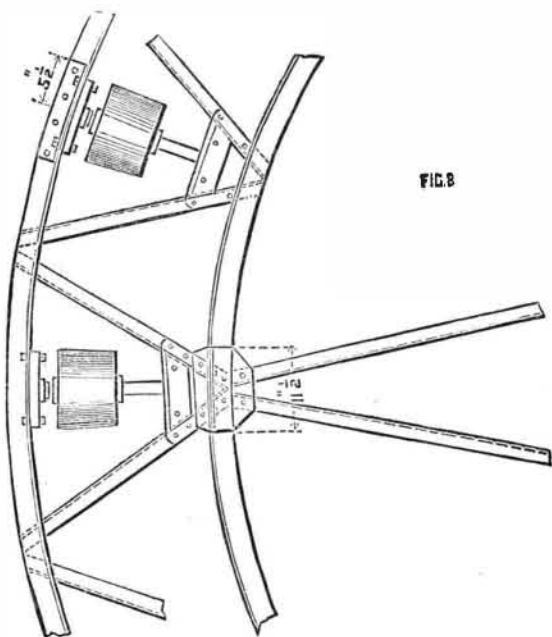


WEYMOUTH BRIDGE.

This bridge, which crosses the harbor, joins Weymouth proper to the Melcombe Regis part of the borough, and with the exception of a decrepit wooden structure in the neighborhood, forms the only road connection between the island of Portland and the mainland. The bridge, as it stood in 1878, dates from about the year 1820, and was strongly built of Portland stone, as shown in Fig. 1. To allow of vessels passing in and out of the inner harbor or back-water, an opening was necessary, and the authorities of that day having at considerable cost built the side arches of masonry, wide enough for a double line of vehicles, fixed an iron opening bridge wide enough only for one line. Thus narrowed, the bridge proved quite inadequate for the traffic of recent years, and the steep gradients of 1 in 10 were not only difficult of ascent with heavy loads, but caused a continuous wearing away of the road surface by the wheel drags in the descent. Besides this the gearing worked with difficulty, and the two leaves of the opening bridge became so loose at their junction at the crown of the bridge as to render the opening and shutting difficult and unsafe. These incon-



DETAILS OF LOOSE RING AND ROLLERS.

veniences at last became unbearable, and the corporation asked Mr. Ewing Matheson, M. Inst. C. E., to advise as to the repair of the old bridge and as to the cost of a new one. Mr. Matheson reported that though the old iron structure might last a little longer before it became unworkable, it was so worn and corroded that it could not be taken to pieces and repaired with any hope of being put together again. On this report an alteration of the old bridge and the construction of a new opening span was decided on, and parliamentary powers were obtained in the session of 1879, the necessary funds being borrowed on the security of the tolls for vehicles—foot passengers going free—with the collateral security of the borough rates.

The scheme as carried out comprises the widening of the south approach, the lowering of the gradients, and the erection of a new opening span of the full width of the stone arches. The plan—Fig. 4—shows the widening of the south approach, the footpath and parapet at the curve being carried on iron girders spanning from the shore arch to the quay wall. The dotted lines indicate the narrow roadway, and the black lines the new opening bridge. As the opening span was much wider than the one it was to replace, a wider space on which to turn was necessary for it, but by removing the upper course of masonry on the south pier, a sufficient and solid base for the ironwork was provided, and in this was placed the roller-path and gearing, the opening span being in one piece and not in two leaves as before. The

