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Apparatus for Determining the Stability of Oils --  
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*Ellen H. Richards.*

[From "TECHNOLOGY QUARTERLY," Vol. IV., No. 4, December, 1891.]

*AN APPARATUS FOR DETERMINING THE LIABILITY  
OF OILS TO SPONTANEOUS COMBUSTION.*

BY ELLEN H. RICHARDS.

In 1877-79 the New England Cotton Manufacturers' Association and the Boston Manufacturers' Mutual Fire Insurance Company took up the question of the conditions under which the oxidation of oils, dye-stuffs, etc., in contact with easily inflammable materials, such as cotton in bales, cotton waste, rags, etc., was most likely to occur, with a view to better protecting themselves from loss and to insure a more efficient inspection. The problem was submitted to Professor Ordway, of the Institute of Technology, who suggested a form of laboratory apparatus to experimentally determine the facility with which oils oxidize under favorable conditions. From the results of the investigations of Mr. William B. Allbright, Class of '77, and Mr. Frederick W. Clark, Class of '79, a process was perfected which has been used by me ever since in determining all test cases which have come up in connection with this Insurance Company.<sup>1</sup> The first general conclusions were stated by Professor Ordway, under whose direction the experiments were carried on, in the Proceedings of the New England Cotton Manufacturers' Association, October 30, 1878 (No. 25). The final report was made December 1, 1884, in Special Report No. 18, Boston Manufacturers' Mutual Fire Insurance Company.

The requirements of an apparatus for laboratory use, *i.e.*, not too large, safe for use in an ordinary room, enabling a test to be made in

<sup>1</sup> At that time the only available records of experiments were those of Coleman in Glasgow and Dollfus in Alsace, published in the Bulletin of the Industrial Society of Mulhouse. The description of the apparatus and quantities used in these experiments was rather meager.

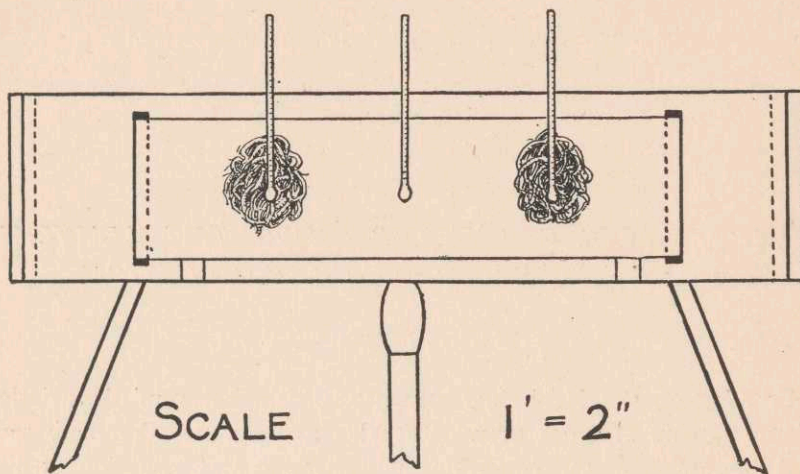
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a working day of eight hours, easily managed and capable of giving uniform and reliable results, are fulfilled in the one shown in the following sketch :



The apparatus consists of a six-inch wrought-iron tube of thick gas pipe, two feet long, closed at each end by discs of wood ; a four-inch tube of thin sheet iron closed at each end with an over-lapping metal cover is contained in this, leaving an inch air-space around it and three inches at the ends. Both tubes are perforated for the insertion of the three thermometers. The apparatus may be conveniently supported upon tripods, and is heated by a Bunsen burner placed midway between the ends. The entire apparatus may be inclosed in a shield if the place is draughty. The diameter of the inner tube permits the use of fifty grams of cotton waste (such as is used to clean machinery), to which is added an equal weight, fifty grams, of the oil to be tested. The oil is evenly distributed by careful manipulation, the waste rolled compactly but not too tightly, and pushed into the end of the tube, which it should fill so that gentle pressure is required to move it. The bulb of the thermometer is now carefully inserted into the middle of this ball. The metal cover, which should fit loosely so as to admit a little air, but affording protection from currents, is put on, and then the outer cover of wood. A blank of unoled waste is placed under the same conditions in the other end. The thermometer in this blank should not be permitted to rise above  $100^{\circ}$  or  $101^{\circ}$  C. at the most. To have it reach this temperature, the middle thermometer must be



kept at about 125°. Since the balls of waste are equidistant from the source of heat, the necessary conditions are fulfilled if there are no draughts to blow the flame or cool one end of the cylinder.

In this apparatus anything which can be finely divided — shavings, leather, skeins of dyed yarn or rolls of dyed cloth — may be readily tested. Paper pulp, boards, and other carbonizable substances may be tested at a higher degree of heat for inflammability. Coal has not been subjected to experiment in it.

The results of greatest practical value obtained in the use of this apparatus have been, first, determining the cause of fires; and second, determining the degree of safety of the various oils used in manufacturing. Mineral oil, as is well known, is not liable to spontaneous combustion; and a certain percentage of animal or vegetable oil may be added to mineral oil without materially increasing the danger under ordinary circumstances. This percentage varies according to the oil; with neat's-foot and first quality lard oil some 50 to 60 per cent. may be used. With cotton-seed, not over 25 per cent. is allowable. The claim so often made for so-called "safe" oils, said to have been changed by special and secret processes of refining so as to be no longer dangerous, is easily exposed by this test.

