(No Model.) 3 Sheets—Sheet 1.

C. & C. E. HALL.

BOLT MACHINE.

No. 447,110. Patented Feb. 24, 1891.

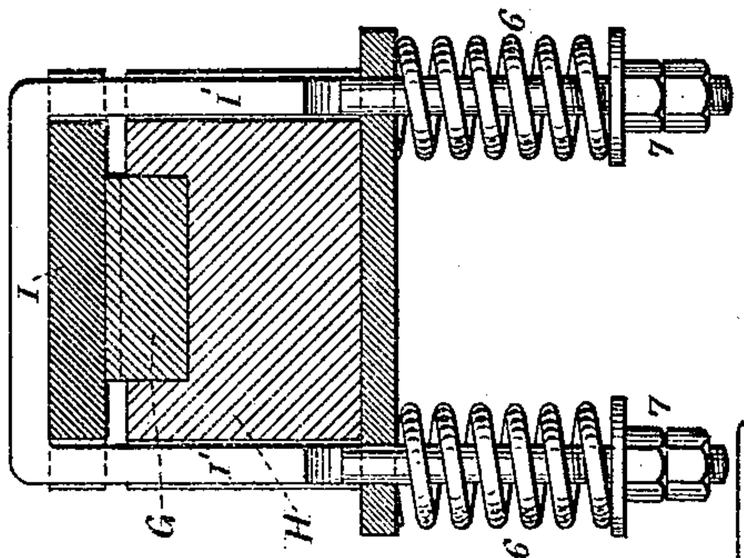

Fig. 3.

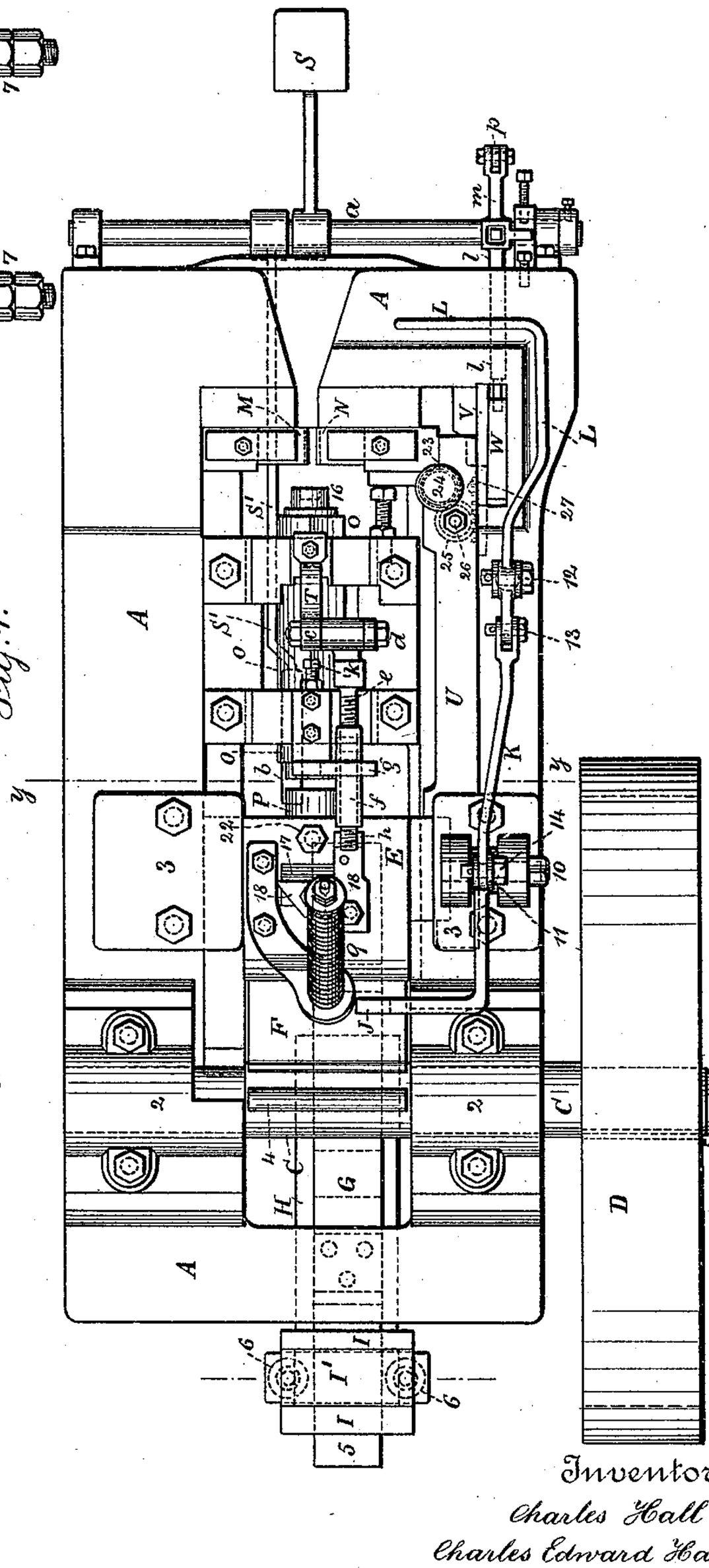

Fig. 1.

