Sept. 16, 1924. 1,508,794

W. E. INGHAM

LATHE TOOL MECHANISM

Filed Dec. 22, 1921

Fig. 1.

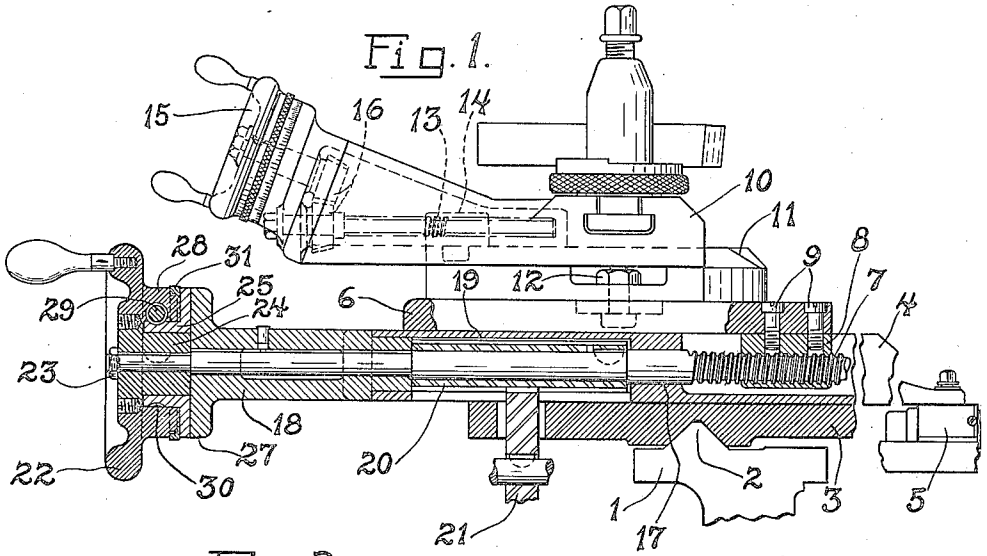


Fig. 2.

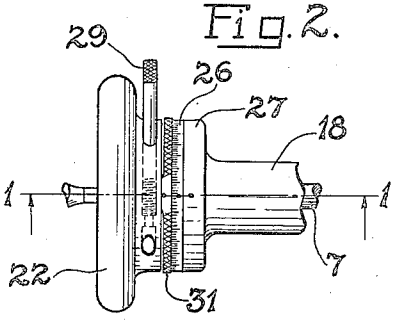


Fig. 3.

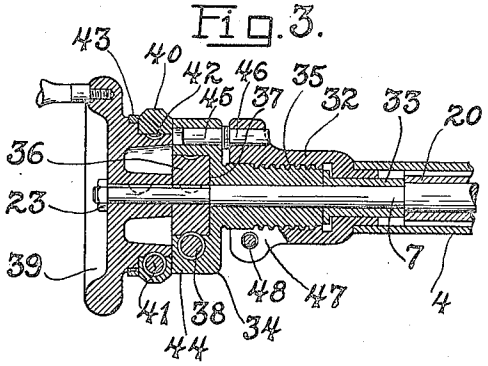


Fig. 5.

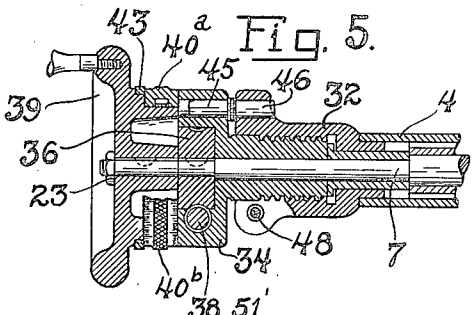


Fig. 4.

