

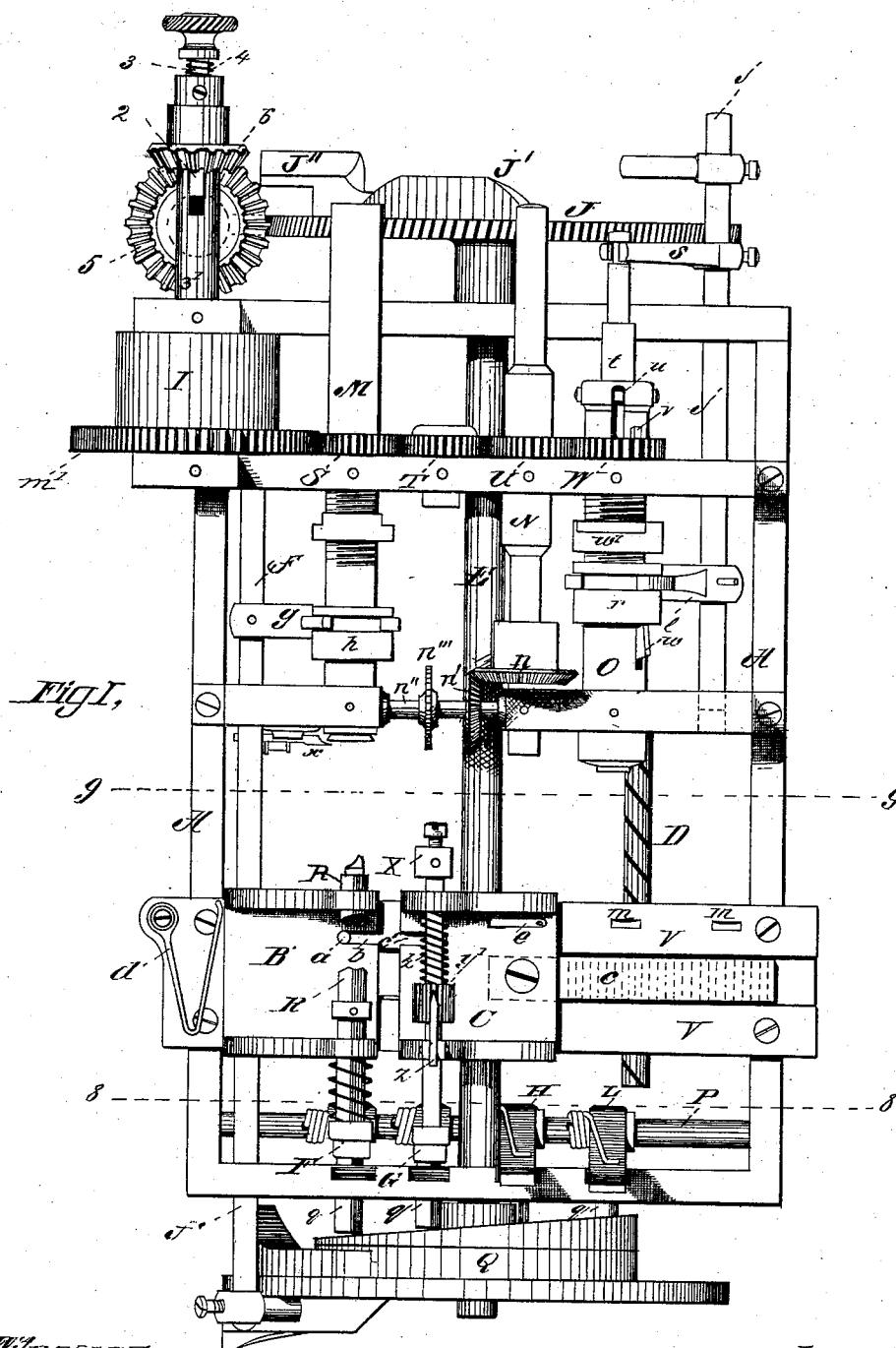
(No Model.)

4 Sheets—Sheet 1.

G. D. BELCHER.  
METAL SCREW MACHINE.

No. 264,609.

Patented Sept. 19, 1882.



