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Contents:

(Illustrated articles are marked with an asterisk.)

THE WATER WHEEL TESTS AT LOWELL.

The opinions we have already expressed in regard to the tests of turbine water wheels, made at Lowell last summer, have strong confirmation from letters received by us from exhibitors and others, cognizant of the facts in the case.

The announcement of the tests contained a general invitation to those who wished to exhibit the working qualities of their wheels, and it gave the impression that everything would be complete, open, and fair, and that each wheel would stand or fall solely upon its merits.

We are informed that the tests were not properly made. The apparatus for measuring the water delivered to the wheels was perfect at first, being constructed after the specific published directions of Mr. Francis; but the edges of the weir became much battered by the action of rubbish that passed over it, in consequence of draining the canal every night for repairs. This compelled the opening of the wheel-gates and also the flood-gates to allow *debris* to escape. The foundation of the bulkhead also became unsettled by the large volume of water passed through and under it, throwing the weir out of level.

We are further informed that the flume, or bulkhead, was not so constructed that the exact available head of water upon the wheels could be determined. No two wheels could be put in alike or occupy the same relative positions. Thus it was impossible to approximate similarity of conditions in the different tests. As one correspondent says, the experiments were, in this respect, mere "cut and try." In one case the water had to turn three right angles, resulting in a loss of two per cent of the head as ascertained by measurement, and of course also giving rise to commotion in the water which injured the effectiveness of the wheel to a greater or less extent.

Fault is also found with the friction brake used in the test, as being unreliable and treacherous. It is said that this brake did not allow the wheels to run steadily; that at times it would allow a wheel to move with a uniform motion, and then would suddenly stop motion altogether. It is stated that at best it would not hold the weight steady one second.

The following terms were prescribed for the test: The wheels should be the ordinary manufacture, and should give about forty-horse power under 14 feet, the cost of test not to exceed a stipulated sum.

Notwithstanding, wheels of various degrees of finish were brought to the test. There was no uniformity in size, some giving not more than eighteen-horse power. The expense, it is said, also exceeded the stipulated sum six-fold.

The apparatus was located on a canal already too small to supply the necessary water to the mills located on it. For weeks at a time there could not a drop of water be had for testing in the day time save a few minutes at noon; and the tests made after September were only such as could be snatched from time to time, at short intervals.

It seems that this incompleteness of the arrangements prevented the satisfactory performance of even preparatory experiments; and it is understood that only one public test was made.

It will thus be seen that the public has lost nothing by the suppression of any report of these tests.

IT is said that an English firm has recently fitted up the engines of a small steamer on Warsop's aero-steam principle with highly satisfactory results.

THE WAGES OF MACHINERY.

"There are in the United States about thirteen millions of laboring *men, women,* and *children.* There are also a very large number of laboring *machines.* It is estimated that there is steam machinery in the United States equal to two million horse power, or more than fourteen millions of full-grown men. A large portion of this machinery works day and night. It is never sick, never idle, never goes on sprees, never strikes. It always works, when required, up to its full capacity, and never tires. It is not unreasonable to estimate the work of the machinery as equal to that of twenty-eight millions of full-grown industrious men. It is evident, therefore, that only one third of the work of the country is done by its *laboring men,* and two thirds are done by its *laboring machinery.* Is it not clear that the wages of the laboring machinery constitute a larger portion of the cost of manufactured goods than the wages of the laboring men? Would not a reduction of the wages of the laboring machinery go further to reduce the price of goods and facilitate competition than a reduction of the wages of the laboring men. Of course it would."

The above from *The Free Trader* is a fair sample of the ingenuity brought to the support of the doctrine of free trade; an ingenuity which expends itself in concocting sophistical arguments to mystify and delude those who have not the time or the facts wherewith to test their accuracy. We would only add a single word to the above quotation, and that at the very end of it, "*Of course it would not,*" is the way we would read it, and for the following reasons:

First, it does not follow that because machinery does the largest portion of the labor performed, that it does it at a greater cost than that of the aggregate manual labor of the country. There is no doubt that it does it at much less cost. It is not clear that the wages of laboring machinery constitute a larger portion of the cost of manufactured goods than the wages of laboring men.

