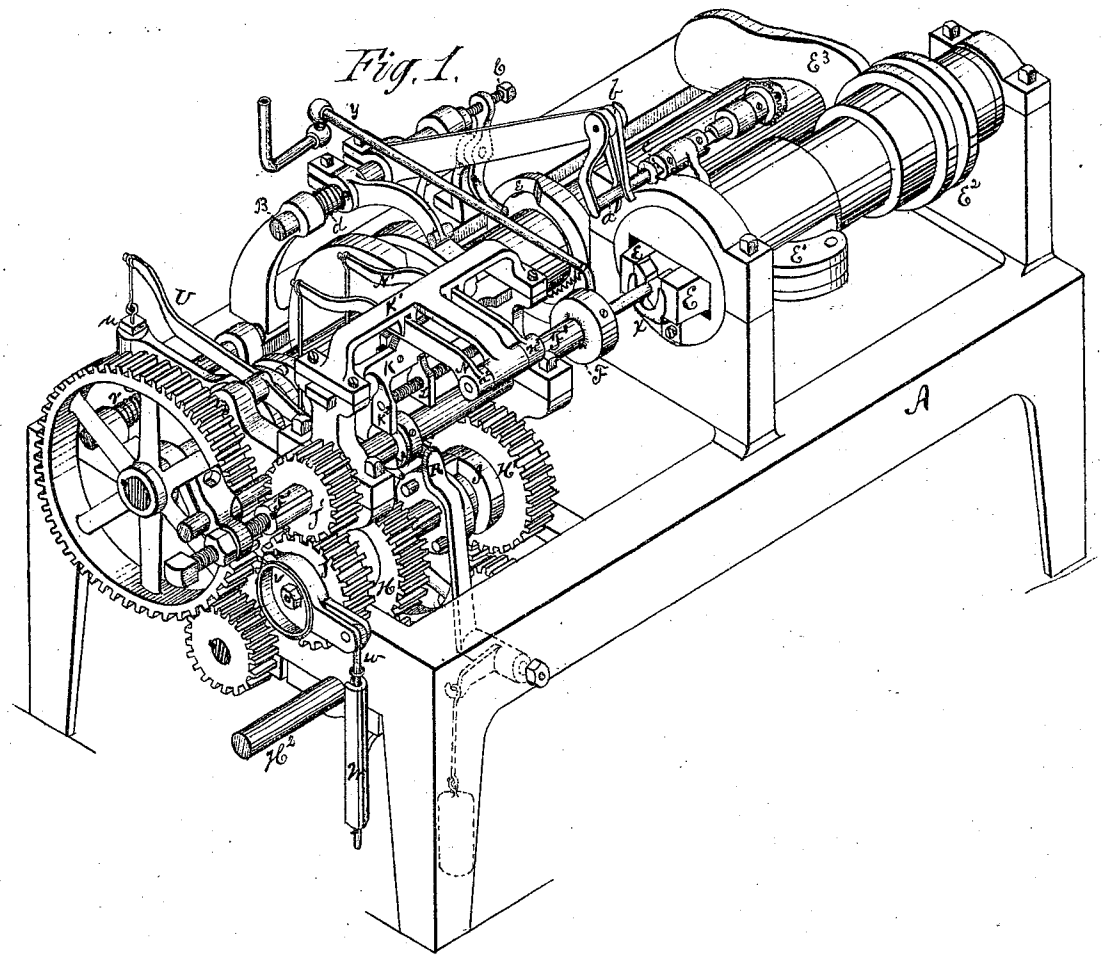
4 Sheets—Sheet 1.

F. P. SHELDON.

MACHINE FOR THREADING SCREWS.

No. 170,496. Patented Nov. 30, 1875.

Fig. 1.



Witnesses.
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4 Sheets—Sheet 2.

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Fig. 2.

