3 Sheets--Sheet 1.

S. C. SMITH.

Bolt-Heading Machine.

No. 162,583. Patented April 27, 1875.

Fig. 1

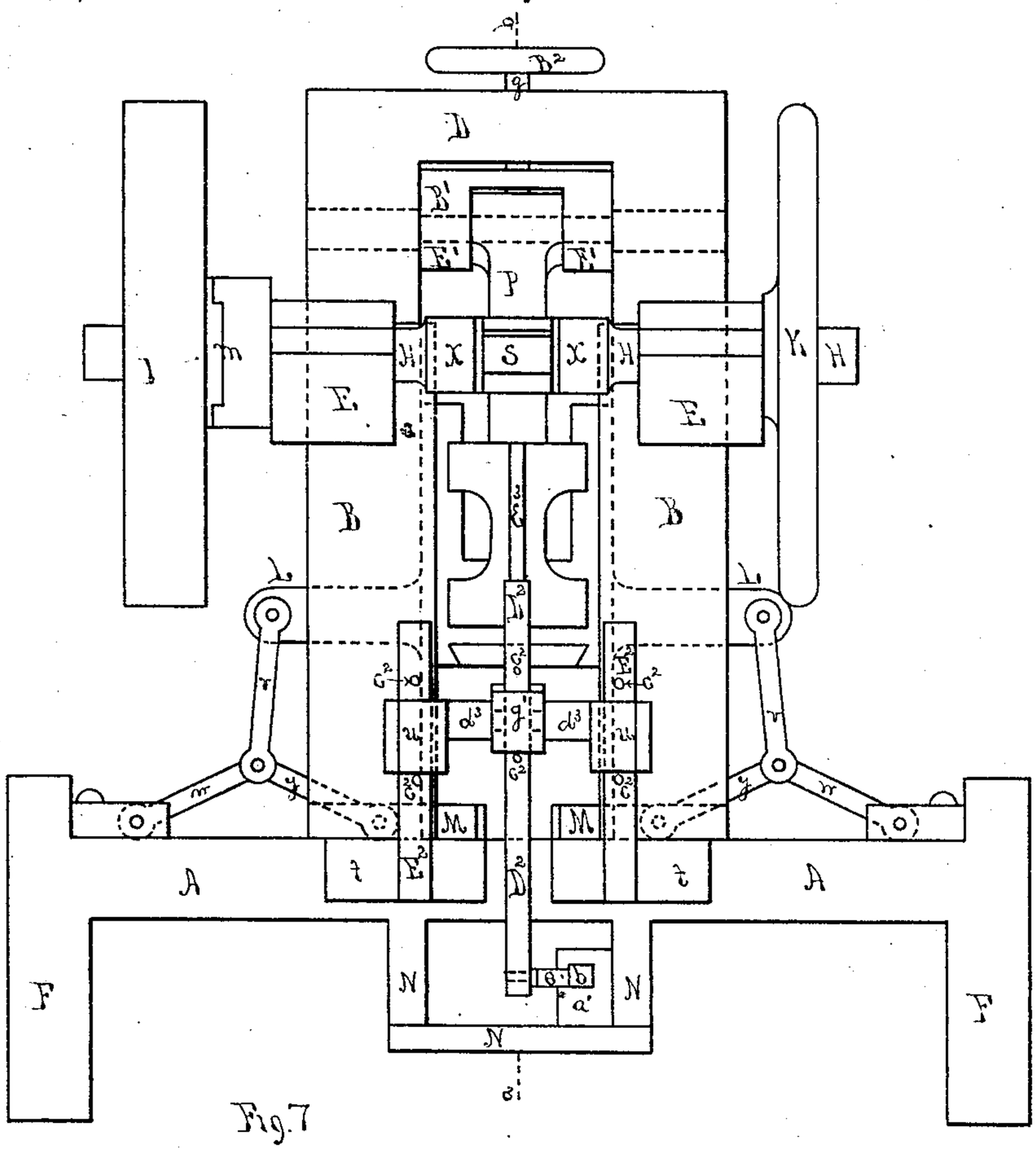
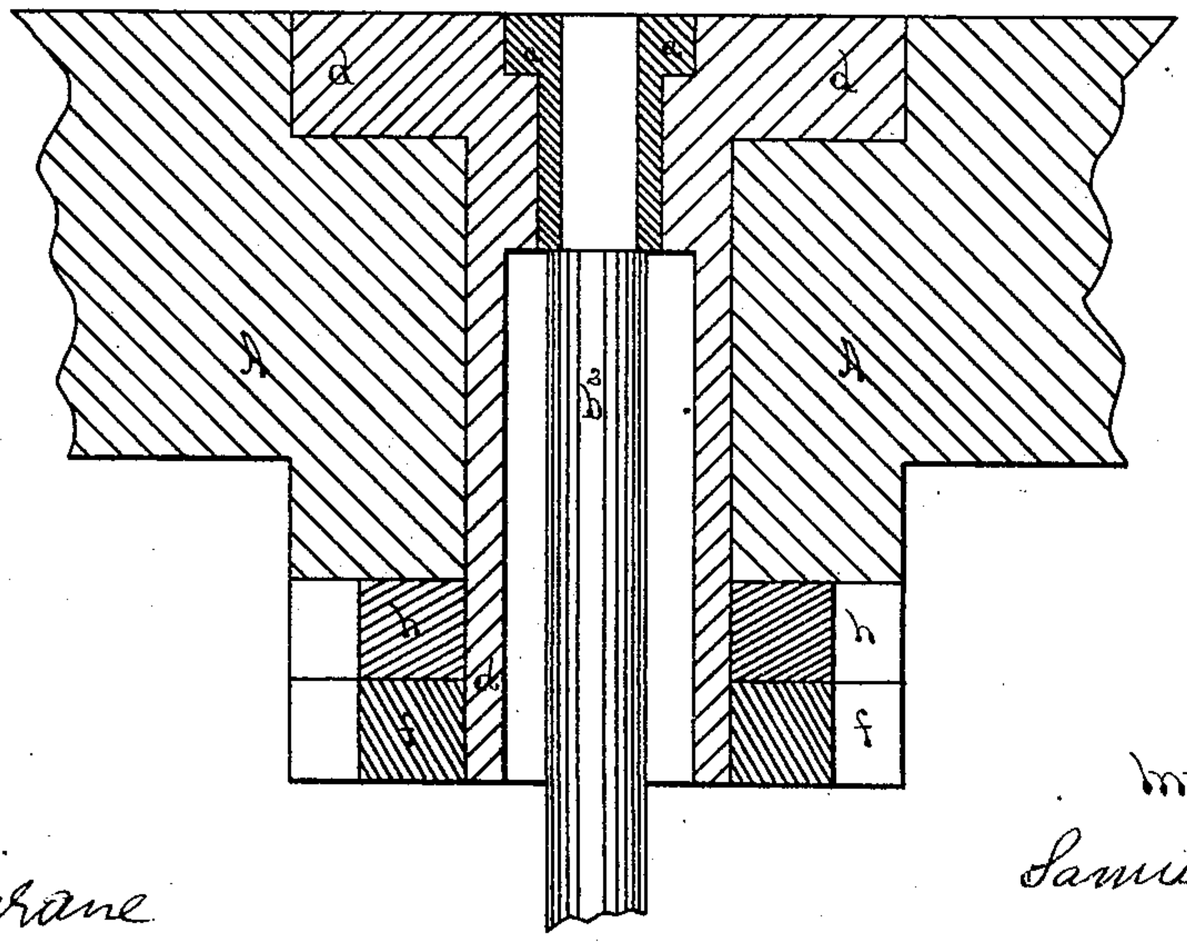


