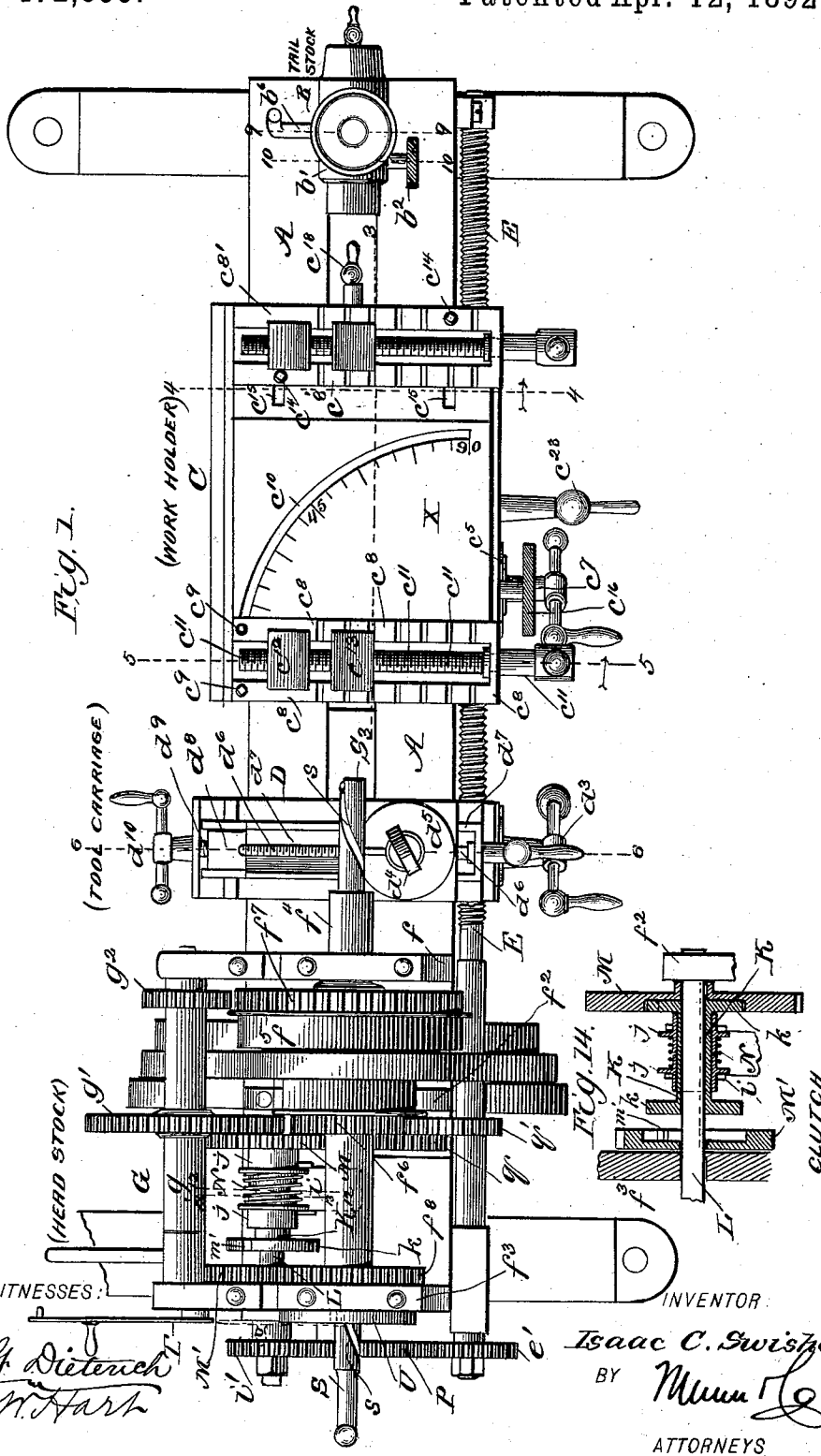


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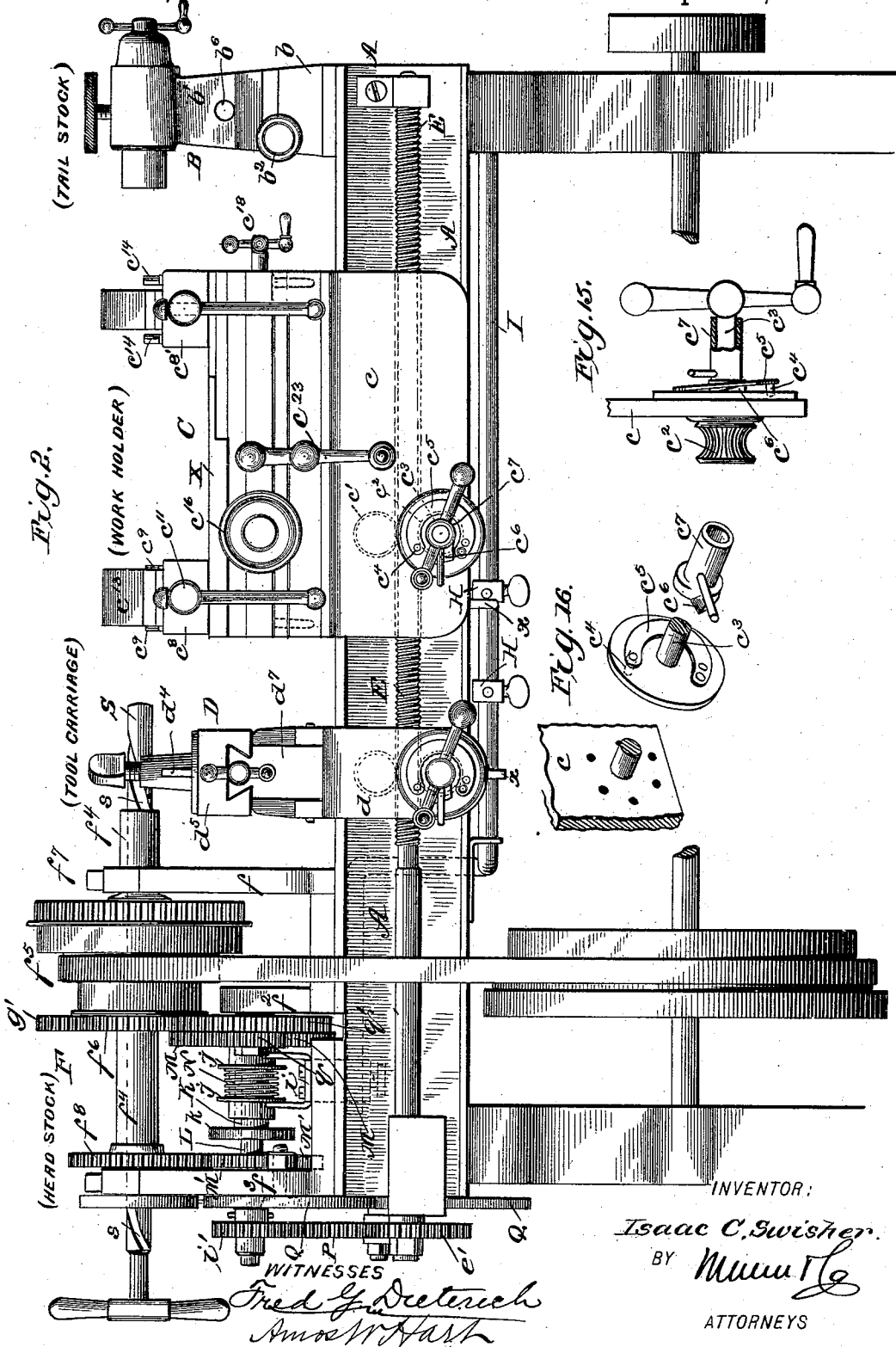


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Fig. 3.

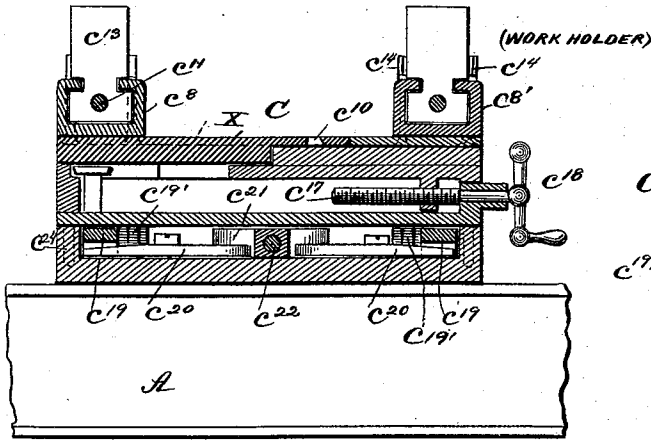


Fig. 4.

