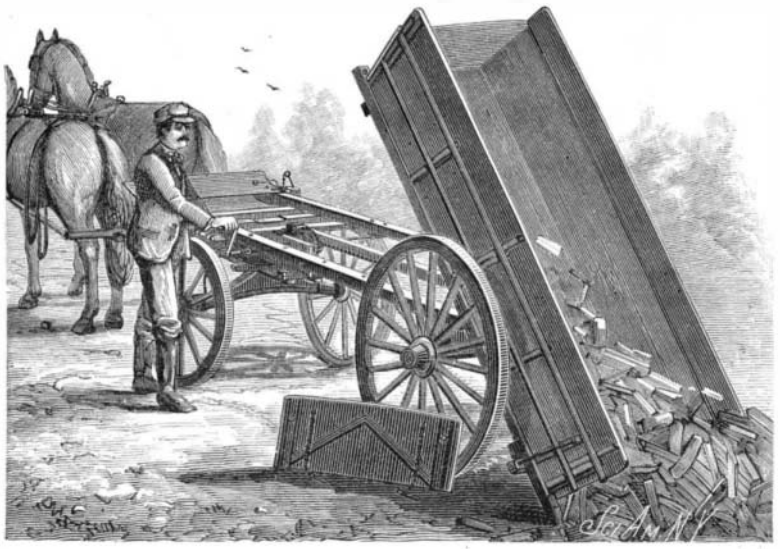
raised, as seen in the illustration; and when the animal steps off, the platform will return to its normal position, and the cover will automatically close over the trough, the cross bars across the top preventing the stock from putting their feet in the trough, and defiling the water. The trough is made in two compartments, of which the one at the left, in the engraving, receives water direct from a tank or reservoir. This compartment is connected with the other by an opening, so that the water will always stand at the same height in both compartments, but the height of the water in the first division is controlled by a stop cock



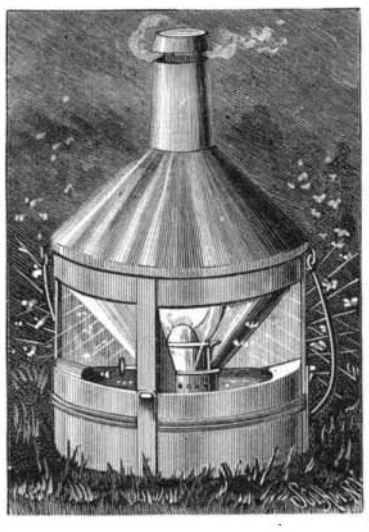
McFARLAND'S DUMPING WAGON.

actuated by a float, which admits water when it falls below a certain level and cuts off the supply as it rises above that level, so that there can be no overflow or waste of water. The sides, ends, and bottoms of the trough, and its covers, are all made with double walls, the space between them being carefully packed with asbestos millboard, as a non-conductor of cold or heat, making a substantial protection against the freezing of the water in cold weather, a difficulty which many of the farmers in some our Western States, where water is scarce, have found to be a most serious one. The cover has a small aperture with which the interior of the trough may be ventilated, and the interior partitions are so made that they can be readily removed for cleaning.

This invention has been patented by Mr. Thaddeus W. Boies, of Beloit, Kan.

INSECT DESTROYER.

During the past summer the insect destroyer shown in the accompanying engraving gave most satisfactory results during thorough and practical tests by the inventor, Mr. Dudley H. Manning, of Sibley, Iowa. The under surface of the conical top, through the center of which the chimney passes, is bright, as are also the partitions that extend inward from the upright of the frame and carry the socket for receiving the lamp.



Panes of glass are held between the inclined inner edges of these partitions, thus forming an inverted conical glass casing around the lamp. The entire apparatus is placed on top of a vessel partly filled with water. The various mirrors reflect the light upon the water, illuminating it very brightly. Insects of nocturnal habits—moths, beetles, etc.—fly toward the light and into the brightly illuminated water, where they perish, or, striking the cone, are thrown downward into the water. An inverted conical ring placed just above the water prevents their escape. The water in the pail may be poisoned or may be sweetened. The top can be easily detached from the base, and the whole apparatus can be carried from place to place by the bail.