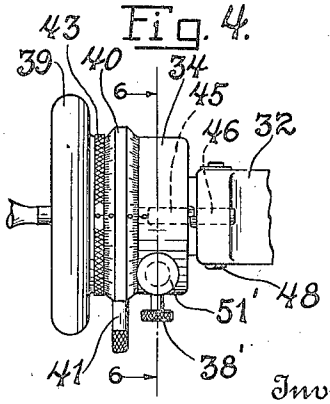
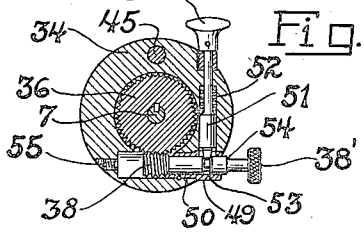


Fig. 6.



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UNITED STATES PATENT OFFICE.

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LATHE-TOOL MECHANISM.

Application filed December 22, 1921. Serial No. 524,267.

To all whom it may concern:

Be it known that I, WALTER E. INGHAM, a citizen of the United States, residing at Newington, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Lathe-Tool Mechanism, of which the following is a specification.

This invention relates to lathes and particularly to an improved tool operating mechanism therefor. In accordance with the invention, a screw with a hand wheel thereon is provided for operating a tool slide, means including adjustable graduated means being provided in connection with the screw for operating the tool slide in a more efficient and improved manner. The improved graduated means is provided with a definite mark or element thereon adapted to register with a cooperating mark or element on the screw support. The graduated means is so constructed that the same may be accurately adjusted prior to each tooling operation to provide for the proper and desired feed of the tool. After such adjustment, rotation of the hand wheel and screw accompanied by the movement of the graduated means to bring the said cooperating marks or elements into register, is adapted to always place the tool in its advanced and proper cutting position. The said graduated means is furthermore adapted to always indicate the total depth of cut taken. One object of the invention is to provide an improved tool feeding mechanism of this type.

A further object of the invention is to provide positive means in combination with the above defined mechanism for accurately adjusting the improved graduated means to secure the proper and desired tool feeds.

Another object of the invention is to provide means in combination with the hand wheel and tool slide operating screw for either slowly actuating the tool slide upon rotation of the hand wheel for feeding purposes or for quickly moving the screw bodily in an axial direction for rapidly actuating the slide upon rotation of the hand wheel.

A further object of the invention is to provide a bearing for the tool slide operating screw, the bearing and screw being relatively adjustable, graduated means for indicating the amount of such adjustment, and means whereby the screw may be freely rotated in the bearing to slowly feed the tool slide from the hand wheel or may be secured to the bearing to rotate the latter with the hand wheel whereby to rapidly actuate the slide, stops preferably being provided for limiting the movement of the bearing, the said graduated means being adapted to indicate the amount of movement of the screw in the bearing.

With the above and other objects in view, my invention consists in the features of construction and operation set forth in the following specification and illustrated in the accompanying drawing. In such drawing annexed hereto and forming a part of this specification, I have shown certain embodiments of my invention but it will be understood that the invention can be otherwise embodied and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

Referring to the figures of the drawing:

Figure 1 is a fragmentary elevation, partially in section on line 1—1 of Fig. 2, of a tool feeding mechanism illustrative of my invention.

Fig. 2 is a fragmentary plan view thereof.

Fig. 3 is a fragmentary sectional view of a modified form of the invention.

Fig. 4 is a plan view thereof.

Fig. 5 is a fragmentary sectional view of the mechanism shown in Fig. 3 slightly modified.

Fig. 6 is a cross sectional view taken on line 6—6 of Fig. 4.

In performing screw cutting or turning operations, wherein a series of progressive cuts are taken by passing the tool along the work a plurality of times, means must be provided for accurately advancing the tool prior to each cutting operation and for indicating at all times the total depth of cut taken. The provision of means for quickly withdrawing the tool at the end of each of said cuts, or for other purposes, is also of considerable advantage.

My invention, as illustrated in Figs. 1 and 2, provides means for accurately performing the first two functions stated and, as illustrated in Figs. 3 to 6, means is provided in combination with the first mentioned means for quickly withdrawing the

tool as stated. The specific structure illustrated in the drawing will now be described.