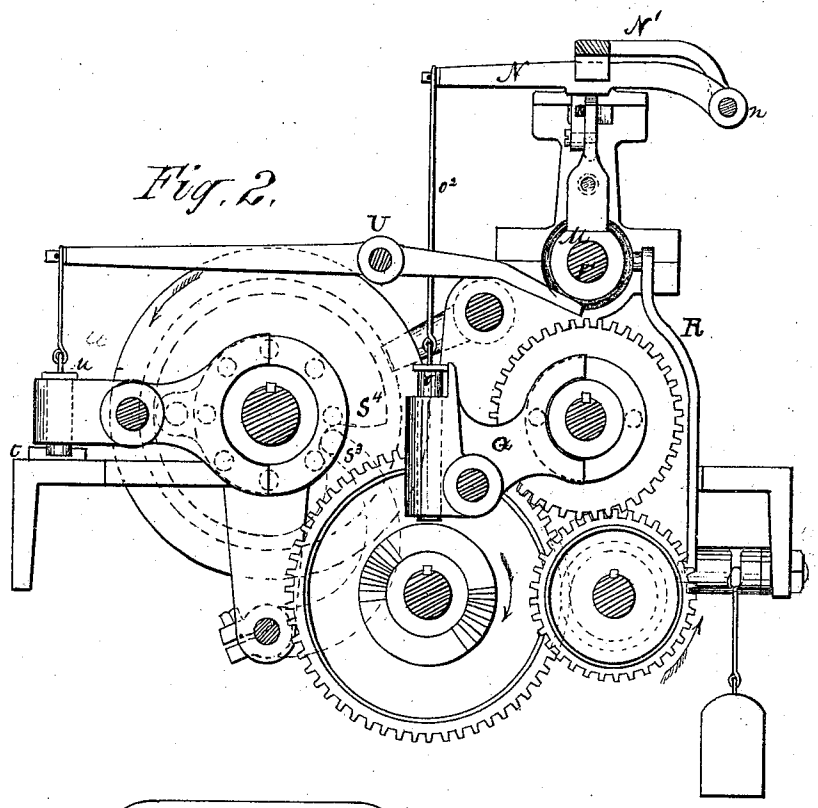
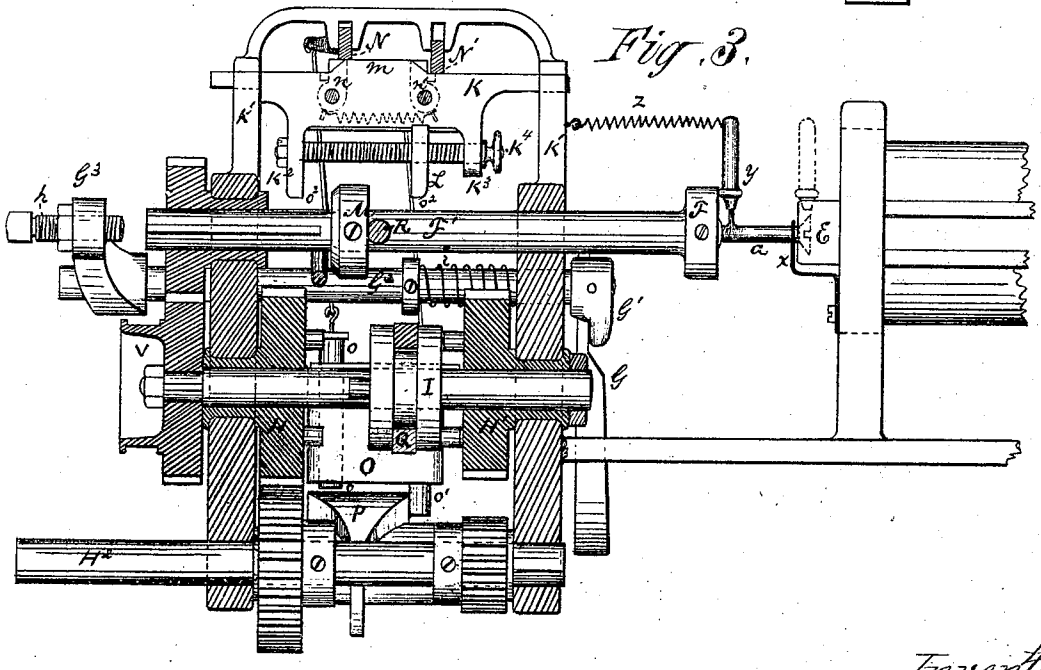


Fig. 3.



