3 Sheets—Sheet 1.

T. O. BENNETT.

Wood-Screw Machine.

No. 220,569. Patented Oct. 14, 1879.

FIG. 2.

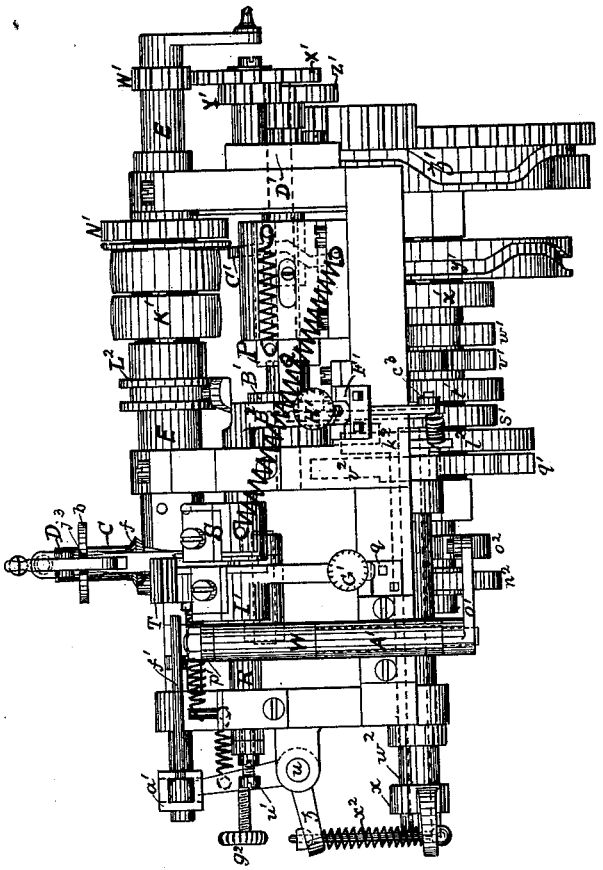
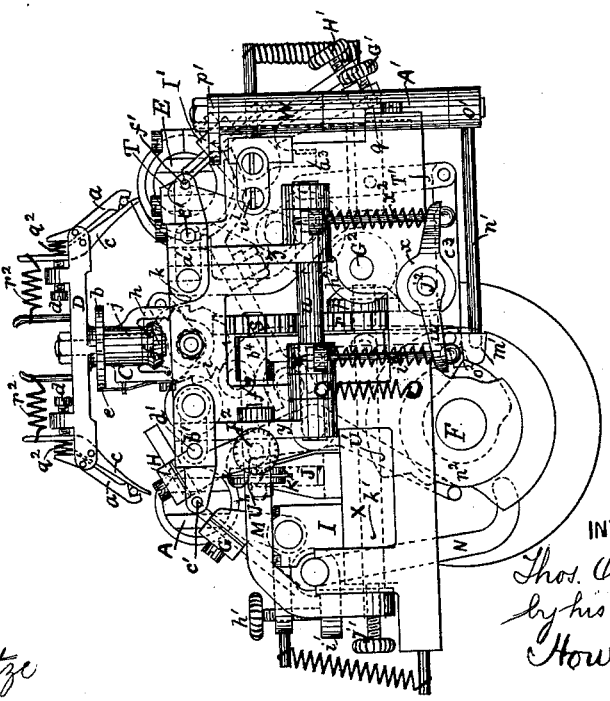


FIG. 1.



WITNESSES

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3 Sheets—Sheet 2.

T. O. BENNETT.

Wood-Screw Machine.

No. 220,569. Patented Oct. 14, 1879.

FIG. 4.