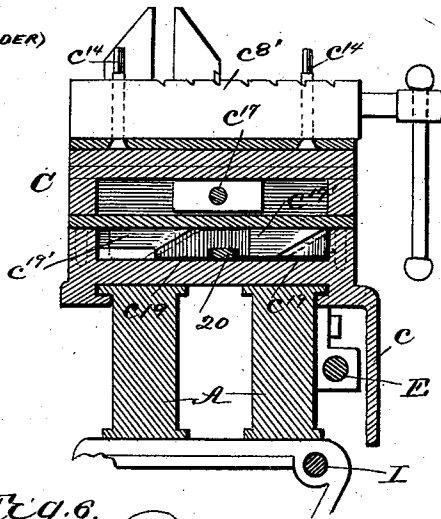


Fig. 5.

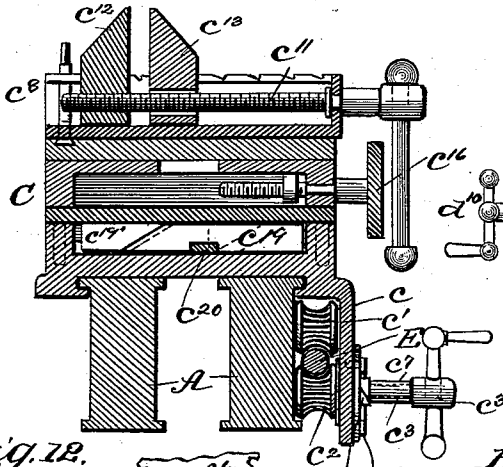


Fig. 6.

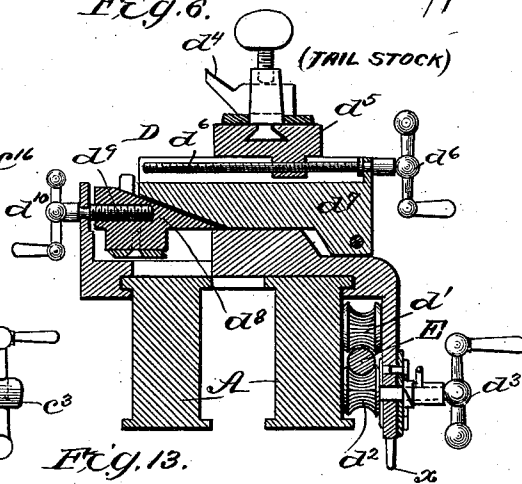
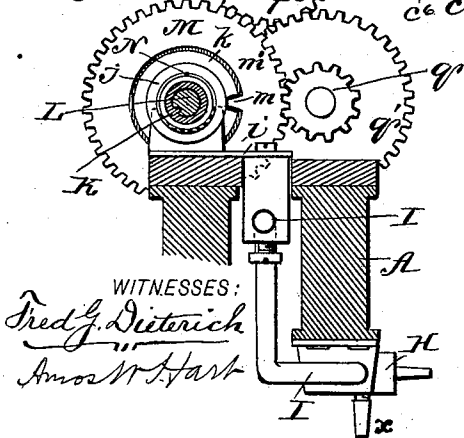
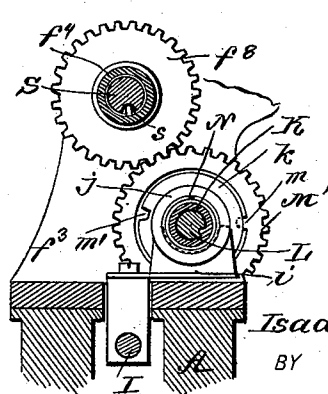


Fig. 12.



WITNESSES:  
*Fred J. Dieterich*  
*Amos W. Hart*

Fig. 13.



