No. 626,234. Patented June 6, 1899.

W. W. HUBBARD, JR.

MACHINE FOR MAKING BOLTS.

(Application filed Dec. 13, 1898.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 2.

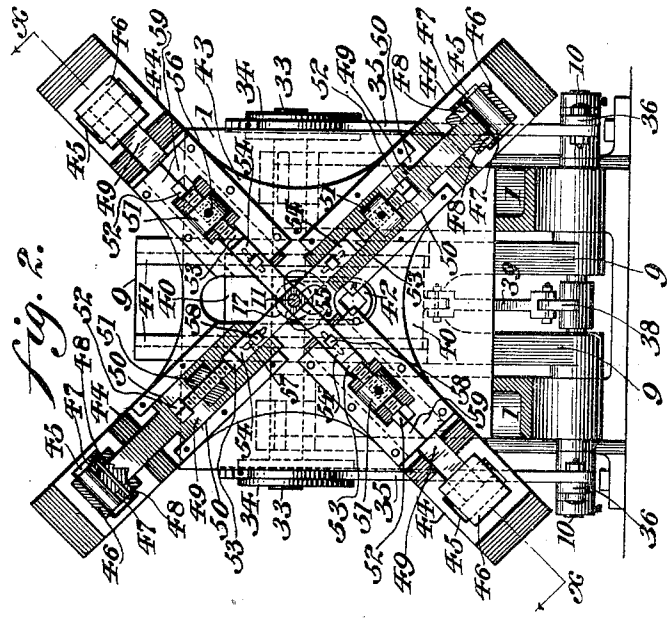
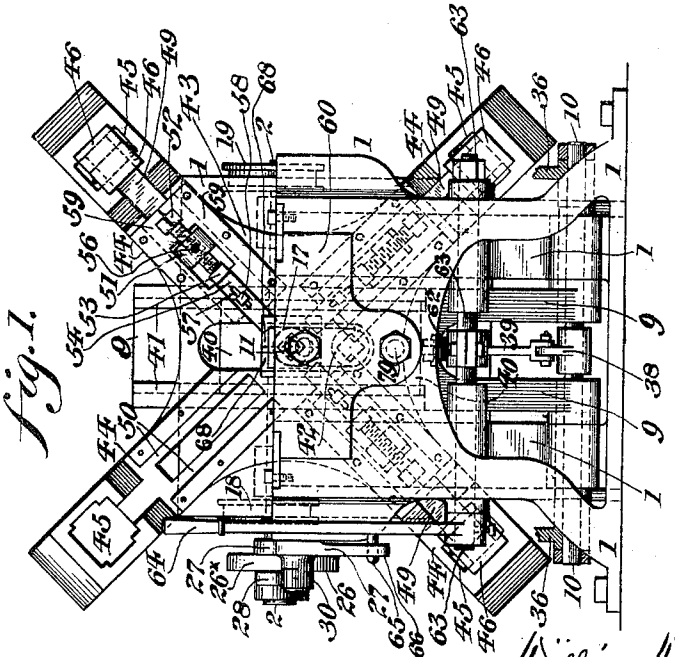


Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

fig. 3.