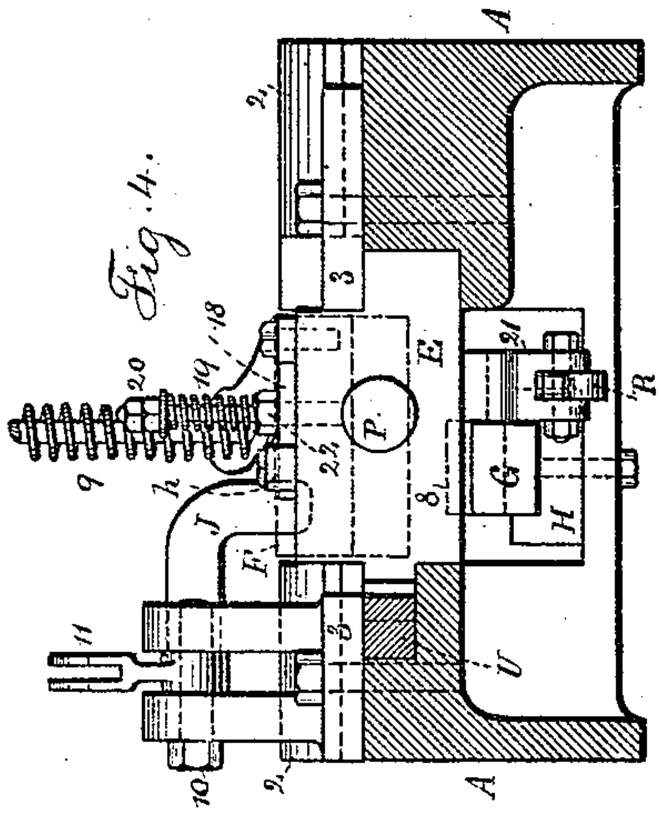

Fig. 4.

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Chas. H. Smith

Inventors.
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Charles Edward Hall
By their Attorney
Lemuel W. Serrell

(No Model.) 3 Sheets—Sheet 2

C. & C. E. HALL.

BOLT MACHINE.

No. 447,110. Patented Feb. 24, 1891.

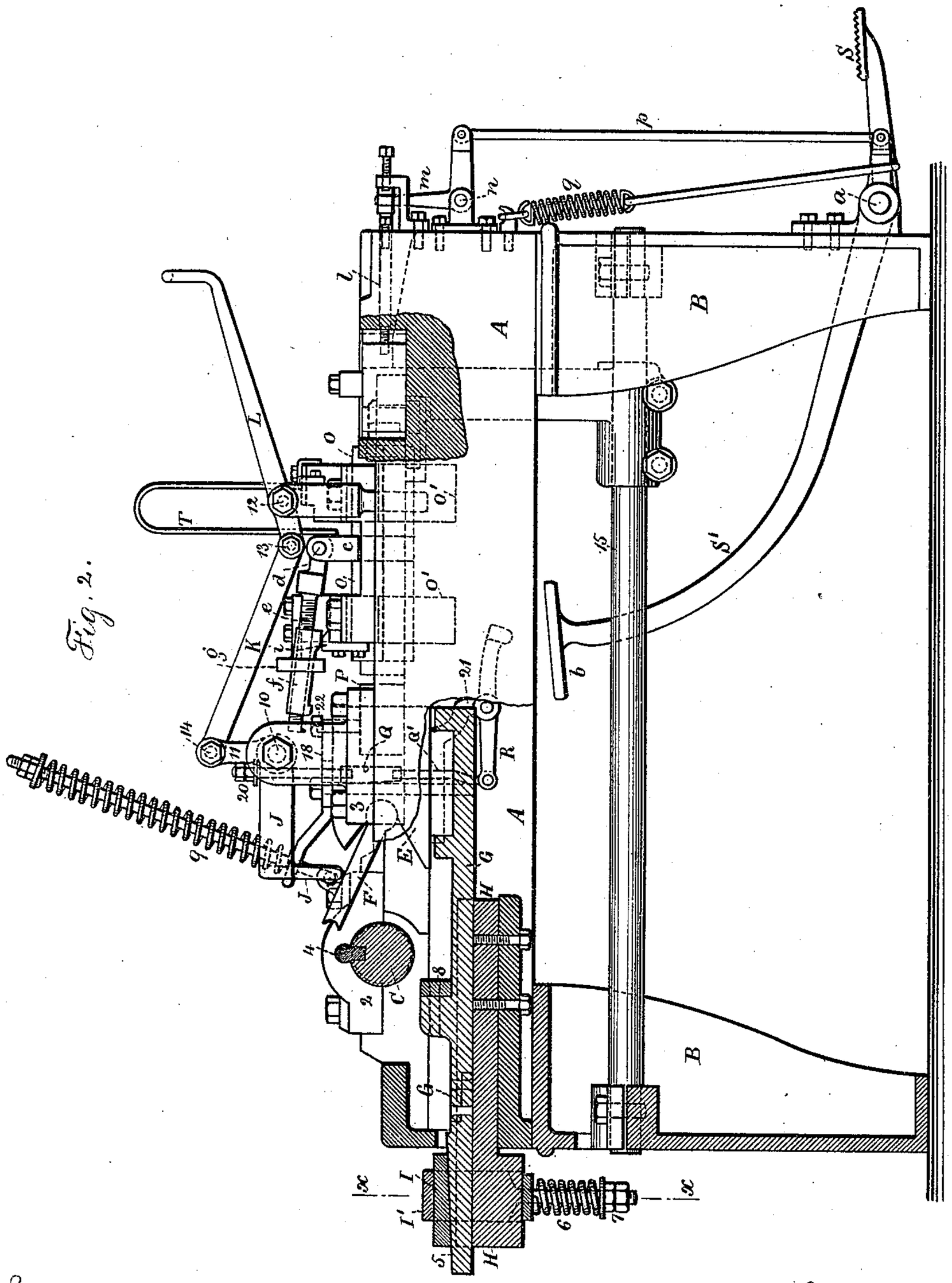

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

C. & C. E. HALL.

BOLT MACHINE.