INVENTOR:  
*Isaac C. Swisher*  
 BY *Manuel G.*  
 ATTORNEYS



# UNITED STATES PATENT OFFICE.

ISAAC C. SWISHER, OF COFFEYVILLE, KANSAS.

## AUTOMATIC METAL BORING AND TURNING LATHE.

SPECIFICATION forming part of Letters Patent No. 472,833, dated April 12, 1892.

Application filed October 26, 1891. Serial No. 409,930. (No model.)

*To all whom it may concern:*

Be it known that I, ISAAC C. SWISHER, residing at Coffeyville, county of Montgomery, and State of Kansas, have invented certain new and useful Improvements in Automatic Metal Boring and Turning Lathes, of which the following is a specification.

My improved lathe is adapted for use in boring and mortising, shaping, turning, and screw-cutting, as well as milling, planing, and rifling.

I have devised improvements in various parts which enable me to operate on objects of greatly differing shapes and to do more accurate and varied work than is usual in this class of lathes.

In the drawings, (four sheets,) Figure 1, Sheet 1, is a plan view of the lathe; and Fig. 2, Sheet 2, is a side view of the same. Fig. 3, Sheet 3, is a longitudinal section of the so-called "work-holder" on line 3 3 of Fig. 1. Figs. 4 and 5, Sheet 3, are transverse vertical sections of the work-holder on lines 4 4 and 5 5, respectively, of Fig. 1. Fig. 6, Sheet 3, is a vertical section of the tool-carriage on line 6 6 of Fig. 1. Fig. 7, Sheet 4, is a plan view of the (inverted) top portion of the work-holder. Fig. 8, Sheet 4, is a plan view of the base or bottom portion of the work-holder. Fig. 9, Sheet 4, is a transverse vertical section of the tail-stock and bed of the lathe. Fig. 10, Sheet 4, is another section of a portion of the same. Fig. 11, Sheet 4, is an end view of the lathe. Figs. 12 and 13, Sheet 3, are vertical sections of the clutch and other gearing in the head-stock on lines 12 12 and 13 13, respectively, of Fig. 1. Fig. 14, Sheet 1, is an enlarged longitudinal section of the clutch mechanism. Fig. 15, Sheet 2, is mainly a side view of the mechanism for locking and releasing one of the worm-gears that meshes with the feed-screw. Fig. 16, Sheet 2, is a perspective view of the parts of such mechanism separated.

The bed A of the lathe has the usual parallel shears or ways on which the tail-stock B, work-holder C, and tool-carriage D are mounted and adapted to slide. The tail-stock B is adjustable on the bed A, and is provided with means that will presently be described for clamping it in any position; but the tool-carriage D and work-holder C are reciprocated automatically by the feed-screw E, ar-

anged, as usual, on the front of bed A. The head-stock F is fixed on the bed A, and its frame comprises three transverse parallel uprights  $f^2 f^3$ , in which the hollow mandrel, the back gear, and differential clutch-gearing are mounted.

I will describe my improvements as applied to, connected with, or comprising said tail-stock, work-holder, tool-carriage, head-stock, and clutch-gearing in the order here indicated.

The standard of the tail-stock B is formed of two parts, the base  $b$  being fitted to and adapted to slide upon the shears A, while the other  $b'$  is adjustable laterally or transversely on such base by means of a rotating screw  $b^2$ , fitted and working in a threaded cylindrical socket. (Shown in Fig. 10.) The part  $b'$  is clamped to the base  $b$  and both are clamped to the shears A by means of a rod  $b^3$ , passing vertically through said parts  $b b'$ , a nut  $b^4$  and cross-bars  $b^5$ , applied to the threaded lower end of such rod, and a crank-shaft  $b^6$ , having an eccentric portion that passes through and works in a loop formed in the upper end of the rod  $b^3$ . When the angular arm of the crank-shaft  $b^6$  is turned down, the eccentric is at its lowest point, (see dotted lines, Fig. 9) which releases the clamp, so that the tail-stock B may be easily slid or adjusted along the bed A; but when the crank-arm  $b^6$  is turned up the eccentric is correspondingly elevated, which raises the rod  $b^3$  and cross-bar  $b^5$ , whereby the tail-stock B is clamped in place on the bed A and its parts together. This does not, however, prevent lateral adjustment of the head or upper part  $b'$  of the tail-stock, since the eccentric portion of the crank-shaft  $b^6$  is elongated to allow the rod-loop to slide on it lengthwise, and both parts  $b$  and  $b'$  are chambered to allow the requisite lateral movement relatively to each other and of the upper one  $b'$  relative to the clamp-rod  $b^3$ .

