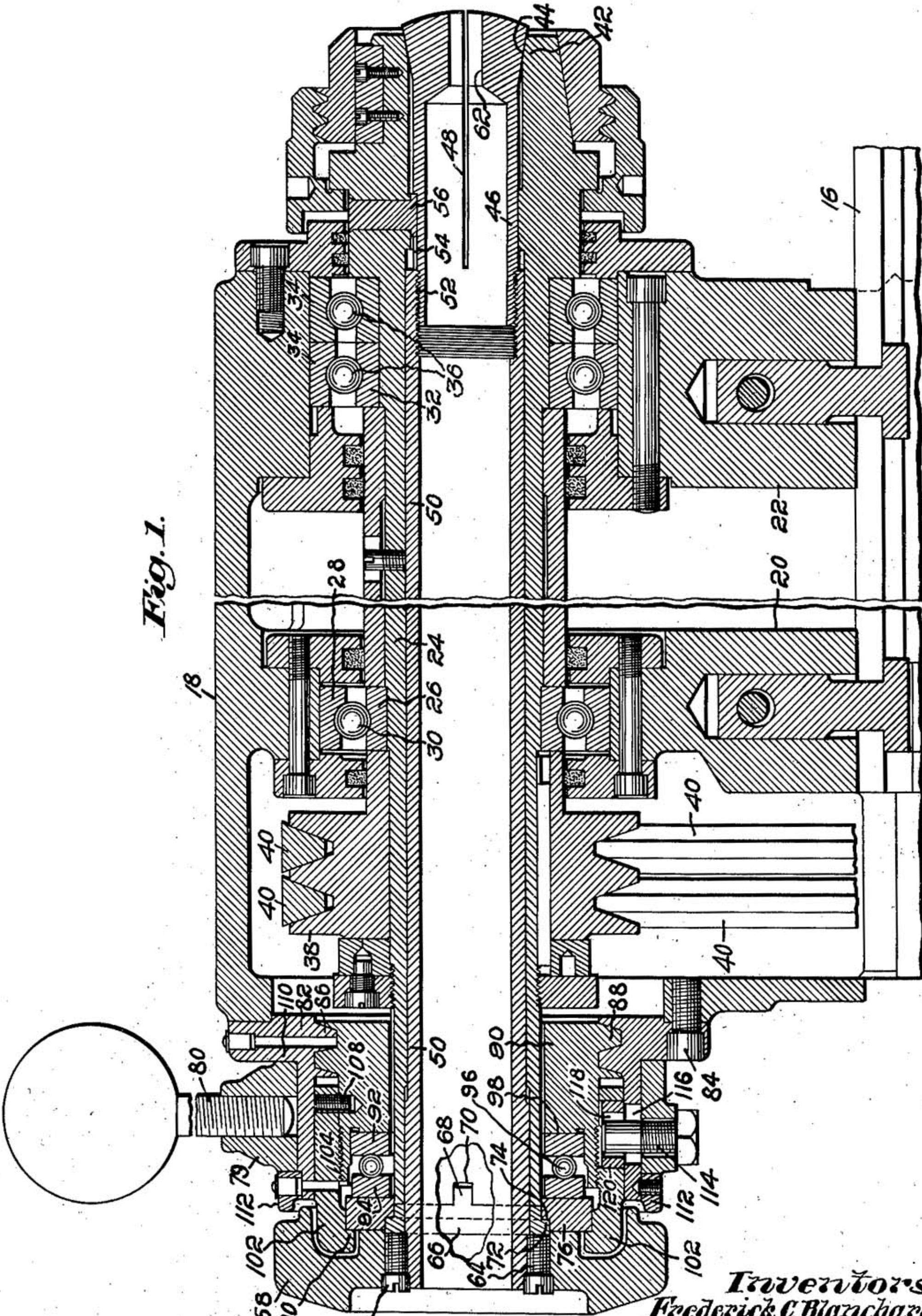
Nov. 18, 1941. F. C. BLANCHARD ET AL 2,263,117

CHUCK OPERATING MECHANISM

Filed Dec. 16, 1939 5 Sheets-Sheet 1



Inventors:
Frederick C. Blanchard
Chester G. Brown,
by
Emery, Booth, Townsend, Miller & Weidner Attys.

Nov. 18, 1941. F. C. BLANCHARD ET AL 2,263,117

CHUCK OPERATING MECHANISM

Filed Dec. 16, 1939 5 Sheets-Sheet 2

Fig. 2.