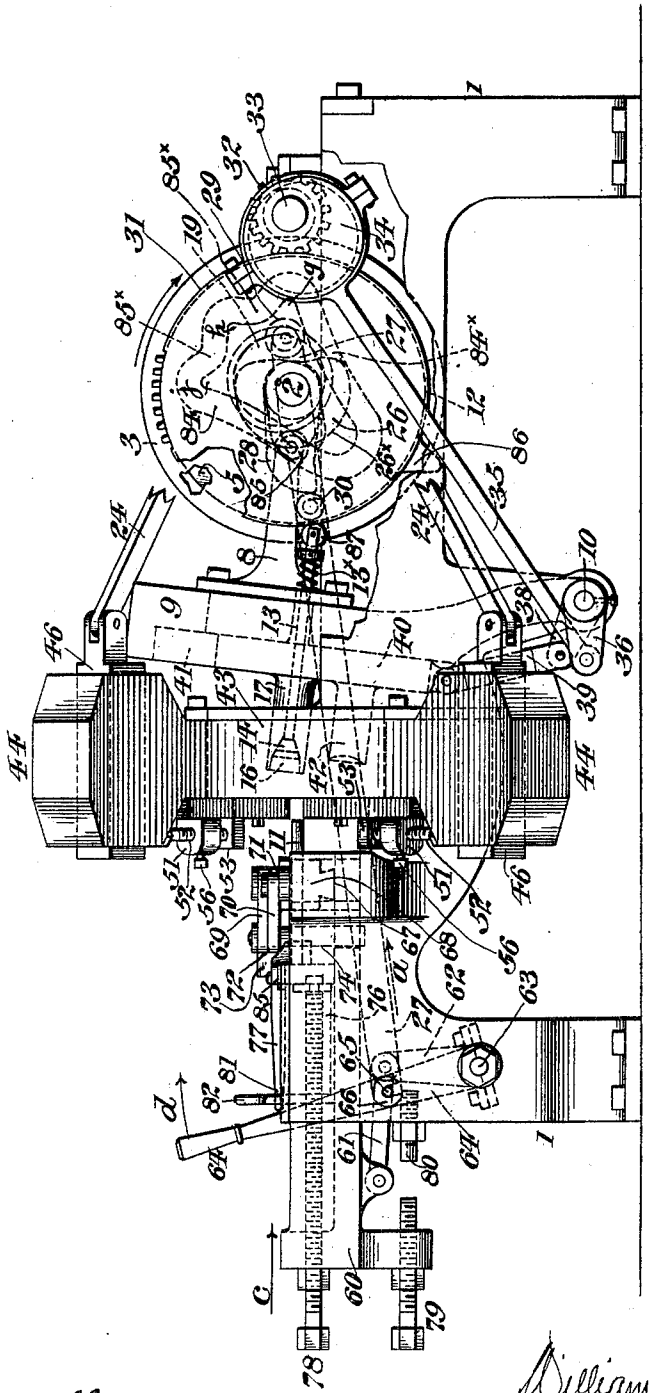

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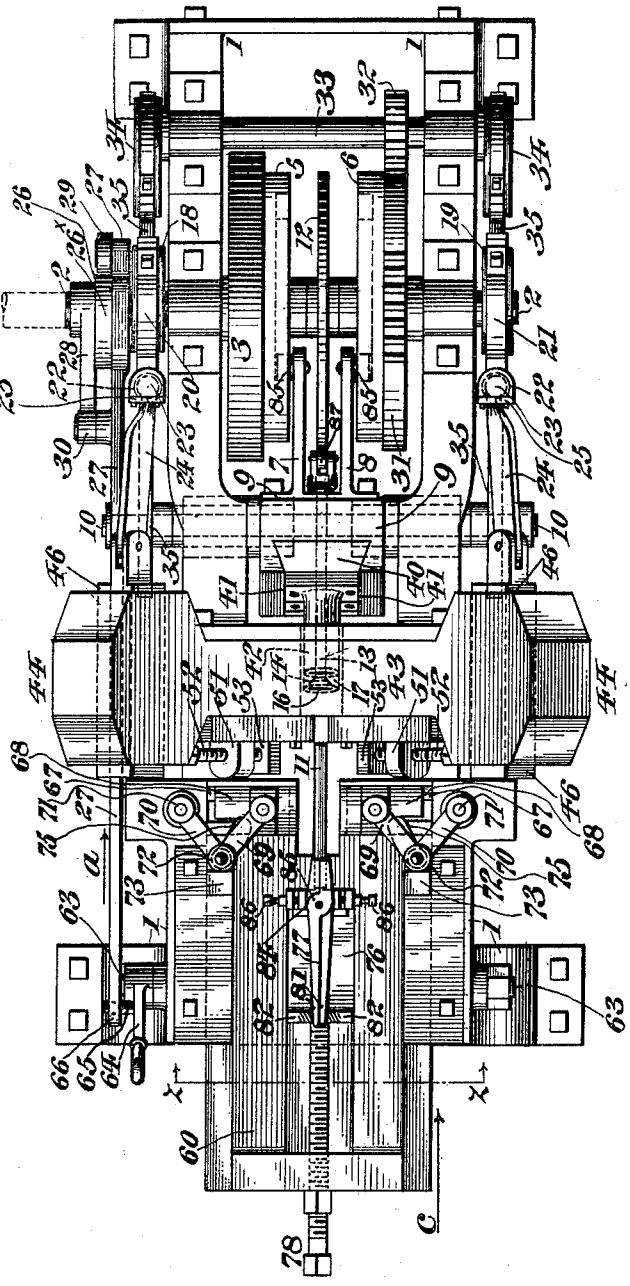
Fig. 4.