In 1860, the capital employed in the United States, in manufacturing, was $1,009,855,715. The wages paid for manual labor amounted the same year to $378,878,966. Twenty per cent of the capital invested will, on the average, pay the entire current expenses of establishments driven by steam power, including the interest on the capital at seven per cent, repairs and depreciation, and exclusive of cost of the material worked and the manual labor employed.

We have purposely made a large average for steam-power manufactories. Where water power is employed the cost of running is much less, owing to the reduction in the fuel account. An average fully large enough for all kinds of power would be 15 per cent. Fifteen per cent of the total manufacturing capital above given would be $151,488,357, for the wages of machinery in 1860, as compared with $378,878,966—the wages of manual labor employed in the manufacturing business.

But the value of manufactured products was, the same year, $1,885,861,676. The wages of machinery was only a trifle over eight per cent of the value of the goods and wares produced. So that if, instead of demanding such enormous wages as the *Free Trader* would have us believe, the machines would be generous to the consumer, and work for nothing and repair themselves, the reduction in the price of goods thus secured would be only eight per cent.

But as the machines will not work for nothing and repair themselves, the free traders have determined on reducing their wages by a removal of duties on iron and coal. The cost of iron in the construction of machines made wholly of that material will not average over ten per cent of their selling price. So, provided that iron were to be obtained without any cost, machines could be thereby cheapened only one tenth, and as the interest on the first cost of machines, and the depreciation which eventually necessitates the purchase of new machinery are items in the entire wages of machinery, which perhaps may be estimated at ten per cent of capital invested, we find that the reduction in the cost of manufactured goods consequent upon the reduction of the wages of machinery caused by getting the iron for nothing at all, would be only one tenth of one half of eight per cent of the entire value of manufactured products, or two fifths of one per cent.

We have already said enough on the subject of the tariff on coal, about which there has been such a hubbub. There is no reason to believe that its removal would affect the price of coal in any appreciable degree.

This attempt to show that machinery is overpaid and that the working man suffers thereby, deserves to be ranked with the attempt to prove that the tariff on salt—18 cents per 100 lbs.—must inevitably render the luxury of salt codfish inaccessible to the poor.

WASTE OF LABOR IN BUILDING.

Of all the painful sights we are called upon to witness in this day of steam engines, and labor-saving appliances, none strikes us as being so absurd and unnecessary as the waste of human toil in building as it is generally conducted. Hodmen crawling up long ladders with small burdens of bricks and mortar, carrying at each trip some sixty or seventy pounds of building material, with thirty or forty pounds of hod, and one hundred and sixty or more of flesh and blood—not to mention beer—seems something so foreign to this age of machinery that we should scarcely feel it more incongruous to see the stocks and pillories restored to our market-places.

If a huge beam or girder is to be raised, we see the crane, tackle, and steam engine employed, but the ordinary carrying is done by human legs. These legs, although they can do climbing passably, are certainly inferior in this respect to other legs designed by nature to make climbing a specialty. A ladder is a very serviceable appliance in its way; we however, believe it to be as hard a road to travel as ever the genius of man devised. The hod belongs to an ancient and honorable family of implements, but it does not seem the most agreeable companion in the world to clasp in affection ate embrace or place one's cheek fondly against.

Therefore we say down with the hod; let it take its place with the host of implements, on the tomb of which modern progress has written the epitaph—"PLAYED OUT."

Let us suppose the two side pieces of a ladder to be replaced by iron rails and the rounds by ties, and let us suppose some genius to conceive the happy idea of causing a locomotive to crawl tediously up this heavy grade, drawing after it a load of one third its own weight. What gibings, what laughter, what derision would such a scheme excite among mechanics! Yet we are importing annually large numbers of locomotives to do the same thing; only these locomotives run on the ties instead of the rails.

