(No Model.) 3 Sheets—Sheet 1.

J. HARTNESS.

ATTACHMENT FOR METAL SCREW MACHINES.

No. 431,809. Patented July 8, 1890.

Fig. 1.

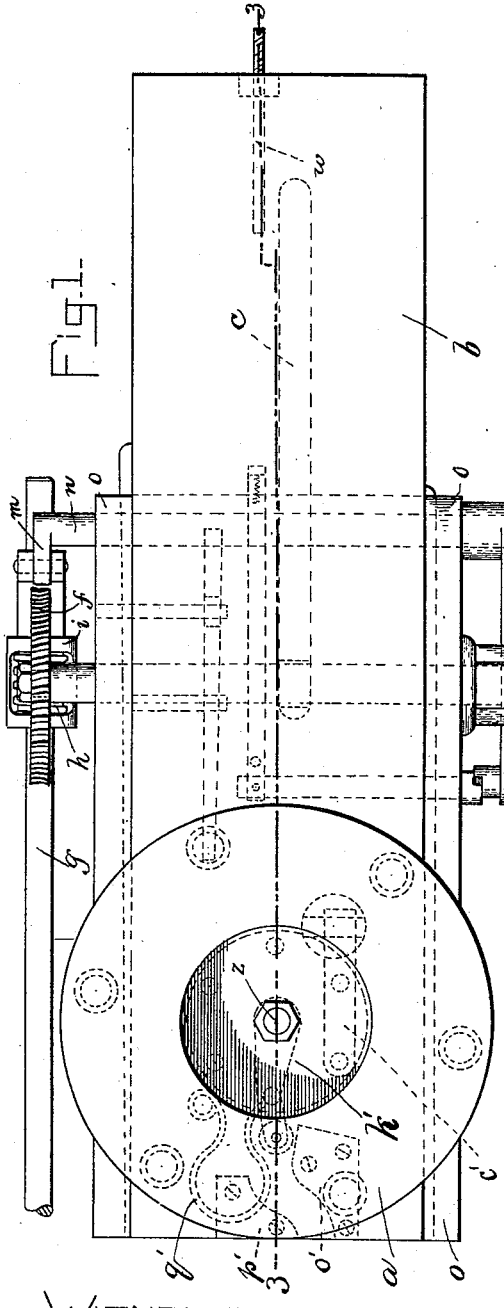
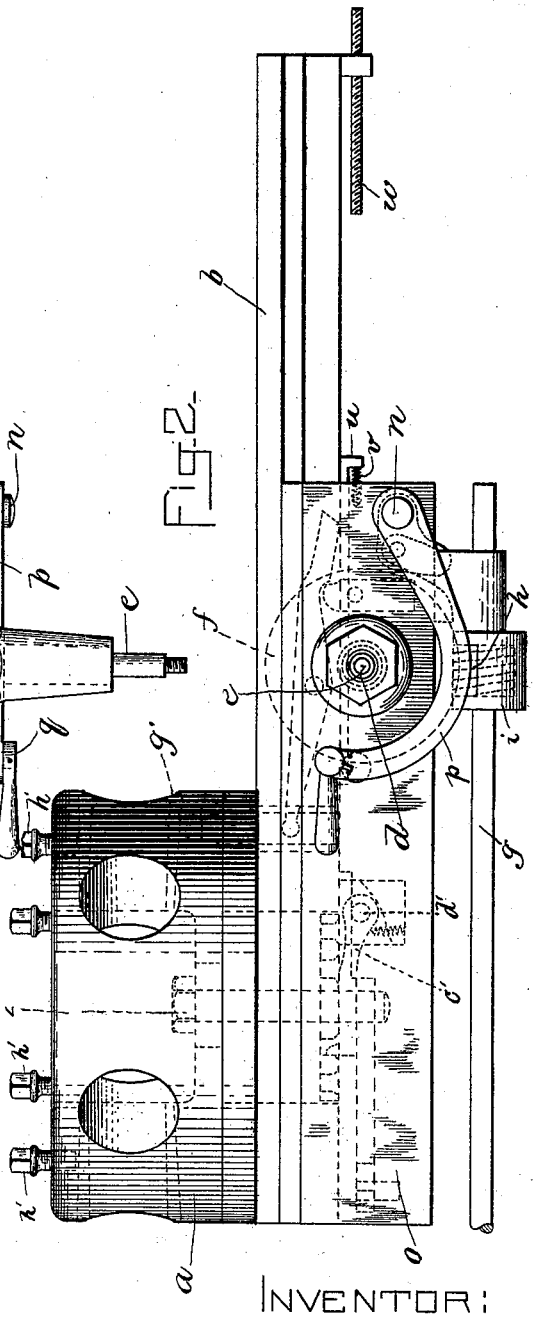


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

J. HARTNESS.

ATTACHMENT FOR METAL SCREW MACHINES.