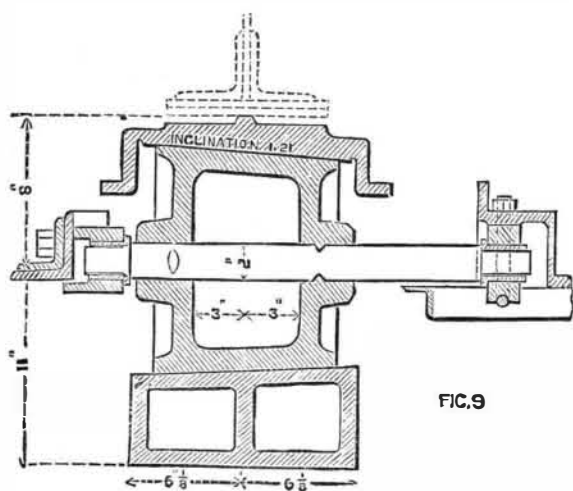


FIG. 9

roadway of the bridge could now be made horizontal, enough masonry being removed from the haunches of the arches without touching the arch stones themselves. On the north approach, however, it was impossible to lower the road because of the headway necessary over the tramway by which the railway traffic has access to the steamer quay seaward. The turntable of the bridge rests on twenty-four cast iron rollers 12 in. diameter—Fig. 9—the upper and lower roller paths being also of cast iron. The rollers are held in a light wrought iron frame-work, being purposely left thus free. The main girders are as shown in the elevation, and are of plate iron, except where they form the parapet over the opening, they there being lattice. The roadway is carried on cross girders, on which, for the overhanging portion, are placed longitudinal planks, cross planks, and wooden blocks, while for the heel or balance weight portion are iron plates, concrete, and granite sets. The weight of iron in the movable part of the bridge is 79 tons, including the machinery, and the total weight, including concrete and paving,

is 207 tons. The center of gravity of this weight coincides exactly with the center of the roller path, and as there are twenty-four rollers the weight on each is 8.6 tons. The bridge when closed is calculated to carry a moving load of 100 lb. per superficial foot. The moving mechanism is double, *i. e.*, there is a pinion under each footpath working into the same fixed rack—Fig. 11—and operated by crank handles and gear, single and double, compactly arranged in the two parapets—Fig. 10—so as not to obstruct the traffic

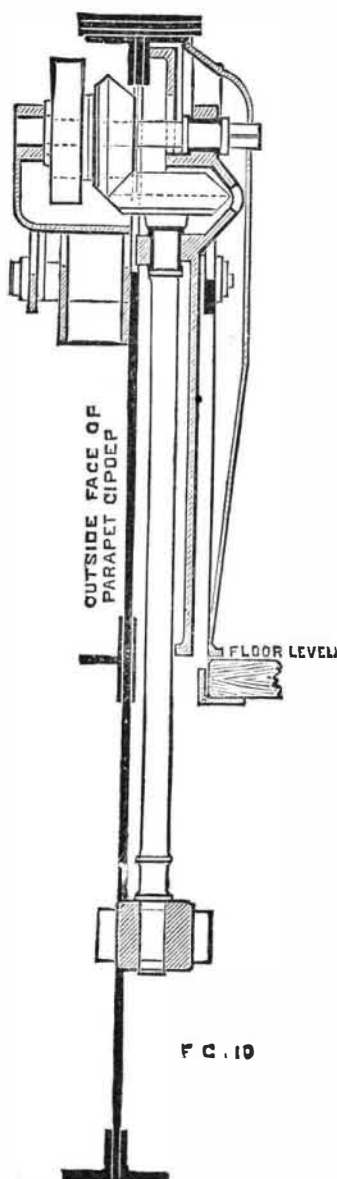


FIG. 10

on the bridge, the workmen standing on the footpaths. The two sets of wheels can be worked separately or together, each being arranged on the planet principle to move in or out of gear.

It was first intended to utilize the water pressure in the town mains for turning the bridge, but as the opening takes place only about once a day, the expense of hydraulic apparatus was avoided, and the hand gear alone provided. The bridge was ready for traffic on May 14, last year, and the accommodation it provides, and the easier traction for vehicles, give great satisfaction. Mr. J. T. Whettam was the