No. 447,110. Patented Feb. 24, 1891.

Fig. 5.

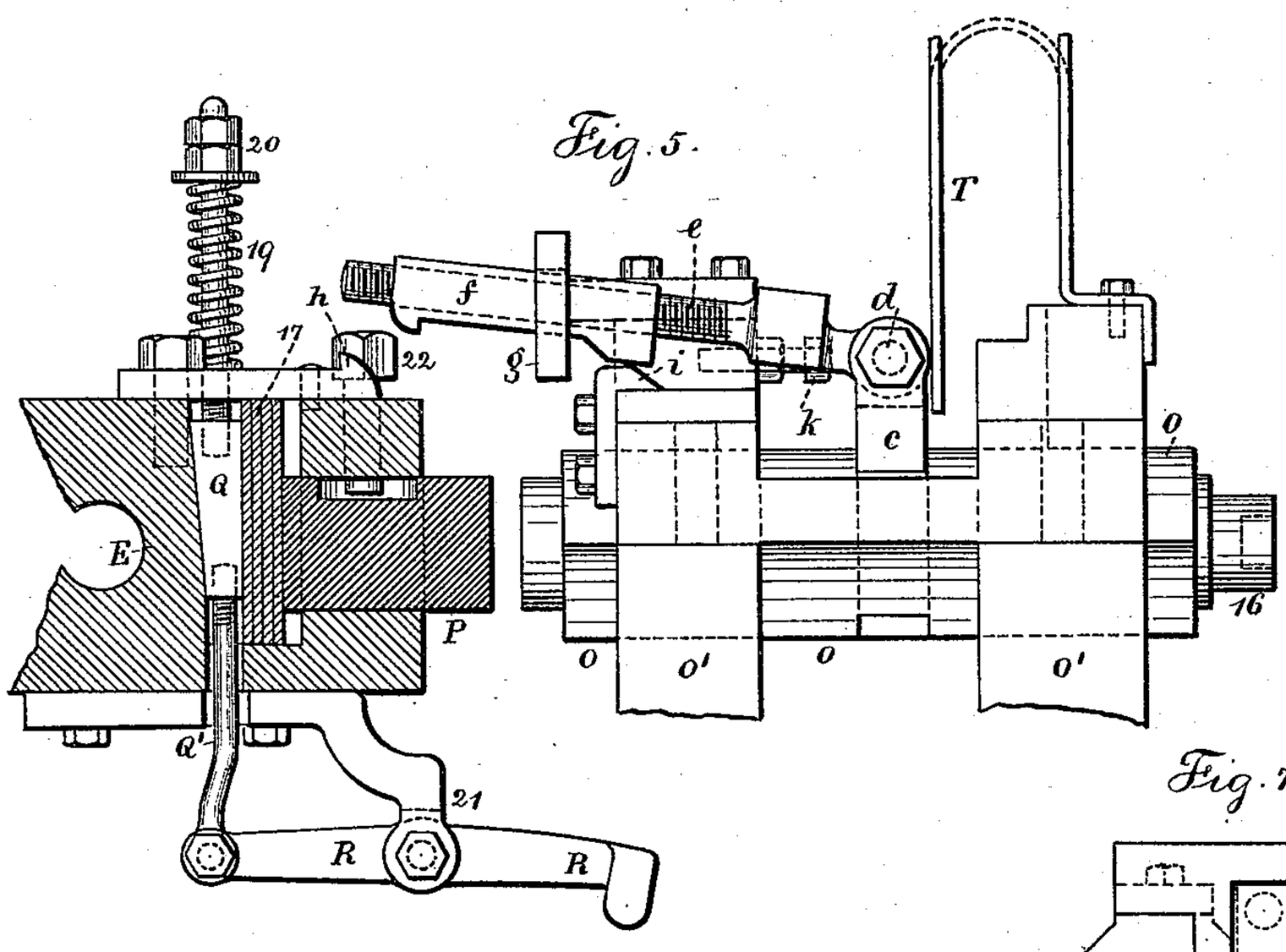

Fig. 6.

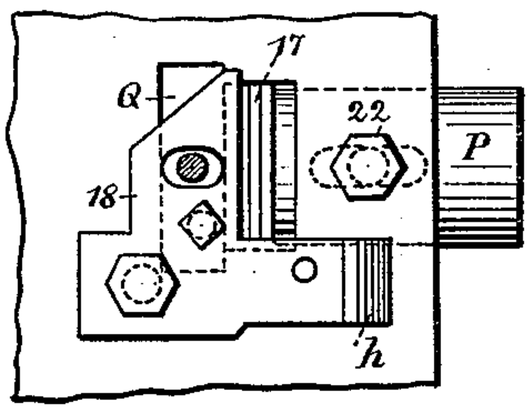

Fig. 7.

