VII. Description of M. de Saussure's diaphanometer

Dr. F.W. Aug. Murhard

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an ink of a red colour, like that of the *rosa centifolia*, which again disappeared when the paper became cold. I was not able to obtain it of a darker tint; but I must confess that I made only a few experiments for that purpose, as I was satisfied with the colour I had got.

VII. *Description of M. DE SAUSSURE'S Diaphanometer.*

By Dr. F. W. AUG. MURHARD, of Gottingen. From Neues Journal der Physik, by Professor GREN. Vol. IV.

THIS instrument, first described by M. de Saussure in the fourth volume of the Memoirs of the Royal Academy of Sciences at Turin, has some resemblance to the *cyanometer**, both in regard to its object and construction. The principal difference is, that the latter shews the whole effect of the vapour and evaporation diffused throughout the atmosphere, from the eye of the observer to the utmost boundary of his view; while the diaphanometer is, on the other hand, designed to shew the greatness of the evaporations existing in any limited part of the atmosphere which surrounds us.

The measure of transparency in M. de Saussure's instrument, is founded on the proportion of the distances at which determined objects cease to be visible; and the point was to find objects, the disappearance of which, at a certain distance, could be determined with the greatest accuracy. M. de Saussure found that the moment of disappearance can be observed much more accurately when a black object is placed on a white ground, than when a white object is placed on a black ground; that the accuracy was still greater when the observation was made in the sun, than in the shade; and that even a still greater degree of accuracy was obtained, when the white space surrounding a black circle, was itself surrounded by a circle or ground of a dark colour. This last

* An instrument for determining the degree of the blueness of the heavens.

circumstance was particularly remarkable, and an observation quite new.

If a circle totally black, of about two lines in diameter, be fastened on the middle of a large sheet of paper or pasteboard, and if this paper or pasteboard be placed in such a manner as to be exposed fully to the light or the sun, if you then approach it at the distance of three or four feet, and afterwards gradually recede from it, keeping your eye constantly directed towards the black circle, it will appear always to decrease in size the farther you retire from it, and at the distance of 33 or 34 feet will have the appearance of a point. If you continue still to recede, you will see it again enlarge itself; and it will seem to form a kind of cloud, the darkness of which decreases more and more according as the circumference becomes enlarged. The cloud will appear still to increase in size, the farther you remove from it; but at length it will totally disappear. The moment of the disappearance, however, cannot be accurately ascertained; and the more experiments were repeated, the more were the results different. This is an observation perfectly accurate; and having myself made a series of experiments under like circumstances, I am the more convinced of the truth of it.

M. de Saussure, having reflected for a long time on the means of remedying this inconveniency, saw clearly, that, as long as this cloud took place, no accuracy could be obtained; and he discovered that it appeared in consequence of the contrast formed by the white parts which were at the greatest distance from the black circle. He thence concluded, that if the ground was left white near this circle, and the parts of the pasteboard at the greatest distance from it were covered with a dark colour, the cloud would no longer be visible, or at least almost totally disappear.

This conjecture was confirmed by experiment. M. de Saussure left a white space around the black circle equal in breadth to its diameter, by placing a circle of black paper a line in diameter on the middle of a white circle three lines
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in diameter, so that the black circle was only surrounded by a white ring a line in breadth. The whole was pasted upon a green ground. A green colour was chosen, because it was dark enough to make the cloud disappear, and the easiest to be procured.

The black circle, surrounded in this manner with white on a green ground, disappeared at a much less distance, than when it was on a white ground of a large size.

If a perfectly black circle, a line in diameter, be pasted on the middle of a white ground exposed to the open light, I can observe it at the distance of from 44 to 45 feet; but if this circle be surrounded by a white ring a line in breadth, while the rest of the ground is green, I lose sight of it at the distance of only $15\frac{1}{2}$ feet.