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Wm. A. Chapin

Inventor,  
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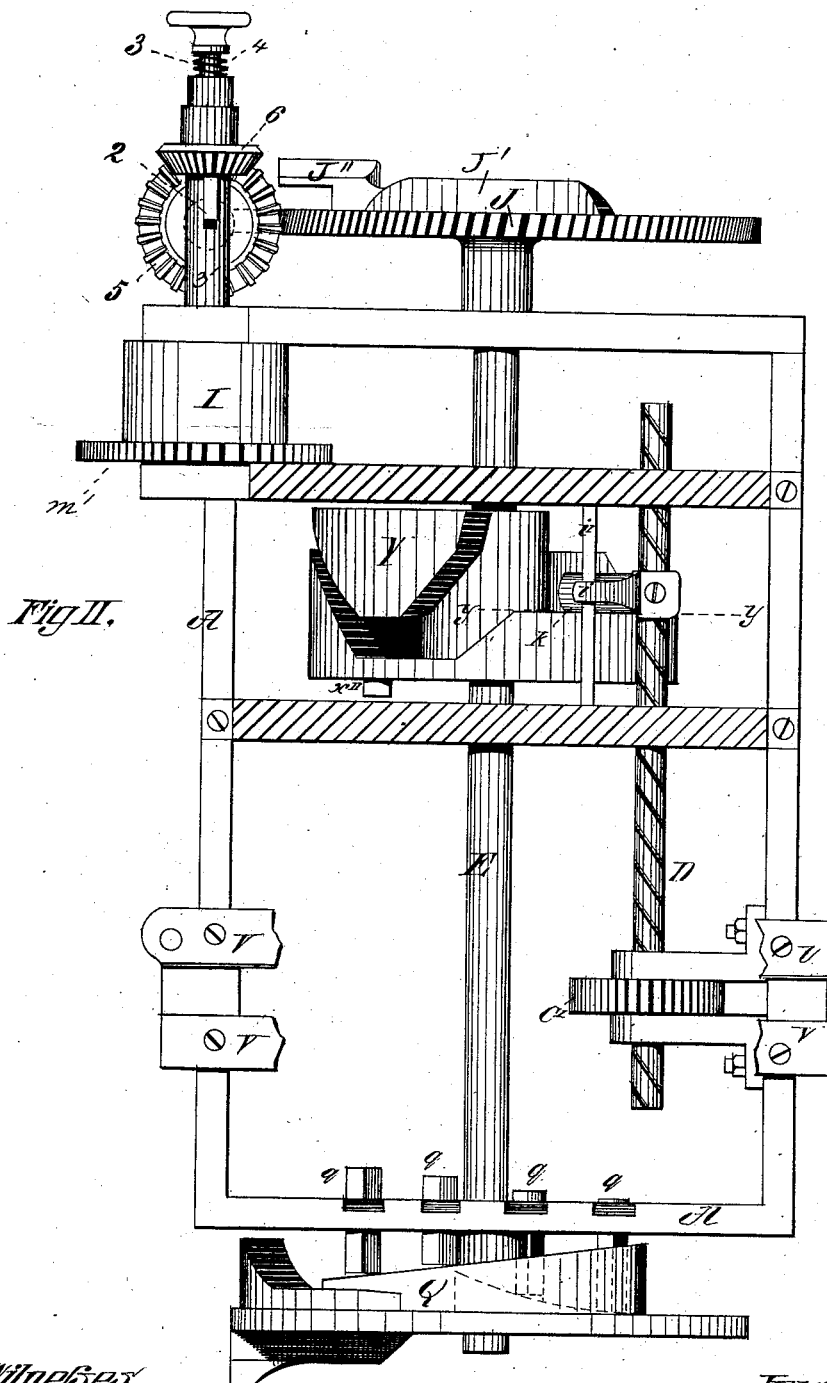
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4 Sheets—Sheet 2.

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Patented Sept. 19, 1882.



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(No Model.)