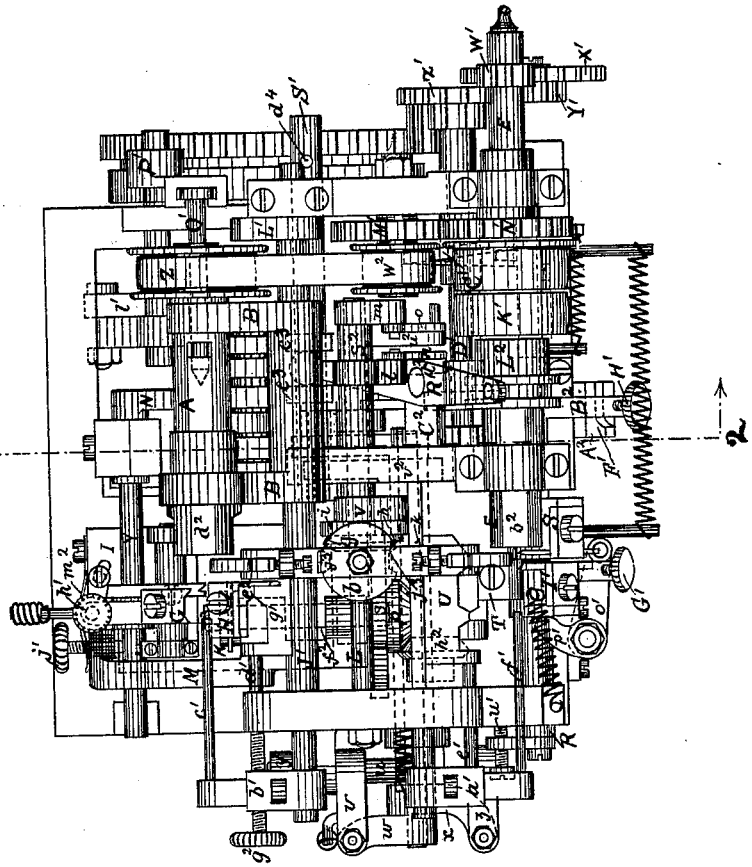
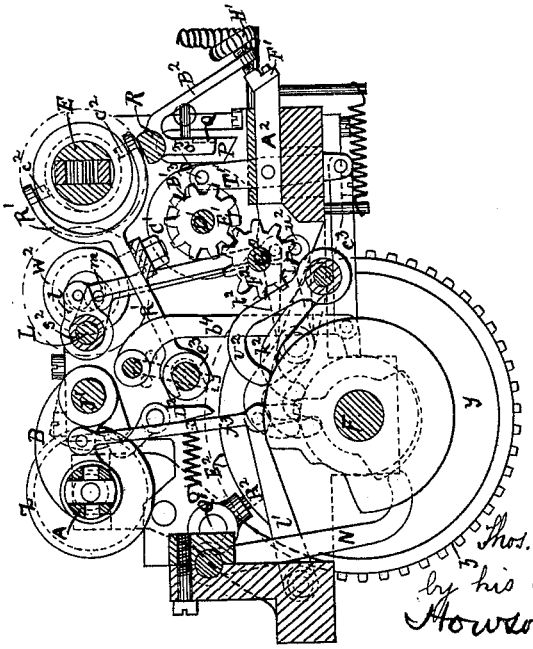


FIG. 3.



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3 Sheets—Sheet 3.

T. O. BENNETT.

Wood-Screw Machine.

No. 220,569. Patented Oct. 14, 1879.

FIG. 6.

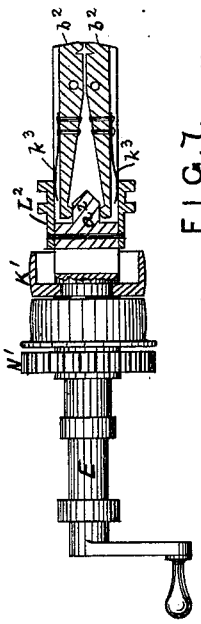


FIG. 7.

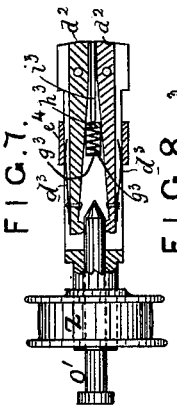


FIG. 8.

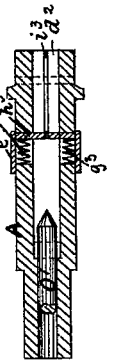


FIG. 9.

FIG. 10.

