A New Self-registering Anemometer and Pluviometer for Sydney Observatory.

By H. C. Russell, B.A., F.R.A.S.

[Read before the Royal Society of N.S.W., 17 December, 1884.]

The first Self-registering Anemometer and Pluviometer in Sydney Observatory was made and set to work in 1863, and, with slight repairs, this instrument has done its work ever since; but the wear and tear of twenty-one years has told so severely on some of the wheels, more particularly the one into which the screw-spindle of the cups works, that it became necessary either to make extensive repairs or a new instrument. As repairing the old one would have stopped the record, it was determined to have a new one made embodying some ideas which experience had suggested. As these may be useful to others, I have determined to explain to you the more important parts of the new instrument.

Owing to the fact that the Time-ball and shaft are on the only available tower, it was necessary from the first to elevate the vane and cups above them; otherwise the wind eddying round the shaft affected the cups and vitiated the record; but as this required the cups to be 17 feet above the leads, there was some difficulty in bringing the motion down to the registering part or cylinder. In the old one this was effected by reducing the rate of motion of the cups, by screw and wheels, until the last wheel which worked the chain turned once for 560 revolutions of the cup, or 4 miles of wind.

In the new anemometer, a brass box 6 × 4 × 3 inches is placed on top of a tube 3 inches in diameter, and extending 17 feet above the leads of the tower. Into the top of this box a piece of inch brass tubing 12 inches long is fixed, and serves to support the upper bearing of the $\frac{5}{8}$-inch tube that carries the vane. The lower bearing of this is attached to the side of the box, and a bevel wheel is attached to the lower end, and gears into one of equal size on a horizontal axis. On this is a wheel with a V-shaped groove.

The cups are 4 inches in diameter, and set 4 feet from centre to centre; they work on a spindle inside the vane spindle, the top bearing being of bone and the lower one a hardened steel cup, larger than the end of the screw spindle that works in it, so that it serves as oil-cup and bearing. This screw spindle works a wheel of fifty teeth, the axis of which is a screw working into a wheel of
fifty-six teeth. The axis of this wheel carries a wheel with a grooved rim and a light arm which is free to move round it; a spring keeps this pressed up to the wheel; the end of this arm projects beyond the edge of the groove, and to it the wire working the velocity-pen is attached in such a way that it hangs in front of the groove, and when the wheel is turned round by the motion of the cups, and the pin in the side of it catches the arm and carries it round, the wire falls into the groove and is wound up one turn on the wheel. As the wheel continues to revolve, it brings the arm against an unlocking part which throws it off the pin, and the weight of the wire at once pulls it round to the starting-point. For each 20 miles of wind, therefore, the wire is drawn up 4 inches and suddenly let go.

In placing the cylinder, a convenient position for reference at all times was considered of paramount importance. The old one being 50 feet above the ground, in the top room of the tower, was very inconvenient, and it was determined to put the new one on the ground floor, but as this was 58 feet below the leads and 75 feet from the vane and cups, it became necessary to devise some means of carrying the motion down which should give the least friction, and at the same time be rigid enough to convey every oscillation of the vane. A suitable material for this was found in steel wire, and it was applied in the following way:

Holes having been cut in the four floors, a wire was taken up to the grooved wheel on the horizontal axis of the bevel-wheel; passed one and a half times round it and then down the tower again, where it was passed through the pulley on a weight of 5 lb., and then fastened to the other end, thus making a double length of wire from the vane to the floor, i.e., 75 feet, arranged for endless motion, so that it does not matter how often the vane turns round, it will not come to the limit of motion allowed by the wire. This motion was made to record itself on the vertical cylinder by attaching the wire to a very light frame made of $\frac{1}{8}$-inch brass tubing, and carrying four pencils. The means of attaching this to the wire is a screw clip, and if the pen frame is carried over a space of 8 inches, that is two complete revolutions of the vane, it is necessary to disconnect it and make it fast again,—an operation taking only a few seconds. This arrangement is even more satisfactory than I anticipated, for I feared the elasticity of such a length of wire might allow the vane to move without moving the pencil, but it does not,—the strain of the weight is sufficient to keep the wire straight, and as it has no friction to overcome except that of the pencil and frame and the axis of the bevel-wheel, it moves with the greatest ease and responds to every motion of the vane.

