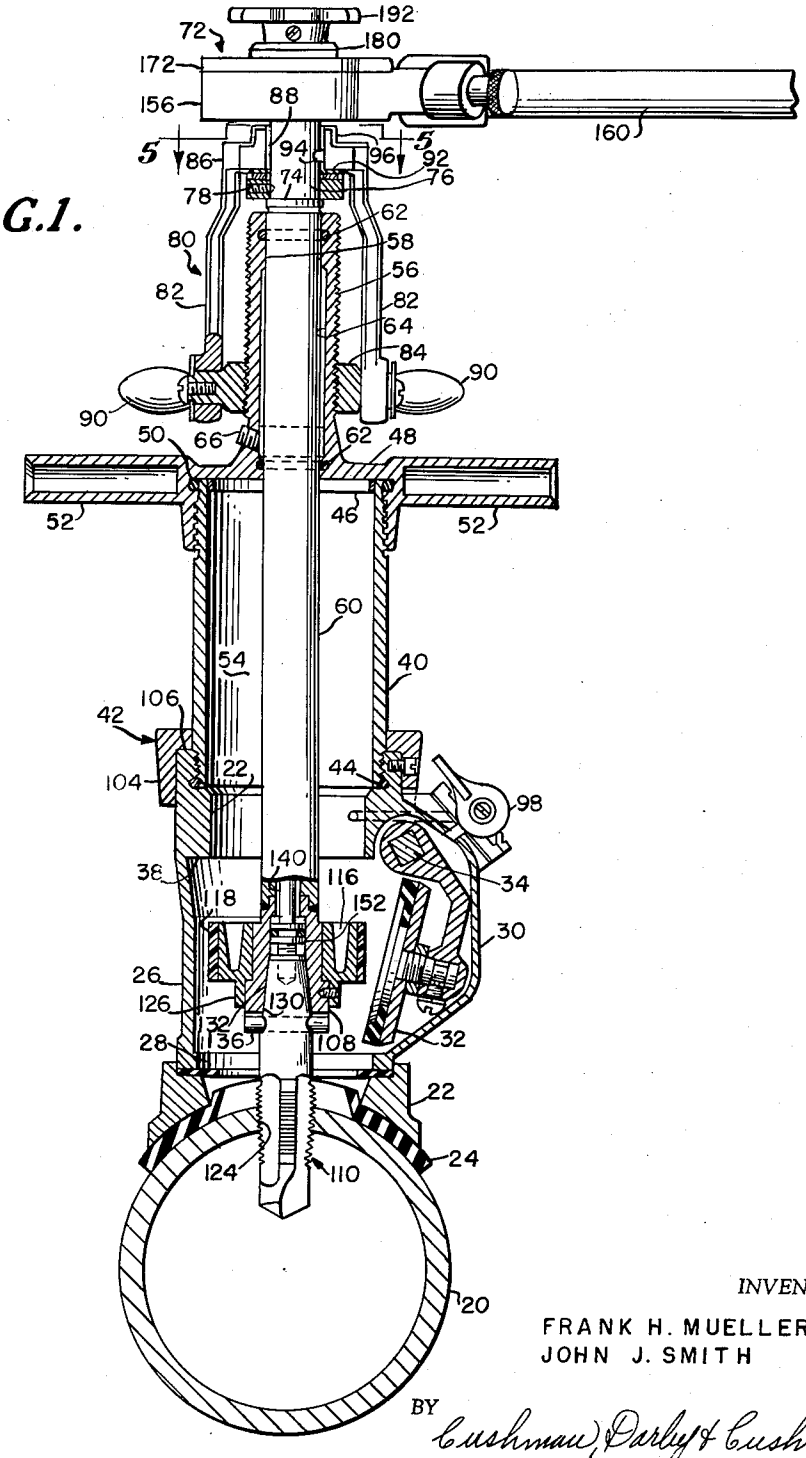
Jan. 3, 1961 F. H. MUELLER ET AL 2,966,814

DRILLING MACHINE

Filed Nov. 15, 1956 6 Sheets-Sheet 1

FIG. 1.