4 Sheets—Sheet 3.

G. D. BELCHER.  
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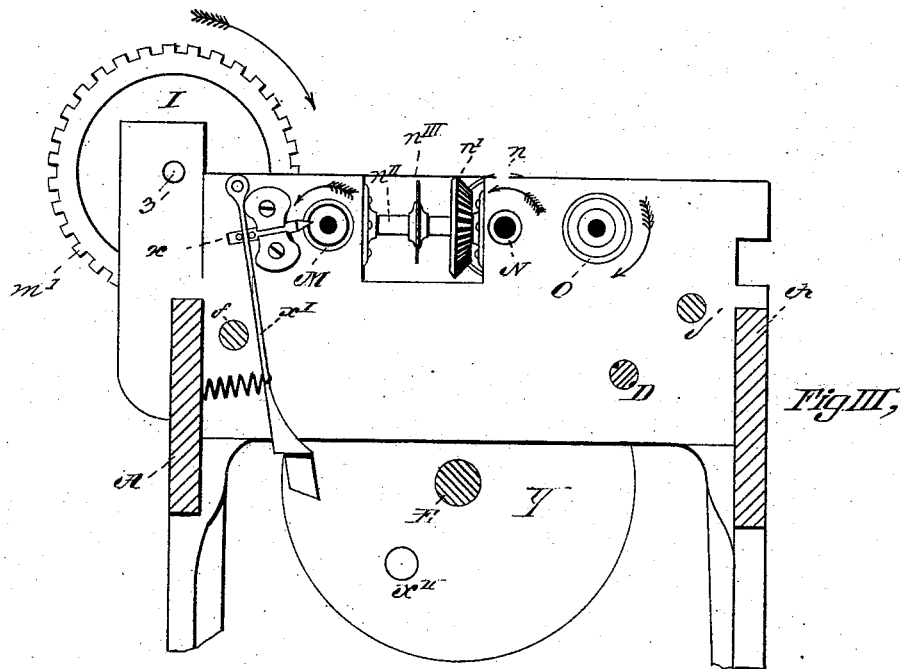


Fig. III.

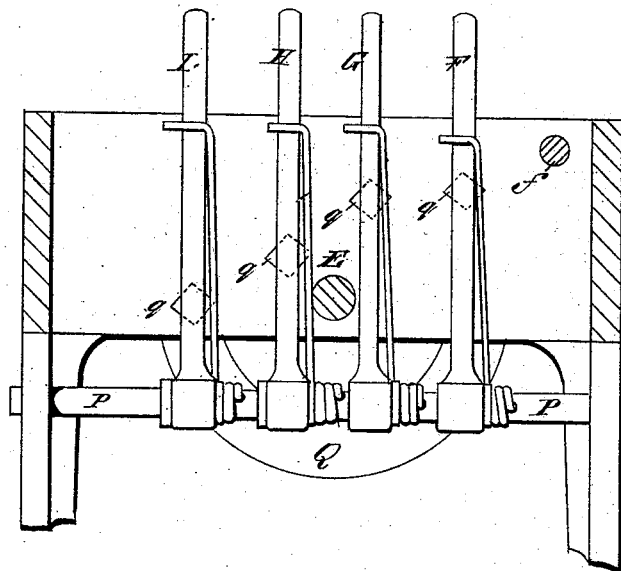


Fig. IV.