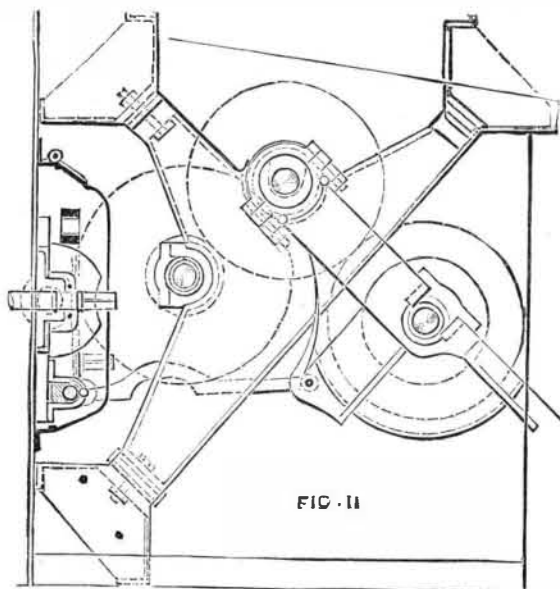


FIG. 11

contractor, the ironwork being made by Messrs. Handyside, of Derby, and the opening gear by Messrs. Brinjes & Goodwin, of London. The total cost was £5,000.—*The Engineer.*

ELECTRIC TRANSFER OF ENERGY TO GREAT DISTANCES.—With Gramme machines of the small kind, weighing about 100 kilos, and modified according to the principles which the author has indicated, he has obtained a work of 37 kilowatts, the resistance interposed between the motor and the receiver being 786 ohms, representing the distance of 78.6 kilometers of ordinary telegraph wire. This transfer is effected without the appearance of sparks at the brushes, the machine remaining perfectly cold, and without the necessity of taking special precautions for the isolation of the conductors.—*M. Deprez.*

DESCRIPTION OF THE DAVIS ISLAND COFFERDAM OF 1881.*

By MR. WM. MARTIN, C.E.