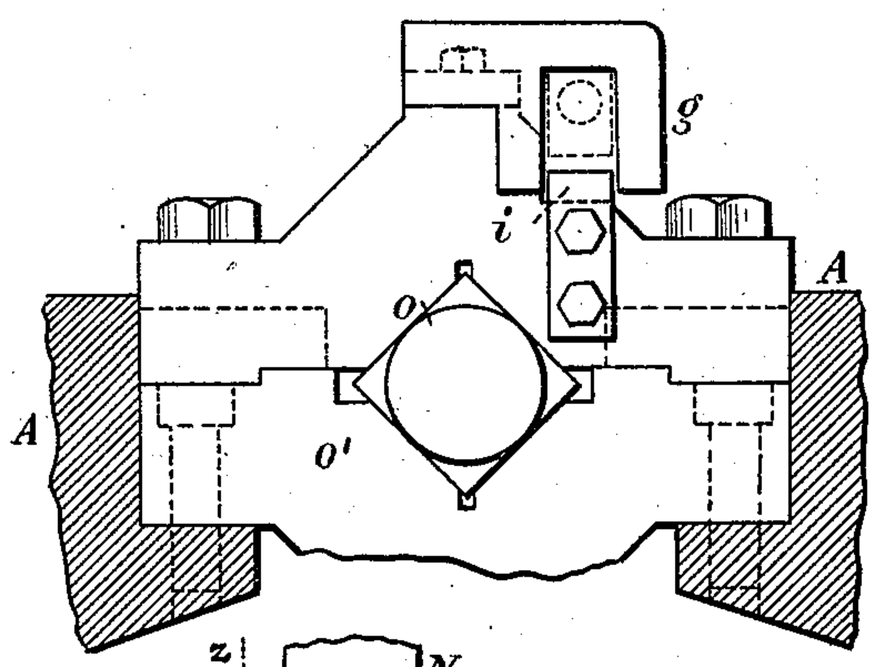

Fig. 8.

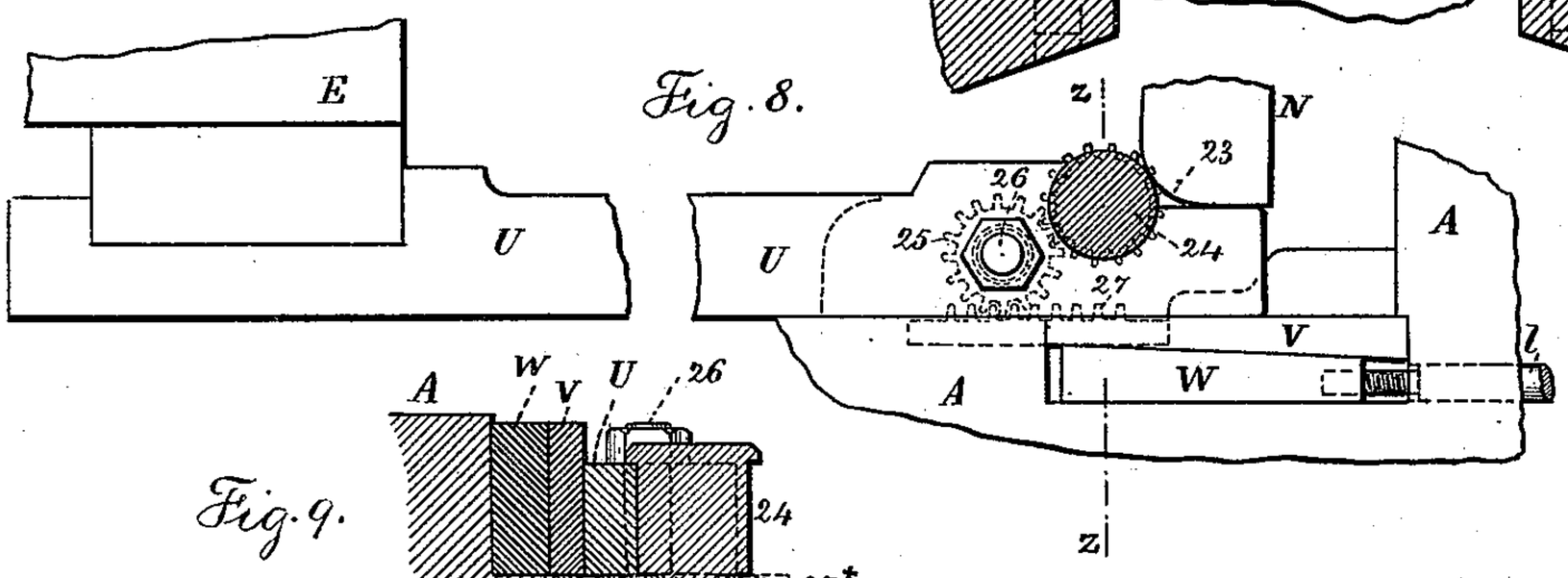

Fig. 9.

Witnesses
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Inventors.
Charles Hall
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By their Attorney
Lemuel W. Serrell

UNITED STATES PATENT OFFICE.

CHARLES HALL AND CHARLES EDWARD HALL, OF NEW YORK, N. Y.

BOLT-MACHINE.

SPECIFICATION forming part of Letters Patent No. 447,110, dated February 24, 1891.

Application filed May 5, 1890. Serial No. 350,591. (No model.)

To all whom it may concern:

Be it known that we, CHARLES HALL and CHARLES EDWARD HALL, citizens of the United States, residing in the city and State of New York, have invented an Improvement in Bolt-Machines, of which the following is a specification.