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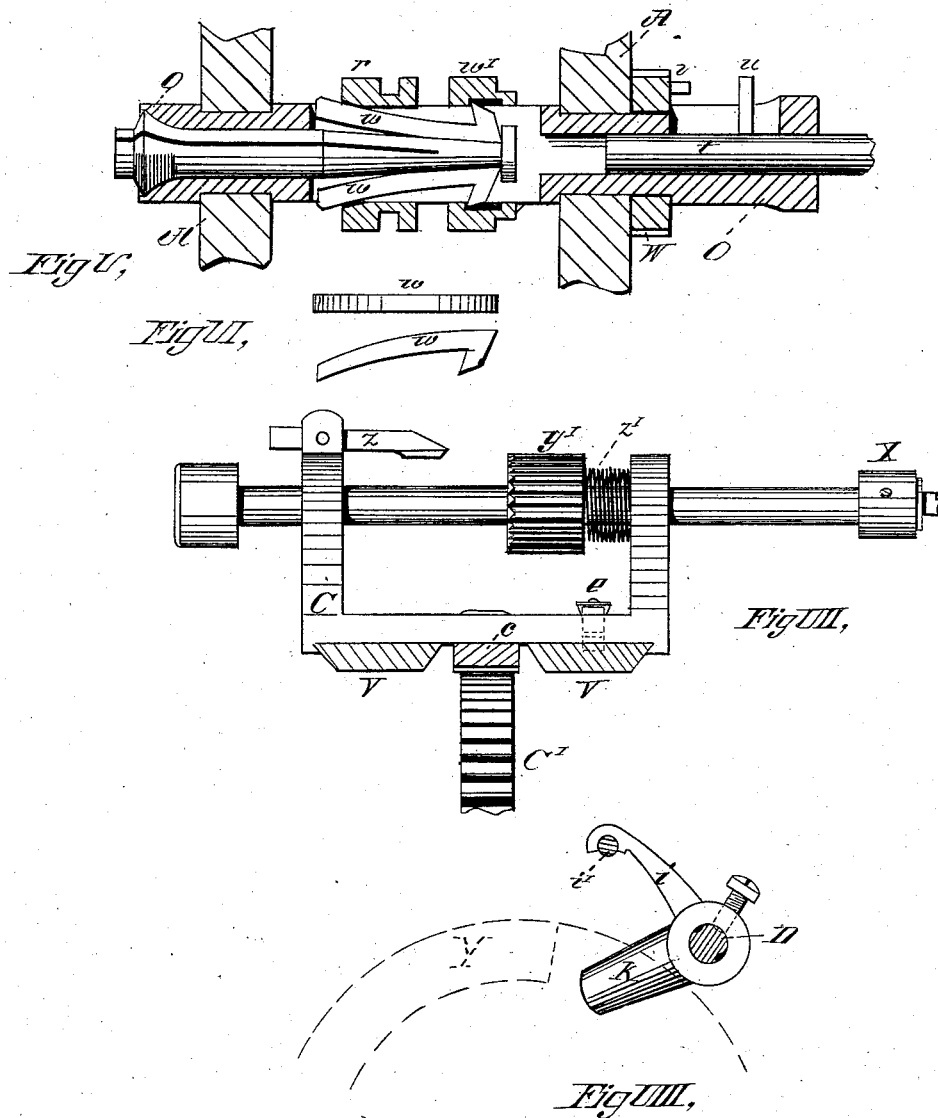
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# UNITED STATES PATENT OFFICE.

GEORGE D. BELCHER, OF CHICOPEE, MASSACHUSETTS.

## METAL-SCREW MACHINE.

SPECIFICATION forming part of Letters Patent No. 264,609, dated September 19, 1882.

Application filed April 14, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE D. BELCHER, a citizen of the United States, residing at Chicopee, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Metal-Screw Machines, of which the following is a specification.

The nature of my invention consists in the construction and arrangement of a screw-machine, as will be hereinafter more fully set forth.

In the drawings, Figure I is a plan view of the upper part of my machine. Fig. II is a plan view in partial section, showing mechanism fully disclosed by the removal of some of the upper portions of the machine. Fig. III is a sectional elevation on the line 9 9 of Fig. I. Fig. IV is a reversed end elevation in section on line 8 8 of Fig. I. Fig. V is an enlarged longitudinal section of a chuck with a portion of the operating mechanism. Fig. VI is a detail view of a portion of the chuck. Fig. VII is an enlarged longitudinal elevation of one of the tool-holders with the threading-die therein, and Fig. VIII is a detail in sectional elevation on line *y y* of Fig. II.

A is the frame of the machine, constructed in any suitable way to afford the required bearings for all of the movable portions of its mechanism.

I is a belt-pulley, by which motion is imparted to all of the movable parts. The pulley I, provided with the gear *m'*, is mounted on the horizontal shaft 3' at one end of the machine, and through the beveled gears 6 and 5 imparts motion through a worm-gear upon the vertical shaft of gear 5 to worm-wheel J upon shaft E. This worm-gear is indicated by dotted lines in Figs. I and II, and as it is common to so connect feed and other shafts with that of the driving-pulley no further illustration is thought necessary. The gear *m'* of pulley I engages with the equal and connected gears S, T, U, and W upon bearings in the frame parallel to those of shaft 3'. The gears S T U W give the proper rotary motion to the spindles and cutter from the time the stock is moved to be first operated upon until the completed screw is dropped by one spindle into a convenient receptacle upon the floor beneath the machine.

The spindle M, of the usual hollow form of

those through which the rod from which the screw is formed is fed, and provided with the chuck for holding and releasing the rod at the proper time, rests longitudinally in bearings in the frame, and forms the shaft of gear S.

