Aug. 20, 1935. C. T. ROTTLER 2,011,875

BORING BAR DRIVE MEANS

Filed Nov. 22, 1932 4 Sheets-Sheet 1

FIG. 1

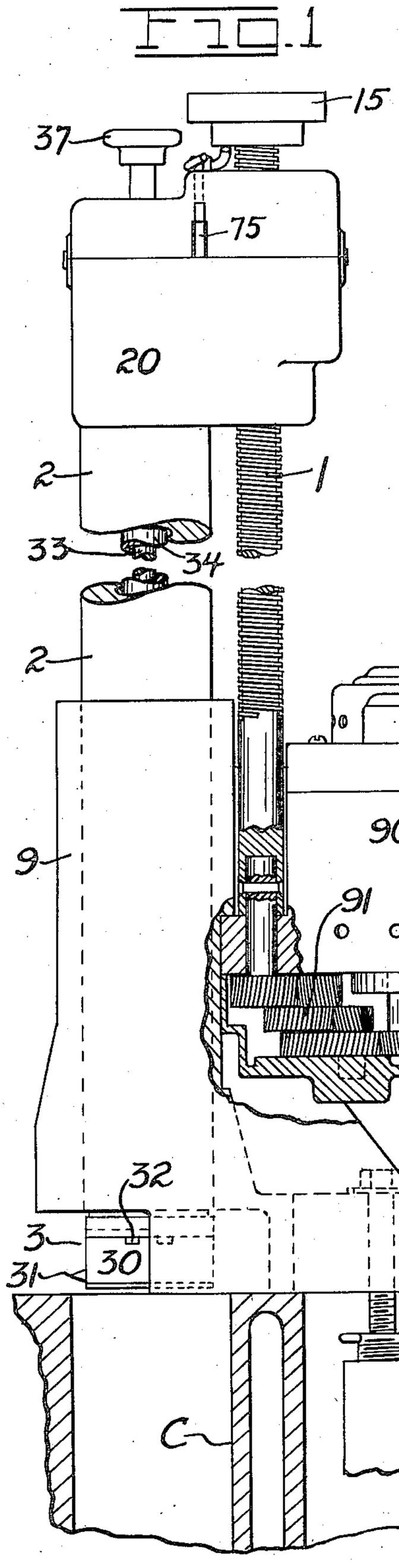
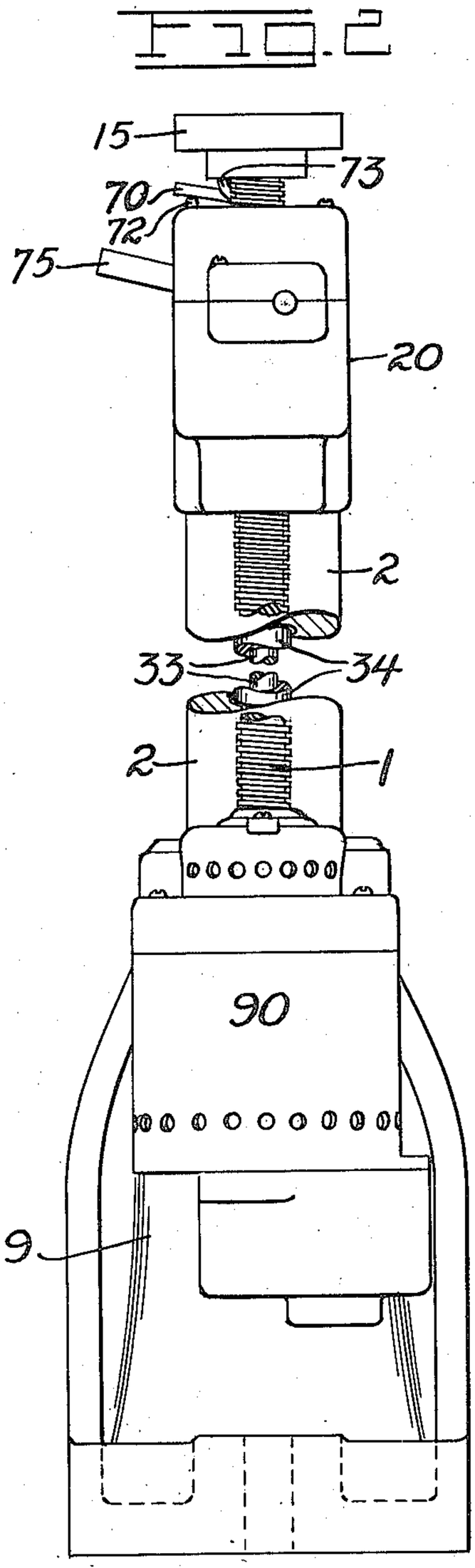