In the manufacture of bolt-heads it has heretofore been usual to pass the heated rod into the machine, grasp the same by a pair of holding-jaws, and upset the metal to form the head. This upsetting operation is usually performed by one stroke of the punch or header, and in order to obtain the proper amount of heated metal for forming the head it has been necessary to allow the heated bolt to project a considerable distance from the holding-jaws, and sometimes this heated bolt, instead of being upset endwise and with uniformity, bends over sidewise and the head is imperfect, and frequently the strain upon the metal at the junction of the head with the shank is such that the head of the bolt breaks off.

The object of the present invention is to upset the head of the bolt by two or more successive operations by the same die and in line with the shank of the bolt in such a manner that the first blow partially fills the die upon the header and the second blow completes the forming of the head, and we also arrange for removing the fin of metal that is produced by the upsetting operation at the base of the head and between the holding-jaws, and we construct the machine in such a manner that the heated bolt will be held firmly during the two upsetting operations which form the head, and at the third operation the attendant partially rotates the bolt to bring the fin under the head and on the shank opposite the solid portions of the holding-jaws, and at the same time partially releases the mechanism that acts upon the holding-jaws, so that the bolt slides through such holding-jaws, and the last operation is simply to remove the fin and give to the head a more perfect finish than that which can be obtained in the machines heretofore constructed, and in the last operation the pressure of the heading-die is lessened, so as to prevent the formation of another fin.

In the drawings, Figure 1 is a plan view of the machine. Fig. 2 is an elevation with some of the parts in section. Fig. 3 is a cross-section in larger size at the line $x\,x$, Fig. 2. Fig. 4 is a cross-section at the line $y\,y$, Fig. 1. Fig. 5 is an elevation of the ram and holder and a section of the moving head-block. Fig. 6 is a plan of the head-block. Fig. 7 is an elevation of the rear end of the ram and ram-holder. Fig. 8 is a detached plan, partially in section, of the device for moving one of the holding-jaws; and Fig. 9 is a section at the line $z\,z$, Fig. 8. Figs. 5 to 9, inclusive, are in larger size.

The frame A of the machine is of any suitable size and character, and it is represented as quadrangular, and it is supported by suitable legs B. The driving-shaft C is in bearings 2 upon the frame A, and it is driven by suitable power, preferably by belt to the driving-pulley D. The head-block E is between the slides 3 upon the frame A, so that the same may be reciprocated longitudinally of the machine, as usual in bolt-making machines, and there is between the head-block E and the driving-shaft C the hinged toggle F, and upon the shaft C there is a key-tappet 4, rounding or cylindrical upon its surface, which tappet coming into contact with the end of the hinged toggle F gives to the head-block E a movement longitudinally of the machine, and after the tappet 4 has given to the head-block and the parts actuated by it a complete movement in one direction the tappet separates from the end of the hinged toggle, as usual in this class of machines, and in the further movement of this key-tappet it comes in contact with the return-slide G, the forward end of which is connected to the head-block E, and the tappet 4, striking against the projection 8 on this return-slide, draws the head-block and the parts therewith connected back after each heading operation. In machines of this character we have found that this return-slide G is liable to be broken, and this appears to arise from the tappet 4 striking the projection 8 and giving to the slide G and head-block E a rapid return movement, and the inertia is liable to break the slide G when the head-block E comes into contact with the shaft C or other stop on the return movement.

The base-piece H runs longitudinally of the machine beneath the return-slide G, and it is

bolted firmly into place, and it forms a guide having a trough-shaped upper surface for such return-slide G, and the upper surface of this return-slide is preferably wedge-shaped at 5, and it extends along beneath the yoke-piece I and strap I′, the ends of which pass through the base-piece H and are provided with springs 6 and adjusting-nuts 7, and this yoke-piece I, resting upon the inclined or wedge-shaped upper surface 5 of the return-slide G, applies to such return-slide a friction, the extent of which can be adjusted by the nuts 7. Hence when the tappet 4 strikes the projection 8 on the return-slide G and gives to the parts a backward movement the friction increases by the wedge being moved along beneath the yoke-piece I, and this friction is sufficient to arrest the backward movement of the parts and to prevent the inertia carrying such parts too far as the tappet 4 passes clear from the projection 8.

In the machines heretofore constructed the guides that have been provided upon the base-piece H become rapidly worn, and sometimes the bolts become loose and the attendant is not aware of the same until the return-slide G breaks. In consequence of applying a friction by a spring to this return-slide G the parts do not wear loose, because the spring sets up such parts and renders the friction uniform, so that the slide G is not liable to be broken, even where the rear portion of such slide may be parallel instead of having an inclined surface, as shown.

It is usual in bolt-machines to apply a spring 9 to lift the hinged toggle F, so that the end of such toggle may be above the tappet 4, and hence the driving-shaft is free to revolve without actuating the machine, except when the hinged toggle F is swung downwardly so that its end is in the path of the tappet 4. This has usually been accomplished by a plain lever in the hands of the workman; but, in consequence of the hinged toggle flying back against the lever with considerable force, the hand of the operator resting upon the other end of the lever receives a concussion that is very disagreeable and often injurious to the workman. To avoid this difficulty we provide a hand-lever L for acting upon the lever J of the hinged toggle. The lever J is pivoted at 10, and one arm extends over the hinged toggle F and the other arm is vertical, or nearly so, as shown at 11, and it is connected by a link K to the hand-lever L, that is pivoted at 12 rigidly upon the frame of the machine, and the parts are arranged so that when the hand-lever L is pressed down by the attendant the joint 13 between the link K and hand-lever L passes into a straight line, or nearly so, between the rigid pivot 12 and the joint 14 at the other end of the link K, and in doing this the lever-arm J is depressed sufficiently to bring the end of the toggle F into the path of the tappet 4, and such hinged toggle, when it rises by the action of the spring 9 and strikes against the end of the arm J, does not affect the hand-lever L, because the joint 13 is in a straight line to the rigid pivot 12, and the hand-lever L does not transmit any concussion to the hand of the attendant, and he can allow his hand to rest upon the lever L, ready to raise that lever instantly for stopping the machine by allowing the spring 9 to lift the hinge-toggle above the path described by the key-tappet.

