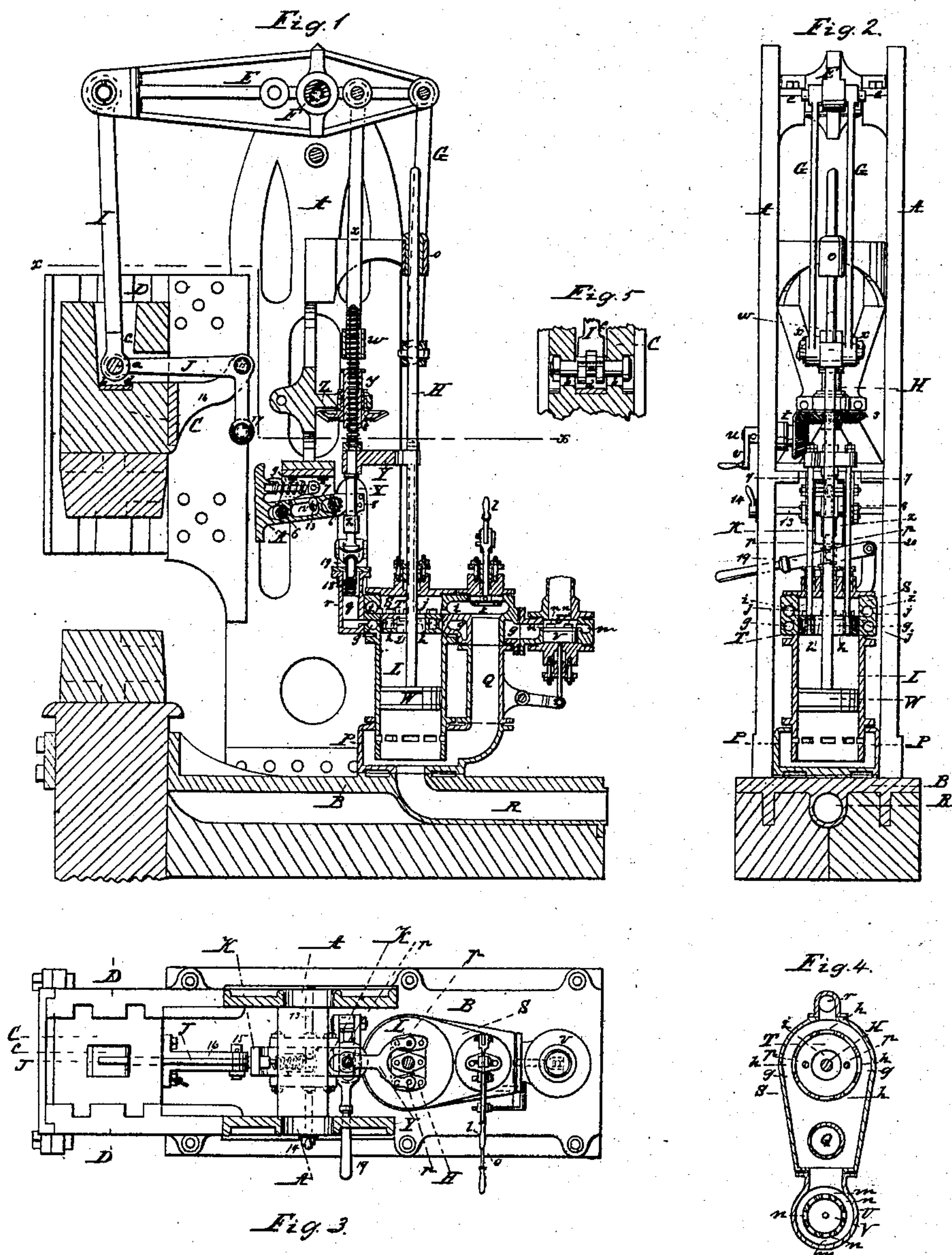


J. L. MORRIS.  
STEAM HAMMER.

No. 10,479.

Patented Jan. 31, 1854.





# UNITED STATES PATENT OFFICE.

JOHN L. L. MORRIS, OF READING, PENNSYLVANIA.

## STEAM-HAMMER.

Specification of Letters Patent No. 10,479, dated January 31, 1854.