Fig. 7



Witnesses.
John E. Crane
William R. Crane.

Inventor.
Samuel C. Smith

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

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Fig. 2

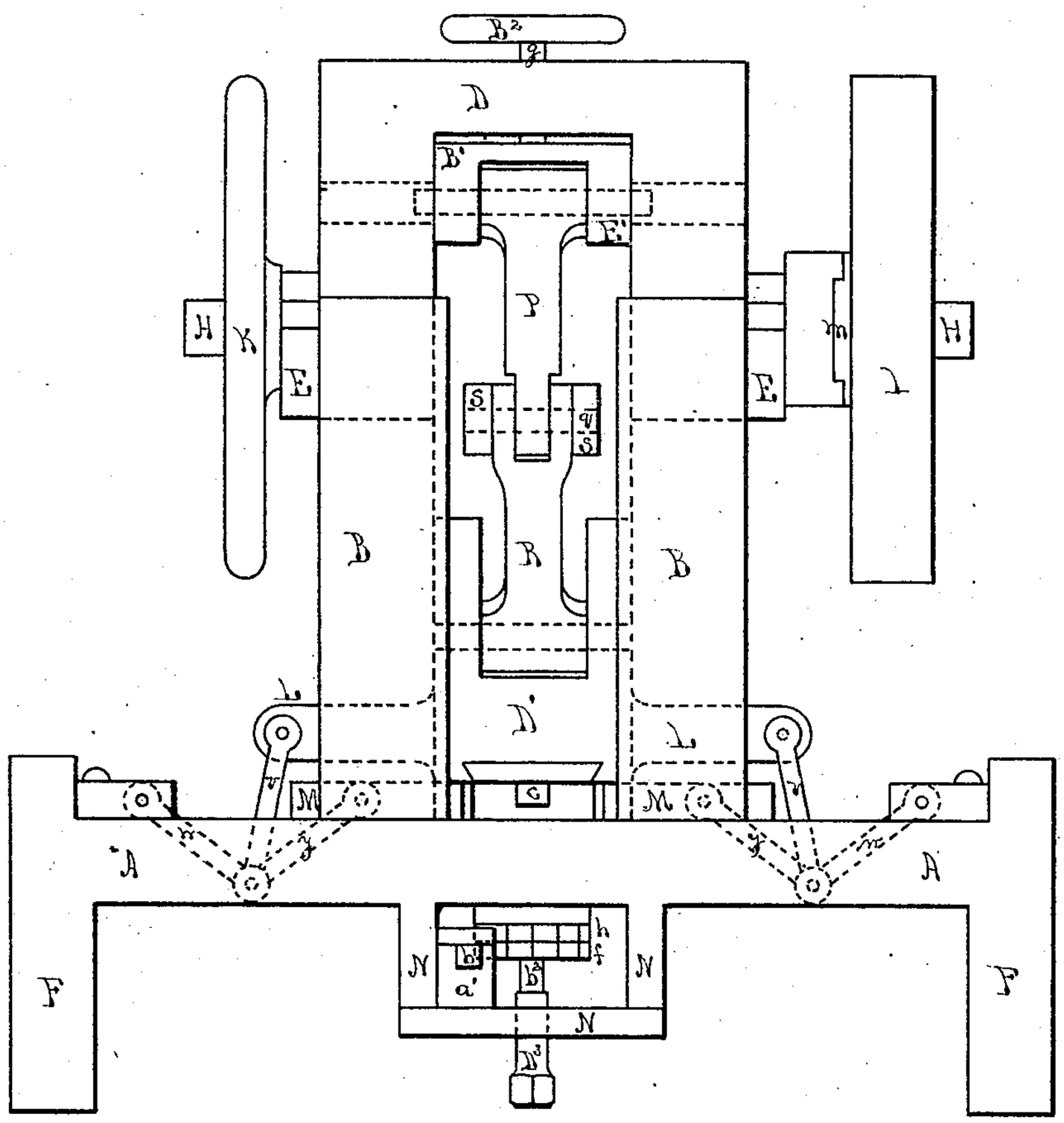


Fig. 5

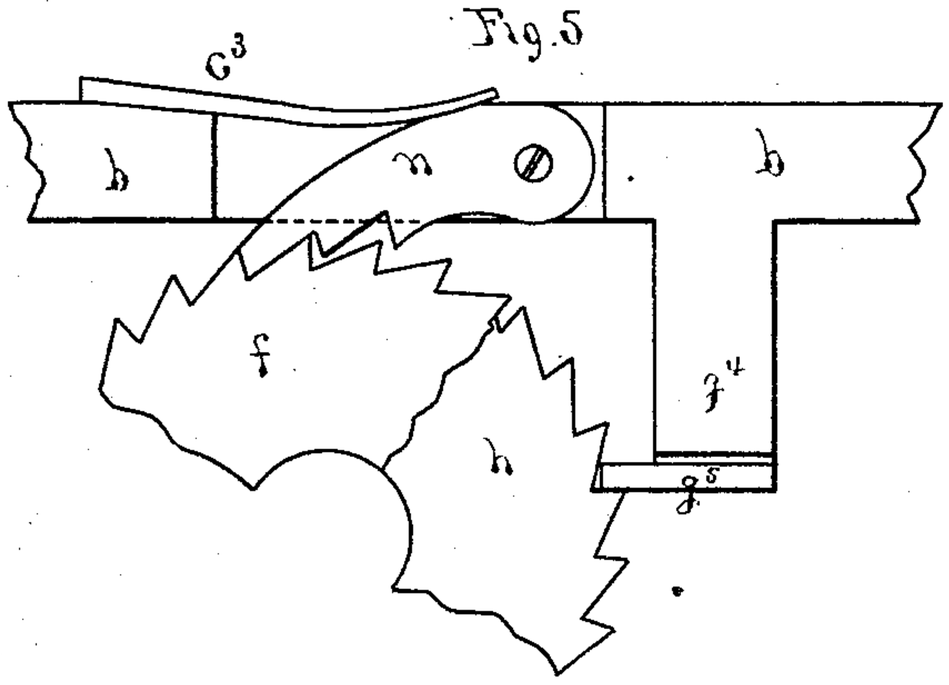
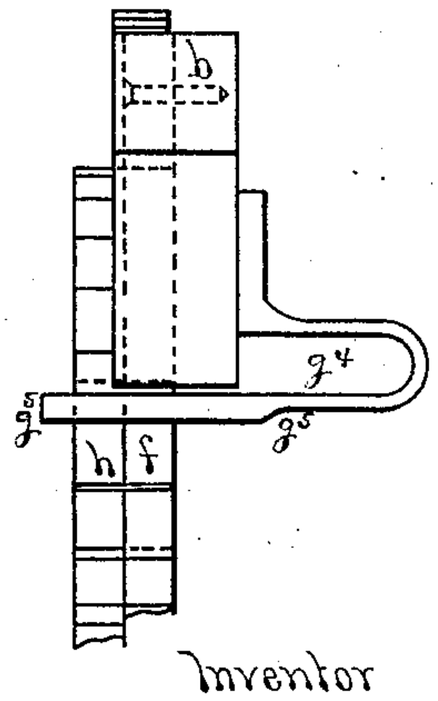