The stationary holding-jaw M and the moving holding-jaw N are of ordinary construction. The latter is upon the shaft 15, so that it may swing thereon in opening the holding-jaws, and these jaws are opened by any suitable spring or counter-weight, as usual in bolt-making machines, and the dies are changeable, so as to adapt the holding-jaws to different sizes of bolts. The ram O is in line with the header P, that is received into and moved with the head-block E, and at the end of the ram is a die 16, having a recess or cavity corresponding in shape and size to the head of the bolt, and this die is changeable for adapting the machine to different-sized bolt-heads.

The header P within the head-block E is backed up by removable plates 17, that are introduced to compensate wear and to regulate the proximity of the end of the die 16 to the faces of the holding-jaws as the head is upset. We add to these parts, which are common in bolt-machines, a wedge Q within the head-block E and between the removable plates 17 and such head-block, and this wedge Q is capable of receiving a vertical motion, there being a rod, preferably connected with the larger end of the wedge and extending vertically through a plate 18 upon the head-block E, and a spring 19 around this rod, acting against a nut 20 upon the rod, serves to lift the wedge when not otherwise acted upon, and there is a rod Q′ fastened to the smaller end of the wedge and connecting the same to the lever R, pivoted to the arm 21 below the head-block E, and we provide a treadle S, pivoted at *a*, and having a rearward-extending lever S′, with a lifter *b* adjacent to the free end of the lever R, so that when the treadle S is depressed the lifter *b* acts upon the lever R and draws down the wedge Q, so as to move the header P slightly forward to give a full movement to the ram O; but when the treadle S is released the spring 19 draws up the wedge and allows the header P to slide back slightly to lessen the motion given to the ram O. We introduce a set-screw 22 through the head-block E and passing into a longitudinal slot or mortise in the header P to prevent the latter becoming disengaged from the head-block, but to allow for the endwise sliding motion to such header, as aforesaid.

The ram O is supported in stationary cross-pieces O′, fitted with movable caps, as usual, and in the manufacture of bolts the ram O has been forced back by the action of a spring, such as shown at T; but where the head of the bolt is pressed up very full into the die

16 the spring T may not be sufficient to draw the die from off the head of the bolt. To avoid this difficulty we make in the ram O a transverse mortise for the reception of a vertical bar *c*, at the upper end of which is a joint *d* for the screw-rod *e*, upon which is a latch-nut *f*, and there is a stationary fork *g*, through which the latch-nut *f* slides freely; but the fork prevents the latch-nut becoming unscrewed or changing position, and upon the head-block E is a latch *h*, which engages the latch-nut *f* as the parts move forward, and as the head-block E is drawn back by the tappet 4 acting upon the return slide G the latch *h* pulls back the latch-nut *f* and the ram O, so as to reliably separate the die 16 from the head of the bolt, and in this movement a projection upon the latch-nut *f* runs over the lifter-incline *i* and separates the latch-nut *f* from the latch *h*, and the further backward movement to the ram O is given by the spring T, and the adjusting-bolt *k* becomes a stop for the vertical bar *c* on the return movement, and this is to be adjusted according to the length of stock required for making the bolt-head, because the operator in supplying the heated rod passes the same in between the holding-jaws M N into the die 16, and the amount of stock upset at each motion depends upon the length of rod projecting through the holding-jaws M N and into the die 16.

If the dies heretofore described are used alone, and the holding-jaws are opened or closed by any suitable means, the head of the bolt can be made by one, two, or three strokes of the ram O. We find it advantageous to make the head by two strokes of the ram O, in order that the die 16 may be filled completely by the two upsetting operations, and in so doing the head will be much more solid and the shank of the bolt will always remain central to the head; but where it is desired to remove from the under side of the bolt-head and on the shank the fin that is formed between the holding-jaws M N it is important to be able to give the bolt-rod one-quarter of a rotation, so that the fin upon the under side of the bolt-head and on the shank may be brought to the smooth portions of the holding-jaws M N and be removed by the pressure resulting from a third stroke of the ram O. If the holding-jaws M N and the die 16 exerted the same force at each movement, the attendant would be obliged to turn the bolt one-quarter of a rotation and hold the under surface of the bolt-head against the face of the jaws M N, and the fins would render this operation often impossible, and the closing of the jaws M N firmly upon the bolt-shank would cause the head to be upset still farther and throw out larger fins, and in addition to this it would be difficult to turn the bolt-holt by hand so accurately that it would correspond to the die 16 in the ram when such die came up against the bolt-head. We find it therefore advantageous for the operator after the second blow has been given on the bolt-head and the die 16 has been drawn back to give to the bolt a quarter-rotation and push the head of the bolt back into the die 16 to determine its correct position, and then it may be drawn forward with the bolt-head against the jaws M N; but the holding action of the jaws M N is lessened, so that as the ram O comes up the die 16 may carry the bolt and head freely up against the face of the holding-jaws M N, such holding-jaws M N only being closed sufficiently to form guides, between which the shank of the bolt is passed with sufficient freedom to allow the head of the bolt to be brought up against the face of such holding-jaws M N to obliterate any traces of fins upon the bolt shank or head resulting from the previous operations. To effect this object we make use of wedges that serve to set up the moving jaw N sufficiently tight to clamp the bolt firmly during the upsetting operations or to lessen the pressure during the third operation and at this time the wedge Q is moved to lessen the pressure of the die 16 on the bolt-head.