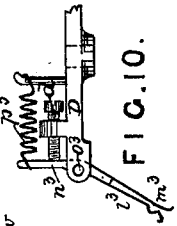
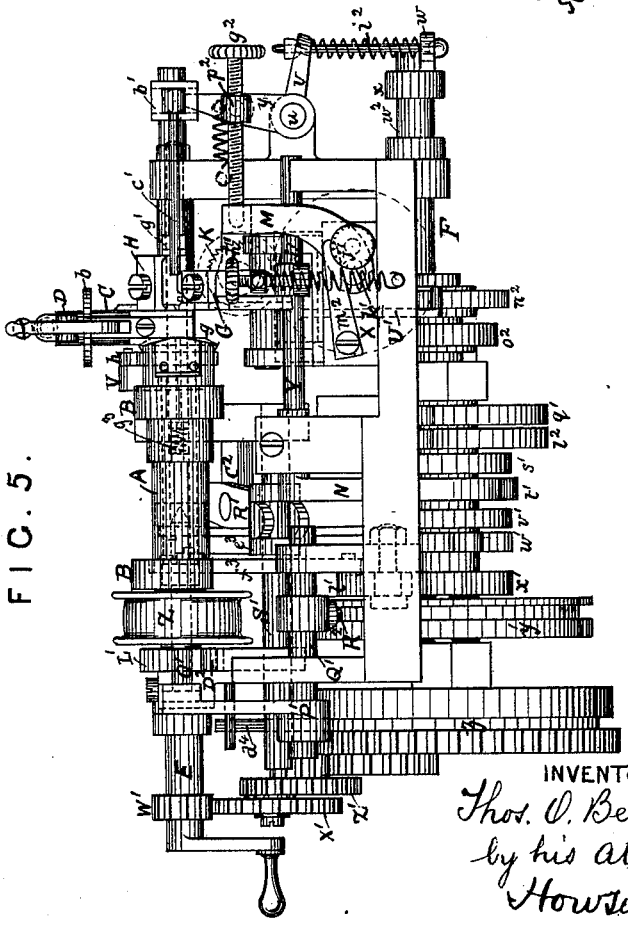


FIG. 5.



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UNITED STATES PATENT OFFICE.

THOMAS O. BENNETT, OF MANCHESTER, ENGLAND.

IMPROVEMENT IN WOOD-SCREW MACHINES.

Specification forming part of Letters Patent No. **220,569**, dated October 14, 1879; application filed February 12, 1879; patented in England, October 18, 1878.

To all whom it may concern:

Be it known that I, THOMAS OLDHAM BENNETT, of Manchester, in the county of Lancaster, Kingdom of Great Britain, have invented new and useful Improvements in the Construction of Machinery or Apparatus for the Manufacture of Wood-Screws and Screw-Nails, of which the following is a specification.

My improvements relate to the shaving, nicking, pointing, and worming of screw-blanks, the operation of which are all of them combined in one frame, and the action throughout is automatic.

The main part of my improvements relates to a double carrier having an oscillating and semi-rotary motion imparted to it, in combination with a shaving-spindle and worming-spindle and operating mechanism, which, with further improvements relating to details in the construction of the screw-machine, are more fully described hereinafter.

The ordinary method of finishing screw-blanks is to have two distinct and separate machines, one for shaving and nicking and the other for pointing and worming the blank.

The object of my improvements is to finish a screw-blank in all its processes in one machine, thereby saving the extra labor required for two separate machines. It also gives more time for the shaving and nicking operations, whereby the tools used for these operations last much longer and need not be replaced so often, and it necessarily makes a larger percentage of good work, and will be freer from breakages and require less repairs.

Another object is that my improved machine takes up less floor-space, and requires less power and less labor for the same quantity of screws manufactured by other machines.

Another part of my invention relates to a carrier having a set of my improved fingers (or ordinary fingers) on each end thereof, with an oscillating motion to convey the carrier-fingers centrally to receive a partly-finished blank from the shaving-spindle, and to present a partly-finished blank which has been previously received from the shaving-spindle on the other end of the carrier to the worming-spindle. The carrier has a semi rotary motion given to it about an axis common to both fingers, which conveys the blank from the shaving to the worming spindle, and by the semi-rotary motion it brings the fingers (which have just deposited the blank into the worming-spindle) empty and ready to receive the blank when partly finished from the shaving-spindle.

The mechanism for giving the oscillating and semi-rotary motion to the carrier is as follows: To obtain the latter motion of the carrier, I place it on the shaft which works the carrier-frame, the center of the shaft being the axis common to both fingers. On this axis is fastened a bevel-wheel pinion, gearing into a bevel-wheel running loose on the oscillating shaft on which is fastened the carrier-frame, this latter shaft being at right angles to the semi-rotary shaft. Attached to the bevel-wheel is a ratchet-wheel, into which works a pawl pivoted to a lever on a hollow oscillating shaft. Through this hollow shaft runs the shaft on which is fastened the carrier-frame, and by the movement of this shaft, which is obtained by a suitable cam giving motion to a cam-lever connected by a suitable rod to a lever on the other end of the hollow shaft, action is given to the pawl, which, at the proper time, comes into contact with the notches of the ratchet-wheel and gives the semi-rotary motion to the carrier. To hold the carrier in its proper position in relation to the spindles, after the semi-revolution has been given to it, I place and fasten on the semi-rotary shaft a disk-plate having two notches on its periphery diametrically opposite to each other, into one of which the stop enters and holds it in proper position until it is rotated another half-turn. The stop, being fixed to a flexible spring, is easily forced out of the notch and a semi-revolution given to the carrier, upon which the notch on the opposite side of the disk is brought round to the stop, which enters and holds it in its proper position until the carrier requires another semi-revolution.

