

unslaked stone-lime, and I think, three sixty gallon casks of oil. I am not certain on this point, although I cannot err greatly; the consistence which the mixture must have, will be a sufficient guide for the proportions. In the process of making, and applying it, the information which I have given is perfectly correct. After it is prepared for use, it is kept in covered vessels to preserve it from the rain, or other moisture. The ship's bottom is prepared for sheathing in the usual way, by being paid with a coat of good half stuff, and allowed to cool, before the plaster is put on, as this accelerates its adhesion to the main bottom.

Although it is out of my province, and I am therefore unable, to form a judgment on this point, I have thought it worth inquiry whether this cheap cement might not be substituted for the costly Roman, or Dutch water cements. It would be worth the trial, whether it would not harden in fresh, as well as in salt water, and answer the purpose of building piers, locks, and other structures under water.

If you think these remarks likely to be useful, please to insert them, and oblige,

Yours, &c.

JAMES MARSH.

On the cause of the Diurnal Fluctuations of the Barometer.

TO THE EDITOR OF THE FRANKLIN JOURNAL.

SIR,—Some years ago I communicated to the American Philosophical Society, a paper explanatory of the diurnal fluctuations of the Barometer. As that paper has not appeared in their transactions, and as no satisfactory explanation of this phenomenon has appeared elsewhere, although it has been attempted by Professor Leslie and others, I send you the substance of it now for publication.

The phenomena, as observed by many philosophers, in the East and West Indies, and in various parts of the torrid zone, are the following:—

From 6 to 10 in the morning, the barometer rises,

From 10 to 6 in the afternoon, it falls,

From 6 to 10 in the evening, it rises,

And from 10 to 6 in the morning, it falls.

Many years ago, Dr. Balfour instituted, at Calcutta, a most laborious course of observations on this subject, in which the height of the barometer was noted almost every half hour, for one lunation; and the preceding phenomena were observed, with but two or three slight exceptions. Humboldt observed nearly the same phenomena in the West Indies.

The cause of this fluctuation is so plain, that it is strange it did not occur to either of those philosophers. But it is still more strange that Mr. Leslie, who has done so much for meteorology, should have assigned so inadequate a cause as the sea breeze for this phenomenon.

Nor has Mr. Daniell been successful in his attempt to elucidate these fluctuations by his laborious theory of the polar winds.

The true cause of this phenomenon is the expansion, and, of course, rise of the atmosphere by heat, and the contraction and consequent fall of the atmosphere by cold. Suppose just before sun-rise in the torrid zone, the temperature of the air neither increasing nor diminishing, and of course the air neither expanding nor contracting, the barometer stands at 30 inches; now when the sun rises at 6 o'clock the air will begin to be heated near the surface of the earth, and of course, by its expanding, will elevate the superincumbent atmosphere; and this, by its inertia, will re-act on the air below, and thus press harder on the mercury of the barometer, than if it were at rest—and the more rapidly it is forced upwards, the greater will be its re-action downwards, and of course the more will the barometer be affected. It is manifest that the most rapid increase of heat and rarefaction of the air will take place somewhere between sun-rise and three o'clock, when the heat is the greatest, and this will evidently be near ten o'clock, at which time the barometer will stand highest. Though the heat is still increasing, and of course the air expanding, yet the rapidity of increase after this hour is not so great, and therefore the barometer will begin to fall, and at the moment of greatest heat, when the air is neither expanding nor contracting, the mercury will again stand 30 inches high. But now the air begins to contract from cold, and the mercury will therefore continue to descend, and the rapidity of the descent will be in proportion to the rapidity of the contraction from cold. Perhaps this effect may be more clearly understood by imagining an extreme case. Suppose the lower strata of atmosphere suddenly annihilated, the mercury of the barometer would be relieved from all pressure for a moment, and fall down into the basin; and if annihilation removes all pressure from the mercury, a contraction of the lower strata by cold will remove some pressure, therefore the mercury will fall—at the moment therefore of a most rapid decrease of heat, which is probably near sunset, the mercury will stand lowest, and will be below the height of 30 inches, at which I have supposed it to stand when the air is neither expanding nor contracting. The mercury will now begin to rise, for the rapidity of contraction diminishes from this moment, and the upper parts of the air are permitted more and more to press upon the lower with their whole weight, and even when the contraction ceases below, the upper parts having acquired a velocity downwards, are inclined to continue that motion, and thus by their momentum will press upon the lower parts with a force greater than their natural gravity, and thus the barometer will rise above 30 inches, at which height it was supposed to stand when the air was neither contracting nor expanding. This effect must take place sometime in the night, and it seems probable, *a priori*, that it would be about ten or twelve o'clock. Now, as the mercury at this hour stands higher than it does by the natural weight of the air at rest, it is plain that it will begin to fall as soon as the force of the superior parts of the air begins to spend itself on the inferior, and when all motion downwards has ceased, the mercury

will again be pressed by the natural weight of the atmosphere, and so stand at 30 inches. In this situation the sun will rise upon it, and the same fluctuations will be renewed.

J. P. ESPY, Prof. Lan.

Philadelphia, March 1st, 1827.

Postscript.—Since writing the above, I have seen the remarks of a very able writer in the American Quarterly Review, on Mr. Daniell's theory: as the reviewer seems to think Mr. Daniell's theory satisfactory, I will merely add that it is not true, that "the first effect of an increase of heat in the atmosphere will be to diminish its pressure," (see page 8 of last American Quarterly Review;) but, on the contrary, the first effect of heat will be to increase the pressure, and cause the air to move outwards and upwards, from where it is heated, and the current will not begin to run towards the heated part until the whole column of air, over this part, becomes lighter by some of the superior parts rolling off from their greater elevation.

On the construction of a Kite, for effecting a communication between a stranded Ship and the Shore, or under other circumstances, where badness of weather renders the ordinary means impracticable. By
CAPTAIN DANSEY.

A SAIL of light canvass or holland, is cut to the shape and adapted for the application of the principles of the common flying kite, and is launched from the vessel or other point, to windward of the space over which a communication is required, and as soon as it appears to be at a sufficient distance, a very simple and efficacious mechanical apparatus is used to destroy its poise, and cause its immediate descent; the kite remaining, however, still attached to the line, and moored by a small anchor, with which it is equipped.

The kite, during its flight, is attached to the line by two cords, placed in the usual manner, which preserves its poise in the air; and to cause its descent, a messenger is employed, made of wood, with a small sail rigged to it. The line being passed through the cylindrical hole of this messenger, the wind takes it rapidly up to the kite, where, striking against a part of the apparatus, it releases the upper cord, and by that means, the head of the kite becomes reversed, and it descends with rapidity.

In the experiments made by Captain Dansey, with a view of gaining communication with a lee-shore, under the supposition of no assistance being there at hand, a grapnel, consisting of four spear-shaped iron spikes, was fixed to the head of the kite, so as to moor it in its fall; and in this emergency, the attempt of some person to get on shore along the line, would be the means resorted to. In those cases where a communication has been gained, and the maintenance of a correspondence has been the object, the person to windward has attached a weight to the messenger, in some cases as much as three