They do these things better in France. Either derricks are employed, or the brick and mortar carriers are used as stationary engines, rather than as locomotives. In passing a building in process of erection in Paris, one may often see a number of men stationed one above the other along a ladder, each of whom passes his load to the next above him, until the load reaches its destination. In this way a continuous procession of materials is kept up, and a large quantity may be elevated in a short time.

This is an improvement on the climbing process, but there must even in this way be an enormous waste of power. And this waste is not only useless, but so easily avoided that the continuance of the employment of human power to perform such rude work, is a disgrace to modern civilization. It can be demonstrated that a small one-horse power engine, with suitable tackle, and the employment of a single man to attend it, will do the work of six men at elevating bricks and mortar, at a cost of less than the wages of two men.

No mechanic who reads this will fail to see many ways in which this application of steam power could be advantageously made. The ladder might be replaced by a railway up and along which a car-load of bricks or mortar might be made to roll, which track might be joined to and made continuous with a horizontal track, by means of an easy curve at the summit, the whole being adjustable to suit the progressive hights of the wall as they advance towards completion. It would require little genius to adjust the detail, and the cost of building would be greatly lessened by dispensing with the hod carriers.

FRENCH EXPERIMENTS WITH LIQUID FUEL.

For more than ten years M. H. St. Clair Deville has been experimenting with mineral oils as fuel. *Comptes Rendus* and *Le Journal de l'Eclairage au Gaz,* have lately published some interesting facts in regard to these experiments, a *resume* of which is our present purpose.

The oils employed have been obtained from various natural sources, and the experiments have also included the heavy oil from the Parisian Gas Company's works.

The experiments have determined the following points: In twelve kinds of crude oils analyzed, there was found to be from 82 to 87·1 per cent of carbon, 7·6 to 14·8 per cent of hydrogen, and 0·9 to 10·4 per cent of oxygen.

The heavy oil of the Parisian Gas Company has a specific gravity at 32° Fah. of 1·044, and at 88° Fah. 1·007. It is of a dark brown color, and contains 82 per cent of carbon, 7·6 per cent of hydrogen, and 10·4 per cent of oxygen, nitrogen, and sulphur. Heated to 424° Fah., only 12·5 per cent volatilizes. It remains fluid at 12° Fah. A tun of it contains about 220 gallons, and its cost is about fifty francs per tun, or in round numbers ten dollars in gold, our currency.

The amount of carbon added to the hydrogen contained in this fuel, must make it a very powerful heat generating combustible. It has nearly the lowest expansibility of all the oils, its coefficient of expansion being 0·000743, and the lowest coefficient being 0·000652.

The most important experiments with the heavy oil were made with a locomotive of the Strasbourg Railway Company. This locomotive has uncoupled wheels and outside cylinders. Its weight is twenty tuns, and that of the tender is fifteen tuns. It has a heating surface of 72 square yards.

The oil was supplied to the furnace from a tank, being fed by its own gravity. An additional supply was carried on the the tender, wherewith to renew the supply in the tank as required.

The fire was kindled by lighting some shavings and sticks on the floor of the fireplace and at the same time admitting a small quantity of oil. A jet of steam was sent into the smoke pipe from the blow-off pipe of another engine to increase the draft. It took an hour and a quarter to get up steam, during which time 11 gallons of oil were consumed. It was shown, however, that by consuming 12½ gallons of oil, steam could be got up in two and one half hours, without assistance from another engine, but with the inconvenience of a large amount of dense black smoke.

On the first experimental trip it was found that a speed of forty miles per hour was obtained with a consumption of about 14 lbs. of oil per mile.

In a second experiment a train of 70 tuns was drawn at a speed of forty miles per hour, with a consumption of about 17 lbs. of oil per mile.

Subsequent experiments gave results not differing essentially from those mentioned.

The grate consists of 20 bars of iron cast in one piece, with channels for the oil to run down, and it is set perpendicularly before the furnace which is lined with fire brick. A separate cock supplies oil to each grate bar.