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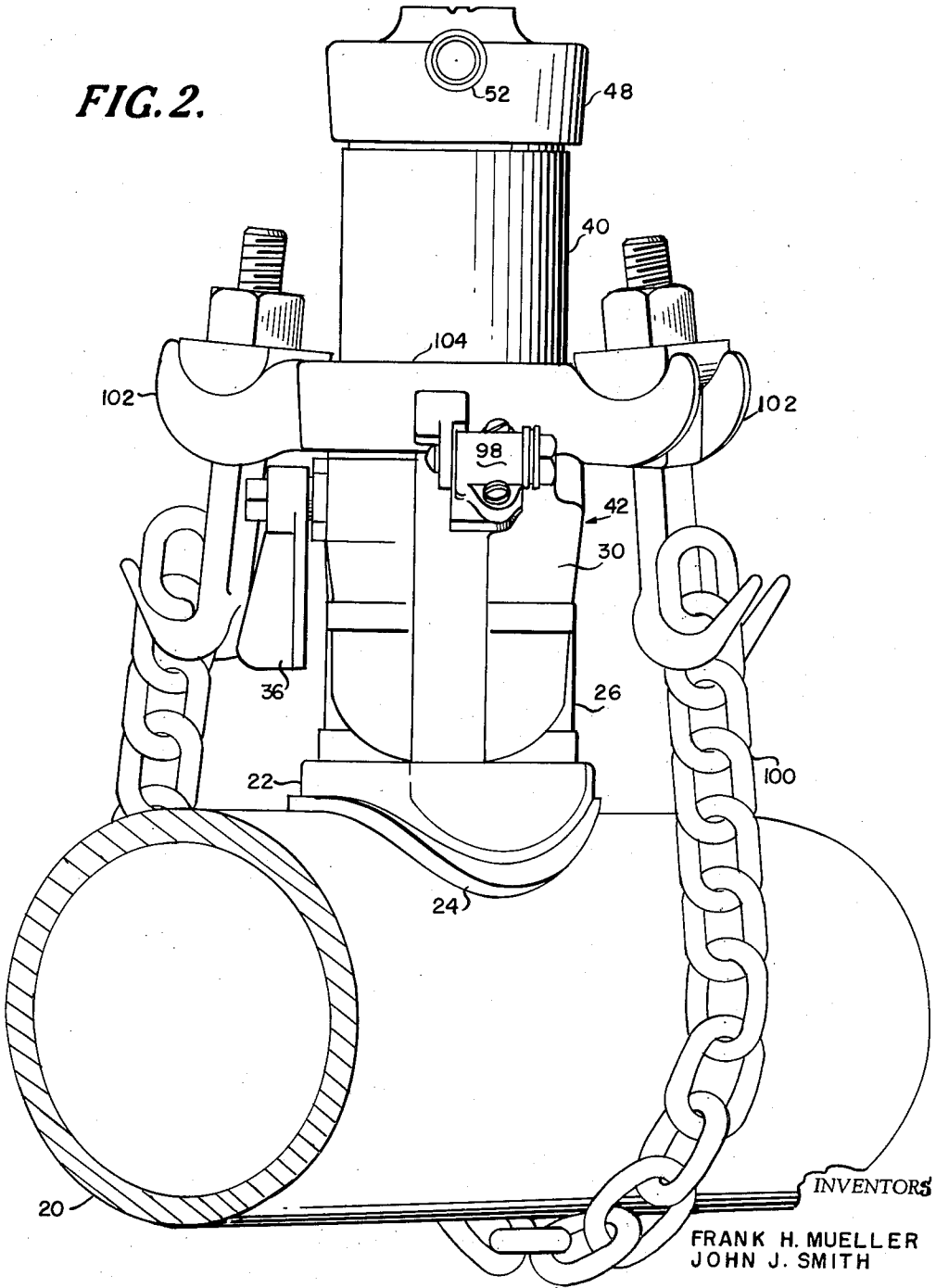
BY Cushman, Darby & Cushman
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DRILLING MACHINE

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FIG. 2.



