These two conceptions have unfortunately been confused in much modern writing, though Thomson was careful to use the word "electron" in its original sense as an atom of charge, not of mass, and to call cathode rays a stream of "corpuscles." The most authoritative writers have continued to use the term "electron" to mean an *element of charge*, as G. Johnstone Stoney first defined it in publications in 1874, 1881 and in 1891.¹

How unambiguously Franklin conceived his theory of electricity and described the most important properties of the electrical atom is shown by the following quotation from his letter to Peter Collinson in his book published in 1774.²

1. The electrical matter consists of particles extremely subtle, since it can permeate common matter, even the densest metals, with such ease and freedom as not to receive any perceptible resistance.

2. If any one should doubt whether the electrical matter passes through the substance of bodies, or only over and along their surfaces, a shock from an electrified large glass jar, taken through his own body, will probably convince him.

3. Electrical matter differs from common matter in this, that the parts of the latter mutually attract, those of the former mutually repel each other. Hence the appearing divergency in a stream of electrified effluvia.

4. But though the particles of electrical matter do repel each other, they are strongly attracted by all other matter.

5. From these three things, the extreme subtilty of the electrical matter, the mutual repulsion of its parts, and the strong attraction between them and other matter, arise[s] this effect, that, when a quantity of electrical matter is applied to a mass of common matter, of any bigness or length, within our observation (which hath not already got its quantity) it is immediately and equally diffused through the whole.

6. Thus common matter is a kind of sponge to the electrical fluid. And as a sponge would receive no water if the parts of water were not smaller than the pores of the sponge; and even then but slowly, if there were not a mutual attraction between those parts and the parts of the sponge; and would still imbibe it faster, if the mutual attraction among the parts of the water did not impede, some force being required to separate them; and fastest, if, instead of attraction, there were a mutual repulsion among those parts, which would act in conjunction with the attraction of the sponge. So is the case between the electrical and common matter.

7. But in common matter there is (generally) as much of the electrical as it will contain within its substance. If more is added, it lies without upon the surface, and forms what we call an electrical atmosphere, and then the body is said to be electrified.

I think the foregoing quotation clearly establishes the right of Benjamin Franklin to be considered the discoverer of the atom of electricity. *The world has recently and properly celebrated the year 1947 as both the 200th anniversary of Franklin's discovery of the electron and the 50th anniversary of J. J. Thomson's unambiguous establishment of the electron theory of matter.*

¹ See also R. A. Millikan, *Electrons (+ and -), protons, photons, neutrons, mesotrons and cosmic rays* (Univ. of Chicago Press, 1947), pp. 332-333.

² *Experiments and observations on electricity, made at Philadelphia in America, by Benjamin Franklin, L.L.D. and F.R.S. Member of the Royal Academy of Sciences at Paris, of the Royal Society at Göttingen, and of the Batavian Society in Holland, and President of the Philosophical Society at Philadelphia. To which are added, letters and papers on philosophical subjects. The whole corrected, methodized, improved, and now collected into one volume, and illustrated with copper plates.* (London, ed. 5, 1774), p. 54. The quotation may also be found in I. B. Cohen's edition (Harvard Univ. Press, 1941), p. 13.

A Convenient Viscosity Apparatus

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THE apparatus described herein has been found to be quite satisfactory for sophomore students and is sufficiently sensitive to indicate a change in the viscosity of