We have made no attempts to ascertain the chemical properties of this modified gas, and there are other points which we should have liked to develop before publishing an account of our experiments, but as one of us is leaving Cambridge for Australia it seemed advisable to publish an account of the experiments we have been able to make together.

We are indebted to Mr. Robinson for advice on some chemical points, and we cannot conclude without acknowledging how much we owe to the zeal and ability of Mr. Sinclair, the Assistant at the Cavendish Laboratory, who has done much the greater part of the large quantity of glass-blowing required for this investigation.

II. "Some Experiments on the Production of Ozone."

By J. J. Thomson, M.A., F.R.S., Fellow of Trinity College, and Cavendish Professor of Experimental Physics in the University of Cambridge, and R. Threlfall, Caius College, Cambridge, and Professor of Experimental Physics in the University of Sydney. Received May 1, 1886.

The first experiment was made in order to see whether ozone could be formed by placing oxygen in a very strong electric field, the field, however, being just not strong enough to cause sparks to pass through the gas.

This experiment finally took the following form:—ABC is a box made of flat pieces of glass about $\frac{1}{16}$th of an inch thick, fastened together with paraffin; into the box two glass tubes, G and H, are inserted, the air entering the box through G, and leaving it through H. Against one side of the box a glass bottle, D, with flat sides, is placed and filled with water containing a little sulphuric acid, this serves as one electrode; the other electrode is a blackened tin plate, E, placed against the opposite side of the box, the distance between the electrodes being an inch and a half. The two electrodes are connected with the terminals of a Holtz machine. By altering the distance between the terminals any difference of potential can be produced between the plates. When the terminals are close together all the sparks pass between them, but when they are pulled far apart the sparks flash across the box, the discharge taking the form of a great number of separate sparks from the inside of one plate to the inside of the opposite one; the appearance of the box when the discharge passes is very pretty, it looks as if several hundred bright silver nails with broad heads were connecting the insides of the box.

The air entered the box through the tube G, having previously passed through a series of tubes and bottles filled respectively with

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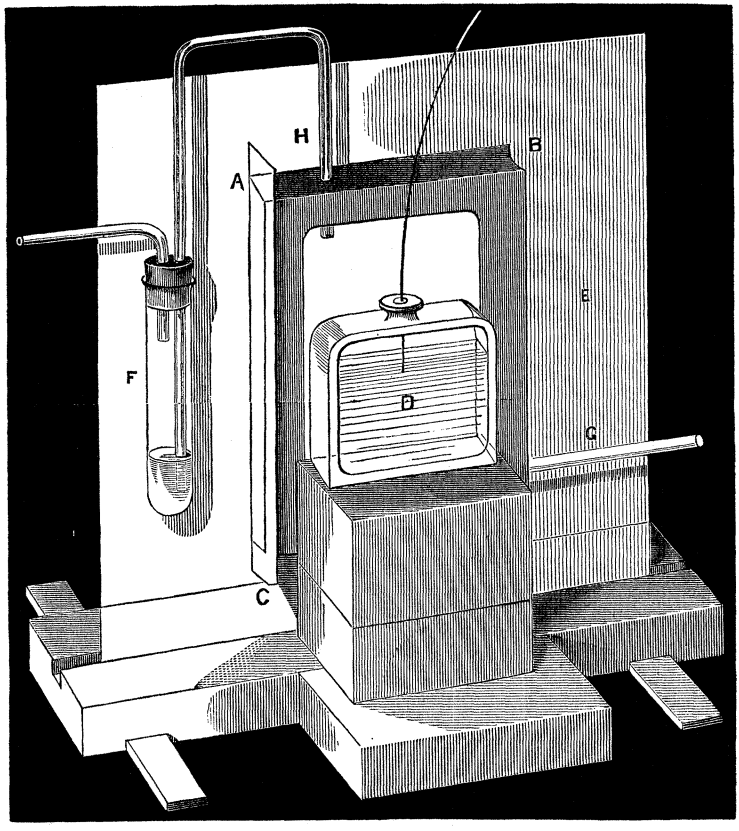
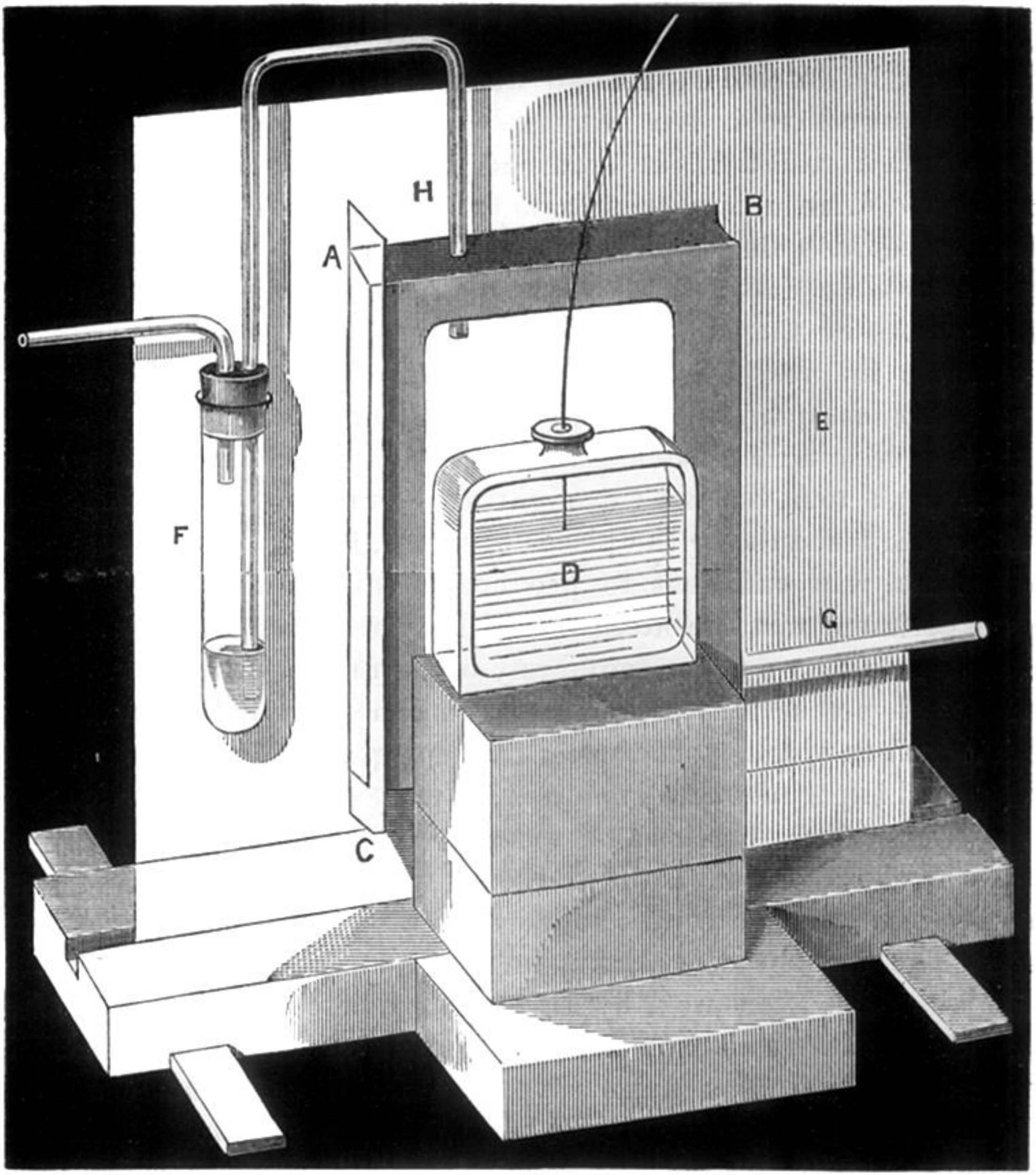