FIG. 2



INVENTOR
Clarence T. Rottler
BY
Charles L. Reynolds
ATTORNEY

Aug. 20, 1935. C. T. ROTTLER 2,011,875

BORING BAR DRIVE MEANS

Filed Nov. 22, 1932 4 Sheets-Sheet 2

FIG. 4

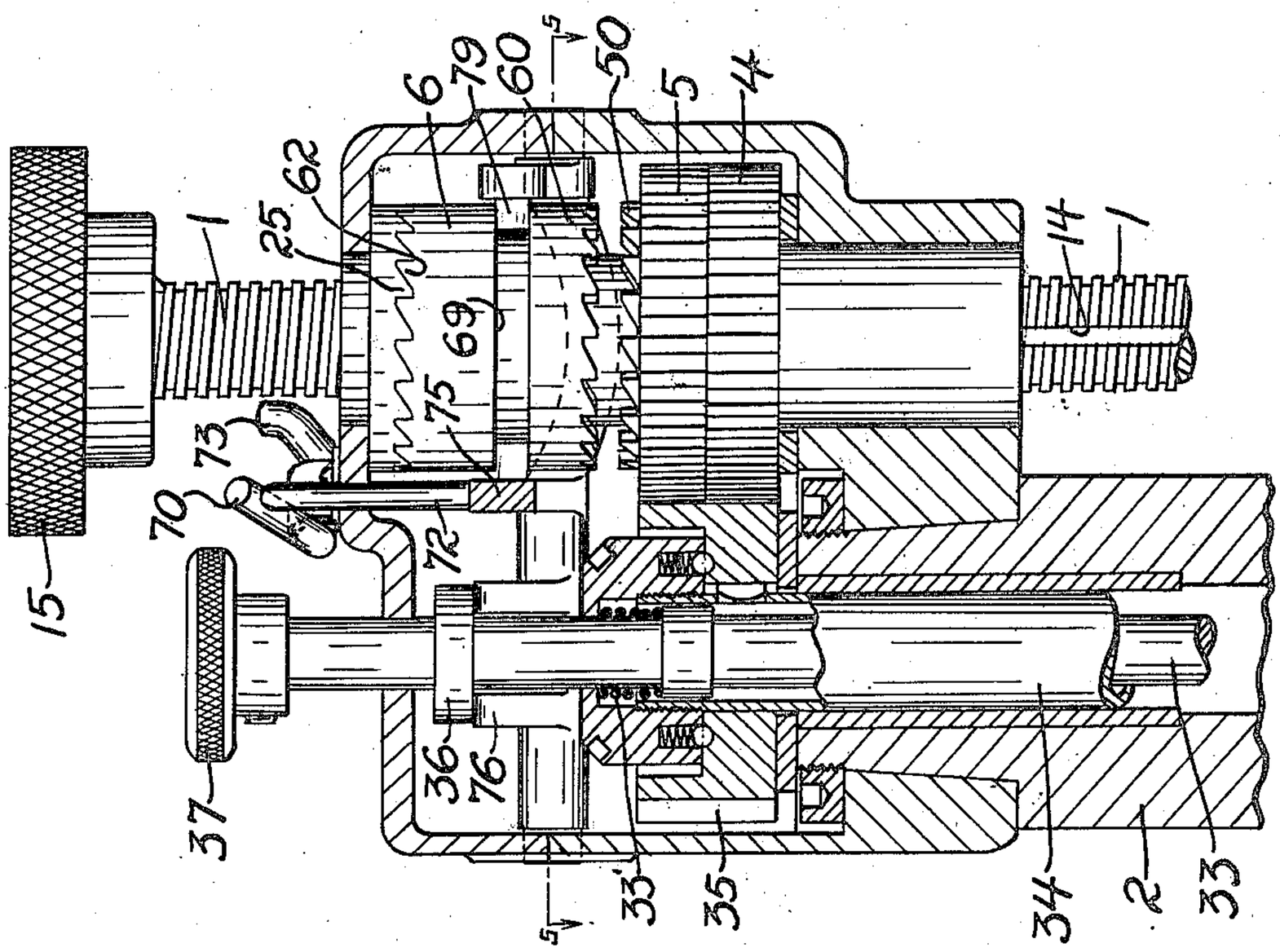
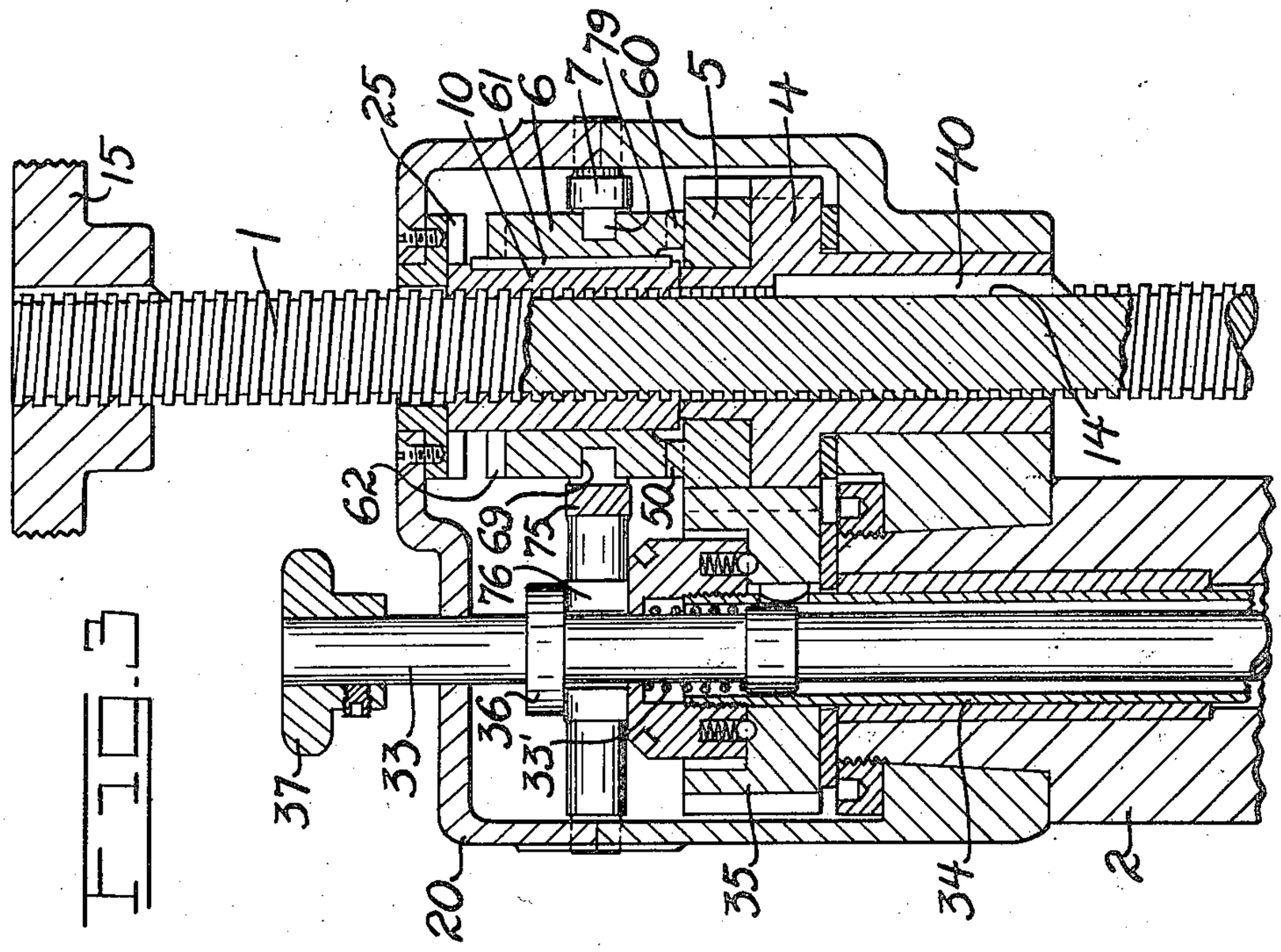