The base of the work-holder C slides on the ways A and is provided with a pendent portion or "apron"  $c$ , to the inner side of which two worm-gears  $c' c^2$  (see Figs. 2 and 5) are attached and arranged on opposite sides of the feed-screw E. The upper gear  $c'$  rotates loosely on its pivot, and the lower one  $c^2$  is fast on the crank-shaft  $c^3$ . Both gears are in constant engagement with the feed-screw, so that by rotating the crank-shaft  $c^3$  the work-holder

C may be reciprocated by hand. The said lower gear  $c^2$  may, however, be locked and prevented from rotating when desired to feed the work-holder C by rotation of the feed-screw E. For locking the said gear  $c^2$  I employ a spring-pin  $c^4$ , Fig. 15—that is to say, a pin attached to the free end of a semicircular spring  $c^5$  and adapted to enter holes in the pendent apron  $c$  of the work-holder C. The said spring  $c^5$  is attached to the face of a disk fixed on the crank-shaft  $c^3$ , Figs. 15 and 16, and the pin  $c^4$  works through a hole formed in it, as shown. The spring  $c^5$  holds the pin  $c^4$  normally in one of the holes in apron  $c$ ; but it may be withdrawn by a cam or wedge  $c^6$ , that projects radially from the sleeve  $c^7$ , mounted loosely on the shaft  $c^3$  and provided with a lever-arm, as shown. By rotating said sleeve  $c^7$  the cam  $c^6$  is forced under the spring  $c^5$ , and thus withdraws the pin  $c^4$ , Fig. 15, and thus releases the crank-shaft  $c^3$  and the attached gear  $c^2$ , as will be readily understood.

The work-holders proper are two vises  $c^8$  and  $c^8'$ , mounted on the top plate X of the work-holder C. The one  $c^8$ , Fig. 1, nearest the head-stock F is pivoted at one end and its free end provided with screws  $c^9$ , passing vertically through it and having flanged heads which work in a curved undercut groove  $c^{10}$ , formed in the said top plate. The latter is graduated adjacent to said groove to indicate the linear divisions of an arc of ninety degrees. By turning the screws  $c^9$  the slotted frame of the vise  $c^8$  may be clamped at any desired angle to the head-stock, and by means of the screw  $c^{11}$  the outer jaws  $c^{12}$  of the vise  $c^8$  may be slid toward or from the other jaw  $c^{13}$ , which is manually adjustable in notches of the vise-frame. The other vise  $c^8'$ —namely, the one nearest the tail-stock B—is not pivoted, but adjustable bodily lengthwise of the work-holder C—that is, toward or from the head-stock F—in order to enable it to be used for holding articles of different lengths. It is secured to the top plate X of the work-holder C by means of two screws  $c^{14}$ , whose flanged heads enter and are adjustable in parallel undercut grooves  $c^{15}$ . This arrangement of the vises  $c^8$   $c^8'$  enables them to hold work of various forms, sizes, and length at various angles to the tool that operates on it. Besides this, that portion of the top plate X, having the quadrant groove  $c^{10}$ , is adapted to slide laterally, being operated by a screw  $c^{16}$ , and thus the adaptation for nice adjustment is further increased.