Witnesses

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4 Sheets—Sheet 3.

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MACHINE FOR THREADING SCREWS.

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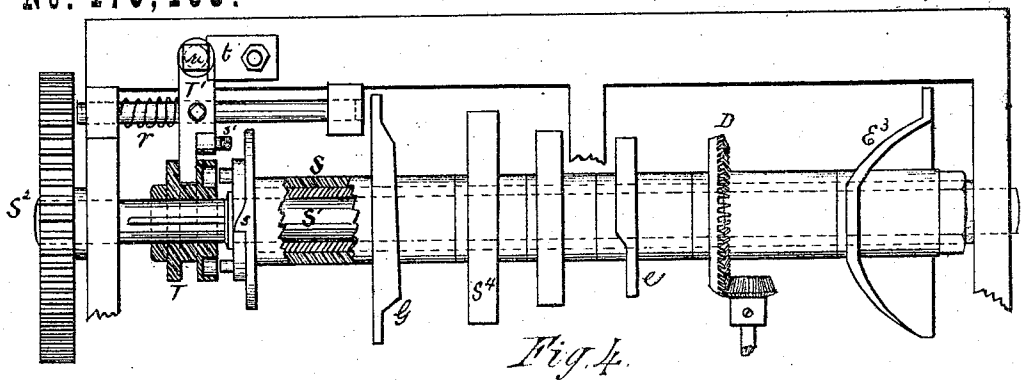

Fig. 4.

Fig. 5.

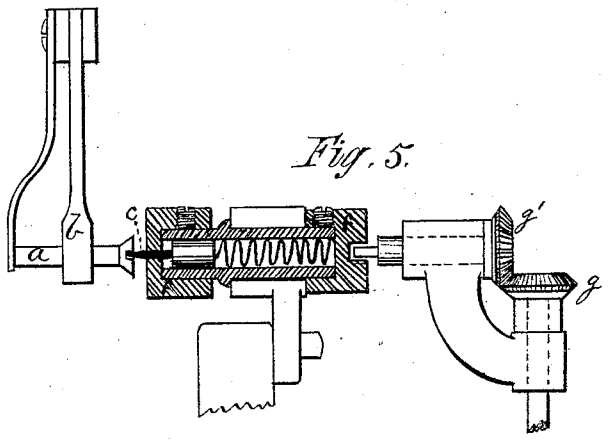

Fig. 6.

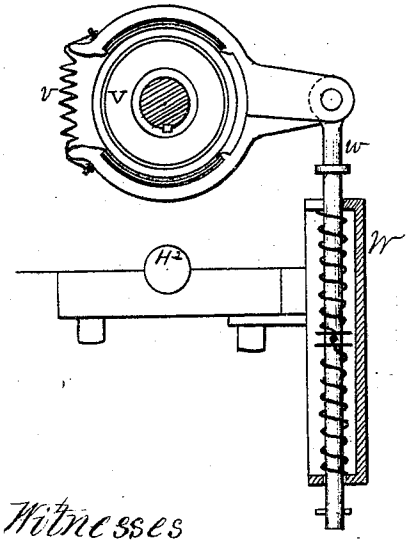

Fig. 7.

