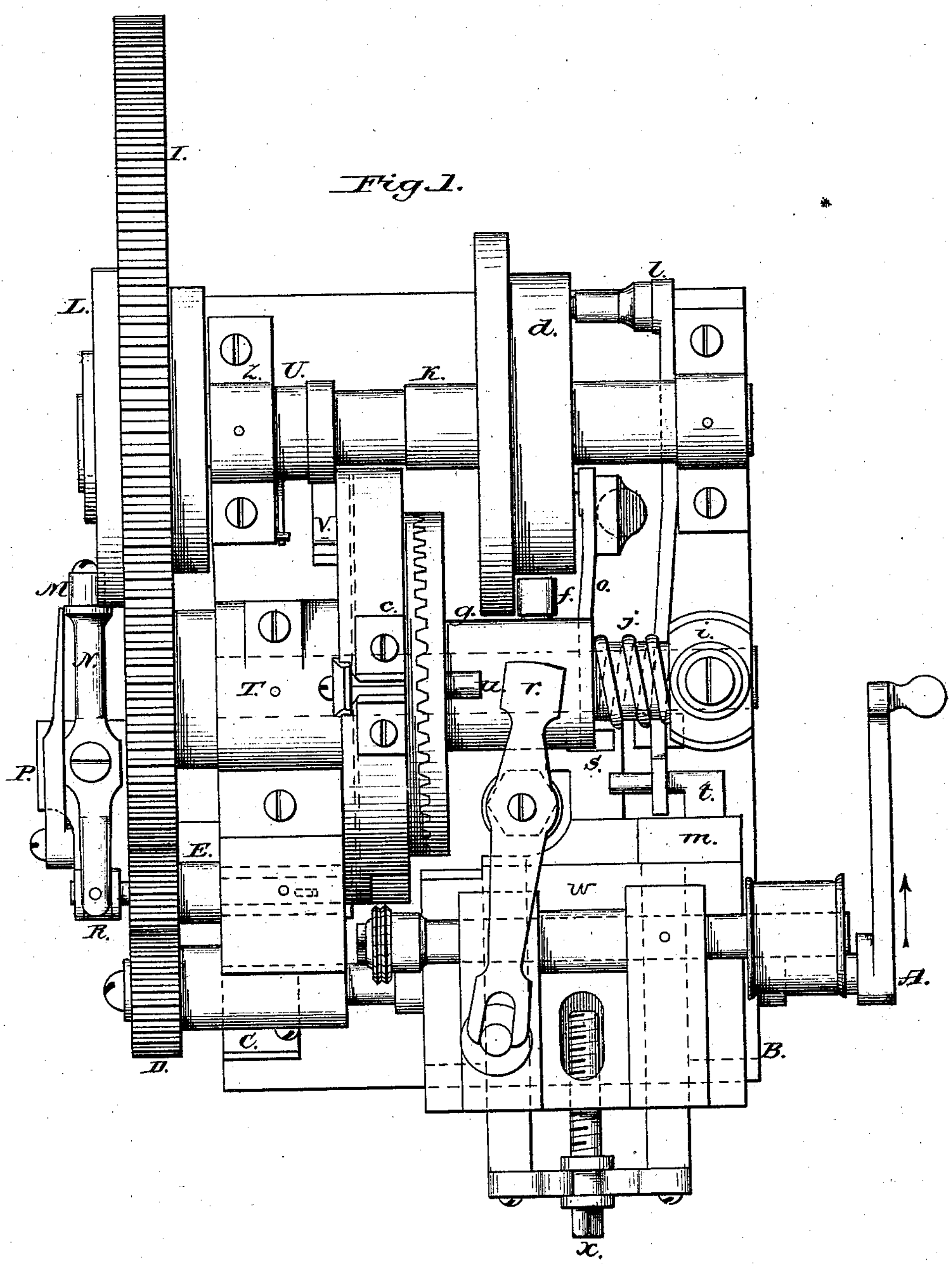
4 Sheets--Sheet 1.

