sion and contraction on longitudinal bearings have a tendency to loosen the screws which bind the rail to the balk.

Break of gauge is of little consequence in reference to passengers, but becomes a great difficulty in transferring heavy goods. It becomes a matter of importance to devise the best, cheapest, and quickest mode of transshipment from one gauge to the other, whether it be by removing the goods from one carriage to another carriage, or by moving the body of one carriage on to another set of wheels by mechanical power; it becomes a question of cost. The measure of the inconvenience is the cost per ton to do it quickly. The expense of constructing powerful lifting machines of little importance where the traffic is large; has laid out £130,000 to save about a halfpenny per ton upon the shipping of coals. Could put up apparatus to move 25 wagons in one minute, or in a couple of minutes, requiring the employment of not less than 50, nor more than 100 men. The cost of transshipment would be a trifle upon a long line, but a large item upon a short one. It is perfectly easy to make wagon frames and wagon bodies for a large trade that would go to any part of the country; the bodies must go quite through, and return again; the frames would keep on their own lines, and the wagons would simply drop into them. There would be no difficulty in constructing passenger carriages to move in the same way; if there is traffic enough to render it worth doing, there is no difficulty in doing it. Civ. Eng. & Arch. Jour.

(To be continued.)

TRANSLATED FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Note on the Measurement of Water delivered through large (or wide) Orifices. By M. MORIN.

I propose communicating, successively, to the Academy, the results of the experiments made by me in 1844 and 1845, at the powder mill of Bouchet, on various hydraulic motive powers; either by order of the Minister of War and with reference to the powder department, or for the purpose of examining questions submitted to the decision of the Academy itself.

In experiments on hydraulic motive powers, the most delicate portion, and that most subject to error, is the measurement of the quantity of water expended. Local circumstances, forms, or shapes, the arrangement of flood-gates, exert on that quantity great influence, which, as yet, has been too little studied, and the inexact appreciation of which has frequently led the most conscientious observers into serious errors, to which may be attributed, very frequently, the manifest exaggeration of certain results announced with the most perfect sincerity.

In order to place myself out of the reach, as far as it depended on me, of such errors, and to establish with some certainty, or at least with a sufficient approximation to it, the ratio of useful effect produced by the motive powers submitted to experiment, to the absolute amount

of water expended, I endeavored to determine upon a mode of measurement beyond the reach of controversy, which was somewhat difficult.

For this purpose, I first reflected whether I could measure, with sufficient exactness, the quantity of water supplied by an overshot-wheel flood-gate fixed at the head of a canal, or race, in which the motive powers to be subjected to experiment were to be placed.

This flood-gate is equal in width to the head-race, which is constructed of masonry; it is inclined from above downwards at an angle of about 65 degrees to the horizon; its upper edge has an acute angle up-stream, and is rounded off down-stream; it is 0.08 m. thick. Two racks, each of 0.05 m. wide, reduce the clear width to 2.017 m.

In order to estimate the volume or quantity of water that passed over this flood-gate, the tail-race, which was constructed of masonry, with a rectangular section, was closed below by a vertical dam of plank, in which were made three openings; to these were fitted wicket-gates of about 0.300 m.* square, of thin sheet iron, of about 0.005 m. in thickness, sliding in front of the orifices, which were formed with sharp edges, similar to those made use of in the experiments of Messrs. Poncelet and Lesbros. These small sheet iron wicket-gates were, by means of screws, worked by hand; rods, with marks showing the level, were placed in front of the overshot-wheel flood-gate and the wicket-gates, in order to show and to verify the invariableness of the levels.

From this short description, it may be readily conceived, that by making simultaneous observations at the overshot-wheel flood-gate, and at the orifices with thin sides, the supply, or quantity delivered, by the two kinds of orifices might be calculated, by means of the very precise results of the experiments of Messrs. Poncelet and Lesbros, and which were evidently applicable, with all desirable exactness, to the case in question.

But these experiments, undertaken on canals of great dimensions, which had vast basins, subject to the effects of the winds, and whose level it was difficult to regulate perfectly by means of an ordinary mill flood-gate, could not possess a degree of exactness comparable to that of experiments made under more favorable circumstances. In order to examine into the whole together, and to disengage the results from accidental influences, we have re-produced them by a graphic construction, taking the values of the *charge*† H, on top of the flood-gate, as abscissa, and those of the coefficient of the supply or delivery as ordinates.

In examining the table of the results, and, above all, the curve which represents them, it is seen that the values of the coefficient of the supply or delivery increase rapidly with those of the *charge* H, on the ground-sill of the orifice, from $H = 0.03$ m. and 0.04 m. up to $H = 0.10$ m., a term beyond which they still continue to increase, but more and more slowly.

