The numerous experiments on the magnetization of ferromagnetic substances at different temperatures were for the most part qualitative, till decided advance in the quantitative determination was made by the researches of Hopkinson and Curie. Although the former used the ballistic method and the magnetizing field was not strong, he did not fail in bringing into light the principal features of the change in magnetization near the critical temperature. The latter utilized the mechanical force brought into play, when a ferromagnetic body is placed in a heterogeneous field. The magnetization can hardly be uniform throughout, but the method was well adapted for heating the substance beyond the melting point and in examining its magnetic quality in fields scarcely attainable by means of a magnetizing coil. It would be superfluous to enter into the discussion of the advantages and disadvantages of the methods and arrangements employed by Hopkinson and Curie, suffice it to remark, that the magnetometric method is after all the best suited for the investigation of the change of magnetization near the critical temperature. We are however beset with difficulties in arranging the magnetizing coil and the heating
apparatus within a small compass, insuring at the same time the uniformity of the field and of temperature.

The method adopted in the present experiment admits of examining the magnetization at different temperatures up to 1200° C, either by keeping the external magnetizing field constant, or in varying fields, by means of a magnetometer. A magnetizing coil 40 cm. long was waterjacketed and the inner face of the core protected by thick asbestos paper. A burner, composed of three branching copper tubes, covered with asbestos, was placed in the coil, and fed with gas and blast. The fine jets of flame issued horizontally, and played on the outer cover of the ferromagnetic ovoid, 1 cm. thick and 20 cm. long. A platinum rhodium-platinum junction was brought in contact with the ovoid at its thickest part, while the rest was insulated with asbestos paper. The ovoid, together with the element leaving its extremities outside, was thickly coated with asbestos, so that the temperature variation of the ovoid was very small even at a temperature of 1000° C. The ovoid was placed vertically in the middle of the coil. A magnetometer suspended by a quartz fibre was placed in such a position that the effect of a small vertical displacement of the ovoid was quite negligible. On the other side of the magnetometer, symmetrical with the magnetizing coil, was placed another coil of the same strength, to compensate the effect of the coil on the magnetometer. The temperature of the ovoid was measured by means of d'Arsonval galvanometer, and the constant of the pyrometer was tested by means of mercury thermometer at about 300° and by the melting point of
sodium chloride at 780°.

The principal results obtained may be summed up in the following words:—

(1) The susceptibility of iron, nickel, cobalt, and steels increases up to a certain temperature and then decreases quite rapidly and vanishes almost asymptotically. Steels show generally several maxima and minima, some of which seem closely related to reccalescence.

(2) The critical temperature depends on the strength of the magnetizing force and is generally high in strong fields.

(3) Keeping the field constant and heating the ferromagnetic substance above the critical temperature and then cooling, it will not be magnetized at the critical temperature for heating, but only at a much lower temperature. The critical temperatures for heating and cooling sometimes differ by 200°.

(4) In moderate fields, the critical temperature by heating for Iron is about... 780°
   „ Nickel ... ... ... ... 430°
   „ Cobalt ... ... ... ... 1100°
   „ Ordinary Steel ... ... ... ... 800°
   „ Wolfram Steel ... ... ... ... 900°

(5) Of the ferromagnetic substances here examined, annealed cobalt is most affected by temperature. The magnetization at ordinary temperature is nearly half of that at 500°, which is 600° lower than the critical temperature.
(1), (2), (3) admit of easy explanation by means of a molecular theory.

Recalcescence can be easily observed with a piece of wolfram steel rod. Heating it by the burner before mentioned to about 800°, and leaving it exposed to air and observing the dazzling metal in the dark, we first notice a taint of dusky hue at both extremities, which gradually spreads upwards and downwards, just as a diluted ink soaks into a red blotting paper. The darkness gradually advances both ways, but with lapse of time, the ends of the rod begin again to brighten. It resembles somewhat the colour of a setting sun just issuing out of a thick cloud; that part of the rod, which was a few minutes before scarcely visible, becomes tinged with red, and the clouds recedes towards the middle, where they meet and disappear. The sombre red then prevails throughout the reheated rod, till it fades into a faint glimmer and ends in complete darkness.