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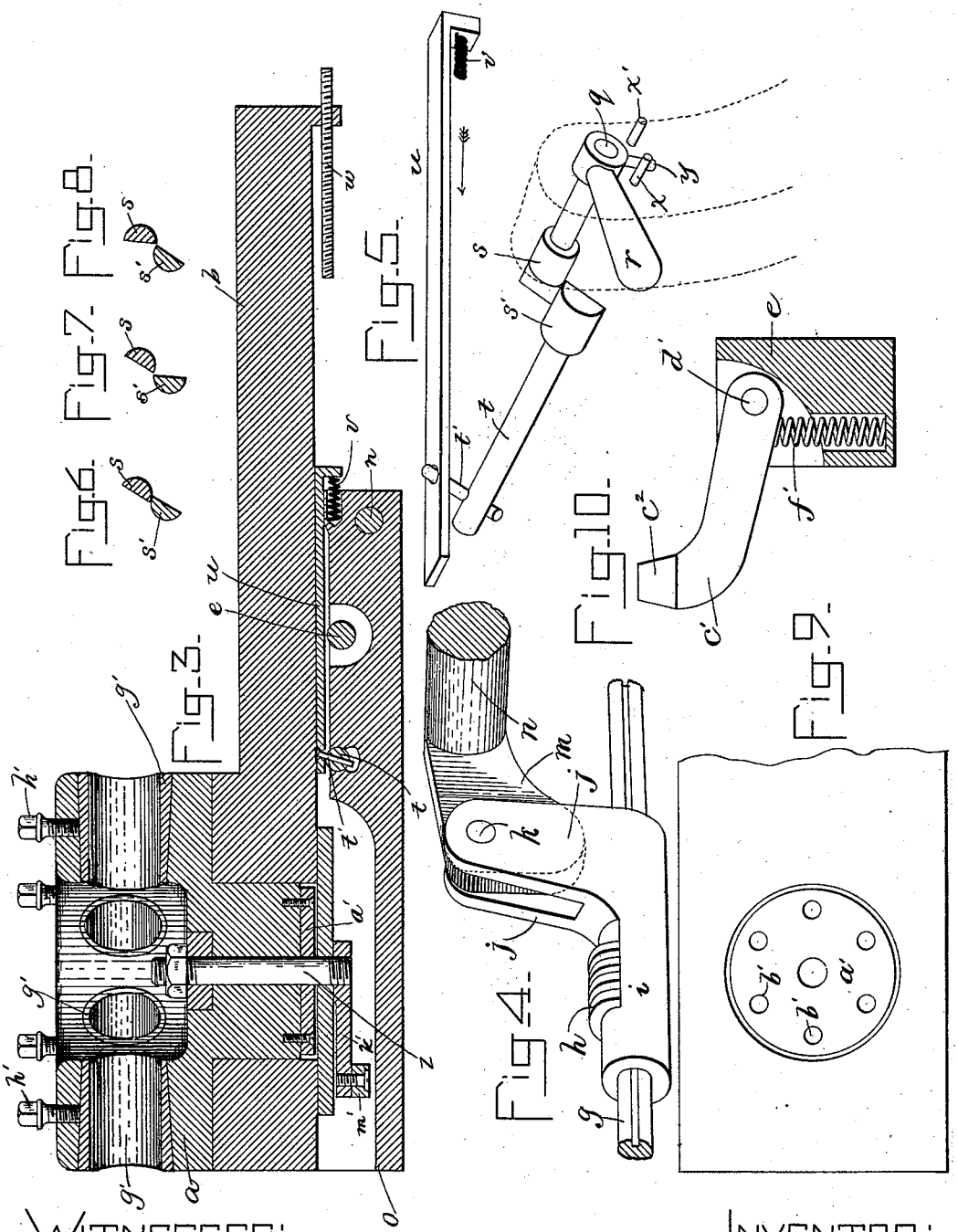

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(No Model.) 3 Sheets—Sheet 3.