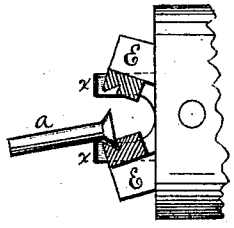

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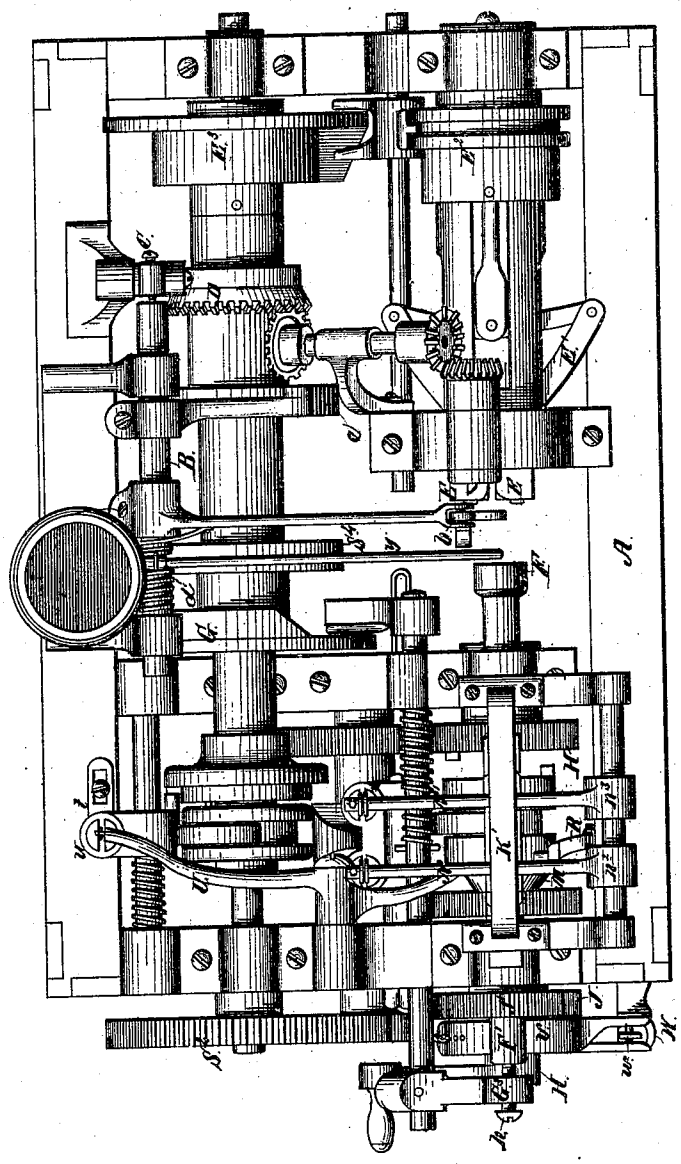
Fig. 8.



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UNITED STATES PATENT OFFICE.

FRANK P. SHELDON, OF PROVIDENCE, RHODE ISLAND.

IMPROVEMENT IN MACHINES FOR THREADING SCREWS.

Specification forming part of Letters Patent No. **170,496**, dated November 30, 1875; application filed June 3, 1875.

To all whom it may concern:

Be it known that I, FRANK P. SHELDON, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Machines for Threading Screws; and I do hereby declare that the following specification, taken in connection with the drawings, making a part of the same, is a full, clear, and exact description thereof.

Figure 1 is a perspective view of the complete organized machine, but the hopper which first receives the screw-blanks in a mass is omitted for the sake of clearness, and also because that part of the machine is already well known in the art. Figs. 2, 3, 4, 5, 6, 7, and 8 are details of the machine to show the special points for more fully illustrating my invention.

The machine belongs to that class of screw-making machines which employ dies for cutting what are called "fine-threaded" or machine screws, as distinguished from coarse-threaded wood-screws, in which the thread is cut by a reciprocating chasing-tool.

The first part of my invention relates to a means for insuring the presentation of the blank to be threaded to the stationary griping and holding jaws, so that the nick or slot in the head of the blank will always stand perpendicularly to the acting faces of the jaws, and thereby, affording the greatest resistance of the head to the gripe of the jaws, prevent the head from being crushed, as it is liable to be in machines of this class in case the blank is held with the nick standing parallel to the planes of the faces of the jaws.

