(No Model.) 3 Sheets—Sheet 1.

# H. A. HARVEY.

## MACHINE FOR ROLLING SCREWS.

No. 357,001. Patented Feb. 1, 1887.

*Fig. 1.*

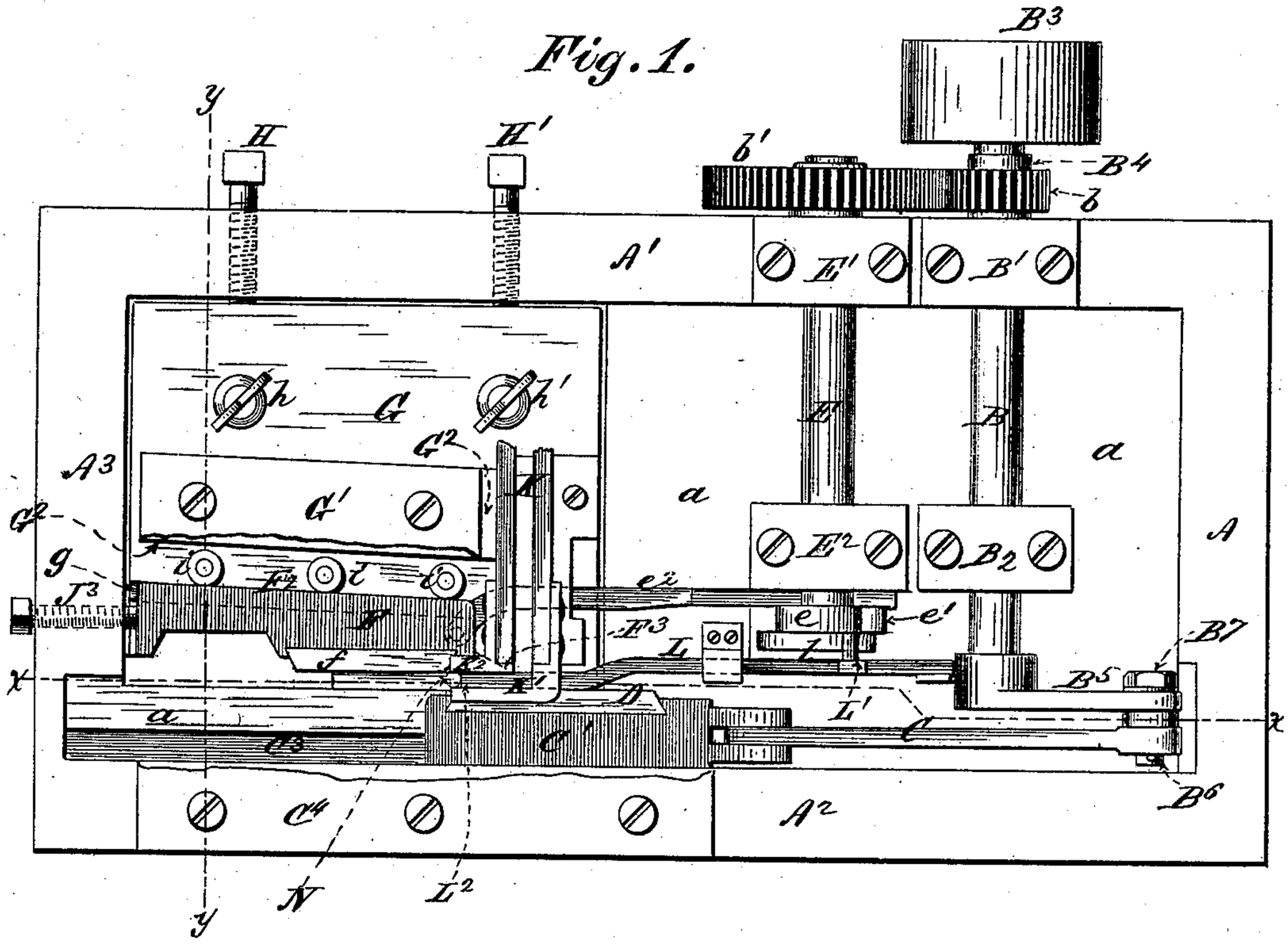
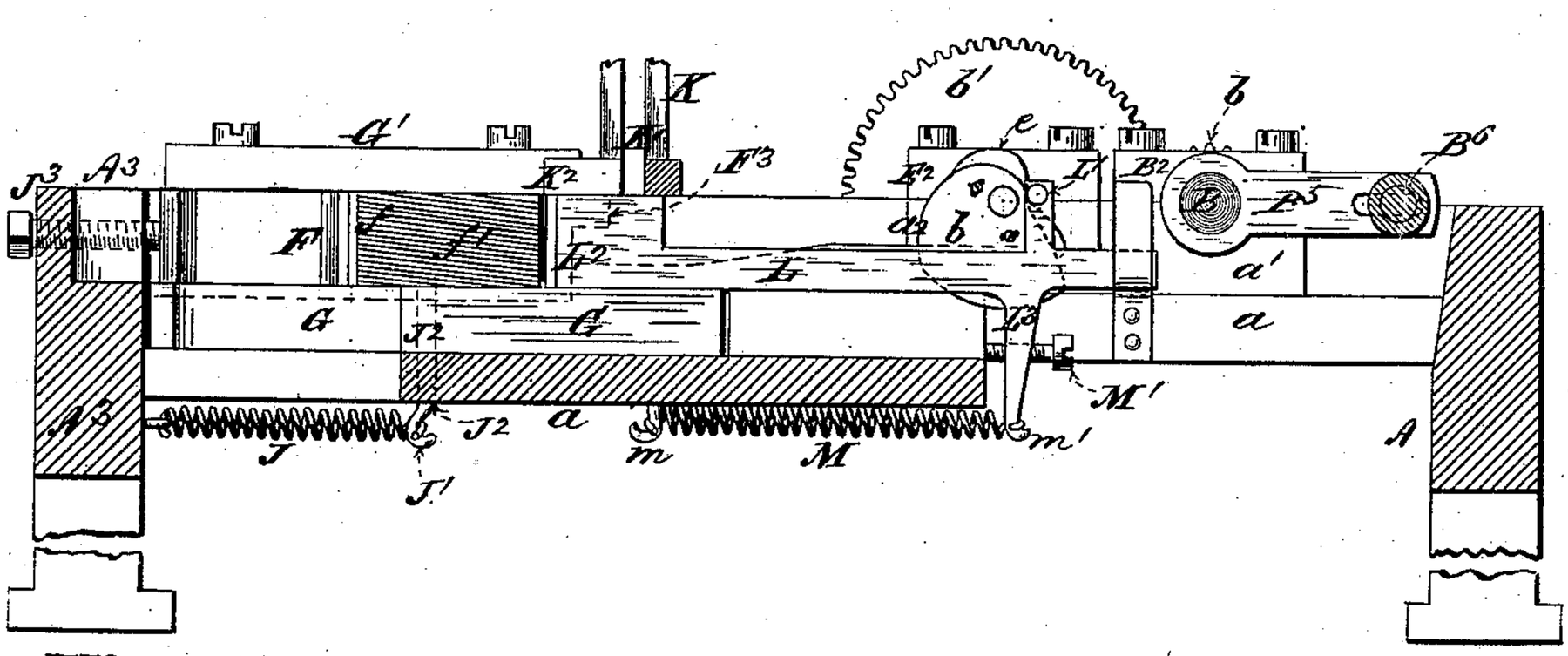