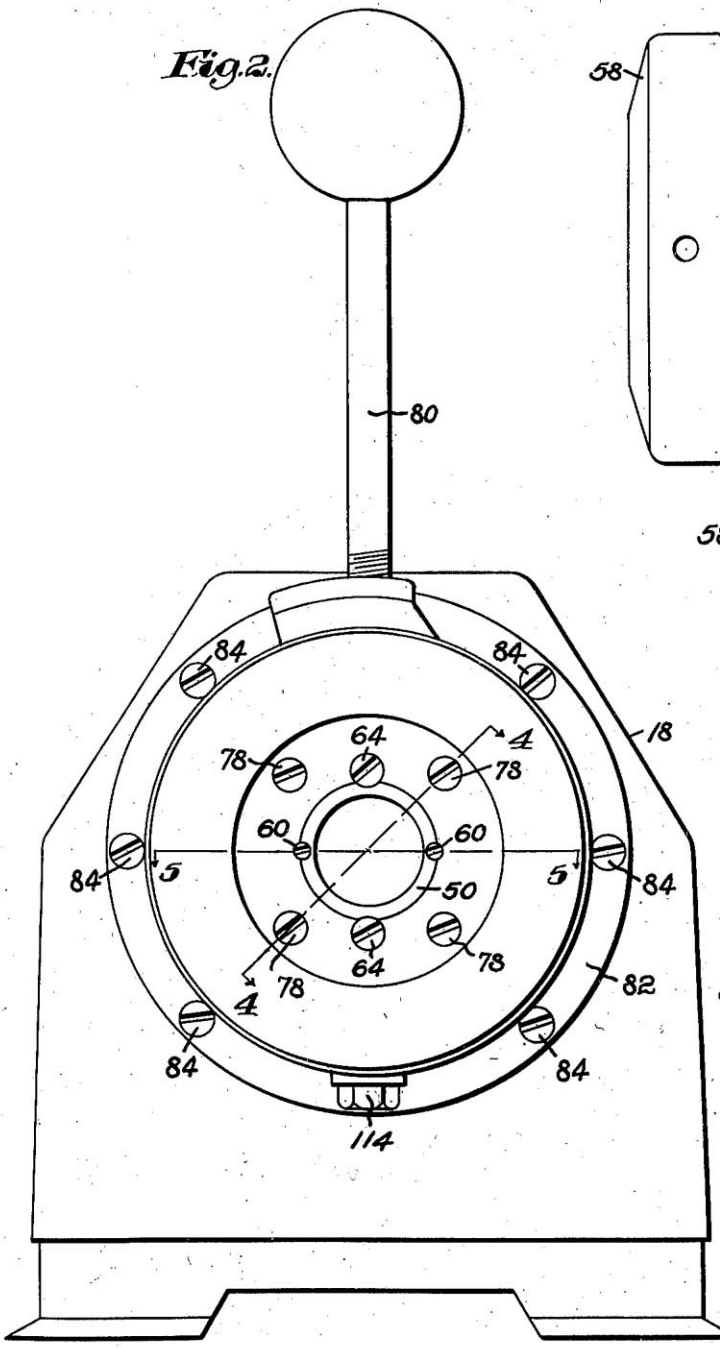


Fig. 3.

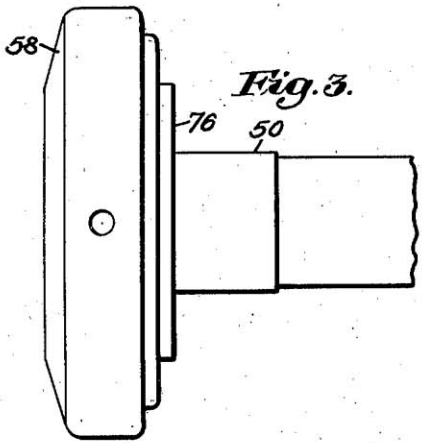


Fig. 4.

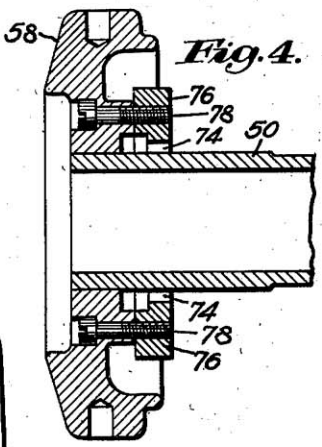
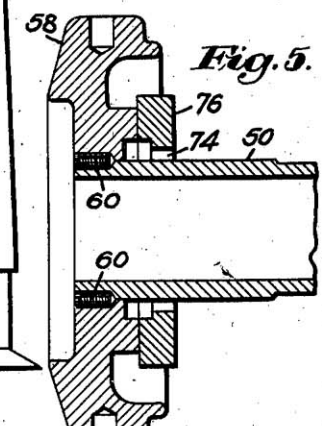


Fig. 5.



Inventors:
Frederick C. Blanchard.
Chester G. Brown,
by Emery, Booth, Townsend, Miller & Neidner Attys.

Nov. 18, 1941. F. C. BLANCHARD ET AL 2,263,117

CHUCK OPERATING MECHANISM

Filed Dec. 16, 1939 5 Sheets-Sheet 3

Fig. 6.