Referring more specifically to the drawing by reference characters, 1 indicates the bed of a lathe on the ways 2 of which a carriage 3 is movably mounted. A tool support comprising a taper slide 4 operated by a taper bar 5 is mounted on the carriage. A cross slide 6 is slidably mounted on the taper slide and is adapted to be actuated by a screw 7 mounted in the taper slide and threadedly engaging a nut 8 secured to the cross slide by means of screws 9. A tool slide 10 is mounted on a support 11 secured to the cross slide 6 by bolts 12. The slide 10 may be actuated by a screw 13 journaled therein and threadedly engaging a nut 14 on the support 11. The screw 13 may be rotated by a hand wheel 15 operatively connected to the screw through a pair of bevel gears 16. The bevel gears provide for an angular mounting of the hand wheel 15 whereby the same is removed from interference with the hand wheel on the screw 7.

The structure shown in Figs. 1 and 2 will first be described. The screw 7 is journaled in a bearing 17 in the taper slide 4 and in a bearing 18 mounted in the taper slide. The taper slide is recessed at 19 between the bearings 17 and 18 and an elongated pinion 20 is keyed to the screw within this recess. This pinion is engaged by a gear 21 of the apron mechanism for power operating the screw 7. For a detailed description of such mechanism, reference should be had to my copending application, Serial No. 498,151 filed September 2, 1921.

A hand wheel 22 is keyed to the outer end of screw 7 and is secured in place by means of a nut 23. The hand wheel 22 is provided with an inner hub 24 on which is loosely and rotatably mounted a bushing 25 provided with a graduated peripheral portion 26 directly adjacent a flanged portion 27 of the bearing 18. The hand wheel is also provided with an outer hub 28 within which is mounted a worm 29 in mesh with worm wheel teeth 30 about the bushing 25. A knurled ring 31 is frictionally mounted in an annular recess on the outer hand wheel hub 28 directly adjacent the graduated portion 26 of the bushing. As illustrated in Fig. 2, the ring 31 and flanged portion 27 of the bearing 18 are each provided with a zero mark adapted to cooperate with the graduated portion 26 of the bushing.

The operation of the mechanism above described and shown in Figs. 1 and 2 is as follows: The tool slide and cross slide are first adjusted by means of hand wheels 15 and 22 to place the tool in a known position directly adjacent the work to be cut. This is the starting position of the cut and in such starting position the bushing 25 and ring 31 should be adjusted to bring the zero marks thereon into alignment with the zero on the flange 27, as illustrated in Fig. 2. The next operation is to advance the tool the required depth of a cut into the work. With the entire mechanism in the starting position defined, the worm 29 is rotated to move the bushing 25 through an arc corresponding to the distance it is desired to advance the tool. This adjustment of the bushing 25 is accurately indicated by reading the graduated portion 26 thereof against the zero on the ring 31. The bushing is adjusted to the right or left depending upon in which direction it is desired to feed the tool. With the bushing thus adjusted, the tool is advanced into the work by rotating the hand wheel 22 a distance sufficient to bring the bushing zero into alignment with the zero on the flange 27. The tool has thus been advanced the desired distance into the work. The movement of the carriage now feeds the tool along the length of the work in the usual manner to perform the first cut.

At the end of the first cut, the tool may be withdrawn from the work by rotating the hand wheel 22 backwardly. It will be noted that the bushing 25 and ring 31 normally rotate as a unit with the hand wheel, one of such elements rotating relative to the other only upon rotation of the worm 29. When the carriage 3 has been traversed to bring the tool back to its original position, the worm 29 is rotated, in the same manner as before, to move the bushing 25 through an arc corresponding to the distance it is desired to advance the tool, this adjustment of the bushing being accurately indicated by reading the graduated portion 26 thereof against the zero on the ring 31, as before. The tool may now be advanced the required distance by rotating the hand wheel 22 to bring the bushing zero into alignment with the zero on the flange 27. The tool is now fed along the work with the carriage as before described. The tool may in this same manner be accurately advanced as many times as required to complete the tooling operation on the work.