J. HARTNESS.

ATTACHMENT FOR METAL SCREW MACHINES.

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Fig. 11.

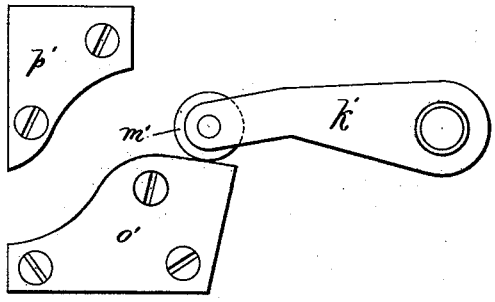
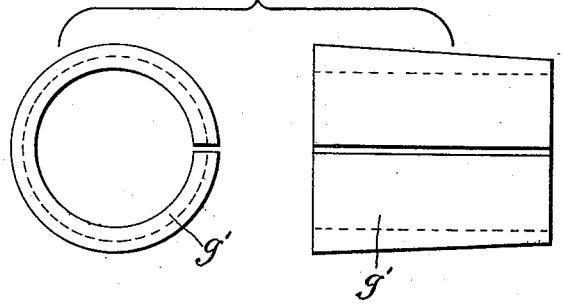


Fig. 12.



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UNITED STATES PATENT OFFICE.

JAMES HARTNESS, OF SPRINGFIELD, VERMONT, ASSIGNOR TO THE JONES & LAMSON MACHINE COMPANY, OF SAME PLACE.

ATTACHMENT FOR METAL-SCREW MACHINES.

SPECIFICATION forming part of Letters Patent No. 431,809, dated July 8, 1890.

Application filed April 3, 1890. Serial No. 346,375. (No model.)

To all whom it may concern:

Be it known that I, JAMES HARTNESS, of Springfield, in the county of Windsor and State of Vermont, have invented certain new and useful Improvements in Screw-Machines, of which the following is a specification.

This invention has for its object to provide improved means for connecting and disconnecting the shaft that directly actuates the turret-carrying slide of a screw-machine by engagement of a pinion on said shaft with a rack on the slide with and from the power-driven shaft that communicates motion to said slide-actuating shaft; secondly, to provide an improved ratchet and pawl for rotating the turret step by step and locking it in each position to which it is rotated, and, thirdly, to provide improved means for holding the operating-tools in the port-holes of the turret of a screw-machine.

The invention consists in the several improvements which I will now proceed to describe and claim.

In the accompanying drawings, forming a part of this specification, Figure 1 represents a top plan view of a portion of a screw-machine, showing the parts which embody my improvements and the portions of the machines which co-operate therewith. Fig. 2 represents a side elevation of the mechanism shown in Fig. 1. Fig. 3 represents a longitudinal section on line 3 3, Fig. 1. Figs. 4 to 12, inclusive, represent detailed views hereinafter referred to.

The same letters of reference indicate the same parts in all of the figures.

In the drawings, *a* represents the turret of a screw-machine, and *b* represents the slide to which said turret is pivotally connected in the usual or any suitable manner, said slide being movable horizontally on guides or ways on the supporting frame or bed of the lathe. On the under side of the slide *b* is a rack *c*, which engages with a pinion *d* on a transverse shaft *e*, which is journaled in fixed bearings and is provided at one end with a worm-wheel *f*.

g represents the feed rod or shaft, which is journaled in bearings at one side of the lathe-bed and is driven by power imparted by belt or otherwise from one of the pulleys of the lathe, said rod being provided with a worm *h*, which is adapted to engage the worm-wheel *f* and thereby impart motion to the shaft *e* and cause the latter to impel the slide *b* and turret *a* in one direction, as usual in this class of machines. The feed-rod *g* is laterally movable to permit the worm *h* to be separated from the worm-wheel *f* for the purpose of stopping the motion of the slide *b* and turret *a*, this feature—viz., the laterally-movable feed-rod—being also common in screw-machines. I have, however, devised certain new and improved means for moving the feed-rod laterally to disconnect its worm from the worm-wheel *f*, said means being capable of operation either automatically or by the operator.

