June 17, 1958 W. C. ALBERTSON, JR., ET AL 2,838,964

DRILLING MACHINE

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FIG. 1.

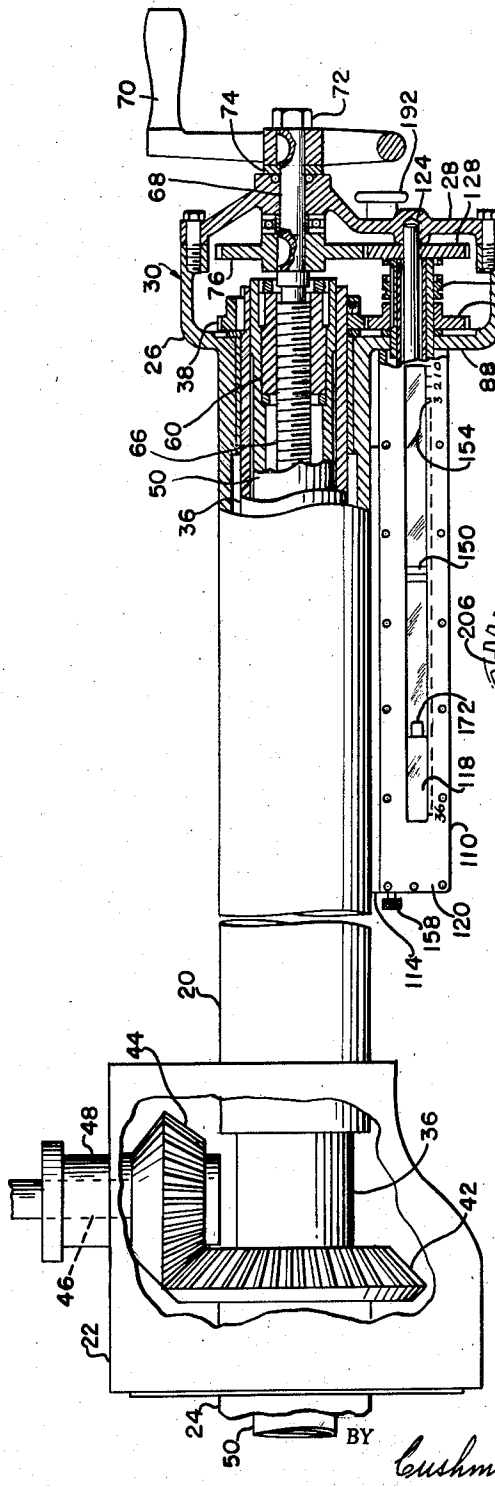


FIG. 11.

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DRILLING MACHINE

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FIG.2.

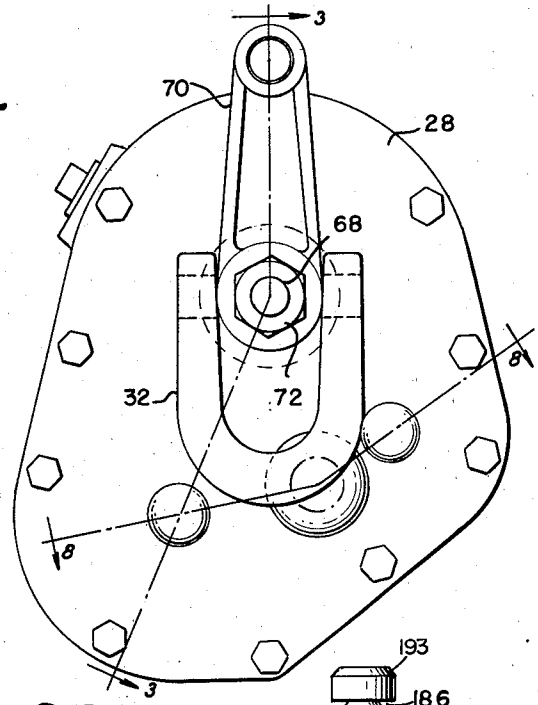
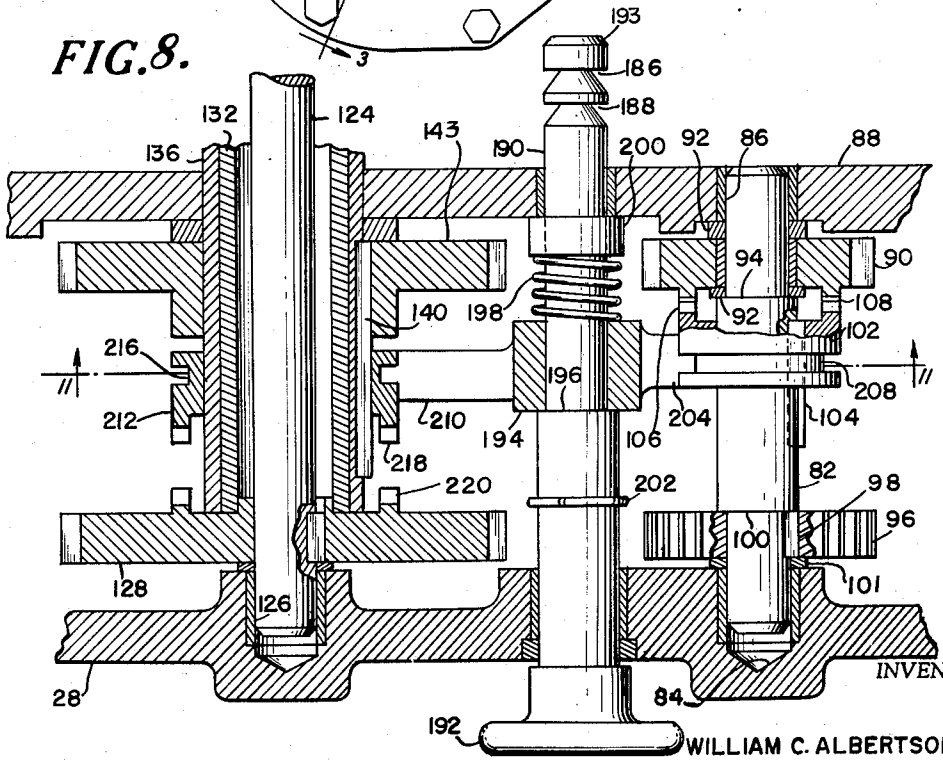


FIG.8.