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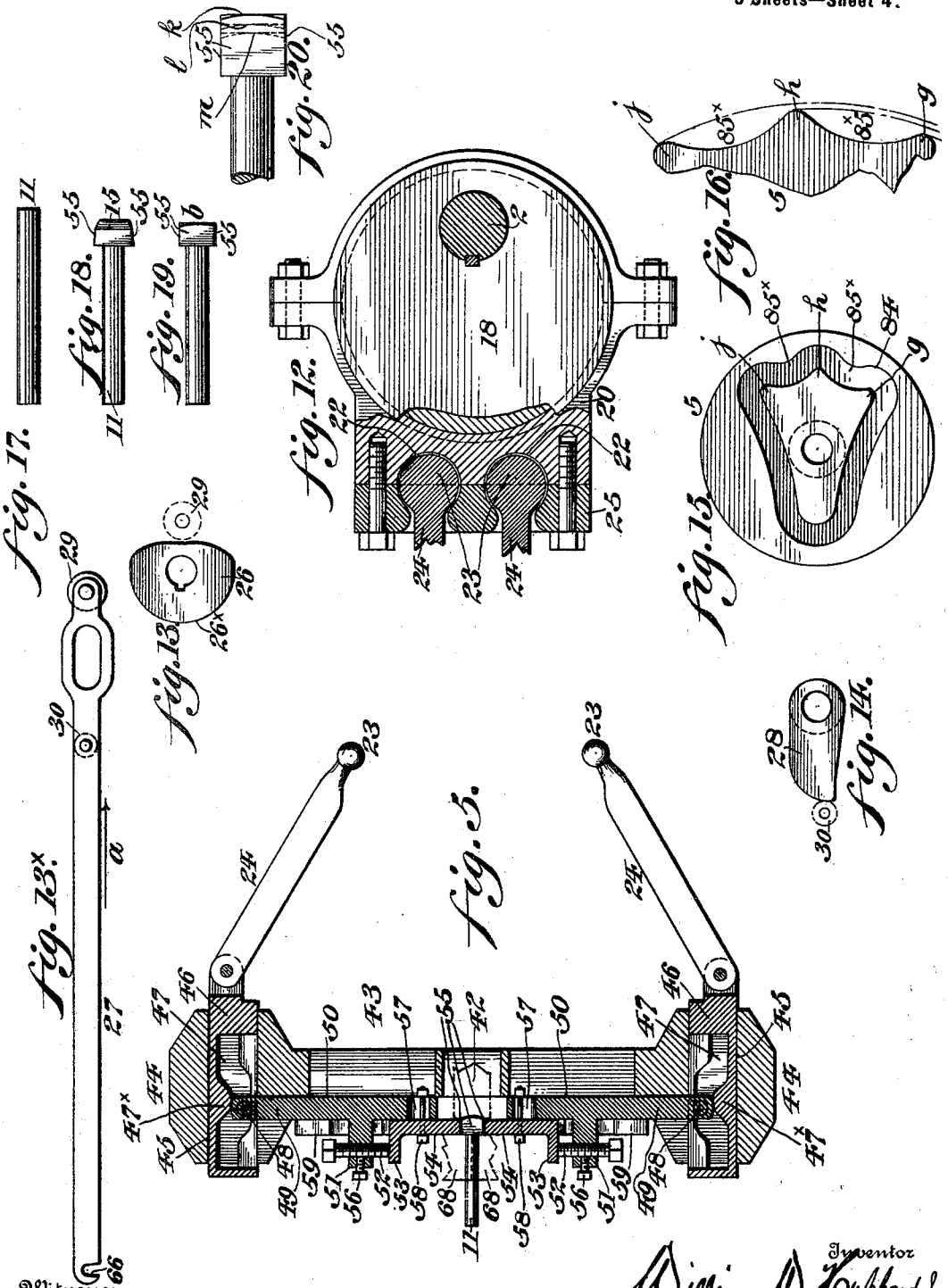

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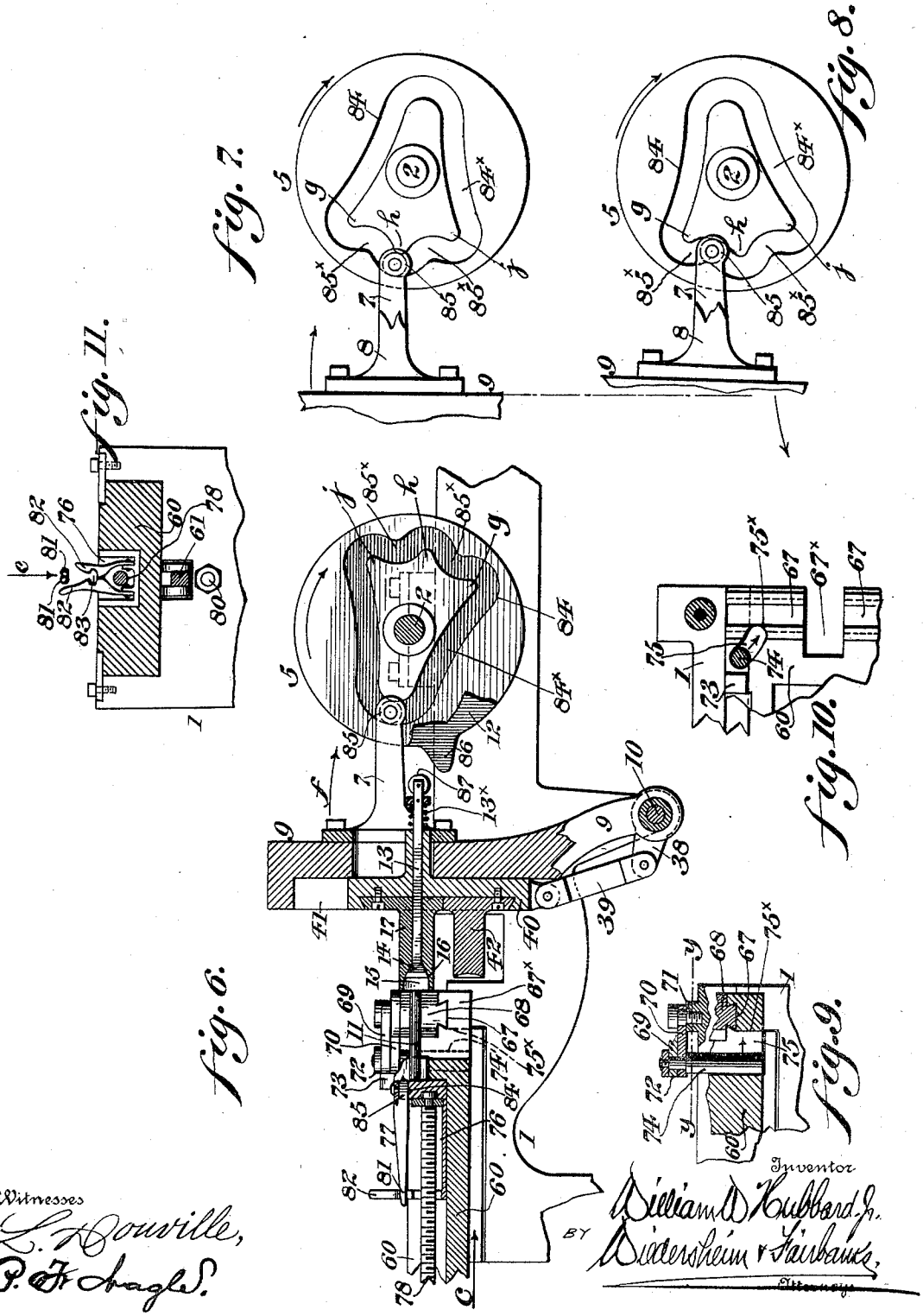