To obtain the oscillating motion I fasten the carrier-frame containing the carrier and other adjuncts described on an oscillating shaft at right angles to the semi-rotary shaft,

and passing through the hollow shaft which actuates the semi-revolution of the carrier. On the shaft previously described on which the carrier-frame is fastened is a lever connected to a cam-lever by a connecting-rod, the said lever being actuated by a suitable cam to give the oscillating motion required.

The bevel-wheel being attached to the ratchet-wheel and loose on its shaft, as already described, and oscillating with the carrier-frame, it is necessary that the pawl should not be in gear with the ratchet-wheel except when it is required, and to accomplish this I give the pawl, with its lever, a little longer traverse than that necessary to rotate the carrier a semi-revolution, and by these means the pawl can be thrown out of gear by having a projection on it coming in contact with a projection placed on the frame of the machine, and by the extra traverse of the pawl it falls into and gears with the ratchet-wheel at the proper time.

By the combination of the oscillating and semi-rotary motion of the carrier a partly-finished blank is received by the shaving-spindle and a partly-finished blank presented centrally to the worming-spindle.

The spindles having their rear ends running in the same direction, and one part of the machine operating to shave and nick the head of the blank and the other part of the machine cutting the worm or thread on the blank, it will be perceived by any one conversant with screw machinery that it is necessary to give the blank a half-turn after being received by the carrier-fingers from the shaving-spindle, so as to present the head of the blank to the worming-spindle, to be held by the jaws and rotated by that spindle, so as to rotate the blank to be operated upon by the cutter to form the thread.

Another part of my invention relates to the fingers of blank-carriers, whereby I make both fingers adjustable by a set-screw, so as to be easily adjusted centrally with the spindles; and each finger being fixed to the carrier-head with only one pin and held in their proper position by springs, they are allowed to move outward at right angles to the axis of the blank; or I can make the fingers of flexible steel, so they would only require to be pivoted by one pin for both fingers and adjusted as previously described—that is, in case the carrier-fingers have just deposited a blank in the spindle, and the spindle-jaws having closed on the blank, but so that the blank does not run axially with the spindle, the fingers are not strained by the blank describing a larger circle while rotating, but are allowed by the springs to give way, and after being freed from the blank immediately return to their former position.

I am aware that somewhat similar fingers have been used in connection with screw-machines, one method being to have only one finger movable, the other being fixed in the head of the carrier.

Another method is to make the fingers of flexible steel, and adjustable by a screw and nut; but neither of these methods possesses the same advantages as the adjustable fingers herein described.

For short blanks the shaving and nicking operations have ample time to prepare a blank while the pointing and worming mechanism is completing the blank already prepared by the shaving and nicking mechanism; but in long blanks the worming operation is much slower, and the shaving and nicking operations may be arranged to operate on two or more blanks while the wormer is operating on one. The extra blanks shaved and nicked over and above what are required to supply the wormer can be thrown out of the shaver-spindle and caught in a receptacle and transferred in the ordinary way to a single worming-machine. This would be accomplished without prejudice to my combined machine, for the arrangement would be such as to supply its worming at the proper time by the carrier retaining one of the blanks after being finished by the shaving-spindle, and transferring it, as previously described, to the worming-spindle.

To shave and nick two or more blanks while the worming mechanism is operating on one would merely require a slight alteration to the cams.

Referring to the drawings, Figure 1 is an end elevation. Fig. 2 is a side elevation on worming side. Fig. 3 is an end section through line 1 2 in Fig. 4; Fig. 4, plan. Fig. 5 is a back elevation on shaving side; Fig. 6, worming-spindle, partly in section; Figs. 7 and 8, shaving-spindle, partly in section. Figs. 9 and 10 show a portion of a double carrier with flexible finger.

In order that the said invention may be more easily understood, I will now give a description of the mechanism and of the different operations by which the machine is enabled to perform its several operations, the same letters of reference indicating the same parts.