B. A. MASON.

Machine for Threading Wood Screws.

No. 166,121. Patented July 27, 1875.

Fig. 1.



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4 Sheets--Sheet 2.

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Fig. 2.

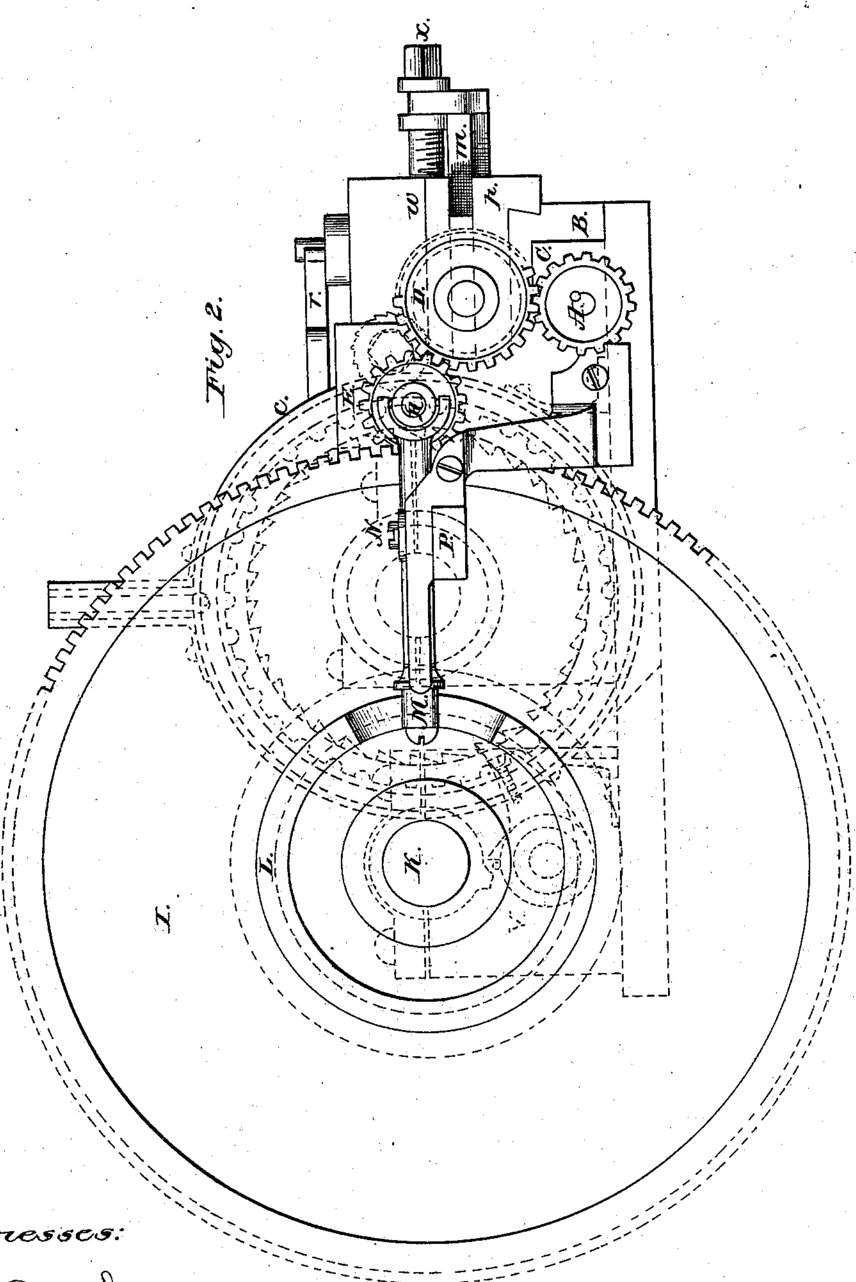

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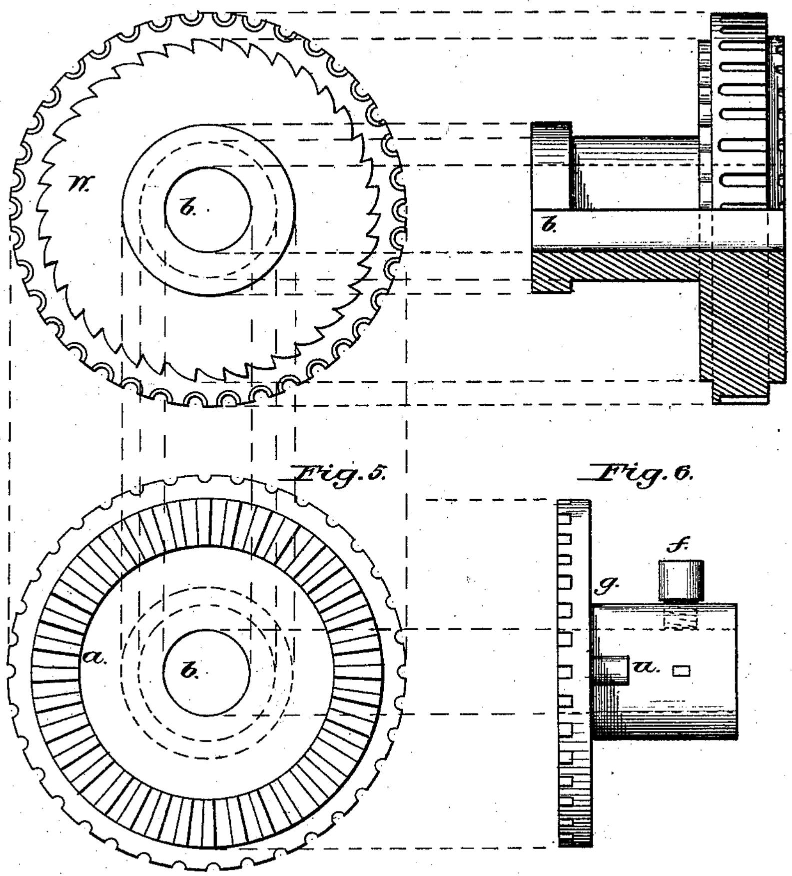
Fig. 4. Fig. 3.

Fig. 5. Fig. 6.



E. Fig. 7.

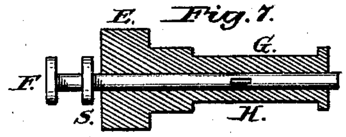