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UNITED STATES PATENT OFFICE.

WILLIAM W. HUBBARD, JR., OF PHILADELPHIA, PENNSYLVANIA.

MACHINE FOR MAKING BOLTS.

SPECIFICATION forming part of Letters Patent No. 626,234, dated June 6, 1899.

Application filed December 13, 1898. Serial No. 699,123. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. HUBBARD, Jr., a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Improvement in Machines for Making Bolts, which improvement is fully set forth in the following specification and accompanying drawings.

My invention relates to improvements in machines for upsetting and heading bolts; and it consists of means for firmly holding a bolt-blank in position when the same is being operated upon by the upsetting device, the hammers, and also the finishing-punch.

It also consists of means for imparting a reciprocating motion to the carriage which conveys the bolt-blank toward the mechanism for heading the same and means for releasing the bolt-blank when the same has had a head formed thereon.

It also consists of means for raising and lowering both the upsetting and the finishing punches, so as to bring each of these into their proper positions at the required time.

It also consists of means for moving the upsetting and the finishing punches to and from the bolt-blank and means for imparting a reciprocating motion to the hammers which form the sides of the bolt-head.

It also consists of means for holding the tongs employed for feeding the bolt-blanks to the machine firmly in position within the same during a portion of the time required for forming a head on the bolt-blank.

It further consists of means for adjusting certain portions of the carriage to suit different lengths of bolt-blanks.

It further consists of novel details of construction, all as will be hereinafter fully set forth, and particularly pointed out in the claims.

Figures 1 and 2 represent end elevations of a machine for upsetting and heading bolts embodying my invention, certain portions of Fig. 2 being in section. Fig. 3 represents a side elevation of the machine. Fig. 4 represents a plan view of the same. Fig. 5 represents a sectional view of certain portions of the machine, the section being taken on line $x\,x$, Fig. 2. Fig. 6 represents a partial side elevation and partial vertical section of certain portions of the machine, the section being taken through the center of the machine. Fig. 7 represents a side elevation of certain of the parts seen in Fig. 6. Fig. 8 represents a side elevation of the parts seen in Fig. 7, but in different positions from those seen in said Fig. 7. Fig. 9 represents a partial side elevation and partial vertical section of certain of the parts seen in Fig. 6. Fig. 10 represents a horizontal section on line $y\,y$, Fig. 9. Fig. 11 represents a transverse vertical section of certain portions of the machine, the section being taken on line $z\,z$, Fig. 4. Fig. 12 represents a partial side elevation and partial vertical section of certain detached parts, the latter being on an enlarged scale. Figs. 13, 14, and 15 represent side elevations of cams employed in connection with my invention. Fig. $13^{\times}$ represents a side elevation of a link employed. Fig. 16 represents a side elevation, on an enlarged scale, of a portion of the cam seen in Fig. 15. Fig. 17 represents a side elevation of a bolt-blank. Fig. 18 represents a side elevation of the bolt-blank seen in Fig. 17, but with one end thereof upset. Fig. 19 represents a side elevation of the bolt-blank seen in Fig. 17, but with one end thereof formed with a finished head. Fig. 20 represents a side elevation of a portion of a bolt and illustrates the successive steps produced by the blows delivered on the head thereof by the finishing-punch.

Similar letters and figures of reference indicate corresponding parts in the figures.

Referring to the drawings, 1 designates the frame of the machine, in which is journaled the main driving-shaft 2, which may be driven either by a belt passed around the balance-wheel 3 on said shaft 2 or by a pulley, clutch, or similar device mounted on an extension 4, (shown in dotted lines in Fig. 4,) said extension being continuous of the shaft 2.