I will now describe the mechanism connected with the operation of shaving the blank. The blank is conveyed into the shaving-spindle A from the hopper-rails in the ordinary manner, (not shown in the drawings,) and held by the griping-jaws d^2, actuated through a clutch-rod, o^1, Figs. 1, 3, 4, 5, 7, and 8, this rod being operated by cam y' on cam-shaft F through pin R^2 on shaft Q′, on the other end of which is an arm, P′, which engages with the clutch-rod O′ at the proper time to operate the griping-jaws d^2. When the clutch-rod moves rearward the jaws are allowed to be opened by the springs d^3, fastened to griping-jaws and pressing on under side of sleeve e^4. The spindle A is made to rotate on its axis through pulley Z by a belt connecting with pulley W^2, fastened to spur-wheel M′, running loose on its shaft and driven from worming-spindle E by wheel N^1.

The shaving and reshaving of the blank is

operated by the shaving-cutter held in tool-box G, which rocks in bearings on the fixing I, and is fastened to slide X by screws, so as to allow of a slight swiveling motion of the tool-box G for more accurate adjustment. The motions necessary for the shaving and reshaving of the blanks are produced by a cam, t^1, on shaft F, which actuates a lever, N, fastened to the end of rod Y, Figs. 1, 4, and 5. On this rod is a lever, i^1, in contact with a projecting arm from tool-box G by adjusting-screw h^1. This screw is for accurately adjusting the cutter to turn the blank to its required diameter. The lever N is held onto the face of the cam t^1 by the action of a spiral spring. The blank is rotated by the shaving-spindle, running in bearings in a frame capable of moving downward in an arc of a circle whose axis is in the center of the shaft J′, onto which the frame B is fastened. This shaft is placed longitudinally and has its bearings in the frame of the machine.

To hold the shaving-spindle in its position for shaving and reshaving a blank, a disk, L^1, is fastened to a shaft, J′, with a notch on its periphery, into which a stop-lever, D^2, enters, held by a spiral spring, Figs. 3 and 5. When the spindle is required to move downward this stop-lever D^2 is drawn out by a projection, E^2, Fig. 3, on cam y', and about the same time the cam x^1 operates the lever l^1, which, being connected to the spindle-frame B by a rod, f^3, allows the shaving-spindle to move downward in an arc of a circle to carry the blank, which is still held in the griping-jaws d^2, to the nicking-saw K, and after having the nick cut in the head of the blank the cam x^1 brings it back to its former position, where it is held firm by the stop-lever D^2 entering the notch in disk L^1, and the blank is then reshaved to remove the burr left by the action of the saw.

To steady the blank while being shaved and reshaved it is rotated against the back-rest H, Figs. 1, 4, 5; but prior to the shaver-spindle falling downward to the nicking-saw K (and when the nicked blank is being taken from the spindle and another blank being griped to go through a similar operation) the back-rest is allowed to fall back out of the way by the action of the sliding cam g^1, which receives its motion through a rod, d^1, connected to the slide b^1. The sliding cam g^1 slides longitudinally on shaft J′, and the projection on the cam slides past the projection e^2 on the back-rest H, and a spiral spring attached to the back-rest draws it back from the blank.

After the blank has been shaved, nicked, and reshaved the clutch-rod O′, Figs. 4, 5, 7, and 8, moves outward and allows the griping-levers d^2 to open. The spiral springs g^3, Figs. 5, 7, and 8, acting through bar h^3, on which is rod i^3, placed centrally in spindle, push out the blank against the end of the rod c^1, Figs. 4 and 5, whence it is taken up by the carrier-fingers, to be conveyed by them to the worming-spindle.

I will now describe the operation of nicking. The saw K receives its rotary motion from the shaft D^1, Figs. 2, 3, 4, which is driven from gear-wheels on end of frame, (see Figs. 1, 3, 4, and 5,) through spur-wheels E^1 F^2, which gives motion to the shaft G^2, on which is a bevel-wheel, h^2, Fig. 1, gearing into another bevel-wheel, p, fastened to spur-wheel r, whose axis is the axis of the oscillating saw-frame M, and which drives the wheel S on the end of saw-shaft f^2. The saw-frame M, containing saw K, has an oscillating motion on the shaft K′, Fig. 5, carrying the spur-wheel r, so as to bring the saw K up to the blank at the proper time to cut the nick, and also to carry it back from the blank when the nick is cut. An adjusting-screw, g^2, connects the oscillating saw-frame M to a lever, y, but is not fast to it; and to keep the previously-mentioned frame against the screw g^2 a spiral spring is attached to the lower end of the frame, above the axis on which it works, and on the lever y moving outward from the saw-frame the action of the spiral spring keeps the frame against the screw g^2. The lever y is fastened on the rocking shaft u, on which is a lever, v, (also fast to shaft u,) connecting with lever w by rod and spring i^2 on rocking shaft j^2. On other end of this shaft j^2 is a cam-lever, k^2, operated by cam l^2. The lever k^2 is held to the cam by the action of a spiral spring. The adjusting-screw g^2 is to set the saw to cut the required depth in the head of the blank.