THE navigable pass is that portion of the dam over which the greatest depth of water is always attained, and extends out into the river at right angles to the lock a distance of 558.89 ft. The cofferdam extends out from the river lock wall a distance of 612 ft., and parallel to the current of the river, a distance of 237 ft., inclosing an area of $3\frac{1}{2}$ acres. The area thus inclosed, besides giving the necessary space required for the dam, gave ample room for all the machinery of construction. A cofferdam may be described as a water-tight wall constructed around the site of any work for the purpose of laying dry the foundation of pier, wall, or any other structure that may be intended, by pumping out the water from the area thus inclosed. The methods used in different works vary according to the uses intended and the facility for procuring the materials of construction. The preliminary step taken in the one which is the subject of this paper was to drive two rows of oak piles 15 in. in diameter and 20 ft. long to an average depth of 8 ft. at a distance of 15 ft. 8 in. transversely and 21 ft. longitudinally between centers, between which the frame-work was constructed, the piles serving to hold the frame-work in position until the puddling was placed. The frame-work consisted of three rows of stringers placed 12 ft. 4 in. apart, between which the sheeting was placed vertically and driven into the gravel 2 ft. The joints of the sheeting were covered with a 1 in. strip 6 in. wide to prevent leakage of the puddling. At the top of the sheeting are spiked two string pieces 2 in. by 13 in. on each side of the sheeting to form a bearing for the joist on which the deck was laid, also to bind the tops of sheeting together. The stringers were placed at the centers of pressure of rectangles of equal pressure, and were united together by a scarf joint with an iron rod passing through the entire width of the cofferdam with a nut on each end. One set of workmen assembled the stringers both in respect to height and width, and were followed by another set who drove the sheeting, and still by another who trimmed the tops of the sheeting and put on the 2 in. by 10 in. string pieces, the joists, and the deck. The most interesting part of the work was the placing of the puddling, and to which this paper chiefly refers. The total length of the cofferdam was 1,437 ft.; 379 ft. of it was puddled by material taken from the cofferdam used in the construction of the river wall; the remaining 1,058 ft. was puddled by material obtained on Davis Island. The method employed in puddling the cofferdams of the land and river walls was to deliver the material in cars by a tramway from the point of excavation to the river, where it was loaded into boats, from thence transported across the river, where it was delivered into the framework of the cofferdam by hand labor, and having to be watered to settle it. The method employed in puddling the cofferdam of the navigable pass was by forcing the material, by means of a centrifugal pump through a pipe, from Davis Island to the cofferdam, the plant of which consists of boiler, engine, piston pump, centrifugal pump, delivery pipe, and the necessary steam and water connections. The pump, which was of the ordinary centrifugal type, was located on Davis Island, a distance of 900 ft. from the cofferdam. Alongside and beneath the pump was a tank for mixing the puddling material, 8 ft. in diameter and 4 ft. deep, sunk to a depth sufficient to secure fall for a water culvert from the river. The piston pump was connected to the delivery pipe by a Y-connection, and was used for clearing the delivery pipe, for priming the centrifugal pump, and keeping the sand from the packing (as described hereafter), and for furnishing water for the agitator hose and the steam boiler. The puddle material, which consisted of loam and sand, was obtained within a radius of 100 ft. from the pump by loosening up the soil with a plow and delivering it in close proximity to the tank by horse scrapers, and from thence delivered to the tank by shovels, where it was mixed with water from the culvert and kept agitated by water from hose pipes in the hands of the workmen to prevent the mixture from settling in the bottom of the tank. The puddle material so mixed was taken up by the feed pipe of the centrifugal pump and forced through the delivery pipe to the coffer, the distance to which was constantly increasing owing to the advancement of the completed work. The delivery pipe was laid from the centrifugal pump along the bottom of the river, and thence rose to about 1 ft. above the top of the cofferdam by an easy ascent, avoiding any sharp angles. On the pipe at the pump a pressure gauge was used for the purpose of detecting any stoppages in the pump or delivery pipe whereby the free working of the pump might be impaired. These were frequently caused by the puddle material being fed too thick. When the gauge indicated a stoppage the operator slackened the speed of the centrifugal and opened the valve in the wye connection to the piston pump. A stream of clear water was then thrown from the piston pump through the delivery pipe at high pressure, and the pipe was cleared. The check valve in the delivery pipe between the wye connection and the centrifugal pump prevented a back flow into the centrifugal pump. On the bottom end of the feed pipe was a screen with meshes of one square inch to prevent stones, roots, or any material which might prevent the free working of the pump from being taken up by the feed pipe. Above the screen and in the same casing was placed a foot valve for the purpose of holding the priming. One of the principal difficulties experienced in working the pump was the rapid wearing of all the parts of the centrifugal pump with which the sand came in contact. The casing, which was originally $\frac{3}{4}$ in. thick, wore through in about ten days. This was renewed by a casing 1 in. thick, which performed all the work required. The stuffing box wore rapidly until the following device was applied: A screw was cut in the chamber in the opposite direction to the motion of the shaft. A pipe was put in back of the packing and connected with the piston pump. Water was forced through this around the shaft, and being under a greater pressure than the centrifugal pump, prevented the puddle material from getting into the stuffing-box. Water so applied performed a double duty, acting as a lubricator and preventing the shaft from heating. At the discharge end of the delivery pipe the puddle material was deposited in the framework of the cofferdam and flowed off for a distance of a few hundred feet, depositing in a hard and solid mass. Being delivered in a liquid form, it penetrated every crack and crevice in the framework and required no ramming or watering to settle it. A point noticed in the mass was, that the puddle material composed of loam and sand in its original state, as on Davis Island, was completely separated.

* Read before the Engineers' Society of Western Pennsylvania, December 30, 1881.

The loam being the lighter body was kept longer in suspension and settled on top of the sand. There was delivered into the cofferdam by the above described process 5,784 cubic yards of puddle material in twenty-three days' time, equal to 2.14 cubic yards per ten hours working time, or 25.14 cubic yards per hour. The cost of this was as follows:

| | |
|---|----------|
| Cost of pump..... | \$145 00 |
| Repairs, fittings, etc | 382 25 |
| Pipe | 364 09 |
| Fuel..... | 33 35 |
| Cost of labor, erecting machinery, making excavations for tank and water culvert feeding the centrifugal pump, etc..... | 3,647 07 |

Total\$4,575 76

A comparison of the above figures with the cost of the puddling of the river wall cofferdam, which was procured from Davis Island as described, and the cross-section of which was the same, shows as follows:

| | Length. ft. | Total Cost. | Cost per Lin. ft. |
|--------------------------------|----------------|-------------|----------------------|
| Cofferdam of river wall..... | 1,165 | \$8,628 37 | \$5 69 |
| Cofferdam of navigable pass... | 1,085 | 4,576 76 | 4 22 |

