AUSTIN'S PERFORATED BRICKS.

After the Meeting, specimens were exhibited of Mr. Austin's Perforated Bricks and Blocks, with dovetailed joints, for straight work, and for circular, or oval culverts; their merit was stated to consist in imparting greater strength and solidity to the work, than with parallel joints, using less mortar, or cement, and enabling great speed to be employed in laying the blocks.

The larger perforations were stated to be intended for ventilation, for channels for warmed air, or for passing holding-down bolts, where the bricks were used instead of stone, for masses to resist, impact, or strain.

A simple and effective earthenware trough, with a cover, for containing the underground wires of the electric telegraph, was also exhibited on the table; and in the ante-room, there were several ingenious sewer-grate traps, and other accessories for sewerage works, the invention of Mr. Austin and of Mr. Jennings.

January 24, 1854.

JAMES SIMPSON, President,
in the Chair.

No. 872.—“Description of an Inclined Plane, for conveying Boats over a Summit, to and from different Levels of a Canal.” By JAMES LESLIE, M. Inst. C.E.

THE Author's attention has been directed to the subject of inclined planes for canal boats, by his having been engaged in designing and constructing one, for passing empty boats, at Blackhill, on the Monkland Canal, near Glasgow, of which a description was recently printed, in the “Transactions of the Royal Scottish Society of Arts.”

On that incline each boat, of about 60 tons burden, is taken up afloat, in a water-tight caisson, set level on a carriage, running on twenty wheels, and fitted with portcullis gates, at each end. The caisson, after being hauled up to the top of the incline, and being pressed hard against the gates of the upper reach of the canal, so as to form a water-tight joint, acts as a portable lock, out of which the boat is floated into

the upper reach, and *vice versâ*, in the case of vessels descending. There are two lines of rails, so that the ascending and descending carriages balance each other.

When there are no special reasons to the contrary, this plan, or a slight modification of it, is the simplest in its working, and the most suitable that can be adopted; at all events, it is free from objection on the score of straining, or otherwise injuring the vessels using it; whilst the waste of water, unless when the canal is over-full, and economy is consequently no object, is scarcely worth notice, being confined to the small quantity, contained between the gates of the canal and those of the caisson, which in the case of the Blackhill Incline, was only about 50 cubic feet.

There are, however, cases where, literally, no water can be spared, or where it is an object to lighten the load on the carriage, as much as possible: under either of these circumstances, it may be desirable, that the vessel should be laid dry, on a cradle, instead of being kept afloat, and it is to meet such occasional, or it may be, exceptional cases, that the present plan is designed.

The difficulty in adapting a carriage, fit to carry a heavy boat, to surmount a summit, and to descend again, so as not to require gates, or any expenditure of water, consists chiefly in this, that it is nearly impossible to get more than two axles fixed in position, relatively to the body of the carriage, to adapt themselves to a change of gradient, and the weight of an ordinary canal boat is generally so great, that it would wear down very fast, and endanger the breaking of any axles having only four bearings.

This difficulty is, in some measure, overcome in the Morris Canal, United States, by using two trucks with four wheels to each, and making the frame of the carriage, which bears the boat, to rest on four pivots; two of them being placed half way between the wheels on each truck, so as to allow the trucks to change their relative positions, and adapt themselves to any gradient. By this arrangement eight wheels are employed instead of four, but from experience gained at the Blackhill Incline, where the weight of the carriage, boat, and water, which is about 80 tons, is borne on twenty wheels, it appears clear, that it is not advisable, with such a load, to

diminish to any extent the number of the wheels; and that some other mode must be had recourse to, than the ingenious method adopted on the Morris Canal.

The simplest plan is to lay the rails in a continuous circle from the lower to the upper reach, so that the wheels, being adapted to that circle, may have a continuous bearing throughout the whole extent of the rails; but unless the height to be surmounted be extremely small, this plan involves the construction of a very great length of rail to prevent the inclination at the lower end becoming inconveniently, or impracticably steep. The inclination would be constantly changing, so that the power which would be required, to pull the carriage out of the water, would be extravagantly great, compared with the demand upon it, when the carriage approaches the summit.