FIG. 5



INVENTOR
Clarence T. Rottler
BY
Charles L. Reynolds
ATTORNEY

Aug. 20, 1935. C. T. ROTTLER 2,011,875

BORING BAR DRIVE MEANS

Filed Nov. 22, 1932 4 Sheets-Sheet 3

FIG. 6

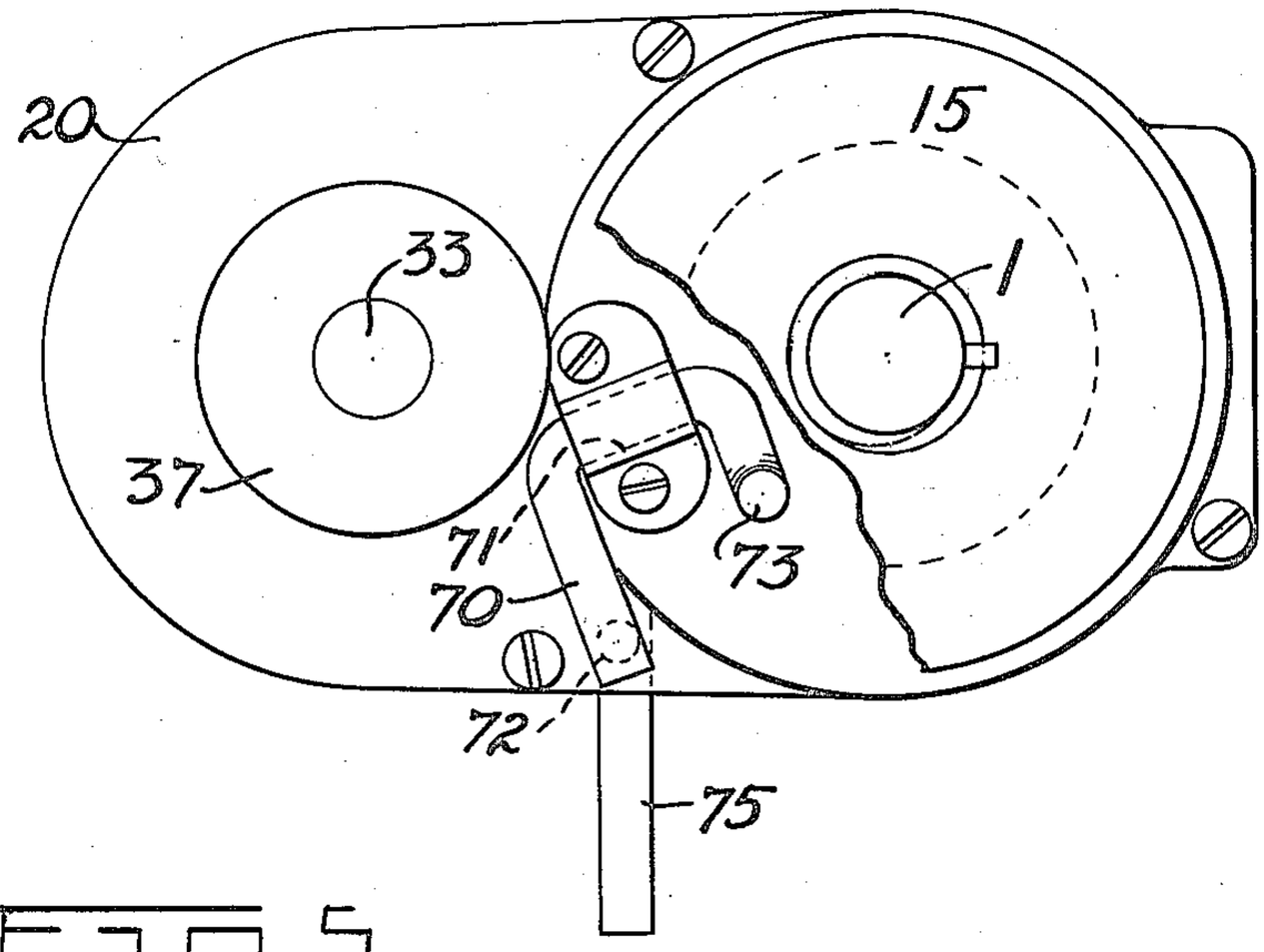
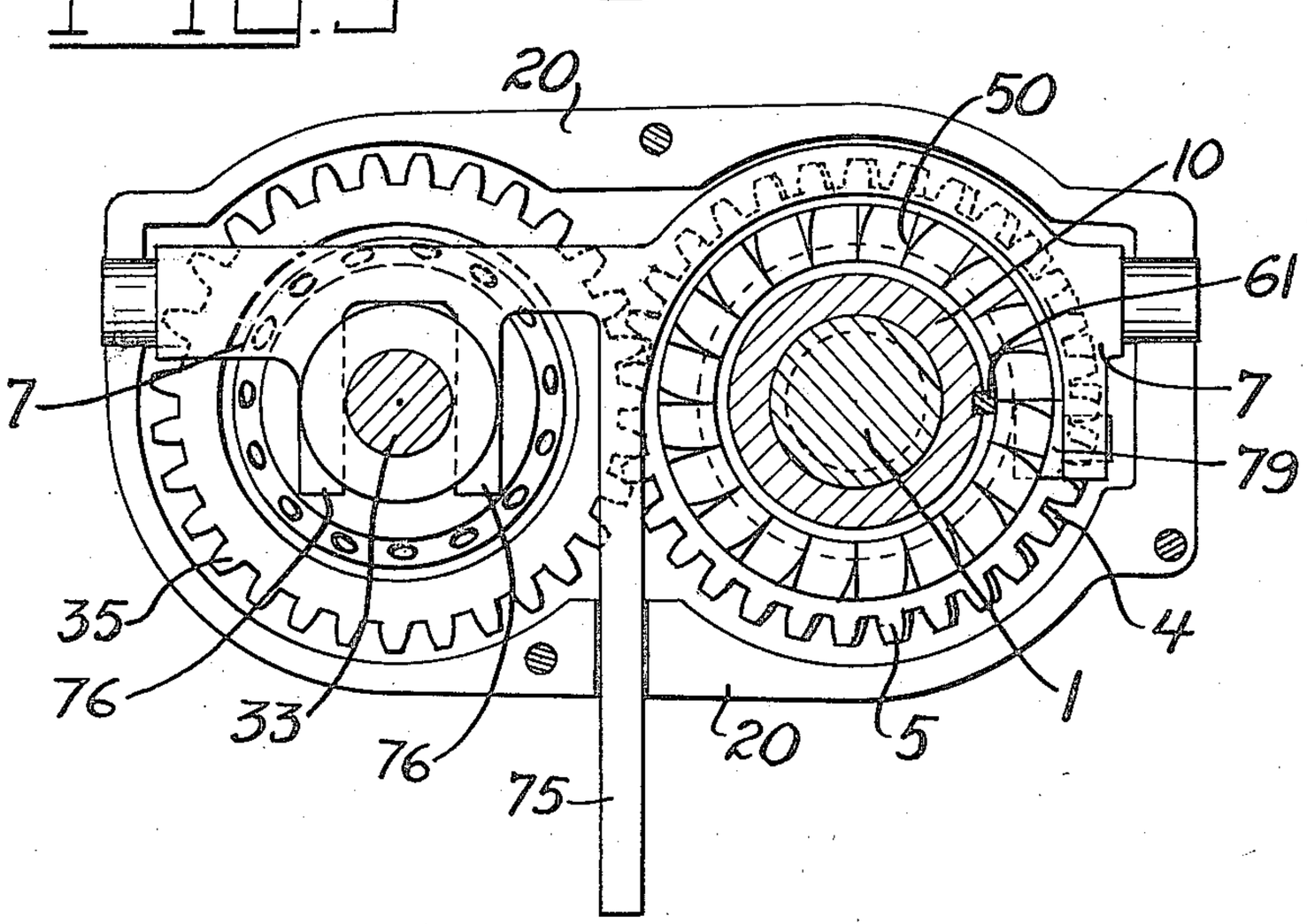