The shaft 2 has firmly secured thereon the cams 5 and 6, which impart an oscillating motion to the arms 7 and 8, respectively, which two latter are secured in any suitable manner to an oscillating frame 9, loosely mounted on the shaft 10, which latter is journaled in the frame 1 of the machine, it being apparent that the motion imparted to the arms 7

and 8 by their cams 5 and 6 will be transmitted to said frame 9, so as to cause the latter to move toward and from a bolt-blank 11, placed in the machine, and for a purpose to be hereinafter described.

12 designates a cam firmly secured to the shaft 2, the object of said cam being to impart a forward movement to a rod 13, (see more particularly Fig. 6,) so that its end 14 may exert pressure against the upset end 15 of the bolt-blank 11, and thereby assist in removing said upset end from the cavity 16 in the upsetting-punch 17, which latter may be secured in any suitable manner to the oscillating frame 9.

18 and 19 designate eccentrics firmly secured to the shaft 2 and provided with the straps 20 and 21, respectively, it being noted that said straps are each provided with sockets 22, (best seen in Fig. 12,) said sockets being adapted to receive the spherical ends 23 of the eccentric-rods 24, it being noted that said eccentric-straps 20 and 21 are each provided with two sockets 22. The spherical ends 23 of the eccentric-rods 24 are retained in position in the adjacent eccentric-straps by the caps 25, as seen in Figs. 4 and 12.

26 designates a cam firmly secured to the shaft 2 and adapted to operate a link 27, (see Figs. 3, 4, and $13^{\times}$,) so as to cause said link to move in the direction indicated by the arrow *a* in Figs. 3, 4, and $13^{\times}$ and for a purpose to be hereinafter described.

28 designates a cam firmly secured to the shaft 2 and adapted to cause the link 27 to move in a direction opposite to that indicated by the arrow *a* in Figs. 3, 4, and $13^{\times}$ and for a purpose to be hereinafter described.

The link 27 is provided with the rollers 29 and 30, the former of said rollers working in conjunction with the cam 26 and the latter roller in conjunction with the cam 28 and as best seen in Fig. 4.

31 designates a mutilated gear-wheel firmly secured to the shaft 2 and meshing with a pinion 32, firmly secured to the shaft 33, which latter is journaled in the frame 1 of the machine, it being noted that the rotation of the gear-wheel 31, which is continuous while the machine is in operation, will impart an intermittent rotary motion to said pinion 32, and consequently to the shaft 33 and eccentrics 34, secured thereon, so that said eccentrics 34 will impart a reciprocating motion to their respective rods 35, which latter are connected to the arms 36, as best seen in Figs. 2, 3, and 4, it being noted that said arms 36 are firmly secured to the shaft 10 and that the reciprocating motion of the eccentric-rods 35 will impart an oscillating motion to said arms, which latter will then impart a rocking motion to the shaft 10.

38 designates an arm firmly secured to the shaft 10, (see Figs. 1, 2, 3, and 6,) said arm having pivotally connected thereto one end of a link 39, the other end of said link being pivotally attached to a sliding block 40, guided in ways 41 in the oscillating frame 9 and provided with the upsetting-punch 17 and finishing-punch 42.

43 designates a frame provided with radial arms 44, whose outer ends are provided with ways 45, (see more particularly Figs. 1, 2, and 5,) in each of which is guided a sliding cam 46, which has connected therewith one end of one of the eccentric-rods 24, it being noted that the rotation of the eccentrics 18 and 19 will impart, through their rods 24, a reciprocating motion to their respective cams 46.

The cams 46 are each provided with grooves 47, (best seen in Figs. 2 and 5,) and in each of said grooves plays a roller 48, journaled in the side of a slide 49, which is guided in ways 50 in the frame 43, it being noted that the slides 49 are in the present instance four in number, or, in other words, one slide 49 to each arm 44.

The slides 49 are each provided with a boss 51, in which is fitted a bolt 52, against which abuts the outer extremity 53 of a hammer 54, it being apparent that the pressure against a hammer 54 due to the blows delivered by the same to the sides 55 of the head of a bolt will be resisted by said bolts 52, and the displacement of a hammer 54 when striking a blow will be prevented.

The bolts 52 may be held in adjusted position by set-screws 56. (See more particularly Fig. 5.)

The hammers 54 may be adjusted longitudinally, so as to compensate for the wear thereof, by means of the slots 57 in the slides 49 and the bolts 58, (see Fig. 5,) it being noted that the bolts 58 assist in holding the hammers 54 in position in the slides 49, the latter being retained in position in the arms 44 by the plates 59. (See Figs. 1, 2, and 5.)

60 designates a carriage adapted to slide to and fro in the frame 1 of the machine, so as to feed a bolt-blank 11 to the upsetting and the finishing punches 17 and 42, respectively, in order that the two latter may operate upon a blank 11, so as to form a head, as at *b* in Fig. 19.

The carriage 60 has pivotally connected thereto one end of a link 61, whose opposite end is pivotally connected to the free end of an arm 62, firmly secured to a shaft 63, journaled in the frame 1 of the machine. (See Figs. 1 and 3.)