The adjusting-screw j^1 is to adjust the saw transversely and centrally with the blank-head. The spring m^2 keeps the point of the screw j^1 against slide X.

To hold the blank firm while the saw K is operating, the shaving-spindle moves downward, as already described, with a blank in the grasp of the griping-jaws d^2 on the rest J, and is grasped by the lever U′ through the action of a spring acting on the lever and cam n^2. When the blank is nicked the lever U′ is lifted from the blank through the action of cam n^2, and the shaving-spindle is free to be returned to its previous position.

I will now describe the mechanism for pushing in the blank and working the shaver back-rest H. The saw-frame M is also operated by a portion of this mechanism. The cam l^2 gives motion to the lever k^2 on the end of the oscillating shaft j^2, Figs. 1, 2, 4, and 5, on the other end of which is a lever or arm, w, connected to the lever v by rod and spring i^2. The lever v is fast on shaft u. On this shaft is also fastened a lever, y, giving motion to the slide b^1, to which is attached a rod, d^1, passing through the frame of the machine, and connected with the sliding cam g^1, which gives the required motion for working the back-rest H. On the lever y is a swivel, p^2, through which passes an adjusting-screw, g^2, connecting with the screw-frame, as previously described. On the end of the slide b^1 is a rod, c^1, to push the blank (when delivered by carrier, not shown in the drawings) into the shav-

ing-spindle, to be griped by the jaws. The rod c^1 also allows the blank to butt against it when being delivered from the shaver-jaws after being shaved and nicked, so that the blank may be received by the carrier-fingers.

I will now describe the operation of the oscillating and semi-rotary carrier D, Figs. 1, 2, 3, 4, 5. This carrier has a pair of adjustable fingers on each end. The fingers *a* are pivoted to the head of the carrier D, and have spiral springs q^2 q^2, which keep them in position in relation to the other fingers, *c c*, which are also pivoted to the head of the carrier D, and have spiral springs r^2 r^2 to keep them against the set-screws *d d*. (See Fig. 1.) The said mentioned set-screws *d d* are to regulate the fingers centrally with the shaving and worming spindles, and by the action of the above-named springs the fingers are kept in proper position; but when their functions are required they are enabled to grasp a blank; also, in case a blank does not run axially in the shaving or worming spindle, the fingers *a a c c* are allowed to follow the motion of the blank, and by the action of the before-mentioned springs the fingers are brought in their position against the set-screw as soon as the blank is relieved from the before-mentioned spindles.

Figs. 9 and 10 shown another method of adjustable finger. l^3 m^3 are flexible steel fingers, fastened to lever n^3, pivoted in head of carrier D, and is free to move on the pin o^3. *d* is a set-screw for adjusting the fingers, and p^3 is a spiral spring to keep the fingers bearing on the end of the set-screw.

