tion which should be of sufficient intensity without a considerable increase in the size of the illluminating surface. Various attempts have been made to adapt the oxy-hydrogen light for the purpose; but there always remains the objection, that however small the incandescent portion of the lime may be, it does

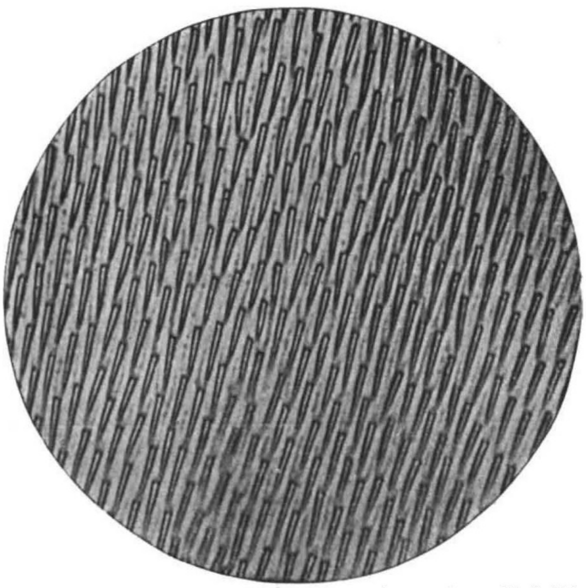

FIG. 1.—Surface markings on Podura scale. Photographed with Swift's 1/12-inch apochromatic, projection ocular 2, and central cone. Magnification, 2500 diameters.

not emit light of equal intensity over the whole of its surface. This can at once be seen if an image of the lime be projected on to a screen. The result is uneven illumination, a defect so often seen in high-power photographs, when the image of the radiant

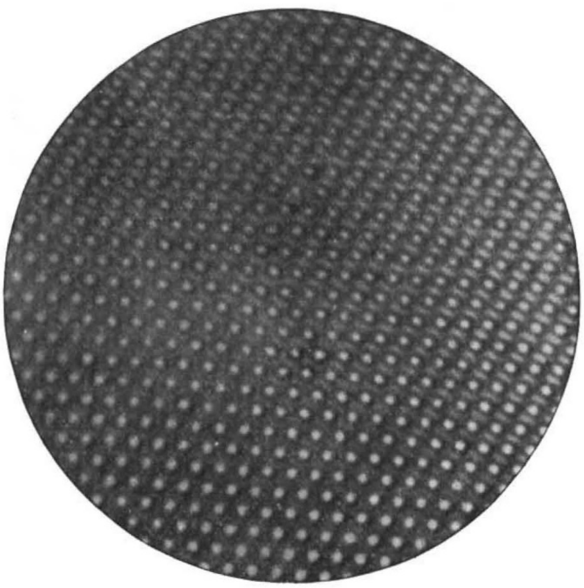

FIG. 2.—*Pleurosigma angulatum*. Photographed with Winkel's 1/20-inch homogeneous immersion, projection ocular 4. Central cone and malachite-green screen. Magnification, 5000 diameters.

is projected by the achromatic condenser across the object, or what is known as "critical illumination."

The electric arc is the light which approaches most nearly to an ideal illuminant. The source of light is extremely small, but the intensity is great, and the incandescent surface is, if working under proper conditions, homogeneous. It has until recently been impossible to so control the arc that these conditions could be obtained with certainty. In all forms of lamp, whether hand-fed or automatic, the difficulty has been to maintain a constant position and condition of the crater on the positive carbon. This can be done by having a simple form of hand-feed apparatus with a pin-hole camera attached, through which an image of the carbon points is projected on to a ground-glass screen. Reference lines are provided on this screen, so that the length of arc and position of the positive crater can be continuously observed. The arrangement was exhibited at the two conversazioni of the Royal Society last year, and has been fully described before the Royal Microscopical Society. With such a form of arc-lamp absolute centration of the light can be secured and maintained without reference to the microscope, after the necessary position of the image of the arc on the screen of the pin-hole camera has been once obtained. The accompanying illustrations have been reproduced from photographs taken with the arc-light so arranged. Fig. 1 shows the surface markings on a Podura scale, magnified 2500 diameters. Fig. 2 is a frustule of *Pleurosigma angulatum*, magnified 5000 diameters. In neither photograph is there the slightest sign of de-centration, and in both cases centration was maintained entirely without reference to the microscopic image.