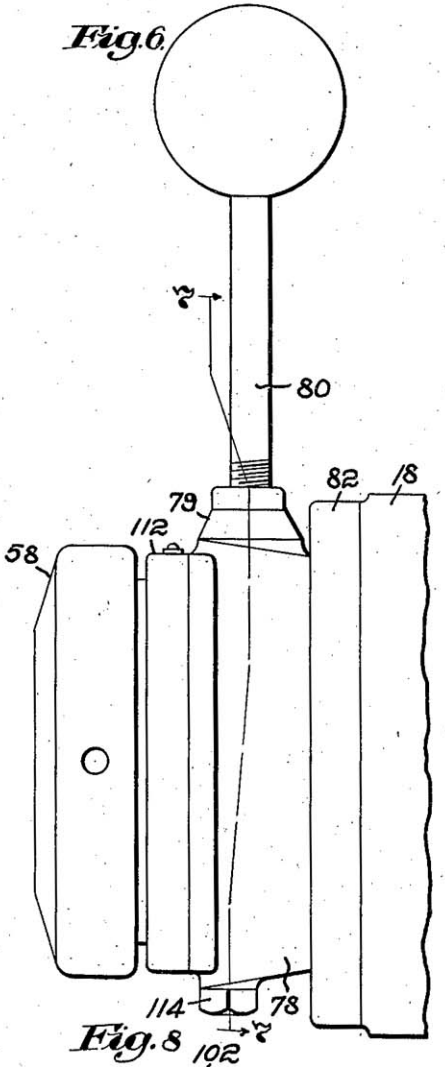


Fig. 7.

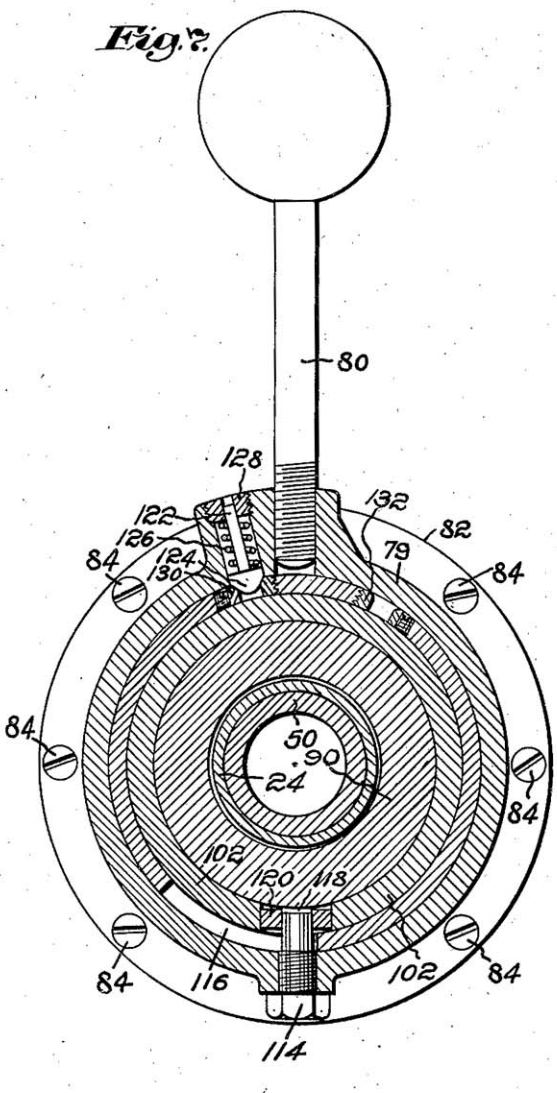
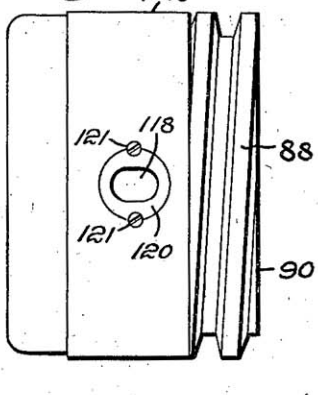


Fig. 8



Inventors:
Frederick C. Blanchard,
Chester G. Brown,
by
Emery, Booth, Townsend, Miller & Maidens Attys.