The spindle N forms the shaft of gear U, and carries upon one end the tool for shaving the burr from the slotted head of the screw. It also carries the gear *n* for operating, through corresponding gear, *n'*, and shaft *n''*, the saw *n'''* for slotting the head of the screw before it is submitted to the shaving-tool. The gear W, forming the last of the train of connected gearing in the same horizontal plane, has the spindle O for its bearing, and alternately rotates it and revolves free upon it, as herein-after described. The gear T, intermediate in the train to the ones S and U, causes the spindles M N to revolve in the same direction. The spindle O moves in the reverse direction to its contiguous spindle, N. The saw *n'''* occupies a position intermediate to the spindles M N and in the space in prolongation of gear T. The ends of the spindles and the cutting-edge of the saw are approximately in a line in the same plane.

The shaft E, driven by gear J upon one of its ends, as before described, extends longitudinally through the frame in bearings therein, and its position is below the spindles M N O and at or near the transverse center of the frame. The shaft E thus centrally located, and in operative connection with gear *m'* upon pulley I, forms the shaft for carrying all of the cams, which, with the train of gearing above described, produce all of the consecutive motions needed to automatically make the screw.

The cams upon shaft E are the cams J' J'' upon gear J, as shown in Figs. I and II; the cam-wheel Y, as shown in Figs. II and III, arranged upon its shaft beneath the spindles M N O, and the cam-wheel Q upon the opposite extremity to the one J. These cams operate the following connections: The cams J' J'' reciprocate rod *j*, sliding in the frame parallel to spindle O, by acting on alternate sides of the cam-block on its end, to, through the arm *s*, rigid therewith, cause spindle O to be clutched with gear W. The clutch is formed by the pin *u* on stem *t* and pin *v* on gear W. The stem *t* is free to slide within the spindle O, as shown in Fig. V, and is free to turn in

arm *s* when connected with the gear. In thus clutching gear *W* and spindle *O* the rod *j* simultaneously moves sleeve *r*, by means of arm *l*, to close the jaws of chuck *O*.

5 The cam *Y*, by means of the projection *x''*, swings the end of spring-lever *x'*, hinged to the frame, as shown in Fig. III, to cause the cutting-off tool *x* to be brought against the screw in the chuck of spindle *M*. The cam *Y* also reciprocates screw *D* to govern the position of the tool-holders *B C* relative to the spindles *M N O* and saw *n'''*.

10 The screw *D* is provided with one or more quick lands or grooves, and has rigidly attached to it the arms *i k*, as shown in Figs. II and VIII. The arm *k* forms a cam-block to cause the screw *D* to be reciprocated by cam *Y*, and the arm *i*, by being sleeved to follow on the rod *i'*, secured in the frame and parallel to screw *D*, prevents the screw *D* from rotating in being reciprocated. The screw *D*, moving loosely in its supports in and from the frame, has an axial nut in the gear *C'*, held in place by lugs from the frame *A*, as shown in Fig. II, so that the reciprocation of the screw *D* will cause the gear *C'* a movement in one direction and an equal one in the reverse.

Upon each side of wheel *C'*, and extending transversely across the frame, are ways *V V*, upon which rest and move the tool-holders *B C*.

Attached to the holder *C*, and arranged to extend between the ways *V V* and to come immediately over and engage with gear *C'*, is the rack *c*, by means of which it will be seen the longitudinal reciprocation of screw *D* is, through wheel *C'*, converted into a transverse reciprocation of tool-holder *C*.

Upon the ways *V V*, upon the opposite side of holder *C* from wheel *C'*, is the holder *B*, held, as shown, by spring *d*, bearing upon one side, to bear in turn upon the stop *a* from the ways *V V*.