MESSRS. PEARS, the celebrated English soap makers, and remarkable for the extent and novelty of their advertisements, offered some time ago a prize of £100 for the best essay on "The Depression of Trade." The general purport of the essays is to the effect that depressions are periodical, and followed by activity; that the present depression is not worse than others that have preceded it; that a future of prosperity must be close at hand; that the causes of the depression are most complex, and the remedies must be similarly various.

AN IMPROVED DUMPING WAGON.

From the accompanying picture the reader can readily understand the general principles on which this wagon is built, but it has some novel features calculated to attract the attention of makers and users of wagons of this character. The box and its supporting frame are slightly wider at the rear than in front, yet the guide pieces are made to work back and forth in parallel lines, so that the box will readily free the load in dumping, while the gear for moving the box is at the back of the chair of the wagon, where the front wheels will come back of it and not interfere with turning the wagons in short curves. The operation of the shafts and intermeshing gear wheels, in connection with the connecting rod and rack, for moving the box of the wagon back and forward, will be readily understood from the engraving, there being hooked guide plates on the sliding frame of the box that engage pinions on the sills of the wagon to limit the backward movement of the box.

There are also plates on the forward end of the sliding frame of the box, which lock in loops on the sills as the box is moved forward, the locking devices preventing bouncing of the box when the wagon is going over rough roads or pavement.

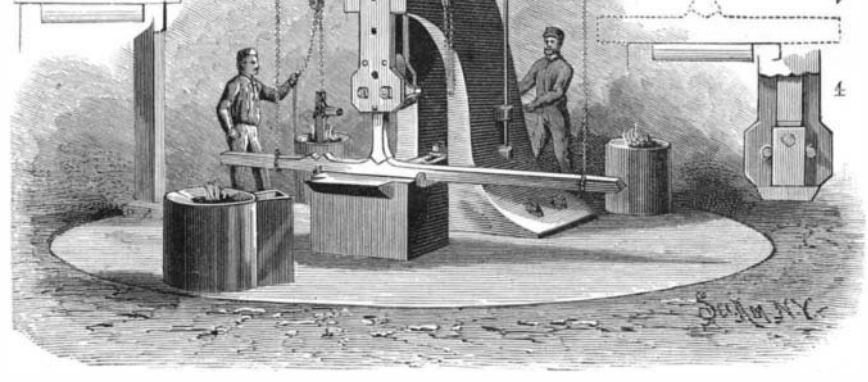
This invention has been patented by Mr. James McFarland, of 235 Main St., Louisville, Kentucky, and wagons are being made according thereto at the factory of Mr. William Tingley, No. 231 East Main Street, in that city.

HAMMER FOR WELDING LOCOMOTIVE FRAMES.

Near the center of the base plate is mounted a steam hammer, grouped in a circle around which are three furnaces, the one in front being provided with two fires and used for heating the main frame and braces, and the side ones for heating the legs of the pedestals. In the front edges of the standards of the hammer are grooved guides, in which slides the hammer head, provided with removable plates carrying the various dies used in welding the different parts of the frame. The anvil is made with an extension placed between the standards, and fastened by a bolt and nut to the base plate of the hammer. A slot in the extension, through which the bolt passes, makes the anvil adjustable, so as to weld on its center or on its front horn, as desired. On top of the anvil are guide stops, against which rests the rear edge of the pedestal of the frame while being welded, and it is provided on each side with pivoted catches to hold the pedestal in place. At each side of the standards is a davit for lifting and swinging the legs of the pedestal to and from the hammer and side furnaces. The main base plate carries a swinging crane having chains, pulleys, runners, etc., to which the pedestal of the frame is attached near its ends, so as to be easily manipulated under the hammer, and be swung to and from the main furnace. Passing through holes near the lower ends of the side plates are steel pins; on one pin is a bushing for forging the rounded outside part of the pedestal to which the legs are welded, and on the other pin is a die shaped to forge the inclined inside of the pedestal.