FIG. 5



INVENTOR
Clarence T. Rottler
BY
Charles L. Reynolds
ATTORNEY

Aug. 20, 1935. C. T. ROTTLER 2,011,875

BORING BAR DRIVE MEANS

Filed Nov. 22, 1932 4 Sheets-Sheet 4

FIG. 7

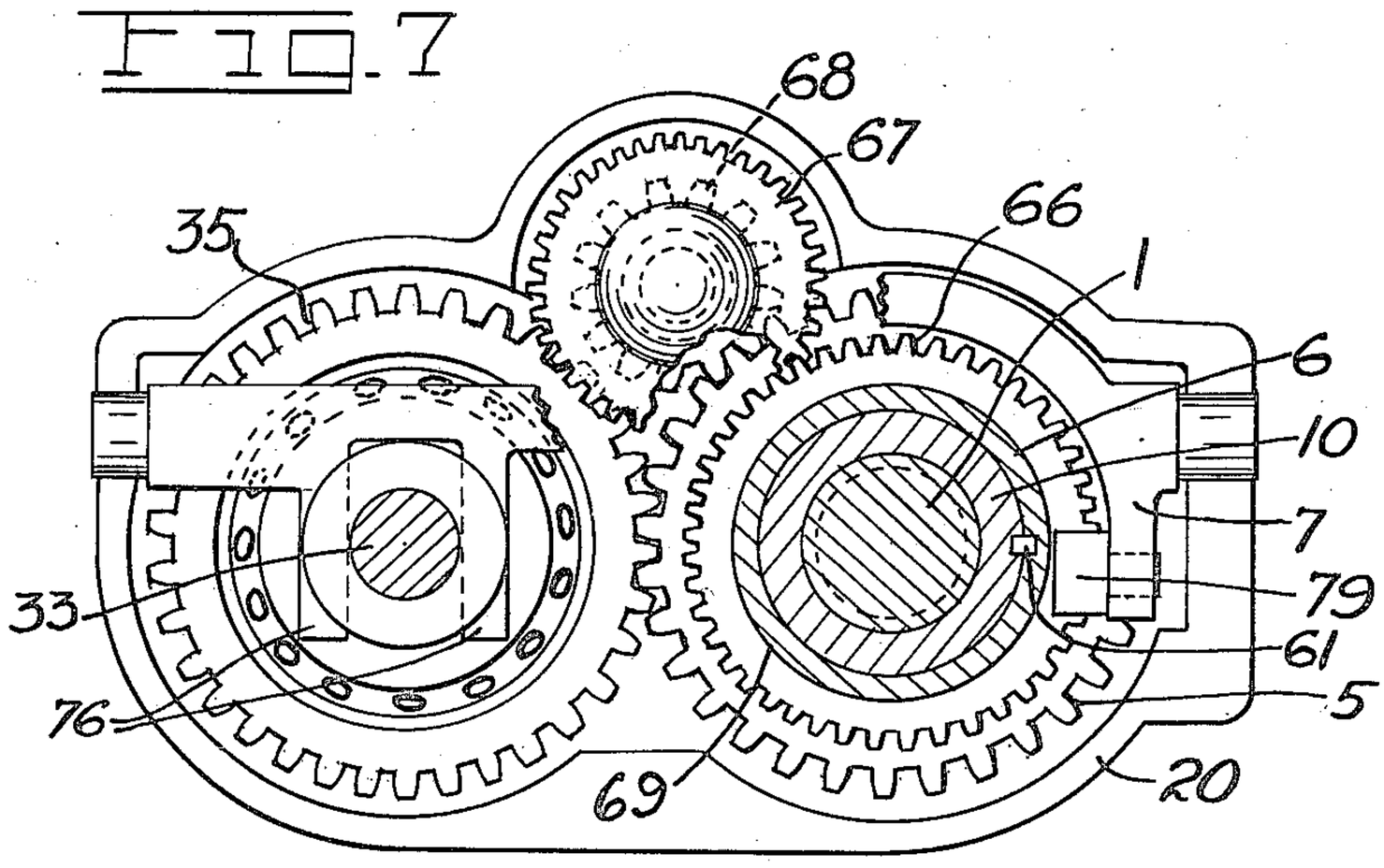
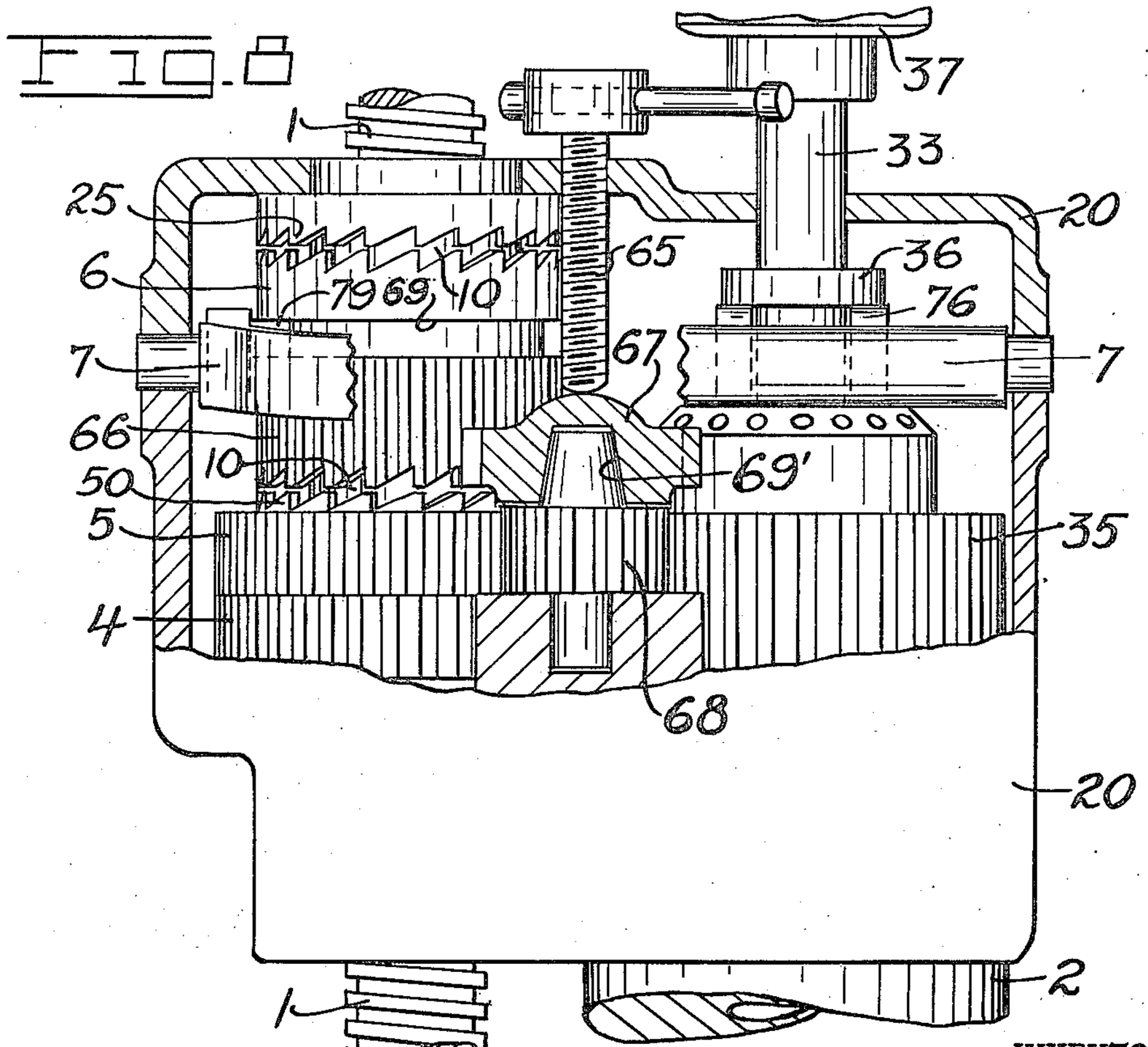