As shown in Fig. I, the stop *a* is received within a slot, *b*, through the bottom of the holder, and a similar slot, *c'*, is formed in the corresponding opposite edge of holder *C*, by which, while the stop *a* brings the holder *B* in the proper position relative to spindle *M*, the holder *C* can push the one *B* away to take its place opposite to the same spindle. The spring *d* returns holder *B* when said holder is released by holder *C*. Holder *C* is provided with a combined reciprocating and intermittingly-revolving die, *X*, and holder *B* with a reciprocating tool, *R*, for forming the head of the screw. Both die *X* and tool *R* have bearings in the holders, and extend across them to have their ends upon one side come opposite to and in the same plane with the spindles and cutting-edge of the saw, while their ends upon the other side of the holders are constructed and arranged to be acted on by suitable reciprocating mechanism. Both tools are also provided with springs, as shown in Fig. I, to retract them to the holder when released. The die *X* has upon its stem the coil-spring *z'*, bearing between an inner

wall of the holder and the ratchet *y'*, which spring retracts the die *X* when it is free to move. The ratchet *y'* is, as shown in enlarged detail, Fig. VII, an elongated wheel fast upon the stem of the die, and working in connection with the pawl *z*, secured to the top of the tool-holder *C*. The end of each tooth upon the ratchet-wheel toward the pawl is beveled, and the end of pawl *z* is correspondingly beveled to cause the wheel, when returned to the pawl, to at once become fast with it, the pawl passing between two teeth instead of riding or chattering for a short distance. By means of this construction of die a single stem, spring, and ratchet-wheel, in connection with the pawl, constitute all of the mechanism needed to permit the die to revolve with the screw when being cut off and make it fast with the holder again, the elongated ratchet permitting die *X* to have its needed reciprocations in slotting, shaving, and having the screw removed from the die. The cam-wheel *Q* operates, by means of cam-blocks *g*, sliding through the wall of the frame, as shown in Figs. I, II, and IV, the levers *F G H L*, to cause them at the proper time to move the tools in the holders *B C*. The ends of these levers are hung upon the transverse rod *P*, and are provided with springs to cause them to follow, through the blocks *g*, the cams upon wheel *Q*. The levers come in contact with the enlarged rear ends of the tools in the holders.

Without a departure from the principle of this invention, the rear end of the stem of die *X* may be provided with a cross-head, which would enable one or more of the levers to be dispensed with by providing a surface against which one lever could act when the holder *C* was in different positions. The cam *Q* also reciprocates the rod *f* to, through arm *g* and sleeve *h*, automatically operate the chuck upon spindle *M*.

To throw the driving-pulley out of operative connection with cam-driving gear *J*, a stem, 3, provided with a dog, 2, moving in a slot in shaft 3', passes through the sleeve of gear 6, and has arranged upon it a coil-spring, 4, to bear between a shoulder upon the stem 3 and the end of the sleeve, by means of which the dog can be pushed to disengage wheel 6 from shaft 3' and render wheel 6 inoperative.

The chucks shown in this machine are, as seen in enlarged views, Figs. V and VI, of peculiar construction, in having the wedges *w* entirely detached from the rest of the chuck, in place of being hinged at their rear ends, as is common, by which form they have their fulcrums movable and adjustable by the position given the screw-sleeve *w'*. Thus by the movement of sleeve *w'* engaging the projecting ends of the wedges above the surface of the chuck in the groove of its inner surface, said projections can be held to cause said wedges to bear upon their extreme rear corners to produce an increase of leverage to be overcome by the sliding sleeve *r* for bearing them against the jaws of the chuck, and through the curved

bearing-surface of the wedges the sleeve *w* can be advanced to throw the fulcrums of said wedges to a point much farther forward.

The automatic operation of the mechanism herein described in making screws is as follows: The rod from which the screw is formed and detached, being fed through spindle M by the feed device common to screw-machines, is reduced to leave the head by the tool R in holder B, through the action of lever F, produced by cam Q through block *g*. At the time this is accomplished and the tool R retracted by its spring upon its release by lever F the holder C is moved to come in contact with holder B to push it away and take its place with its die X opposite to the end of the blank in spindle M, and in a prolongation of its axis, this position being determined by the stop *a*. When die X is thus in the proper position it is moved by lever F to cut the thread upon the blank. The tool *x* is swung by projection *x''* on cam Y to cut the screw off. During the interval of time between the cutting of the thread and the cutting off of the screw, the die X is revolving with the screw, and continues to revolve until the cutting off of the screw releases it to fly back with the screw to bring the ratchet *y'* under the pawl *z*. The holder C, with the screw in the die X, is then moved to a position opposite saw *n'''*, and the die is pushed forward by lever G to have the slot in the head of the screw cut, the holder being held in exact place by the spring-detent *e* falling into the depression *m*. The detent *e* and depression *m* are sufficient to steady the holder and bring it into exact position without opposing an obstacle to the movement of the holder by its driving-wheel. The holder C is next moved to have the screw-head shaved by tool in spindle N, and is then finally moved opposite to spindle O to have die X, with the completed screw, advanced to insert the head of the screw in the open jaws of the chuck in spindle O. The jaws of the chuck are at once closed and the spindle O put into motion to unscrew the screw from the die, after which the jaws are opened to drop the screw, the revolving movement of the spindle being simultaneously stopped by the movement of rod *j* by cam J'. As the holder C moves from opposite to spindle M the holder B, propelled by its spring, takes its place simultaneously with the release by rod *f* of the chuck of spindle M to permit the feed of another length of rod to be operated upon by the screw-forming tools. Thus while holder C is completing and depositing the screw, holder B is commencing another, and direct movement is only imparted to one tool-holder to cause the screw to be begun, finished, and deposited during one transverse reciprocation of the same. The ends of the spindles and cutting-edge of the saw are so aligned as to cause the die X only to be free to revolve with spindle M after cutting a thread. The gear O', driven by screw D, instantly converts any movement of the screw to

