T. R. MORGAN.

STEAM-HAMMER.

No. 184,414. Patented Nov. 14, 1876.

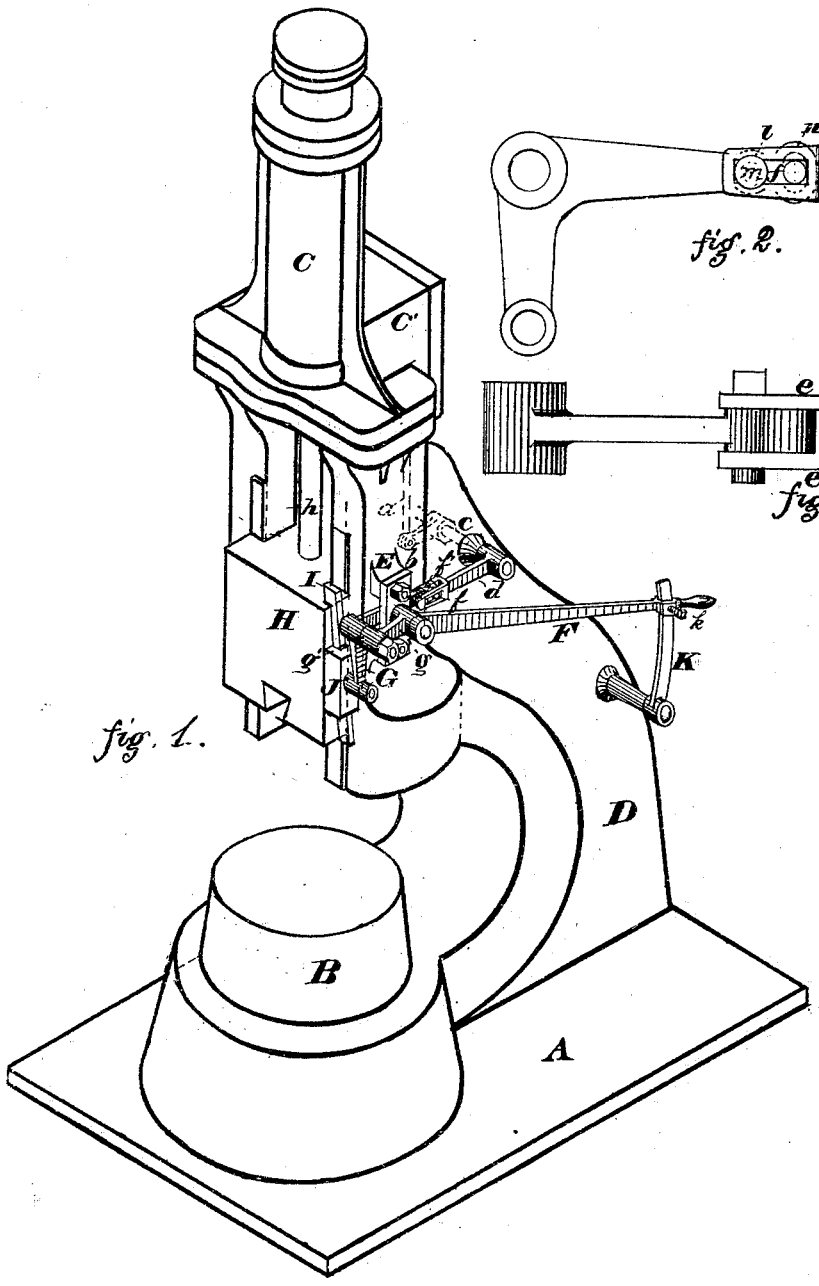

fig. 1.

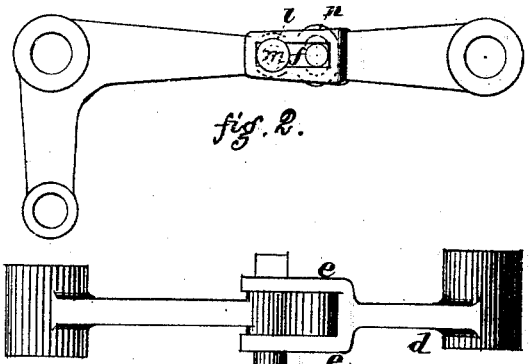

fig. 2.

fig. 3.

Witnesses
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UNITED STATES PATENT OFFICE.

THOMAS R. MORGAN, OF ALLIANCE, OHIO, ASSIGNOR TO HIMSELF AND CHARLES E. MARCHAND, OF SAME PLACE.

IMPROVEMENT IN STEAM-HAMMERS.

Specification forming part of Letters Patent No. **184,414**, dated November 14, 1876; application filed April 11, 1872.

To all whom it may concern:

Be it known that I, THOMAS R. MORGAN, of Alliance, in the county of Stark and State of Ohio, have invented certain Improvements in Steam-Hammers, of which the following is a specification:

My invention relates to certain improvements in valve-gear for steam-hammers; and it consists, first, in the combination, with the ram and slide-valve of a steam-hammer, of a bell-crank lever having a slotted shoe pivoted to its free end, the other end of the lever being journaled in an oscillating arm, and an operating-lever pivoted to an arch, and having its outer or shorter end pivoted to the bell-crank lever, whereby the several parts are arranged in close proximity to the ram, and thus allow of the maximum range for the regulation of the stroke of the hammer; second, in the combination, with the slide-valve ram and operating-lever, of a bell-crank lever constructed and arranged to be actuated by the ram, one end of said lever being constructed to be pivoted to a bifurcated arm connecting with the slide-valve, in such a manner that it may be readily adapted to impart a constant and positive movement to the slide-valve, and secure rapid and cushioned strokes, or adjusted to impart an intermittent movement to the valve and effect a heavy dead-blow to the hammer.