*Fig. 2.*




Witnesses:
Geo. H. Miatt
R. C. Howes.

Inventor:
H. A. Harvey
For Edw. E. Dumby
Atty.

(No Model.) 3 Sheets—Sheet 2.

# H. A. HARVEY.

## MACHINE FOR ROLLING SCREWS.

No. 357,001. Patented Feb. 1, 1887.

*Fig. 3.*

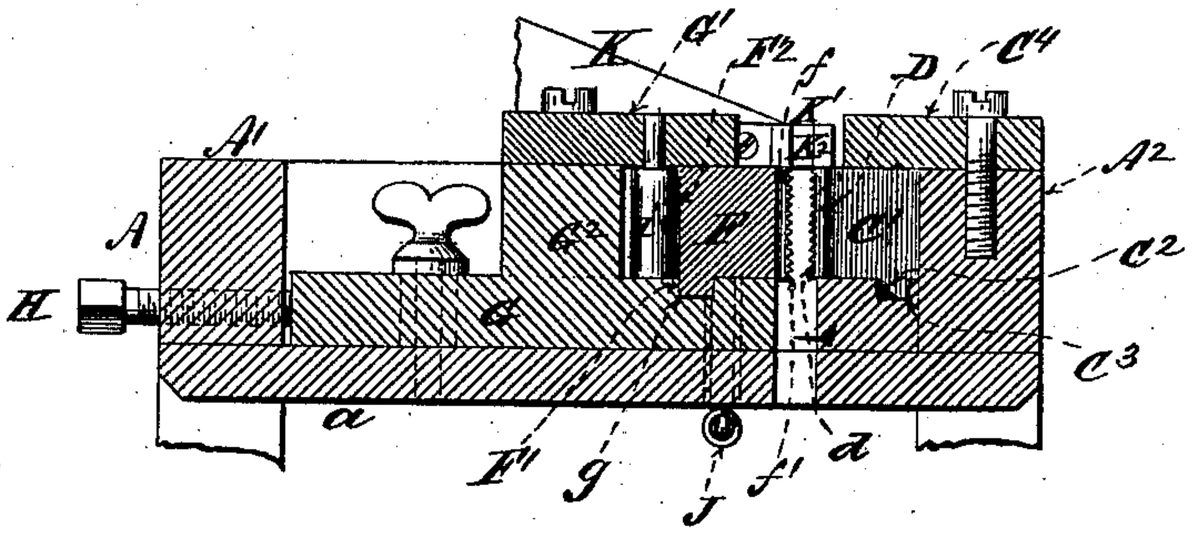



*Fig. 4.*

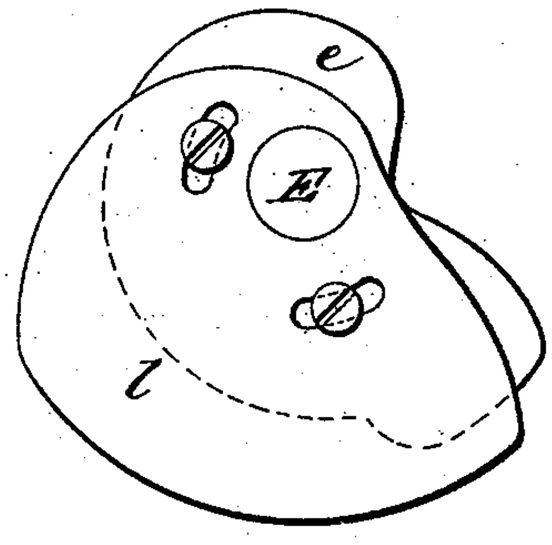



*Fig. 5.*

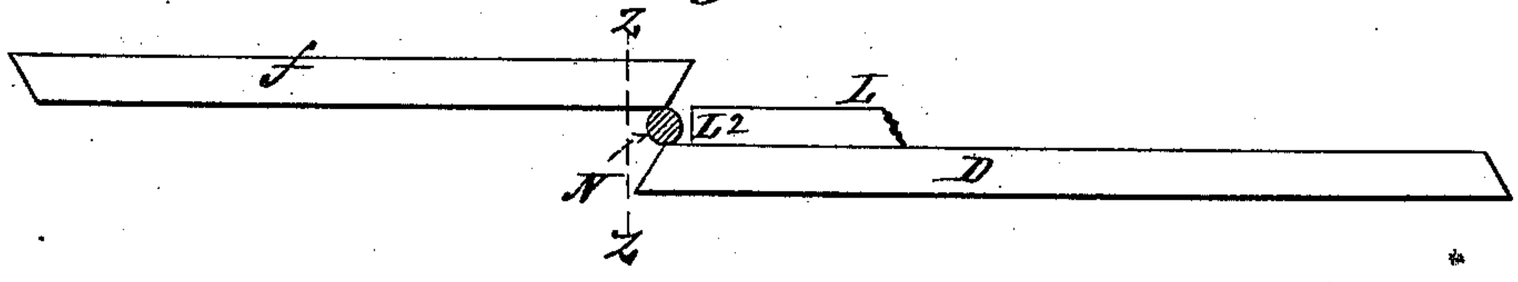
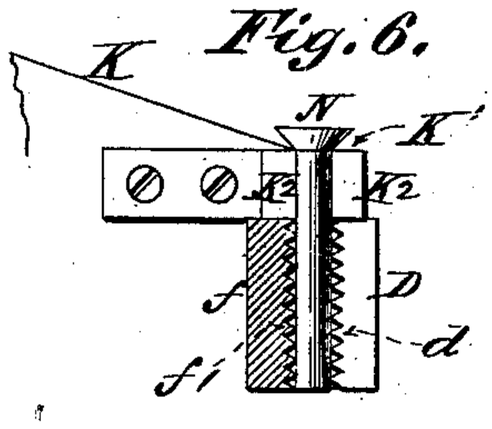



