(No Model.)

J. N. WARRINGTON.

STEAM PILE DRIVING HAMMER.

No. 378,745. Patented Feb. 28, 1888.

Fig. 1.

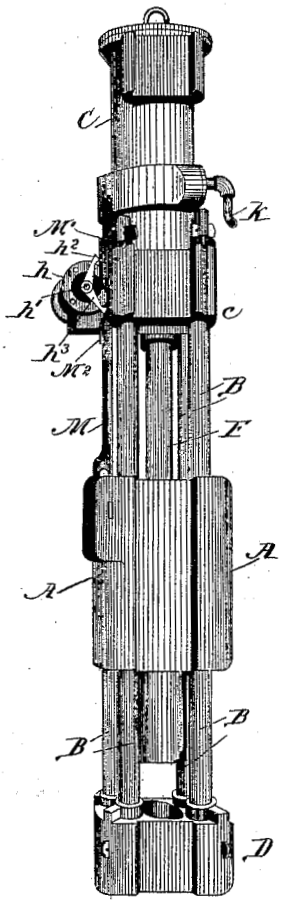


Fig. 4.

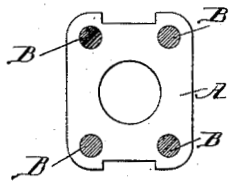


Fig. 5.

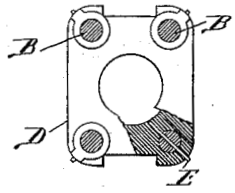


Fig. 6.

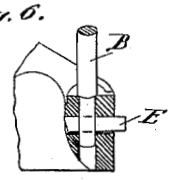


Fig. 7.

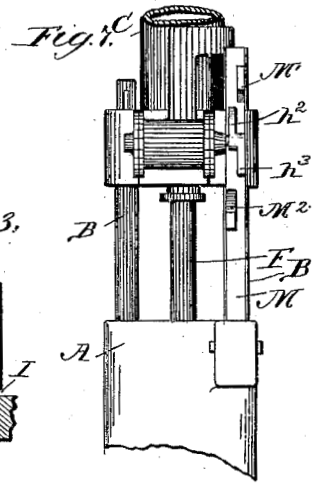


Fig. 3.

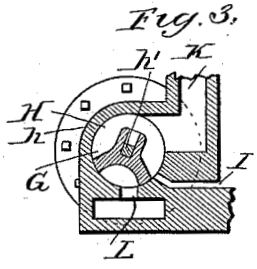
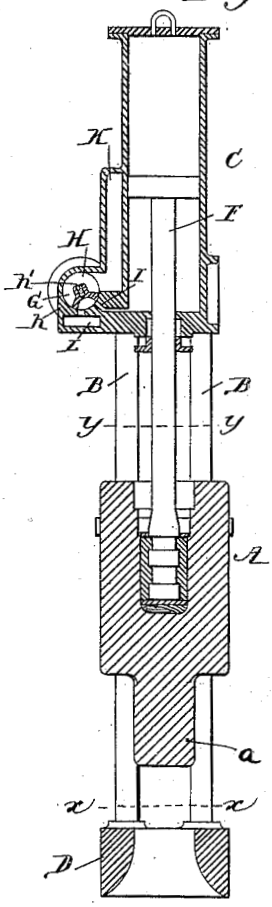


Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES N. WARRINGTON, OF CHICAGO, ILLINOIS.

STEAM PILE-DRIVING HAMMER.

SPECIFICATION forming part of Letters Patent No. 378,745, dated February 28, 1888.

Application filed July 22, 1887. Serial No. 245,035. (No model.)

To all whom it may concern:

Be it known that I, JAMES N. WARRINGTON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Steam Pile-Driving Hammers, of which the following is a specification.

This invention relates to an improvement in steam pile-driving hammers of that class wherein the hammer-head is attached to a piston which is raised by the admission of steam into the piston-cylinder and permitted to drop by the subsequent exhaust, and both the admission and exhaust governed by an oscillatory valve, in contradistinction to steam pile-driving hammers wherein the supply and exhaust are controlled by longitudinally-reciprocating piston-valves, which in practice are found to be objectionable, particularly on account of the hammering, which is detrimental to the valve action, and which results from the shock or jar at each end of the stroke of the piston-valve.