A is the rectangular bed or table of the machine. It is to be understood that some one of the many known automatic feeding devices are to be employed, so that a single blank, *a*, Fig. 3, is able to be seized by the spring-fingers *b*, Fig. 1, whose office is to present the same to a pair of griping-jaws, to be by them held while the operation of cutting the thread is being performed by a revolving die. Supposing now that a blank, *a*, Figs. 1 and 5, has been taken by the fingers, the first operation is for the fingers to move laterally toward a revolving yielding screw-driver, *c*. This movement is effected by means of a spring, *d*, on the finger-shaft B, and controlled, as to time, by the revolving cam *e*, the same finger-shaft B being capable of a slight endwise movement on its bearings, the extent of which can be adjusted by the screw-gage C. The screw-driver *c* has its construction clearly shown at Fig. 5. It is arranged to make, at least, one complete revolution in its bearing *f*, while the blank is presented to it by means of the bevel-gears *g g'*, driven by a gear, D, on the principal cam-shaft, Fig. 4. As the screw-driver rotates it will of necessity be able at the same time to spring into the nick of the blank, and cause the blank itself to rotate until such time as the side cam *e* moves the finger-shaft, and, consequently the fingers, away from engagement with the screw-driver. The action of the cam *e* is so timed as to leave the blank, when withdrawn from the screw-driver, with its nick standing in the proper position required to best withstand pressure when seized by the griping-jaws. The fingers are now permitted, in a well-understood way, to carry the blank in front of the griping-jaws E. These are stationary holding-clamps, adapted to seize the blank by the head and hold it firmly, and are made to perform this office of seizing and holding the blank, and releasing it after it has been threaded, by their combination with toggle-levers E^1, sliding sleeve E^2, and revolving scroll-cam E^3, in a way well understood.

The next operation to be performed is that of threading the blank. This is done by a die, F, mounted on an arbor, F', which is made to revolve first in one direction, while the die is cutting the thread, and then in the reverse direction to enable it to back off from the screw so made. There is nothing new in this operation, and the machinery by which it can be performed is familiar to all constructors of screw machinery.

In this instance, the side cam G, Figs. 3 and 4, acts upon an arm, G^1, Fig. 3, set on the shaft G^2, which latter is arranged on bearings so as to have an endwise movement. The forward movement so given to the shaft G^2 is communicated, by means of the arm G^3 and adjustable screw-head *h*, to the die-arbor F', and the latter is thereby moved far enough to bring the die up to the blank. The cam G continues to revolve for a sufficient length of

time, (acting now as a leading cam with an inclination of face corresponding with the pitch of the threads on the die,) to enable the thread to be well started, when it ceases its action, and the spring *i* throws the shaft G^2 to the position shown at Fig. 3, the die continuing its work.

The next part of my invention consists in the means by which the machine can be adapted at pleasure to cut different lengths of thread, and perform promptly the whole sequence of operations necessary to the threading of a blank, without being obliged to wait for any member of the machine to "come to time," in case the machine is threading the shortest blank, over what would be necessary in case it were threading the longest blank.

In machines of this class, as hitherto constructed, it is required, in order to cut screws of different lengths, to make changes in the cams or gears, or both, involving a great loss of time, and complicating the machine with a large number of change-gears. The device presently to be described is independent of the rest of the machine, and may be applied to any screw-machine, when it is desired to regulate, at will, the length of the thread to be cut. The die-arbor or spindle F′ is caused to rotate alternately in opposite directions by means of the gear-wheels H H^1, which are constantly revolving in opposite directions, and receive motion from the driving-shaft H^2, to which power is applied and an intermediate gear. The changes in the direction of rotation in the die-arbor are effected by means of a shifting-clutch, I, which is capable of sliding on the same shaft upon which the gears H H^1 are mounted, and is made to engage with the one or the other by means of clutch-pins. Such clutch is connected with the shaft by means of a spline. Necessarily the gears H H^1 are made to revolve around their shaft, except at such times as they are respectively locked therewith by means of the clutch I, which always revolves with the shaft, and, consequently, the die-arbor will be rotated in one direction or the other by means of the gears J J′, according as the clutch I has locked the shaft with the one or the other of the gears H H^1.

As already stated, the die-arbor F′ must have a longitudinal movement in its bearings, to enable the die which it carries to traverse the part of the blank to be threaded, and, consequently, the connection of the die-arbor with gear J′ must be by a spline.