FIG. 8



INVENTOR
Clarence T. Rottler
BY
Charles L. Reynolds
ATTORNEY

Patented Aug. 20, 1935 2,011,875

UNITED STATES PATENT OFFICE

2,011,875

BORING BAR DRIVE MEANS

Clarence T. Rottler, Seattle, Wash.

Application November 22, 1932, Serial No. 643,858

14 Claims. (Cl. 77—2)

My invention relates to boring bars, machines for boring or reboring the cylinders of internal combustion engines, or the like. The present invention is concerned with a means to drive the rotary tool, and to effect feed and retraction thereof, while a companion application is concerned with the general assembly of the tool and the mounting of the boring bar.

Such a machine must be lifted about and placed upon the upper surface of a cylinder block which is being bored or rebored. In consequence, it must be as light and compact as possible, having consideration for the heavy work it must do, so that it may be moved without too great difficulty and accurately positioned by the mechanic. It follows that it cannot have incorporated in it complicated gear shift and clutch mechanisms, yet it is highly desirable to provide the following: (*a*) means to drive the rotary tool; (*b*) means to advance the tool slowly as it rotates; (*c*) means to retract the tool rapidly after a cut has been completed; and (*d*) for special occasions, as will appear in the description of the companion case, it is desirable to provide means operable upon certain occasions for advancing or projecting the tool rapidly.

It is an object of the present invention to devise a boring bar meeting the above requirements, which is compact and simple in its construction and operation, and thoroughly rugged and serviceable.

My invention comprises the novel parts, and the novel combination and arrangement of such parts, in the accomplishment of the above ends, as is shown in the accompanying drawings, described in this specification, and as will be more particularly pointed out by the claims which terminate the same.

In the accompanying drawings I have shown my invention embodied in illustrative forms such as are at present preferred by me, it being understood that the principles thereof, as pointed out in the specification and claims, may be incorporated in various forms, within the scope indicated by such claims.

Figure 1 is a side elevation of my boring bar, with parts broken away.

Figure 2 is an elevation of the same taken at right angles to Figure 1.

Figure 3 is an axial section through the upper part of the boring bar and the screw, and Figure 4 is a similar view, showing parts in a different operative position.

Figure 5 is a section substantially on the line **5—5** of Figure 4.

Figure 6 is a top plan view of the upper end of the boring bar.

Figure 7 is a view similar to Figure 5, and Figure 8 is a view similar to Figures 3 and 4, illustrating a slightly modified construction.