In carrying out this part of my invention I mount upon feed-rod *g* a box *i*, in which said feed-rod and the worm *h* are capable of rotating, said box being shown in detail in Fig. 4. On the box *i* are formed upwardly-projecting ears *j j*, to which is connected by a pivot *k* an arm or crank *m*, formed on the rock-shaft *n*, which is journaled in a bearing in the slide-bed *o*. Said rock-shaft *n* extends across the slide-bed, and to the end of said rock-shaft, opposite the crank *m*, is attached an arm or lever *p*, in the free end of which is journaled a short stud *q*, which is provided with a handle *r*, and has at its inner end a tooth or dog *s*, formed to engage a corresponding tooth or dog *s'*, formed on a short stud *t*, which is also journaled in the slide-bed. The stud *t* is provided with an arm or pin *t'*, (shown in Fig. 5,) which enters an orifice in a slide-bar *u*, which is fitted to move in a guide or way in the slide-bed *o*, one end of said slide-bar *u* projecting from one end of the slide-bed, and yieldingly held in the position shown in Figs. 2, 3, and 5 by a spring *v*. The slide-bar *u* is arranged so that a stop-screw *w*, inserted in a lug on the slide *b*, strikes the projecting end of said slide-bar *u* and forces the latter in the direction indicated by the arrow in Fig. 5, thus causing said bar to partially rotate the stud *t*, and thereby turn the tooth or detent *s'* from the position shown in Figs. 5 and 6 to that shown in Fig. 7. The detent *s'* is thus caused to release the detent *s*, so that the arm or lever *p*

is deprived of the support afforded by the detent s' when the parts are in the position shown in Figs. 5 and 6, and is permitted to drop. The weight of the feed-rod g, worm h, and worm-box i is supported by the crank m of the rock-shaft n, and therefore exerts a downward pressure through said crank and rock-shaft on the lever p. When the lever p is supported by the engagement of the tooth s with the tooth or detent s', the feed-rod and its worm are held thereby in position to engage the worm-wheel f on the shaft e, and thus cause the rotation of the feed-rod to move the slide b, as already described; but when the sliding bar u is moved by the stop-screw w on the carriage, (said movement occurring just before the carriage reaches the end of its operative movement,) the feed-rod and worm being no longer supported in their operative relation to the worm-wheel fall by their own weight until the worm is entirely separated from the worm-wheel, thus stopping the movement of the slide b. When the slide b is returned to its starting position, the spring v forces the sliding bar u back to the position shown in Fig. 5, and thus holds the detent s' in position to engage the tooth s on the lever-supported stud q, so that when the lever p is raised to bring the worm h into engagement with the worm-wheel f, said detent s' will re-engage the tooth s and hold the lever in its raised position. The stud q is permitted a slight independent rocking or oscillating motion in the lever p by means of a pin y, projecting from one side of said stud near its outer end, and two stop-pins $x\,x'$, projecting outwardly from the outer side of the lever p, as shown in Fig. 5. When the stud q is in position to engage its tooth s with the detent s', the pin y is in contact with the stop-pin x.

When the operator or attendant desires to stop the machine independently of the automatic arrangement above described, he turns the stud q by means of the handle r until the pin y strikes the stop-pin x', the position of the detent s' remaining unchanged. This movement of the stud q brings the tooth s into the position shown in Fig. 8, and thus disengages it from the detent s', so that the lever p and the feed-rod and other parts thereto connected are permitted to fall. It will be observed that when the stud q is in the position shown in Fig. 5, its pin y bearing against the stop-pin x, the handle r is supported so that it can be used in raising the lever p and the feed-rod and its worm to their highest position, the said handle being in effect rigidly connected with the said lever when upward pressure is exerted on the handle; hence a single lever or handle r is capable of performing two functions, viz: First, raising the feed-rod and its worm to make the feed-rod operative, or, in other words, to throw the feed in; and, secondly, releasing the feed-rod and allowing it to fall, or, in other words, throwing the feed out, said handle r being raised to throw the feed in and depressed to throw it out.