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DRILLING MACHINE

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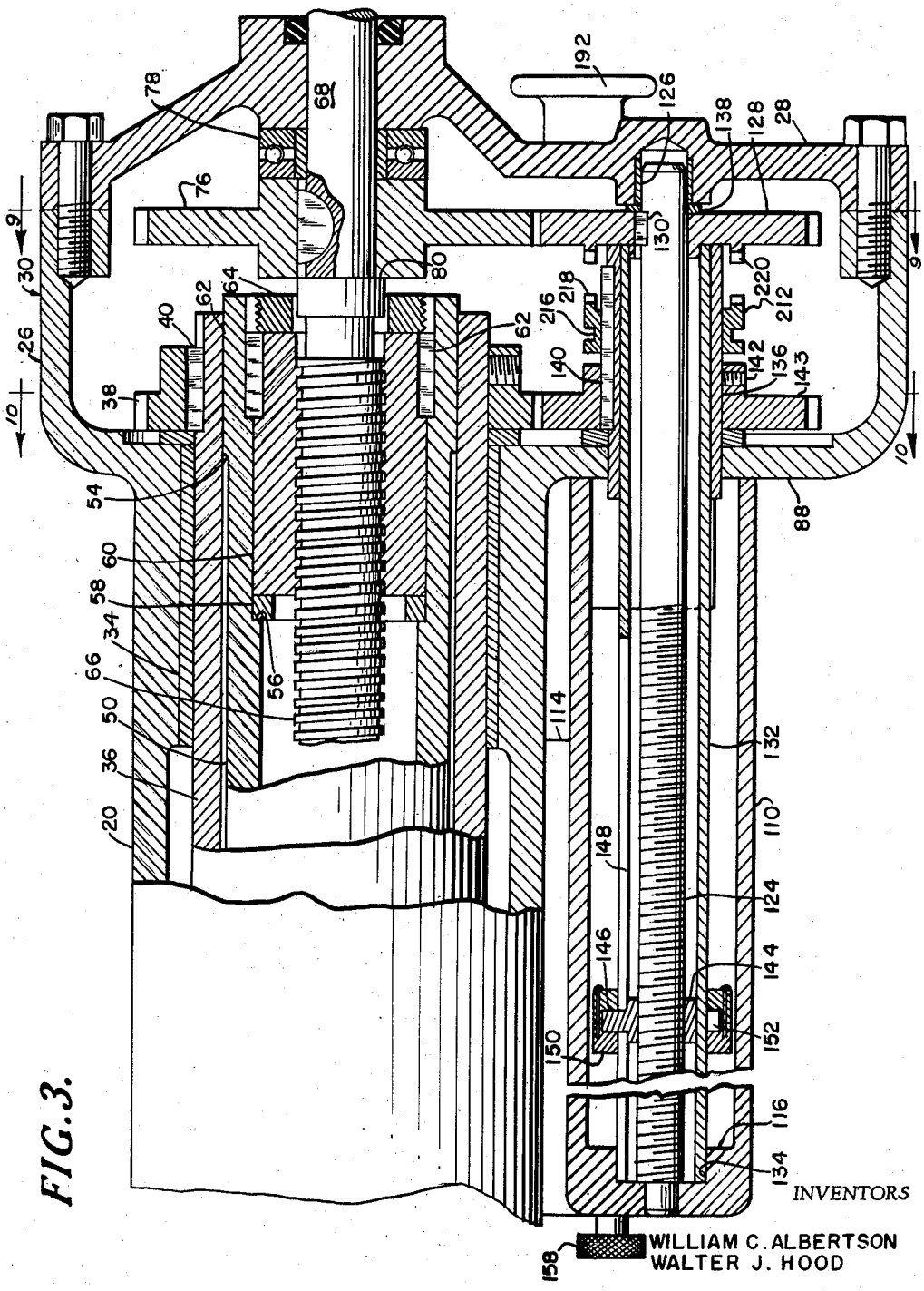


FIG. 3.

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DRILLING MACHINE

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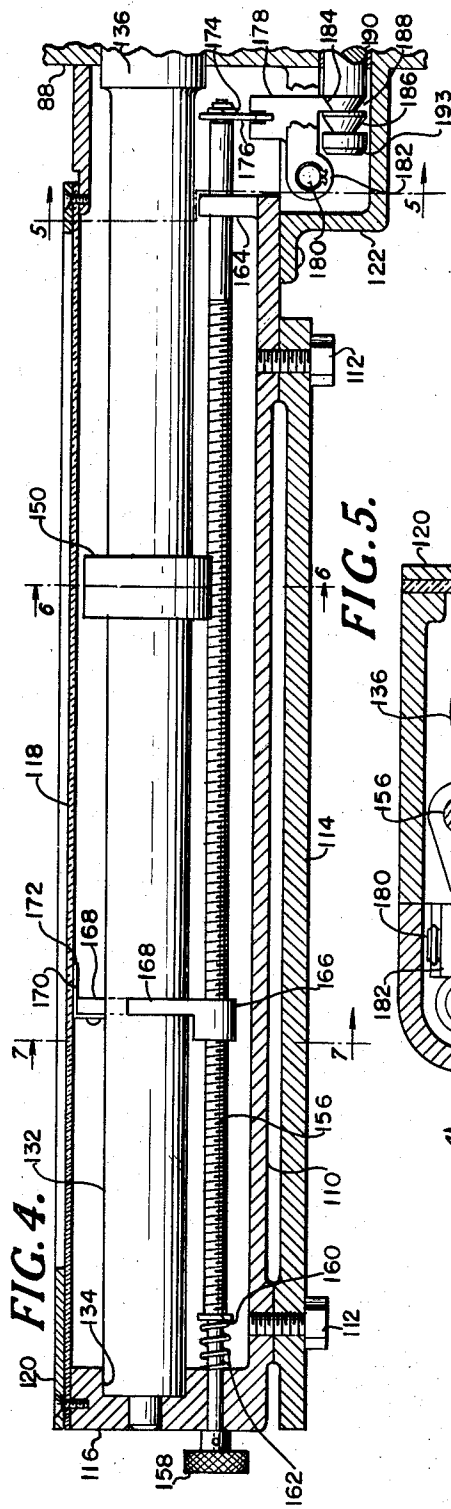


FIG. 4.