The shaft 63 has firmly secured thereto a lever 64, adapted to be engaged by the hook 66 of the link 27, so that the reciprocatory motions imparted to said link 27 by the cams 26 and 28 will impart an oscillating motion to said lever 64, which in turn will rock the shaft 63, so that the latter may impart an oscillating motion to the arm 62 in order that said arm may, through the medium of the link 61, impart a reciprocating motion to the carriage 60, for the purpose hereinbefore described.

The carriage 60 is provided with ways 67, in which are guided the sliding jaws 68, which

are adapted to take hold of a bolt-blank 11 and retain the same firmly in position while a head is being formed thereon by the punches 17 and 42 and hammers 54. Each jaw 68 has pivotally connected thereto one end of the member 69 of a toggle-lever. (See more particularly Fig. 4.)

One end of the member 70 of each toggle-lever is pivotally connected, as at 71, to the frame 1 of the machine.

The joint 72 of each toggle-lever has abutting against it a lug 73, adapted to assist the members 69 and 70 of said toggle-lever to straighten out relatively to each other when the carriage 60 is moving in the direction indicated by the arrow *c* in Figs. 3, 4, and 6.

74 designates a stem (best seen in Figs. 9 and 10) depending from the joint 72 of each toggle-lever, said stem 74 moving freely in a slot 75 in the carriage 60 and for a purpose to be hereinafter described.

The carriage 60 is provided with a holding device 76 for a pair of tongs 77, which latter are employed to supply bolt-blanks 11 to the machine, said holding device being adapted to slide in the carriage 60 in order to be brought nearer to or farther from the jaws 68, according to the length of a bolt-blank 11. The adjustment of the holding device 76 is effected by rotating the screw-threaded rod 78.

The carriage 60 is provided with a screw 79, which limits the movement of the same in the direction indicated by the arrows *c*, and when said carriage 60 is moved to and fro by hand instead of by the mechanism hereinbefore described, it being apparent that the lever 64, if operated by hand, might at times be oscillated too far in the direction indicated by the arrow *d* in Fig. 3 if it were not for the screw 79 and a stud 80, against which the end of said screw abuts.

The end portions 81 of the tongs 77 are held in position in the holding device 76 by spring-jaws 82, (see Figs. 3, 4, 6, and 11,) it being apparent that when said end portions 81 are moved in the direction indicated by the arrow *e* in Fig. 11 they separate the jaws 82 when passing between the same, and when said end portions 81 reach the open space 83 said spring-jaws 82 immediately close or return to their normal positions and retain the handle of the tongs 77 within the holding device 76 and also prevent said handles from opening.

The holding device 76 is provided with a recess 84, adapted to receive the portion 85 of the tongs 77, so as to assist the spring-jaws 82 in retaining said tongs 77 firmly in position within the holding device 76.

The width of the recess 84 may be adjusted relatively to the size of a pair of tongs by rotating the screws 86. (See Fig. 4.)

The operation is as follows: The machine is started and a heated bolt-blank 11, held in the tongs 77, is placed in the holding device 76, as best seen in Figs. 4 and 6. When the groove 84 in each of the cams 5 is in the position seen in Fig. 3, the oscillating frame 9 will be in the position seen in said Fig. 3. When the cams 5 have rotated sufficiently to bring the grooves 84 in the position seen in Fig. 6, they will cause the frame 9 to occupy the position seen in said Fig. 6 and cause the upsetting-punch 17 to produce the upset-head 15. (Seen in Fig. 18.) The cam 26 is so timed relatively to the cams 5 that the former of these will cause the carriage 60 to move in the direction indicated by the arrows *c* and a little in advance of the movement of the frame 9, so that a blank 11 may be brought in the position seen in Fig. 6, so as to be operated upon by the upsetting-punch 17 in order to produce the head or upset portion 15. (Seen in Figs. 6 and 18.) The cams 5 in rotating will at a certain time present the portions $84^{\times}$ of the grooves 84 to the rollers 85 on the arms 7 and 8 and cause the latter, and consequently the frame 9, to oscillate in the direction indicated by the arrow *f* in Fig. 6 and so return said frame 9 to the position seen in Fig. 3. The projection 86 of the cam 12 is so timed relatively to the movement of the frame 9 in the direction indicated by the arrow *f* that said projection 86 is brought in contact with a roller 87, journaled in the sliding rod 13, and causes the latter to slide in the present instance from right to left, so as to force the upset portion 15 of a bolt-blank 11 out of the cavity 16 in the upsetting-punch 17, thereby removing any possibility of said upset portion 15 sticking in the cavity 16, which would, as is evident, sever said portion 15 from the shank of a bolt-blank 11 when the frame 9 is moving in the direction indicated by the arrow *f* in Fig. 6. The sliding rod 13 is returned to its normal position by a spring $13^{\times}$. (See Figs. 3 and 6.) When the portions $84^{\times}$ of the grooves 84 are in contact with the rollers 85, and the frame 9 consequently in the position seen in Fig. 3, the teeth of the mutilated gear-wheel 31 engage certain of the teeth of the mutilated pinion 32 and impart half a revolution to said pinion, and consequently to the eccentrics 34, which latter exert a pull upon their rods 35, thereby causing the shaft 10 to rock, and thus raise the sliding block 40, so as to bring the finishing-punch 42 in alinement with the upset portion 15 of a bolt-blank 11, so that said finishing-punch 42 may operate upon the portion 15 and complete, with the assistance of the hammers 54, the formation of the head *b*. (Seen in Fig. 19.) It will be seen on referring to Fig. 16 that the portion *g* of a cam 5 is set back a short distance from the portion *h* and that the latter is set back a trifle from the portion *j*, so that when said portion *g* is brought in contact with the roller 85 it will cause the frame 9 to move in a direction opposite to that indicated by the arrow *f* in Fig. 6, and thereby cause the finishing-punch 42 to strike the upset portion 15 and produce the result seen at *k* in Fig. 20. When the portion *h* is brought in contact with the roller 85, the finishing-punch 42 will be caused to somewhat flatten the head of a bolt, thereby