I am aware that it is not new to make the feed-rod of a screw-machine laterally movable, so as to make its worm separable from the worm-wheel to which motion is imparted by the feed-rod; but heretofore, so far as I am aware, two handles or operating-levers have been required, one to throw the feed in and the other to throw the feed out. It will be seen that by adapting one handle or lever to perform both operations I simplify and cheapen the machine as compared with others having two handles. It will also be observed that the stop-screw w serves both as a position-stop to limit the forward movement of the slide and as a means for automatically disconnecting the feed-rod from the worm-wheel which transmits motion to the slide. Heretofore two separate stop-screws have been provided, one to limit the forward movement of the slide and the other to act as a knock-off for the feed. This arrangement was found objectionable, because in case of any slipping or displacement of the knock-off stop the position-stop would act to prevent the forward motion of the slide while the feed-rod was still operatively connected with the slide, so that breakage of feed-gears would ensue. This objection is entirely obviated by the employment of a single device to serve both as a position-stop screw and as a feed-disconnecting device.

For the sake of simplicity of illustration I have shown the worm-wheel f attached to the pinion-shaft e, but in practice it is usual to secure said worm to a stud and connect said stud to the pinion-shaft e by suitable gearing. The turret a is connected to the slide b by means of a central pivot-stud z, on which the turret is adapted to rotate freely, as usual.

My improved ratchet arrangement whereby the turret is partially rotated during each backward movement of the slide is as follows: a' represents a disk which is attached rigidly to the bottom of the turret or to the bottom of the central boss on the turret that enters the socket formed for its reception in the slide b. Said disk is provided with a series of holes b', Fig. 9, corresponding in number to the number of positions to which the turret is to be rotated; said holes being substitutes for the teeth as ordinarily formed on the ratchet-wheel attached to the turret of a screw-machine. c' represents the pawl which co-operates with the perforated disk a' in rotating the turret. Said pawl is pivoted at d' to cylindrical stud or swivel which is inserted and adapted to rotate in a socket formed in the slide-bed o, the pivot d' being arranged to permit the pawl to oscillate vertically while the connection of the swivel to the slide-bed permits said swivel and the pawl to oscillate horizontally. The pawl is pressed upwardly against the disk a' by means of a spring f' inserted in the swivel, as shown in Fig. 10. The swinging end of the pawl c' is

formed as a tapered boss adapted to enter either of the holes b' in the disk a', the upward pressure of the spring f' causing said boss to spring into either hole b' that is brought into coincidence with said boss by the progressive movement of the turret and the slide b.

Heretofore the pawl engaging the ratchet affixed to the turret of a screw-machine has been arranged in the same plane as the ratchet to oscillate horizontally, and in order to permit the horizontal movement of the pawl a space has had to be cut out of the under part of the bearing-surface of the turret-slide b, said space being objectionable for various reasons. By arranging the pawl so that it is entirely below the ratchet wheel or disk a' and moves at right angles to the plane of said disk in engaging the holes therein, I avoid the formation of the space above referred to and provide a simpler, cheaper, and better ratchet-and-pawl device than has heretofore been used. The ratchet composed of the disk with holes drilled in it is obviously much simpler and cheaper than the ratchet-wheel having teeth formed on its periphery, as heretofore. The boss c^2 on the pawl that engages the holes b' is formed so that after the spring f' has inserted its upper end in one of said holes the complete insertion of said boss into the hole will be effected by the force of pressure exerted upon said boss by the movement of the slide b without further aid from the spring f'.

The turret is provided with radial port-holes to receive the bushings g', in which the tools carried by the turret are inserted. My improvements include the making of said holes and the external surfaces of the bushings conical, or larger in diameter at their outer than at their inner ends, and in splitting or dividing the bushings longitudinally at one or more sides, so that each is capable of expanding or contracting, as required by the size of the tool inserted in it and by the size of the port-hole in which it is inserted. The bushing is crowded into the tapering hole in the turret after the tool has been inserted in said hole in about the position it is to occupy. The crowding of the bushing into the hole causes the tapered surface of the hole to compress the bushing upon the tool, the bushing at the same time accommodating itself to the size of the portion of the tool inserted in it; hence all looseness is taken up, so that when the bushing is clamped or secured by a set-screw h' inserted in the upper portion of the port there can be no displacement of the bushing and tool by the pressure of said screw against the bushing.