J. EDWIN BARNARD.
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A METHOD OF MEASURING WIND PRESSURE.[1]

THERE are few physical problems of greater immediate and obvious practical importance, than that involved in the measurement of air pressures under complex conditions of motion, and there are few problems which present greater difficulty, or—what is worse—uncertainty. It may be comparatively easy to obtain under any particular set of circumstances evidences of barometric variation by means of some indicating instrument, apparently suitable for the particular purpose, but it is a very different matter to decide how far the quantitative result is unaffected by actions set up by the instrument itself. Thus the record of the pressure plate gives information which is of little, if any, value in relation to the distribution of pressure over a large building; while the barometer itself is capable of giving misleading indications, whether it is too effectually protected from external influences, or too much exposed.

For measuring the wind pressure at any point of a structure of considerable size, a receiver or collector is required, with a convenient gauge connected by a tube. It is essential that the collector should not itself give rise to compressions or rarefactions affecting the gauge. To the invention of such an instrument Prof. F. E. Nipher has devoted much attention, and his final apparatus seems to fulfil its purpose admirably. Two equal thin metal discs, 2·5 inches in diameter, having bevelled rims, are screwed together, so as to leave a small space between, into which a connecting tube is passed through the centre of one of the discs. The end of the tube is flush with the inner surface, and the interspace is filled up with a certain number of layers of fine wire screen, which project at least half an inch beyond the edges of the metal discs. When this simple device is placed in a stream of air, it is found that the effects of rarefaction and compression, set up at different parts of the porous screen, completely neutralise each other, so that the pressure at the mouth of the tube is the same as the true intrinsic pressure of the external air. This property of the collector was severely tested by thrusting it out of a carriage window in a train which was travelling at the rate of sixty miles an hour: no effect on the gauge could be noticed, although the instrument was sufficiently sensitive to show instantly the effect of placing the hand at a tangent to the edge. The gauge which Prof. Nipher employed was a water manometer consisting of a cylindrical vessel partly filled with water, with a straight glass tube leading out from the bottom and inclined at 5 in 100 to the horizontal. The open end of this tube was in communication with a collector of the form suggested by Abbe so as to secure a standard pressure of comparison.

[1] "A Method of Measuring the Pressure at any Point of a Structure, due to Wind blowing against that Structure." By Francis E. Nipher. (*Transactions* of the Academy of Science of St. Louis, vol. viii. No. 1.)

[2] Report of the Chief Signal Officer, 1887, 2, 144.

Being now satisfied with the trustworthy nature of his apparatus, Prof. Nipher determined to apply it to the determination of the distribution of pressure over a large pressure board. For this purpose the board, which was a wooden one, 4 feet long by 3 feet wide, was mounted on the roof of a railway carriage. It was bolted to a vertical iron pipe, and the couple required to keep it perpendicular to the direction of the wind was measured by a spring balance. On opposite sides of the board, and at the centre of one of the 108 4-inch squares into which the board was divided, two disc collectors were fixed and connected by rubber tubes with their respective gauges. The latter, together with a third, which was used as a level, were mounted on a board which was rigidly attached to a heavy pendulum within the carriage. The speed of the train varied generally between twenty and fifty miles an hour, and was checked by direct observations.

The total action on the board is the result of an increase of pressure in front and a decrease behind. Both the increase and the decrease are shown by this series of experiments to be proportional to the force necessary to hold the board to the wind as indicated by the spring balance. Further, the force measured in this way differs from that deduced from the data given by the collectors by no more than 1 per cent., and although this may be in a measure accidental, it affords a confirmation of the accuracy of Prof. Nipher's method. On both sides of the board the difference from the ordinary pressure becomes less as the periphery is approached, although there is some evidence of a minimum excess at the centre of the front face. Prof. Nipher gives a few notes on the application of the device to the study of pressure variation around a building. It is to be hoped that such developments as this will be realised. At present it is too early to estimate the full importance of these researches as a contribution to the study of anemometry; but the idea is full of promise, and the simplicity of the apparatus is certainly a great point in its favour.

AN ENCHANTED MESA.[1]

THE pueblo of Acoma, in Western Central New Mexico, is the oldest settlement within the limits of the United States. Many of the walls that still stand on that beetling peñol were seen by Coronado during his marvellous journey in 1540, and even then they were centuries old.

The valley of Acoma has been described as "the Garden of the Gods multiplied by ten, and with ten equal but other wonders thrown in; plus a human interest, an archæological value, an atmosphere of romance and mystery"; and the comparison has not been overdrawn. Stretching away for miles lies a beautiful level plain clothed in grama and bound on every side by mesas of variegated sandstone rising precipitously from 300 to 400 feet, and relieved by minarets and pinnacles and domes and many other features of nature's architecture.

None of these great rock-tables is so precipitous, so awe-inspiring, and seemingly so out of place as the majestic isolated Katzímo or Enchanted Mesa, which rises 430 feet from the middle of the plain as if too proud to keep company with its fellows; and this was one of the many wonderful homesites of the Acomas during their wanderings from the mystic Shípäpu in the far north to their present lofty dwelling-place.