*To all whom it may concern:*

Be it known that I, JOHN L. L. MORRIS, of Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Steam-hammers for forging, stamping, and cutting metals and for stamping or crushing refractory matters like gold quartz and metallic ores and other substances; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1, is a central longitudinal vertical section of a steam-hammer, constructed according to my invention. Fig. 2, is a transverse vertical section of the same, taken through the center of the cylinder. Fig. 3, is a horizontal section of the same, taken through the line, *x, x*, of Fig. 1. Fig. 4, is a horizontal section of the steam chest, taken through the induction passage. Fig. 5, is a section showing the way of attaching the hammer to the connecting rod.

Similar letters of reference indicate corresponding parts in each of the several figures.

The object of this invention is, to construct a steam-hammer which shall be free from the defects which exist in the two forms of steam-hammer now in use.

The defects to which I refer in the "direct action" steam-hammer, are, the upsetting and bending of the piston rod, and the difficulty of keeping tight packing, when the hammer head is attached to the rod; the bursting or breaking of the cylinders, when the hammer is attached to a cylinder moving on a stationary piston; the strain on all the parts of the machinery, if the work be not directly under the center of the hammer; and the difficulty of working on more than one side of the anvil. The defects in the "helve" steam-hammer, are, the constant breaking of the helves, and the failure of the face of the hammer to fall parallel with the face of the anvil, except at one height. The bending and upsetting of the piston rod, and the breaking or bursting of the cylinder, in the "direct action" steam-hammer, and the breaking of the helves in the "helve" steam-hammer, arise from the effect of the percussion being transmitted through all the mechanism; but in my improved hammer, the parts are so con-

structed, arranged, and connected, that this effect is imperceptible.

The object is, also, to give the hammerman ample room for the free manipulation of the work, and to place all the steam apparatus entirely out of his way, and to place all the handles in such position as to be under the control of the engineer standing in one place.

To enable those skilled in the art to make and use my invention, I will proceed to describe the construction and operation of the same.

The framing of the hammer consists of two strong standards, A, A, firmly secured to a bedplate, B, which rests upon a suitable foundation. The hammer-block, C, works vertically between guide plates, D, D, right over the anvil, and is connected by a connecting rod, I, to one end of a beam, E, of cast or wrought iron, which vibrates upon a fixed center or gudgeon, F, working in suitable bearings, *e, e*, secured to the standards, A, A, and has its opposite end connected by links, G, G, with the piston rod, H, whose piston, W, works in a cylinder, L, and is caused to raise the hammer by the elastic force of steam acting on its upper side. The piston rod is kept in a vertical position by a guide, O, secured to the standards, A, A. The connecting rod, I, is attached to the beam in the ordinary manner of making such attachments, and is attached to the hammer in such a way as to lift it, but to receive no shock from its percussion in giving the blow.

The connection between the hammer and rod is made by a pin, *a*, which passes through a strong jaw or head formed at the bottom of the rod, and through the sides of the hammer block; the jaw or head entering a recess, *c*, in the block. The pin, *a*, is a good fit in the jaw; but the holes, *b, b*, in the hammer block, through which it passes, are elongated vertically, to allow the pin to play in that direction; and the bottom of the recess, *c*, is furnished with an elastic cushion, *d*, consisting of a piece of india-rubber or a spiral or other spring. One effect of this connection is, that after the hammer has been arrested by striking its blow, the connecting rod will be allowed to descend by reason of the momentum acquired by it, some distance farther, for the purpose of giving the necessary movement to a latch lever, J, which is connected with its



jaw, to act upon a trigger, K, which sets free and causes the opening of the steam valve, and the admission of the steam above the piston, instantly upon the striking of the blow, and before the momentum of the rod, and the end of the beam to which it is connected, can have caused percussion to take place between the rod and hammer; all of which operations will be found herein-  
 5 after fully described in a more suitable place. Another effect of this connection is, that, if the hammer should rebound after giving its blow, the evil effects of its percussive action on the mechanism is prevented by the spring or elastic cushion, *d*.