In addition to the tool feeding function of the mechanism just described, it will be noted that such mechanism also provides a means indicating at all times the total depth of tool cut taken. This means comprises the relation established between the zero on the ring 31 and the graduations on the portion 26 of the bushing. The ring 31 is normally a part of the hand wheel, being frictionally secured thereto. During the entire series of cutting operations on a piece of work, the position of ring 31 on the hand wheel is not disturbed. In each adjustment by the worm 29 as above described, the zero on the portion 26 of the bushing is moved away from

the zero on the ring 31, each adjustment increasing the distance between these two zeros. The distance between these two zeros therefore at all times indicates the total feed of the tool and therefore the total depth of the cut taken in the work.

In Figs. 3, 4 and 6, I have illustrated a mechanism of the type just described in combination with means for quickly withdrawing the tool at the end of each cutting operation along the work, whereby the tool may be traversed backwardly to its original position and then quickly moved to its starting position against the work. The taper slide 4, screw 7, pinion 20 and the mechanism not illustrated in these figures, are the same as those illustrated in Fig. 1. A bearing block 32 is mounted in the slide 4 and carries a bushing 33 therein supporting the screw 7. A bearing 34 for the screw is provided with double threads 35 of considerably greater pitch than the threads of screw 7, such bearing being threaded into the block 32. A worm wheel 36 is keyed to the screw and is rotatably seated within a recess 37 in the bearing 34, a worm 38 in the bearing providing an operative connection between the bearing and worm wheel. A hand wheel 39 is keyed to the screw and is secured thereon with the other mechanism by means of the nut 23. A graduated ring 40 is mounted on the hub of the hand wheel directly adjacent the bearing 34, a worm 41 mounted in the ring and engaging worm wheel teeth 42 in the hub providing an operative connection between the ring and hand wheel. A knurled ring 43 is frictionally mounted on the hand wheel hub directly adjacent the ring 40. The ring 43 and flanged portion 44 of the bearing 34 are each provided with zero marks adapted to cooperate with the graduations on the ring 40.

The bearing 34 and bearing block 32 are provided with cooperating stops 45 and 46 for a purpose to be hereinafter described. It will furthermore be noted that the bearing block 32 is split at 47 and provided with a clamping bolt 48 whereby the bearing may be secured against movement in the block when desired.

In Fig. 6 is illustrated a latch mechanism for holding the worm 38 either in an engaged or a disengaged position. The worm is rotatably mounted in a bushing 49 secured within a bore 50 in the bearing 34. A spring pressed detent 51 is mounted in a relatively right angular bore 52 and is adapted to engage within an annular groove 53 to hold the worm in its operative position, or back of a shoulder 54 to hold the worm in an inoperative position. An adjustable stop screw 55 is provided for limiting the inward movement of the worm 38. To disengage the worm from its worm wheel 36, the detent 51 is drawn outwardly by means of a knob 51′ thereon and the worm is rotated by means of its knob 38′ to screw the worm inwardly to seat against the screw 55. In its inoperative position, the worm is held between the screw 55 and detent 51 seating against the shoulder 54.

The mechanism shown in Figs. 3, 4 and 6 may be used in the same manner as that illustrated in Figs. 1 and 2. When it is to be thus used, the bearing 34 is brought to the position illustrated in Fig. 4, the clamping bolt 48 is tightened to secure the bearing against rotation, and the worm 38 is disengaged from its worm wheel 36 and held between the stop screw 55 and detent 51 seating against the shoulder 54. In such position, the bearing 34 becomes the equivalent of bearing 18 in Fig. 1 and the screw 7 with the worm wheel 36 thereon is free to rotate in such bearing. Friction ring 43 is the equivalent of friction ring 31 and the graduated ring 40 may be rotated on the hand wheel by means of the worm 41 in the same manner that the graduated bushing 25 is rotated by means of the worm 29. The operation of this mechanism, as thus set and adjusted, is the same as that above described in reference to Figs. 1 and 2.