In a steam pile-driving hammer embodying my improvement the spindle of the oscillatory valve is provided with a couple of arms arranged in separate parallel planes, and the hammer-head is provided with an upright rod or bar having a couple of cams likewise arranged in separate parallel planes, whereby when the piston approaches the terminal of its downstroke one of said cams will act upon one of said arms of the oscillatory-valve spindle in a manner to turn the valve so as to admit steam under the piston, while on the other hand, when the piston approaches the desired limit of its upstroke, the other one of said cams will act upon the remaining arm of the oscillatory-valve spindle in a manner to reverse the valve and permit the escape of steam from under the piston-head, the particular features of improvement resulting from thus relatively arranging the cams and arms being hereinafter set forth.

The piston-cylinder is to be raised and lowered between guides or leaders, as usual, and, as a preferred arrangement of guides for accurately guiding and steadying the hammer-head, the latter is provided with a set of vertical bosses for upright cylindric guide-rods, which at their lower ends are rigid with a perforated base-block and at their upper ends rigidly connected with the piston-cylinder, it being observed that, while the feature of a perforated base-block having a flaring or conical opening for engaging the top end of a pile and cylindric guide-rods for guiding the hammer-heads are matters of considerable antiquity, the presence of such guide-rods rigid with a base in which the end of the pile is received and serving as guides for the hammer-head is more desirable than guide-plates of channel-iron secured by rivets to a base, since in the latter case the rivet-holes, for lack of proper bearings, soon become elongated, thereby impairing the efficiency of the machine and rendering it not only difficult to attain an accurate operation of the valve mechanism, but further preventing the accurate working of the hammer from which the valve mechanism is controlled.

In the drawings, Figure 1 represents in perspective a steam-hammer adapted for pile-driving and embodying the features of my invention, the usual main upright or leaders and devices for raising and lowering the machine being omitted. Fig. 2 is a central vertical section of the same. Fig. 3 is a detail view representing a section taken transversely through the oscillatory valve and the valve-casing, the valve in this figure being in position to permit the admission of steam into the piston-cylinder, whereas in Fig. 2 the valve is in position for the exhaust. Fig. 4 is a horizontal sectional plan on line x x, Fig. 2, with a portion of the base-collar broken away for convenience of illustration. Fig. 5 is a horizontal sectional plan on line y y, Fig. 2, the piston being, however, omitted. Fig. 6 is a sectional detail showing in perspective a corner portion of the base ring or collar, and illustrating one of the guide-rods keyed therein. Fig. 7 is a detail representing in elevation portions of the piston-cylinder, hammer-head, and guide-rods, and including the valve-movement, so as to illustrate the positions of the arms h^2 and h^3 on the oscillatory-valve spindle.

In said drawings, A represents the reciprocating hammer-head, which is provided with vertical cylindric bores for the straight cylindric guide-rods B. These bores or guide-pas-

sages are arranged about and located at equal distances from the vertical center or vertical axis of the hammer, and relatively to such vertical center are outside of the lower striking end, *a*, of the hammer. These guide-rods are at their upper ends in rigid connection with the lower end of the piston-cylinder C, and at their lower ends similarly connected with a base ring or collar, D, that is to fit on the top end of the pile. The piston-cylinder is at its lower end provided with a thick ledge or strong head extended somewhat beyond the perimeter of the cylinder and provided with lugs *c*, wherein sockets are formed for the reception of the upper ends of the guide-rods.

The base-ring D is provided with similar sockets for the lower ends of the base-rods, which rods are secured in their allotted sockets by keys E. The hammer-head, which is thus guided and steadied by the rods B, is secured to the piston F, which has its head fitted to work within the piston-cylinder. The oscillatory valve G is arranged to work within a cylindric chamber, H, that is formed in a shell or casing, *h*, united to the piston-cylinder and constituting a steam-chest suitable for the oscillatory valve. The valve-chamber H is provided with three ports or passages—to wit, the port I, opening into the piston-cylinder at the lower end of the latter, the port K, for the admission of live steam, and the exhaust-port L, it being understood that steam can be admitted to the port from a flexible pipe, *k*, Fig. 1, as is customary in steam pile-driving hammers. The axle or spindle *h'* of the oscillatory valve has its bearings in the end walls of the valve-chamber, and is extended beyond one of said end walls. This extended end of the valve-spindle is provided with a couple of laterally-projecting arms, h^2 and h^3, extending in opposite directions from the spindle at points which cause said arms to respectively stand in separate vertical lines or planes.