Nov. 18, 1941. F. C. BLANCHARD ET AL 2,263,117

CHUCK OPERATING MECHANISM

Filed Dec. 16, 1939 5 Sheets-Sheet 4

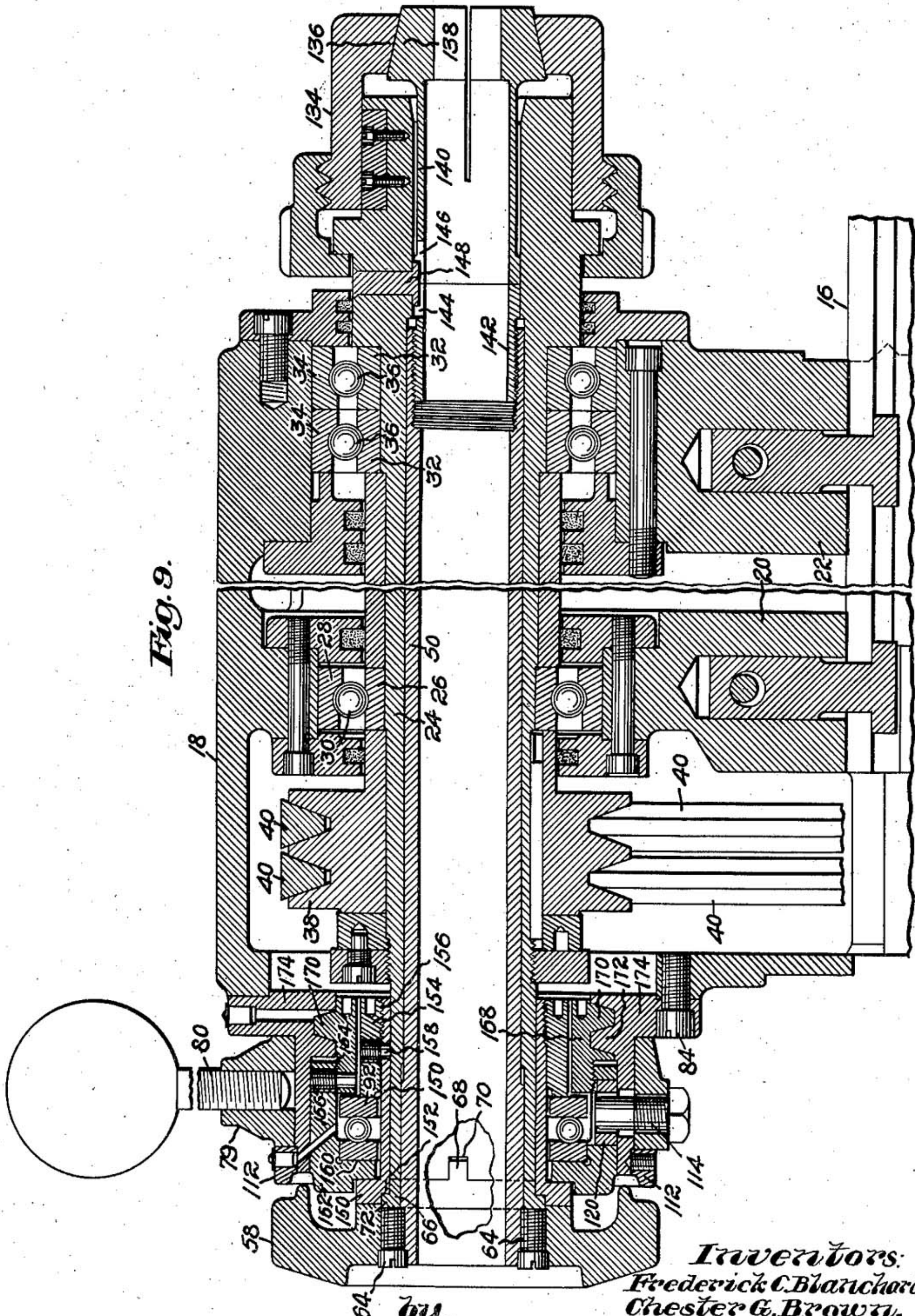


Fig. 9.

Inventors:
Frederick C. Blanchard
Chester G. Brown,
by Emery, Booth, Townsend, Miller & Weidner
Attys.

Nov. 18, 1941. F. C. BLANCHARD ET AL 2,263,117

CHUCK OPERATING MECHANISM

Filed Dec. 16, 1939 5 Sheets-Sheet 5

Fig. 10.

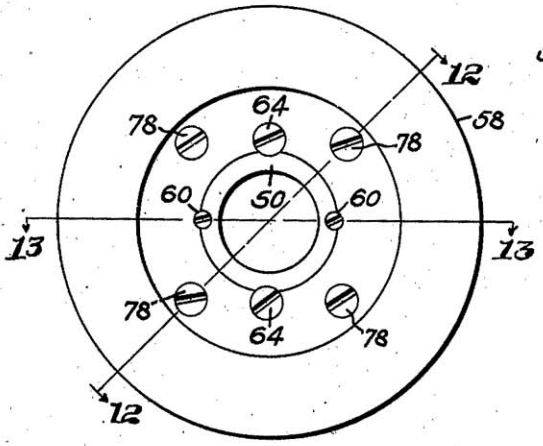


Fig. 11.