*Fig. 6.*




Witnesses:
Geo. W. Miatt
R. C. Howes

Inventor:
H. A. Harvey
Per Edw. E. Lumby
Atty.

(No Model.) 3 Sheets—Sheet 3.

# H. A. HARVEY.

## MACHINE FOR ROLLING SCREWS.

No. 357,001. Patented Feb. 1, 1887.

*Fig. 7.*

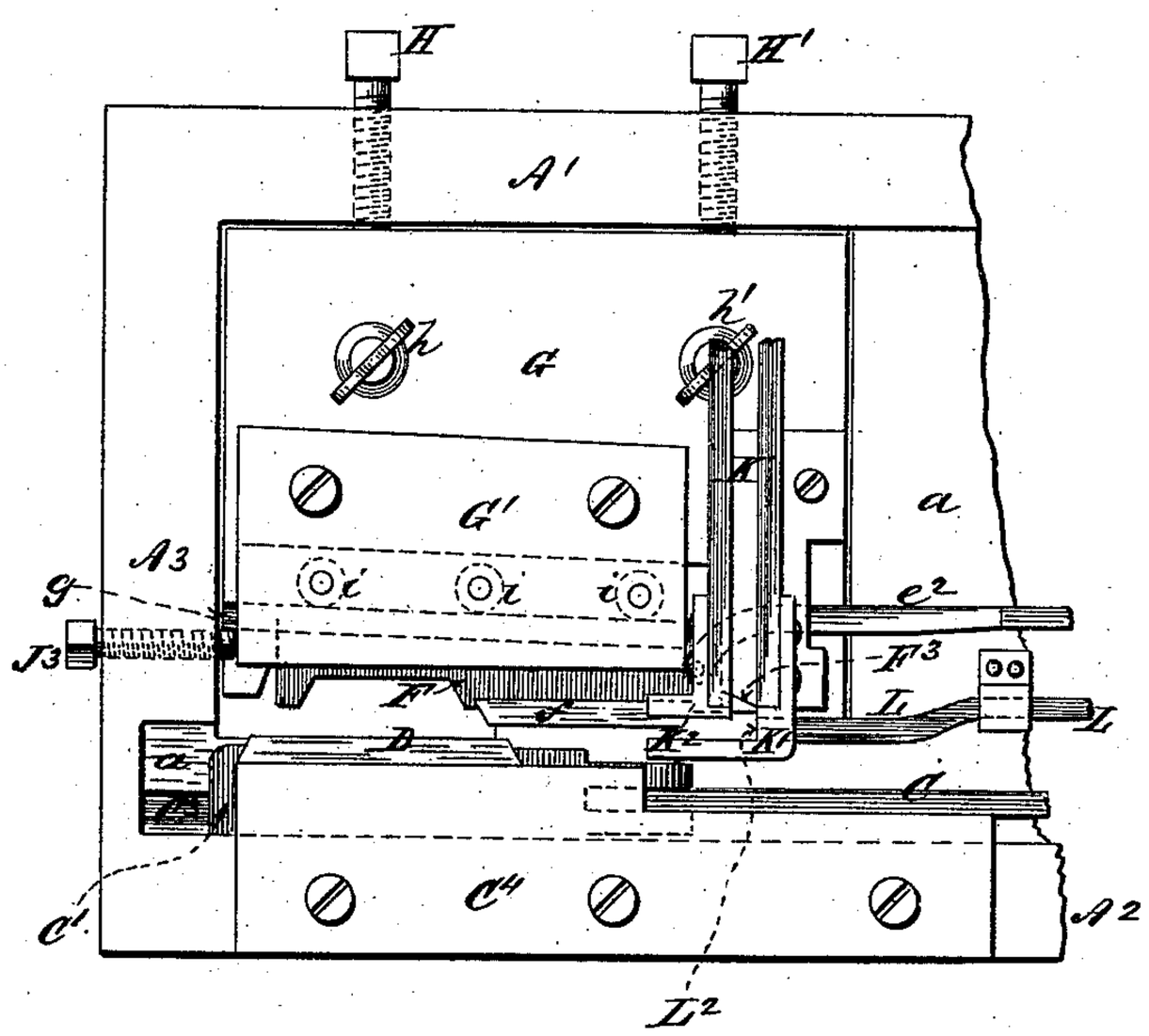
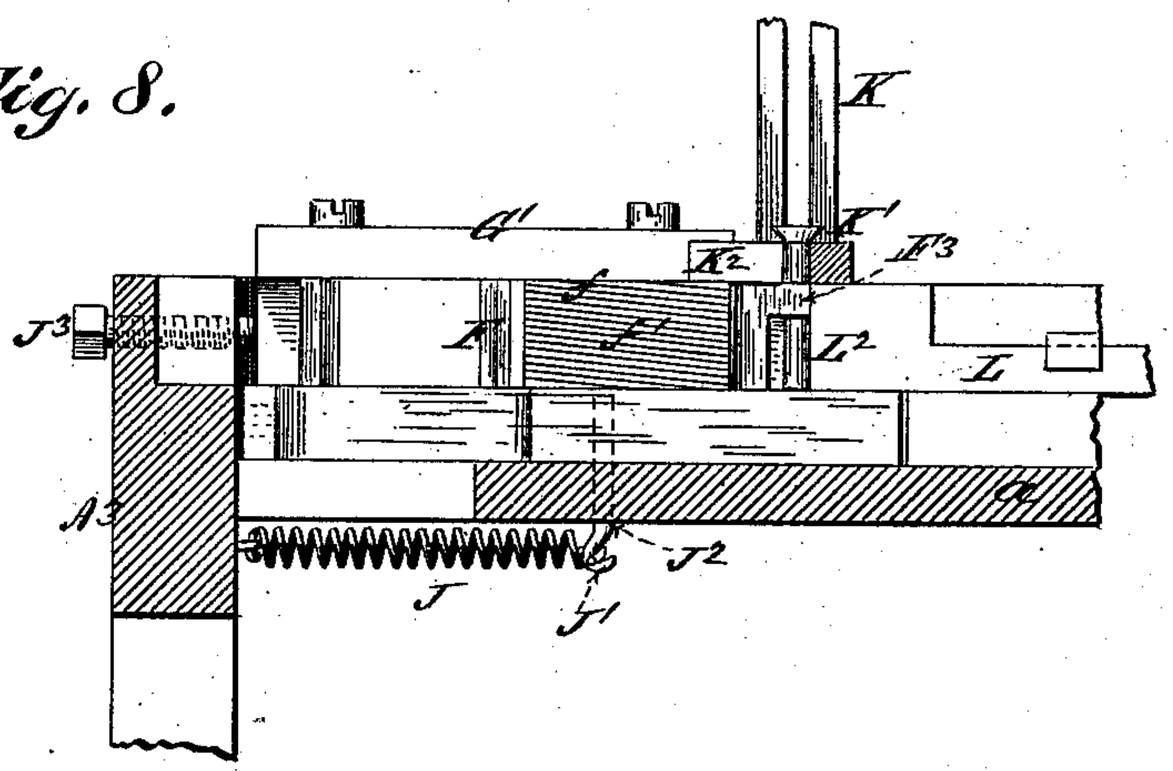



*Fig. 8.*




Witnesses:
Geo. H. Miatt
R. C. Howes

Inventor:
H. A. Harvey
Per Edco. E. Lunby
Atty.

# UNITED STATES PATENT OFFICE.

HAYWARD A. HARVEY, OF ORANGE, NEW JERSEY.

## MACHINE FOR ROLLING SCREWS.

SPECIFICATION forming part of Letters Patent No. 357,001, dated February 1, 1887.

Application filed September 14, 1886. Serial No. 213,486. (No model.)

*To all whom it may concern:*

Be it known that I, HAYWARD A. HARVEY, of Orange, New Jersey, have invented certain Improvements in Machines for Rolling the Threads on Screws and Bolts, of which the following is a specification.

