is turned upon this rod, there is at first a sudden deflection of twenty magnetometer-scale-divisions to the left, the spot afterwards moving slowly and steadily towards the right. When the light is shut off there occurs at once a jump of twenty divisions further towards the right before the spot begins to move back in the zero direction.

Some attempts have been made to repeat the experiments with light polarised by means of a Nicol's prism; but, either because the largest prism at my disposal was too small (its aperture being barely 2 cm.), or because too much of the radiant energy was absorbed by the spar, I failed to get any magnetic effects whatever with the prism in either position.

[Professor Silvanus Thompson has quite recently been kind enough to lend me a very large and excellent Nicol's prism. From a few experiments already made with this instrument it appears that the action of the light is quite independent of the plane of polarisation.—March 16.]

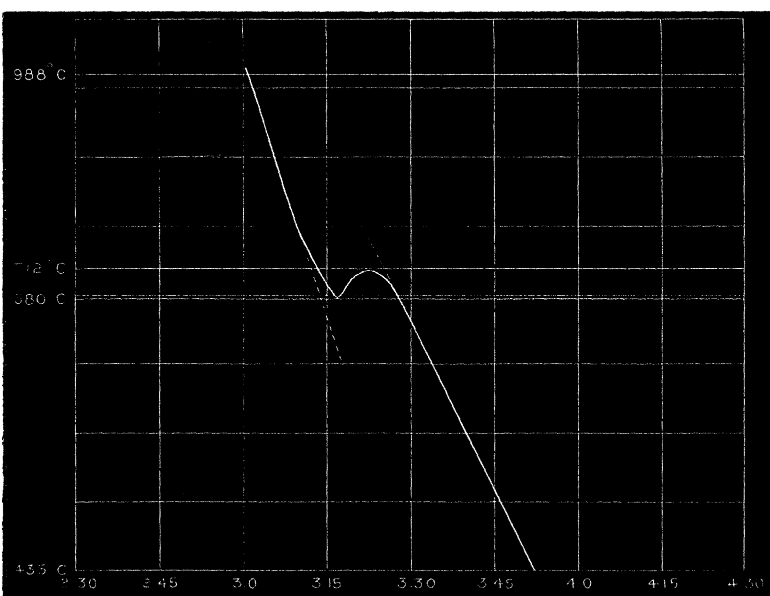
There can be no doubt whatever of the reality of the effects here described: they are perfectly distinct, and are at any time reproducible with certainty. The only question is how much of them is primarily caused by the action of light, and how much by mere incidental change of temperature. But taking all the circumstances into consideration, I think the evidence is in favour of the conclusion that the *instantaneous* magnetic change, which occurs when a prepared iron bar is illuminated, is purely and directly an effect of radiation.

## IV. "Recalescence of Iron." By J. Hopkinson, F.R.S.

Received March 7, 1889.

Professor Barrett has observed that if an iron wire be heated to a bright redness and then be allowed to cool, that this cooling does not go on continuously, but that after the wire has sunk to a very dull red it suddenly becomes brighter, and then continues to cool down. He surmised that the temperature at which this occurs is the temperature at which the iron ceases to be magnetisable. In repeating Professor Barrett's experiments, I found no difficulty in obtaining the phenomenon with hard steel wire, but I failed to observe it in the case of soft iron wire, or in the case of manganese steel wire. It appeared to be of interest to determine the actual temperature at which the phenomenon occurred, and also the amount of heat which was liberated. Although other explanations of the phenomenon have been offered, there can never, I think, have been much doubt that it was due to the liberation of heat owing to some change in the material, and not due to any change in the conductivity or emissive power. My method of experiment was exceedingly simple. I took a

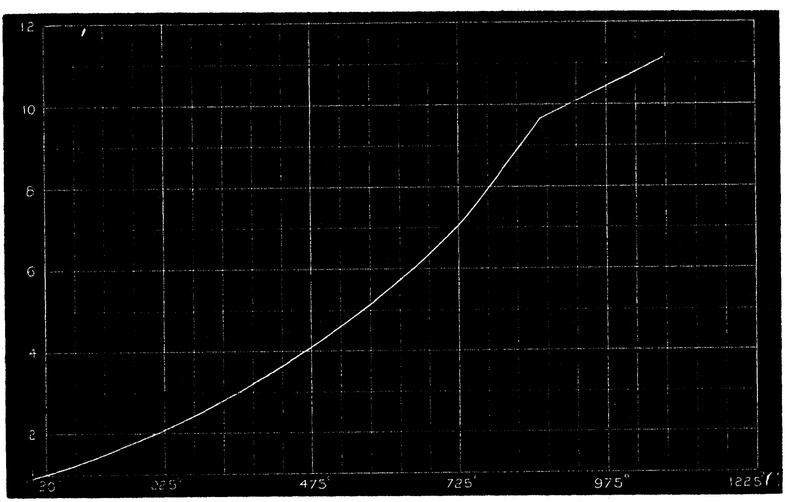
cylinder of hard steel, 6·3 cm. long and 5·1 cm. diameter, cut a groove in it, and wrapped in the groove a copper wire insulated with asbestos. The cylinder was wrapped in a large number of coverings of asbestos paper to retard its cooling, the whole was then heated to a bright redness in a gas furnace, was taken from the furnace and allowed to cool in the open air, the resistance of the copper wire being from time to time observed. The result is plotted in the accompanying curve, in which the ordinates are the logarithms of the increments of resistance above the resistance at the temperature of the room, and the abscissæ are the times. If the specific heat of the material were constant, and the rate of loss of heat were proportional to the excess of temperature, the curve would be a straight line. It will be observed that below a certain point this is very nearly the case, but that there is a remarkable wave in the curve. The temperature was observed to be falling rapidly, then to be suddenly retarded, next to increase, then again to fall. The temperature reached in the first descent was 680° C. The temperature to which the iron subsequently ascends is 712° C. The temperature at which another sample of hard steel ceased to be magnetic, determined in the same way by the resistance of a copper coil, was found to be 690° C. This shows that within the limits of errors of observation the temperature of recalescence is that at which the material ceases to be magnetic. This curve gives the material for determining the