Heretofore turret-holes have been bored out straight, or with parallel sides and the bushing has been split longitudinally, and owing to the straight form of the hole in which it is inserted has not been firmly supported by the wall or surface of the hole along its entire length; hence the insertion of the clamping-screw h' has been liable to displace the bushing and tool to such an extent as to crowd the tool out of alignment with the main spindle carrying the work. It is very important that the tool be kept in exact alignment with said main spindle; hence the importance of my improved form of port-hole and the split externally-tapered bushing adapted to conform to slight variations in the size of the tool, so that it cannot be forced out of alignment by the pressure of the screw h' will be obvious.

The advantages of this part of my improvement will be made more plain when it is understood that it is impossible to bore all the holes in the turret exactly to one diameter, and to make all the tools exactly the same diameter at the portions which are inserted in the turret. My improvements compensate for the necessary slight variations in the diameters of the holes and the portions of the tools which are inserted in the holes.

In machines of this class the turret is locked in each position to which it is rotated by means of a binding-lever which has heretofore been located on the top of the turret and formed at its inner end as a nut to engage the screw-threaded upper end of the pivot on which the turret rotates, the movement of said lever in one direction causing it to clamp the turret firmly against its seat, while the movement of the lever in the opposite direction releases the binding-pressure. Said binding-lever has always heretofore been operated by hand.

Another of my improvements includes the provision of means whereby the binding-lever k' may be operated automatically, and to this end I arrange the binding-lever k' at the lower end of the pivot-stud z below the turret, and provide its swinging end with a trundle-roll m'. To the slide-bed o, I affix two cams o' and p', separated by a way or space through which the trundle-roll m' is adapted to pass. Said cams are arranged so that when the slide b is moving backwardly one of said cams will force the binding-lever in the direction required to loosen the turret and allow it to turn freely, and when the slide is moving forward the other cam will turn the binding-lever in the direction required to tighten the turret and make it rigid. The spring q' is shown in Fig. 1 arranged to bear upon the binding-lever and force it against the cam o'. Said spring may be used as an auxiliary to the cam p' or as a substitute therefor, said cam p' being required to simply give the releasing-movement to the binding-lever, so that it does not have to exert so great a degree of force as the cam o', which gives the binding-lever its turret-binding movement; hence a suitable stiff spring can be used as a substitute for the cam p'.

I do not limit myself in all cases to the details of construction of the mechanism shown, as the same may be variously modified without departing from the spirit of my invention;

nor do I limit myself to the conjoint use of all the parts of the mechanism for throwing the feed in and out. For example, the tooth *s* may be rigidly affixed to the feed-rod-raising lever *p* in case it is not desirable to release said lever by hand; again, the tooth *s*, arranged, as shown, to be turned by hand, may be employed with a detent *s'* of any suitable construction and arranged to be operated automatically or not.

I claim—

1. The turret-slide, the vertically-movable feed-rod having a worm and intermediate gearing, whereby motion is imparted from the worm to the slide, combined with a rock-shaft having an arm or crank, a box or bearing supporting the worm-shaft and connected directly with said crank, whereby the feed-rod and its worm may be raised when the rock-shaft is rotated, and means for locking the rock-shaft to support the feed-rod and its worm in a raised position, as set forth.

2. The turret-slide, the vertically-movable feed-rod having a worm and intermediate gearing, whereby motion is imparted from the worm to the slide, combined with a rock-shaft having an arm or crank, a box or bearing supporting the worm-shaft and connected with said crank, whereby the feed-rod and its worm may be raised when the rock-shaft is rotated, a lever connected to said rock-shaft, and a movable locking device or detent, whereby said lever may be engaged to hold the feed-rod and its worm in a raised position, as set forth.

3. The turret-slide, the vertically-movable feed-rod having a worm, and intermediate gearing, whereby motion is imparted from the worm to the slide, combined with a rock-shaft, having an arm or crank, a box or bearing supporting the worm-shaft and connected with said crank, whereby the feed-rod and its worm may be raised when the rock-shaft is rotated, a lever connected to said rock-shaft, a movable locking device or detent, whereby said lever may be engaged to hold the feed-rod and its worm in a raised position, and an attachment on the slide, arranged to displace said detent and thereby permit the feed-rod and worm to drop, as set forth.