Fig. 6



Witnesses
John E Crane
William R. Crane

Inventor
Samuel C. Smith

3 Sheets--Sheet 3.

S. C. SMITH.

Bolt-Heading Machine.

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Fig. 3

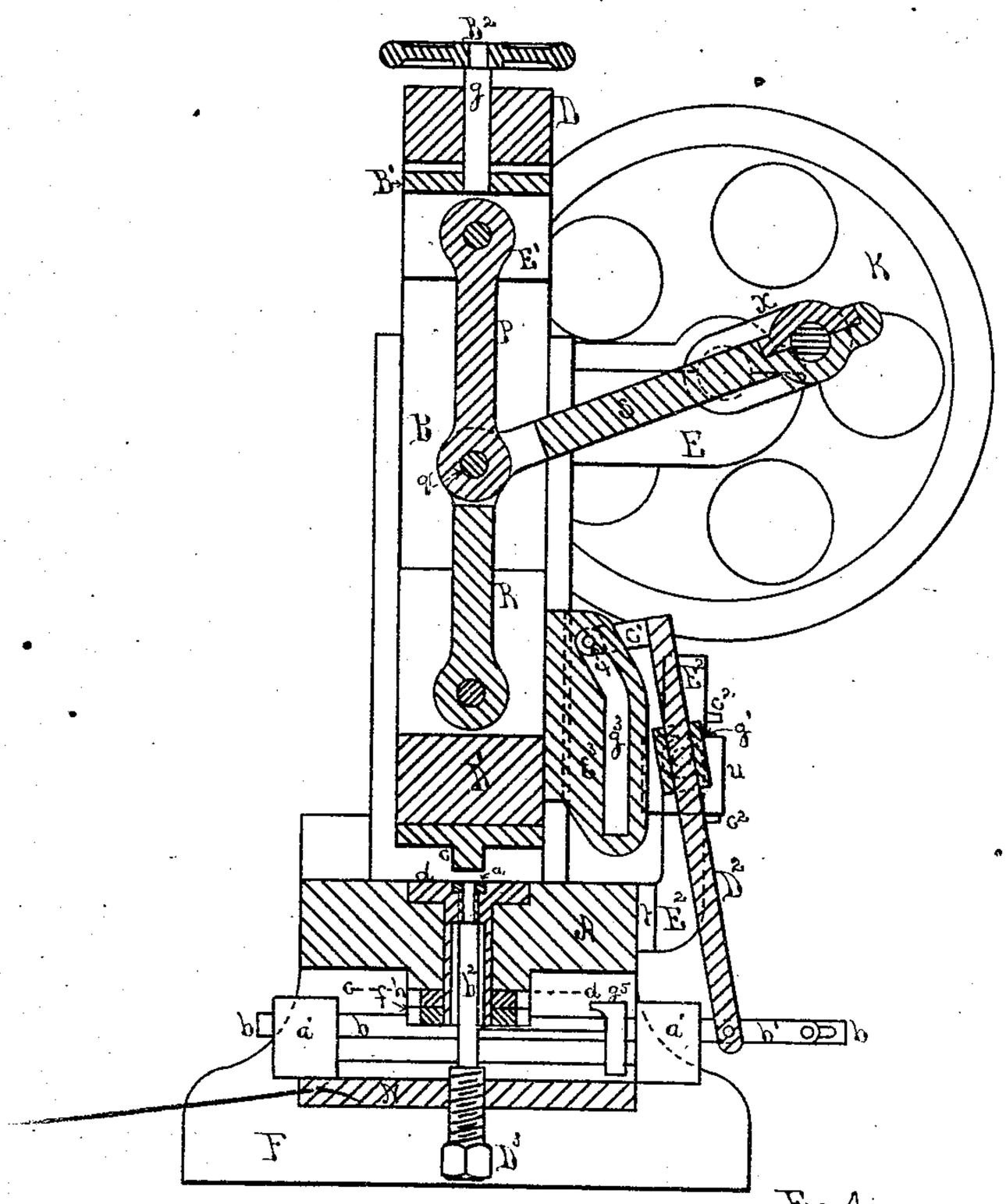
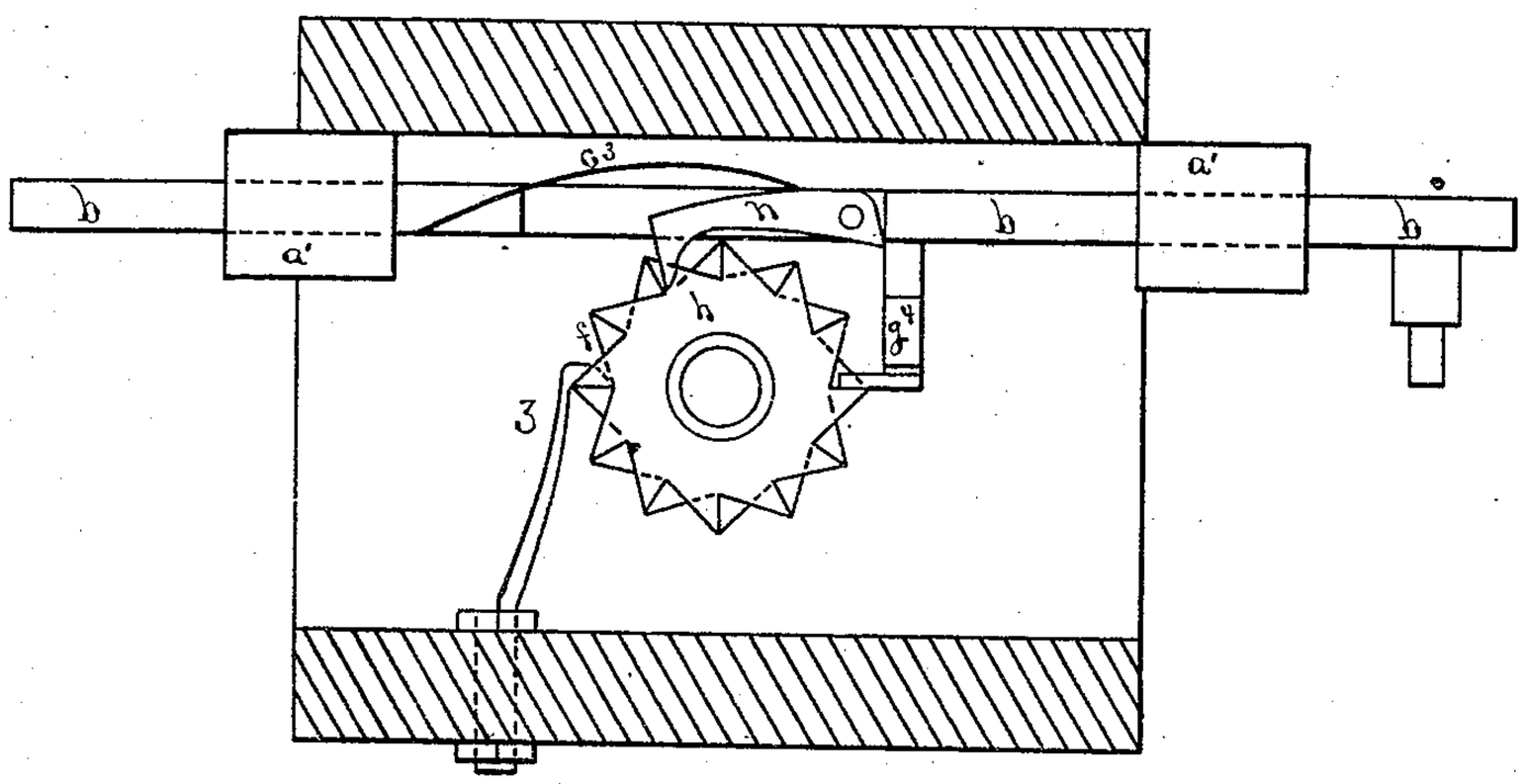


Fig. 4



Witnesses
John E Lorane
William R. Lorane

Inventor
Samuel C. Smith.