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DRILLING MACHINE

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FIG.3.

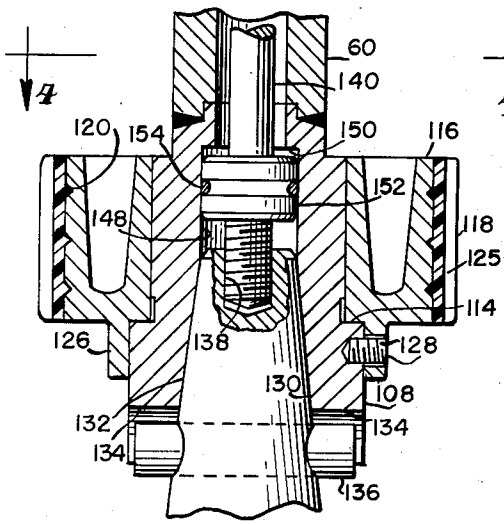


FIG12.

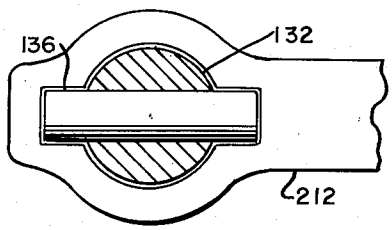


FIG.11.

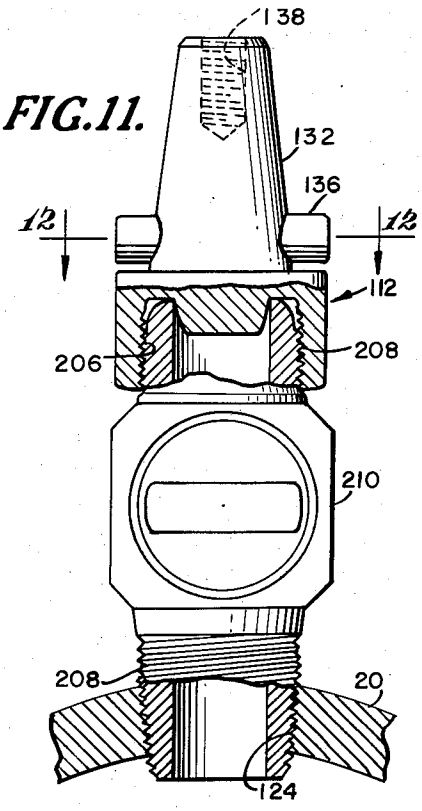


FIG.5.

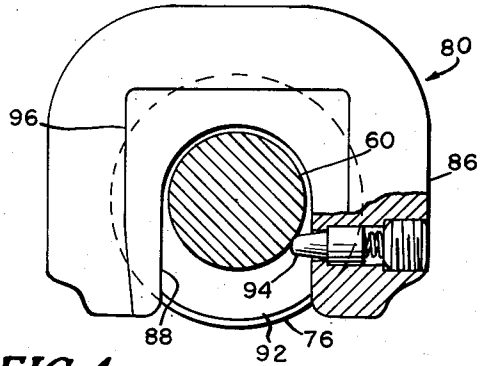
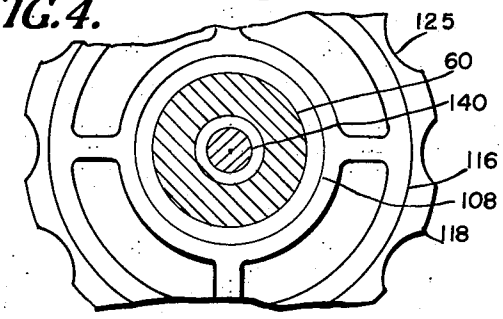


FIG.4.



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DRILLING MACHINE

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FIG.6.