In general the tool comprises a base frame **9**, a boring bar **2** vertically disposed and guided in the frame **9** for vertical movement, a rotary tool **3** supported at the lower end of the boring bar, a motor **90** or equivalent means for delivering power to the machine, preferably integrally mounted upon the base frame **9**, a rotary screw **1** journaled in the frame **9** and driven by the motor **90**, and operatively connected, through means which in the embodiment illustrated are enclosed within the casing **20**, to accomplish not only rotation of the tool **3** but axial movement of the boring bar **2** in each direction. The drive from the motor **90** to the screw **1** may be through any suitable means, but preferably is through a reduction gear illustrated at **91**, which, however, may be varied as desired, and which forms no essential part of the present invention, except as it is preferable that the screw rotate at a slower rate of speed than that of the usual electric motor.

In order that the operation of the drive means may be understood it will now be explained how the rotary tool is supported and driven with relation to the boring bar. It may be pointed out first that the rotary tool comprises a casing **30**, a tool **31** which projects radially therefrom, and centering means **32** which are projectable at will from within the casing **30** to engage the sides of the cylinder C which is being bored or rebored. A rod **33** serves to control projection and retraction of the tool **31**, for it is essential that the tool be not projected, and in contact with the walls of a cylinder C which has been bored, during the time the tool is retracted. The connection between the rod and the tool it is not necessary to describe here, however, and it is fully described and claimed in the companion application referred to above. Suffice it to say that the rod **33** is reciprocably mounted, and is normally held down by a spring **33'**; when the rod is raised the tool is retracted, and when the rod is down the tool is projected. Surrounding this rod is a tube **34** which extends entirely through the boring bar, and upon the lower end of which is supported the rotary tool **3**. The latter is rotatable with the tube **34**, and at its upper end the tube **34** is keyed to a driven gear **35** (see Figures 3 and 4).

The casing **20** is rigidly fixed upon the upper

end of the boring bar 2, and therefore moves vertically with the boring bar, and parts supported or received in the casing are in effect held upon the boring bar, and in fact are held by the casing in definite relation to the boring bar. The screw 1 extends through this casing, and within the casing there is threaded upon the screw a nut 10. Journaled within the casing about the screw 1 is a drive gear 4 which has a sliding feather engagement with the screw, to be rotated thereby. Thus the key 40 is shown in Figure 3, received in a groove 14 in the screw 1.

Journaled coaxially with the drive gear 4 is a differential gear 5. This gear is preferably interposed between the nut 10 and the drive gear 4, and while it is of substantially the same diameter as the drive gear 4, it has a slightly different number of teeth, for instance, slightly fewer teeth than the drive gear 4. In a commercial machine, the gear 4 has thirty-four teeth, and the gear 5 has thirty-three. Both these gears, however, are in mesh with the driven gear 35 previously referred to, which in the same commercial machine has thirty teeth.

The engagement of the drive gear 4, rotated from the rotary screw 1, with the driven gear 35 connected to the rotary tool, causes rotation of the tool at a rate of speed which is a function of the diametrical relationship of the gears 4 and 35. If these are of nearly the same diameter, substantially as shown herein, the rate of rotation of the tool is nearly the same as the rate of rotation of the screw 1. Because of the meshing of the differential gear 5 with the driven gear 35, the differential gear 5 will be rotated, but because it has, in the example given, slightly fewer teeth than the drive gear 4, there will be a slightly faster peripheral rate of advance of the gear 5 with relation to the gear 4.

If the nut 10 were free to rotate with and at the same speed as the screw 1 there would be no advance of the boring bar, which in effect carries the nut 10, longitudinally of the screw. If, however, the nut is made to turn at a rate slightly different, say slightly faster than the screw 1 or the drive gear 4 which rotates at the same rate as the screw 1, a slow axial advance of the boring bar relative to the screw 1 will ensue.

To accomplish this I provide clutch teeth or like means, indicated at 50, upon the differential gear 5, and a complemental clutch member 60 forming part of a sliding sleeve 6 which has a sliding feather engagement with the nut 10, as indicated at 61. An oscillatable yoke 7, having one or more pins 79 engageable within a groove 69, may be provided to control the movement of the complemental clutch sleeve 6, and by this or like means the engagement of the complemental clutch members 50 and 60 is controlled. When they are engaged the nut rotates at a slightly faster speed than the screw, and the screw is so threaded (left-handed as shown) that a slight advance of the boring bar and projection of the tool towards the work follows.

In order that the tool may be withdrawn rapidly upon completion of a cut, I provide means whereby the nut may be held immovable with respect to the boring bar; conveniently this may take the form of a fixed clutch means 25, fixed to the casing 20 and surrounding the screw, and upon the upper end of the clutch sleeve 6 I provide clutch teeth 62 which are engageable with the teeth 25. Thus, as may be seen in Figure 4, upon raising the yoke 7, these teeth are engaged, and now the nut 10 is held fixed with relation to the boring bar 2, and as the screw continues to rotate, the boring bar is rapidy raised.

It will be remembered that the cutting tool 31 must be retracted when the boring bar is being raised or retracted, and that raising the rod 33 accomplishes or permits retraction of the tool. Now, since raising of the boring bar is brought about as a result of raising the sleeve 6, it is convenient to insure raising of the rod 33 and the ensuing retraction of the tool at the same time and by the same means. The rod 33 is provided with a flange 36, beneath which are engageable fingers 76 oscillatable with and preferably formed as part of the yoke 7. Now as the yoke is raised to bring about retraction of the boring bar, the rod 33 is raised to bring about immediate retraction of the cutting tool. The tool can also be retracted without oscillation of the yoke 7, by manually raising the head 37 upon the upper end of the rod 33.

Operation of the clutch sleeve 6 under control of the yoke 7 is controlled by an arm 75 projecting from the yoke through a suitable slot in the casing 20. To insure that the clutch members 25 and 62 do not remain in engagement after the boring bar has been fully retracted, and thereby damage the machine, I provide automatic throwout means which, in the form shown, consists of a lever 70 pivoted at 71 upon the top of the casing 20, one arm of this lever engaging a pin 72 projecting upwardly from the control arm 75, so that the latter may be depressed upon downward movement of the arm 70, and the other arm 73 is disposed beneath a head 15 secured upon the upper end of the screw 1. As the boring bar and the casing 29 move upwardly under the influence of the temporarily fixed nut 10, the head 15 contacts the arm 73 and depresses it, and in doing so depresses the pin 72 and the arm 75, thus moving downward the sleeve 6, and disengaging the clutch teeth 62 from the fixed teeth 25.