* The *metre*, which is the measure adopted in this paper, is equal to 39.371 English inches.

† The word *charge* throughout this paper, is intended to designate the depth of water on top of the flood-gate.

If, to compare these results obtained with a flood-gate of 2.017 m. in width, equal to that of the head-race, and placed in the before-mentioned circumstances, with those which relate to a flood-gate of 0.20 m. wide, to complete contraction, we determine, by means of the figure, the values corresponding with the *charges* observed, in this last case, the following table may be formed, which we limit to the charges with which we have operated :

Width of Orifices.	Values of the coefficient m , of the formula $Q = m L H \sqrt{2gH}$, For the values of H equal to					
	0.04 m.	0.06 m.	0.08 m.	0.10 m.	0.15 m.	0.20 m.
0.200 m.	0.407	0.401	0.397	0.395	0.393	0.390
2.017	0.264	0.355	0.418	0.448	0.469	0.482

It is seen that for small *charges*, this flood-gate, of 0.08 m. thick, produces a notable diminution in the supply or delivery, although the contraction may be nearly annulled on the vertical sides of the orifice. This effect is analogous to that observed by Messrs. Poncelet and Lesbros on small overfalls passing through a shute. We know, in fact, that, in the cases in which the contraction is nearly null on the sides, these observers found the following values of m :

Charges on the upper side of the overfall.	0.04 m.	0.06 m.	0.10 m.	0.15 m.	0.21 m.
Values of m .	0.246	0.271	0.308	"	0.324

These values, which, for small *charges*, make a very near approach to those we have obtained, show that the diminution of the supply or delivery depends, in both cases, on the same cause, on the resistance of the side or wall of the flood-gate, or of the shute. We notice, in fact, that in small *charges*, the fluid vein wets and follows the surface of the flood-gate ; but in proportion to the increase of the *charge*, this influence of the sides or walls diminishes, and soon, indeed, the fluid vein detaches itself completely from the upper edge, which is sharp up-stream, and the resistance of the surface of the flood-gate ceases to be felt, whilst at the same time the suppression of the lateral contraction continues to exert an increasing influence on the augmentation of the supply or quantity delivered ; whence it results that the coefficient of the supply or delivery increases.

Such is the natural and simple explanation that may be given of the smallness of the values of the coefficient of the supply or delivery for the small *charges*, and of their magnitude for the large *charges* observed in our experiments.

Notwithstanding the care taken in the execution of these experiments, the local causes and circumstances mentioned did not permit us to approximate nearer than $\frac{1}{15}$ th or $\frac{1}{10}$ th ; but the sketch shows,

nevertheless, by taking them as a whole, the gradual and continual progress of the increase of the coefficient of the supply or delivery, and, until new and more precise researches are made, I think we may, in applications to analogous cases, adopt with sufficient accuracy for practice, the values deduced from the sketch, for the coefficient of the supply or delivery, viz :—

Charges on the Sill of the Overflow,—in metres.

0·04, 0·05, 0·06, 0·07, 0·08, 0·09, 0·10, 0·12, 0·14, 0·16,
0·18, 0·20.

Values of the Coefficient m ,—in metres.

0·264, 0·313, 0·335, 0·390, 0·418, 0·437, 0·448, 0·460,
0·467, 0·472, 0·477, 0·482.

These values, which, for *charges* exceeding 0·10 m., are much greater than those which have been, up to this time, adopted for similar cases, show that flood-gates, arranged like that made use of by us, which is the case with many horizontal wheels, deliver more water than is generally admitted to be the case; and that, in experiments on hydraulic motive powers, we are liable, for want of a good method of measurement, to estimate the supply or delivery of water at one-sixth or one-seventh below the real amount, and, on the other hand, very much to overvalue the useful effect.

It would therefore be desirable that new, special experiments, on large flood-gates, of the proportions most in use, and arranged as is most customary, should be made with proper accuracy. The preparation and arrangement of the necessary apparatus require considerable outlay, convenient localities, and a combination of means and circumstances such as are rarely to be found, and these difficulties make us regret that the experiments already made with so much care and precision, by order of the Minister of War, at Metz, at the expense of the Government, from 1827 to 1834, with a view to the wants of the Artillery and of the Corps of Engineers, should not yet have been published, or even communicated to these corps.

Experiments on an Orifice with the Charge on the Summit.

Although the *ensemble* of the results obtained with the overshot water-wheel flood-gates, enables us to determine with sufficient exactness, at least for practice, the amount of water actually supplied or delivered in the experiments proposed, on hydraulic motive powers, I have thought it best to make use, for this purpose, of an orifice with the *charge* on the summit, so that the height, and, consequently, the area of the orifice remaining the same, the *charge* on the centre, being alone exposed to slight errors of measurement, enters into the calculation of the supply or delivery, but as under a radical of the second degree, and the influence of these errors diminishes when the *charge* increases.