The slide-bar U is connected with the head-block E and moves with it, and this slide-bar gives motion to the moving holding-jaw N, the portion 23 of the holding-jaw N being rounding, as seen in Fig. 8, and against this rounding portion 23 of the moving holding-jaw N the slide U might act directly by an inclined or rounded surface; but we prefer the devices hereinafter described.

Adjacent to the vertical edge of the slide-bar U is a wedge V, set into a recess in the frame, and outside of that is a second wedge W, having at one end a rod *l*, passing through the frame and connected by a bent lever *m* upon a fulcrum *n* and a connecting-rod *p* with the treadle S, so that by the depression of the treadle S the wedge W is moved endwise, and, acting upon the wedge V, moves the slide-bar U sufficiently toward the rounding end 23 of the holding-jaw N to cause such holding-jaw N to firmly grasp and hold the heated rod against the jaw M, and when this treadle S is released the spring *q* draws up such treadle, and, through the connecting-rod *p*, bent lever *m*, and rod *l*, the wedge W is moved backwardly, and when the slide-bar U receives its next endwise movement the holding-jaw N is brought up against the heated rod with but a slight pressure for the purposes before mentioned, and we remark that when the treadle S is released the wedge Q is drawn up by the spring 19, so that the ram O is not pressed forward so closely in the third operation, that removes the fin, as it is in the first and second upsetting operations in making the head.

By lessening the pressure of the die 16 upon the head of the bolt at the third operation we prevent another fin being formed at the under side of the head in consequence of the powerful pressure to which said head is ordinarily exposed.

As there are considerable friction and wear between the slide-bar U and the rounding end 23 of the holding-jaw N, we prefer to introduce into a circular cavity in the slide-bar U a roller 24, which may be of hardened steel, and its position can be changed by turning it around from time to time, and one portion of the surface of this roller 24 acts against the rounding end 23 of the holding-jaw N, and such roller takes a bearing within the round opening in the slide-bar U, and in order to lessen wear upon the surface we prefer to rotate this roller 24, so that its surface may be moving in the same direction and at the same speed as the motion given to such roller by contact with the rounding end of N, and this we accomplish by the pinion 25 upon a stud 26, such pinion 25 being below the under side of the slide-bar U and gearing into teeth cut upon the lower end of the roller 24, and there is a stationary toothed rack 27, supported within a recess in the frame of the machine, with which rack the teeth of the pinion 25 are in gear. Hence as the pinion 25 and roller 24 are moved along by and with the slide U the teeth of the rack 27 rotate this pinion 25, and also rotate the roller 24, so that when the roller 24 comes in contact with the end 23 of the holding-jaw the parts roll one upon the other with but little sliding or wearing action, and the holding-jaws are closed rapidly and remain closed during the heading operation, because the roller 24 is moving across the straight end of the stock of the holding-jaw adjacent to the rounding portion 23 during the time that the die 16 is upsetting the metal and forming the head of the bolt.

In operating the machine the attendant introduces the heated rod between the jaws M N in the usual manner, and by drawing down the hand-lever L the toggle F is brought into position for the tappet 4 to take the end thereof and give motion to the head-block E and the slide-bar U, which closes the jaws M N, and the header P comes up against the back end of the ram O, and the head is upset by the first blow. As the parts draw back, the lever L, being held down, the jaws M N open, the rod is pressed back with the partially-formed head in the die 16, and the operations are repeated at the second stroke. The attendant during both the strokes keeps his foot on the treadle S, and then for the third stroke he releases the pressure on the treadle to allow the springs 19 and *q* and wedge W to lessen the action of the die 16 and the grasping action of the jaws M N. The die 16 separates from the head at each backward movement, and between the first and second strokes the attendant simply pushes the partly-formed head back into the die. Between the second and third strokes the rod is turned a quarter-rotation and pressed back into the die, as before described, and the fin is removed during the third stroke. The lever L is released, and the attendant cuts off the bolt and reintroduces the heated rod, or else introduces another heated rod and places his foot on the treadle and brings down the lever L, and the operations are repeated.

We are aware that in the manufacture of rounding heads for carriage-bolts such heads have been subjected to two heading operations, the metal in each instance being spread outwardly or upset from the middle to the periphery of the rounding head. In forging bolts with square, hexagonal, octagonal, or T-shaped heads the flat inner surface of the die which comes into contact with the end of the heated rod is liable to bend such heated rod by the end sliding upon the flat surface. This risk does not exist in upsetting the rounding heads of carriage-bolts. We find, therefore, that it is necessary to project the end of the heated rod a comparatively short distance for the first heading operation in order that the metal may be upset with uniformity in all directions, and we find that in this mode of making polygonal heads the exterior surfaces of the heads are smooth and uniform, and there is nothing to indicate a mark or seam between the first and second operation, and the die is filled out completely and with uniformity.

It will be understood that the pinion 25 is only introduced to give to the roller 24 a motion in the proper direction, and that if the rack 27 was upon the opposite side of the pinion of the roller 24 from that shown in Fig. 8, and as represented by dotted lines at 27*, Fig. 9, the pinion 25 might be dispensed with.