The beam, E, is made with that part between the center and the connecting rod twice the length of that part between the center and the piston rod, for the purpose  
 20 of making the stroke of the piston as short as possible, and giving a rapid motion to the hammer block, and also to throw the center of the hammer block and anvil so far from the standards, as to allow of free manipulation of the work at both sides of the anvil. The short stroke of the piston diminishes the first cost of the machine, and also its wear and tear, in proportion to the fall obtained for the hammer; and the increased length of that part of the beam to  
 25 which the hammer is attached, brings the whole of the steam apparatus out of the hammer-man's way.

The cylinder is bolted on the top of a circular chamber, P, which is bolted to the bedplate, and serves to receive the exhaust steam through the eduction pipe, Q, leading from the eduction passage, previously to its escape to the atmosphere through the exhaust pipe, R, which leads from the bottom of the said chamber under the bedplate, of which the said pipe, R, forms a part. On the top of the cylinder is bolted a steam chest, S, of which, one part forms a continuation of the cylinder; being bored to the same size as the cylinder and receiving an annular piston valve, T, which is attached by two rods, *p*, *p*, to a forked arm, Y, on a vertical rod, X, (see Figs. 1, and 2,) and  
 30 which works steam tight within the cylindrical part of the chest, and, by reason of the opening, 21, through it, and the steam being admitted above and below, is perfectly balanced. The induction and eduction passages surround the cylindrical part of the chest; the induction passage, *g*, being the lowest, and communicating with the interior of the cylinder by a large number of ports, *h*, *h*, at equal distances apart, all around; these passages are shown in Figs. 1, and 2, in dotted lines; being at the present time closed and hidden by the valve; the steam being shut off, and the hammer descending. The eduction passage, *i*, is immediately  
 35 above the induction passage, and communi-

cates with the interior of the cylinder by a number of ports, *j*, *j*, similarly arranged to the steam ports, *h*, *h*.

The steam and eduction ports being almost equal in length to the circumference of the cylinder, will require to be of but little depth, and therefore a very short motion of the valve will be necessary to close one and open the other, respectively, as may be required, at the same time admitting steam equally all round the piston. The steam being admitted at once to act equally on all sides of the piston, will prevent any tendency to racking and produce a more perfect movement than could be obtained by any other arrangement of ports. The eduction pipe, Q, opens from the eduction passage, and a valve seat is formed in its opening; furnished with a puppet valve, *k*, which is furnished with a rod passing through a stuffing box, in the cover of the chest, and connected with a hand-lever, *l*, which places it under the control of the engineer, to open, close, or partly close the pipe, as may be desired. If this valve were closed, the exhaust steam could not make its escape through the pipe, Q, to the exhaust pipe, and therefore would arrest the upward motion of the piston, and descent of the hammer; and it may be closed sufficiently to produce such a resistance to the ascent of the piston, as to allow the hammer to descend as gently as might be required in any case, so that it might, when occasion required, operate as a "squeezer," on small forging, or in taking welding heats. The valve, R, is thus made to serve as a "governor," to regulate the fall of the hammer, instead of letting fresh steam into the cylinder for the same purpose. The induction passage encircles the eduction pipe, Q, as well as the cylindrical part of the steam chest, and form a connection with a passage, *m*, surrounding the throttle-valve box, U, which is of cylindrical form, and is fitted with a cylindrical valve, V, of similar construction to the valve, T, having openings, 22, through it; the said openings leading to the bottom of the valve box, U, to admit steam below the valve to balance it.

The throttle valve box receives the steam pipe, and communicates with the passage, *m*, by ports, *n*, *n*, arranged at intervals apart, all around, like the induction and eduction ports around the cylinder. The ports, *n*, *n*, are opened and closed or their width of opening is regulated by moving the piston valve downward or upward in the valve box; the valve being furnished with a rod, working through a stuffing-box, and connected by suitable levers and a rod with a hand lever, *o*, whose position is close to the lever, *l*.