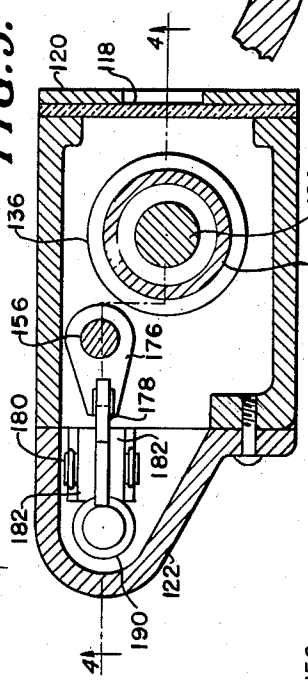


FIG. 5.

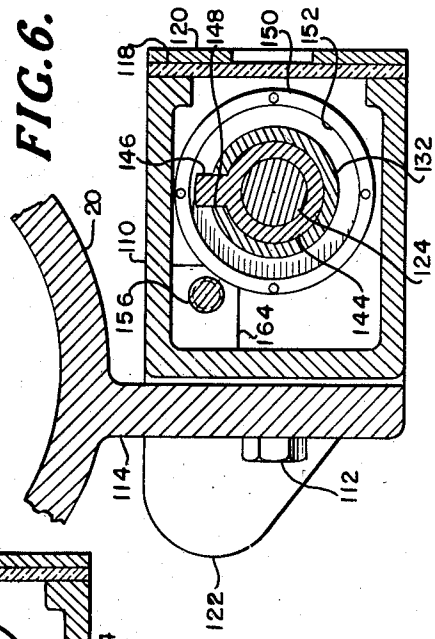


FIG. 6.

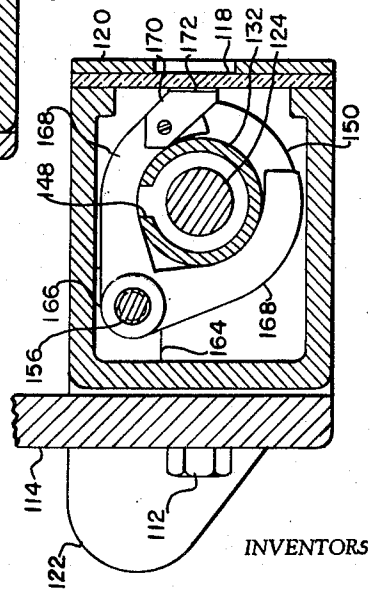


FIG. 7.

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DRILLING MACHINE

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FIG.9.

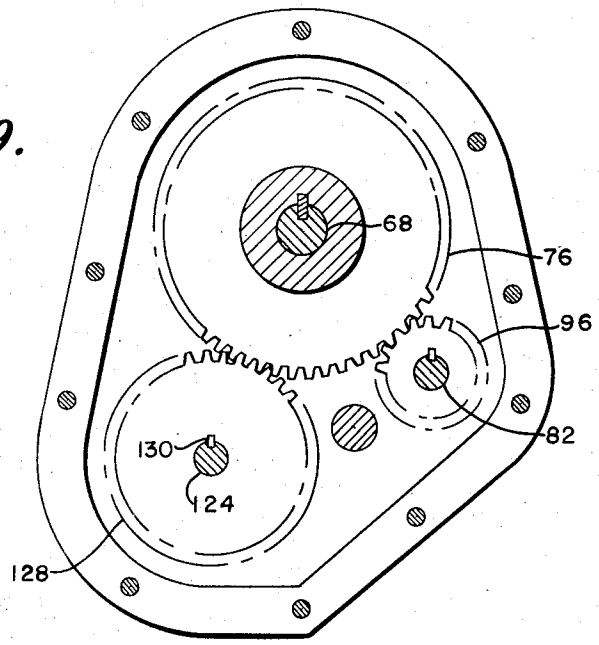
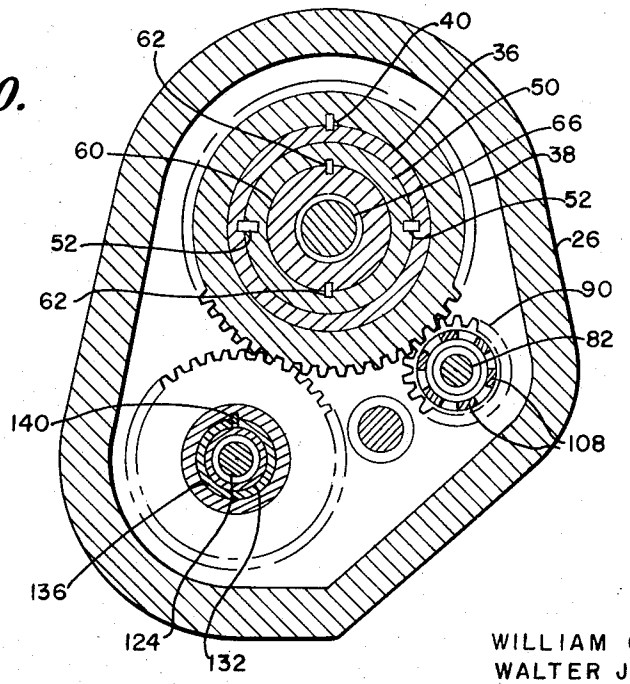


FIG.10.