In case it is desired to arrange the tool so as to permit moving the boring bar downward rapidly the arrangement of Figures 7 and 8 may be employed. In this form gear teeth 66 are formed upon the sleeve 6, by means of which the nut 10 may be directly rotated when neither of the clutch elements are in engagement, that is to say, when the clutch sleeve 6 is in neutral position. In mesh with the gear 66 is one portion 67 of a two-part idler gear. The other part 68 is in mesh at all times with one of the other gears, for instance, the driven gear 35, so that it rotates continuously, and in order to prevent rotation of the nut except as this may be desired to advance the tool and boring bar rapidly, the two parts of the idler gear, 67 and 68 respectively, are connected by a tapered friction clutch, illustrated at 69'. The two parts may be engaged by suitable means, as for instance by a screw 65 threaded in the casing 20. When the two parts of the clutch 69' are pressed together the upper portion 67 is driven from the lower portion 68, and when the pressure is relieved the natural friction of the parts disconnects the clutch at 69', and prevents drive of the nut gear 66. Rotation of the sleeve 6 through this idler gear 67, 68, effects rapid rotation of the nut relative to the screw, in a direction to cause advance or projection of the boring bar.

What I claim as my invention is:

1. A cylinder reboring machine comprising a supporting frame, a boring bar vertically disposed and vertically movable therein, a rotary tool supported at the lower end of said bar, a casing supported upon the upper end of the boring bar and

movable therewith, a screw journaled in said frame parallel to the boring bar and received within said casing, means within said casing for transmitting movement of the screw to the tool to rotate the latter, means also within the casing for transmitting movement of the screw to the boring bar to move the same upward or downward, selective means within the casing for controlling the direction of such movement of the boring bar, and means operable as the boring bar reaches the upper limit of its movement to disconnect the means to move the boring bar upward.

2. A cylinder reboring machine comprising a supporting frame, a boring bar vertically disposed and vertically movable therein, a rotary tool supported at the lower end of said bar, a gear casing supported upon the upper end of the boring bar and movable therewith, a screw journaled in said frame parallel to the boring bar and received within said gear casing, gearing within said casing for transmitting movement of the screw to the tool to rotate it, means also within the casing to move the boring bar with the tool, to advance the tool, means also within the casing to move the boring bar with the tool, to retract the tool at a rate of speed in excess of the rate of its advance, and selective means to control the engagement of the two latter means with the screw, and thereby to control the direction of movement of the boring bar and tool.

3. A cylinder reboring machine comprising a supporting frame adapted to rest upon the upper surface of a cylinder block, a boring bar vertically disposed and guided therein for vertical movement, a rotary tool supported at the lower end of said bar, a gear casing supported upon the upper end of the boring bar, a screw journaled in the frame parallel to the boring bar and received within said gear casing, a drive gear within the casing having a sliding feather connection with said screw, a nut threaded upon said screw, a driven gear having driving connection with said tool and meshing with the drive gear, a differential gear having a slightly different number of teeth than the drive gear, interposed between the drive gear and the nut and meshing with the driven gear, clutch means interengageable between the differential gear and the nut, to accomplish slow speed advance of the boring bar and the associated tool, and alternative clutch means interengageable between the nut and the casing to accomplish higher speed retraction of the boring bar and tool.

4. A cylinder reboring machine comprising a supporting frame adapted to rest upon the upper surface of a cylinder block, a boring bar vertically disposed and vertically movable therein, a rotary tool supported at the lower end of said bar, a screw journaled in the frame parallel to the boring bar, a drive gear having a sliding feather connection with said screw, a nut thereabove threaded upon said screw, a driven gear having driving connection with said tool and meshing with the drive gear, a differential gear having a slightly different number of teeth than the drive gear, interposed between the drive gear and the nut and meshing with the driven gear, idler gear means operatively interposed between the differential gear and the nut, clutch means interengageable between the differential gear and the nut, to accomplish slow speed advance of the boring bar and the associated tool, and clutch means interengageable to initiate drive through the idler gear means, to accomplish high speed advance of the boring bar.

5. A cylinder reboring machine comprising a supporting frame adapted to rest upon the upper surface of a cylinder block, a boring bar vertically disposed and vertically movable therein, a rotary tool supported at the lower end of said bar, a screw journaled in the frame parallel to the boring bar, a drive gear having a sliding feather connection with said screw, a nut thereabove threaded upon said screw, a driven gear having driving connection with said tool and meshing with the drive gear, a differential gear having a slightly different number of teeth than the drive gear, interposed between the drive gear and the nut and meshing with the driven gear, idler gear means operatively interposed between the differential gear and the nut, clutch means interengageable between the differential gear and the nut, to accomplish slow speed advance of the boring bar and the associated tool, alternative clutch means interengageable between the nut and a member fixed with relation to the boring bar to accomplish higher speed retraction of the boring bar and tool, and clutch means interengageable to initiate drive through the idler gear means, to accomplish high speed advance of the boring bar.

6. A cylinder reboring machine comprising a boring bar vertically disposed and vertically movable, a rotary tool supported at the lower end of said bar, a screw disposed parallel to said boring bar, means to rotate the screw, a driven gear journaled upon the upper end of the boring bar and operatively connected to rotate said tool, a drive gear journaled about the screw and slidingly keyed thereto, a differential gear journaled coaxially with the drive gear, and having a slightly different number of teeth than the drive gear, both the drive gear and the differential gear meshing with the driven gear, whereby the differential gear is driven at a peripheral speed slightly different from that of the drive gear, a nut threaded on the screw, clutch means associated with the differential gear, complemental clutch means coaxial with the differential gear, rotatable with the nut, and adapted to engage the associated clutch means, and means to shift the complemental clutch means axially of the screw to engage the two clutch means and thereby to effect a differential rotation between the screw and nut.