the holder C in one direction, and the reverse, as no clutch or shipping device for operating belts upon pulleys could possibly do.

The machine thus constructed and with its parts so arranged and operating forms a complete automatic screw-machine in compact form.

What I claim is—

1. In a screw-machine, the combination, with hollow spindle M, with gearing *m'* S for rotating it, and with an automatically-actuated chuck, of tool-holder B, slotted at *b*, ways V V, spring *d*, stop *a*, spring-retracted tool R, carried by said holder, and the automatic devices operatively connected with pulley I to advance said tool R against the blank in the chuck, substantially as shown and described.
2. The combination of spindle M, holder B, ways V V, spring *d*, stop *a*, holder C, and the mechanism adapted to move said holder upon the ways to cause it to displace holder B and be held with its die X in prolongation of the blank in spindle M, as shown and described.
3. The combination, in a screw-machine, with holder C and screw-bearing die X, and mechanism, substantially as shown, for reciprocating the die in the holder and preventing it from revolving meanwhile, of the chuck spindle O, reciprocating rod *j*, having shipping-arms *s l*, connected respectively to rod *t*, sleeved within the spindle, and to chuck-operating sleever upon it, and the gear W, arranged upon spindle O, and adapted to be by the movement of rod *j* clutched to the spindle O simultaneously with the closing of the jaws of the chuck, and released from the spindle upon the opening of said chuck-jaws, all arranged to operate for the purpose set forth.
4. In a screw-machine, the combination, with the cutting-off tool *x*, saw *n'''*, and spindles M N O, all arranged as shown, of holders B and C, recessed respectively at *b c'*, stop *a*, spring *d*, tools R *x*, and mechanism, as shown and described, for moving holder C upon the ways V V and reciprocating the tools R *x* in the holders.
5. In a screw-machine, the combination, with the horizontally-arranged spindles M N O, and gearing *m'*, S, T, U, and W, and with cam-shaft E in operative connection therewith through intermediate gearing, and arranged centrally in frame A below said spindles, of cams J', J'', and Q, arranged upon the shaft E, and shipper-rods *j f*, arranged within the frame upon each side of the spindles.
6. The combination, with shaft E, arranged and operated as shown and described, and with cam Q thereon, and with holders B C and their tools R *x*, of levers F G H L, bearing P, and blocks *g*, for the purpose as shown and described.
7. The combination, in a screw-machine, with quick screw D, supported in the frame A, and splined to move therein without turning and reciprocated by suitable mechanism, of the

nut-gear C', held by means from the frame from sliding on screw D, and tool-holder C, provided with rack c, as and for the purpose set forth.

5 8. In a screw-machine, the combination, with die X and holder C, of the elongated corrugated wheel y', coil-spring z', arranged upon the stem of die X, and pawl z, arranged upon the holder in prolongation of the corrugations  
10 upon wheel y', as and for the purpose set forth.

9. The combination, with the jaws of a chuck

and with sleeve r and sleeve w', having a groove upon its inner surface, of the detached wedges w w, adapted to bear, as shown, upon the jaws through sleeve r, and be adjusted, 15 through the movement of sleeve w', against their projecting corners, as set forth.

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