The hammer-head is provided with an upright rod or bar, M, herein shown secured at its lower end between a pair of lugs on the hammer, which arrangement affords a suitable socket wherein the rod or bar can be securely held by bolting, riveting, or the like.

The bar M stands parallel with the line of motion of the hammer-head, and is preferably guided and steadied by the ledge or one of the lugs at the lower end of the piston-cylinder, whereby it will work true and steady. This rod or bar M is provided with two cam projections, M' and M^2, for successively engaging one and the other of the arms upon the valve-spindle, in order to cause the automatic operation of the piston carrying the hammer-head.

The cams or projections on the rod or bar M, in place of being in alignment with one another or in one and the same vertical line or plane, are set, respectively, in separate vertical parallel lines or planes in correspondence with the adjustment of the vertical arms on the oscillatory-valve spindle, so that at the terminal portion of the upstroke of the piston the lower cam, M^2, will have passed alongside the lower arm, h^3, without coming in contact therewith, and will act against the upper arm, h^2, thereby causing a partial rotation on the part of the valve to an extent sufficient to place the port I in open communication with the exhaust-port L, as in Fig. 2, while, on the other hand, at the terminal portion of the downstroke of the piston the upper cam, M', which will have passed alongside the upper arm, h^2, without coming in contact therewith, will act against the lower arm, h^3, and thereby reverse the valve, so as to place the steam-inlet port K in open communication with the port I, as in Fig. 3, it being observed that the oscillatory valve is so hollowed out that when it is in position for the exhaust, as in Fig. 2, it will straddle both ports I and L, which are then in communication with one another, but both cut off from the inlet-port K, and that a comparatively slight turn of the valve to the left from such position will simply place it in position to straddle the exhaust-port only, as in Fig. 3, thereby leaving the ports K and I in open communication with one another. By reason of the foregoing arrangement the action of the inclined face of either cam against the particular arm standing in its allotted line of travel will be in a direction substantially at right angles to the arm, which is understood to radiate from the oscillatory-valve spindle. This action avoids undue strain and lateral pressure upon the valve-spindle, it being seen that when one of the cams is brought against one of the arms the arm will swing away from and freely yield to the passing cam, whereas should, for example, the arrangement be such that during the downstroke of the piston the upper cam, M', strikes the upper arm, the frictional contact between the two would tend to force or crowd the arm to some extent back toward the valve-spindle, and thereby destroy the balance of the valve. During the descent of the piston the valve will be in position to connect the port or passage I with the exhaust-port L, as illustrated in Fig. 2. When the valve is reversed at the terminal portion of such downstroke on the part of the piston, the direction of rotary throw on the part of the valve will be toward the port L, the extent of such movement being sufficient to open communication between ports I and K through the valve-chamber, but to cover and close the exhaust-port L. This disposition of parts also permits the employment of wide ports, and, as has already been observed, avoids any hammering action on the part of the valve.

What I claim as my invention is—

1. The combination, with the reciprocating hammer-head attached to the piston, of the piston-cylinder, the oscillatory valve G, arranged within a chamber, H, provided with the inlet-port K, the port I, leading to the lower end of the piston-cylinder, and the exhaust-port L, substantially as described, arms on the oscillatory-valve spindle, and the two

cams upon a rod or bar which rises from the hammer-head, said cams being arranged for alternately engaging one and the other of the two arms upon the valve-spindle, substantially as described.

2. The combination, with the reciprocating hammer-head carried by the piston, of the oscillatory valve provided with arms h^2 and h^3, arranged in parallel planes, and the arm or bar rising from the hammer-head, and provided with cams disposed in parallel planes for acting upon said arms, substantially in the manner described.

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