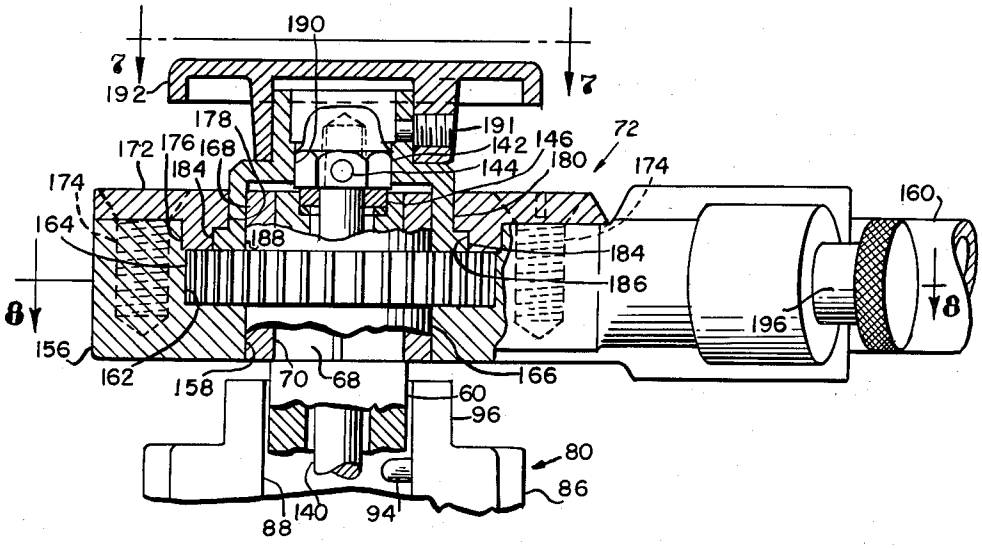


FIG. 8.

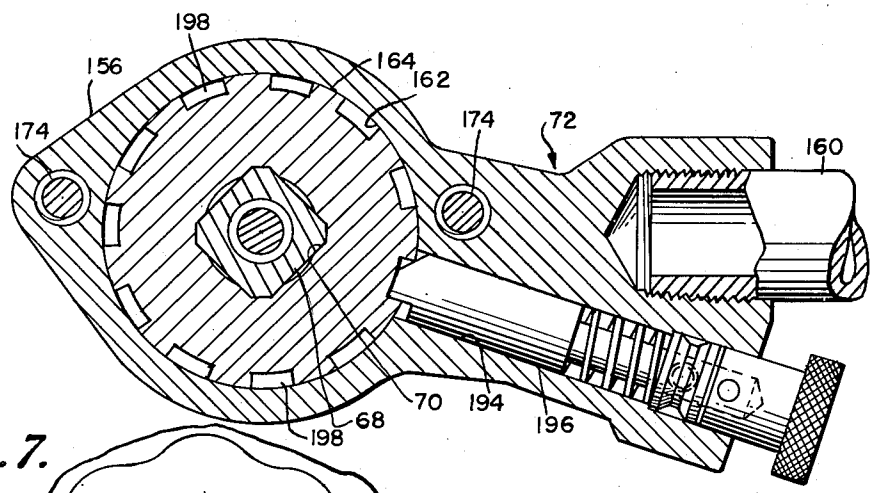
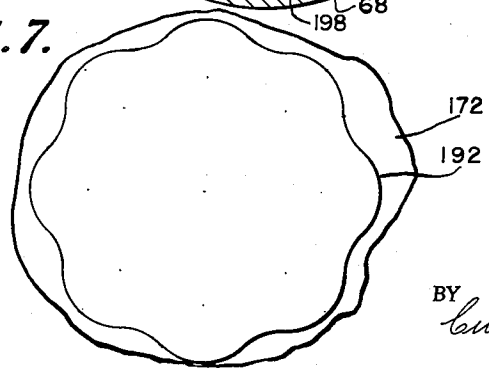


FIG. 7.



