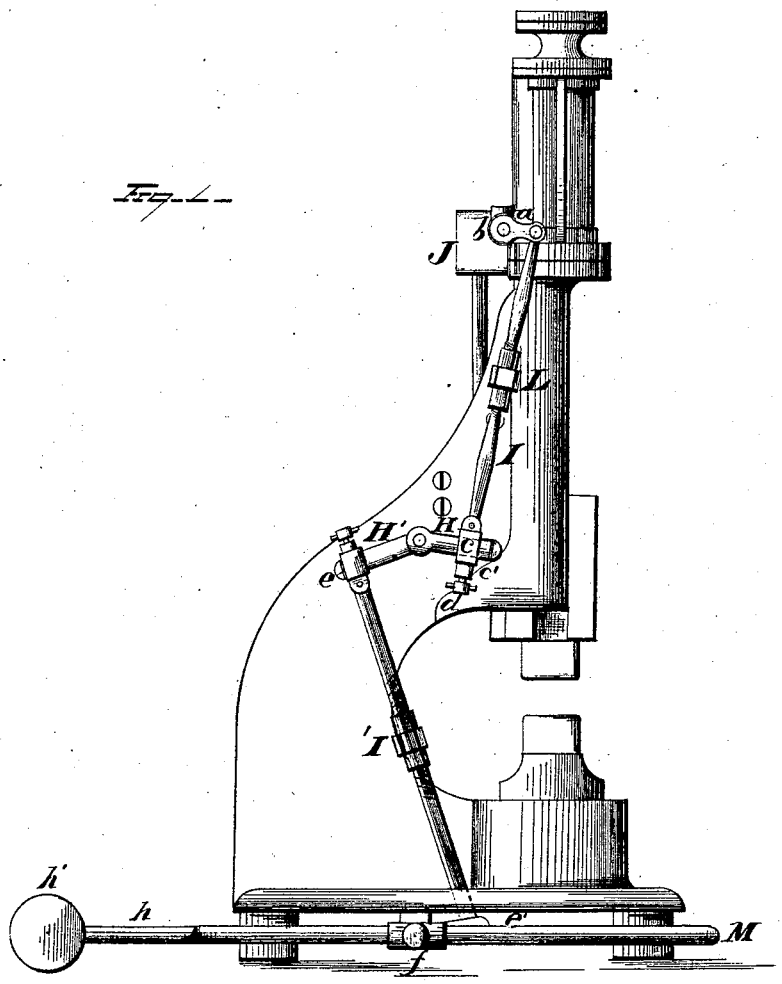
3 Sheets—Sheet 1.

T. R. MORGAN.

STEAM-HAMMER.

No. 184,412. Patented Nov. 14, 1876.

Fig. 1.



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3 Sheets—Sheet 2.

T. R. MORGAN.

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Fig. 2.

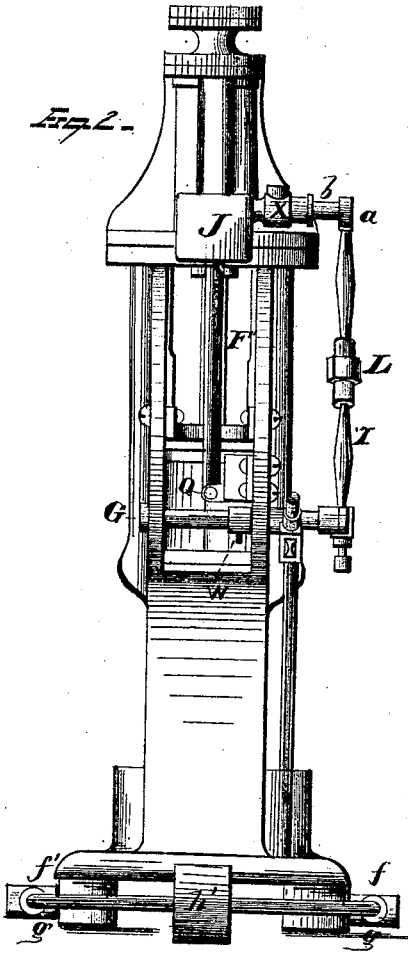
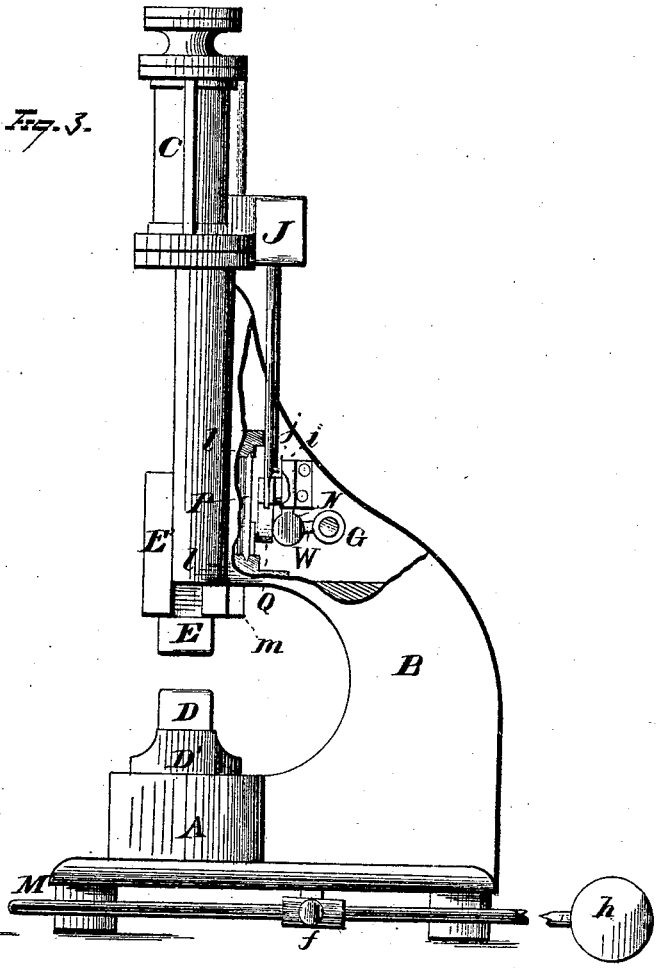