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United States Patent Office 2,838,964 Patented June 17, 1958

2,838,964

DRILLING MACHINE

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Application May 1, 1956, Serial No. 581,917

13 Claims. (Cl. 77—34.4)

This invention relates to machines for drilling or tapping mains and pipes without escape of fluid pressure therefrom and more particularly pertainss to improvements in drilling machines of the type disclosed in U. S. Patents Nos. 1,956,129, 2,470,044 and 2,646,699.

Drilling machines of the type disclosed in the foregoing patents are provided with a pressure-tight housing completely enclosing a boring bar that usually is driven by power but can be rotated by hand. The machines have feed mechanism for advancing the boring bar, and the tool carried thereby, and are also equipped with an automatic drive for the feed mechanism to advance the bar at a rate appropriate for a cutting operation. The automatic drive includes a clutch device which, upon its disengagement, permits hand advance of the boring bar by the rotation of a crank handle connected to the feed mechanism. Advance of the boring bar by hand usually is at a much faster rate than that effected by the automatic drive in order to obtain rapid advance of the cutting tool from a fully retracted position into engagement with the work, and rapid retraction from the work on completion of a cutting operation.

Since the boring bar of drilling machines of the type under consideration is completely enclosed, there arises the problem of determining the axial position of the boring bar at all times. Machines of the foregoing type are employed in many instances for drilling or tapping operations on mains and pipes that are under high pressures, and in such an operation, it will be seen that the feed mechanism and the automatic drive therefor will remain under a heavy load after a hole has been cut into the pipe, because further advance of the boring bar is resisted by the high fluid pressure in the main or pipe. Thus, there is no obvious indication to an operator of the machine that the drilling or tapping operation has been completed. In some instances, this disadvantage, particularly when operating on a pipe of relatively small diameter, has resulted in the operator neglecting to shut off the power to the machine so that the boring bar continues to advance and cuts a hole in the opposite side of the main. Unless such a dual cut is intended and the appropriate apparatus provided therefor, the second cut could have disastrous effects.

It thus will be seen that it would be highly advantageous to provide means in a machine of the type under consideration for continuously indicating the extent of advance of the boring bar from a fully retracted position. It is, therefore, an object of this invention to provide such a universal travel indicator that is relatively simple, accurate in operation, involves no change-speed mechanism for compensating for the differences between automatic and hand rates of advance, and requires no adjustment whatever by an operator of the machine.

It also will be seen that in a machine of the type under consideration, it would be highly desirable to provide a preset feed mechanism, that is, a mechanism which could

be adjusted to advance the boring bar, under automatic feed, through a predetermined distance starting from any selected axial position of the boring bar, and then automatically operate to disengage the clutch mechanism in the automatic drive so that the boring bar will stop at the end of its predetermined extent of advance. It is, therefore, an object of this invention to provide a preset feed mechanism for a drilling machine of the type under consideration, such mechanism being adjustable and operable with facility by an operator of the machine.

As pointed out above, in drilling machines of the type under consideration, the automatic drive can be disengaged and the feed mechanism operated by a hand crank to advance or retract the boring bar. During such manual advance or retraction of the boring bar, the latter does not rotate because of the large friction in the power train of the drive for such bar. It will be seen, however, that in some instances it may be desirable to rotate the boring bar by hand, but without any longitudinal movement thereof. Consequently, it is another object of this invention to provide a drilling machine of the type under consideration with a mechanism that can be adjusted so that the boring bar can be rotated by hand without effecting any longitudinal movement thereof.

Other objects and advantages of the invention will become apparent from the following description and accompanying drawings in which:

Figure 1 is a side view of a drilling machine embodying this invention, with parts broken away and other parts being shown in longitudinal section;

Figure 2 is an end view of the machine shown in Figure 1, and taken from the right hand end of the latter figure;

Figure 3 is an enlarged, fragmentary, sectional view taken substantially on the line 3—3 of Figure 2;

Figure 4 is an enlarged, fragmentary, longitudinal, sectional view through the casing of the indicator mechanism shown in Figure 1, and taken substantially on the line 4—4 of Figure 5;

Figure 5 is an enlarged, transverse, sectional view taken substantially on the line 5—5 of Figure 4;

Figure 6 is an enlarged, transverse, sectional view taken substantially on the line 6—6 of Figure 4;

Figure 7 is an enlarged, transverse, sectional view taken substantially on the line 7—7 of Figure 4;

Figure 8 is an enlarged, fragmentary, sectional view taken substantially on the line 8—8 of Figure 2;

Figure 9 is a sectional view taken substantially on the line 9—9 of Figure 3;

Figure 10 is a sectional view taken substantially on the line 10—10 of Figure 3;

Figure 11 is a fragmentary, sectional view taken substantially on the line 11—11 of Figure 8.

Referring now to Figures 1 and 3 of the drawings, there is shown a drilling machine embodying this invention having a barrel 20 provided with an enlarged gear housing 22 on the forward or lower end thereof. The housing 22 has a tubular bearing and guiding extension 24 opposite the barrel 20 and aligned therewith for securing the machine in the usual manner to one end of a valve (not shown). At its upper end, the barrel 20 is enlarged as at 26, which enlarged portion, in conjunction with a top cap 28 bolted thereto, constitutes an upper or rearward gear housing 28 having a pivoted lifting handle 32 (Figure 2) for the entire machine.

Journaled in a lower bushing (not shown) and an upper bushing 34 (Figure 3) in the barrel 20 is a drive tube 36, the upper and lower ends of which project, respectively, into the upper and lower housings 30 and 22.