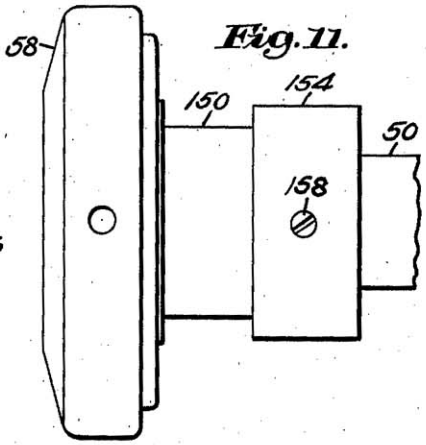


Fig. 12.

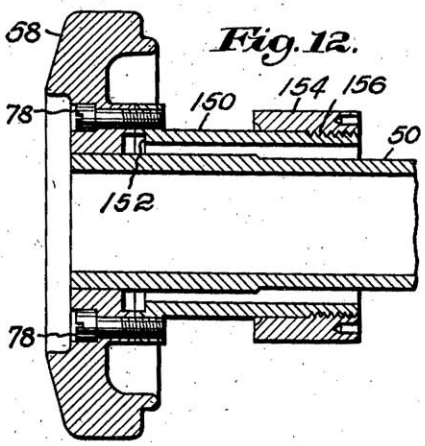


Fig. 13.

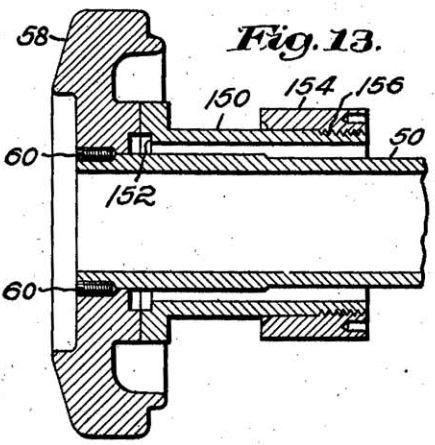
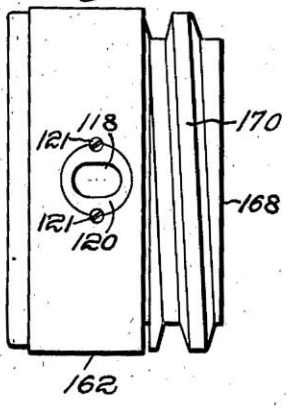


Fig. 14.



Inventors:
Frederick C. Blanchard
Chester G. Brown,
by
Emery, Booth, Townsend, Miller & Maidman Attys.

Patented Nov. 18, 1941

2,263,117

UNITED STATES PATENT OFFICE

2,263,117

CHUCK OPERATING MECHANISM

Frederick C. Blanchard, Brookline, and Chester G. Brown, Newton, Mass., assignors to Rivett Lathe & Grinder, Inc., Boston, Mass., a corporation of Massachusetts

Application December 16, 1939, Serial No. 309,614

9 Claims. (Cl. 279—52)

This invention relates to lathe head-stock structures of the class wherein the work-piece, in the nature of a rod-like body is passed through a hollow head-stock spindle and is held by a holder in the nature of a collet-type chuck. The invention is more particularly concerned with novel chuck operating mechanism in two forms, one for a "draw in" chuck and the other for a "push out" chuck, one operating in a direction reverse to the other. The invention will best be understood by reference to the following description when taken in connection with the accompanying drawings of both forms, while its scope will be pointed out more particularly in the appended claims.

In the drawings:

Fig. 1 is a vertical, longitudinal sectional view of a lathe head-stock equipped with a chuck closer of the "draw in" type;

Fig. 2 is an elevation of the same as viewed from the left end of Fig. 1;

Fig. 3 is a front elevation of the hand-wheel or knob and parts secured thereto;

Fig. 4 is a sectional view on line 4—4 of Fig. 2;

Fig. 5 is a sectional view on line 5—5 of Fig. 2;

Fig. 6 is a front elevation of a portion of the structure;

Fig. 7 is a sectional view on line 7—7 of Fig. 6;

Fig. 8 is a bottom plan of the chuck operating screw and attached sleeve;

Fig. 9 is a vertical, longitudinal section of a head-stock structure equipped with a chuck mechanism of the "push out" type;

Fig. 10 is a left-hand elevation of the hand-wheel or knob and attached parts;

Fig. 11 is a front elevation of the parts shown in Fig. 10;

Fig. 12 is a sectional view on line 12—12 of Fig. 10;

Fig. 13 is a sectional view on line 13—13 of Fig. 10; and

Fig. 14 is a bottom plan of the chuck operating screw and attached sleeve of the "push out" type.