Fastened between the plates by pins is a center bar, Fig. 3, which reaches to and enters a recess in the bottom of the hammer head. The dabs to be welded are placed between the bushing and die, when the hammer head strikes the dab through the center bar and forges it to the leg, as shown by the dotted lines, Fig. 3. The bushing and its pin, and the center bar, are then removed, and the leg of the pedestal is placed between the plates and against the die, when the bushing is replaced. The pedestal of the frame to which the leg is to be welded having been formed under the hammer to the desired shape for the lower end of the leg, the frame is swung from the main furnace to the anvil, and the heated leg set in position on it, as shown by the dotted lines in Fig. 1. The hammer head then strikes the top of the leg and forges it to the pedestal, the bushing, die, and side plates acting as guides for the leg. On the lower end of the outer plate is a steel cutter that assists in welding, and cuts the sides to the proper size of the pedestals. The leg can be taken from the plates by removing the bushing. Fig. 4 is a front elevation of the hammer block, showing a die for welding the braces to the frame. The braces are heated with the main frame over the front furnace, which is provided with two fires.

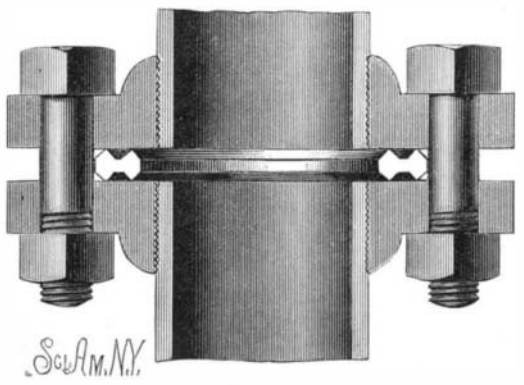
The difficulty of obtaining perfectly welded locomotive frames by blows of heavy sledges is well known; but by means of the hammer above described each weld can be perfectly made, and the parts can be easily handled and brought under the hammer. The inventor of this hammer, Mr. John R. James, of Dunkirk, N. Y., is confident that with this hammer and the aid of three men he can do more and far superior work than with seven men in the old way.



JAMES' HAMMER FOR WELDING LOCOMOTIVE FRAMES.

PACKING FOR STEAM PIPE JOINT.

The accompanying illustration represents two meeting lengths of pipe, each of which is threaded to engage with an internally threaded coupling flange. The flanges are united by bolts in the ordinary way, but instead of the usual rubber or soft metal packing ring, a steel or iron ring is placed between the flanges. This ring consists essentially of two or more concentric ridges projecting from each side of a central web. The bearing edges of these ridges are V-shaped, and all are of the same height; and, being sharp and preferably made of steel, they will, to a certain extent, cut into the flanges. It will be seen that the packing ring may



LYONS' PACKING FOR STEAM PIPE JOINT.

be used upon the ordinary form of flanged coupling piece, without the slightest alteration of the coupling. This packing is more particularly designed for use when the joint is subjected to a high degree of heat.

This invention has been patented by Mr. J. B. Lyons; further particulars can be obtained by addressing F. L. Hirschmann, M.D., of Norway, Mich.

Artificial Leather.

Artificial leather is, according to a French invention recently patented, made by a cotton fabric, the warp threads of which are very slightly twisted, and the weft threads of which are finer than usual. This fabric is serrated on both sides, and immersed in a preparation consisting of a decoction of linseed, rabbit skin glue, linseed oil, and coloring matter. When the fabric is impregnated with this preparation, it is stretched upon a polished zinc plate laid upon a steam heated hot plate, the drying being continued until the aqueous portion is entirely evaporated. It is claimed that this artificial leather is an excellent imitation of the real thing.

FARADAY proved the magnetic condition of matter, and that magnetism, unlike electricity, cannot be insulated.

THE NEW TAY VIADUCT.