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Fig. 8.

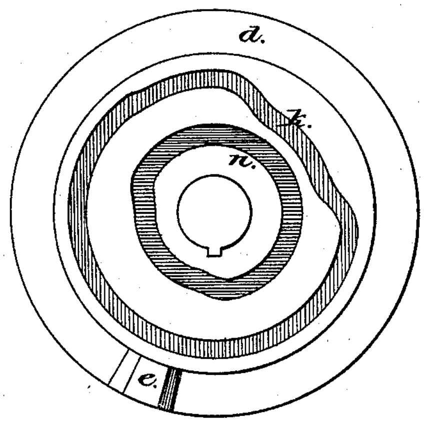


Fig. 9.

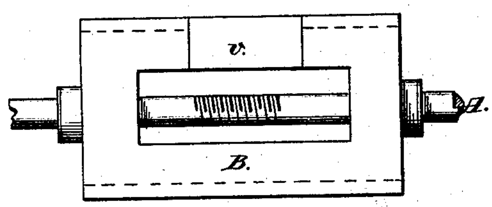
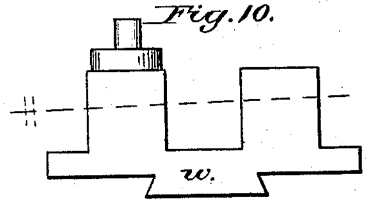


Fig. 10.



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UNITED STATES PATENT OFFICE.

BENJAMIN A. MASON, OF NEW YORK, N. Y.

IMPROVEMENT IN MACHINES FOR THREADING WOOD-SCREWS.

Specification forming part of Letters Patent No. **166,121**, dated July 27, 1875; application filed July 12, 1875.