4. The combination, with the turret-slide, the vertically-movable feed-rod, the worm thereon, and intermediate gearing, whereby motion is communicated from the worm to the slide, of a lever *p*, pivotally connected to the slide-bed, connections between said lever and the feed-rod, whereby the feed-rod and worm are raised and held by a movement of the lever, a movable detent, as *s'*, adapted to engage a tooth or projection on said lever and thereby hold the feed-rod and its worm in their raised position, a sliding bar, as *u*, connected with said detent, and a device, as the stop-screw *w*, on the slide, whereby said bar is moved automatically to displace the detent from its feed-rod-holding position, as set forth.

5. The combination, with the turret-slide, the vertically-movable feed-rod, the worm thereon, and intermediate gearing, whereby motion is communicated from the worm to the slide, of a lever *p*, pivotally connected to the slide-bed, connections between said lever and the feed-rod, whereby the feed-rod and worm are raised and held by a movement of the lever, a detent, as *s'*, supported by the slide-bed, a tooth or projection, as *s*, supported by the swinging end of the lever *p* and having a limited rotary movement thereon, whereby said tooth may assume two positions, the tooth being adapted to engage the detent *s'* when in one position and to be disengaged from said detent when moved to its other position, as set forth.

6. The combination, with the turret-slide, the vertically-movable feed-rod, the worm thereon, and intermediate gearing, whereby motion is communicated from the worm to the slide, of a lever *p*, pivotally connected to the slide-bed, connections between said lever and the feed-rod, whereby the feed-rod and worm are raised and held by a movement of the lever, a detent, as *s'*, supported by the slide-bed, a stud *q*, having a limited rotary movement in the swinging end of the lever *p*, a tooth *s* at one end of said stud, adapted to engage the detent *s'* when the stud *q* is at one extreme of its rotary movement, and a handle on said stud, whereby the stud may be turned to the other extreme of its movement to disengage the tooth from the detent, as set forth.

7. The combination of the feed-rod-raising lever *p*, the stud *q*, having a limited rotary movement in the swinging end of the lever *p*, and provided with a tooth *s*, and a handle *r*, and the detent *s'*, supported by the slide-bed and adapted to engage the tooth *s*, as set forth.

8. The combination of the feed-rod-raising lever *p*, having a tooth or projection, as *s*, of the detent *s'*, supported by the slide-bed, and a spring *v*, and connections between said spring and the detent, whereby the latter is yieldingly held in position to engage the tooth of the lever *p*, as set forth.

9. The combination of the feed-rod-raising lever *p*, having a tooth or projection, as *s*, of the stud *t*, journaled in a bearing in the slide-bed, and provided with the detent *s'* and the arm *t'*, the sliding bar *u* on the slide-bed engaged with the arm *t'*, and the spring *v*, arranged to normally hold the detent in its operative position through the bar *u* and stud *t*, as set forth.

10. The combination of the turret and its supporting-slide, the slide-bed, a swivel fitted to turn horizontally in a socket in the bed, a spring-raised pawl pivoted to oscillate vertically on said swivel, and a wheel or disk attached to the turret and arranged over said pawl, said disk being formed to engage the pawl, as set forth.

11. The combination of the turret having tapered port-holes which decrease in diameter from the periphery of the turret inwardly,

and the externally-tapered split bushings made of uniform diameter internally, as set forth.

12. The combination, with the rotary turret, its slide, and the fixed slide-bed, of the binding-lever engaged with the pivot that connects the turret with the slide, and a cam o', affixed to the slide-bed and arranged to give the lever its turret-binding movement, as set forth.

13. The combination, with the rotary turret, its slide and the fixed slide-bed, of the binding-lever, engaged with the pivot that connects the turret with the slide, a cam o', affixed to the slide-bed and arranged to give the lever its turret-binding movement, and a cam p', or its specified equivalent, arranged to give the lever its turret-releasing movement, as set forth.

14. The combination, with the rotary turret, its slide, and the fixed slide-bed, of the binding-lever engaged with the pivot that connects the turret with the slide, a cam o', affixed to the slide-bed and arranged to give the lever its turret-binding movement, the cams o' and p', affixed to the slide-bed and arranged to move the binding-lever, and the spring q', arranged to co-operate with the cam p' in moving said lever, as set forth.

15. The combination, with the feed-rod and the worm thereon, of the feed-rod-supporting box i, having ears j, and the rock-shaft having a crank or arm m, pivoted to said ears, as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 14th day of March, A. D. 1890.

JAMES HARTNESS.

Witnesses:
W. D. WOOLSON,
C. G. RICHARDSON.