Fig. 3.



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3 Sheets—Sheet 3.

T. R. MORGAN.

STEAM-HAMMER.

No. 184,412. Patented Nov. 14, 1876.

Fig. 3.

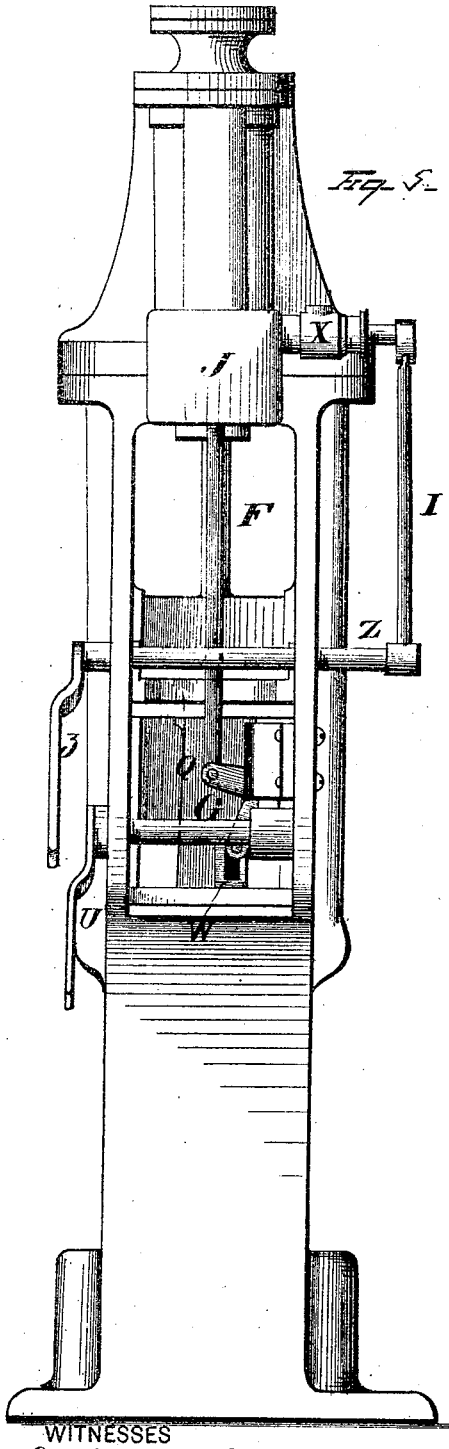
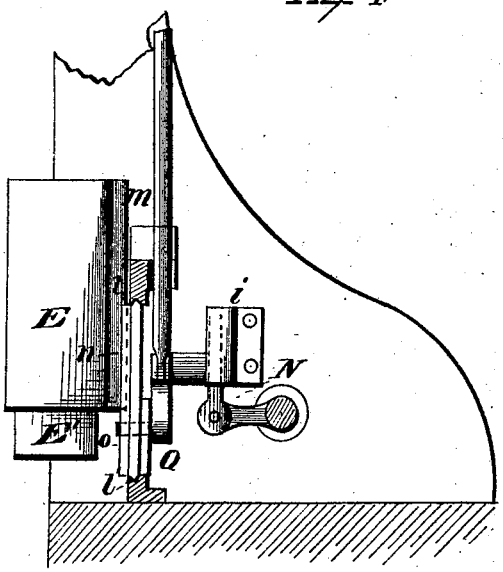


Fig. 4



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UNITED STATES PATENT OFFICE.