The cylinder for receiving the record is on a vertical axis, and is 8 inches in diameter and 10 inches long, and is turned by the clock.
at the rate of 1 inch per hour; but the clock is provided with an additional wheel which can be thrown into gear in a moment, and which then causes the cylinder to revolve at the rate of 2 inches per hour. This is only used for heavy storms.

The top and bottom bearing of the cylinder project beyond it 1\(\frac{1}{2}\) in. and form the guides for the pencil carriage just described, as well as for that which carries the pen showing the velocity. I have already described the motion of the parts of the velocity gear for 20 miles of wind, and the wire there referred to passes right down the tower by the side of the direction wires and is attached to a light frame similar to that used for the direction, and the record is made by a glass pen. This frame and pen serve to pull the wire down when the click is unlocked at the top.

It will be seen from what has already been said that the motion of direction pencils and velocity pen are in straight lines; and it is only necessary to add that the points record in line so that both point to the same hour line at once. The direction pencil accords on the upper part of the paper using 4 inches and the velocity pen records on the lower 4 inches, and the spare pencils do not catch on the pen because, when passing it, they are riding on the guide which lifts them off the paper except when over that part on which they have to record.

The rain is collected on the tower 65 feet above the ground, and is carried by a pipe thence to the top of a vertical tube 2 inches in diameter and 45 feet long, and it drops from the pipe into the middle of the tube, and thence to the bottom without touching the sides, so that little or none is lost between the receiver and the recording parts. When the rain reaches the bottom of the tube it is caught in a small glass funnel fitting the tube, and thence led into the tip bucket which happens to be uppermost. These buckets each hold 0.20 in. of rain, and are fixed bottom to bottom on an axis in such a way that when standing upright they are not balanced but tend to fall over. This tendency is prevented by a catch which holds them upright until 0.20 in. rain has fallen in. As the rain accumulates, the bucket which is at the end of a lever and held up by a spiral spring, descends, pulling down with it the pen frame which records the rain, and is similar to the other two. By the time the bucket has received the 0.20 in. it has descended far enough to bring the catch on to a stud and unhook itself. Its want of balance instantly takes effect. It falls over and the momentum carries it 180°, or until the other bucket has taken its place to receive the rain and follow the same motions. When the water is thrown out, the spring lifts up the pen-frame ready to begin again; so that the rain record appears as a series of lines more or less like the teeth of a saw according to the rate of rainfall. The pen moves 2 inches for 0.20 in. rain. The rain so thrown out by the machine is received in a bucket and
measured when the paper is changed, i.e. once a day. I have already spoken of the ease with which the direction-parts work, and may add that the cups which are, as just stated, 75 feet above the ground, will go on recording one or two miles per hour, when there is perfect calm on the ground and amongst the trees 20 or 30 feet high. This favourable result has been attained by making the cups as thin as possible and the arms supporting them of brass tubing,—the gross weight of cups, arms, and screw-spindle, being only 30 ounces. The old and new anemometers have some time been working side by side, and in very light winds the new one sometimes registers 10 per cent. more than the old one, but in a good breeze, 20 or 30 miles per hour, there is practically no difference in the number of miles recorded.

The design for this instrument includes a record of the pressure of the wind, and also an electric pen which, under a signal from the standard clock, will record on the paper each hour as a check upon the time of its own clock, but these parts are not yet made. One valuable property of this arrangement was not seen in the design, viz., that the position of the join in the wire showing the direction keeps a record of the number of whole revolutions the wind has made in one direction, and in four months it has not made one complete turn backwards, but several times the vane has "hacked" 90°, and once or twice 180°, but in 120 days it has turned in the normal direction 12½ times, or once in ten days.

**View This Item Online:** [https://www.biodiversitylibrary.org/item/126798](https://www.biodiversitylibrary.org/item/126798)

**DOI:** [https://doi.org/10.5962/p.358974](https://doi.org/10.5962/p.358974)

**Permalink:** [https://www.biodiversitylibrary.org/partpdf/358974](https://www.biodiversitylibrary.org/partpdf/358974)

**Holding Institution**
Missouri Botanical Garden, Peter H. Raven Library

**Sponsored by**
Missouri Botanical Garden

**Copyright & Reuse**
Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the Biodiversity Heritage Library, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at [https://www.biodiversitylibrary.org](https://www.biodiversitylibrary.org).