The mechanism shown in Fig. 5 is the same as that shown in Figs. 3, 4 and 6 except that the graduated ring 40^a is frictionally mounted on the hub of the hand wheel instead of being positively connected thereto through a worm and worm wheel connection. The operation of this mechanism is the same as has been above described except that the graduated ring 40^a is rotatably adjusted by grasping the knurled portion 40^b thereof instead of through a worm, as the worm 41 shown in Figs. 3 and 4.

When using the mechanism shown in Figs. 3 to 6 in the manner above described, the clamping bolt 48 is tightened to hold the bearing 34 against rotation and the worm 38 is disengaged from the worm wheel 36 whereby to permit free rotation of the screw 7 within the bearing 34. With such adjustment, the screw 7 becomes the slide operating element. As above stated, this mechanism may also be adjusted to permit operation thereof in a manner to quickly withdraw the tool from the work and thereafter replace the same in its original cutting position. When so operated, as is hereinafter described, the clamping bolt 48 is loosened to permit rotation of the bearing 34 and the bearing is connected to the hand wheel and screw 7 by engaging the worm 38 with the worm wheel 36. As thus adjusted, the threaded bearing 34 becomes the slide operating element. Briefly stated, the screw 7 becomes the slide operating element when the clamping bolt 48 is tightened and the worm 38 is disengaged from the worm wheel 36 to permit the hand wheel to rotate freely

within the bearing, and the threaded bearing 34 becomes the slide operating element when the clamping bolt 48 is loosened and the hand wheel is locked to the bearing 34 by the worm 38.

The operation of the quick tool withdrawing feature of the invention, as illustrated in Figs. 3 to 6 will now be described. It should first be stated that in this operation, the friction ring 43 normally performs no useful function. The operation of this mechanism is as follows: The tool and cross slides are first adjusted to place the tool in a known position directly adjacent the work to be cut as has heretofore been described in reference to Figs. 1 and 2. The mechanism is adjusted to bring the zeros on the graduated ring and on the bearing 34 into alignment and the stops 45 and 46 into contact as illustrated in Fig. 4. With the mechanism thus set and adjusted, the tool is in position to be advanced the depth of a cut into the work. This operation is performed by rotating the worm 38 in a direction to relatively rotate the screw 7 and bearing 34 in a manner to separate the stops 45 and 46, the amount of such relative rotation being through an arc corresponding to the distance it is desired to advance the tool. This rotative adjustment is accurately indicated by reading the graduated ring 40 against the zero on the flanged portion 44 of the bearing 34, it being understood that the ring 40 in this operation moves only with the screw and hand wheel. By now moving the hand wheel and screw to a position bringing the stops 45 and 46 together, the tool will be advanced into the work the distance of the required cut. The movement of the carriage 3 now feeds the tool along the length of the work in the usual manner to perform the first cut.

At the end of the first cut, the tool may be quickly withdrawn from the work by giving the hand wheel a slight backward rotation. Since the threads 35 on the bearing 34 are double threads of greater pitch than the threads on screw 7, only a slight rotation of the hand wheel, screw and bearing, all of which are secured together, is necessary to withdraw the tool from the work. The carriage is thereafter traversed to bring the tool back to its original position and the mechanism may then again be adjusted to feed the tool the required distance of another cut, such operations being performed in the same manner as before by rotating the worm 38. In the manner before described, the tool may thereafter be quickly advanced, to accurately place the same in its new cutting position in the work, by a slight rotation of the hand wheel to a position to contact the stops 45 and 46. These same operations are repeated to perform as many cuts as may be necessary to complete the work.