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

IMPROVEMENT IN STEAM-HAMMERS.

Specification forming part of Letters Patent No. **184,412**, dated November 14, 1876; application filed October 17, 1876.

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 new and useful Improvements in Steam-Hammers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to certain improvements in steam-hammers.

Figure 1 is a side elevation of my improved steam-hammer. Fig. 2 is a rear elevation of the same, while Fig. 3 is a side elevation, showing a portion of the frame cut away to clearly represent certain parts of the valve-gear. Fig. 4 represents an enlarged view of the mechanism for actuating the valve; and Fig. 5 represents the levers applied independently of each other.

My invention consists, first, in the combination, with the ram of a steam-hammer, of a laterally-moving slide arranged to engage with the rear side of the ram, and a bell-crank lever, one end of which connects with the valve-stem and the other with the treadle, by means of a rock-shaft and connecting-rod. Second, the combination, with the ram, valve-stem, and laterally-moving slide, of a bell-crank lever pivoted to a vertically-moving slide, whereby the throw of the valve may be adjusted by varying the position of the bell-crank lever. Third, in the several combinations of parts hereinafter described, and pointed out in the claims.

A is the base of the hammer, B the frame. C represents a steam-cylinder secured on top of frame B. D is the lower die, secured to anvil D′, while the upper die E is attached to the ram E′, which is connected to a steam-piston in cylinder C by means of the piston-rod F. G is a rock-shaft, journaled in the frame B, and upon the outer end of said rock-shaft the arms H H′ are rigidly secured. I designates a connecting-rod, the upper end of which is pivoted to an arm, *a*, secured to the stem *b* of a rotary throttle-valve, *x*, which serves to govern the admission of steam to the valve-chest J of the steam-cylinder. The lower end of rod I is pivoted to a slide, *c*, which is constructed to snugly fit the squared end of crank H. Slide *c* is provided with a boss, *c′*, which is screw-threaded to receive a set-nut, *d*, the latter serving to secure the slide to the arm in any desired position. A further provision to regulate the throw of the valve is made, by forming the rod I in two parts, as shown, and providing the adjacent ends with right and left handed screw-threads, with which engage corresponding female threads ot the adjusting-nut L. By simply turning the nut L, the rod is lengthened or shortened, and the movement of the valve is correspondingly adjusted. The rod I′ is preferably constructed in two parts, the same as rod I, and is pivoted at its upper end to a slide, *e*, which may be adjusted, as desired, on the arm H′. The lower end of rod I′ is pivoted to an arm, *e′*, secured to rock-shaft *f*, the ends of which are supported in bearings *g g′* secured to the base A. A treadle, M, is secured to the ends of rock-shaft *f* by means of joints *f′ f″*. The rear portion of said treadle is provided with an arm, *h*, upon which a counter-weight, *h′*, is placed, and adapted to be adjusted, so that its power shall be sufficient to overcome the weight of the several parts connected to the treadle, and keep the forward end of the treadle raised when the hammer is not in operation. An arm, W, is rigidly secured to the rock-shaft, G, between the plates of frame B, and to the outer end of said arm is pivoted the lower end of a slide, N, which slide travels between the undercut guide *i*. The slide N has a bearing, *j*, secured to its outer face, upon which is journaled a bell-crank lever, O; hence the position of the bell-crank lever may be varied by raising or lowering the slide N.

The upper end of the bell-crank lever is pivoted to the lower end of the valve-stem attached to the slide-valve, which latter may be one of the many known forms of slide-valves. The lower end of bell-crank

lever O is provided with a pin, upon which is preferably placed a steel anti-friction roller, which engages in a vertical slot formed in the rear face of the laterally-moving slide P. The slide P travels at right angles to the direction of the ram, in grooved guides *l l'*, which latter are provided with flanges, and thus firmly attached to the frame B. A guide, *m*, is secured to the rear side of the ram, diagonally from top to bottom of same, and said guide engages in a diagonal way or groove, *n*, in the front face of the slide N. This groove may be formed between the plates *o*, which may be secured to the slide in an adjustable manner, in order to take up for any wear of the plate or guides.

