The President said Mr. Dethridge had opened up not one phase of the question, but the whole question. Therefore the discussion was not nearly exhausted. They did not want to close a discussion of such immediate value too abruptly; it would be continued at the next gathering.

EXHIBIT.

The President introduced Mr. Hunt, one of their Associates, the Commonwealth Meteorologist. The instrument Mr. Hunt had designed and would exhibit and describe was one to record the impulse and pressure of wind upon structures. This was one of those matters upon which in Australia they had exceedingly little local data. They were working upon data which had been calculated in other countries; but they knew very little yet of the wind velocity even in the immediate vicinity of Melbourne. Mr. Hunt’s apparatus performed functions that other apparatus had not performed. He would ask Mr. Hunt to show them the machine in operation.

Mr. H. A. Hunt said the apparatus, to be understood, was an apparatus more to be looked at than described. The unit of measurement was a cubic foot. His object in asking their indulgence to show it that evening was that unless he took that opportunity it would be very difficult to show it again. It was to be placed on top of a building for exposure, and being awkward to get at, it would be almost impossible to describe it in such a situation. A cube of 1 foot measurement was adopted as a unit and receiver; it at once presented a flat surface and a body to the wind, and also provided for suction action on its lee side.

Mr. Hunt described the apparatus in detail as follows:—

The Cube or Receiver is a box of light aluminium, so pivoted as to present one side constantly to the direction whence the wind is blowing.

Internal mechanism is provided to enable the wind pressure to induce linear movement of the cube. The cube is stiffened inside by two three-armed aluminium castings attached thereto by bolts. These frames are connected together by three rails made of brass tubing, which run in guide rollers, in order to keep the cube in a rigid horizontal plane. The weight of the cube and attachments, which amounts altogether to about five pounds, is supported by two of the rollers, pivoted on uprights at either end of a revolving table; and to prevent the cube swinging sideways two other pulleys, set horizontally, are so placed under the table as to barely touch the inside edge of the two bottom connecting rails of the cube.

To allow the cube to move freely with changes in the direction of the wind, the table carrying the cube is fixed upon a sleeve, which revolves around a stationary upright tube inside it; and works on ball bearings fixed at its inside extremities. A brass
coupling is attached to the revolving sleeve, with two tapped holes in the front and back, in which two tubes, each 3 feet in length, are screwed, the front one carrying the counterpoise weight, and the back one the vane. The coupling is placed three inches below the bottom level of the cube, so as to minimise any possible suspicion of wind-pressure deflection.

Wind Vane.—Various forms of wind vanes were experimented with, but the one which best controlled the cube and reduced its oscillations or pendulous movements most effectively is the one adopted. It is a shallow cone, the inversion end facing the wind; it apparently acts as an aerial sheet anchor.

Vane Brake.—In addition, however, to the vane it was found desirable, in order to obtain a more exact approximation to the true direction, to augment the controlling vane by a brake. This, swinging from a hinge, is a simple contrivance, comprising a light board and collar, and is attached to the lower reverse end of the revolving sleeve, and when facing the main direction the board is blown out of the perpendicular and brings the collar made of sheet aluminium into grip with the flange of the fixed standard.

Pressure Balance.—To measure the force of wind pressure the variable expansion of a helical spring is used. Although fully conscious of the weakness in this form of balance, it was considered preferable to the introduction of the inertia and pendulous movement inseparable from the use of the weight or balance of the steelyard variety. The tensility of the spring used during the eighteen months covering the experiments made was only exercised up to a pull of 23 lbs.; it is only possible to expand it an inch and a quarter, a distance which measures the full stroke of the cube, and which amount of expansion is equal to one-third of the length of the spring. The capacity of this range in the spring was found sufficient for all the gales sustained by the instrument during the period mentioned, but provision is made in the design by means of which a spring of much lower (or higher) tensility may be substituted in a few moments for experiments in very light winds, or to meet predicted severe gales, or for exceptional requirements for varying latitudes and altitudes.

Damper.—To neutralise the recoil shocks upon the mechanism between gusts of wind, it was found necessary to provide a pneumatic pump, which has proved entirely satisfactory. This was very carefully designed, principally from the point of dust exclusion, so that whilst not in any way loading the receiver it would yet be free from loss of efficiency by looseness of connecting joints.

It consists mainly of a cylinder 3 inches long and $\frac{1}{4}$ inches in diameter, and a piston or plunger 2 inches long, and having a $\frac{1}{4}$-inch stroke. It is connected with the cube or receiver by means of a flexible rod from the bottom of the piston to a lever fulcrumed on the cylinder cover, and from the lever to the face of the cube by two wire rods with ball joints. From the cyl-
WIND-PRESSURE RECORDER.

inder cover a thin brass sleeve is dropped to within \( \frac{1}{2} \) inch of the bottom of the piston, and the space between this sleeve and the strap connecting rod is filled with cotton wool, so that any air getting into the cylinder is filtered of all dirt. To operate the damper the wind impinging on the receiving face of the cube causes the piston, by the release of the connecting rods and lever, to descend in the cylinder, at the same time excluding the air and oil therefrom through a ball valve and returning the oil per medium of the pipe to the top of the cylinder for recirculation between the piston and cylinder. A very efficient partial vacuum is thus maintained to act as a buffer when the wind pressure on the face of the cube is suddenly released.