In the mechanism just described, it will be noted that the worm 38 provides a positive connection between the screw 7 and bearing 34. In advancing the tool by means of the worm 38, it will be noted that the zero on the ring 40 has at each adjustment been separated from the zero on the flanged portion 44 of the bearing. The graduated distance therefore between these two zeros at all times indicates the total feed of the tool and the depth of cut taken.

It should, of course, be understood that if desired the tool may be advanced for feeding purposes by means of the hand wheel 15 instead of by the worm 38, the amount of such advance being indicated by the graduated ring shown in connection with such hand wheel. In this case the hand wheel 39 is used only for quickly withdrawing the tool and thereafter replacing the same in its original position, such position being always indicated by the engagement of stop 45 with stop 46. Also in such method of operation the worm 38 and worm wheel 36 operate merely as a positive connection between the hand wheel 39 and bearing 34. Since the worm 38 may be engaged with any portion of the worm wheel 36, the hand wheel may be rotatably adjusted to a position to bring the handle thereon in the most convenient position for the operator.

While the methods of operation described are very convenient and accurate in feeding the tool, it will be noted that the same mechanism may be used to feed the tool in the usual and ordinary manner should such operation thereof be desired. In such operation, the tool and its operating mechanism should first be set to the positions above described, the bearing 34 being set and secured in position with the stops 45 and 46 in contact as illustrated in Fig. 2. Rotation of the hand wheel thereafter carries the graduated element 40 therewith as a unit and the rotation of the hand wheel may be accurately indicated by reading the graduated element 40 against the zero on the flange 44.

What I claim is:

1. The combination of a support, a tool supporting slide thereon, a screw for actuating the slide, a hand wheel on the screw, adjustable graduated means operatively connected with the screw, such means being adapted to be accurately adjusted to a position indicative of the respective tool feeding movement it is desired to give to the screw, means on the support adapted to cooperate with the graduated means, movement of the hand wheel and screw to move the adjustable graduated means, after the proper tool feeding adjustment thereof, to a position to register a definite location thereon with the said cooperating means on the support being adapted to always place the tool in its advanced cutting position, and means cooperat-

ing with the said adjustable graduated means for always indicating the total depth of tool cut taken.

2. The combination of a support, a tool supporting slide thereon, a screw for actuating the slide, a hand wheel on the screw, rotary adjustable graduated means on the screw, such means being adapted to be accurately adjusted to a position indicative of the respective tool feeding movement it is desired to give to the screw, means on the support adapted to cooperate with the graduated means, rotation of the hand wheel and screw to rotate the adjustable graduated means, after the proper tool feeding adjustment thereof, to a position to register a definite location thereon with the said cooperating means on the support being adapted to always place the tool in its advanced cutting position, and means cooperating with the said adjustable graduated means for always indicating the total depth of tool cut taken.

3. The combination of a support, a tool supporting slide thereon, a screw for actuating the slide, a hand wheel on the screw, rotary adjustable graduated ring means on the screw between the hand wheel and the support, the said means being adapted to be accurately adjusted to a position indicative of the tool feeding movement it is desired to give to the screw, means on the support provided with a graduation mark adapted to cooperate with the graduated ring means, rotation of the hand wheel and screw to rotate the graduated ring means, after the proper tool feeding adjustment thereof, to a position to register a definite graduation mark thereon with the graduation mark on the support being adapted to always place the tool in its advanced cutting position, and means cooperating with the said graduated ring means for always indicating the total depth of tool cut taken.

4. The combination of a support, a slide thereon, a screw for actuating the slide, a bearing projecting from the support and provided with a graduation thereon, a hand wheel on the screw, a graduated ring surrounding the screw between the hand wheel and bearing, and a second ring adjacent the graduated ring and provided with a graduation thereon, the said two rings each being rotatably adjustable relative to the hand wheel and bearing.

