

ing or falling of the water will cause the rod to rotate on its axis. The outer end also carries an arm, which is connected by means of a slot and pin with an index which moves on an upright guide in the box, and marks the height of the water on a graduated scale.

This apparatus is no improvement so far as we can see upon the old and simple float-indicator invented by Watt, and reproduces the stuffing-box which the gauges of Faber and Grimes were devised to get rid of. As French machinists have borrowed Faber's magnetic gauge (without acknowledgment, of course,) just sufficiently altered in form to render it difficult to recognise at first sight, they had better stick to a good thing, although badly obtained.

Remarks on Radiation and Absorption. By JOHN TYNDALL.

From the Lond. Mechanics' Mag., November, 1861.

TO SIR JOHN F. W. HERSCHEL, Bart., &c.

DEAR SIR JOHN:—I am anxious to address this note to you upon a subject which you have in great part made your own, because I fear that neither in my book upon the Alps, nor in my recently published papers, have I made due reference to your estimable researches on Solar Radiation. I have been for some time experimenting on the permeability of our atmosphere to radiant heat, and have arrived at the conclusion that true air, that is to say, the mixture of oxygen and nitrogen which forms the body of our atmosphere, is, as regards the transmission of radiant heat, a practical vacuum. The results from which the opacity of air has been inferred, are all to be ascribed to the extraneous matters diffused in the atmosphere, and mainly to the aqueous vapor. The negative results recently obtained by that eminent experimenter, Professor Magnus, of Berlin, have induced me to re-investigate this point; and the experiments which I have made, not only establish the action of aqueous vapor, but prove this action to be comparatively enormous. Here is a typical case:—On the 10th of this month, I found the absorptive action of the common air of our laboratory to be made up of three components, the first of which, due to the pure air, was represented in magnitude by the number 1; the second, due to the transparent aqueous vapor, was represented by the number 40; while the third, due to the effluvia of the locality and the carbonic acid of the air, was represented by the number 27. The total action of its foreign constituents on the day in question, was certainly sixty-seven times that of the atmosphere itself; while the aqueous vapor alone exerted an action at least forty times that of the air.

I have also to communicate to you some results of lunar radiation which connect themselves with your speculations. On Friday, the 18th of this month, I made a series of observations on the moon, from the roof of the Royal Institution. From six concurrent experiments, I was compelled to infer that my thermo-electric pile lost more heat when presented to the moon than when turned to any other portion

of the heavens of the same altitude. The effect was equivalent to a radiation of *cold* from our satellite. I was quite unprepared for this result, which, however, you will at once perceive may be an immediate consequence of the moon's *heat*. On the evening in question, a faint halo which surrounded the moon, and which was only visible when sought for, showed that a small quantity of precipitated vapor was afloat in the atmosphere. Such precipitated particles, in virtue of their multitudinous reflections, constitute a powerful screen to intercept the terrestrial rays, and any agency that removes them and establishes the optical continuity of the atmosphere, must assist the transmission of terrestrial heat.* I think it may be affirmed that no sensible quantity of the obscure heat of the moon, which, when she is full, probably constitutes a large proportion of the total heat emitted in the direction of the earth, reaches us. This heat is entirely absorbed in our atmosphere; and on the evening in question, it was in part applied to evaporate the precipitated particles, hence to augment the transparency of the air round the moon, and thus to open a door in that direction for the escape of heat from the face of my pile. The instrument, I may remark, was furnished with a conical reflector, the angular area of which was very many times that of the moon itself.

October 21, 1861.

*I was going to add "into space," but the expression might lead to misapprehension. My experiments indicate that the absorption of water is a *molecular* phenomenon. If we suppose the aqueous vapor of the atmosphere to be condensed to a liquid shell enveloping the earth, the experiments of Melloni would lead us to conclude that such a shell would completely intercept the obscure terrestrial rays. And if the vapor be equally energetic, our atmosphere would prevent the *direct* transmission of the obscure heat of the earth into space. On this point, however, I wish to make some further observations.

New Tracing Paper.

It is recommended to moisten a sheet of common paper with benzine by means of a sponge. The paper becomes temporarily transparent, and any lines may be traced through it. In a few hours, the benzine evaporates, and the paper becomes opaque as before.

Cosmos.

On the Surface Condensation of Steam. By J. P. JOULE, LL.D., F.R.S.

From the Lond. Mechanics' Magazine, November, 1861.

In the author's experiments, steam was passed into a tube, to the outside of which a stream of water was applied, by passing it along the concentric space between the steam-tube and a wider tube in which the steam-tube was placed. The steam-tube was connected at its lower end with a receiver to hold the condensed water. A mercury gauge indicated the pressure within the apparatus. The principal object of the author was to ascertain the conductivity of the tube under varied circumstances, by applying the formula suggested by Professor Thomson,

$$c = \frac{w}{a} \log \frac{v}{v'}$$