These improvements relate to the type of machines for forming the threads of screws and bolts in which the blank is rolled between two flat dies, the faces of which are provided with series of parallel ribs which are inclined in relatively opposite directions; and the chief feature of the invention consists in means for giving to one of these dies several to-and-fro endwise movements while the other die is making a single endwise movement, and in means for, at the same time, gradually narrowing the space between the two dies, whereby the thread is impressed upon the body of a screw-blank during a prescribed number of forward and backward movements, the blank being fed into the space between the dies at one end of the slow-moving die, then rolled back and forth a prescribed number of times along the face of the slow-moving die, and finally discharged, after the thread is formed, by being rolled off from the end of the slow-moving die opposite that to which it was fed.

The invention also embraces certain details in the organization of the machine and some especial features of the mechanism for feeding in the screw-blanks.

The accompanying drawings of a machine containing the improvements are as follows: Figure 1 is a top view. Fig. 2 is a longitudinal vertical section taken through the offset dotted line *x x* on Fig. 1. Fig. 3 is a transverse vertical section taken through the dotted line *y y* on Fig. 1. Fig. 4 is a side view of the cams. Fig. 5 is a top view of the dies, illustrating their relative positions when in the act of seizing a blank at the commencement of the rolling operation. Fig. 6 is a transverse vertical section taken through the dotted line *z z* on Fig. 5, and also showing in elevation the ways and a blank which has just been seized by the dies. Fig. 7 is a top view of the portion of the machine in which the dies are supported; and Fig. 8 is a vertical section taken through the line *w w* on Fig. 7, showing the die *f* and the dividing-finger $F^3$ in their extreme forward position.

The machine illustrated in the drawings is erected upon a substantial horizontal frame, A, provided with legs at its corners, by means of which it is supported upon and secured to the bench upon which the machine is placed.

The driving-shaft B is horizontal, and has its bearings, respectively, in the box B′ upon the top of the side member A′ of the frame and in the box $B^2$ on the top of the standard *a′*, cast upon or affixed to the horizontal bed or table *a*.

The driving-pulley $B^3$ is affixed to the projecting outer end, $B^4$, of the driving-shaft B. At its inner end the driving-shaft is provided with the crank $B^5$, from which reciprocating motion is imparted, by means of the pitman C, to the carriage C′, provided on its under side with the tongue $C^2$, seated in the horizontal groove $C^3$, formed in the bed *a*. The carriage C′ is held down in its place by means of the cap $C^4$, bolted to the top of the side member $A^2$ of the frame. The carriage C′ carries the die D, the flat vertical face of which is provided with a system of parallel inclined ribs, *d*.

The part of the bed *a* adjoining the side member $A^2$ of the frame is suitably slotted to allow the necessary clearance for the moving parts of the machine.

A spur-wheel, *b*, affixed to the driving-shaft B engages the pinion *b′*, affixed to the horizontal cam-shaft E, having its bearings, respectively, in the box E′ on the top of the side member A′ of the frame and in the box $E^2$ upon the top of the standard $a^2$, cast upon or affixed to the bed *a*. Upon its inner end the cam-shaft E is provided with a cam, *e*, acting upon a roller, *e′*, mounted upon a cam-pin inserted in the arm $e^2$, which is connected with the carriage F, carrying the die *f*, which is provided upon its face with a series of parallel inclined ribs, *f′*. The carriage F is provided upon its under side with a tongue, F′, which is slightly diagonal with relation to the face of the die *f*, and which is seated in a correspondingly diagonal groove, *g*, formed in the top of the horizontal plate G, which is supported upon the bed *a*, and is made adjustable thereon toward and from the side member $A^2$ of the frame by means of the horizontal adjusting-bolts H and H′, inserted horizontally through the side member A′ of the frame and into the plate G.

The plate G is rigidly secured in the posi-

tion to which it may have been adjusted by means of the jam-screws *h h'*, which are provided with large collars and inserted through holes in the plate G into the bed *a*, the holes in the plate G being made large enough to permit the required range of adjustable movement of the plate G.

The vertical side $F^2$ of the carriage F is also diagonal relatively to the face of the die *f*, as shown, and may be provided with a correspondingly diagonal bearing, along which it can slide; or, as shown in the drawings, it may have a bearing against a series of anti-friction rollers, *i i*, &c., rotating in vertical bearings formed, respectively, in the plate G and in the cap G', bolted to the top of the rib $G^2$, which is cast in one piece with or affixed to the plate G. The cap G' extends over the top of the carriage F and holds it down in its seat.