Now, to determine the length of time that the die-arbor shall rotate in the direction to enable the die to cut a thread, and to fix the time when its direction of rotation shall be reversed, there are employed the hereinafter-next-described devices and combinations of instrumentalities. K, Fig. 3, is a sliding bar mounted in suitable guides in a frame, k^1, and is capable of a limited endwise movement, the extent of which can be regulated by adjustable stops. Upon the under side of this bar are two brackets, k^2 k^3, in which the adjusting screw-rod k^4 is mounted. The bracket k^2 projects downward lower than its fellow k^3, and this extended portion forms an ear-piece, which, with its fellow L—the latter being mounted on the screw-rod k^4, so that its distance from k^2 can be regulated at pleasure—constitute, in combination with a collar or equivalent device on the die-arbor, a part of the means for changing the direction of rotation of the die-arbor. Upon the die-arbor or spindle F′ it will be observed there is placed a collar, M, the position of which is adjustable, and which will partake of all the movements of the spindle, and, will, at some time during the forward movement of the die-arbor, while the die F is cutting a thread, come into contact with the ear-piece L, and will, also, during the reverse movement of the die-arbor, induced by the die unscrewing from the thread which it has cut, come into contact with the fellow ear-piece k^2.

Upon the upper side of the sliding bar *k* is an elevated section, *m*, having two inclined approaches, and also two spring-latches, *n* n^1. In combination with the upper side of the sliding bar, as thus constructed, are two levers, N N′, Fig. 3, having their fulcra at n^2 n^3, Fig. 1. These levers are placed at such distance from each other, and in such a relation to the inclined approaches and spring-latches above mentioned, that it is impossible for more than one of the levers to be resting upon the lower level of the upper surface of the sliding bar at the same time. From the ends of the levers N N′ depend two pins, *o* o^1, Fig. 3, by means of links o^2, and play loosely in guides in a block, O, which latter is free to slide laterally upon a stud-pin projecting from the frame of the machine. Underneath this sliding block is a double-faced rotating cam, P, which, as it revolves, will come into contact with that one of the pins *o* o^1 which lies at the moment within its path of rotation, and consequently will cause the block O to slide on its stud-support to the right or to the left. This block carries a clutch-shifter, Q, which controls the clutch-gear I, and thereby the direction of rotation of the die-arbor.

From the foregoing description of the elements which compose this part of the organization of the machine it will be understood that the general mode of operation is as follows: Suppose the die F to be cutting a thread upon a blank held by the jaws. The clutch I and the die-arbor are being driven by the gear H^1. When the die-arbor has traversed so far forward as to bring the collar M in contact with the adjustable ear-piece L the sliding bar *k* will then commence to slide in the same direction with the die-arbor. This will cause the lever N′ to ride up the inclined approach to the elevated section *m* of the sliding bar, the spring-latch n^1 allowing this to be done. By this movement the pin o^1 has been lifted clear of the revolving cam P. The continuing forward movement of the sliding bar will

next cause the fellow lever N to drop off the abrupt face of the spring-latch *n*, whereby the pin *o* will drop within the path of rotation of the cam P, and as a consequence of this the clutch I will be shifted from engagement with the gear H′ into engagement with the gear H, when a reverse movement of the die-arbor will commence.

It is obvious that the time during which the die-arbor shall rotate in the direction to enable the die to cut a thread, and consequently the length of the threaded portion of the blank, is under complete control by simply adjusting the collar M and the ear-piece L properly with reference to each other. While the die is unscrewing from the threaded screw the die-arbor and its collar are moving longitudinally backward, and when near the end of its movement the collar M comes into contact with the ear-piece k^2, thereby causing the lever N and its pin *o* to be raised and the pin o^1 to be lowered, so as to engage with the cam P, and thus, by a mode of operation similar to that above explained, change the direction of the rotation of the die-arbor.

It will be obvious to constructors of screw-machinery that substantially the same means above described for the same purpose can be applied to screw-cutting machines in which the threading-die does not revolve, but in which the die has only a to-and-fro movement, and the blank alone is revolved.

In order to give room between the face of the die and the holding-jaws for the insertion of another blank, a lever, R, Figs. 1, 2, and 3, actuated by the force of a spring or weight, presses against the face of the collar M, and slides the die-arbor farther backward in its bearings so soon as the die has backed off from the screw which has been cut.

Another feature of my invention resides in the fact that the devices by which successive blanks are fed to the machine are permitted to remain at rest while a screw is being cut, but are started on the instant that the finished screw is ready to be discharged.