phosphorous pentoxide, pumice moistened with sulphuric acid, and caustic potash; it was also freed from dust by passing through a tube containing a plug of cotton-wool. After passing through the box it bubbled through a test-tube, F, containing an iodide of potassium and starch solution, pieces of filter-paper moistened with this solution were also fastened to the sides of the box. We determined the most sensitive solution of potassium iodide and starch by adding a constant quantity of chlorine-water to various proportions of potassium iodide and starch; when the most sensitive solution had been determined it was always made up of this strength. We found that the papers were quite as delicate a test of ozone as the test-tube full of the solution.

When the observations were being made the whole arrangement was placed inside a large wooden box, the sides of which were blackened, the observer put his head through a hole in one of the

sides of the box, and a black velvet cloth was then put over the box so that all stray light was excluded, and any spark traversing the box could easily be detected. The air was sucked through the box at the rate of about a litre in ten minutes. Before trying the experiment air was sucked through for about half an hour when the electrodes were at the same potential; but not the slightest colouration of the potassium iodide solution in the test-tube or on the pieces of paper in the box could be detected. We then adjusted the distance between the terminals of the Holtz machine so that the sparks just did not pass across the vessel, in this case the terminals of the Holtz were about 4 inches apart, so that the field was as intense as it could be without producing a discharge. Air was then sucked through for more than an hour, but not the slightest colouration could be detected in either the test-tube or the pieces of paper, though the passage of a single flash was sufficient to produce a most distinct colouration. This experiment was repeated over and over again, but always with the same result; we never found any ozone unless we had previously seen a flash across the vessel, hence we conclude that ozone is only produced when sparks pass through the oxygen.

A special experiment was made in order to estimate the delicacy of the test for ozone: to the same quantity of the solution of iodide of potassium as that through which the air bubbled on its way out from the vessel, chlorine-water was added until we could detect a discolouration. The amount of chlorine in the quantity of chlorine-water added was then determined by finding the quantity of iodine set free by 10 c.c. of it. This was done by means of some very carefully prepared solution of sodium hyposulphite, kindly made up and standardised for us by Mr. M. M. Pattison Muir. From the minimum quantity of chlorine required to produce a discolouration of the solution, we found that the smallest quantity of ozone we could detect with certainty was 0·0384 mgram. But 6 litres of air, that is 1·5 litres of oxygen, had passed slowly through the apparatus and, since no discolouration was produced, the amount of ozone formed must have been less than 0·0384 mgram., or less than 0·00016 of the whole quantity of oxygen which had passed through the apparatus. In the second experiment we took an ozonizer made of two concentric tubes, and sealed up in it air free from ozone and a large quantity of phosphorous pentoxide, this was left for three months, so that at the end of the time the air was presumably dry; on causing the electric discharge to pass through it, however, ozone was produced in large quantities, so that ozone is produced when an electric spark passes through very carefully dried oxygen.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