The modification now proposed is to have two uniform inclined planes, descending each way, from a point, or summit, placed at a suitable elevation above the surface of the water in the upper reach. Each of these inclines is cut down for a distance from the summit, equal to that of the length of a carriage fit to carry the longest boat, and a circular piece of rail is formed there, on a lower level, the circle being drawn from a centre so placed, that lines parallel to, and equidistant from, the inclined planes, shall each be a tangent to the circle, at a point half way between their summit, or apex, if produced, and the terminations of the circular piece of rail. Upon the latter is placed a lower, or subsidiary carriage, running either on wheels, or what would be better, on rollers, so as to have no friction on the axles; and having straight rails and ratchets on its upper surface.

When the lower carriage is placed at either end of the circular rail, its upper surface forms a direct continuation of one of the inclined planes, and as it is exactly one-half of the length of the circular rail, the uppermost point of the rails fixed on the carriage coincides exactly with the apex of the two inclines.

The principal carriage, with the boat on it, is then to be run forward, by a rope and drum motion, upon this lower carriage, and held in its place by palls dropping into the ratchets; after which the lower carriage, with the travelling carriage and boat

on it, are all to be moved forward, by a wheel working into a rack, placed under the lower carriage, until the upper surface of the rails of the lower carriage comes to form a portion of the other incline, leading down into the upper reach, when the rope and drum motion is again to be made use of, for lowering the vessel into the water, until it floats off the carriage; the carriage may then either be hauled up again empty, or with another vessel on it.

The machinery requires to be adapted to shift into and out of gear, so that the engine may work either the drum motion, or the rack-work moving the under carriage on the circular rail; but the last motion may be very nearly counterbalanced, so as to be worked by hand.

This plan is more complicated than that with the caissons, and the one incline, and it requires two drums and two ropes, one on each side, instead of one in the middle, which arrangement would interfere with the lower carriage; two large guide sheaves are also required to lead the rope in a proper direction in the descent into, or ascent out of the upper reach, as on that side the rope coils, or uncoils below the drum, and without the guide sheaves it would be too low, by the full diameter of the drum. The two ropes, or chains require a swivel, or bridle below the carriage, so as to render the strain on them always equal, and also a spring to take off any jerks.

There would be some difficulty in adapting this plan to two lines of rails having the ascending and descending carriages to counterbalance each other, as at Blackhill: it could, nevertheless, be accomplished, if there were always at the same time ascending and descending boats of nearly equal weight. This, however, is not to be anticipated, and generally, there might be only an empty carriage to balance a carriage and boat.

One great advantage of the caisson plan is, that whether the caisson has a boat floating in it, or it be merely filled with water, the weight is the same in both cases, so that the system of counterbalancing is always complete, whether boats are both ascending and descending, or are all going in only one direction. In many cases, however, such as when there is a scarcity of water, and more especially, when the inclined plane is very flat, so as to render the counterbalancing of less

importance, the plan now described would be quite effective, and might be very useful.

This plan was first proposed for taking vessels into a small dock by the side of the Vistula at Warsaw, so as to be out of the reach of floods, and of ice in winter. The dock in question has no supply of water for locking, or sluicing, so that it became necessary to take the vessels over the summit; and the vessels are by no means of equal dimensions, or burden, and, consequently, are not well suited for being floated in a caisson.

Various means and appliances would be necessary to make the plan work well, and to prevent the vessel from being strained, or otherwise injured by lying dry on the cradle; such as guides, bilge-cods, &c., somewhat similar to those in use on Morton's patent slip, all of which could be satisfactorily arranged.

The Paper is illustrated by diagrams, showing the inclines upon the Morris Canal, and that adopted by the Author.

Mr. VIGNOLES said, that it was by his advice, that this ingenious plan had been adopted at Warsaw, where the depth of the river and its obstruction by ice during the winter, rendered it peculiarly applicable. The principle, which was similar to that of Morton's patent slip, was excellent in all cases where there were two levels: and the details could be modified to meet the circumstances of each individual case.

Mr. GIBBS said, that the same principle was applied, in a rude manner, in China: no lockage was used, but an inclined plane, at a slight angle, was constructed of paved stone, and the boats were hauled up by means of capstans. Fulton proposed an analogous plan for working a canal from Ambleteuse to Guisnes. The execution of this project was prevented by the great wars in Europe, and now the introduction of railways had entirely superseded the scheme. He thought, that the plan under discussion advantageously combined the advantages of railways and canals; the incline might be worked either by water-wheels, or by steam power.

Mr. GRAVATT said, that on an incline under his control, he had found it more economical to unload the barges by barrows