Referring to the drawings and to the embodiments of the invention illustrated therein by way of example, and having reference at first to Fig. 1, there is shown a portion of a lathe comprising a bed 16 supporting a head-stock 18 having transverse walls 20 and 22 which support appropriate bearings, presently to be described, for a hollow, head-stock spindle 24. In the present example there are two such bearings, and one of them is a one-row ball bearing while the other is a two-row ball bearing. The first bearing comprises inner and outer races 26 and 28 and an intermediate set of balls 30, while the second comprises two inner races 32, two outer races 34 and two sets of balls 36. It is deemed unnecessary to describe the bearings in further detail. The head-stock spindle is suitably driven as by a pulley 38, herein grooved to receive V belts 40, and suitably secured to the spindle.

In the "draw in" type, the head-stock spindle has an internal taper 42 which receives an external taper 44 on a hollow, collet chuck 46 provided with longitudinal slots 48 to render the same resiliently contractible by being drawn in (i. e. moved to the left as viewed in Fig. 1) by a hollow chuck spindle 50 whose inner or right-hand end is secured to the adjacent end of the chuck as by a screw thread 52 having sufficient end clearance to allow axial adjustment of the chuck to suit variations in diameter of the work. The chuck is suitably held against rotation in the head-stock spindle 24 but is permitted to move axially therein as by providing the chuck with a keyway 54 which receives a key 56 attached to the head-stock spindle.

A hand-wheel 58 is located at the outer end of the coaxial hollow spindles, and is secured to the chuck spindle 50 (see Fig. 5) as by screws 60, commonly called "Dutchmen," threaded partly into the hand wheel and partly into the chuck-spindle. It will be remembered that the chuck and the chuck-spindle have screw-threaded connection wth each other and that the chuck, although free to move axially, is prevented by the key 56 from turning in the head-stock spindle. It follows that, by grasping the hand-wheel 58 and turning the chuck spindle 50, the chuck may be drawn in to the extent necessary to establish preliminary engagement of the internal surface 62 of the chuck with the work.

To maintain the adjustment thus obtained, screws 64 threaded into the hand-wheel are then screwed inwardly into firm engagement with a friction ring 66 non-rotatably coupled to the adjacent end of the head-stock spindle 24 as by jaws or teeth 68 on the ring received in corresponding slots 70 in the end of the spindle. The slots are of sufficient length to provide a clearance beyond the ends of the jaws. Thus, the pressure of the screws 64 against the friction ring 66 forces a shoulder 72 on the latter axially against a shoulder 74 on a second friction ring 76, which, as shown in Fig. 4, is suitably secured as by screws 78 to the hand-wheel 58.

The binding of the friction ring 66 against the friction ring 76, as just described, prevents rel-

ative rotation of the two spindles 24 and 50 inasmuch as the friction ring 66 is, as stated, non-rotatively coupled to the outer end of the spindle 24. All is now in readiness for the application of clamping pressure of the chuck 46 against the work by a powerful inward pull of the chuck produced by the closing mechanism now to be described.

The closing mechanism comprises an actuator, herein a ring 79 (see Fig. 1) which turns about the common axis of the described spindles, and is provided with a handle 80. This turning movement is utilized to impart an axial movement to the chuck-spindle 50 by appropriate mechanism such as an outer sleeve 82 secured to the outer end of the head-stock 18 as by screws 84 and having an internal, left-hand, screw-thread 86, mating with an external screw-thread 88 on an inner sleeve 90. It will be convenient, sometimes, to refer to the outer, internally threaded sleeve as the nut, and to refer to the inner, externally threaded sleeve as the screw. Inasmuch as the nut is held fixed by reason of the fact that it is secured to the head-stock, it follows that rotation of the screw is accompanied by axial movement of the latter.

Assuming then that the screw moves outwardly, i. e. toward the left as viewed in Fig. 1, its movement is imparted to the chuck spindle 50 through a suitable thrust bearing herein comprising ball-races 92 and 94 and intermediate balls 96. The race 92 rests against a shoulder 98 presented by the inner ring 90 and the race 94 rests against the friction ring 76. On the other hand, when the screw moves inwardly, i. e., toward the right in Fig. 1, the movement is imparted to the chuck spindle 50 by reason of the fact that the outer face of the ring 76 is engaged by a shoulder 100 presented by ring 102 suitably secured to the screw 90 as by a thread 104 and a fastening element such as screw 108.

Returning now to the actuating ring 79, the latter is conveniently mounted to turn on and about the sleeve 82 (sometimes called the nut) and is received between a shoulder 110 on said sleeve and a collar 112 secured to said sleeve. Hence, the actuating ring, though free to turn, is prevented from moving axially. Turning movement of the ring is conveniently communicated to the screw 90 (see Fig. 7) as by a stud 114 carried by the ring and projecting radially inward through a circumferential slot 116 in the nut 82 and into a slot 118 (see Fig. 1) in a hardened bushing 120 pressed into a correspondingly shaped opening in the ring 102 (see Fig. 8), and is additionally secured by two "Dutchmen" screws 121.