producing the result seen at *l* in Fig. 20. When the portion *j* is brought in contact with the roller 85, the finishing-punch 42 will be caused to still further flatten the head of a bolt and produce the result seen at *m* in Fig. 20, it being apparent that by delivering several blows with the finishing-punch 42, and thus flattening the head of a bolt by degrees, better results are obtained than if the process of flattening were done with one blow, since in the latter case a greater pressure would be exerted at a given time on the shank of a bolt. The dwell $26^{\times}$ of the cam 26 is of sufficient length to retain the carriage 60 in the position seen in Fig. 3 during the operation of the punches 17 and 42. When a cam 5 is in the position seen in Fig. 8, the inwardly-extending portions $85^{\times}$ of the grooves 84 will cause the frame 9 to oscillate in the direction indicated by the arrow in Fig. 6, and thereby cause the punches 17 and 42 to move in a similar direction, so as to be removed from the path of the hammers 54 in order to permit the latter to strike the sides 55 of the head of a bolt without touching said punches. The eccentrics 18 and 19 are so timed relatively to inwardly-extending portions $85^{\times}$ of the grooves 84 that the projecting portions $47^{\times}$ of the sliding cams 46 (see Fig. 5) cause the hammers 54 to strike the sides of the head of a bolt when the rollers 85 occupy one or the other of said inwardly-extending portions $85^{\times}$. When the head of a bolt has been completed, the teeth of the mutilated gear-wheel 31 engage certain of the teeth of the mutilated pinion 32 and impart half a revolution to said pinion, and consequently to the eccentrics 34, which latter exert a push upon their rods 35 and rock the shaft 10, so as to cause the sliding block 40 to lower in order to again bring the upsetting-punch 17 in alinement with a subsequent bolt-blank 11 to be operated upon as hereinbefore described. When a bolt-head has been completed, the cam 28 is brought in contact with the roller 30, and thereby causes the carriage 60 to move in a direction opposite to that indicated by the arrows *c* in Figs. 3, 4, and 6. When the carriage 60 is moving in a direction opposite to that indicated by the arrows *c*, the jaws 68 will be caused to move away from each other, owing to the toggle-levers connected therewith and to the frame 1 of the machine, it being apparent that the opening of said jaws will release their hold on the shank of a bolt and permit the same to drop through the space $67^{\times}$ in the carriage 60 (see Fig. 10) and fall into a receptacle of any suitable description. When the carriage 60 is moving in the direction just described, the walls $75^{\times}$ of the slots 75 (against which the stems 74 abut when said carriage is in the position seen in Fig. 6) assist the members 69 and 70 of the toggle-levers to return to their normal positions. When the jaws 68 have taken hold of a bolt-blank 11, the tongs 77 may be removed from the machine in order to grip and supply the machine with a subsequent blank 11.

It will be evident that, if desired, the sliding cams 46 may each be formed with more than one projection $47^{\times}$.

It is to be noted with reference to Fig. 6 that the members 69 and 70 of one of the toggle-levers are in the same relative position as seen in Fig. 4. This is done for the purpose of clearness of illustration of certain of the parts of the toggle-lever which would otherwise be invisible were said toggle-lever shown in its actual position when the carriage 60 is in the position seen in said Fig. 6, for in said figure the carriage 60 is in the position it occupies when moved to its full extent in the direction indicated by the arrows *c*, and when said carriage 60 is in this position the axes of the members 69 and 70 of the toggle-levers are nearly in a continuous straight line, and the depending stem 74 is brought in contact with the wall $75^{\times}$ of the slot 75.

It will be apparent that bolts formed in my machine and having their heads upset and shaped by the novel manner and means described will be much stronger at the point where the head joins the shank of the bolt, as will be understood from Figs. 18 and 19, and that the injurious cracks or weakening which ordinarily occurs in machine-made bolts at the point where the head joins the shank will be entirely absent in bolts constructed as hereinabove described.

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

1. In a machine for making bolts, a sliding carriage, a frame pivotally supported and adapted to rock toward and away from said carriage, movable punches carried by said frame, hammers suitably supported, means for actuating said carriage, punches and hammers and means for removing a bolt-head from one of said punches.

2. In a machine of the character named, a main shaft, an oscillating frame, an upsetting and a finishing punch carried thereby, connections common to said frame and main shaft, arms suitably supported, cams carried by said arms, means for reciprocating said cams from said main shaft and hammers operated by said cams.