During the construction of the river wall cofferdam 12½ cents per hour were paid to laborers, and 22½ cents per hour to the mechanics, while during the construction of the navigable pass cofferdam laborers received from 17½ cents to 20 cents per hour, and mechanics from 25 cents to 27½ cents per hour. This makes the above statement still more favorable to the method of pumping. The dimensions of the principal parts of the machinery were as follows:

| | |
|---|--------------------------------------|
| Tubular steam boiler..... | 36 in. diameter, 16 ft. long. |
| Steam engine..... | 10 in. diameter, cyl. 10 in. stroke. |
| Piston pump { steam cyl. 12 in. diam'r, cyl. 18 in. stroke. | |
| { water cyl. 6½ in. diam'r, cyl. 18 in. stroke. | |
| Centrifugal pump | 4 in. diameter of discharge. |
| Delivery pipe..... | 4 in. diameter. |
| Clearing pipe..... | 2½ in. diameter. |
| Priming pipe | 1½ in. diameter. |
| Lubricator pipe | 1 in. diameter. |
| Agitator hose..... | 1½ in. diameter. |
| Steam pipe to engine..... | 2½ in. diameter. |
| Steam pipe to piston pump..... | 2 in. diameter. |
| Band wheel on engine shaft | 4 ft. 6 in. diameter. |
| Pulley on centrifugal pump shaft..... | 10 in. diameter. |
| Width of driving belt | 10 in. |

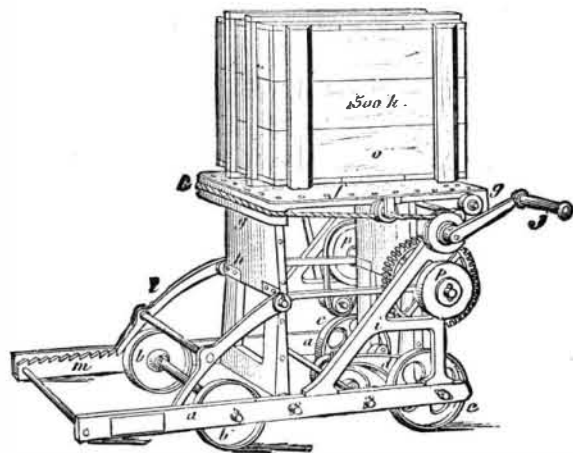
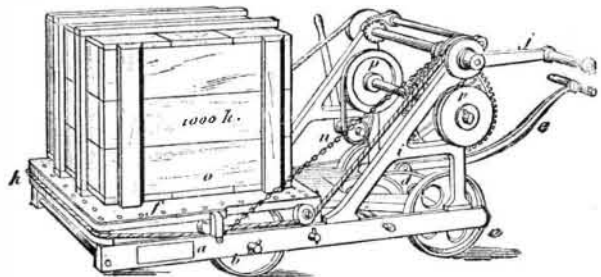
The pressures carried were as follows:

| | |
|-----------------------------|--------------------------|
| Steam boiler pressure..... | 100 lb. per square inch. |
| Gauge on piston pump..... | 70 lb. per square inch. |
| Gauge on delivery pipe..... | 35 lb. per square inch. |

The plant of the above described process, as originally designed, was very much simplified during the progress of the work, much that was complicated having been omitted for more simple devices. The cost of placing the puddling was thereby considerably increased. It is believed that with the improved machinery, as described above, the puddle material can be placed at one-half the figure given.

POIROT'S ELEVATOR TRUCK.

THE accompanying cuts represent an apparatus recently invented and put into market by Mr. Paul Poirot, of Paris, and called by him an elevator or hoist truck. It is designed chiefly for loading and unloading merchandise on carts or drays, although it may be likewise used for other hoisting



ELEVATOR TRUCK.

purposes where the height to be reached does not exceed four feet.