The whole top plate X, with both vises  $c^8$   $c^8'$  attached, is adjustable lengthwise by means of a screw-shaft  $c^{17}$  and ball-crank  $c^{18}$ , Figs. 1 and 2. The top plate of the work-holder with the vises may also be elevated, as required, to bring the work into position relative to the operating-tool. To this end, the bed or base of the work-holder C is recessed, Figs. 3, 4, 5, and 8, to accommodate two parallel transversely-sliding bars  $c^{19}$ , Fig. 8, two pivoted levers  $c^{20}$ , a sliding cross-head  $c^{21}$ , and rotatable

screw-shaft  $c^{22}$ . The latter is arranged transversely and operated by the ball-crank  $c^{23}$ . It passes through the cross-head  $c^{21}$ , whose notched ends receive the inner ends of the levers  $c^{20}$ , whose outer ends enter slots in the bars  $c^{19}$ . The latter have cams or wedge-shaped projections which work in frictional contact with and are dovetailed to corresponding projections or cams formed on the under side of the top portion of the work-holder C. By rotating the screw-shaft  $c^{22}$  the levers  $c^{20}$  are turned on their pivots and the bars  $c^{19}$  thereby slide lengthwise transversely of the work-holder C, thus raising the top portion to the required degree. The said plate is guided in its vertical movement by means of pins  $c^{24}$ , working in sockets, as shown in Figs. 3 and 8.

The tool-carriage D, Figs. 1, 2, and 6, has a pendent apron  $d$ , provided with worm-gears  $d^1$   $d^2$ , a crank-shaft  $d^3$ , a spring locking-pin, cam, and sleeve, like the work-holder C, and which adapt it to operate and be adjusted manually or reciprocated automatically in precisely the same way. The tool  $d^4$ , which is used for cutting screw-threads or for turning off cylindrical surfaces, is adjustably clamped to a block  $d^5$  upon a bar  $d^7$ , that is pivoted at one end of the tool-carriage proper. The free end of this bar  $d^7$  is adjusted vertically in order to better adapt the tool  $d^4$  to the work by means of a wedge  $d^8$ , which slides on the bed of the carriage D, and is adjusted by a screw-shaft  $d^9$  and bell-crank  $d^{10}$ . The free end of the bar  $d^7$  is held between vertical guides, and the wedge  $d^8$  works in a guide-socket formed in it.

I will now describe the parts connected with or forming part of the head-stock. (See Figs. 1 and 2.) The hollow mandrel  $f^4$  is journaled in the outer two of the three uprights  $f^2$   $f^3$  of the head-stock F and provided with a stepped speed-pulley  $f^5$ . Parallel to it is the shaft  $g$  of the back gearing G, Fig. 1, usually employed on engine-lathes, said shaft being mounted eccentrically and thus adapted to be shifted laterally to carry its large and small gears  $g^1$  and  $g^2$  into or out of engagement with corresponding gears  $f^6$  and  $f^7$  on the mandrel  $f^4$ .

I will now describe the clutch-shifting mechanism, which automatically reverses the rotation of the mandrel  $f^4$  and the movement or feed of the work-holder C or tool-carriage D, as the case may be. It will be seen that both the latter have a pendent finger  $x$ , Figs. 2 and 12, which is adapted to come in contact with tappets H on a rod I, arranged under and lengthwise and parallel to the front portion of the lathe-bed A. These tappets are clamped by a thumb-screw, and may hence be adjusted on the rod I as occasion requires. For convenience of description I will suppose the tool-carriage D to be removed from the bed A, or else thrown out of working connection with the feed-screws E, and will refer solely to the automatic operation of the work-holder C, since the same description will apply equally

to the tool-carriage D. The aforesaid rod I slides in its supports, and its front portion (see Fig. 12) is bent inward horizontally, and then upward, and connected with a sliding plate *i*, Figs. 1 and 2, having two forks which engage two flanged sleeves *jj*, Fig. 14, adapted to slide on the sleeve K on a shaft L, and having a spline connection therewith, Fig. 12, and arranged between the large and small gears M M'. The shaft L has its bearing in the outer and intermediate uprights  $f^3$   $f^2$ . The gears M M' are loose on said shaft and have a circular recess on the inner side, Fig. 14, and also a lug *m*, Fig. 12, that projects into the recess, as shown. The sleeve K has a circular flange or head *k* on each end, and each flange has a notch *m'* to receive the lug *m*. A spiral spring N encircles the inner ends of the aforesaid sleeves *jj* and holds them normally separated. It will be seen that when the work-holder C moves in either direction its pendent finger *x* will engage one of the tappets H, and thereby shift the rod I lengthwise, which, through the medium of the forked plate *i*, will move one of the notched heads or flanges *k* of sleeve K out of engagement with one of the recessed gears M or M' and carry the opposite flange *k* into engagement with the other gear M or M', thus reversing the rotation of the feed-screw E, so that the motion of the work-holder C is also reversed. This reversal is effected by gearing that will be presently described. In other words, when the clutch-shifting rod I is thus shifted the effect is at once to remove one of the notched heads *k* out of engagement with the adjacent gear M or M' and to force the other head or flange *k* against the other gear; but it usually happens that the notch or recess *m'* of the latter is not in position to allow the flange or head to enter it, since the notch *m'* and lug *m* of the adjacent and contacted parts do not then coincide; but the spring N holds the parts pressed together until the continued rotation of the gear brings the notch *m'* and lug *m* opposite each other, when it forces the head into the recess in the gear, and thereby effects the engagement.

