PHILOSOPHICAL

TRANSACTIONS.

XI. *On a new form of the differential thermometer, with some of its applications.* *By* WILLIAM RITCHIE, *A. M. Rector of Tain Academy.* *Communicated by* J. F. W. HERSCHEL, *Esq. Sec. R. S.*

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IN using metallic reflectors for experiments on radiant heat, the results are liable to considerable uncertainty, in consequence of the imperfection of the reflectors, and of the difficulty of placing the bulb of the thermometer exactly in the focus, when the source of heat is removed to different distances. The following contrivance is free from these objections, and will illustrate the various properties of radiant heat in a more simple and accurate manner than by the more expensive and imposing method of reflectors.

The instrument consists of two cylindrical chambers of very thin brass, or tin plate, from two to six or eight inches in diameter, and from a quarter of an inch to an inch thick. These chambers, like those of the photometer formerly described, are connected by a thermometer-tube bent in the form of the letter U, having small bulbs blown near its upper extremities. The tube, like that of the differential

thermometer, contains a coloured fluid, such as sulphuric acid tinged with carmine, alcohol, &c. The exterior surfaces of the cylindrical chambers are coated with lamp black, for the purpose of absorbing the radiant heat, which is rapidly conducted to the interior of the chamber, and thus causes an expansion of the inclosed air. As the results of this instrument are only comparable with each other, the scale has no reference to a fixed standard, and consequently may be divided into any convenient number of equal parts.

This instrument is well calculated for ascertaining the relative radiating powers of different surfaces; but the only application which I shall now illustrate, is that of determining the law according to which radiant heat diminishes, as the instrument is removed to different distances from the radiating source.

Experiment 1.

Place a cylindrical vessel of tin plate filled with hot water, and having the same diameter as the chambers of the instrument, at different distances from the thermometer; the results will deviate very considerably from the ratio of the squares of the distances.

Experiment 2.

Repeat the preceding experiment with a canister having a smaller diameter, and the results will approach more nearly to the squares of the distances.

Experiment 3.

Instead of the canister, I employed iron balls about two inches in diameter, and found that the effects were, (within

the limits of error) as the squares of the distances of the centre of the balls from the end of the instrument.

This property is demonstrated by LAMBERT to hold with regard to light. *Photometria*, page 56. Theor. VI.

Experiment 4.

Place two heated balls on one side of the instrument, and one on the other, (the whole being of the same temperature) and move the instrument till the fluid remains at zero, and the distances of the centres of the balls will be as 1 to the square root of 2.

Since the effects of radiant heat from the heated balls diminish as the squares of the distances, how are we to account for the striking deviation from this law, when the large canister was used? Professor LESLIE says "such a striking deviation from the properties of rectilineal emanations must originate somehow, either wholly, or in part, from an *imperfect reflection.*" As the same thing holds without *reflectors*, it appears that the cause assigned by Mr. LESLIE cannot be the true one.