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DRILLING MACHINE

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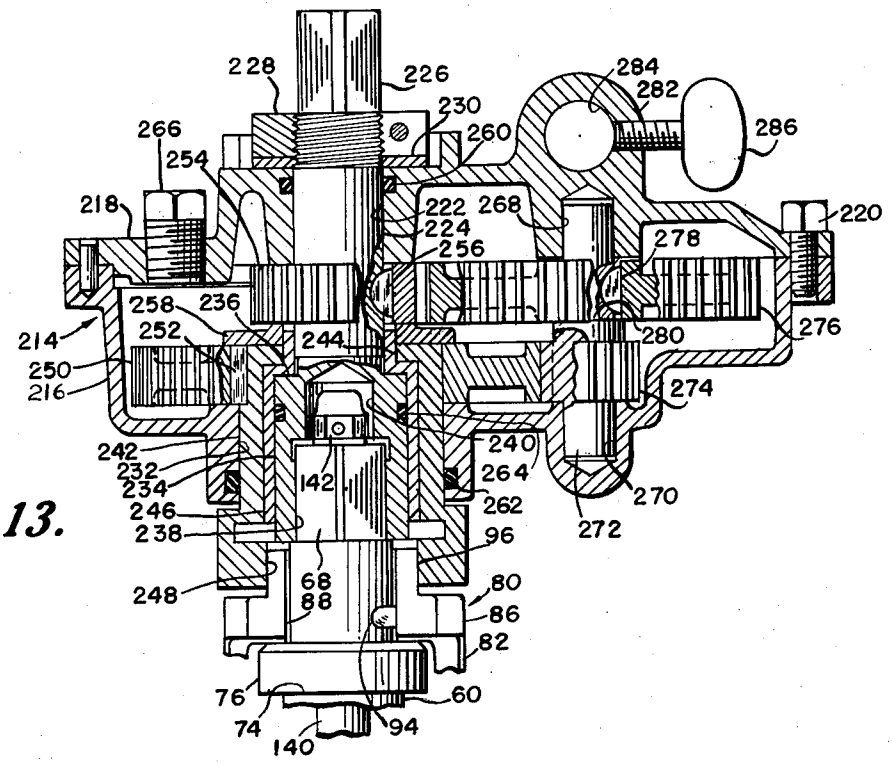


FIG. 13.

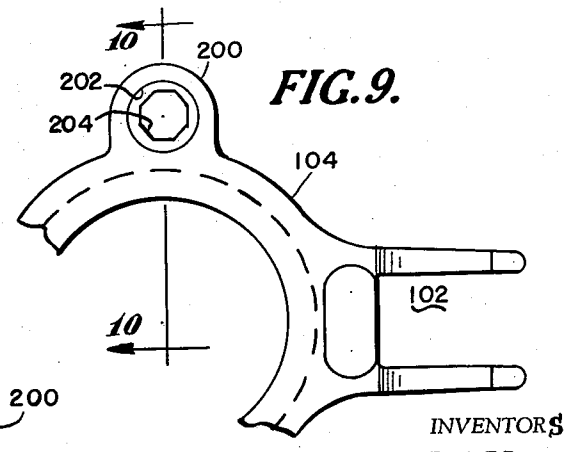
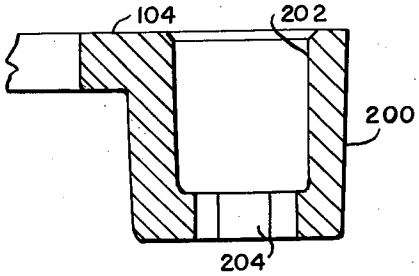


FIG. 9.

FIG. 10.



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Jan. 3, 1961 F. H. MUELLER ET AL 2,966,814

DRILLING MACHINE

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FIG. 14.