7. A cylinder reboring machine comprising a boring bar vertically disposed and vertically movable, a rotary tool supported at the lower end of said bar, a screw disposed parallel to said boring bar, means to rotate the screw, a driven gear journaled upon the upper end of the boring bar and operatively connected to rotate said tool, a drive gear journaled about the screw and slidingly keyed thereto, a differential gear journaled coaxially with the drive gear, both the differential gear and the drive gear meshing with the driven gear, whereby the tool is rotated, and the differential gear being of substantially the same diameter and having slightly fewer teeth than the drive gear, whereby the differential gear is driven at a peripheral speed slightly faster than that of the drive gear, a nut threaded on the screw, clutch means associated with the differential gear, other clutch means fixed relative to the boring bar and coaxial with but spaced from the first clutch means, and complemental clutch means non-rotatively engaged with the nut, and means to shift said complemental clutch means

to engage the first clutch means to effect slow rotation of the screw relative to the nut in a direction to advance the tool, or alternatively to engage the fixed clutch means to effect rapid rotation of the screw relative to the now fixed nut in the opposite direction, to retract the tool.

8. A cylinder reboring machine comprising a boring bar vertically disposed and vertically movable, a rotary tool supported at the lower end of said bar, a screw disposed parallel to said boring bar, means to rotate the screw, a driven gear journaled upon the upper end of the boring bar and operatively connected to rotate said tool, a drive gear journaled about the screw and slidingly keyed thereto, a differential gear journaled coaxially with the drive gear, both the differential gear and the drive gear meshing with the driven gear, whereby the tool is rotated, and the differential gear being of substantially the same diameter and having slightly fewer teeth than the drive gear, whereby the differential gear is driven at a peripheral speed slightly faster than that of the drive gear, a nut threaded on the screw, clutch means associated with the differential gear, other clutch means fixed relative to the boring bar and coaxial with but spaced from the first clutch means, and complemental clutch means non-rotatively engaged with the nut, means to shift said complemental clutch means to engage the first clutch means to effect slow rotation of the screw relative to the nut in a direction to advance the tool, or alternatively to engage the fixed clutch means to effect rapid rotation of the screw relative to the now fixed nut in the opposite direction, to retract the tool, and means operable as the tool reaches the limit of its retraction to disengage the complemental clutch means from the fixed clutch means.

9. A cylinder reboring machine comprising a boring bar vertically disposed and vertically movable, a rotary tool supported at the lower end of said bar, a screw disposed parallel to said boring bar, means to rotate the screw, a driven gear journaled upon the upper end of the boring bar and operatively connected to rotate said tool, a drive gear journaled about the screw and slidingly keyed thereto, a differential gear journaled coaxially with the drive gear, both the differential gear and the drive gear meshing with the driven gear, whereby the tool is rotated, and the differential gear being of substantially the same diameter and having slightly fewer teeth than the drive gear, whereby the differential gear is driven at a peripheral speed slightly faster than that of the drive gear, a nut threaded on the screw, clutch means associated with the differential gear, other clutch means fixed relative to the boring bar and coaxial with but spaced from the first clutch means, and complemental clutch means non-rotatively engaged with the nut, means to shift said complemental clutch means to engage the first clutch means to effect slow rotation of the screw relative to the nut in a direction to advance the tool, or alternatively to engage the fixed clutch means to effect rapid rotation of the screw relative to the now fixed nut in the opposite direction, to retract the tool, a yoke engaged with the complemental clutch means and oscillatable to shift the latter, a head on the upper end of the screw, and means engaged with the yoke and positioned for engagement by said head as the nut approaches the upper end of the screw to disengage the complemental clutch means from the fixed clutch means.

10. In a cylinder reboring machine, in combination, a base to rest upon the top of a cylinder block, an upright screw rotatably mounted in said base and held thereby against longitudinal movement, means carried by the base for rotating said screw, a bar parallel to said screw and mounted in the base for longitudinal movement relative thereto, a shaft carried by said bar, a cutting tool carried by the lower end of said shaft, means for the transmission of rotary movement of said screw to said shaft, a rotary member driven by said screw at a speed different from the speed of rotation of said screw, a nut threaded on said screw and held against longitudinal movement relative to said bar, and clutch means operable to couple and uncouple said nut with and from said rotary member.

11. In a cylinder reboring machine, in combination, a base to rest upon the top of a cylinder block, an upright screw rotatably mounted in said base and held thereby against longitudinal movement, means carried by the base for rotating said screw, a bar parallel to said screw and mounted in the base for longitudinal movement relative thereto, a shaft carried by said bar, a cutting tool carried by the lower end of said shaft, means for the transmission of rotary movement of said screw to said shaft, a rotary member driven by said screw at a speed different from the speed of rotation of said screw, a nut threaded on said screw and held against longitudinal movement relative to said bar, and clutch means operable to selectively couple said nut with and from said rotary member and with and from the bar.

12. The combination as set forth in claim 11 in which the clutch means has an intermediate position permitting free rotation of the nut with the screw.

13. In a cylinder reboring machine, in combination, a base to rest upon the top of a cylinder block, an upright screw rotatably mounted in said base and held thereby against longitudinal movement, means carried by the base for rotating said screw, a bar parallel to said screw and mounted in the base for longitudinal movement relative thereto, a shaft carried by said bar, a cutting tool carried by the lower end of said shaft, a gear on said shaft, a driving connection between said screw and said gear for the transmission of rotary motion of the screw to the shaft, a second gear in mesh with said first mentioned gear and driven thereby at a speed different from the speed of rotation of the screw, a nut threaded on the screw and held against longitudinal movement relative to the bar, and clutch means operable to selectively couple and uncouple said nut with and from said second mentioned gear, to hold the nut against rotation relative to the bar, and to permit free rotation of the nut with the screw.

14. In a cylinder reboring machine, in combination, a base to rest upon the top of a cylinder block, an upright screw rotatably mounted in said base and held thereby against longitudinal movement, means carried by the base for rotating said screw, an upright bar parallel to said screw mounted in the base for longitudinal movement relative thereto, a housing carried by the upper end of said bar, a shaft extending through said bar, a cutting tool carried by the lower end of said shaft, a gear on said shaft within said housing, a driving gear splined to said screw and in mesh with said first mentioned gear whereby the shaft is rotatably driven by the screw, a gear coaxial with the screw and in mesh with the first men-

tioned gear and driven by said first mentioned gear at a speed different from the speed of rotation of the screw, a nut threaded on the screw within the housing and held against longitudinal movement relative to the housing whereby movement of the nut along the screw effects corresponding movement of the housing and the bar and the shaft and the tool, and clutch means operable to selectively couple and uncouple said nut with and from said last mentioned gear, to hold the nut against rotation relative to the housing and bar, and to permit free rotation of the nut with the screw.

CLARENCE T. ROTTLER.