A gear 38 is secured by a key 40 to the upper end of the tube 36 within the upper housing 30. Fixed to the lower end of the drive tube 36 within the lower housing 22 is a beveled gear 42 engaged by a pinion gear 44 fixed to a driving stub shaft 46 journaled in a bearing 48 fixed in a side wall of the housing. The projecting outer end of the stub shaft 46 may be driven by an appropriate motor (not shown).

Received in the drive tube 36 is a hollow boring bar 50, the upper portion of which has a close, sliding fit in the drive tube and is splined thereto, for rotation thereby and axial movement relative thereto, by a pair of keys 52 (Figure 10) secured to the bar and slidable in diametrically opposite, interior longitudinal grooves or keyways extending the length of the drive tube. Beneath its upper portion, the boring bar 50, for the purpose of reducing friction, is externally reduced so that a downwardly facing shoulder 54 (Figure 3) exists. The lower reduced portion of the boring bar 50 extends through the lower gear housing 22 and is journaled and pressure sealed in the extension 24 thereof. The lower end (not shown) of the boring bar 50 is adapted to have an appropriate tool (not shown) detachably secured thereto.

The upper interior portion of the boring bar 50 is enlarged to provide a shoulder 56 (Figure 3) which supports an inwardly overhanging abutment ring 58 against which is seated a coaxial feed nut 60. The nut 60 is fixed against rotation relative to the bar 50 by keys 62 and fixed against axial movement relative to the bar by a retaining ring 64 threaded into the upper end of the boring bar. A feed screw 66 is engaged within the nut 60 and extends coaxially within the boring bar 50. The upper end of the screw 66 has an unthreaded extension 68 which extends through the upper gear housing 30 and projects through and is journaled in the top cap 28. The projecting outer end of the screw extension 68 has the hub portion of a crank handle 70 keyed thereon, with the handle being securely retained on the extension by a nut 72 threaded onto the extreme outer end of the extension. A thrust washer 74 preferably is interposed between the hub of the handle 70 and the outer side of the cap 28. Within the upper gear housing 30, the screw extension 68 has a gear 76 keyed thereto, with one side of the gear hub engaging an anti-friction thrust bearing 78 interposed between the hub of the gear and the top cap 28. The other side of the hub of the gear 76 engages a shoulder 80 formed on the extension 68. It thus will be seen that the feed screw 66 is fixed against axial displacement.

The feed nut 60 and the feed screw 66 constitute the feed mechanism of the machine for advancing or retracting the boring bar 50 on relative rotation between the nut and the screw. In a machine of the type under consideration, the length of the barrel 20, the boring bar 50, and the feed screw 66 may be such as to permit the boring bar to have an overall travel, i. e., from its fully retracted position shown in Figures 1 and 3 to a fully extended position, of about 36 inches. In such a machine, the pitch of the feed screw threads usually is such that one complete revolution of the screw 66 relative to the feed nut 60 moves the boring bar axially one-tenth of an inch.

An idler shaft 82 is disposed within the gear housing 30 in spaced, parallel relation to the feed screw 66 and has one end thereof journaled in a bushed bearing socket 84 formed in the inner side of the top cap 28 and the other end thereof journaled in a bushed bearing aperture 86 formed in the bottom wall 88 of the housing. The shaft 82 has a gear 90 journaled thereon and fixed against longitudinal movement by washers 92, one bearing against the bottom wall 88 of the housing and the other bearing against a shoulder 94 on the shaft 82. The shaft 82 has another gear 96 thereon and fixed thereto by a key 98. At one side, the gear 96 bears against a shoulder 100 formed on the shaft 82, and on the other side against a washer 101 bearing against the top cap 28, so that the gear 96 is fixed against movement longitudinally of the shaft and the latter is likewise fixed against axial movement in the housing 30. Mounted on the shaft 82 between the gears 90 and 96 is a clutch member 102 that is splined to the shaft for rotation therewith, as by a key 104, but is slidable longitudinally on the shaft 82. On its face opposed to the gear 90, the clutch member 102 has a circular row of clutch teeth 106 for engagement with complementary teeth 108 formed on the gear 90. Consequently, it will be seen that when the clutch member 102 is engaged with the gear 90, the latter will rotate with the shaft 82, but when the clutch member is disengaged from the gear 90, the latter is free to rotate relative to the shaft 82.

The gears 38 and 90 are in constant mesh and the gears 76 and 96 are in constant mesh. Consequently, when the drive tube 36 is driven to rotate the boring bar 50 and the clutch member 102 is engaged with the gear 90, the gears 38 and 90, the clutch member 102, the shaft 82, and the gears 96 and 76 form a power train that constitutes an automatic drive for the feed mechanism. The ratio of the gears in the automatic drive are such that rotation of the drive tube 36 drives the feed screw 66 at a slightly greater rate of rotation than the feed nut 60, to thereby advance the boring bar 50 axially at an appropriate rate for a cutting operation. When the clutch device in the automatic drive is disengaged, however, it will be seen that when the power drive for the boring bar 50 is not operating so that the feed nut 60 is at rest, the feed screw 66 can be rotated manually by the crank handle 70 to advance or retract the boring bar at a rate considerably greater than that effected by the automatic drive for the feed mechanism. A universal boring bar travel indicator embodying this invention includes an elongated indicator casing 110 extending longitudinally of the barrel 20 and secured exteriorly thereon, as by cap screws 112 extending through a longitudinal exterior flange 114 on the barrel. One end of the casing 110 is open and bears against the bottom wall 88 of the gear housing 30 while the other end of the casing is closed by an end wall 116. One side or top of the casing 110 is closed by a transparent cover 118 detachably secured in place by screws extending through a cover frame 120. At its end adjacent the gear housing 30, the bottom wall of the casing 110 is cut away in registration with the open mouth of a cup-like formation 122 on the bottom wall 88 of the housing 30.