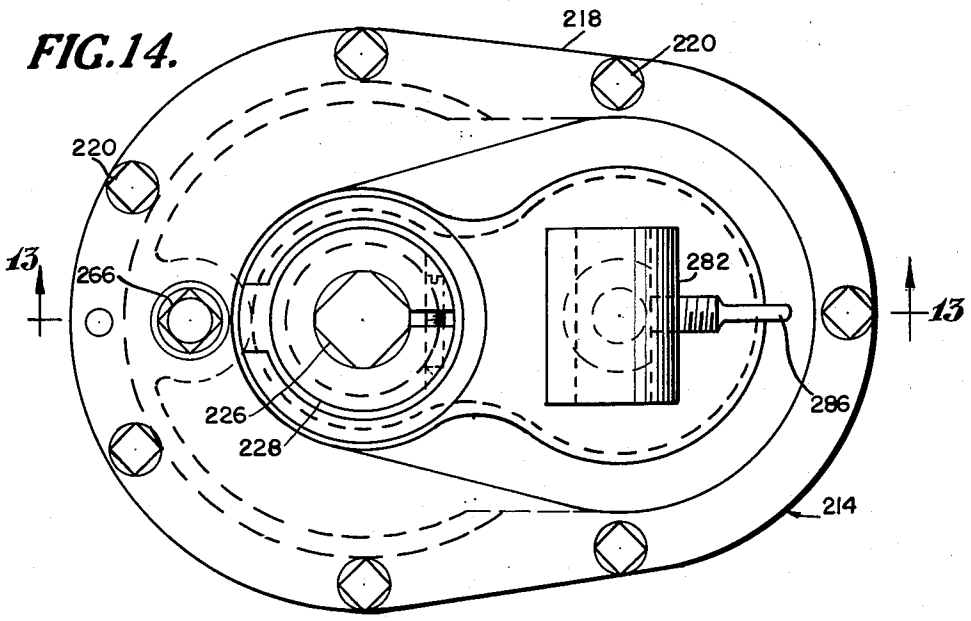
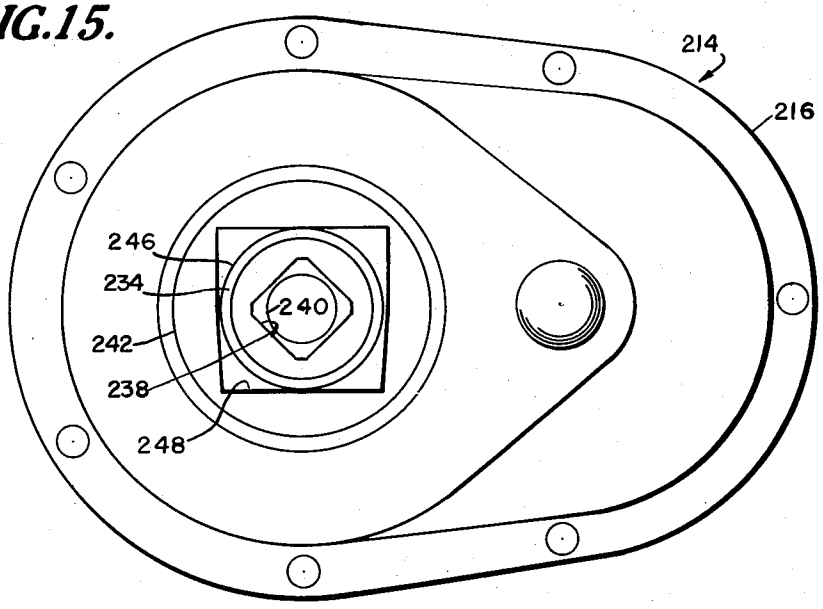


FIG. 15.



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United States Patent Office 2,966,814 Patented Jan. 3, 1961

2,966,814

DRILLING MACHINE

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Filed Nov. 15, 1956, Ser. No. 622,470

13 Claims. (Cl. 77—40)

This invention relates to enclosed drilling and tapping machines of the type employed to cut an opening in a wall of a fluid chamber, thread the cut opening, and screw into the tapped opening a fitting, such as a valve body or a service T for connecting a branch line to the fluid chamber. Such operations are customary, for example, in attaching lateral or service connections to a fluid conduit, such as a water or a gas main, while the latter is in service.

In particular, this invention pertains to improvements in machines of the type disclosed in U.S. Patents Nos. 2,291,979 and 2,745,669.

The machines disclosed in the aforementioned patents, while outstandingly successful for their intended purposes, are susceptible of improvements to facilitate their operation.