According to these principles M. de Sauffure delineated several black circles, the diameters of which increased in a geometrical progression, the exponent of which was $\frac{3}{2}$. His smallest circle was $\frac{1}{5}$ or 0.2 of a line in diameter; the second, 0.3; the third, 0.45; and so on to the sixteenth, which was 87.527, or about 7 inches $3\frac{1}{2}$ lines. Each of these circles was surrounded by a white ring, the breadth of which was equal to the diameter of the circle, and the whole was pasted on a green ground.

M. de Sauffure, for his experiments, selected a straight road or plain of about 12 or 1500 feet in circumference, which towards the North was bounded by trees or an ascent. Those who repeat them, however, must pay attention to the following remarks:—When a person retires backwards, keeping his eye constantly fixed on the pasteboard, the eye becomes fatigued, and soon ceases to perceive the circle; as soon therefore as it ceases to be distinguishable, you must suffer your eyes to rest; not, however, by shutting them, for they would when again opened be dazzled by the light, but by turning them gradually to some less illuminated object in the horizon. When you have done this for about half a minute,
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and again directed your eyes to the pasteboard, the circle will be again visible, and you must continue to recede till it disappears once more. You must then let your eyes rest a second time in order to look at the circle again, and continue in this manner till the circle becomes actually invisible.

If you wish to find an accurate expression for the want of transparency, you must employ a number of circles, the diameters of which increase according to a certain progression, and a comparison of the distances at which they disappear will give the law according to which the transparency of the atmosphere decreases at different distances. If you wish to compare the transparency of the atmosphere on two days, or in two different places, two circles will be sufficient for the experiment.

According to these principles, M. de Sauffure caused to be prepared a piece of white linen cloth eight feet square. In the middle of this square he sewed a perfect circle, two feet in diameter, of beautiful black wool; around this circle he left a white ring two feet in breadth, and the rest of the square was covered with pale green. In the like manner, and of the same materials, he prepared another square; which was, however, equal to only $\frac{1}{2}$ of the size of the former, so that each side of it was 8 inches; the black circle in the middle was two inches in diameter, and the white space around the circle was 2 inches also.

If two squares of this kind be suspended vertically and parallel to each other, so that they may be both illuminated in an equal degree by the sun; and if the atmosphere, at the moment when the experiment is made, be perfectly transparent, the circle of the large square, which is twelve times the size of the other, must be seen at twelve times the distance. In M. de Sauffure's experiments the small circle disappeared at the distance of 314 feet, and the large one at the distance of 3588 feet, whereas it should have disappeared at the distance of 3768. The atmosphere, therefore, was not perfectly transparent.

transparent. This arose from the thin vapours which at that time were floating in it.

It is of great importance to ascertain the laws according to which the distinctness of the visibility of an object decreases, either when the transparency of the medium through which the object is viewed is lessened, or when the thickness of the stratum of the medium is increased. Lambert, in his Photometry, has given an account of many ingenious experiments which he made on the decrease of the quantity of light, by its propagation through a medium imperfectly transparent; but M. de Saussure is the first who has considered the decrease of the distinctness with which an object is seen through such a medium at different distances.

VIII. *History of Astronomy for the Year 1798. Read in the College de France, Nov. 20. By JEROME LALANDE, Inspector and Dean of the College, and formerly Director of the Observatory.*

BEING permitted for the tenth time to entertain the public with the progress of a science which has engaged my attention fifty years, I am happy in being able to announce things still more interesting than on the last occasion; and, in the first place, the conclusion of that grand operation the measurement of the earth, or of $9\frac{2}{3}$ degrees of the meridian from Dunkirk to Barcelona.

About the middle of January, Delambre, impatient to begin his fatiguing labours, proceeded, notwithstanding the cold and the rain, to prepare a base from Lieurfaint to Melun; to complete the wooden pyramids, which were seventy feet in height, and to measure the angles.

On the 24th of February he had already finished seven stations for the angles at the base: three men had been employed for six weeks to cut down and remove from the high-

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