Extending longitudinally within the casing 110 and having one end reduced and journaled in the end wall 116 of the casing is an indicator screw 124. The other end of the screw 124 has an unthreaded portion that extends through the lower wall 88 of the gear housing 30 into the latter and has its end journaled in a bushed bearing socket 126 in the top cap 28. A gear 128 is secured, as by a key 130, on the screw 124 within the housing 30 and is in constant mesh with the gear 76. Coaxially enclosing the indicator screw 124, in spaced relation thereto, is an indicator tube 132 having one end thereof journaled in a bearing socket 134 (Figures 3 and 4) in the end wall 116 of the casing 110 and the other end thereof projecting through and journaled in the lower wall 88 of the gear housing 30 and into the latter into abutting engagement with the gear 128. As is best shown in Figures 3 and 8, that portion of the indicator tube 132 projecting through the wall 88 and extending within the gear housing 30 is exteriorly enlarged, as by a sleeve 136 welded thereto. Interposed between the gear 128 and the top cap 28 is a washer 138 which also has the gear 128 bearing thereagainst, so that the gear 128, the indicator tube 132, and the screw 124 are fixed against axial movement. Fixed as

by an elongated key **140** and a set screw **142** (Figure 3) to that portion of the indicator tube **132** extending within the gear housing **30** is a gear **143** having the same number of teeth as the gear **128** and in constant mesh with the drive tube gear **38**. This latter gear **38** has the same number of teeth as the gear **76**. Consequently, it will be seen that the indicator screw **124** and the indicator tube **132** rotate at rates directly proportional to the rates of rotation of the feed screw **66** and the feed nut **60**, respectively.

Threaded on the indicator screw **124** is an indicator nut **144** (Figures 3 and 6) having a radial lug or projection **146** that extends through a longitudinal slot **148** in the indicator tube **132** extending substantially the full length of the indicator casing **110**. Slidable longitudinally on the indicator tube **132** is an indicator collar **150** having an interior circumferential groove **152** rotatably receiving the projection **146** on the indicator nut. For constructional purposes, the collar **150** preferably is formed in two parts separable on a transverse midplane and secured together by screws, as shown in Figures 3 and 6.

From the foregoing construction, it will be seen that when relative rotation is effected between the indicator screw **124** and the indicator tube **132**, the indicator nut **144** will be threaded along the indicator screw, and carry the collar **150** therewith, a distance directly proportional to the extent of relative rotation between the indicator screw and the indicator tube, and consequently directly proportional to the extent of axial movement of the boring bar **50**. Essentially the screw **124**, tube **132**, and nut **144** constitute a differential mechanism. Along one edge, the frame **120** may be provided with appropriate scale indicia **154** (Figure 1) which cooperate with the midplane separation line of the indicator collar **150** to indicate the extent of advance, in inches and fractions thereof, of the boring bar **50** from its fully retracted position. In this connection, it is pointed out that the drawing figures are somewhat inconsistent in that they all show the boring bar **50** in its fully retracted position, while the indicator collar **150** shows that the boring bar should be in a position somewhat advanced from its fully retracted position. These showings obviously are for the purpose of clairity.

A preset feed mechanism embodying this invention is operated by the aforedescribed universal travel indicator mechanism and includes a preset feed screw **156** extending longitudinally within the indicator casing **110** in spaced, parallel relation to the indicator tube **132**. One end of the screw **156**, as shown in Figure 4, has a smooth, reduced, unthreaded portion which journally extends through the end wall **116** of the casing **110** and has a knurled adjusting knob **158** affixed to its exteriorly projecting end. Interposed between a shoulder **160** on the screw **156**, formed by its reduced portion, and the end wall **116** of the casing is a coil compression spring **162** which yieldably urges the screw to shift axially to the right, as is shown in Figure 4. The other end of the screw has a smooth exterior portion journaled in a flange-like projection **164** which may be formed integrally with and extends inwardly of the casing **110** from a side wall thereof. Threaded onto the screw **156** is a preset feed nut **166** having a pair of radially-extending, yoke-like arms **168** that partially embrace the indicator tube **132**, as best shown in Figure 7, so that the nut is fixed against rotation relative to the casing **110** while rotation of the screw **156** serves to adjust the position of the arms **168** longitudinally along the indicator tube. Secured to one of the arms **168** of the nut **166** is an indicator plate or pointer **170** having a straight edge **172** adapted for cooperation with the scale indicia **154** and the midplane line of separation or indicator line of the collar **150**.

As is best shown in Figure 4, the arms **168** embrace the tube **132** at a location between the collar **150** and

the end wall **116** of the casing **110**, so that when the boring bar **50** is advancing, the collar **150** will move along the tube **132** and eventually abut against the arms **168** to thereby force the screw **156** to move to the left, as shown in Figure 4, against the action of the spring **162**. When the collar **150** is engaged against the arms **168**, it will be seen that the edge **172** of the plate **170** will exactly coincide with the indicator line on the collar.

Secured on a reduced end portion of the screw **156** beyond the flange **164**, as by a snap ring **174**, is a bifurcated finger **176** extending into a notch in, and straddling, a latch pawl **178**. The latch pawl is mounted within the cup **122** on a pivot pin **180** extending through ears **182** formed exteriorly on the lower wall **88** of the gear housing **30**. Consequently, it will be seen that the latch pawl will rock upwardly when the screw **156** moves to the left from the position shown in Figure 4. The latch pawl **178** has a latch finger **184** which cooperates with either of two circumferential grooves **186** and **188** formed on the end of a shifting rod **190** that projects through appropriately bushed openings in the lower wall **88** of the housing **30** and in the top cap **28**. Exteriorly of the cap **28**, the shifting rod **190** has an appropriate shifting knob **192** affixed thereto. It will be seen that one side of the latch finger **184** is straight, for latching engagement with corresponding flat sides of the grooves **186** and **188**, while the other side of the finger is beveled for ratcheting engagement with corresponding conical side walls of the grooves and with the beveled end **193** of the shifting rod.