The annular piston valve T, is packed in the same way as a steam-piston, and fits in



the same manner to the cylinder or the part of the steam chest, which forms an upward continuation thereof. The opening through it allows the piston rod, H, to work through it with perfect freedom, and leaves room enough for the free escape of the steam from above the piston, when the induction passages are closed, and the eduction passages open. The rods, *p, p*, to which the valve, T, is attached, work through stuffing boxes in the cylinder cover, one on each side of the piston rod; and the forked arm, Y, to which they are attached, is rigidly secured to the valve rod, X. This valve rod is furnished at its lower end with a small piston, *q*, which fits steam tight in a small cylinder, *r*, which has an opening in its bottom communicating with the induction passage, *g*, in the steam chest; the said opening admitting steam under the piston, at all times when the throttle valve is open, for the purpose of raising the rod and valve, and thereby closing the eduction and opening the induction ports when the valve rod is set free from the trigger, K, before referred to. The valve rod, X, has a boss or fixed collar, *z*, surrounding it, just above the small cylinder, *r*, for the purpose of forming a shoulder for the trigger to rest on, and keep the valve in a depressed state during the fall of the hammer, and thus keep the eduction ports open and induction ports closed, during the fall of the hammer, and until the blow is struck. All that part of the valve rod above the arm, Y, is screwed and furnished with a long nut, *y*, which slides in the hub of one, *s*, of a pair of bevel toothed wheels, but does not turn therein by reason of its being furnished with a feather. The hub of the wheel, *s*, is fitted to turn freely in a vertical bearing in a strong arm, Z, which is bolted to or cast with the cross-bracing of the framing; and thus the nut is made to serve as a guide to the upper part of the valve rod. The bevel wheel, *t*, into which the wheel, *s*, gears, and by which it is turned, is fast on a small shaft, *u*, which works in a suitable bearing in the front standard, A, and is furnished with a handle, *v*, under the control of the engineer or other attendant.

The valve rod is prevented turning by its rigid connection with the forked arm, Y, and rods, *p, p*; and therefore, when the nut is turned by turning the bevel wheels, it is only raised or lowered upon the screw. The valve rod is operated upon, to shut off the steam and open the exhaust, when the hammer is raised to the proper height by means of a sliding bush, *w*, which is attached by links, *x, x*, to the beam, and slides up and down freely on the upper part of the valve rod, coming in contact at the proper time with the nut, *y*, and forcing down the valve rod until the eduction ports are

opened, and the induction ports are closed, by the valve, when, the piston being left free, the hammer falls. During the latter part of the descent of the valve rod, the shoulder at the top of the collar, *z*, passes the trigger, which catches it and prevents the ascent of the rod; thus keeping the valve in the position described and shown in the drawing, until the trigger is moved to set the rod free. The reason for using a nut, *y*, instead of a fixed piece, to be acted upon by the bush, *w*, is, that the steam may be shut off at any given point in the downward stroke of the piston; the nut being raised on the rod, causing the steam to be shut off sooner, and being lowered to be shut off later, in the stroke, and the fall of the hammer being thereby diminished or increased as may be desired. The nut may be lowered on the screw to such a position that the bush would never reach it, and it would then be inoperative; and it would be thus lowered, whenever it might be necessary or desirable to control the operation of the hammer by hand.

The trigger may be made of cast iron; and, as seen sidewise, it is nearly of the form of the letter, T, prostrated thus, —; and it is capable of moving nearly horizontally upon two rollers, 6, 6, whose axes are secured in a small carriage, 7, bolted to the framing. One end is forked, to receive the rod, X, and also a piece of case-hardened steel or iron, 8, to rest on the collar, *z*, the collar being also hardened, or having a piece of hardened iron or steel let into it where the trigger rests upon it, to prevent wear and lost motion. The opposite end of the trigger forms the cross piece of the T, and stands nearly vertical with a straight smooth face, at the back of which there is a small boss, to admit the end of a small eyebolt, *q*, which is secured by a transverse pin, 10, to the carriage, 7, and is surrounded by a spiral spring, so confined that its tendency is always to draw the trigger into contact with the rod, and make it stop the ascent of the latter, whenever the shoulder of the collar, *z*, passes below it. There is a recess or hole, 11, in the trigger, which serves to allow a small transverse shaft, 13, fitting in bearings on the standards, to pass through it. This small shaft carries a small cam, 12, which is within the recess, 11, and is furnished with a handle, 14, outside the framing, convenient to the engineer, for turning it. This shaft and cam serve the purpose of throwing the trigger altogether out of gear, when it is desired to control the operation of the hammer by hand, and also to move the trigger, to set the valve rod and valve free to open the induction and close the eduction ports, to raise the hammer for a new stroke, at such times as the descent of the hammer has been made so



gentle, by using the eduction valve, as before described, that the latch lever fails to operate upon the trigger. In case of any accident, as for instance, the forging falling  
 5 off the anvil, or in case of the hammer man not being quick enough to turn some piece of heavy work, the shaft, 13, and cam, 12, serve to disengage the valve rod from the trigger, and thus admit steam above the  
 10 piston to arrest the blow of the hammer.

