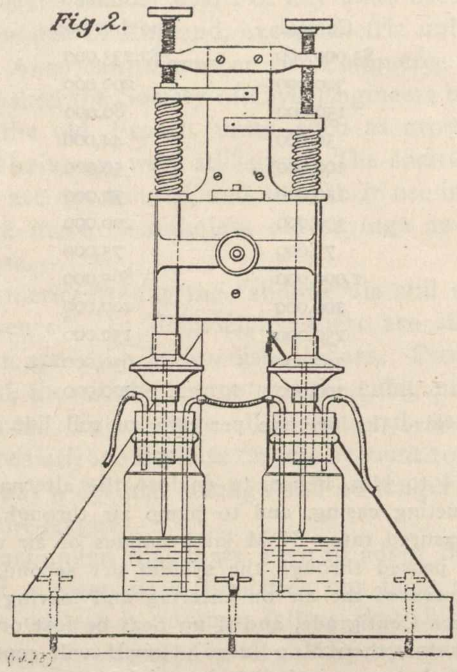
experimentally in these researches by Mr. Threlfall, that this lost momentum amounts to almost exactly half of the total, and that the velocity pressure is nearly equal to $\frac{pV^2}{2}$ dynes per square centimetre, where p is the density of the air in grammes per cubic centimetre, and V its velocity in centimetres per second. A side gauge has to be provided to mark the static pressure of the external air. This may be a flanged tube (3 in Fig. 1), according to Heenan and Gilbert; or a hole may simply be drilled into the wall and a pipe screwed into it; but then care must be taken to avoid the very variable suction effect.

From the Pitot tube and the side gauge rubber tubes extend to the two bottles communicating with one another (Fig 2) by a siphon, in which readings of the pressure dif-

Fig. 2.



ferences are taken with the aid of needle points. The needles are set just to touch the colored water in the bottle; the level difference is, in the instrument illustrated, which Mr. Threlfall has himself made and used daily for two years, measured by callipering jaws to within 0.01 millimetre; in a new form, made by the Scientific Instrument Company ,of Cambridge, a micrometer screw effects the reading within one second. A multiplying pressure gauge, in which the motion of a float operates a finger moving round a dial, which indicates square roots of the pressure differences (as the velocity $V = \sqrt{2p/p}$), serves as an auxiliary instrument. From Rateau's experiments we know that we want the means of the square roots of the pressure differences. If the velocity were the same at the various points of a vertical section through which a fluid is streaming, Mr. Threlfall's task would have been easy. For water we may, according to Darcy, take as average velocity that at the circumference of a circle of radius r, when R is the radius of the pipe, defined by the equation r = 4⅔R = 0.689 R, or approxi-

(— / 7)

mately 2-3 R. But for an air current produced by a ventilator, no such law holds, even if baffles are used. Mr. Threlfall found Marey's device of passing the air through muslin—mosquito netting, in fact—useful to secure a uniform though arbitrary velocity distribution. He had, however, to explore a whole section of his air pipe, 21 in. in diameter, thoroughly with the aid of a small size Pitot tube made of tin or millboard, the other large Pitot tube being kept in the centre of the air pipe and joined together with its side gauge to the auxiliary pressure gauge in order to make sure that the fan speed keeps fairly regularly during this exploration.

All this sounds f[illegible] complicated. Mr. Threlfall was, however, able [illegible] himself, by experiments, tabulated in his p[illegible] pressure distribution over the vertical section of his pipe remained practically constant with considerable changes in the velocity of the air current, which was varied between 325 feet and 3,640 feet per minute. When, however, the positions of the fan and pipe are altered, a new calibration has to be made. The calculation of the results of an experiment, fully given in the communication, is not difficult. For carrying out the actual tests, the 300-kilowatt alternator of 40 periods, which runs for about one-third of its diameter in a pit of concrete, was encased in wood, and the pit, which exposed a good deal of concrete, boarded round, and 3-4-in. of felt fastened over the boards. The whole casing was papered and covered with tinfoil. The fan was run at such a speed that the mean temperature within the casing remained as high as that of the engine-room. This was easily attained, and there was little danger, therefore, of direct heat leakage; connection and radiational losses were proved to be very small. Kew standard mercury thermometers were placed in the inlet and outlet, and at various points. Before the final tests were entered upon, attempts were made to measure the external currents by sending them through iron strips, 3-4-in. wide, 1-25-in. thick, wound in zig-zag in a water tank. This water calorimeter was not wanted afterwards, but experiments were conducted with 130 ft. of this iron strip to ascertain the heat effect produced in the enclosure when a current of known strength was sent through this iron resistance.

Electrical measurements were also made with the aid of a Kelvin kilowatt balance, a Duddell oscillograph, and, further, a new hot-wire voltmeter, designed and constructed by Mr. Threlfall himself, and found reliable and very sensitive during three years of continuous use with currents of 2,000 amperes maximum and 40 periods. The instrument responds to currents of 0.01 volt, and is reliable within 1 per cent. The wire is the finest silver (lace) wire obtainable. A length of about 6 centimetres is fixed between a support and the multiplying device working the micrometer screw. The wire is kept stretched by a spiral of the same wire attached to a hook, resting on the middle of the wire. As the change in length effected by the current heat is measured, the stretching must always be uniform. To ensure this, a second wire is fixed over the first and a little mirror attached to it, which mirror is tilted by the stretched calorimeter wire, whose two arms form an angle of 179 deg. The light of a small glow-lamp is reflected by this mirror, and this image is watched through a window in the front of the double aluminium case covering the instrument.—Engineering.

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