Within the gear housing **30**, the rod **190** has the hub portion of a dual shifting yoke **194** slidably mounted thereon and urged against a shoulder **196** on the rod by a spring **198** interposed between the yoke and a thrust collar or washer **200** which bears against the bottom wall **88** of the gear housing **30**. Consequently, the spring **198** urges the rod **190** to move to the right, as shown in Figure 4. It thus will be seen that the rod **190**, and hence the yoke **194**, has three operative positions: two latched positions wherein the latch finger **184** engages with one or the other of the grooves **186** and **188**, and a third position wherein the end **193** of the rod is positioned to the right of the latch finger **184**, as viewed in Figure 4. The rod **190** is prevented from shifting too far to the right by a snap ring **202** thereon (Figure 8) engageable against the top cap **28**.

The shifting yoke **194** has a pair of arms **204** straddling the clutch member **102** and provided with opposed inwardly-extending pins **206** (Figure 11) which ride in a circumferential groove **208** in the clutch member so that movement of the shifting yoke **194** with the shifting rod **190** will serve to engage or disengage the clutch member with or from the gear **90**. It will be seen that when the shifting rod **190** is moved by the knob **192** to its extreme inward position, as is shown in Figures 4 and 8, the shifting yoke **194** serves to engage the clutch mechanism in the automatic drive for the feed mechanism, and that the shifting rod will become latched in such position by engagement of the latch pawl **178** with the groove **188** in the shifting rod. The shifting yoke has another pair of arms **210** which straddle a clutch member **212** slidable but fixed against rotation on the indicator tube **132** by the key **140**. The arms **210** also have pins **214** (Figure 11) riding in a circumferential groove **216** in the clutch member **212** for moving the latter axially on the tube **132**. On its face opposed to the gear **128**, the clutch member **212** has a circular row of clutch teeth **218** engageable with a complementary row of teeth **220** on gear **128**. Consequently, it will be seen that when the clutch member **212** is engaged with the gear **128**, the gears **128** and **143** are locked together for rotation as a unit and hence, the feed screw **66** and feed nut **60** are caused to rotate as a unit, so that the boring bar can be rotated, without advance or retraction, by the crank **70**.

From the foregoing, it will be seen that in the extreme inward latched position of the shifting rod **190**, i. e., with the pawl **178** engaged in the groove **188**, the automatic

drive for the feed mechanism is operative, in the latched position of the rod 190 where the pawl 178 engages in the groove 186, the machine is in hand feed, and in the extreme outer and unlatched position of the rod 190, the machine is in no-feed.

In operating a drilling machine embodying this invention, the shifting rod 190 is first pulled outwardly by the knob 192, if need be first unlatching the same by pulling outwardly on the knurled knob 158 on the end of the preset feed mechanism screw 156, until the clutch mechanism in the automatic drive is disengaged and the machine is in hand feed. The rod 190 is latched in this position by engagement of the latch pawl 178 in the groove 186 in the rod. Thereupon, the boring bar 50 can be run down through the usual valve (not shown) by operation of the crank handle 70, until the cutting tool (not shown) engages the work, i. e., a pipe to be cut. The preset feed mechanism screw 156 is then rotated manually by the knot 158 to cause the preset feed nut 166 to travel along the indicator tube 132 a predetermined distance in advance of the indicator line on the collar 150 as measured on the indicator scale 154, such predetermined distance being the distance through which the boring bar will have to advance in making the intended cut. The shifting knob 192 is then pushed inwardly to its full extent to engage the clutch mechanism in the automatic drive and latch the shifting rod 190 in such position. Power is then turned on and the drilling machine operated to make the desired cut. When the boring bar 50 reaches the end of its predetermined extent of travel necessary to make the cut, the indicator collar 150 will engage the arms 168 on the preset feed nut 166, and thereby cause the screw 156 to move to the left, as shown in Figure 4, and disengage the latch pawl 178 from the shifting rod 190. The spring 198 will then move the shifting rod 190 outwardly to its no-feed position, thus disengaging the clutch mechanism in the automatic drive and stopping further advance of the boring bar.

In this connection, it will be seen that overtravel of the boring bar 50 past its maximum above-mentioned 36 inch travel, for example, cannot readily occur, because when the preset feed mechanism is set for such maximum advance, the indicator collar will always engage the arms on the preset feed nut at such maximum extent of travel and prevent the shifting rod from being latched in its automatic feed position. Consequently, overtravel of the boring bar, with resulting damage caused by its shoulder 54 and keys 52 engaging with the packing and bearing structure in the lower gear housing extension 24, can be effected only by deliberately holding the shifting rod in its extreme inward position against the force of the spring 198, a mis-manipulation which will not happen with even the most unskilled operator.

After the automatic feed has been automatically disengaged by the preset feed mechanism, as described above, the shifting knob 192 is pushed inwardly until the shifting rod 190 becomes latched in its hand feed position. Thereupon, the boring bar can be rapidly retracted from the work and back through the valve (not shown) by operation of the hand crank 70. The valve can then be closed and the drilling machine detached therefrom. It will be seen that at any time when it becomes desirable to rotate the boring bar either by hand or by power, without any longitudinal movement thereof, the knob 158 of the preset feed mechanism can be pulled out to unlatch the shifting rod 190 so that the latter can be pulled outwardly to its extreme outer, no-feed position by the knob 192.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

We claim:

1. In a machine having a translatable and rotatable element and a non-translatable element engaged therewith and rotatable relative thereto for effecting translation thereof, the combination of indicator mechanism for showing the extent of translation of the translatable element comprising: a pair of parallel, non-translatable, relatively-rotatable members; a part threadedly engaged with one of said member for movement longitudinally thereof on relative rotation therebetween and drivenly engaged with the other of said members for rotation thereby and for slidable movement longitudinally therealong; and means for driving one of said members with one of the elements and for driving the other of said members with the other of the elements, whereby the position of said part longitudinally along said one member indicates the extent of translation of the translatable element.