To all whom it may concern:

Be it known that I, BENJAMIN A. MASON, of the city, county, and State of New York, have invented a new and useful Improvement in Machinery for the Manufacture of Gimlet-Pointed Screws; and that the following is a full description of the same, reference being had to the accompanying drawings forming a part of this specification, in which—

Figure 1 is a plan of the machine. Fig. 2 is a side elevation, showing the gearing. Fig. 3 is a plan of the rotating blank-holder, part shown in section. Fig. 4 is a front view of Fig. 3. Fig. 5 is a rear or end view of Fig. 4. Fig. 6 is a plan of clutch, operating with clutch on face of blank-holder. Fig. 7 is a plan of screw-driver with sectional view of the rotating sleeve through which it plays, and by which it is operated. Fig. 8 is a plan of cam-disk that operates the clutch that holds the blank-holder, and by the cam-grooves imparts the requisite movements to the tool-carriage, and also the nut working in the leading-screw upon the main driving-shaft of the machine. Fig. 9 is a plan view of tool-carriage bed, showing the driving-shaft passing through. Fig. 10 is a front elevation of tool-slide, showing the axis of the cutter-shaft and its inclination by dotted lines.

The same letters indicate like parts in all the drawings.

Upon reference to these drawings it will be readily seen that the machine is simple in design, economical in all its parts and arrangements, and that I cut or thread screws with less machinery and intricate or complicated movements than has been done heretofore; and, furthermore, that the severe strain and resultant wear and tear which other machines for like purposes are incessantly subjected to is avoided, and not experienced by my mechanism, even when run at comparatively high velocity.

By my invention screws are threaded rapidly, uniformly, and economically.

I now proceed to describe the structure and operation of the machine.

Power being communicated to the shaft A, Fig. 1, by a suitable pulley, the shaft rotates in the direction of the arrow, Fig. 1, and is retained in suitable bearings as it passes longitudinally through the ends of the bed B, Fig. 1, and the bearing C, Fig. 1, the shaft being turned smaller at these points. The same result may be obtained by the use of collars upon the shaft. Upon that portion of the shaft within the bed B a thread is cut, having the same pitch as that intended to be cut upon the screw-blank. On the extreme end of the shaft A, where it projects beyond the bearing C, a small gear is placed, and secured by a key in the usual manner. This wheel, in rotating, imparts motion to the intermediate gear D, Fig. 2, and through it power to the gear E, Fig. 1, which, in turn, rotates the screw-driver F, Fig. 7, working in the sleeve G, Fig. 7, with an intermittent longitudinal movement while rotating. The gear on the outer end of the sleeve G is the same size, and has the same number of teeth as the gear at the end of the driving-shaft A; consequently the screw-driver makes the same number of revolutions as shaft A, and, by the introduction of the intermediate gear D, rotates in the same direction. There is a slot cut through the body of the screw-driver, as shown at H, Fig. 7, through which a pin passes, and is held in place by being riveted in the walls of the sleeve.

It will be observed that the gear E forms a part of the sleeve, and that the pin passing through the slot H in the screw-driver rotates the latter, while the length of the slot limits the longitudinal movement of the driver. The end of the screw-driver is fitted to enter the nick in the head of the screw-blank to rotate it while being threaded, as hereafter described.

