The dates of all these auroras should be mentioned here, but this paper has already been extended beyond the limits originally intended; and I must content myself with mentioning a few dates when there was a remarkable change of the dew-point here, but no aurora, in the hope that some persons who keep a meteorological journal to the north of this, may have the curiosity to examine whether an aurora occurred at any of those times or not, and publish the result of their examination, whether it shall be in the negative or affirmative. At all events, the comparison of these accounts, if published, will be highly interesting, and cannot fail to aid in the formation of a just theory in explanation of this meteor.

In 1832. January 26th; February 21st and 24th; March 14th, 18th and 27th; April 20th or 21st; May 21st and 27th; August 25th; September 5th and 23d; October 16th, 24th and 26th; November 14th and 20th; December 19th or 20th.

In 1833. January 11th or 12th, 16th and 26th; February 7th and 25th; March 2d; July 31st; August 8th; October 3d and 11th.

In 1834. January 3d or 4th, 13th and 21st; February 12th and 26th; March 3d, 8th, 21st or 22d, and 30th; April 11th and 27th; June 2d or 3d, 11th or 12th, and 27th; July 11th; November 16th.

At all these times there was a remarkable *depression* of the dew-point; but I have not had it in my power to ascertain whether the aurora was seen or not at distant places on these nights;—it was not seen at Philadelphia. It may be mentioned too, that in case the aurora was seen about these times, it was probably seen a little before them, in places north of Philadelphia; for I observe that when the aurora was seen about the same time at New Haven and at Philadelphia, it occurred a day or two sooner at New Haven than at Philadelphia, and that in like manner, it occurred sooner in one instance at Philadelphia than at Wilmington, Del.

This probability is increased from the fact, that the aurora, and especially auroral arches, are known generally to travel towards the south.

As there are no facts in opposition to the suggestions here made, and some, though not enough to found a theory upon, in favour of them, I am sure that even the rigid inductive philosopher will excuse me for throwing out these hints as worthy of further investigation.

(*To be continued.*)

Remarks upon the Employment of Pressure Engines, as a substitute for Water Wheels. By Daniel Livermore, *Civil Engineer.*

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The committee of the Institute have, by their accurate and valuable experiments, afforded the most satisfactory evidence that, under peculiarly favourable circumstances, water wheels may be so constructed and used as to ensure an *effective* application of three-fourths of the power applied for their propulsion; and from this, some mechanics have inferred that the present modes of applying water power admit of little or no improvement.

A more comprehensive view of the subject will, in the opinion of the writer, lead to a different conclusion. The following remarks are, therefore, offered in illustration of the probable advantages of substituting pressure engines for water wheels, in the propulsion of machinery, under various circumstances.

Before entering upon this subject, it may be proper to premise that the location of water power is generally such as to afford only a moderate amount of head and fall; and it may be assumed with tolerable certainty, that more than nine-tenths of the water power in the United States is confined to situations which do not afford an aggregate of ten feet, head and fall.

It is well known that, by the present modes of application, the *proportion* of power rendered effective is much less, with a moderate amount of head and fall, than in situations where the elevation is sufficient to admit the application to large overshot wheels, or other wheels, on which its action is continuous, by weight, or steady pressure, instead of the sudden effort of impact, whether derived from *direct* percussion, or by reaction; in the latter case, the greatest *effective force* found by actual experiment does not, as I am informed, exceed one-third of the power applied.

To simplify the subject, suppose, in *every* case, ten feet head and fall can be obtained for use. Then we will first consider it as applied to a pitch back, or breast wheel, both of which act upon the same *principle*, and are justly considered the most effective wheels for this amount of head and fall; yet, to prevent obstruction from flood water setting up the tail-race, it is generally expedient to leave 2½ feet of fall, equal to one-fourth of the power, unappropriated. The remaining 7½ feet head and fall, equal to seventy-five per cent. of the power, is further reduced by percussive action of the water at its introduction on the wheel; by its premature escape from the buckets; its retrograde action at its final delivery therefrom, and the retarding effects of centrifugal force, during its action on the wheel; so that not more than sixty per cent. of the power, *as applied*, is effective; or, taking into consideration the fall unappropriated, the *effective* force is only forty-five per cent. of the power.

2dly. If the water be applied to the best constructed reacting wheels, no loss is sustained by flood water, so long as the rise of water in the fore-bay is in the same proportion as in the tail-race; and the whole column may, in all cases, be brought to act, *in effect*, by percussion, and thus produce an effective application of force equal to one-third, or thirty-three per cent. of the actual power.

3dly. Undershot and tub-wheels are subject to obstruction by flood water, and if we leave 2½ feet of fall unappropriated, there remains seventy-five per cent. of the power, which is applied percussively, and thus produces an effective application equal to twenty-five per cent. of the actual force.