5. The combination of a support, a slide thereon, a screw for actuating the slide, a bearing projecting from the support and provided with a graduation thereon, a hand wheel on the screw, a graduated ring surrounding the screw directly adjacent the bearing, and a friction ring directly adjacent the graduated ring and provided with a graduation thereon, the said two rings each being rotatably adjustable relative to the hand wheel and bearing.

6. The combination of a support, a slide thereon, a screw for actuating the slide, a bearing projecting from the support and provided with a graduation thereon, a hand wheel on the screw, a graduated ring surrounding the screw directly adjacent the bearing, and a second ring mounted on a hub of the hand wheel directly adjacent the graduated ring and provided with a graduation thereon, the said two rings each being rotatably adjustable relative to the hand wheel and bearing.

7. The combination of a support, a slide thereon, a screw for actuating the slide, a bearing projecting from the support and provided with a graduation thereon, a hand wheel on the screw, a graduated ring surrounding the screw between the hand wheel and bearing, means for rotatably adjusting the ring relative to the hand wheel, and a second ring adjacent the graduated ring and provided with a graduation thereon, the said two rings each being rotatably adjustable relative to the hand wheel and bearing.

8. The combination of a support, a slide thereon, a screw for actuating the slide, a bearing projecting from the support and provided with a graduation thereon, a hand wheel on the screw, a graduated ring surrounding the screw between the hand wheel and bearing, means for rotatably adjusting the ring relative to the hand wheel comprising a worm mounted in one member and engaging worm wheel teeth on the other member, and a second ring adjacent the graduated ring and provided with a graduation thereon, the said two rings each being rotatably adjustable relative to the hand wheel and bearing.

9. The combination of a support, a slide thereon, a screw having screw threads operatively connecting the screw to the slide, a hand wheel mounted on the screw, rotation of the hand wheel being adapted by the said screw threads to slowly actuate the slide, and means other than the said screw threads whereby the screw may be quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide.

10. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, and means operative on the bearing whereby the bearing and screw may be quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide.

11. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing rotatably mounted in the support, the screw being rotatably mounted

in the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, and means operative on the bearing whereby the bearing and screw may be rotated together and thereby quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide.

12. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing threadedly engaging the support, the screw being rotatable within the bearing, means for optionally securing the bearing against rotation in the support, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, and means for operatively connecting the hand wheel with the bearing whereby the bearing and screw may be rotated together and thereby quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide.

13. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative on the bearing whereby the bearing and screw may be quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide, a stop on the support, and a cooperating stop on the bearing adapted to engage the first stop to limit the movement of the bearing.

14. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing threadedly engaging the support, the screw being rotatable within the bearing, means for optionally securing the bearing against rotation in the support, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means for operatively connecting the hand wheel with the bearing whereby the bearing and screw may be rotated together and thereby quickly moved bodily in an axial direction by the rotation of the hand wheel for rapidly actuating the slide, a stop on the support, and a cooperating stop on the bearing adapted to engage the first stop to limit the rotation of the bearing.

15. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative between the screw and bearing for relatively rotating the screw and bearing, and graduated means for indicating the amount of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide.

16. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a graduation on the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative between the screw and bearing for relatively rotating the screw and bearing, and graduated means on the screw adapted to cooperate with the said graduation on the bearing for indicating the amount of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide.

17. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a graduation on the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative between the screw and bearing for relatively rotating the screw and bearing, and a graduated ring rotatably adjustable on the hub of the hand wheel and adapted to cooperate with the said graduation on the bearing for indicating the amount of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide.

18. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means for relatively rotating the screw and bearing comprising a worm mounted in one member and engaging worm wheel teeth in the other member, and graduated means for indicating the amount of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide.

19. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing threadedly engaging the support, the screw being rotatable within the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative between the screw and bearing for relatively rotating the screw and bearing, and graduated means for indicating the amount of such relative movement, the hand wheel being adapted to rotate the

bearing and screw together to move the same bodily in an axial direction for rapidly actuating the slide.

20. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing threadedly engaging the support, the screw being rotatable within the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means for relatively rotating the screw and bearing comprising a worm mounted in one member and engaging worm wheel teeth in the other member, and graduated means for indicating the amount of such relative movement, the hand wheel being adapted to rotate the bearing and screw together to move the same bodily in an axial direction for rapidly actuating the slide.

21. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, an operative connection between the screw and bearing including means for relatively rotating the screw and bearing, graduated means for indicating the extent of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide, and means for disengaging the said connection whereby the screw may be freely rotated in the bearing by the hand wheel.

22. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, an operative connection between the screw and bearing including means for relatively rotating the screw and bearing, graduated ring means on the screw adjacent the bearing for indicating the extent of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide, and means for disengaging the said connection whereby the screw may be freely rotated in the bearing by the hand wheel.

23. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, an operative connection between the screw and bearing including a worm mounted in one member and engaging worm wheel teeth in the other member for relatively rotating such members, graduated means for indicating the extent of such relative rotation, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide, and means for disengaging the said connection whereby the screw may be freely rotated in the bearing by the hand wheel.

24. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operative between the screw and bearing for relatively rotating the screw and bearing, graduated means for indicating the amount of such relative movement, the hand wheel being adapted to operate the bearing and screw to move the same bodily in an axial direction for rapidly actuating the slide, a stop on the support, and a co-operating stop on the bearing adapted to to engage the first stop to limit the movement of the bearing.

25. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing threadedly engaging the support, the screw being rotatable within the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, means operatively between the screw and bearing for relatively rotating the screw and bearing, graduated means for indicating the amount of such relative movement, the hand wheel being adapted to rotate the bearing and screw together to move the same bodily in an axial direction for rapidly actuating the slide, a stop on the support, and a co-operating stop on the bearing adapted to engage the first stop to limit the rotation of the bearing.

26. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, graduated means for indicating the amount of movement of the screw in the bearing, means for connecting the hand wheel with or disconnecting the hand wheel from the bearing whereby the hand wheel may either rotate the screw freely in the bearing to slowly actuate the slide or operate on the bearing to move the same bodily together with the screw in an axial direction to rapidly actuate the slide.

27. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing rotatably mounted in the support, the screw being rotatably mounted in the bearing, a hand wheel mounted on the screw, rotation of the screw within the

bearing being adapted to slowly actuate the slide, graduated means for indicating the amount of movement of the screw in the bearing, means for engaging the hand wheel with or disengaging the hand wheel from the bearing whereby the hand wheel may either rotate the screw freely in the bearing to slowly actuate the slide or operate on the bearing to rotate and thereby move the same bodily together with the screw in an axial direction to rapidly actuate the slide.

28. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing having a relatively coarse threaded engagement with the support, the screw being rotatable within the bearing, means for optionally securing the bearing against rotation in the support, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, graduated means for indicating the amount of movement of the screw in the bearing, means for engaging the hand wheel with or disengaging the hand wheel from the bearing whereby the hand wheel may rotate the screw freely in the bearing to slowly actuate the slide or rotate the bearing with the screw to rapidly actuate the slide.

29. The combination of a support, a slide thereon, a screw operatively connected to the slide, a bearing in which the screw is adapted to rotate, a graduation on the bearing, a hand wheel mounted on the screw, rotation of the screw within the bearing being adapted to slowly actuate the slide, and graduated means on the screw adapted to cooperate with the said graduation on the bearing for indicating the amount of movement of the screw in the bearing, means for connecting the hand wheel with or disconnecting the hand wheel from the bearing whereby the hand wheel may either rotate the screw freely in the bearing to slowly actuate the slide or operate on the bearing to move the same bodily together with the screw in an axial direction to rapidly actuate the slide.

In testimony whereof, I hereto affix my signature.

WALTER E. INGHAM.