INTERESTING CORRESPONDENCE.

WORKING STEAM EXPANSIVELY.

We have never been so much embarrassed with an overflow of valuable correspondence as we have in relation to this subject; and while we were hesitating what to do with it all, we were fortunately relieved from doubt by the receipt of the following communication from the engineer of the hydraulic works of the Illinois and Michigan Canal. As the theoretical question has been pretty fully discussed, and as this communication gives an account of a thorough experiment on a large scale with very marked results, we think that our readers will deem it valuable, and that our ablest correspondents will be willing to give place to it:—

MESSRS. EDITORS:—I promised to send you the results of some experiments I have been making the past summer to test the value of using steam expansively, and now fulfill my promise.

In the first place, let me say that these experiments have been made at the hydraulic works of the Illinois and Michigan Canal at Chicago. They were erected for supplying any deficiency of water in the dryest part of the season that might be needed by the canal, and are capable of raising fifty thousand cubic feet in a minute: the water is taken from an arm of the lake (Michigan), which is always at or very near a uniform hight, except when varied by high winds. It is raised about eight feet by means of two wheels nearly forty feet in diameter, ten feet wide in the clear, and dipping usually between five and six feet, the depth being registered day by day. Upon the outer rims of each wheel are placed cogged segments for driving it by pinions direct on the main shaft.

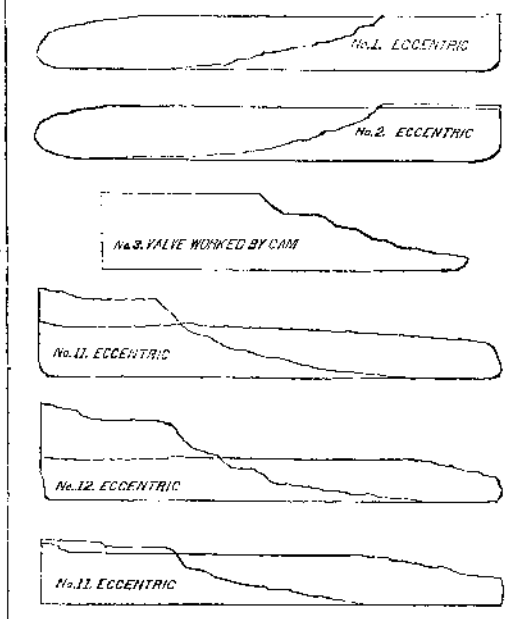
The ordinary duty of each wheel is from fifteen to seventeen thousand cubic feet of water per minute, which falls directly into the canal from the wheel, the hight varying only about six inches as it falls, and is again filled up. The fuel is bituminous Illinois coal taken from the same bed, with not the least discoverable difference in its quality, and always carefully weighed before the firing. There are twelve boilers in nests of six in each, exactly alike, and not one leak in any of them; they are 26 feet long, 42 inches in diameter, with two 16-inch flues in each. They are fired by firemen, employed for the last twelve years, who, we have good reason to know, are capable for their places. The engines work horizontally, are high-pressure non-condensing, the escape steam heating the water for the boilers to very near 210°, which is fed to them as near as may be in a uniform stream. The firemen have a steam gage in plain view, as also have the engineers. The engines are packed with metallic rings, held out by springs in the usual manner. We use puppet valves of the usual Mississippi form, which are in perfect order. They can be worked readily at a full stroke, or cut off at any point below a half, and can be changed to any given point during the progress of the stroke, and without stopping.

We usually carry the steam in the boilers at from 50 to 55 pounds pressure, and cut off at one-fourth of the stroke. One pair of the engines are 6 feet stroke, by 32 inches diameter of cylinder, the valves of these worked by cams. The other pair are 8 feet stroke by 28 inches, worked by eccentrics, and all cut off at the main valve by an arrangement I have never seen before, but working very effectually and certain.

With the great uniformity of the work we have to do from season to season, with so little variation of the water in the lake, and so little in the canal, any carefully made experiment here must give a reliable and truthful result; and especially when frequently repeated as it has been, I cannot see where there is a chance to doubt. The experiments have been made at frequent intervals since May, one day running with cut-off at half stroke, at others down to one-eighth, alternating with full stroke. The experiments continued daily from the 11th to the 27th of August: average about fifteen revolutions of the wheel, with the cut-off at one quarter against eleven with a full stroke; thus—Aug. 11, 10.40 revolutions; 12th, 11.00; 13th, 10.14; 14th, 11.01. Although these experiments were satisfactory enough to me, yet I deemed it proper to make some with special reference to the publication of them in your valuable paper. Accordingly on the 17th of September, every part of the machinery was examined to see that it was in perfect working order. The boilers were cleaned out and filled with clean water. The cylinder heads were taken off at one end, and the steam allowed to drive the piston out to the end, when no leak was found traceable. The valves were all carefully examined, and found in perfect order. The covers to the cylinders were then replaced, and the works set in operation, the firemen knowing nothing of the designs we had in view; they were only instructed to keep the steam as near 52½ pounds pressure as possible, and to keep the coal evenly distributed through the day. The coal was then weighed in half a tun at a time, then allowed to burn out in each experiment until the steam fell to 50 pounds, then the next half tun would be begun upon, and the cut-off changed. This was continued for twelve experiments, and the average result was 1,254 revolutions, with the cut-off at one quarter, and 798 at the full stroke, being a little over 57 per cent gain by the use of the cut-off.