Thus, it has been found desirable to improve the connection between the boring bar of the machine and the tool carried thereby. The objects of such improvement are to provide a construction wherein no special tools are required to secure the tool to the end of the boring bar, and wherein such construction facilitates the ready attachment or detachment of tools. A particular object of such improvement is to provide a construction wherein a tool, known as a stop carrier, can be positively detached from the bar without opening the machine or removing the bar therefrom.

In previous machines of the type under consideration, the boring bar is fed by the manual rotation of a feed collar that is threadedly engaged with a fixed part of the machine and has a yoke pivotally connected thereto for swinging movement into and out of engagement with a shoulder on the boring bar. In actual practice, it has been found that occasionally the yoke tends to slip off such shoulder on the boring bar, with the consequent annoyance and delay of having to back up the feed collar and re-engage the yoke. Hence, it is another object of this invention to correct this deficiency.

In present-day machines of the type under consideration, the boring bar normally is driven manually by a ratchet wrench, but in the improved construction under consideration here, it is desirable to provide an improved ratchet wrench which not only may be utilized to drive the boring bar by hand, but also may be used to facilitate the attachment and detachment of tools to and from the boring bar. Hence, it is another object of this invention to provide such an improved wrench.

Additionally, as previously stated, the boring bars of the machines of the type under consideration substantially always have been driven by hand, by means of a ratchet wrench. The manual drive of a boring bar, however, becomes quite fatiguing and time-consuming when drilling operations are being performed, although the tapping operation, after an opening has been cut in the main, may be accomplished quite readily by hand without undue fatigue or consumption of time. Accordingly, it is still another object of this invention to provide a power driven attachment for a drilling machine

of the type under consideration, which attachment may be used to provide both a power drive and an automatic feed for the boring bar during drilling operations.

Numerous other objects and advantages of the invention will become apparent from the following decription and accompanying drawings in which:

Figure 1 is a central, vertical, sectional view of a tapping machine embodying this invention. The machine is shown attached to a main and with the parts in their position at the termination of a tapping operation.

Figure 2 is an enlarged, fragmentary perspective view of the machine shown in Figure 1.

Figure 3 is an enlarged, fragmentary view of the tool-carrying end of the boring bar of the machine shown in Figure 1.

Figure 4 is a sectional view taken substantially on line 4—4 of Figure 3.

Figure 5 is an enlarged, sectional view with parts broken away to illustrate details, taken substantially on line 5—5 of Figure 1.

Figure 6 is an enlarged, fragmentary view, partly in vertical section, of the machine shown in Figure 1 and illustrating the construction of the ratchet wrench and its attachment to the machine.

Figure 7 is a plan view taken substantially on line 7—7 of Figure 6.

Figure 8 is a sectional view taken substantially on line 8—8 of Figure 6.

Figure 9 is a fragmentary plan view of the chain yoke shown in Figures 1 and 2.

Figure 10 is an enlarged, fragmentary, sectional view taken substantially on line 10—10 of Figure 9.

Figure 11 is an enlarged, fragmentary view, partly in vertical section, illustrating the use of a stop carrier, embodying this invention, for attaching a corporation stop to a main.

Figure 12 is a sectional view taken substantially on line 12—12 of Figure 11 and additionally illustrating, in fragmentary view, a special type wrench engaged with the stop carrier for disconnecting the latter from the stop.

Figure 13 is a central, vertical, sectional view taken substantially on line 13—13 of Figure 14 of a combined power drive and automatic feed attachment for the drilling machine shown in Figure 1 and showing such attachment connected to the machine.

Figure 14 is a top plan view of the attachment shown in Figure 13.

Figure 15 is a bottom view of the attachment shown in Figure 13.

Referring now to the drawings, there is shown in Figures 1 and 2 a curved wall chamber, such as a gas or water main 20, having mounted thereon the usual saddle 22 with a gasket 24 interposed therebetween. The saddle 22 has an opening therethrough that is counterbored at its outer end to receive the lower open end of a flop valve housing 26. A gasket 28 is interposed between the saddle 22 and the housing 26.