4thly. Flutter wheels, of the description used for saw mills, are peculiarly liable to obstruction from back water, and it is generally necessary to leave 2½ feet fall, or one-fourth of the power, unappropriated, and the loss from percussive application of the remainder would reduce it to twenty-five per cent.; furthermore, at least one-third of the water escapes from these wheels without *any beneficial* action, leaving only about seventeen per cent. of effective force.

If we allow only one foot unappropriated fall, the calculations would give, for five feet head and fall, the same *proportional* results for the *effective force*, as before shown; but the *practical* result would be the stoppage of every wheel, except the reacting wheel, whenever there happened to be a superabundance of water.

In the application of water for the propulsion of pressure engines, the *whole column* acts by *weight*, or *pressure*, and the force is not diminished by flood water, so long as the rise at the outlet, or tail-race, does not exceed that in the fore-bay.

Pressure engines may likewise be constructed for use in situations where there is but a small quantity of water, and a greater amount of head and fall than can be applied to any single wheel; in such situations, these engines have been applied in Europe.

The engine which I have patented, under the denomination of the "Regulated Pressure Engine," is materially different in its construction, and adapted to situations affording but *small amount of head and fall;* this engine affords the means of adjusting the intensity of the force excited in either direction, so as to meet the resistance to be overcome principally in one direction, if required; or it may be equalized, and applied to produce a rotary motion, in like manner as is adopted for the steam engine.

This engine has the advantage over other pressure engines, in point of simplicity, and economy of construction,—affords more ample water way through the valves,—and so perfectly obviates the defect heretofore experienced from the non-elastic action of water, that, in a recently constructed working model, not the least concussion was observable from the action of the water, which was applied with between four and five feet head.

It must, however, be admitted, that this engine labours under the disadvantage attending all new machines on their *first* introduction, viz: the mechanical execution, in many of the minor details, will lack that accuracy of finish, and that due adjustment of the component parts, which are easily effected in the construction of machines to which thousands of ingenious mechanics have served a regular apprenticeship, and to the due execution of which they have for years devoted their whole attention. A full development of the advantages to be derived from the use of such engines, could not, therefore, be reasonably expected in their *first* construction. The first working model of this description being furnished with a piston six inches square, attached to a working beam, propelled a pump, having a plunger four inches square, with the same length of stroke as the engine, and so applied as to raise water from the outlet, or tail-race, into the fore-bay. Thus, if we make no allowance for leakage, the *effect* was equal to $\frac{16}{36}$, or a little more than forty-four per cent. of the force applied, and in this case the full force of the engine was not excited; and, from the best calculation we could make, the *unexcited* force would exceed the most liberal allowance for loss from leakage, so as to leave the effect fully equal to forty-four per cent., after allowing for leakage and friction.

The head and fall applied to the breast wheels used at the Fairmount Water Works, as appears by a report of the Watering Committee in 1823, is eight feet six inches; and forty gallons, acting on the wheels, raise (after allowing for leakage) one gallon to the height of 96 feet: here the effect is $1 \times 96 = 96$; and the power, $40 \times 8\frac{1}{2} = 340$

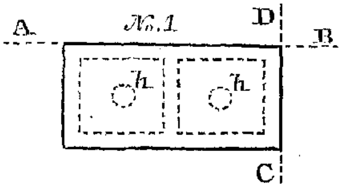
Thus, the *effect*, independent of leakage and friction, would but little exceed twenty-eight per cent. of the power, although applied to machinery exhibiting, in every part, evidence of consummate skill, and accuracy of workmanship.

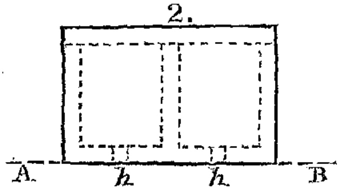
Blairsville, Indiana county, Pa., Jan 1st, 1835.

Notice of Hollow Bricks, used for the Construction of Arches.

TO THE COMMITTEE ON PUBLICATIONS.

Gentlemen,—During a recent visit to Europe, I saw, at Toulon, buildings, the roofs of which were made fire proof, by the use of *hollow bricks*, making an arch so light as to be supported by walls of moderate thickness. I have not the means of giving exact information as to the dimensions of the bricks used by the French engineers, or the thickness of the walls by which the arches are sustained; but I think I can give a general notion of the manner of making these bricks, which will enable an architect to apply them, after a few trials, to any building to which they may be adapted; and I would particularly recommend the subject to the attention of the architect of the Girard College.





The form of the brick being that of a voussoir of an arch, except that the top and bottom are both made flat, suppose the dimensions of the upper surface to be ten inches by five inches, and the depth six inches, the radius of the arch twenty feet; agreeably to which supposition the subjoined drawings are made, allowing half an inch for the thickness of the material. Of the cuts, No. 1 is a plan of the brick, No. 2 an elevation on the line A B of the plan, and No. 3 an elevation on C D.