The movement of the carriage F toward the driving-shaft, which for convenience may be called its "forward movement," is effected by the rotation of the cam *e*. Its return movement is effected by the retracting spiral spring J, connected at one end to the hook J' on the lower end of the vertical arm $J^2$, inserted in the under side of the carriage F, and extending downward therefrom through a suitable slot in the bed *a*. The opposite end of the spring J is connected to the frame.

The limit of the backward movement of the carriage F is adjustably regulated by means of the abutment-screw $J^3$, inserted horizontally through the end member, $A^3$, of the frame, against the end of which the carriage F strikes at the termination of its backward movement.

It will be seen that the die *f*, carried by the carriage F, makes one forward excursion during each revolution of the cam-shaft E, and at the end of its forward excursion is instantly retracted to its former position by the backward pull of the spring J, and that while making its forward excursion the face of the die *f*, by reason of the diagonal bearing afforded for the diagonal side $F^2$ of the carriage F, moves in a slightly diagonal direction, and thus gradually approaches the plane in which the die D reciprocates; and it will also be seen that the driving-shaft B is so geared to the cam-shaft E as to make several revolutions while the cam-shaft is making one revolution, and that at each revolution of the driving-shaft B there is imparted from it, by means of its crank $B^5$ and the pitman C, a forward and backward movement to the carriage C', carrying the die D.

The driving-shaft and cam-shaft are to be so geared together as to impart to the die D any required number of forward and backward movements while the die *f* is making one forward and backward movement. By the use of the gearing shown in the drawings, the die D makes three forward and backward movements while the die *f* is making one.

For convenience of adjusting the range of movement of the carriage C', carrying the die D, the crank $B^5$ is provided with a radial slot for the reception of the crank-pin $B^6$, which engages the forward end of the link C. The crank-pin is provided with a suitable shoulder, and is secured in the position to which it may have been adjusted by means of the jam-nut $B^7$.

Various kinds of feeding mechanism may be employed for feeding the blanks to the machine. That shown in the drawings consists of the inclined ways K, down which the blanks, hanging by their heads, slide by their own gravity to the horizontal part K' of the ways, which, as will be seen, bends to a right angle and is in alignment with the space between the faces of the two dies.

As a measure of precaution, although it will not in all cases be necessary, the forward end of the carriage F is provided with the dividing-finger $F^3$, the point of which, just before the carriage F completes its forward movement, enters the space between the lowermost blank of the row of blanks in the ways and the blank behind it, and separates the lowermost blank from the blank behind it, and insures its passage from the lower end of the inclined portion of the ways to the forward end of the horizontal portion of the ways, where it is in position to be transferred to the delivery end $K^2$ of the ways. This transfer is effected by means of the sliding transferrer L, provided with a cam-pin, L', which is engaged by the cam *l*, mounted on the cam-shaft E.

The transferrer is a horizontally-sliding plate provided with suitable bearings and sliding in a path parallel with and adjoining the plane in which the face of the die D reciprocates. By the rotation of the cam *l* the transferrer is drawn forward a little in advance of the forward movement of the carriage F, in order to afford time for the lowermost blank in the ways to reach the horizontal part of the ways in front of the end $L^2$ of the transferrer.

The transferring movement of the transferrer is effected by the retracting-spring M, one end of which is secured to a hook, *m*, inserted in the under side of the bed *a*, and the other end to the hook *m'* on the lower end of the arm $L^3$, projecting downward from the transferrer L.

The limit of the backward movement of the transferrer L is determined by the abutting against a shoulder forming a portion of the bed *a* of the adjusting-screw M', inserted transversely through the arm $L^3$.