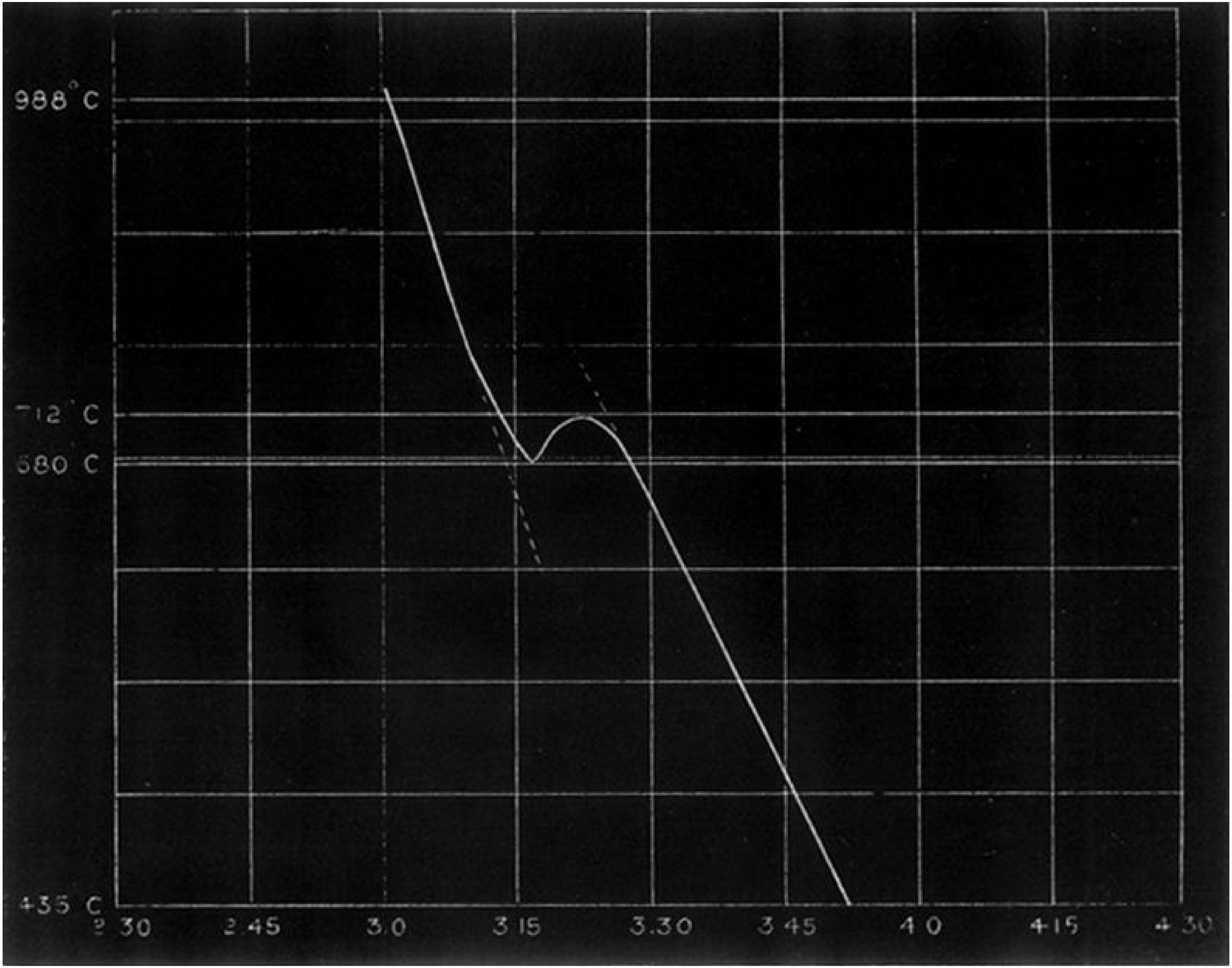
quantity of heat liberated. The dotted lines in the curve show the continuation of the first and second parts of the curve, the horizontal distance between these approximately represents the time during which the material was giving out heat without fall of temperature. After the bend in the curve the temperature is falling at the rate of 0·21° C. per second. The distance between the two curves is 810 seconds. It follows that the heat liberated in recalescence of this sample is 173 times the heat liberated when the iron falls in temperature 1° C. With the same sample I have also observed an ascending curve of temperature. There is in this case no reduction of temperature at the point of recalescence, but there is a very substantial reduction in the rate at which the temperature rises.

## V. "Electrical Resistance of Iron at a High Temperature." By J. HOPKINSON. Received March 14, 1889.

Auerbach, Callendar, and I think also Tait, have observed that the temperature coefficient of electrical resistance of iron is abnormally high. So far as I know no one has pushed his observations to the temperature at which iron ceases to be magnetic.




The accompanying curve shows the results of experiments made upon a very soft iron wire. The abscissæ are the temperatures as estimated by the resistance of a copper wire, the ordinates represent the resistance of the iron wire having unit resistance at 20° C. It



988° C
712° C
680° C
435 C
2.30
2.45
3.0
3.15
3.30
3.45
4.0
4.15
4.30