Figure 1 is a perspective view of a steam-hammer provided with my improved valve-gear. Figs. 2 and 3 are detached views of parts of the attachment.

A is the base and B the die of the hammer. C is the steam-cylinder, located on top of the frame D. The steam-cylinder C is provided with a valve-box, C′, through the lower side of which extends the valve-stem *a*, its lower end being pivoted to the arm *b* of rock-shaft *c*. Upon the outer end of rock-shaft *c* is journaled one end of a bifurcated lever, *d*, the arms *e e′* of which are formed with oblong slots or openings *f f′*. E is an arch or bridge secured to the side of frame D, to which is pivoted the operating or hand lever F. The short end *g* of lever F is pivoted to the bell-crank lever G at *g′*, and serves to raise and lower lever G, for a purpose hereafter explained. H is the ram of the hammer, properly notched to receive the upper die, and connected to the piston of steam-cylinder C by means of the piston-rod *h*. In the edge of the ram H, which is adjacent to the arch E, is secured a plate or fin, I, the same extending diagonally across the edge of the ram. To the outer or free end of the bell-crank lever G is pivoted a shoe or guide, J, while the other end of lever G is pivoted between the arms of the bifurcated arm or lever *d*. The ram, in its movement, imparts a vibratory movement to the bell-crank lever G, which, in turn, raises and lowers the valve by means of its connection with the rock-shaft *c* through the bifurcated lever *d*.

The operation of the device is as follows: The length of stroke being determined on, the bell-crank lever G is raised or lowered to secure a long or short stroke, as the case may be, by means of the hand-lever F, the end of which is secured to the sector K by a set-nut, *k*. Steam is then admitted to the valve-chest through the throttle-valve, and passes beneath the piston in the steam-cylinder and raises the ram. When the ram has reached the end of its upstroke, the valve will have moved a sufficient distance to cut off live steam from below the piston and open the exhaust therefrom, and at the same time admit steam above the piston to force the piston and ram through its downstroke.

Before the hammer reaches the end of its downward stroke the valve mechanism will have shifted the valve to exhaust steam from above the piston, and admit live steam below the same, thus cushioning the stroke of the hammer. In order to accomplish this continuous movement of the valve, and thus cushion the stroke of the ram, the bell-crank lever G is connected to the bifurcated arm *d* by means of the removable pin or bolt *l*, which snugly passes through openings *f f′* in lever *d*, and hole *m* in lever G, and thus causes them to move simultaneously.

When it is desired to strike a heavy dead-blow, the pin *l* is removed from the holes *m* in lever G and inserted in the oblong or arc-shaped slot *n*, formed in the extreme end of said lever. The valve-gearing, when thus ar-

ranged, operates as follows: When the hammer has reached the limit of its downstroke, and the upper and lower dies are in contact with each other, the steam-port leading below the piston is partially uncovered, and as the throttle-valve is opened steam enters below the piston, and forces it and the ram in an upward direction. The upward movement of the ram serves to raise the end of bell-crank lever G; but the pin *l* remains out of contact with this lever until it has moved a sufficient distance to cause the lower portion of the slot *n* to strike the pin, and thus suddenly lift the bifurcated arm and shift the valve, exhausting steam from below the piston, and admitting live steam above the same, to force the ram through its downstroke. As the valve remains unshifted until the ram has nearly reached the end of the downstroke, the ram is not cushioned, and gives a heavy dead-stroke.

When the valve-gear is arranged to produce a heavy dead-stroke of the hammer, there is considerable lost motion, as the rock-shaft to which the valve-stem is attached is moved only when the bell-crank lever reaches the upper and lower extremes of its movement; but the valve is moved its regular distance, owing to the increased leverage obtained by shifting the pin to the extreme end of the bell-crank lever.

These different strokes are readily obtained by shifting the pin *l*, as described. It is obvious that the same effect can be secured by valve-gearing slightly differing from that herein shown and set forth; hence I do not limit myself to the exact construction shown and described.

Having fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a steam-hammer, the combination, with the ram and slide-valve, of a bell-crank lever, journaled to the short end of a hand-lever, one end of said bell-crank lever provided with means for engagement with the ram, and actuated thereby, and the other end pivoted to the arms of a bifurcated lever, connected to a rock-shaft that operates the slide-valve, substantially as and for the purpose set forth.

2. The combination, with the ram, slide-valve, operating-lever, and shifting-gear of a steam-hammer, of a bridge or arch adapted to serve as a guide for the bell-crank lever, and a fulcrum for the operating-lever, substantially as and for the purpose set forth.

3. The combination, with the ram, slide-valve, and hand-lever of a steam-hammer, of a bifurcated lever constructed with oblong openings or slots, and a bell-crank lever formed with a hole, *m*, and oblong or arc-shaped slot *n*, whereby the stroke is readily made light or heavy, substantially as and for the purpose specified.

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Witnesses:
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