(*Continued from first page*).

the platform, and are provided with apertures of the same diameter and spacing as the preceding. Moreover, the plates, D D, are provided with a longitudinal grove of a length equal to that of the stroke of the piston of the hydraulic engine. The ascent is effected as follows: Let us suppose the piston at the end of its stroke; the apparatus is keyed by passing a steel pin into the apertures of the guide bars, B, and into the head, I, of the piston. The admission of water above the latter presses the pin against the bars, B, and, as the column with which these are connected is bearing against the ground, the cylinder, E, is forced to rise and carry along the plates, D, along with the platform. When the entire affair has risen 6 inches, the apertures in the plates, D, come opposite those in the bars, B B, and a second pin is then passed into the corresponding apertures under the piston. The water contained in the cylinder, E, is then expelled, and the platform rests upon the lower pin that has just been inserted, thus allowing the other one to be removed. It is now only necessary to cause the piston to rise, and to replace the first pin, to prepare the system for an ascent. The descent is effected by proceeding in just the opposite way. The two cylinders, E, of each column are always conjugate, and can, when necessary, be joined to those of the other columns.

The method employed for submerging the cylindrical caissons is based upon the same principle. The caissons weigh, on an average, 50 tons, inclusive of the brick filling which is put in during the sinking. Four rods, L, of square section (Nos. 2 and 3, Fig. 5) are fixed at their lower end to a strong disk riveted to the caisson, and slide in a piston having a hollow rod, P, movable in a cylinder, A, on the platform. This cylinder is surmounted by a crosspiece, B (Fig. 5), which gives passage to the rods, L, which latter contain three rectangular apertures. When at rest, a bar inserted at K in one of these apertures holds the caisson. Let us suppose that each piston, P, has reached the end of its stroke; the cock, Q, that admits water is closed, and a bar is inserted in the hole, M that succeeds the hole K. Then the cock is opened so that the whole apparatus shall be supported by the piston, thus allowing of the removal of the bar inserted in the hole, K. Upon then opening the eduction, the piston and caisson descend together as far as the end of the former's stroke. At this moment a bar is inserted in the hole that has reached the level of the crosspiece, and everything is now ready for a second operation. The caisson thus gradually descends to the bottom.

From what precedes, it may be easily seen how the piers are constructed. The pontoon is set afloat, and hauled to the spot selected for the foundations by means of the service crane and of capstans around which wind cables fixed to the piers of the old bridge. Then the temporary supports that sustain the columns are removed, and allowed to rest upon the ground, care being taken to open the water valves of the caisson in order to prevent the pontoon from floating when the tide is rising. The platform is then raised to a proper height by means of the hydraulic cylinders. The stability of the whole is secured by means of anchors and chains.

The construction and submersion of the foundation caissons is performed as follows in the openings of the platform:

The rings are brought to the spot all prepared for being placed in position to be riveted together. While the riveting is being done, a lining of bricks is constructed in order to increase the caisson's weight. During the mounting of the sections, the entire affair is gradually let down by means of the hydraulic cylinders above described until the caisson touches bottom. The excavating apparatus are then set in motion, and the caisson sinks by its own weight (which, when necessary, is increased by a surcharge) until it reaches the proper depth. The interior is afterward filled in with concrete, and the foundation caisson is finished. When the second caisson has been finished in a similar manner, the platform is removed to another point of the work. This is done by lowering it to the proper level for floating, and then towing it to the desired spot.

When the pontoon has been removed, it remains to build the masonry pier up to the level of the octagonal metallic pier which is to surmount it. To this effect, temporary caissons are bolted to the main one before sinking it. These serve both for carrying the additional load above mentioned and for guiding the caisson during its descent. After exhausting the water from the latter the masonry is completed, and an anchor bolt two inches in diameter is inserted 20 inches beneath the summit. When the upper masonry is finished, the temporary caissons are unbolted, and those pieces are adjusted that serve to connect the metallic part of the piers with the masonry.