3. In a machine of the character described, the combination of a sliding carriage, a main shaft, an oscillatory frame, connections common to said frame and shaft, a stationary frame having radial arms, cams supported in said arms, hammers actuated by said cams, an upsetting-punch, a finishing-punch mounted on said oscillatory frame, and means for removing a bolt-head from said upsetting-punch.

4. In a machine of the character named, a sliding carriage having stops therefor, a main shaft, means for operating said carriage manually or by connections from said main shaft, a holding device carried by said carriage and

provided with spring-jaws, said jaws being adapted to retain in position the ends of the tongs for holding the bolt-blank.

5. In a machine of the character named, a main shaft having cams 5 mounted thereon, a frame pivotally supported, connections common to said frame and to said cams, a sliding block carried by said frame, an upsetting-punch and a finishing-punch carried by said sliding block, a stationary frame provided with radial arms, hammers actuated by cams located in said arms and means operated from the main shaft for removing a bolt-head from said upsetting-punch.

6. In a machine of the character named, a sliding carriage, means for gripping a bolt-blank carried thereby, an oscillatory frame carrying an upsetting-punch and a finishing-punch, and a stationary frame provided with radial arms, and cams in said arms, said cams operating hammers, in combination with a device passing through the upsetting-punch and adapted to insure the removal of the bolt-head therefrom.

7. In a machine of the character named, a main shaft, carrying cams 5 and 6, an oscillatory frame, connections common to said frame and cams, eccentrics mounted on said main shaft, a stationary frame having radial arms, cams movable in the extremities of said arms, connections common to said eccentrics and cams for reciprocating the latter, a second shaft located in proximity to the main shaft and provided with eccentrics, connecting-rods leading from said eccentrics to devices for operating a sliding block carried in said movable frame, an upsetting-punch and finishing-punch carried by said block, a rod passing through said upsetting-punch and actuated by means carried on said main shaft, said rod being adapted to assist the removal of the bolt-head from the upsetting-punch, a sliding carriage and connections common to said main shaft and carriage for operating the latter.

8. In a machine of the character named, a main shaft, a stationary frame having diagonal arms, cams reciprocating in the ends of said arms, slides operated by said cams, hammers operated by said slides, eccentrics mounted on the main shaft, rods having one of their ends attached to said cams, and their other ends provided with spherical heads adapted to engage suitable seats in the eccentric-straps mounted on said eccentrics.

9. In a machine of the character named, an oscillating frame, a sliding block carried thereby, said block having secured thereto an upsetting-punch and a finishing-punch, a sliding carriage, means for gripping a bolt-blank thereon, means for moving said carriage forward at the proper periods, so as to enable the bolt-blank to meet the upsetting-punch and the finishing-punch, hammers for shaping said bolt and means for operating said hammers.

10. In a machine of the character named, a main shaft carrying cams 5, 6 26, 28 and 12 thereupon, eccentrics also carried by said main shaft, a sliding carriage, means for actuating said sliding carriage from the eccentrics 26 and 28, an oscillatory frame, means for actuating said frames from the cams 5 and 6, a sliding block carried in said frame, an upsetting-punch and a finishing-punch carried by said block, means operated by said cam 12 for removing the head of a bolt-blank from the upsetting-punch, means carried by the sliding carriage for gripping the bolt-blank and hammers operated by suitable cams.

11. In a machine of the character named, an oscillatory frame, a sliding block therein, an upsetting-punch and a finishing-punch, carried by said block, a main shaft having cams mounted thereon, said cams being provided with the portions g, h, j and the recesses 84, $84^{\times}$ and $85^{\times}$ for actuating said finishing-punch, a sliding carriage, means carried thereby for gripping a bolt-blank and means for actuating said carriage.

12. In a machine of the character named, a stationary frame, provided with diagonal arms, cams mounted in the extremities of each of said arms, slides actuated by said cams, hammers actuated by said slides, means for gripping a bolt-blank during the action of said hammers thereon, a main shaft carrying an eccentric, rods having their ends pivoted to said cams, the opposite ends of said rods being spherical, an eccentric-strap carried by said eccentric, caps on said eccentrics and recesses intermediate said eccentrics and caps, the spherical ends of said rods being seated in said recesses.

13. In a machine of the character named, jaws adapted to grip a bolt-blank, an oscillatory frame having a sliding block carried thereby, an upsetting-punch and a finishing-punch carried by said block, a rod passing through said upsetting-punch and adapted to force the bolt-head therefrom at the proper intervals, hammers suitably supported and adapted to shape the sides of the bolt-head, and means for operating said hammers.

14. In a machine of the character named, a sliding carriage, a frame pivotally supported and adapted to rock toward and away from said carriage, movable punches carried by said frame, hammers suitably supported and means for actuating said carriage, punches and hammers.

15. In a machine of the character named, a sliding carriage, a frame pivotally supported and adapted to rock toward and away from said carriage, movable punches carried by said frame, hammers suitably supported, means for actuating said punches and hammers, and means for operating said carriage manually or mechanically.

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