When the hoisting is to be performed in factories, at railway stations, on docks, or anywhere that cranes are employed, this apparatus will have no application; but, in all other cases, it will be found of undoubted utility when the weight to be raised is too great to be lifted by manual strength.

Every day we see carts being loaded and unloaded by means of an inclined plane—a method that is certainly convenient and practical, but, nevertheless, often laborious. Mr. Poirot's apparatus, therefore, comes to supply a want existing between the large elevating apparatus at present in use and inclined planes.

In addition to the facility that it offers for hoisting a load, it possesses the advantage of being portable.

The apparatus consists principally of a frame elevated but slightly from the ground, and carried on four wheels, two of which form part of a sort of fore-carriage. To this frame there are fixed by joints the four arms of a parallelogram, which are united in pairs, and carry a platform on which rests the load to be maneuvered. A special windlass fixed to the frame acts upon a cord, which raises or lowers the parallelogram, as may be desired. It will be readily seen that the platform may be lowered in such a way that there will be only a height of one inch or less to lift the goods to place on it. When the load is in place, it is only necessary to give the winch a few turns to elevate it to the desired height; and when the latter is reached, the frame of the parallelogram is almost vertical, as shown in one of the figures. The truck then having been wheeled up alongside of the cart to be loaded, there is nothing to do but to roll the merchandise off.

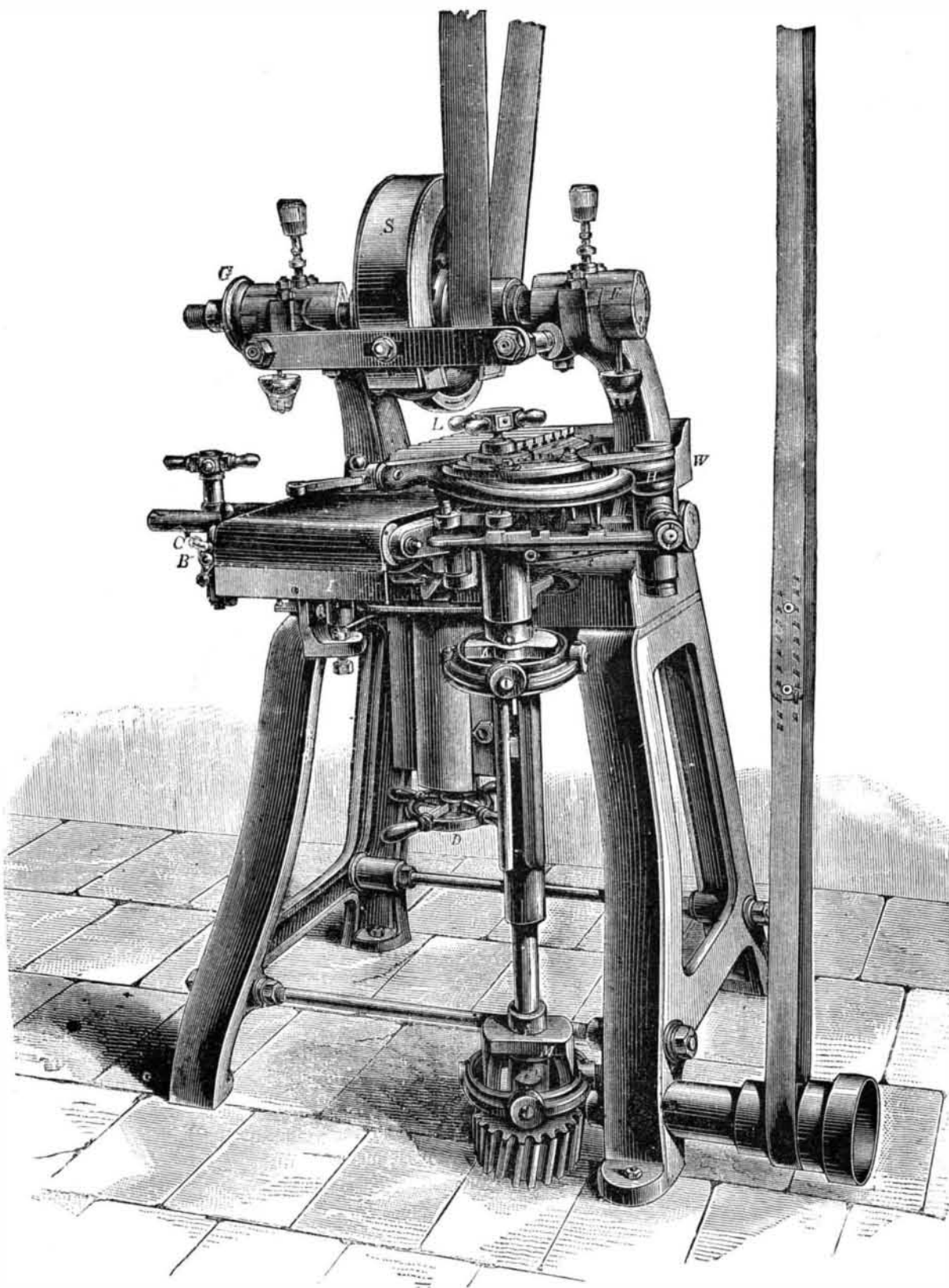
The inventor makes four sizes of the apparatus for lifting weights of 550, 1,100, 2,200 and 4,500 pounds respectively.