There would be many ways to judge of the reliability of these experiments, if any one were present. For instance, the moment the full stroke was put on, the firemen had to increase their efforts to keep up steam, and this was invariable through all the experiments, the full stroke having the steam low, and the cut-off having it high. In experiment No. 4, one of the firemen went to dinner, and the full stroke run down the steam 20 pounds; the cut-off took it and brought it back, but by doing so fell off say from 115 revolutions for two hundred pounds of coal down to 93, but this was counted as though nothing had occurred.

I send you five diagrams taken along through the trials that any one acquainted may see the condition of valves,



as it was working, I could send you many more, but this perhaps is more than is neeessary. It has been our aim to take cards from the engines daily, and lay them away for future reference.

Thinking that even these experiments might not prove entirely satisfactory to the advocates of non-expansion, I yesterday went over with as many as I could during the day, with different firemen selected, so that they could not know what were our designs. The diagrams, 11, 12 and 11 were taken yesterday, No. 1 aad 2 taken the 17th No. 3 is from the cam engine, merely to show the state of that engine; we have not been obliged to run more than one wheel, and this has lain still.

The result of yesterday's experiments are 108 revolutions with the cut-off, and 73 with full stroke. The water in the river steady at 5 feet 3 inches; in the canal 6 feet 4 inches raised to 7 feet, which is the highest point we pump. I would remark that every part of the machinery was oiled once during each experiment; the temperature of the water for the boilers varying but little during the day. I have already drawn out these papers too long, but before closing I would be glad to say it is our purpose to use higher steam, say 100 pounds, and cut shorter, but the blow from steam higher than 50 pounds on the cut-off is unpleasant. This will, in another season, be corrected, and no doubt we shall cut at one-eighth. A. GUTHRIE.

Chicago, Ill., Oct. 4, 1860.

A DECISIVE EXPERIMENT IN FAVOR OF EXPANSION.

MESSRS. EDITORS:—The subject of working steam expansively being the order of the day, we will give you the results of some experiments made at the Tivoli Railroad Mills, of Henry Lansing & Co., of this place. Having noticed in your valuable paper the result of the experiments at the Metropolitan Mills, we thought it to our interest to ascertain whether they were correct or not; for if they were, we had been laboring to a great disadvantage. We have an excellent opportunity for testing the matter, as our work is regular at all times. We have in use one engine of 18-inch bore, by 36-inch stroke, built by Franklin Townsend, of this place, under the superintendence of the able and efficient mechanical engineer, George P. Jackson, Esq., fitted with Burnap's patent variable cut-off valve (but no throttle valve), which consists of a cut-off valve, sliding on the back of the main valve in a steam-tight box or chamber, having no pressure of steam at all, and being varied by the governor to cut off at any point desired. The cylinder is lagged and covered to guard against condensation, and the piston is fitted with Jas. O. Haight's patent Z packing-spring, effecting a great reduction of friction; in short, it is constructed with every desirable improvement for working steam expansively. It runs 50 revolutions per minute, cutting-off at ¼ stroke, drives three runs of stones and all the other machinery connected with a first class flouring mill.

We ran one day with our usual head of steam 45 pounds, and cut-off at 9 inches, weighing the coal. The next day we carried a lower head of steam, and cut-off at 18 inches, or half-stroke, when we found that we consumed one-third less fuel the first day at short stroke than on the second on the long stroke. As we ran the same number of hours, and the labor performed was exactly the same, the stones being in the same condition both days, and the amount of flour the same, with a small amount in favor of the short cut-off, we came to the conclusion that we derived a decided benefit from the expansion. But in order to thoroughly test the matter, we tried it for several days in succession, cutting off at 9 inches one day, and 18 the next, to be certain that no difference in the atmosphere could effect the consumption of the fuel, and invariably found a gain of one-third the amount used in favor of the short cut-off system. We also found much more difficulty in keeping the low head of steam with the long cut-off. One day when we could not keep the requisite amount, we stopped until we got the steam up to 45 pounds, and then cutting off at 9 inches we had no trouble. This, we think, is another argument in favor of expansion. We also tried one other experiment, which was to carry a greater quantity of steam than was required, and throttled it in the pipes, wire-drawing it into the steam chest, and found this made a material difference, using considerable more fuel than when giving it free passage. As the result of our trials have been perfectly satisfactory to us, we have continued our former plan of working steam expansively, and have arrived at the conclusion, that there cannot fail to be a decided gain by it when the engine is so constructed as that the full pressure of steam in the boiler is conveyed directly to the piston, without throttling or strangling in the pipe or ports.

S. M. SHEPARD, Superintendent.
C. W. ROSE, Engineer.

Albany, N. Y., October 4, 1860.

NIGHT AIR.

MESSRS. EDITORS:—It has been lately discovered—as we must infer from various paragraphs just now circulating in the papers—that we are very foolish in excluding night air from our chambers. Air—air, it is contended, why should the air of the night be less salubrious than the air of the day? Why should the air which the "songster of the forest" breathes in his nest at night, be injurious to man (in his bed)? &c., &c.

Well, is it not strange that in looking at one point, the *salubrity* of the air, people can overlook the surrounding circumstances or conditions! We might just as well propose that a cold bath is harmless at any time or condition of the body, because water is the most salutary of all the liquids.

It seems as if those "lovers of night air" forget that,

1st. We are *undressed* at night (not wholly so, its true), though more or less under quilts, &c.