For this purpose, I caused to be made on the same race or canal, an orifice of 1·496 m. in width, the vertical sides of which were 0·16 m.

and 0.165 m. from the sides of walls of the canal, and as the movements or risings of the flood-gate were very slight, when compared with these distances, the contraction might be considered as nearly complete on these sides, as well as on the upper and lower sides.

The determination of the actual supply or delivery by this orifice, was made, as has been before explained, by means of small wicket-gates, whose greatest opening was 0.300 m.

The examination of the results obtained, and above all, their graphic representation, show that the greatest deviations did not amount to more, and were almost always less than $\frac{1}{10}$ th of the ordinates of the curve which represents them. And as, for experiments on hydraulic motive powers, such an approximation is quite sufficient, we have been able, in the ulterior calculations of the supply or delivery of water, to adopt the values of the coefficient of the supply or delivery deduced from this very curve.

We wish it to be observed that, in our experiments, the *charges* on the summit of the orifices having been comprised between 0.050 m. and 0.180 m. at farthest, and that this dimension, agreeably to the experiments of Messrs. Poncelet and Lesbros, producing an influence, at most, of only $\frac{1}{7}$, the variation of the coefficients has scarcely depended on any thing except the height of the orifices.

We have therefore been enabled, in accordance with this remark, to seek to compare the values of the coefficient of the supply or delivery which we have found, with those which have been determined for equal heights of orifices of 0.20 m. in width, by Messrs. Poncelet and Lesbros, and we have thus formed the following table:—

Nature of the Orifices.	Values of the coefficient of the theoretical supply or delivery for height of orifices of		
	0.20 m.	0.10 m.	0.05 m.
Orifice of 0.200 m. wide, .	0.592 m.	0.611 m.	0.630 m.
“ 1.496 m. “ . . .	0.675 m.	0.679 m.	0.727 m.
Increase owing to the augmentation of width, .	0.083 m.	0.068 m.	0.097 m.
Or . . .	.100 m.	.100 m.	.100 m.
	8.130	10.000	7.530

It is seen that the width of our orifice appears to have had a considerable influence on the supply or delivery, and that the increase resulting from it for this supply or delivery has varied, in the cases in question, from $\frac{1}{7}$ to $\frac{1}{10}$.

These results prove how necessary it was to verify beforehand the exactness of the formula to be made use of for the measurement of the supply or delivery of water, since differences of this kind might result from it.

We will moreover observe that these results, giving amounts of supply or delivery much greater than might have been calculated

agreeably to the rules generally admitted, the useful effects obtained from the motive powers studied in the experiments of which we have to give an account, will be diminished in the same proportion, and that, in this point of view, our results will be less favorable to them than if we had been content to follow the ordinary rules.

The experiments on motive powers will be the object of subsequent communications.—(*Academie des Sciences.*)

AMERICAN PATENTS.

List of American Patents which issued in the month of January, 1846,—with Exemplifications, by CHARLES M. KELLER, late Chief Examiner of Patents in the U. S. Patent Office.

1. For an *Improvement in the Corn Sheller*; Elijah Converse, Cincinnati, Ohio, January 7.

In this machine, the corn is shelled by the action of radial bars projecting from the surface of a horizontal disk, hung and rotated in manner similar to the runner of a mill, the ears of corn being retained to receive this action by another series of radial bars projecting downwards from the under surface of a dome-formed cap. The ears of corn are fed through an eye in the cap, and pass from thence towards the periphery of the runner, where the cob and grains are discharged. And as the dome shape of the cap gives an inclination to the series of radial bars attached to it, their outer ends are much nearer the face of the runner than their inner ends, which will adapt the machine to ears of all sizes.

Claim.—“What I claim as my invention and desire to secure by letters patent, is the before described manner of constructing the case, that is to say, with a circle of inclined radial bars on the under side of the dome, inclining downward and outward from the eye towards the base of the dome, forming, with the radial bars of the disk, a circle of triangular shaped cells for the reception and shelling of various sized ears of corn, thus doing away with the necessity of having movable concaves and boards, supported by springs to accommodate themselves to the varied sizes of the ears, which springs are liable to get out of order.”

2. For an *Improvement in the Machine for Raising Water from Wells*; Jehiel T. Farrand, Port Byron, New York, January 7.

This is for an improvement on the method of raising water from wells by means of a bucket and windlass. The bucket is hung by two ropes, one on each side, which wind around two drums on the windlass shaft, and these ropes are forced and kept out of the perpendicular by a guide-roller, so as to prevent the bucket from swinging, and the ropes from twisting together. And for the purpose of tilting the bucket, to discharge the water, the delivery spout is provided with