It follows that partial rotation of the actuating ring 79 is accompanied by corresponding rotation and consequent axial movement of the screw 90, and this axial movement is communicated to the chuck spindle.

The normal position of the actuating ring is as shown in Fig. 7 with its handle 80 upright. Partial clockwise rotation of the ring, herein through an angle of 45° from the position shown causes the chuck to grip the work firmly. A detent pin 122 has a rounded head 124 which, under the urge of a spring 126, between the head and a bushing 128, enters either of two bushings 130 and 132 the proper angular distance apart, in this instance 45 degrees, thus to hold the actuating ring in either of its two positions.

As already indicated, the foregoing description is concerned with a chuck of the draw-in type. To adapt the invention to a chuck of the push-out type, certain modifications are made and they are illustrated in Figs. 9 to 14, inclusive. Those parts which remain unchanged, or substantially so, will not require a second description, and so far as possible bear the same reference characters as before. It is therefore convenient to proceed directly to the modifications occasioned by the "push out" arrangement as distinguished from the "draw in" arrangement.

In this instance, a spindle-nose 134, suitably secured to the head-stock spindle 24, has an internal taper 136 which receives an external taper 138 on a chuck 140, and the direction of taper is the reverse of that hereinbefore described. In this instance, the chuck does not have direct, screw-threaded connection with the chuck-spindle 50, but instead there is an indirect connection comprising a coupling 142 threaded into the spindle, and this coupling has a key-way 144 registering with a key-way 146 in the chuck, and both key-ways receiving a key 148 which holds both against rotation with relation to the head-stock spindle 24. Hence, turning of the chuck-spindle 50 in the proper direction produces axial outward movement of the chuck because the chuck abuts endwise against the coupling 142. When, on the other hand, the chuck spindle is retracted, i. e. moved toward the left as viewed in Fig. 9, the resiliency of the chuck, tending to open the same, plus the rather abrupt angle of the tapers 136 and 138, causes the chuck to recede and follow the chuck spindle.

Turning now to the operating mechanism, it is evident that the thrusts should be reversed as compared with the "draw in" type. This involves not only a reversal of the threads of the screw and nut, but also a reversal of the surfaces which operate through the thrust bearing. In this form, the screws 78 (see Fig. 12) secure to the hand-wheel 58 a friction ring 150 which takes the place of the friction ring 76 of the first form and has a shoulder 152 resting against the shoulder 72 of the friction ring 66 which remains unchanged. However, in this example, the friction ring 150 is greatly elongated, as best shown in Fig. 12, and to it a collar 154 is appropriately secured as by a screw-thread 156 and by a stud 158 (see Fig. 9) screwed into said collar and projecting radially inward into said friction ring. The collar 154 is disposed at the right-hand side of the thrust bearing as contrasted with the first form in which the friction ring 76 is disposed at the left-hand side of the thrust bearing.

In this second example, at the left-hand side of the thrust bearing, there is a shoulder 160 presented by a ring 162 secured as by a thread 164 and by a screw 166 to an inner sleeve 168 (best shown in Fig. 14) having a right-hand, external thread 170 which mates with an internal thread 172 (see Fig. 9) formed in an outer sleeve 174. It will be convenient in this case, also, to refer to the inner, threaded sleeve 168 as the screw and to refer to the outer, threaded sleeve 174 as the nut, as in the first example.

It should now be evident that rocking of the actuating ring 79 of the second example by movement of the handle 80 toward the operator acts through the screw 168 and nut 174 to push the chuck 140 outwardly, i. e., to the right as viewed in Fig. 9, thereby causing contraction of the chuck and consequent gripping of the work, and conversely that rocking of the handle rearwardly causes the chuck to relax and to release the work.

In each example, the required movement of

the operating handle is slight, and the movement is smooth and powerful.

Having thus described two embodiments of the invention but without limiting ourselves thereto, what we claim and desire, by Letters Patent, to secure is:

1. In a mechanism for operating a chuck of the collet type wherein the work to be grasped by the chuck is disposed axially within a hollow spindle by which the work is rotated, the combination of inner and outer members which are relatively rotatable about the chuck axis, means connecting said members to each other to utilize their relative rotation to cause their relative axial movement, an actuator which turns on and about said outer member about said axis, means extending from said actuator through said outer member and connecting said actuator to said inner member, a rotatable and axially movable chuck spindle, and means to cause axial movement of said inner member to be transmitted to said chuck spindle.

2. The combination with a machine tool head and its spindle, of a hollow chuck to be rotated by said spindle, inner and outer, concentric, relatively rotatable members coaxial with said spindle and said chuck, one of said members being secured to said head, means connecting said members to utilize rotation of the other member to cause its axial movement, an actuating ring coaxial with said spindle, means to cause turning of said ring to be accompanied by turning of said other member, and means to utilize said axial movement to cause said chuck to grip the work.