The mechanism for giving the oscillating and semi-rotary motion is as follows: To obtain the latter motion of the carrier D, I fasten it on a shaft, *j*, Fig. 1, in the carrier-frame C, the center of the shaft being common to the axis of both fingers. On the shaft *j* is fastened a bevel-pinion, *f*, gearing into a bevel-wheel, *g*, Fig. 4, loose on the oscillating shaft L. On this shaft L is fastened the carrier-frame C. Attached to the bevel-wheel *g* is a ratchet-wheel, *i*, into which gears a pawl, *h*, pivoted to a lever, V, on the hollow oscillating shaft S^2. On the other end of the hollow oscillating shaft S^2 is another lever, *l*, connected by rod *n* to lever t^2, Figs. 3 and 4, working on cam v^1, by which the semi-rotary motion is given to the carrier D. To hold the carrier in relation to the shaving and worming spindles after the semi-revolution has been given to it, a disk-plate, *b*, having notches j^3 j^3 diametrically opposite to each other, is fastened on the shaft *j*, and a spring-stop, *e*, Fig. 1, enters and holds it until it is to be rotated another half-turn. The bevel-wheel *g* being attached to the ratchet-wheel *i* and loose on the shaft L, as already described, and the oscillating motion of the carrier-frame C, and the bevel-wheel *g* being in gear with the bevel-pinion *f*, also oscillating with the carrier-frame C, it is therefore necessary that the pawl *h* should not be in gear with the ratchet-wheel *i* until required to give the carrier D the semi-rotary motion; and to accomplish this the lever V, with its pawl *h*, has a little longer traverse than is necessary to rotate the carrier D a semi-revolution, and the pawl *h*, having on it a projection, comes in contact with a portion of the frame *k*, Figs. 1 and 4, of the machine, which lifts the pawl clear of the ratchet-wheel *g* and holds it in this position until required to give another semi-revolution. To give the semi-revolution of the carrier the movement of the lever V allows the pawl to fall into and gear with the ratchet-wheel *i* at the proper time.

I will now describe the oscillating motion of the carrier D. The carrier-frame C (containing the carrier D and the adjuncts described) is fastened on shaft L, which passes through the hollow shaft S^2, (being loose therein,) and has a bearing on the frame of the machine. The shaft L has fastened on it a lever or arm, *m*, Figs. 3, 4, and 5, connected with a cam-lever, u^2, by connecting-rod *o*. This cam-lever u^2 has motion given to it by a cam, w^1, which produces the oscillating of the carrier D required. The lever u^2 is held on the cam by a spiral spring.

I will now describe the motion for operating the back-rest T, Figs. 1, 2 and 4, and pushing the blank into the worming-spindle E. A cam, g^1, gives motion to lever v^2, fastened on a hollow rocking shaft, w^2, on the other end of which is a lever, *x*, working (by means of rod and spring x^2) a lever, *z*, which in its turn works a slide, a^1. Connected with this slide is a rod, e^1, sliding through the frame of the machine and fastened to the sliding cam U, which gives the necessary movements to the back-rest T. On the end of the slide a^1 is a rod, f^1, which at the proper time pushes in the blank brought by the carrier-fingers into the worming-spindle.

I will now proceed to describe the devices for pointing the blank, (see Figs. 1, 2 and 4,) consisting of the tool-holder I′, which carries its pointing-tool and is free to slide on bar R, upright shaft W, with levers p^1 and o^1, and oscillating in fixing A^1, and operated by lever m^1 through rod n^1 by cam o^2. When the blank is griped by the worming-jaws b^2, lever p^1 pushes tool-holder I′, carrying pointing-cutter, toward the end of the blank, and by its movement forward carries an arm projecting from it with adjusting-screw G along the former *g*, which has on it a projection which gives a rocking motion to the tool-holder I′ and presses it forward to point the blank. Screw G^1 is for adjusting pointing-tool to the required depth after the blank is pointed. The tool-holder I′ is allowed to fall back from the end of the blank to its former position by the action of a spiral spring.

I will now describe the mechanism connected with the worming operation, Figs. 1, 2, 3, 4, and 6.

E is the worming-spindle; b^2, griping-jaws;

L^2, sleeve containing wedge a^2 for closing jaws b^2; K′, pulley; S, tool-holder carrying cutter fastened on bar R, on which is a projecting arm, B^2, with adjusting-screw H′, back-rest T, containing die for steadying blank; U, sliding cam for operating back-rest T, spur-pinion W^1, gearing in wheel X′, on which is fastened pinion Y′, gearing in its turn with wheel Z′ and giving motion to shaft D^1, on which is fastened cam C′ for giving longitudinal motion to bar R through slide P, to which is fastened tongue Q.