The gear connection between the mandrel  $f^4$  and shaft L and feed-screw E is effected by the following means: The loose clutch-gear M', Figs. 1 and 2, is in constant mesh with a gear  $f^3$ , which is fast on the mandrel  $f^4$ , and the corresponding but larger clutch-gear M is similarly engaged with a pinion *q*, Figs. 2 and 12, attached to a large gear  $q'$ , that meshes with the small central gear  $f^6$  on the mandrel. The connected pinion *q* and gear  $f^6$  rotate free on a horizontal journal, which is fixed in the intermediate upright  $f^2$ . It will now be apparent that the gears on the mandrel constantly rotate with it in one direction, and will impart motion alternately to that one of the loose clutch-gears M M' on shaft L which is at that time locked with such shaft by means of the sleeve K. Through this

shaft L and the gearing on the end of the bed A, Fig. 11, motion is imparted correspondingly in one direction or the other to the feed-screw E. The last-named gearing is composed of small gears *i'* and *e'* on the shaft L and feed-screw E, respectively, and a larger intermediate gear P, that normally meshes with them; but such larger gear is mounted on a forked and slotted arm Q, that is pivoted on the shaft L, and may be shifted around such point for engaging with or disengaging from the gear *e'* on the feed-screw. A clamp-bolt  $q^2$  works in the arc slot of said arm Q and serves to clamp the latter in any adjustment for holding the arm in the required position. When it is not desired to operate the feed-screw E, the arm Q is adjusted to remove the gear P from mesh with the gear *e'*, as shown by dotted lines, Fig. 11, and this is generally required when the rifling-tool is brought into use, whose operation I will now describe. A rifling-rod S, Figs. 1, 2, and 11, is arranged to slide in the mandrel  $f^4$ , it being operated manually. A screw enters the spiral groove *s* in said rod S and compels it to revolve as it is reciprocated.

When the machine is used for rifling or milling, the mandrel  $f^4$  is locked by a spring-catch T, whose point enters any one of the holes in the grooves of a space wheel or disk U, mounted on the outer end of the mandrel, adjacent to the upright *f*. The arm Q is also shifted to throw the feed-screw E out of action, so that the tool-carriage and work-holder will remain at rest. The aforesaid catch T is pivoted to the upright of the head-rest, and its spring-shank holds it normally engaged with the disk, but permits easy disengagement when required. The pin or point of the catch is adjusted in different holes in the space-disk, according to the number of rifles or grooves to be cut. The gun-barrel to be rifled is held in the vises  $c^8$   $c^9$ .

What I claim is—

1. In a boring and turning lathe, the combination, with the bed A, of the tail-stock having a base portion *b*, having half of a screw-socket formed in its upper side, and the laterally-adjustable top portion *b'*, and the screw-shaft  $b^2$ , fitted in the socket, and thereby engaging the thread in the lower half of the same, and means for holding the said parts together, yet permitting adjustment of the upper one, as specified.

2. In a boring and turning lathe, the combination, with the sliding carriage C and the vise C', adjustable in the arc of a circle, of another vise C<sup>2</sup>, which is adjustable toward and from the other, as shown and described.

3. In a boring and turning lathe, the sliding work-holder having a recessed base, the vertically-adjustable top plate having guides  $c^{24}$  and cam projections on its under side, the screw-shaft  $c^{22}$ , the notched cross-head  $c^{21}$ , the levers  $c^{20}$ , pivoted to said recessed base, the bars  $c^{19}$ , sliding on the latter and having slots