In short, the work is performed in the following order: 1. Putting the pontoon in place, descent of the caisson, excavation, and filling with masonry. 2. Tests of the strength of the foundation. 3. Construction of the upper masonry of the piers beneath the level of high water. 4. Finishing the pier up to the level of the octagonal metallic portion.

Four of these pontoons are now in use, the largest of which is 82 feet in length by 65 in width, and the smallest 55 by 36 feet. They are proportioned to the dimensions of the piers to whose construction they are to be applied. This very ingenious device can be economical only for large works, where there is quite a number of piers to be constructed. At the Tay viaduct it is giving excellent results. On the north shore (Dundee side), it has permitted of sinking and finishing one pier per week, consisting of two caissons 10 feet in diameter.

The work was begun in June, 1882. At present the masonry arches of the two extremities are finished, and nearly all the foundation caissons are sunk and filled. Half of these have received the octagonal piers, and part of the bridge, with its railway track, is now completed for a total length of 1,640 feet. The girders and superstructure of the 13 middle spans are being

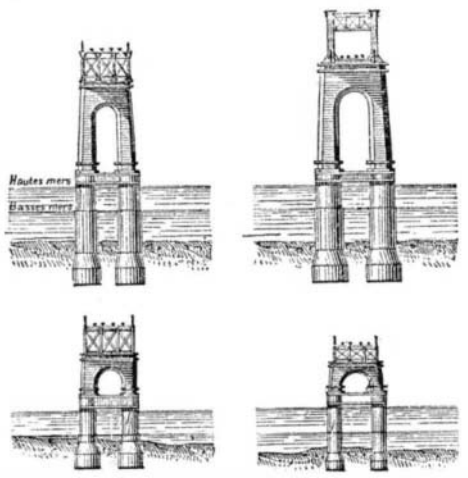


Fig. 3.—ELEVATIONS THROUGH A, B, C, AND D.

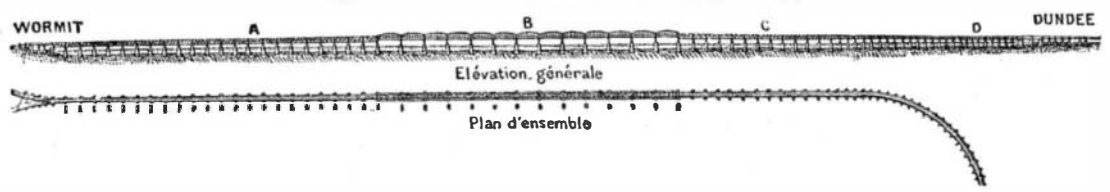


Fig. 4.—TAY VIADUCT.

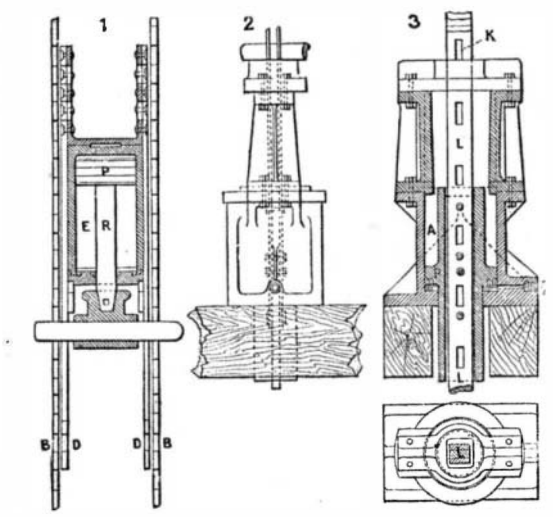


Fig. 5.—HYDRAULIC CYLINDER, FOR RAISING AND LOWERING MOVABLE PLATFORM.

put together upon a scaffolding at the extreme south of the work. When the parts for each span have been assembled, the irons will be placed upon the caissons already constructed, and will afterward be raised by hydraulic engines to the height that they are to occupy upon the octagonal piers.—*La Nature.*

The Sun's Corona.