When it is required to discharge the finished screw in the worming-spindle and admit a blank to be operated upon, the tongue Q is disengaged from the arm a^3, Fig. 3, and allows the tool-holder to remain stationary. This is effected by the cam s' working cam-lever b^4, which is connected by a rod, c^3, to lever T′, pivoted to the transverse slide A^2. The time for changing the blank in the worming-spindle having arrived, the cam s' allows the transverse slide A^2 to move inward toward the machine and disengages the tongue Q from arm a^3, fastened to bar R. The cam s' also forces the point of the cutter against the blanks to give the requisite depth of thread. Cam B′ acts on pin b^3, attached to lever T′. This motion allows the tool-holder carrying worming-tool to fall back from the blank at every pass over of the cutter, for, the blank not being finished at one cut, it is necessary that the cutter should clear the blank when traversing back to commence another cut across it, and while the cutter is traversing across the blank it is being forced deeper at every traverse by cam s' until it has had the required number of traverses to finish the screw. At each traverse of the bar R rearward the set-screw w^1 strikes against the frame, and when the tongue Q disengages from arm a^3 keeps the bar in right position to be engaged by the tongue at the required time. Former F^1 is attached to the end of the slide A^2, which acts against the adjusting-screw H′, passing through the arm B^2, and causes the cutter to move farther forward as it approaches the end of the blank, by which means a gimlet-point is given to the screw. The screw H′ is kept on face of former F^1 by a spiral spring, which also brings bar R back for each separate traverse.

The griping of the worming-jaws is performed in the following manner: On the sliding rod S^1 is a pin, d^4, which works in the cam-groove z', which gives a longitudinal motion to the rod S^1, which works the lever R^1 by means of two collars, e^3 e^3, fastened on the rod. The lever R^1 is pivoted on the fixing C^2, and is attached to the sleeve L^2 by pins c^2 c^2 in the groove on sleeve, and moves the sleeve L^2, on which is wedged piece a^2, sliding inside the worming-spindle, which, on being drawn away from the griping-jaws b^2, the jaws are opened by springs k^3 k^3, fastened to them and pressing on the under side of the sleeve L^2. When the sleeve is moved forward the jaws are closed on the blank.

I will now give a brief description, showing how a screw-blank is finished in this machine.

The blank is fed into the shaving-spindle from the conductor or hopper-rail in the ordinary way (not shown in the drawings) and grasped by the jaws of the spindle, which rotates the blank against the shaving-tool to turn up the head. After the blank has been shaved the shaving-spindle falls down in an arc of a circle and moves inward toward the machine, carrying the blank still in the grasp of the jaws. This movement inward of the shaving-spindle causes the belt which drives it to become slack, and therefore the rotary motion of the spindle ceases. The spindle having fallen down, as already described, the blank is grasped by a lever onto a rest and nicked by the nicking-saw. After the latter operation is performed, the shaving-spindle is moved upward by the mechanism already described, and the belt is tightened and rotates the spindle. The blank is now reshaved, or the burr taken off which was left by the saw. The carrier-fingers now descend and pass over the blank, which is released from the griping-jaws and pushed out from the spindle by a spring. By the oscillating motion connected with the carrier-fingers the blank is now taken away from the shaving-spindle, and the shaving-spindle is free to operate on another blank in a similar manner. The carrier-fingers on the other end of the oscillating and semi-rotary carrier, having previously obtained a blank in like manner, and the carrier having received a semi-rotary motion, as previously described, move down to the worming-spindle, when the blank is pushed into the worming-spindle to be operated upon by the worming mechanism, and the blank is rotated by the griping-jaws of the worming-spindle and operated upon by a pointing-tool to prepare the point. The worming-cutter then passes over the blank a sufficient number of times to cut the thread by the mechanism previously described, and when the screw is finished the jaws are released and the blank is let fall into a receptacle below.

I claim as my invention—

1. In a screw-machine, the double carrier D, provided with adjustable fingers at each end, in combination with mechanism for imparting thereto an oscillating and semi-rotary motion, as set forth.

2. The combination of the double carrier D with the shaving-spindle A and worming-spindle E and mechanism for imparting an oscillating and semi-rotary motion to the said carrier, substantially as and for the purpose set forth.

3. The combination of the worming-spindle with the pointing-cutter holder I′, former q, vertical shaft W, lever p^1, and mechanism for operating said shaft W.

4. The combination of the worming-spindle with cutter-holder I′, former q, screw G^1, shaft W, levers o^1 and p^1, rod n^1, lever m^1, and cam o^2, all substantially as specified.

5. The combination of a spindle, E, worming-cutter holder S, sliding and oscillating bar R, arm a^3, slide P, and tongue Q, as set forth.

6. The combination of a spindle, E, worming-cutter holder S, and bar R, having an arm, B^2, with slide A^2 and former F^1 and devices for operating said slide, substantially as described.

7. The carrier D, provided with pivoted spring-fingers, set-screw d, and spring r^2 p^3, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

THOS. O. BENNETT.

Witnesses:
JNO. HUGHES,
CHARLES DAVIES.