BOLLMAN'S AUTOMATIC EMERY GRINDER.

THE machine represented in the accompanying cut is designed for automatically rough-finishing the surface of metals.

The emery wheel, provided with a guard, S, is actuated by power transmitted from the workshop, and which causes the revolution of the emery wheel axle resting on the bearings, F and G.

The table, L, designed to hold the piece to be worked, is raised or lowered at will by means of a hand-wheel, D, which is keyed to a vertical rod carrying a thread and working in a bronze nut. The backward and forward motion of the movable table is effected in the following manner: At the base of the machine there is a small cast-iron cone, which is revolved by the belt, and which is keyed to an endless screw that actuates a helicoidal gearing pinion. This latter controls a vertical movable rod provided with an expansion coupling and having two Cardan joints, M and N, at its extremities. Above the joint, N, there is an eccentric which is jointed with the fixed point, H, and



AUTOMATIC EMERY GRINDER.

DESCRIPTION OF THE FIGURES.—A, frame of the truck; b, hind wheels; c, balance wheels; d, fore carriage and its wheels; e, lever for steering the fore carriage, for drawing the truck, and for directing the rear end of the truck by causing the latter to tilt; f, platform for reception of the load; g, parallelogram for guiding the platform during its ascent and descent; h, f and a, the four parts which go to form the parallelogram; i, the motive windlass, actuated by the winch j; k, the cord which transmits the action of the windlass to the hoisting system; l, safety ratchet, to prevent the platform dropping back in case the rope should break; m, safety rack into the teeth of which the ratchet falls during the ascent of the platform. In machines of from 550 to 1,100 pounds the ratchet is replaced by a safety chain, n, which should be slack, and not taut. This serves to hold the platform suspended in case the rope should give way during either the ascent or descent; o, the load to be raised, represented here by a box of merchandise. According to the purpose for which they are to be employed, these apparatus may be provided with a brake mounted on the windlass for facilitating the descent of the hoisting parts.

is at the same time connected with a lever attached to the table, L, so that the backward and forward motion of the latter is produced by the rotary motion of the eccentric. The expansion coupling of the vertical rod which connects the two Cardan joints is designed to cause the length of the rod to vary according as it becomes necessary to raise or lower the movable table, L.

MACHINE FOR SHARPENING AND SETTING THE TEETH OF BAND-SAWS.

THE sharpening of band-saws by means of the file, and the use of the saw set for setting the teeth properly, requires a certain dexterity on the part of the workman, and always takes considerable time. For effecting these two operations by mechanical means, and consequently with great precision, Mr. J. Sudrat has devised a machine which we represent in the accompanying cut from drawings communicated to us by the manufacturer, Mr. E. Baras.

In this machine the saw is stretched over two loose pulleys trimmed with rubber, whose axles are mounted on a