UNITED STATES PATENT OFFICE.

SAMUEL C. SMITH, OF LOWELL, MASSACHUSETTS.

IMPROVEMENT IN BOLT-HEADING MACHINES.

Specification forming part of Letters Patent No. **162,583,** dated April 27, 1875; application filed January 23, 1875.

To all whom it may concern:

Be it known that I, SAMUEL C. SMITH, of Lowell, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Bolt-Heading Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings making part of this specification, in which—

Figure 1 represents a rear-side elevation; Fig. 2, a front-side elevation; Fig. 3, a central vertical section on the line *a b* of Fig. 1. Fig. 4 represents a horizontal cross-section on the line *c d* of Fig. 3. Figs. 5 and 6 represent detached details considerably enlarged. Fig. 7 represents an enlarged sectional elevation of the heading-die, the socket which carries the die, and the bottom set-screw and its spindle for removing the die and some other parts.

This invention relates to machines for heading bolts; and has for its object to form the heads of bolts of equal or uniform size, and with reasonable rapidity, whether such bolt-heads are four-square or six-square. The thickness of the bolt-head is not regarded as an important feature, but the diameter, or the external dimensions or square of the bolt-head, to which the wrench is applied for turning the screw-threaded bolt in or out, is the important feature; and it is for the purpose of forging or forming heads to bolts, all of which heads shall be so nearly alike or equal as to require no finishing, that I have invented and constructed my said invention of the bolt-heading machine.

This invention consists, first, in the screw-furnished adjustable connection B^1, in combination with the toggle-bars and hammer-head and its die, and with the side hammers, connected with and operated by the hammer-head, by means of arms L and toggle-levers, as hereinafter fully described. This invention also consists of certain new and useful improvements in the mechanism which operates to turn or revolve the bolt and the die, and to arrest the revolving motion of them without breaking the parts, and at intervals which are regulated by adjusting certain of the co-operative elements, so as to form bolt-heads, which are four or six square—that is, so as to present the different or opposite four or six square forming sides of the bolt-head regularly to the side hammers, and thereby to insure the formation of a head with equal and uniform sides, and of any number of bolt-heads so nearly alike or equal as to require no finishing, the said mechanism being connected and co-operating with the combination of elements which operate the heading-hammer and the side hammers, so as to produce unitary results by certain described elements or combinations of elements, and a complete result by the whole machine, containing such new elements, combinations, or mechanisms, as hereinafter described.

In the said drawings, A represents the bed or beam which carries the bolt-heading die *a*, and the revolving die-socket *d*, which is rotated by a ratchet-wheel, *f*, and a pawl, *n*, carried by a horizontal reciprocating slide, *b*, arranged in guides *a* beneath the beam A. End posts B connect with and are supported by the beam A, having extensions below the latter, and terminate in a base or feet, F. Said posts also rise above the beam, and their top ends are supported by a cross-girt or beam, D. On the rear sides of the posts B are projecting arms E, which support the bearings of the main crank-shaft H, which in its turn carries the driving clutch-pulley I and the balance-wheel K.

Between the posts B I arrange the hammer-head D^1, which has a vertical motion and works in guides formed in or upon the posts, or secured thereto. The hammer-head is constructed with, or carries, side arms L, for connecting and operating the reciprocating side hammers M, each by three toggle-bars, *v w y*, as shown. Beneath the bed or beam A, and secured thereto, is a box or frame, N, which supports the guides *a* and the slide *b*, to which is adjustably connected a stud, *e*, and a link, *b*, and the latter is connected to an adjustable rocking-lever, which operates the slide, as hereinafter described. The two ratchet-wheels *f* and *h* are secured to the periphery or barrel of the die-socket *d*, so as to revolve the die and the forming-bolt. The pawl *n* on the slide *b* operates the lower ratchet-wheel, to turn or revolve the socket *d* and the die in one direction, as when the head of the bolt is being

formed, and to arrest the rotary motion of socket and the die. The upper ratchet-wheel is a co-operative element, and up to this point I have described old machinery.