The several cams from which the necessary motions are obtained are shown at Fig. 4, and are all attached to a hollow shell, S, that surrounds a shaft, S^1, which latter is in constant revolution by gearing S^2, deriving motion from the driving-shaft through a train of gears. The shell S is held locked when not in motion by means of a spring-arm, S^3, Fig. 2, which engages with a notch in the cam S^4. A sliding clutch, T, Fig. 4, constantly revolving with the shaft S^1, and connected therewith by a spline, serves at the proper time to give motion to the cams. It is thrown into engagement with the cam-shell S, by means of the spring *r*, which constantly presses against its shifter T′, and it is thrown out of engagement by the cam face *s*, which, at each revolution of the shell, acts against a projecting lug, s^1, on the side of the shifter. The clutch is held out of engagement with the cam-shell after the cam last mentioned has performed its office by means of a stop, *t*, set on the frame of the machine with which a catch-pin, *u*, Fig. 2, engages. This catch-pin is set loosely in a socket-hole through the shifter, and is connected, by a link, to the end of the long arm of the lever U. The shorter arm of this lever is located so as to interfere with the path of backward movement of the collar M on the die-arbor F′, when the latter is acted upon by the lever R for the purpose, as above explained, of moving the threading-die away from the jaws far enough to allow for the insertion of a new blank. The back edge of the collar M is beveled so as to present an inclined plane to the side of the short arm of the lever U, and, consequently, the backward movement of the collar will, by depressing the shorter arm of the lever, raise the catch-pin *u*, and allow the spring *r* to cause the clutch to engage with the cam-shell.

From this description it will be understood that the backward movement of the die-arbor which occurs just as the finished screw is ready to be discharged from the holding-jaws, indicates the time when the feeding devices are to again be put into operation, and thereby any idle running of the machine to bring the feeding devices to time in case the machine is cutting short, instead of long, screws, is avoided. After a new blank has been inserted in the jaws, and after the cutting-die has taken hold of the same, the completed revolution of the cam-shell causes the cam-face *s* to open the clutch-gear, when, nothing being in the way to prevent it, the catch-pin *u* will fall into engagement with the stop *t*, and the cam-shell will remain at rest.

It will be noticed as a result of the construction last described, that if, from any cause, there is a failure to present a blank to the jaws, the die-arbor will immediately afterward be moved to its extreme backward limit by the spring-lever R, and, consequently, the feeding device will be at once put again into operation without waste of time, and the attendant can always tell from a distance whether the machine is performing all its functions in their regular sequence by observing whether the feeding-fingers are in continuous movement. If they are, he knows that the machine is not threading blanks.

The device shown in Fig. 6 is to lessen the severity of the blow on the gears when the direction of rotation of the die-arbor is reversed. It consists, essentially, of a friction-brake, formed of two bands of leather held in two semicircular pieces of metal, which inclose the pulley V, which is secured to gear J, Fig. 1. The brakes are pressed together by a spring, *v*, Fig. 6. They are joined together and attached to a rod, *w*, which passes through a hollow stand, W, fastened to the frame of the machine. The rod *w* is encircled by two spiral springs of equal length and tension, which press in opposite directions against the washers on the rod. The normal position of the brakes, when the pulley V is stationary,

will be such that the springs are both equally closed. So soon as the pulley revolves in either direction, the friction of the brakes will cause the rod to be moved in one direction or another, compressing one of the springs until the tension of that spring is sufficient to balance the friction of the brakes. As soon as the clutch is disengaged from the gear which is driving it, this spring will suddenly be relieved, and will act upon the rod and pulley V and start it in the opposite direction before the clutch has engaged with the other gear, so that, when it does so engage with the gear which is rotating in the opposite direction, the blow on the gear and clutch-pins will be very much lighter. And thus the machine will work much smoother, and there will be less liability of breaking gears than would be the case if the clutch were suddenly thrown into a contrary motion without preparation.

The device shown at Fig. 7 is designed to insure the discharge of the finished screw from the jaws, in case it sticks to either jaw from the effect of the severe gripe to which the blank is subjected. A bifurcated plate of thin metal, *x*, Fig. 1, is attached rigidly to the head of the mandrel which contains the jaws, and so that the two legs will act as stops to interfere with the screw as it is moved in the arc of a circle by the jaw to which it sticks as such jaw is opening, and thus will be stripped off the jaw.