The gear E imparts motion to the large gear-wheel I, Fig. 2, mounted upon shaft K, Fig. 1, having its bearings near the edges of the bed-plate, and at the rear end of the same. Upon the side of this wheel is a circular cam, L, Fig. 2, or ring, against which the roller M, Fig. 1, continually impinges, by the action of the spring pressing against the end of the lever N, Fig. 1, carrying the roller M, Fig. 1, at its extremity. The fulcrum of this lever is at P, Fig. 1. The short arm of the lever, being flattened and forked at the end, controls the longitudinal movement of the screw-driver F by the sleeve R, Fig. 2. This sleeve is a ring fitting the end of the screw-driver, and rests outside against a collar on the end of the shaft and the shoulder S, Fig. 7, on the shaft. The sleeve being secured to the forked ends of the lever by pins, the driver is free to revolve within the ring, and is pressed up against the head of the screw-blank while the roller M is moving over the face of the revolving cam-ring L, but is withdrawn when the recess in the face of the cam is in position, by the revolution of the wheel I, to allow the spring to press the end of the lever inward, so as to force the roller M into the recess, thereby withdrawing the screw-driver from the head of the threaded blank, and keeping it in that position while the finished screw is removed, and a new blank is brought to its place, when the forward movement to the blank is made by the continually advancing or rotating cam pressing the roller M outward, carrying the screw-driver to the nick in the head of the blank, and rotates it against the cutting mechanism.

The rotating blank-holder, Fig. 3, is mounted in the bearing T, Fig. 1, and rotates intermittently toward the front of the machine. This movement is attained by the action of the cam U, Fig. 1, on the shaft K, Fig. 1, the toe of which, at each revolution of the shaft, impinges against the toe of the lever V, (shown by dotted lines in Fig. 2,) in contact with a tooth of the ratchet-wheel W, Fig. 4, and moves the blank-holder one tooth or space. The lever V is mounted on a stud-pin (below the shaft K) in the inside wall of the pillar-block Z, upon which it moves freely, and is retained on the stud-pin by a nut on the end of the same.

The blank-holder has thirty-six recesses cut horizontally in its periphery, equidistant. (I do not limit myself to the number of these recesses, as they may be more or less, as desired.) These recesses are receptacles for the screw-blanks, receiving them, one at a time, from the foot of the ways Y, Fig. 2, taking them in turn to the cutters, and from thence to the place of discharge beneath the machine. These recesses are a little less in depth than one-half the diameter of the screw-blank to be threaded, are countersunk at one side to admit the beveled side of the head of the blank, and allow the blank to revolve freely in the recess. Upon the face of the blank-holder are thirty-six teeth, the centers of which are radial lines drawn from the axis of the holder through the center or axis of the screw-blank receptacles. These are shown at *a*, Fig. 5, while in like manner, at W, Fig. 4, thirty-six ratchet-teeth are seen. The latter, as will be seen, are ratchet-teeth. The former are for the purpose of holding the blank-holder firmly in place while the blank is being threaded, and perform the office of a clutch, and should correspond (in both cases) to the number of receptacles in the blank-holder. The blank-holder is bored out at its center, as shown at *b*, Figs. 3, 4, and 5, and is chamfered or beveled off at the edge where countersunk for the heads of the blanks to rest, so as to allow the blank-head to drop from the feeding-ways into a recess, without difficulty or danger of impinging against the guard plate or ring, hereafter described.

The guard plate or ring *c*, Figs. 1 and 2, encircles the blank-holder, and covers that portion of its circumference containing the blank-receptacles, except as hereafter described. The guard projects inward on the back side of the blank-holder to near the edge of the ratchet-wheel. Through this rim a hole is bored in line with the screw-driver, to admit the latter through the guard, and reach the screw-blank lying in a recess in the blank-holder. This hole is less in diameter than the head of the blank, so that in withdrawing the driver from the nick the head will not be drawn through the guard, nor the rotation of the blank-holder impeded, which would be the result if the hole in the guard is the same size as the head of the blank. The inner edge of the guard is designed to be of a diameter that will allow a screw-blank of a desired size to lie or be rotated in the rim of the blank-holder, as described, one-half within the circumference of the same, the other half in the open space between the rim of the holder and the inner edge of the guard, the rear wall of which is beveled to take one-half the beveled head of the screw-blank, so that it will be rotated between the two without difficulty. The blanks descending in the vertical ways Y, Fig. 2, rest, one at a time, on the rim of the holder or drop in a recess, as the case may be. When the ratchet W is operated a blank will fall into a recess in the rim as the disk advances one space, while the succeeding blank in the ways will fall upon the disk and remain there until the next movement of the disk advances it one space, and so on, the space between the guard and the disk being insufficient to permit a blank to pass the opening in the guard at the foot of the ways unless one-half of it rests horizontally in a recess in the disk. The blanks thus moved intermittently forward reach, in succession, the screw-driver, and, after being rotated and threaded, pass, by the rotation of the disk, to a point in the guard beneath the bed, where they drop through an opening in the guard made for that purpose into a receptacle prepared for them. At the foot of the ways Y the guard is cut through to allow the blanks to pass. In line with the screw-driver a portion of the guard sufficient to expose that portion of the blank to be threaded to the action of the cutters is removed, the opening being so shaped as to admit the revolving cutters or milling-tools to revolve without contact with anything but the screw-blank.