I will now describe what I believe to be new in my machine, and as my invention, and, referring to said drawings, B^1 represents a movable and adjustable toggle-connection, placed between the upper ends of the posts B, and having a screw, *g*, passing through the top girt D, and working in a nut or screw-thread in the connection B^1, so as to raise or lower the latter and the connected toggle-bars P and R and the hammer-head D^1, and thereby to regulate the length of the motion and the stroke of the hammer and its die *c*, so as to cause the latter to strike with greater or less force upon the top of the forming bolt-head, while the side hammers M forge up the sides of the head. The forming bolt-head being in full view of the operator, he is enabled, by the screw *g* and the connection B^1, to so control and regulate the action of the top hammer as to work all the stock of each blank into a bolt and its head with unerring precision, and without perceptible variation in any number of bolt-heads thus formed, except in the thickness of the bolt-heads, which is of no great importance, as most of the heads are finished on the top and under side, and the removal of a little more or less of that part of the head by the simple turning process makes but little difference in the labor or cost of finishing. Without this adjustment of the heading-hammer to regulate its length of motion and stroke, the bolt-heads would all be of the same thickness, but the sides and square of the heads would vary considerably, and, as a consequence, the sides must be slabbed off by a slow and expensive process, in order to reduce the sides to a condition of equality or uniformity that will admit the application of the wrench used for turning the screw-threaded bolts. In connection or in combination with the heading-hammer adjusting devices, I employ two toggle-bars, P and R, and a crank and toggle connecting knuckle-bar S, the knuckle-joint being at the junction of the three bars, which are fitted and shouldered together, and the knuckle-bar is forked onto the toggle-bars at this point, as shown, and connected by a pin or pivot, *q*, passing through their joint. The lower toggle-bar has its lower end pivoted to the hammer-head D^1.

The upper end of the upper toggle-bar is pivoted to the under side of the connection B^1, or to ears or chocks E^1 depending therefrom. The outer end of the knuckle-bar connects with the crank X, and when the crank-shaft H revolves, the crank operates the toggle-bars, and through these the hammer-head D^1; and what I consider as one new feature in this mechanism is the predetermined construction, arrangement, and combination of the parts or elements, whereby the hammer-head, or the top die *c*, is caused to strike the top end of the forming bolt-head with the greatest force when the crank X is on its center, and the toggle bars P and R are vertical, as shown in Fig. 3, as by this construction, arrangement, and combination, I obtain the greatest possible amount of power of the crank X and the operative connections, and with the smallest amount of power to drive or operate the crank, and the toggle-bars, and the connected hammer-head.

I have mentioned the adjustable rocking-lever which operates the slide *b*. This lever is marked D^2, and, in addition to its link and stud connection with the slide, it has a clamping and adjusting box, g^1, near its upper end, by which it is held in position, the box g^1 being furnished with end pivots which enter the side hubs d^3 projecting inward from other clamping-boxes *u*, which are adjustable on vertical horns E^2, or supports, secured by feet or flanges *t* to the rear side of the beam A. The upper end of the rocking-lever D^2 has forward-projecting ears c^1, which carry a roller-stud, 4, working in a cam-groove, g^3, of a cam, E^3, secured to the rear side of the hammer-head D^1, and carried by the latter, so as to cause the cam-groove to operate the rocking-lever by the vertical reciprocating motion of the head D^1, and by this rocking motion of the lever to operate the slide *b*, and, through this, the pawl *n* and the lower ratchet-wheel *f*, to revolve or turn the connected socket *d* and the die *a* and the forming bolt in one direction, and either one-sixth or one-fourth of a revolution, so that the side hammer will forge the bolt-head either six or four square; and, to regulate the length of stroke given to the rocking-lever by the cam E^3, and thereby the connected slide; to cause the pawl *n* to turn the ratchet one-sixth or one-fourth of a revolution. The rocking-lever and the clamping-boxes *u* are made adjustable, the lever in its box g^1, and the boxes *u* on their horns or supports, by pins or stops c^2, set in the lever and in the horns E^2, to regulate the adjustment. By moving the boxes *u* and the box g^1 up against the upper pins, the motion of the rocking-lever will be long enough to move the slide *b* and the pawl *n* sufficient to cause the pawl to turn the ratchet *f* and the socket, the die *a*, and the forming bolt-head one-fourth of a revolution at each forward motion of the slide, and thereby to cause the side hammers to form a four-square bolt-head. To form a six-sided bolt-head the boxes *u* and the box g^1 are moved down against the lower pins c^2, and this lengthens the short end of the lever D^2 from its fulcrum or pivoting, and shortens the motion of the slide, causing the pawl to turn the ratchet *f* and the socket, the die, and bolt, one sixth of a revolution at each forward motion of slide, and then the side hammers will form a six-sided bolt-head.

