with a few hundred pounds of sand. If the envelope were absolutely tight, this would be ample for several ascents to 10,000 feet, or to keep the balloon in suspension many days. Nothing of scientific accuracy can be had at a high level without a practised hand on the spot. Questions of exposure of instruments, observations of clouds, etc., demand an immediate answer at each record, if we desire valuable observations. Glaisher made thousands of observations of the moisture-contents of the air in his memorable scientific ascents, but, though these have been utilized by others in doubtful computations, he himself does not summarize them in considering his results. All who have tried to make humidity-observations in a room, with no air stirring (which is precisely the condition in a balloon), know how exceedingly unsatisfactory they are.

I believe that the investigations needed may be made at an expense much less than is ordinarily supposed. There is needed a balloon of about 60,000 cubic feet capacity (a larger one would be too unwieldy, and is not necessary for ascents up to 20,000 feet). The gas for inflation should be the last that comes in the process of manufacture: this is poor in illuminating power, because it has less carbon, but it is nearly one-fourth more buoyant than ordinary coal-gas. This is not exactly a refuse product, yet it can be had very cheaply. It would be a most excellent plan to send up four balloons at once, about two hundred miles from the centre of a storm, in the north-east, north-west, south-west, and south-east quadrants. But, as this would be rather expensive, we must explore the most interesting point first. I would send up the balloon either to the south-west or west of a storm: at a height of 6,000 feet, it would, in all probability, outstrip the storm, and the descent could be made either in the centre or a little to the east of it. We could then either make another ascent immediately, or wait till the storm has passed overhead, and then make another trip just as at first. This will enable us to determine, not only the vertical distribution of temperature and moisture in the neighborhood of the storm, but also the action, whirling or otherwise, that takes place at the seat of the storm, or where the 'power' of the storm is developed. When the balloon is no longer able to rise, a fresh supply of gas may be carried to it in a small balloon, or in a long flexible cylinder (as suggested by Professor King). If near any gas-works, the balloon may be towed near enough to obtain a fresh supply. As about 30,000 feet of gas would be needed to float the balloon and all its appliances, it will be seen that this would effect a great saving. I understand perfectly that carrying out such suggestions as these may be a very difficult matter in practice, and often impossible in a high wind. For ten thousand dollars, I think, fifty or sixty ascents might be made, which would be of incalculable importance in the study of the origin, development, and progress of storms. Such investigation is absolutely necessary if we would advance our knowledge of the generation of storms. Any advance in this direction is of such moment to almost all classes of people, especially to farmers and mariners, that we may hope such a small sum will be volunteered, or obtained from government, ere long for this study. H. ALLEN HAZEN.

Washington, D.C., July 19.

Cloud-Heights.

THE following method, which can often be used to determine the elevation of certain clouds, may interest some of your readers, particularly topographers and meteorologists.

I was watching to-day, from Little Monadnock, the shadow of a dense cumulus moving slowly along the southern slope of Monadnock, until finally the edge touched the hotel about half-way up the mountain. It occurred to me, that, if the point where I stood and the hotel were plotted on a plane-table sheet, and the sheet oriented, the elevation of the cloud could easily be found in this way At the moment the shadow reaches the second plotted position, draw, through the station occupied by the observer, a line, and read a vertical angle to the edge of the cloud that casts the shadow. Then, through the second plotted position, draw a line in the direction of the sun. The point of intersection of these two lines is the horizontal projection of the position of a point on the edge of the cloud at the time the shadow has reached the second plotted position. The distance (to be scaled from the map) from this intersection to the point occupied, is the base, and the vertical angle of elevation the adjacent angle of a right-triangle, of which the altitude is the height of the cloud above the observer. This may be corrected for curvature and refraction.

When a plane-table sheet is nearly complete, with many located points on it, the same cloud may be observed several times, and the determinations of altitude compared.

This method is extremely simple, and I am very anxious to have it tried. I shall not be able to do this myself for several weeks, but I hope some one who is working with a plane-table will, and let me know his results. H. L. SMYTH.

Dublin, N.H., July 2.

The Wholesomeness of Swill-Milk.

THE discussion carried on in the pages of *Science* for some weeks past upon the healthfulness of milk from cows fed upon distillery-swill has, in my opinion, failed to definitely settle the question. There can be no doubt of the vital importance of the matter, and all physicians and sanitarians will agree that a solution of the problem is highly desirable.

1. I venture to say that no positive evidence has been submitted showing any ill effect of swill upon cows fed with it. The evils attributable to it are largely, if not entirely, to be ascribed to the unsanitary surroundings of the animals.

2. Whatever evidence has any positive value indicates that swill is equally as good and proper food (used with judgment) as hay, dried fodder, ensilage, or bulbous roots. These all differ widely in chemical composition from the green foods (grass, clover, green oats, and corn), which may be looked upon as the normal food of cows.

3. It may be worth while remembering that lactation in a dairy is not a normal process. Dairy-cows are 'milk-machines.' The dairy business would not be very profitable if lactation were not forced to some degree.

4. Experienced agriculturists, like Professor Armsby and Dr. Sturtevant (*Science*, ix. pp. 602–3), have failed to see any ill effects attributable entirely to swill, and such veterinarians of ability as Professor Law and Dr. Salmon (*Ibid*, p. 552) corroborate this testimony.

5. The facts collated by Professor Brewer (*Ibid*, p. 550), showing the ready absorption of germs and odors by milk, the transmission of the flavor of various odoriferous substances eaten by the animal to the secretion, the passage of certain drugs administered medicinally into the milk of nursing women, or the notorious fact that swill-milk stables are 'proverbially foul and stinking,' have no bearing upon the case. The evidence required to establish the unwholesomeness of swill as food for milk-giving animals must be of a different character.

6. While it may be conceded that 'chemical analyses will not settle the question' of the wholesomeness of swill-milk, the fact remains that we have at present no other way of determining the physical qualities of a specimen of milk. Bacteriological investigation may determine the presence of the germs of tuberculosis, typhoid, and, in view of recent discoveries, of scarlet-fever, but will not enable us to ascertain the relative proportions of saccharine, fatty, aqueous, or proteid matters present. Chemistry is here still our main-stay, and, other things being equal (more definitely, disease-germs being absent), a specimen of milk nearly approaching the chemical standard established by Kœnig may be looked upon as a wholesome food. Other factors besides the food of the animal enter into the production of milk. The age of the animal, period of lactation, time when the milk is drawn, and general sanitary condition, must not be ignored.

7. The asserted greater firmness, and consequent indigestibility, of the coagulum in swill-milk is not based upon a sufficient number of observations to admit of unquestioned acceptance. It should be easy to determine this in any chemical laboratory. No single series of observations would decide this, however. It would be necessary to test milk from cows fed upon swill but kept under good sanitary conditions, side by side with milk from animals kept under the ordinary conditions of city stable-life, and fed upon various foods.

8. A scientific solution of the question will not be furthered by