3. The combination of a machine tool head and its spindle, of a hollow chuck to be rotated by said spindle, inner and outer, concentric, relatively rotatable members coaxial with said spindle and said chuck, one of said members being secured to said head, means connecting said members to utilize rotation of the other member to cause its axial movement, an actuating ring about and coaxial with the member which is secured to said head, means connecting said ring to the other member to cause turning of said ring to be accompanied by turning of said other member, and means to utilize said axial movement to cause said chuck to grip the work.

4. In a machine tool, the combination of a head, a first spindle rotatably mounted therein and having an internal taper, a contractible chuck within and keyed to said spindle and having an external taper engaging said internal taper, a second spindle mounted within said first spindle to move axially and rotatably and having screw-threaded connection with said chuck, a hand-wheel secured to the outer end of said second spindle, an outer sleeve secured to the outer end of said head and having an internal screw-thread, a circumferentially extending slot and an outwardly-facing shoulder, a collar secured to said sleeve and having an inwardly-facing shoulder, an actuating ring disposed between said shoulders and mounted to turn on and about said sleeve, a handle to swing said ring about said sleeve, a stud carried by said ring and projecting radially inward through said slot, an axially and rotatably movable, inner sleeve having an external screw-thread mating with said internal screw-thread and connected with said stud to be turned in unison with said actuating ring, a thrust bearing about said first spindle, and means to utilize axial movement of said inner sleeve to act through said thrust bearing to move said chuck spindle and said chuck axially.

5. In a machine tool, the combination of a head, a first spindle rotatably mounted therein and having an internal taper, a contractible chuck within and keyed to said spindle and having an external taper engaging said internal taper, a second spindle mounted within said first spindle to move axially and rotatably and having screw-threaded connection with said chuck, a hand-wheel secured to the outer end of said second spindle, a friction ring non-rotatably coupled to said first spindle, screw means carried by said hand-wheel to exert a pressure on said clamping ring, an outer sleeve secured to the outer end of said head and having an internal screw-thread, a circumferentially extending slot and an outwardly-facing shoulder, a collar secured to said sleeve and having an inwardly-facing shoulder, an actuating ring disposed between said shoulders and mounted to turn on and about said sleeve, a handle to swing said ring about said sleeve, a stud carried by said ring and projecting radially inward through said slot, an axially and rotatably movable, inner sleeve having an external screw-thread mating with said internal screw-thread and connected with said stud to be turned in unison with said actuating ring, a thrust bearing about said first spindle, and means to utilize axial movement of said inner sleeve to act through said thrust bearing to move said second spindle and said chuck axially.

6. In a mechanism for operating a chuck of the type wherein the work to be held by the chuck is passed through a hollow spindle by which the chuck is rotated, the combination of two members which are relatively rotatable about the spindle axis, means connecting said members to each other to utilize their relative rotation to cause their relative axial movement, means to hold one of said members fixed against rotation, an actuator coaxial with and turning about the fixed member and connected with the other member to rotate the latter about the chuck axis, actuator limiting means to limit and define the angular movement of said actuator about said axis, said limiting means including a part carried by said actuator, and a fixed part having a formation which cooperates with the first-named part, and means to utilize relative axial movement of said members to operate the chuck, the last-mentioned means including a hollow chuck spindle operating through the first-mentioned spindle.

7. In a mechanism for operating a chuck of the type wherein the work to be held by the chuck is passed through a hollow spindle by which the chuck is rotated, the combination of two members which are relatively rotatable about the spindle axis, means connecting said members to each other to utilize their relative rotation to cause their relative axial movement, means to hold one of said members fixed against rotation, an actuator coaxial with and turning about the fixed member and connected with the other member to rotate the latter about the chuck axis, actuator limiting means to limit and define angular movement of said actuator about said axis, said limiting means including a fixed part having a slot, and a movable part which moves angularly to and fro in said slot, and means to utilize relative axial movement of said members to operate the chuck, the last-mentioned means

including a hollow chuck-spindle operating through the first-mentioned spindle.

8. In a machine tool, the combination of a head, a spindle and a chuck having cooperating tapers to utilize their relative axial movement to operate said chuck, and mechanism to move said chuck axially, said mechanism including two members which are supported by said head independently of said spindle and turn one with relation to the other about the spindle axis, and means connecting said members to each other to utilize their relative rotation to move said chuck axially, one of said members being attached to said head and thereby held fixed against rotation.

9. In a machine tool, the combination of a head, a spindle and a chuck having cooperating tapers to utilize their relative axial movement to operate said chuck, and mechanism to move said chuck axially, said mechanism including two members one of which is secured to said head and the other of which is rotatable about the spindle axis, means connecting said members to utilize rotation of one to cause axial movement of the same, an actuator supported by said head independently of said spindle and arranged to turn the rotatable member, and means to transmit axial movement of the rotatable member to said chuck.

FREDERICK C. BLANCHARD.
CHESTER G. BROWN.