The bifurcated piece *x* may be made movable, so as to be drawn out of the way of the dies when cutting a thread, close up to the jaws, and be brought into action only, just as the jaws open; or a spring behind or between the jaws to press upon the head, might answer the purpose in same cases; but the form shown in the drawing I consider the more effectual and positive.

Another difficulty in die-machines which cut a thread nearly the whole length of the blank, is, that the chips of iron caused by the die will lodge on the jaws, and when they open will find their way into the recess which fits around the head of the blank, and when the jaws again close upon a blank, the head will be bruised by such chips and become spoiled. This has been overcome, (but only very imperfectly,) hitherto, in hand machinery, by the operator wiping out the jaws by hand, after the cutting of every screw; and it consumes much time, besides being very ineffectual.

I make use of a stream of some suitable liquid which is delivered from a pipe, *y*, Fig. 3, upon the outer surface of the jaws before they open, thus washing off the chips which have lodged thereon, so that when the jaws open there will be no chips there to fall in. I make use of oil, because the stream of oil is necessary as a lubricator of the dies in cutting the thread, and by having the oil-pipe hung on a swivel-joint and pressed against the head of the die-spindle by a spring, *z*, it serves the double purpose of lubricating dies, and of washing the jaws.

I wish it to be understood that I do not limit myself to the construction and arrangement of the several parts of the machinery composing the subjects of my invention, as described, but intend to include all mere formal variations of structure and arrangement accomplishing the same mode of operation by equivalent means.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of the following instrumentalities for causing the nick in the head of a screw-blank to be set in a given position before presentation to the holding-jaws, viz: a suitable feeding mechanism for selecting blanks one by one, *b*, holding-jaws E E, and a revolving blank-turner, *c*, substantially as described.

2. The combination of the spring-fingers *b*, arranged to be capable of a sidewise movement, as described, with a revolving blank-turner, *c*, for enabling the screw-blank to become engaged with the blank-turner, and afterward be disengaged therefrom, as specified.

3. The combination of the following instrumentalities for changing the backing-off motion, after the threaded screw is clear of the dies, to the motion for threading the next blank, viz: an adjustable collar, M, partaking of the longitudinal movement of the die-holder, a shifting-clutch, I, operated by suitable mechanism, as described, and the revolving gear H^1, inducing, by suitable gearing, the requisite rotation for cutting the thread, substantially as specified.

4. The combination of a sliding bar, K, having ear-pieces k^2 L, as described, an adjustable collar, M, partaking of the longitudinal motion of the die-holder, a shifting-clutch, I, operated by the cam P, and alternately engaging pins o o^1 at the times determined by the said sliding bar and collar, and gears H H^1, revolving in opposite directions, substantially as described, for the purpose of automatically changing the direction of rotation of the die-arbor, as specified.

5. The combination of the sliding bar K, constructed as described, the levers N N′, and the spring-latches n n', substantially as specified.

6. The combination of the adjustable collar M, partaking of the longitudinal motion of the die-holder, with the system of cams on the hollow shaft S, by means of a vibrating clutch-gear connecting such shaft with the source of motion, and the lever U, controlling a stop-catch, u t, whereby the said cam-shaft may be stopped while a blank is under the action of the cutting-die, and be started again after a blank has been discharged from the jaws, or in case a blank has not been presented to the die, substantially as described.

7. In combination with the gears J J′, whose direction of rotation is alternately changing to reverse the motion of the die-arbor, the friction-pulley V, and double-acting spring-

brakes, described, for giving an easy initial movement to the gearing for changing direction, substantially as specified.

8. The combination, in an automatic screw-threading machine, of the bifurcated discharger, the griping-jaws, and the feeding-fingers, arranged and operating together substantially as described, whereby the finished screw is ejected from the jaws, and the way cleared for the advance of the fingers with a blank, as set forth.

9. The combination, substantially as described, of the feeding-fingers *b b*, with the stationary holding-jaws E E, when the latter are arranged to open in a plane which is intersected by the path of movement of the fingers, whereby the blank can be presented so as to be griped by the jaws without the requirement of any sidewise movement on the part of the fingers.

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