In connection with the last-described combination of elements there is a second ratchet-wheel, *h*, having its teeth pointing in the opposite direction from those on the wheel *f*, and connected to the slide *b* is a spring-dog, g^4,

whose office is to arrest the rotary motion of the bolt and die carrying the socket, by contact of the spring portion of the dog with the teeth of the upper ratchet *h*. The position of the parts, when thus operating or acting, is clearly shown in Figs. 4 and 5, wherein the pawl *n* is represented as having turned the ratchet *f* a certain part of a revolution, and the spring-dog g^4, or the spring portion g^5 thereof, having been brought into contact with a tooth of the upper ratchet, and arrested its rotary motion.

The new feature in this combination is the spring-dog, without which (and if a rigid dog is used) the motion of the ratchet is arrested so suddenly as to break the dog, or the lever D^2, or the teeth from the ratchet *h*, or some other part of this combination. The spring-dog prevents breakage or injury to itself or to other connected parts, and insures the safe and certain operation of the bolt-turning apparatus.

I sometimes employ a spring-catch, *z*, at the forward side of the lowe rratchet *f*, to prevent any back action of ratchets when the slide *b* recedes, and the pawl *n* is drawn back against the teeth of the ratchet. The pawl is held in contact with, or pressed against, such teeth by a spring, c^3, bearing on the back of the pawl. One end of the spring c^3 is secured to some part of the slide, as shown. The spring g^5 of the spring-dog is, as at present advised, best made in the form of a bow, as seen in Fig. 6, and then it will be more free to yield to the striking action of the ratchet-teeth, and less liable to break by the same or any other like or similar action. A set-screw, D^3, passes through the bottom of the box N, and has a loose or a connected spindle, b^2, extending upward into the interior of the die-socket *d*, and adjustable by the screw for a double purpose: First, by its predetermined construction, to force up the heading-die *a* whenever it becomes necessary to remove it from the socket *d* to replace the die by another, or for other reason; and, second, for adjustment, to regulate the length of the shank of the bolt, without contact with the die-socket, and consequently without obstructing or retarding the action of the ratchets, the pawl *n*, or the slide, and other die and socket turning mechanisms.

To form a bolt with my improved machine, I generally use square iron, and after heating the end of a bar I forge or swage a portion of the end of sufficient length for the round shank of the bolt, and cut it off in the square and leave enough of the square portion for the bolt-head; then placing the round swaged shank in the die *a*, I ship in the clutch *m* of the driving-wheel or clutch-pulley *i*, and thus set the machine in motion, causing the hammer-head to move up and down, and the top die to strike on the top of the head portion of the forming-bolt, and the side-hammers to strike the sides of the bolt-head, while the ratchets *f* and *h* and the socket and die *a* are rotated by the pawl *n*, and the connecting mechanisms, as described. Watching the operation of the hammers, I turn the screw *g* by the wheel B^2, and either raise or lower the connection B^1, and with it the toggles, the hammer-head, and the top die *c*, causing the latter to form the top end of the bolt-head perfect, while the side hammers perfect the sides or squares of the head with perfect corners, sometimes raising the connection B^1 a little, by the screw *g*, to relieve the blows of the top die *c*, and thereby to favor the action of the side hammers and allow them to form the head with full sharp corners and equal and uniform sides, regardless of the thickness of the head, which I regard as of little importance, as before stated. After the bolt and its head are fully formed, it is easily withdrawn from the die *a* by a pair of tongs, taking hold of the head of the bolt, and the process of making other bolts is repeated, as before described.

I claim as my invention—

1. The adjustable connection B^1 and its screw *g*, in combination with toggle-bars P and R, and hammer-head D^1, and its die *c*, and with the side hammers M by means of arms L and toggle levers *v w y*, substantially as described.

2. The adjustable slide and pawl-operating mechanism, consisting of the cam E^3 with the cam-groove g^3, the rocking-lever D^2, having ears c^1, carrying a roller-stud, 4, in the said cam-groove, and connected to the slide *b* by a link, d^2, and a stud, *e*, and adjustable to vary the motion of the slide by a box, g^1, on the latter, and by similar boxes *u* on horns E^2, and with stops c^2 in the slide and the horns, substantially as described.

3. The stops c^2, in combination with the adjustable clamping-boxes g^1 and *u*, and with the lever D^2, and horns or supports E^2, substantially as described.

4. The spring-dog g^4, having a spring, g^5, in combination with the slide *b*, pawl *n*, and ratchets *f* and *h*, and die-socket *d*, and operating substantially as described.

SAMUEL C. SMITH.

Witnesses:
JOHN E. CRANE,
WILLIAM R. CRANE.