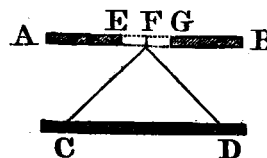


XXXII. *On a new Photometer, founded on the Principles of Bouguer.* By WILLIAM RITCHIE, A. M. Rector of Tain Academy. Communicated by Dr BREWSTER.

(Read May 1. 1826.)

THE celebrated BOUGUER was the first who discovered the important fact, that the eye can detect a very small difference between two similar illuminated surfaces, when viewed at the same moment,—the only principle which has yet been applied with any degree of success, in determining the relative illuminating powers of artificial flames. The following is perhaps the most commodious application of this principle, to determine the relative illuminating powers of different artificial lights, particularly of coal and oil gas. The instrument, or photometer, which I employ for this purpose, is extremely simple. It consists of a rectangular box, about an inch and a half, or two inches square, open at both ends, and blackened within for the purpose of absorbing the stray-light. Within the box are placed two rectangular pieces of plane mirror, forming a right angle with each other, and cutting the sides of the box at an angle of forty-five degrees. In the upper side, or lid of the box, there is cut a rectangular opening, about an inch long, and one-eighth of an inch broad. This opening is covered with a slip of fine tissue or oiled paper. In the annexed figure, A B C D is the box; C F, F D, the two plane mirrors; E G the rectangular opening covered with a small disc of oiled or fine paper. I need hardly mention, that the two mirrors should be cut from the same plate, in order that their reflective powers may be exactly equal. The rec-



tangular slit should have a small division of blackened card at F, to prevent the possibility of the lights mingling with each other, and thus affecting the accuracy of the result.

In using this instrument, place it in the same straight line between two antagonist flames, at the distance of six or eight feet from each other; move it nearer the one or the other, till the disc of paper appear equally illuminated on each side of the middle division, and the illuminating powers of the flames will be *directly* as the squares of their distances from the middle of the photometer. In moving the instrument rapidly between the two lights, we very soon discover a boundary, on each side of which the difference between the illuminated discs becomes quite apparent. By making the instrument move from one side of this line to the other, and gradually diminishing the lengths of the oscillations, we at last place it almost exactly in its proper position. It is very convenient to have a board of the same breadth with the instrument, divided into equal parts, for the purpose of supporting it, and reading off with ease and accuracy the distances of the flames from the middle of the instrument.

In viewing the illuminated disc of paper, I use a box, about eight inches long, in the form of a prismoid, and blackened within, in order to prevent any light entering the eye, except what passes directly through the disc of paper.

Instead of the two mirrors, I sometimes use the same instrument, with a piece of white paper pasted on the faces of the mirrors, or on a piece of smooth wood, forming, as before, a right angle. In this case, the illuminated discs are viewed directly through the rectangular opening in the lid, without the intervention of the tissue or oiled paper.

This instrument is still simpler than the preceding, and in some experiments has decided advantages. But whatever form of the instrument be employed, the following precautions should

be employed, in order to insure a very close approximation to the truth. Take any number of observations, turning the instrument round at each time, and the mean of these will give a result, perhaps as accurate as the nature of the case admits; at least, it will be sufficiently accurate for all ordinary purposes.

When the colours of the flames are different, it is very difficult to ascertain the place of equal illumination. We can, however, as before, find the space over which the instrument moves, before we discover an obvious difference between the illuminated halves of the oiled or white paper. We must then take the middle of this space, which will, even in that difficult case, give us a very good approximation to the truth. The same method was also used by M. BOUGUER, and found to be the best in similar cases.* But still this method is of very difficult application, when one of the lights is of a fine white, and the other of a dusky red or blue colour. In this case, I prefer the following contrivance.

Procure a piece of fine white paper, and get it printed with a small distinct type. Paste it on the rectangular opening in the instrument, which, in this case, may be somewhat enlarged. Brush over the paper with fine transparent oil, or, if the paper be very fine, this will be unnecessary. Place the instrument between the flames, and cause two assistants move them in either direction, till you can just read continuously along the paper with the same ease, and the squares of the distances will then afford a good approximation to the truth. If the second form of the instrument be used, the printed slip of paper must be pasted on the faces of the mirrors, or smooth wood, and read directly through the opening in the lid.

* *Traité d'Optique*, page 50.