The timing of the moving parts is such that when the die D makes its first backward movement after the die *f* has completed its backward movement it finds a blank, N, in the position in which it is represented in dotted lines in Fig. 1. The result is, that the shank of the blank is caught between the back end of the face of the die D and the forward end of the face of the die *f*, as shown in Fig. 5, and, by the backward movement of the die D, is rolled backward a prescribed distance along the face of the die *f*. The return move-

ment of the die D rolls the blank forward along the face of the die *f;* but in the meantime the die *f* has made a portion of its forward movement, and the blank is therefore retained between the faces of the two dies, instead of being rolled clear of the face of the die *f*, as it would have been if the die *f* had remained stationary. During the next following backward and forward movement of the die D the blank is rolled backward and forward along the face of the die *f*, until finally, at the end of the third backward movement of the die D, when the screw-thread has been completely formed, the die *f* has moved so far forward that the finished screw is rolled off the back end of the die *f* and drops through an opening in the bed *a* to the bench below, or to a receptacle placed to receive it. During these backward and forward movements of the die D, while the die *f* has been making its forward movement, the face of the die *f* has been gradually approaching the plane in which the face of the die D moves, and hence, during both the backward and the forward rolling movements of the blank upon the face of the die *f*, the oppositely-inclined ribs upon the faces of the two dies have been gradually pressing deeper and deeper into the surface of the shank of the blank, until finally a spiral thread has been formed thereon of the desired depth and of a shape corresponding in cross-section to the cross-section of the spaces between the ribs of the dies.

It will be seen that both the backward and the forward movements of the die D are rendered effective in impressing the thread upon the blank by reason of the steady approach of the die *f* toward the plane in which the die D reciprocates, and it will also be seen that the slow movement of the die *f* in one direction during the reciprocating movements of the die D, allowing the blank to be fed against the forward end of the die *f*, and to be rolled back and forth along the face of the die *f*, and to be finally discharged from the end of the die *f* opposite to that to which it was fed, permits the employment of comparatively short dies, which are inexpensive in their construction and easily replaced when worn.

What is claimed as the invention is—

1. In a machine for rolling screw-threads, the combination, substantially as herein set forth, of two reciprocating dies having their opposed faces suitably ribbed, means for giving to one of said dies a prescribed range of slow endwise movement in one direction, and means for giving in the same time to the other of the said dies two or more relatively rapid reciprocating movements, for the purpose of rolling a screw-thread upon the body of a blank introduced into the space between the two dies.

2. In a machine for rolling screw-threads, the combination, substantially as herein set forth, of two reciprocating dies having their opposed faces suitably ribbed, means for guiding the movements of said dies in planes slightly diagonal to each other, means for giving to one of said dies a prescribed range of slow endwise movement in one direction, means for giving in the same time to the other of the said dies two or more relatively rapid reciprocating movements, and means for feeding screw-blanks into the space between the two dies, whereby spiral grooves are impressed in the body of the blank and gradually deepened during the backward and forward movements of the quick-moving die as the width of the space between the faces of the two dies gradually diminishes.

3. The combination, substantially as and for the purposes set forth, of the reciprocating die D, means for guiding and means for imparting a prescribed range of reciprocating motion to the die block or carriage carrying the die D, the die *f*, the carriage F, means for guiding the movement of the carriage F in a path slightly diagonal to the face of the die *f*, means for imparting a slow forward movement to the carriage F and means for imparting a quick backward movement thereto, and the adjustable abutment-screw $J^3$, for limiting the range of backward movement of the carriage F.

4. In combination with the reciprocating dies D and *f*, the adjusting-plate G, for regulating relatively to the plane of motion of the die D the position of the diagonal guide for the carriage F, carrying the die *f*.

5. The combination, substantially as and for the purposes set forth, of the reciprocating die D, the carriage F, carrying the die *f*, the cam *e*, the arm $e^2$, engaging the cam *e* and connected with the carriage F, and the retracting-spring J.

6. The combination, substantially as set forth, of the reciprocating die *f*, the die D, the carriage C′, the pitman C, the radially-slotted crank-arm $B^5$, and the adjustable crank-pin $B^6$.

7. The combination, substantially as set forth, of the reciprocating dies D and *f*, the transferrer L, the ways K′, for supporting a screw-blank in front of the end of the transferrer and in alignment with the space between the faces of the dies, and means for at the proper time imparting endwise movement to the transferrer in a path parallel or nearly parallel to the plane of movement of the dies, for the purpose of transferring the blank sidewise to the delivery end $K^2$ of the ways K′ and presenting it in position to be caught between the corners of the dies and rolled into the space between the dies.

8. The combination, substantially as and for the purposes set forth, of the reciprocating dies D and *f*, the inclined ways K, the horizontal ways K′, the transferrer L, the cam *l*, and the retracting-spring M.

HAYWARD A. HARVEY.

Witnesses:
ROBERT C. HOWES,
ROBERT W. ARMSTRONG.