Wind Direction Recorder.—To ensure absolute wind direction the instrument is devised consisting of a four-armed wheel or star disc mounted on a spindle at a convenient height above the recording drum. At each extremity of the arms is pivoted a pencil lever of the length equal to the semi-diameter of the star wheel; opposite pairs are coupled together by connecting links.

The motions of these pencil levers are controlled by pins on links operating on the edge of a cam. The revolutions of the star wheel are governed by the fixed spur wheel on the standard, and its rate is reduced four times by the reducing train at the foot of its axle, so that the travel of a single pencil point from N to N would denote a complete revolution of the cube. On the spindle a lever attachment is provided to enable the disconnexion of the wheel with reducing gear wheels, so that the pencils at the back of the machine may be readily accessible, sharpened and renewed when necessary. As the cube revolves and the pencils pass with corresponding variations of the wind through the cardinal points (indicated by longitudinal lines on the recording paper) as shown on the record, they are depressed successively by the buttons on top of pencils, making contact with the depressing plane.

The design of the pencil cases provides that upon the pencil button meeting depressing plane a fine helical spring is compressed bringing the lead definitely upon the paper.

Time Clock.—Since the anemometer is not too readily accessible in boisterous weather, expansive provision had to be made for continuous records, to meet which a strong eight-day lever clock is provided. This is connected with the recording drum by a spindle and pinions with engaging gear.

Spools for Recording Paper.—Spool will contain 60 feet of paper, which, passing over recording drum, is taken up over spool after receiving the imprints of the various recording pens.

Clock Gearing for Winding Up Recording Papers.—The spring barrel, together with gearing and necessary brake attachments, provides power for winding up the paper on spool.

Pen for Marking Pressure Gusts.—The vagaries of wind pressures necessitated the design of a special pen to meet every possible contingency. It consists of a wheel pivoted on the lever
hinged on a long arm; it is about \( \frac{3}{8} \) inch in diameter, and has a milled edge, which obtains the ink by contact from a rotating wad above, which is held by an arm fulcrumed from the same pivot holding the pen lever. The object of the milled edge is to facilitate the wheel revolving when moving along the paper, and to insure that a freshly-inked surface of the wheel pen be always in contact with the recording paper, a light hinged pawl operates on the upper milled part of the wheel, with the result that in moving forward the wheel revolves, but in returning to zero merely drags back. This pen device has proved entirely satisfactory, and it has been found expedient to substitute it in place of the old forms of pens on various recording instruments, with the best results. It requires very little attention, is thoroughly reliable, and is not subject to clog. A drop of ink on the saturated wad is sufficient to last several days under the most exacting conditions. The movements of the pen are actuated by a system of multiplying levels and rods connected with the rear bracket, which in turn transmits all impulses of wind pressure received on the face of the cube. The travel of the pen extends over 7 inches of the full width of the recording paper.

Reproduction of a Typical Record.

The record between N and W indicates the wind direction, varying between N.N.W. and W.N.W. The lower record (which does not lend itself to perfect reproduction) indicates the variation in wind pressure.

Pressure Accumulator.—The latest addition to the anemometer is the device which has been styled a pressure accumulator. It
WIND-PRESSURE RECORDER.

is primarily a watch movement actuated by pressure puffs, and approximately gives the total pressures received by the cube during gales; six full strokes of the cube releases the lever operated by the cam recording successive ticks by a pencil resting upon the extreme left hand side of the registering paper.

*Time Annotator.*—The paper being subject to expansion and contraction by exposure to variations in temperature and humidity, it was found imperative to automatically print the time, which desideratum is attained by the numeral wheel with inking wad, this, by a system governed by a cam on the end of the time spindle, operating pawls and a ratchet wheel at the back of the numeral wheel drops successive figures (1 to 12) on the recording paper at intervals of one or two inches per hour, as desired.

The President said they had to thank Mr. Hunt for giving them the opportunity of inspecting a fine example of his ingenuity in minute mechanism, and now they wanted results. The Institute would be glad at some future time to have a paper from Mr. Hunt dealing with that phase. In revising Melbourne's building regulations they had had to deal with wind pressures, and some very large figures had been mentioned, but there was no authentic record of even 25 lbs. per square foot here, although there were long series of records of lesser magnitude which were authentic. He thought, personally, that 25 lbs. would be a reasonable provision. Did Mr. Hunt think there was any likelihood of that being exceeded?

Mr. Hunt said he did not think so. He had the instrument in use in Sydney for 18 months, and the highest velocity registered was 181b. in an exposed place.

The President said the instrument gave, inter alia, a record of every 250 lbs. of cumulative impulse. In doing that it gave them something they had not had before, but whether the information was complete was an open question. For instance, one impulse of 25 lbs. would give just the same record as five impulses of 5 lbs.; but the energy in the first case would be five times as great as that manifested in the sum of the five lesser impulses. Still it was a record of something they had not had before, and subject to limitation it was useful. The apparatus was very ingenious, and they would look forward to receiving a paper from Mr. Hunt upon its performance.

At 10.30 the meeting closed.
Library Digitised Collections

Author/s:
Hunt, Henry Ambrose

Title:
Wind Data Recorder (Exhibit)

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1910

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