Native tradition, as distinguished from myth, when uninfluenced by Caucasian contact, may usually be relied on even to the extent of disproving or verifying that which purports to be historical testimony. The Acoma Indians have handed down from shaman to novitiate, from father to son, in true prescriptorial fashion for many generations, the story that Katzímo was once the home of their ancestors, but during a great convulsion of nature, at a time when most of the inhabitants were at work in their fields below, an immense rocky mass became freed from the friable wall of the cliff, destroying the only trail to the summit and leaving a few old women to perish on the inaccessible height. What more, then, could be necessary to enwrap the place for ever after in the mystery of enchantment?

This tradition was recorded in its native purity some twelve years ago by Mr. Charles F. Lummis, and the same story was repeated by Acoma lips to the present writer while conducting a reconnaissance of the pueblos in the autumn of 1895. During this visit, desiring to test the verity of the tradition, a trip was made to the base of Katzímo, where a careful examination of the talus (especially where it is piled high about the foot of the great south-western cleft (Fig. 1) up which the ancient pathway was reputed to have wound its course) was rewarded by the discovery of numerous fragments of pottery of very ancient type, some of which were decorated in a vitreous glaze, an art now lost to Pueblo potters. The talus at this point rises to a height of 224 feet above the plain, and therefore slightly more than half-way up the mesa side. It is composed largely of earth, which could have been deposited there in no other way whatsoever than by washing from the summit during periods of storm through many centuries. An examination of the trail to a point within 60 feet of the top exhibited traces of what were evidently the hand and foot holes that had once aided in the ascent of the ancient trail, (Fig. 2) as at Acoma to-day. Even then the indications of the former occupancy of the Enchanted Mesa were regarded as sufficient, and that another one of many native traditions had been verified by archæologic proof.

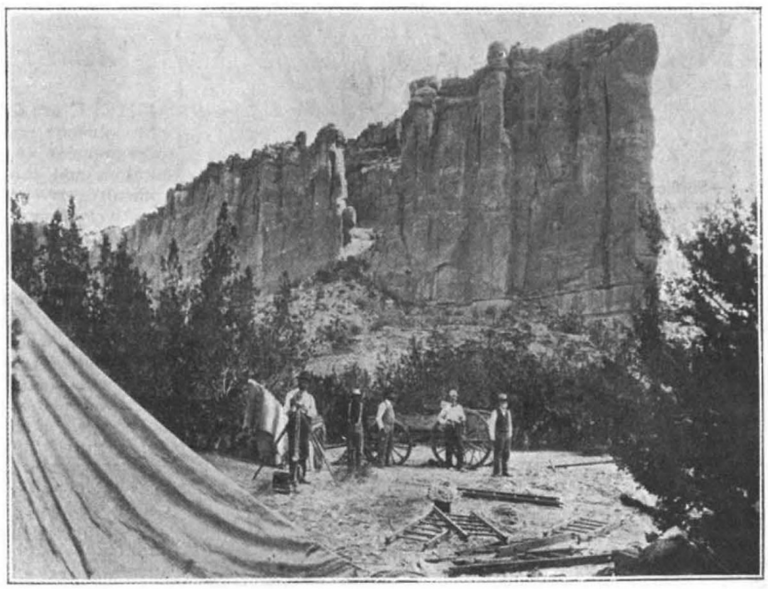

FIG. 1.—The Enchanted Mesa—the Great South-western Cleft and Talus Heap.

More recently the author visited Katzímo a second time, on this occasion with Major George H. Pradt, Mr. A. C. Vroman, and Mr. H. C. Hayt, in order to determine what additional data of an archæological nature might be gathered by an examination of the summit.

The ascent of the talus, in which the potsherds had been observed in such considerable quantities two years previously, was made in a few minutes, the ladders, ropes, and photographic and surveying instruments being carried with some effort, since climbing, heavily laden, at an altitude of 6000 feet, in a broiling sun, is no trifling labour; but the real work began when the beginning of the rocky slope of the cleft was reached. One member of the party, taking the lead, dragged the end of a rope to a convenient landing place, where a dwarf piñon finds sufficient nourishment from the storm-water and sand from above to eke out a precarious existence. Fastening the rope to the tree, the outfit was hauled up, and the other members of the party found a ready means of ascent. The next landing was several feet above, at the base of a rather steep pitch of about twelve feet. This wall, although somewhat difficult to scale,

[1] Abridged from a paper by Mr. F. W. Hodge, of the United States Bureau of American Ethnology, in the *National Geographic Magazine*.