If the wedge V is dispensed with, the wedge W might act directly against the vertical side of the slide-bar U, the inclines of the respective surfaces being adapted to the position of the wedge M.

In place of the straight wedges Q or W, or both, circular wedges or cams may be employed as the known equivalents for adjusting the action of the parts.

We claim as our invention—

1. In a bolt-heading machine, the combination, with the hinged toggle, the tappet, the moving head-block, and device for raising the hinged toggle, of the lever for depressing the hinged toggle, a hand-lever upon a rigid fulcrum, and a connection therefrom to the lever that acts upon the hinged toggle, the parts being arranged substantially as specified, so that the concussion from the hinged toggle is received upon the stationary fulcrum of the hand-lever, substantially as set forth.

2. The combination, with the hinged toggle F, the spring for raising the same, and the driving-shaft C and key-tappet 4, of the lever J for acting upon such hinged toggle, the hand-lever L and its rigid pivot 12, and the link K, extending from the hand-lever L to the lever J, the parts being arranged, substantially as specified, so that the concussion

of the hinged toggle F upon the lever J is received upon the rigid pivot 12, substantially as set forth.

3. The combination, with the driving-shaft, the key-tappet, the head-block, and the hinged toggle, of the return-slide G, having a wedge-shaped surface, a yoke-piece, and a spring for pressing the yoke-piece against the wedge-surface of the return-slide, substantially as and for the purposes set forth.

4. The combination, with the ram, the head-block and the header, and means for giving motion to the head-block, of a wedge within the head-block and acting between the same and the header, a spring for moving the wedge in one direction, and a treadle and lever for moving the wedge in the other direction, substantially as and for the purposes set forth.

5. The combination, with the head-block and means for reciprocating the same, of the ram and die for heading a bolt, a swinging latch connected with the ram, and a latch upon the head-block for drawing back the ram and its die to separate the latter from the head of the bolt, substantially as set forth.

6. The combination, with the head-block and means for moving the same, of a ram and die, a screw-rod and joint upon the ram, a latch-nut upon said screw-rod, and a latch upon the head-block, whereby the ram and die are drawn back for separating the die from the bolt-head, substantially as set forth.

7. The combination, in a bolt-machine, with the ram and die for forming the head, of the holding-jaws, a slide-bar for giving motion to the holding-jaws, and a wedge or its equivalent, and a hand-connection under the control of the workman for regulating the action of the slide-bar in giving more or less motion to the holding-jaws, substantially as set forth.

8. The combination, with the ram and die in a bolt-machine, of the holding-jaws M N, the slide-bar U for giving motion to the holding-jaw N, and a wedge W, intervening between the slide-bar U and the frame of the machine for varying the action of the slide-bar U upon the moving holding-jaw, substantially as set forth.

9. The combination, with the slide-bar U, of the wedge V within a recess in the frame and adjacent to the slide-bar, a moving wedge W, treadle and connections for moving such wedge, and the holding-jaws M N for the bolt-shank, substantially as set forth.

10. The combination, in a bolt-machine, with the holding-jaws, of the slide-bar U, the roller 24, moving with such slide-bar, and the pinion and rack for giving motion to the roller as it moves in contact with the end portion of the moving holding-jaw, substantially as set forth.

11. The combination, with a heading-die in a bolt-forming machine and the holding-dies for grasping the rod, of mechanism acting upon the holding-jaws for lessening the pressure of the holding-jaws upon the rod during the last stroke of the heading-dies and allowing the bolt to slide through them, substantially as set forth.

12. The combination, with the driving-shaft, the key-tappet, hinged toggle, and head-block, of the return-slide G, the base H, supporting the same, the yoke-piece, and a spring for pressing the yoke-piece against the return-slide and applying to the same the required friction, substantially as set forth.

13. The combination, in a bolt-machine, with the holding-jaws, of the slide-bar U, the roller 24, moving with such slide-bar and having gear-teeth upon one end and a rack for giving motion to the roller and causing it to roll with the end portion of the moving holding-jaw, substantially as set forth.

14. The method herein specified of forming bolt-heads and removing the fin, consisting in feeding into the machine a heated rod, grasping the rod, upsetting the metal to form the head by one or more blows of the heading-die, partially rotating the rod and the head to bring the fin of the metal adjacent to the smooth portion of the holding-dies, and partly releasing the pressure upon the holding-dies and against the heading-die in order that the bolt may be partly slid through the holding-dies in removing the fin and the pressure of the heading-die may not produce another fin, substantially as set forth.

15. The method herein specified of forming bolt-heads, consisting in feeding into a machine a heated rod, grasping the rod and upsetting the metal to form the head by two or more blows of the heading-die, and partly lessening the movement of the heading-die during its last stroke to lessen the pressure of such heading-die in the finishing operation, substantially as set forth.

16. In a machine for heading bolts, the combination, with a heading-die and the holding-dies, of means, substantially as specified, for lessening the pressure of the holding-dies and for lessening the pressure of the heading-die upon the head of the bolt during the last blow upon such bolt, substantially as set forth.

17. In a bolt-making machine, the combination, with the dies for grasping the rod and the heading-die, of mechanism, substantially as specified, for lessening the movement of the heading-die during its last stroke upon the bolt-head in the finishing operation, substantially as specified.

Signed by us this 1st day of May, 1890.

CHAS. HALL.
CHARLES EDWARD HALL.

Witnesses:
GEO. T. PINCKNEY,
WILLIAM G. MOTT.