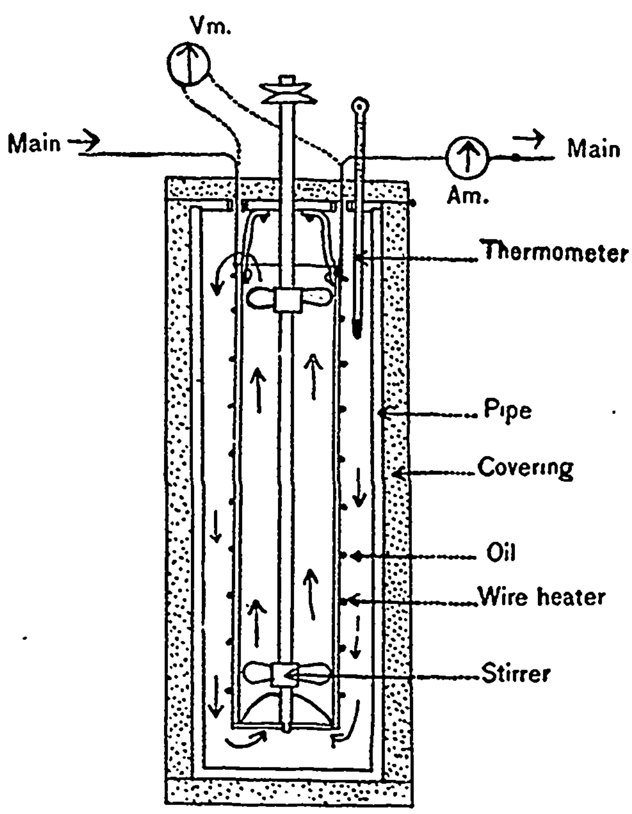
tory will be admirably suited for the purpose for which it has been designed, and there is strong reason to think that the series of observations at Agincourt will be practically a continuation of the old and valuable series of observations in Toronto. All the photographic records will be sent for development to the central office of the Dominion Meteorological Service.

THE PROTECTION OF STEAM HEATED SURFACES.

An interesting investigation has recently been carried on at the request of Edward Atkinson, having for its first object the discovery of the relative efficiency of several kinds of steam-pipe covering, and second to ascertain the fire risk attained upon this and certain methods and materials for insulation of steam-pipes. An attempt was made to show the gain in economy attendant on the increase and thickness of covering, and to show the exact financial returns which may be expected from the given outlay for covering steam pipes. Charles L. Norton made the experiments during a large part of the years 1896 and 1897, and considerable information is given in the report of these investigations on many minor matters and conditions affecting the transfer of heat from the steam pipe to the surrounding air. In reproducing some of the conclusions reached, as a result of Mr. Norton's experiments, we omit results of the tests of insulating materials, as they are not of great interest to Canadian steam users, but the report of the methods employed, as described in the Technology Quarterly, is given in full.



PLAN OF APPARATUS FOR TESTING STEAM PIPE COVERINGS.

The method adopted is one which, so far as is known, is original. A piece of steam pipe is heated from the inside by electricity. The amount of electrical energy supplied is measured, and hence the amount of heat furnished is known. If the steam pipe is kept at a constant temperature by a given amount of heat, it is because that amount is just equal to the heat it is losing, for if the supply were not equal to the loss, the temperature would rise or fall. In other words, the heat put into the pipe is just equal to the heat lost from it by radiation, convection and conjunction. By measuring the electrical energy supplied, the heat put in can be determined, and hence also the heat taken out or lost. It must be borne in mind that a given amount of electrical energy always produces the same definite amount of heat, the amount of heat furnished by one electrical unit of energy being known with greater accuracy than the amount of heat given out by a pound of steam in condensing.

The apparatus for making tests by this method comprises several pieces of steam pipe of different diameters and lengths, heated electrically within by means of coils of wire in oil. The oil is stirred vigorously and serves as a very efficient carrier to heat from the wires to the pipes. A brief description of the smallest tester may make the details of the apparatus more easily understood. A section is shown in the figure.

A piece of 4-inch steam pipe, 18 inches long, is closed at one end by a plate welding in, and at the other end by a tightly fitting cover. This pipe is then filled with cylinder oil, and a coil of wire of sufficient carrying capacity, and a stirrer are introduced into the coil. A thermometer is inserted in such a position as to record the temperature of the oil. An ammeter and voltmeter or a wattmeter may then be connected so as to record the amount of electrical energy supplied. The stirring must be brisk, and if enough power is put into the stirrer, to be comparable with the electrical energy supplied, such amount must of course be added, as it also is converted into heat. The apparatus is suspended in the middle of the room on non-conducting cords, and the thermometer read with a telescope, so that no heat from the person of the observer may be added to the supply given to the cover from within, and also that care may be taken not to produce air currents by walking near the apparatus during a test.

In making a test the following operations are carried out, and observations are taken in the following order:

The current is turned on, and heat is generated in the wire coil until the wire, oil and steam pipe have reached the desired temperature at which it is proposed to test. The current is then gradually diminished, until it is found to be of just the amount necessary to keep the pipe at this temperature without a rise or fall of one-tenth of a degree in 30 minutes. A reading of the voltage and current is now taken at intervals of 30 seconds, and the Watts and B.T.U. are computed from their average. We then have the number of B.T.U. lost from the outside of this particular pipe at this particular temperature. If, now, there is placed a steam-pipe cover around the pipe, it is found that a less amount of energy is sufficient to keep it at the required temperature, the difference being the amount of heat saved by the covering. The minimum length of time considered sufficient for equalization of heat, or "soaking in," to the cover, is 6 hours. If, after a second heating of 6 hours, no change in the conducting power is noted, the cover is considered in a permanent condition, and is tested. Some covers, notably those composed wholly or in part of wool, cannot be considered dry and constant until after an exposure upon a pipe at 200 pounds pressure for 6 or 8 days. Covers containing sulphite of lime are also slow in drying.

The three thermometers used were frequently standardized in naphthaline, and were examined to note any