2. The structure defined in claim 1 wherein the part is a nut.

3. The structure defined in claim 1 wherein the members are coaxial with the said one member disposed in spaced relation within the other, said other member has a longitudinal slot, and the part is a nut having a radial projection extending outwardly through said slot, and including an indicator collar on and slidable longitudinally along said other member and engaging said projection for longitudinal movement in either direction thereby.

4. The structure defined in claim 3 in which the collar has an interior circumferential groove receiving the projection for permitting relative rotation between said collar and the nut.

5. In a drilling machine having an axially and rotatably movable boring bar and feed mechanism to advance or retract the bar including interengaged feed nut and feed screw elements, one rotatable with the bar, the combination of indicator mechanism for showing the extent of advance of the bar comprising: a pair of parallel, non-translatable, relatively-rotatable members; a part threadedly engaged with one of said members for movement longitudinally therealong on relative rotation therebetween and drivenly engaged with the other of said members for rotation thereby and for slidable movement longitudinally therealong; and means for driving one of said members with one of the feed elements and for driving the other of said members with the other of the feed elements, whereby the position of said part longitudinally along said one member shows the extent of advance of the boring bar.

6. In a drilling machine having an axially and rotatably movable boring bar and feed mechanism to advance or retract the bar including interengaged feed nut and feed screw elements, one rotatable with the bar, the combination of indicator mechanism for showing the extent of advance of the bar comprising: a hollow rotatable shaft offset and parallel to the bar and having a longitudinal slot therein; gear means for driving said tube with the bar and consequently with one of the feed elements; a rotatable screw disposed coaxially within said shaft in spaced relation thereto; gear means for driving said screw with the other of the feed elements; and nut means threaded on said screw and having a radial projection extending through said shaft slot, whereby relative rotation between said shaft and screw effects movement of said nut means longitudinally along said screw and the position of said nut means along said screw shows the extent of advance of the boring bar.

7. The structure defined in claim 6 in which the nut means includes an indicator collar on and slidable longitudinally along the shaft and engaging the projection for longitudinal movement in either direction thereby.

8. In a drilling machine having an axially and rotatably

movable boring bar, feed mechanism therefor including interengaged feed nut and feed screw elements, one rotatable with the bar, an automatic drive for the feed mechanism to advance the bar at a certain rate on rotation thereof, and shiftable means for rendering the automatic drive operative or inoperative, the combination of: a pair of parallel, non-translatable, relatively-rotatable members; a part threadedly engaged with one of said members for movement longitudinally thereof on relative rotation therebetween and drivenly engaged with the other of said members for rotation thereby and for slidable movement longitudinally therealong; means for driving one of said members with one of the feed elements and for driving the other of said members with the other feed element, whereby the position of said part longitudinally along said one member indicates the extent of advance of the bar; abutment means mounted for adjustment longitudinally along said members in position to be engaged by said part on advance of the bar a predetermined distance; and means connected to said abutment means for operating the shiftable means to render the automatic drive inoperative on said engagement of said abutment means by said part.

9. The structure defined in claim 8 in which the abutment means includes an axially-movable screw, a nut mounted thereon in position to be engaged by the part and force said screw to move in one direction, and resilient means urging said screw in the opposite direction; the shiftable means includes a clutch mechanism and spring means urging the clutch mechanism to disengage; and the shiftable means operating means includes a releasable latch for retaining the clutch mechanism in engagement and connected to said screw for release on movement of the latter in said one direction.

10. In a drilling machine having an axially and rotatably movable boring bar, feed mechanism therefor including interengaged feed nut and feed screw elements, one rotatable with the bar, an automatic drive for the feed mechanism to advance the bar at a certain rate on rotation thereof, and shiftable means for rendering the automatic drive operative or inoperative, the combination of: a hollow, rotatable shaft offset and parallel to the bar and having a longitudinal slot therein; gear means for driving said tube with the bar and consequently with one of the feed elements; a rotatable first screw disposed coaxially within said shaft in spaced relation thereto; gear means for driving said screw with the other of the feed elements; nut means threaded on said screw and having a radial projection extending through said shaft slot, whereby relative rotation between said shaft and screw effects movement of said nut means longitudinally along said screw and the position of said nut means along said screw shows the extent of advance of the boring bar; an axially-shiftable manually-rotatable second screw mounted in offset parallel relation to said shaft; a second nut means threaded on said second screw, engaged with said shaft against rotation with said second screw, and having an abutment thereon engageable by said first nut means on a predetermined extent of advance of the bar to urge said second screw to shift in one direction; resilient means urging said second screw to shift in the opposite direction; spring means urging the shiftable means in a direction to render the automatic drive inoperative; and latch means engageable with the shiftable means to retain the latter in position to render the automatic drive operative and operatively connected to said second screw for unlatching movement on shifting of the latter in said one direction.

11. In a drilling machine having an axially and rotatably movable boring bar, feed mechanism therefor including interengaged feed nut and feed screw elements, one rotatable with the bar, an automatic drive for the feed mechanism to advance the bar at a certain rate of rotation thereof, clutch means in the drive, and manually operable means to rotate the other feed element to advance or retract the bar when the clutch means is disengaged, the combination comprising: means including second clutch means connecting the feed elements for rotation as a unit; and a single manually-operable axially-shiftable rod means connected to operate both the clutch means and shiftable between three positions, first wherein the automatic drive clutch means is engaged and said second clutch means is disengaged, second wherein both clutch means are disengaged, and third wherein the automatic drive clutch means is disengaged and said second clutch means is engaged.

12. The structure defined in claim 11 including spring means urging the shiftable means to move to the third position, and releasable latch means for retaining said shiftable means in either the first or second positions.

13. The structure defined in claim 12 including settable means operative when the automatic drive clutch means is engaged to release the latch means on a predetermined advance of the boring bar.

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