The latch lever, J, before described as actuating the trigger to set the valve rod free, is what is known as a bell crank lever. Its fulcrum is a pin, 15, which is placed  
 5 transversely in a bracket, 16, attached to the back of the hammer block, and one of its arms, which occupies nearly a horizontal position passes through an opening in the back of the block, into the recess, c, and is  
 10 connected to the connecting-rod, I, by the pin, a, which also connects the rod to the hammer block; the other arm hangs nearly vertical, and is furnished at its lower end with an anti-friction roller, 17, to work  
 15 against the vertical face of the trigger. The movement of the lever, J, on its fulcrum, can only be such as is allowed to the pin, a, by the slots, b, b. When the hammer is being raised, the pin is of course at the top of  
 20 the slots; and during the descent of the hammer, the slight resistance to the descent of the rod, I, which is offered by the weight and friction of the piston is sufficient to keep the pin, a, in the same position; (see  
 25 Fig. 1, in which the slots are shown by dotted lines,) and when in this position, the roller, 17, either does not touch, or works in easy contact without pressing on the face of the trigger; but when the blow is struck,  
 30 and the movement of the hammer is arrested, the slightly continued descent of the rod and the pin, a, throws back the roller in contact with the trigger with sufficient force to move the trigger back from contact with  
 35 the shoulder on the collar, z, and set free the valve rod and valve to admit steam to the cylinder, and close the exhaust, to raise the hammer for its next stroke. In order to prevent the piston, g, being driven into  
 40 forcible contact with the cover of its cylinder, r, when the valve rod is set free, a spring, 18, is placed above it, which stops it easily. When desired, the whole operation of lifting and letting fall the hammer  
 5 may be controlled by the hand lever, 19,

which works on a fixed fulcrum, 20, on a standard attached to the small cylinder, r, and is connected to the valve rod; the manner in which this is done will be readily  
 60 understood by the previous description of the self-acting operation of the valve rod.

Instead of placing the piston at one, and the hammer at the other end of the beam, as shown, the beam may oscillate from  
 65 a fixed point at one end, and the piston be connected half way between this point and the hammer; this will enable the beam to be shortened, and still give as long a stroke. A long stroke may also be obtained  
 70 by connecting the hammer and piston to opposite ends of a beam which oscillates from the center of its length, if the ends of the beam are furnished with segments, and the piston and hammer are connected  
 75 thereto by straps of flat metal, or by any flexible material, or by chains.

I do not claim attaching the hammer to a beam, which is operated by a piston in a steam-cylinder, when the hammer is connected rigidly to the beam, as that would  
 80 be equivalent to what is known as the "helve" steam hammer. But

What I claim as my invention, and desire to secure by Letters-Patent, is—

1. Admitting steam to the cylinder above  
 85 the piston, and exhausting the steam therefrom, through ports, g, g, and j, j, which are opened and closed by an annular valve, T, working in the cylinder itself, or in a steam chest, S, which is placed above, and  
 90 forms a continuation of the cylinder substantially as herein described.

2. I claim, the combination of a bell crank latch lever, J, with a trigger or catch, K, of T or other shape, capable of operating as  
 95 described, when the fulcrum of the said catch lever, is attached and stationary in relation to the hammer-block, and one end or arm is attached to the connecting rod of the hammer-block, and receives the neces-  
 100 sary movement to actuate the trigger or catch, to set free the valve rod by means of a continued descent of the connecting-rod, after the hammer is arrested by striking the blow, as and for the purpose herein set forth. 105

JOHN L. L. MORRIS.

Witnesses:

JAMES MILLHOLLAND,  
 WM. CAMERER.