On the shaft K the cam-disk *d*, Figs. 1 and 8, is properly keyed. This disk, in making one revolution, (the same as the wheel I,) performs the following work: Upon the rim forming its greatest diameter is secured a piece, the two ends of which form inclined planes, as seen, *e*, Fig. 8, which, in coming in contact with the roller *f*, Figs. 1 and 6, forces the sliding clutch *g*, Figs. 1 and 6, outward from its contact with the teeth on the face of the blank-holder, (already described,) and permits the latter to be rotated one space, while the flat portion of the wedge or double incline presses against the roller *f*. By this pressure the clutch *g* slides longitudinally on a feather (either in the clutch or the shaft, as may be) on the shaft *h*, which rests one end in the hole in the journal of the blank-holder, Fig. 3, the other in the pillar-block *i*, Fig. 1, and is prevented from any movement by a set-screw passing vertically through the top of the pillar-block *i*. Thus secured the clutch *g* has only a longitudinal movement, and, when in contact with the teeth which are on the face of the blank-holder, holds the latter perfectly still while a screw is being cut—an essential feature in this combination. The wedge or incline *e* having passed the roller *f*, the clutch is forced forward, and engages the teeth on the face of the blank-holder by action of the spring *j*, Fig. 1.

On the side of the cam-disk *d* the cam-groove *k*, Fig. 8, is seen. In this groove runs a roller mounted on a pin projecting from the sliding bar *l*, Fig. 1. This bar connects with a slide at *m*, Fig. 1, forming a part of the tool-carriage. This cam is so shaped that, the milling-tools or cutters being opposite to that portion of the blank where the thread is to be commenced, the cam by its rotation draws them in toward the center or axis of the blank, until the desired depth of thread is reached in the blank, (the tool-carriage being in motion, as hereafter described,) which will be attained in about one and one-half revolution of the screw-blank. The groove retains this depth of thread along the blank until the commencement of the point is reached, when the groove draws the milling-tools or cutters steadily in until the point of the screw is formed. The groove then throws the tool-slide back, so that the tools will not strike the blank-holder and guard when carried back to their normal position. On the same face of the disk the cam-groove *n*, Fig. 8, is cut. A roller runs in this groove, and is mounted upon a pin in sliding bar *o*, Fig. 1, which connects with and operates the half-nut sliding in proper slides on the under side of the tool-carriage or sliding bed *p*, Fig. 1. The groove is shaped to throw the nut in gear with the thread on the driving-shaft A, and imparts motion to the tool-carriage when the screw-blank begins to rotate, and keeps in gear until the tools have passed over the blank, when the groove withdraws the nut, and keeps it out of gear until the carriage is moved back to cut another screw, when it throws the nut in gear again, and withdraws the same in like manner.

The sliding bar *l*, at its contact with the slide, has a hole in it to permit the pintle *t*, Fig. 1, on the slide to move freely through it, and the slide-bar *o* has a hook on its end in contact with and running vertically through a slot in the projecting arm of the half-nut, as seen at S, Fig. 1, which also allows the slide to move without hinderance.

The tool-carriage and slide having been carried by action of the half-nut gearing in shaft A the desired distance and stopped by withdrawal of the nut, they are moved back by the action of the lever *r*, Fig. 1, the short arm of which having by movement of the long arm connected with the tool-carriage reached, when stopped, the projection *u*, Fig. 6, on the barrel of clutch *g*, and when the clutch is forced back by action of the cam-disk *d*, contact with the lever-arm *r* moves the carriage back to its starting-point.