Signor F. Tacchini, the successor of Signor F. Secchi at the Observatory of the Collegio Romano, has published a confirmation of the astronomer Forel's statement that the sun's corona is, in a clear sky, discernible on high mountains in a surprisingly distinct manner. He himself observed the phenomenon from the summit of Ætna at the beginning of July. At Rome, Naples, Messina, Catania, the sun appeared surrounded by a broad white crown; but from the top of Ætna, 3,300 meters above the level of the sea, in a very clear sky, it presented the appearance of a white ring surrounded by a splendid copper red corona. Near the horizon, the sun's appearance changed into an ill-defined arch of great span. He was able to observe all these phenomena at leisure on two different days. At sunrise and sunset he saw clearly the beautiful red light of the arch. But he is of opinion that those appearances are not as strong and brilliant this year as in 1833 and 1884.

Management and Care of Steam Boilers.

The following summary is issued by the Hewes & Phillips Iron Works, of Newark, N. J., and it comprises useful information to all in charge of engines:

"The first duty of an engineer, when he enters his boiler room in the morning, is to ascertain how many gauges of water there are in his boilers. *Never unbank nor replenish the fires until this is done.* Accidents have occurred, and many boilers have been entirely ruined, from neglect of this precaution.

"In case of low water, immediately cover the fires with ashes, or, if no ashes are at hand, use *fresh coal.* Do not turn on the feed under any circumstances, nor tamper with or open the safety valve. Let the steam outlets remain as they are.

"In cases of foaming, close throttle, and keep closed long enough to show true level of water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In cases of violent foaming, caused by dirty water, or change from salt to fresh, or *vice versa*, in addition to the action before stated, check draught and cover fires with fresh coal.

"When leaks are discovered, they should be repaired as soon as possible.

"Blow off 8 or 10 inches at least once a week; every Saturday night would be better. In case the feed becomes muddy, blow out 6 or 8 inches every day. Never blow entirely off except when boiler needs scraping or repairing, and then not until fire has been drawn for at least ten hours, as boilers are often seriously injured or ruined by being emptied when the walls are hot. Where surface blow-cocks are used, they should be often opened for a few moments at a time.

"After blowing down, *allow the boiler to become cool* before filling again. Cold water pumped into hot boilers is very injurious from sudden contraction.

"Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

"In tubular boilers the hand-holes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blown off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

"Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats, and useless for the purpose intended.

"Should the gauge at any time indicate an excessive pressure, see that the safety valves are blowing off. In case of difference, notify the parties from whom boiler was purchased.

"Keep gauge cocks clear, and in constant use. Glass gauges should not be relied on altogether.

"When a blister appears, there must be no delay in having it carefully examined, and *trimmed* or *patched*, as the case may require.

"Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean, also all tubes, flues, and connections well swept. This is particularly necessary where wood or soft coal is used for fuel.

"Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

"Barium chloride and milk of lime are said to be used with good effect at Krupp's Works, in Prussia, for waters impregnated with gypsum.

"Soda ash and other alkalies are very useful in waters containing sulphate of lime, by converting it into a carbonate, and so forming a soft scale easily cleaned; but when used in excess they cause foaming, particularly where there is oil coming from the engine, with which they form soap. All soapy substances are objectionable for the same reason.

"Petroleum has been much used of late years. It acts best in water in which sulphate of lime predominates. As crude petroleum, however, sometimes helps in forming a very injurious crust, the refined only should be used.

"Rogers' tannate of soda is probably the best preparation for general use, but in waters containing much sulphate it should be supplemented by a portion of carbonate of soda or soda ash.

"For muddy water, particularly if it contain salts of lime, no preventive of incrustation will prevail except filtration; and in almost every instance the use of a filter, either alone or in connection with some means of precipitating the solid matter from solution, will be found very desirable.

"In all cases where impure or hard waters are used, frequent 'blowing' from the mud drum is necessary to carry off the accumulated matter, which if allowed to remain would form a scale."

BEWARE of long, crooked suction pipes, when erecting a pump. Bends, returns, and angles increase friction very rapidly. Also remember that doubling the diameter of a pipe increases its capacity four times.