I contemplate three different methods of constructing the parts last described: First, the laterally-moving slide may be formed solid, and a diagonal groove cut therein to receive the diagonal guide; second, to construct the slide N with oblong slots formed across its face, and secure the plates *o* to the face of the slide by means of bolts, the outer ends of which may be let into the plates *o o'* flush with their front faces, while the rear ends of the bolts are provided with set-nuts to firmly secure the plates in any desired position.

When the guides or plates are worn loose they can be readily set up snugly to the guide by loosening the nuts and pressing them against the diagonal guide, and then securing them to the slide by means of the bolts and set-nuts above set forth.

Instead of securing the diagonal guide to the ram it may be formed as a part of or secured to the slide, and the guides attached to the ram, or the latter may be grooved and the same result accomplished, the object being to have the ram impart a lateral movement to the slide.

The operation of the hammer is as follows: The operator places his foot on the treadle M, and partially turns the rock-shaft *f*, thereby opening the throttle-valve *x*, which connects with the treadle by means of the connecting-rods and intermediate rock-shaft. The amount of steam used can be varied by adjusting the position of the upper connecting-rod relative to the crank-arm H, and a further adjustment is allowed by adjusting the length of the rod itself by means of the right and left handed nut.

The movement of the slide-valve is adjusted for long or short strokes by means of the lower connecting-rod, the length of which may be varied, or the position of the rod on the crank-arm changed, the same as in the case of the upper rod.

When the treadle is depressed it serves to open the throttle-valve, and also shift the slide-valve to open the steam-port leading from the valve-chest to the lower end of the steam-cylinder, thus admitting steam beneath the piston, and raising the ram.

The ram in its upward stroke imparts a lateral movement to slide N, which, in turn, moves the valve toward the upper end of the valve-chest, and this movement is accomplished by means of the bell-crank lever engaging within the slot formed in the rear side of the slide N.

When the ram has reached the limit of its upstroke, the valve will have shifted to exhaust steam from below the piston, and admit live steam above the same, the expansive force of which materially assists in imparting sufficient force to the blow of the ram. Just before the ram has reached the limit of its downstroke the valve will have shifted to admit live steam below the piston, and thus cushion its stroke.

The valve-gearing, constructed and arranged as above described, is adapted for use on any hammer, and a positive connection of the ram and gearing is always assured, regardless of the length or size of the ram.

When a short ram is employed, there is always sufficient room to secure ample means to actuate the the slide-valve. Instead of connecting the slide-valve and throttle-valve to a single operating lever or treadle, the several parts may be arranged as shown in Fig. 5. The connecting-rod I, by means of which the throttle-valve *x* is opened and closed, is adjustably secured to a rock-shaft, Z, and an operating handle, *z*, attached to the opposite end.

The rock-shaft G, to which the valve-stem is secured by means of the bell-crank lever, is rotated by the handle *u*, thus allowing the valve to be operated independently, if desired.

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

1. In a steam-hammer, the combination, with the ram and slide-valve, of a laterally-moving slide, constructed to engage with the rear side of the ram, and a bell-crank lever, one end of which is connected with, and is operated by, the slide, substantially as and for the purpose specified.

2. In a steam-hammer, the combination, with the ram E', slide-valve and stem, and laterally-moving slide P, of the bell-crank lever O, slide N, and means for raising and lowering the slide, substantially as and for the purpose specified.

3. In a steam-hammer, the combination, with the guide *m*, secured to the rear side of the ram, of a laterally-moving slide and means, substantially as set forth, for actuating the slide-valve, substantially as and for the purpose set forth.

4. In a steam-hammer, the combination, with the slide-valve and ram, of a laterally-moving slide, P, bell-crank lever O, slide N, rock-shaft G, and means for operating the valves, substantially as and for the purpose specified.

5. The combination, with the rock-shaft G

and valve-gear connecting with the slide-valve, of the treadle M and connecting-rod, constructed to be adjustably secured to crank H′ by a slide, *e*, provided with a set-screw, substantially as and for the purpose specified.

6. The rock-shaft G, provided with arms H H′, and connecting-rods adjustably secured thereto, in combination with the throttle-valve, treadle, and slide-valve, the latter connected with the rock-shaft by suitable valve-gear, substantially as and for the purpose set forth.

7. The combination, with the throttle-valve and treadle, of an intermediate rock-shaft and connecting-rods, one or both constructed to be readily varied in length by means of a right and left hand screw-threaded nut, substantially as and for the purpose specified.

In testimony that I claim the foregoing I have hereunto set my hand this 10th day of October, 1876.

THOS. R. MORGAN.

Witnesses:

A. L. JONES,

J. R. MORGAN.