On the sides of the bed B, Fig. 1, near the upper edge, are cut grooves to receive the angular slides on the under side of the bed of the tool-carriage, in which they move in the usual manner.

The bed B is cut away in a portion of its inner wall, as shown at *v*, Fig. 9. This is done to afford room for the half-nut moving in slides on the under side of slide *p* to move freely while the slide passes from left to right and from right to left. On the upper side of slide *p* is fitted a plate to slide transversely in groove planed for the purpose. This plate is moved forward and back, as already described, by sliding bar *l*, Fig. 1, and cam-groove *k*, Fig. 8, connecting with the plate by hook at *m*, Fig. 1.

In the surface or upper face of the latter-described slide a groove is planed, in the usual manner, for a slide across its face and in the center of the same. In this last-mentioned groove slides the tool-carriage proper, *w*. This consists of a plate carrying on its upper side two raised boxes or frames to carry the cutter-shaft and its driving-pulley, and is adjusted by the screw *x*, attached to the plate *m*.

This screw is shown, *x*, Fig. 1, and is for the purpose of regulating, in conjunction with the cam-groove *k*, Fig. 8, the depth of the thread to be cut on the screw-blank.

One end of the shaft carrying the cutters is so raised above the horizontal plane as to incline the milling-tools to the angle of the screw-thread to be cut, as shown by dotted lines, Fig. 10. The object in raising one end of the shaft, so as to produce the desired inclination above the horizontal plane, is to prevent the cutting away the upper side of the thread more than the under side, which will be the result if the shaft rotates in the horizontal plane.

In describing the milling-tools or cutters I do not wish to be understood to limit myself to the use of two, as shown in the drawings. On the contrary, I claim for my purpose the use of one or more, or a series of tools arranged as described. These tools are circular, small in diameter, and placed on the shaft equidistant, one to the other, with the pitch of the thread to be cut. They have beveled teeth that cut at the sides as well as at the point. They are so arranged that the leading cutter does not cut a full thread. It has less face than the others, which are so graduated as to finish a full thread by the last or end cutter. They revolve at a high rate of speed, and are kept cool by proper lubrication. The other parts of the machine move at a low rate of speed, and are free from all the sudden and violent shocks so often experienced in other machines.

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

1. The cam on the face of the wheel I, in combination with the rotating sliding turn-screw and lever, substantially as described, and for the purpose set forth.

2. The cylindrical blank holder and carrier, with clutch-teeth on its face, ratchet-teeth on its rear, and the hollow journal, substantially as described, and for the purpose set forth.

3. The combination of the sliding clutch-disk *g* and the roller *f*, by which it is operated, the shaft and bearings upon which it moves, and the feather *u* upon the exterior of the barrel for operating the lever *r*, substantially as described, and for the purpose set forth.

4. The cam U on the shaft K, in combination with the vibrating lever V, mounted on stud-pin F, substantially as described, and for the purpose set forth.

5. The cam-disk *d*, having the wedge *e*, and the cam-grooves *k* and *n*, substantially as described, and for the purpose set forth.

6. The sliding bar *l* and the sliding bar *o* and their connection, in combination with the cam-disk *d*, the half-nut slide, and tool-carriage, substantially as described, and for the purpose set forth.

7. The automatic sliding tool-carriage, operating as herein described, in combination with the rotating milling-tools and the blank holder or carrier, substantially as described, and for the purpose set forth.

8. The combination of the cam-groove disk *d*, tool-carriage *w*, bar *l*, and adjusting-screw *x*, as and for the purpose set forth.

9. The combination of the intermittingly-rotating screw-blank carrier and holder, the rotating screw-driver for revolving the screw-blank, one or more revolving milling-tools for cutting the thread on the blank, and mechanism to impart to said tool or tools the proper feed movement toward the axis, and also longitudinally of the blank, the combination being and operating substantially as described.

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