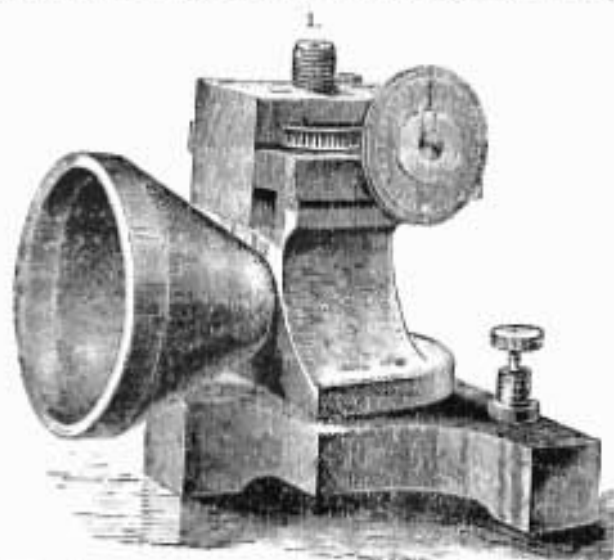


ART. V.—*On the use of the Tasimeter for Measuring the Heat of the Stars and of the Sun's Corona*;* by THOMAS A. EDISON, Ph.D.

To Professor Henry Draper M.D., Director of the Draper Eclipse Expedition:—

Dear Sir: The instrument which I used at Rawlins, Wyoming, during the solar eclipse of July 29, 1878, for the purpose of measuring the heat of the sun's corona, was devised by me a short time only before that event; and the time was insufficient to allow me to give it as thorough a test as was desirable to ascertain its full capabilities and characteristics.

This instrument I have named the tasimeter, from the Greek words *τασις*, extension, and *μετρον*, measure, because primarily the effect is to measure extension of any kind. The form of instrument which I used is shown in the annexed wood-cut (fig. 1.)

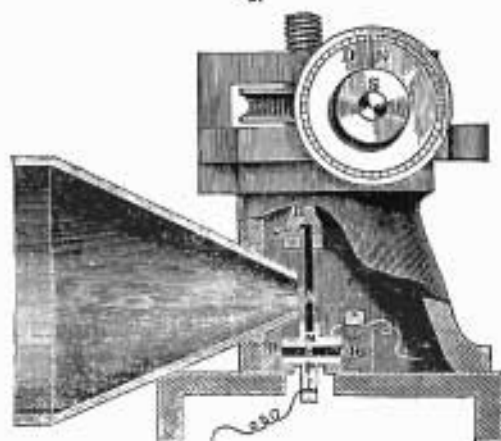


With this instrument was used a Thomson's reflecting galvanometer, on a tripod, and having a resistance of three-fourths of an ohm. The galvanometer was placed in the bridge wire of a Wheatstone balance, two of the branches of which had constant resistances of ten ohms each, while of the other two one had a constant of three ohms, and the other contained the tasimeter which was adjusted by means of the screw to three ohms. When thus balanced if the strip of vulcanized rubber placed between the fixed point and the carbon button (seen in fig. 2)

* Read, by permission of Dr. Draper, at the St. Louis meeting of the American Association.

was exposed to heat from any source, it expanded, producing pressure upon the carbon button, decreasing its resistance and destroying the balance; a current was thus allowed to pass

2.



through the bridge wire containing the galvanometer, the amount of this current of course being proportional to the expansion of the rubber and to the strength of the battery.

The form of instrument here described was only finished two days before leaving for the west; hence I was unable to test it. However, I set it up upon my arrival at Rawlins, but found that it was a very difficult matter to balance so delicate an instrument as a reflecting galvanometer with one cell of a battery, through such small resistances. In fact, I did not succeed in balancing it at all in the usual way. Nor could it be balanced in any way until I devised a method which I may designate "fractional balancing," when it became very easy to accomplish the result and also to increase the effect by using two cells in place of a single one. This device consisted of a rheostat formed of two rows of pins. The rows were about one-half an inch apart. A wire was connected from a pin on one row to a pin on the other row and so on, so that the current had to pass through the whole length of the wire, which was No. 24 gauge and four feet long. This was used as a shunt around the galvanometer. A copper wire connecting all the pins of one row served to reduce the resistance to zero. When the galvanometer was then shunted, a very feeble current passed through it. If the spot of light was not at zero it was brought there by either increasing or decreasing the pressure upon the vulcanite of the tasimeter by the adjusting nut. When thus brought to zero the copper wire of the shunt rheostat was taken off of one

pin, thus increasing the resistance of the shunt perhaps to one-fiftieth of an ohm. The spot of light was generally deflected nearly off of the scale. The light was again brought to zero by varying the resistance of the tasimeter, and another one-half inch of wire included in the shunt, another deflection and another balance was obtained by the tasimeter. Thus by gradually increasing the delicacy of the galvanometer by increasing the resistance of the shunt and balancing at every increase, the whole of the current was allowed to pass through the galvanometer and the shunt taken off. When this point was reached the damping magnet or director was in close proximity to the case of the galvanometer. To increase its delicacy to the fullest extent it became necessary to raise the director to the top of the rod. This was done by raising it cautiously a quarter of an inch at a time, bringing the spot of light to zero each time by the tasimeter.

In order to form some idea of the delicacy of the apparatus when thus adjusted, a preliminary experiment was made on the evening of the 27th, with the star Arcturus. The tasimeter being attached to the telescope, the image of the star was brought on the vulcanized rubber. The spot of light from the galvanometer moved to the side of heat. After some minor adjustments, five uniform and successive deflections were obtained with the instrument, as the light of the star was allowed to fall on the vulcanite to produce the deflection, or was screened off to allow of a return to zero.

It was in this condition when the eclipse occurred. The tasimeter was placed in a double tin case, with water at the temperature of the air between each case. This case was secured to a Dollond telescope of four inches aperture. No eye-piece was used. At the moment of totality the spot of light was slowly passing towards cold. When I withdrew a tin screen and allowed the edge of the luminous corona to fall upon the rubber, the spot of light stopped, went gradually off of the scale towards heat, its velocity accelerating as it approached the end.

The time required for the light to leave the scale was from four to five seconds.

I interposed the screen and endeavored to bring the light back to zero, but I was unsuccessful. Had I known that the heat was so great I should have used a platinum strip in place of the vulcanite, and decreased the delicacy of the galvanometer by the approach of the damping magnet. I then should doubtless have succeeded in getting two or more readings, and afterwards by comparison with bodies of known temperature should have obtained a near approach to the temperature of the sun's corona.

Respectfully yours,
Menlo Park, N. J., August 15, 1878.

THOMAS A. EDISON.