The housing 26 is hollow and bulges outwardly at one side thereof to form a lateral enlargement 30 for the reception of a flop valve 32 when the latter is in its open or inoperative position, as best shown in Figure 1. The flop valve 32 is carried on a shaft 34 journaled in the walls of the housing 26 and provided with an exterior handle 36 to move the valve into or out of engagement with a valve seat 38 in the housing, to either close or open the valve. The open upper end of the flop valve housing 26 is interiorly threaded for connection of one end of a cylinder 40 which, together with the housing, constitutes the barrel 42 of the machine. Preferably, a circumferential groove is provided in the housing 26 at the inner end of its threads, and an O-ring 44 is disposed in such groove for sealing engagement with a smooth-

walled portion of the inner end of the cylinder **40**. The upper open end of the cylinder **40** is provided with an interior reinforcing ring or band **46** and is closed by a threaded bonnet or cap **48** that is sealed to the cylinder by an O-ring **50**. Preferably, the cap **48** is provided with radial handles **52** to facilitate its attachment and detachment to and from the cylinder **40**. Thus, the barrel **42** and the cap **48** form an interior fluid chamber **54**.

Projecting upwardly from the top of the cap **48** is an exteriorly threaded cylindrical bearing extension **56** of reduced diameter. The cap **48** and its extension **56** have an axial bore **58** which forms a bearing for and through which extends an axially and rotatably movable tubular boring bar **60**. Adjacent its ends the bore **58** is provided with interior circumferential grooves having O-rings **62** therein for sealing engagement with the boring bar **60**. Between these O-rings **62**, the bore **58** is enlarged, as at **64**, to provide considerable clearance between the bore and the boring bar **60** and form an annular chamber into which lubricant can be introduced through a charging opening that is normally closed by a screw plug **66**. The upper exterior end portion **68** of the boring bar **60** is square, or of other noncircular formation, best shown in Figures 6 and 8, for reception in a complementary socket or opening **70** of a ratchet wrench **72** that is used to rotate the bar by hand. For a short distance below its square end portion **68**, the boring bar **60** is reduced in diameter to provide a shoulder **74** facing the end portion. A thrust collar **76** is seated against the shoulder **74** and is held in place by a set screw **78**.

A generally U-shaped yoke **80** has the ends of its legs or arms **82** pivotally carried by a feed collar **84** threadedly mounted on the extension **56**. The base **86** of the yoke **80** has a generally U-shaped notch **88** therein, as best shown in Figure 5, so that the yoke may be swung up into the position shown in Figure 1, wherein the boring bar **60** is received in such notch and the yoke base may bear against the top of the thrust collar **76**. In such position, a feeding movement may be imparted to the bar **60** on rotation of the feed collar **84**, which rotation can be accomplished manually by radial handles **90** thereon. Preferably, a nylon washer **92** is interposed between the thrust collar **76** and the base **86** to reduce friction therebetween. Projecting from one side of the notch **88** is a spring-pressed detent **94**, best shown in Figure 5, that is spaced from the bottom of the notch a distance greater than one-half the diameter of the bar **60**. Hence, in the operative position of the yoke **80**, the detent **94** engages the bar **60** to retain the yoke in such position. Disposed about the notch **88** and extending upwardly from the base **86**, the yoke **80** is provided with a square, or other noncircularly-shaped, extension **96** (Figures 5, 6 and 13), the utility of which will be later explained.

A bypass valve **98**, mounted on the flop valve housing **26**, is employed in the usual manner to control communication between the portions of the fluid chamber **54** above and below the flop valve seat **38** when the valve **32** is closed, to facilitate both tight engagement of the valve with the seat and subsequent opening of such valve. The barrel **42** is held against the saddle **22** by a chain **100** extending about the main **20** and having its opposite ends secured to the opposite forks **102** of a chain yoke **104** that is engaged against an upwardly facing shoulder **106** on the barrel **42** formed by the upper end of the flop valve housing **26**, as is best shown in Figures 1 and 2.

The lower or forward end of the boring bar **60** has an enlarged tool holder **108** secured thereto, as by welding, as best shown in Figure 3, for removably carrying a tool, such as a combined drill and tap **110** (Figure 1) or a stop carrier **112** (Figure 11). Seated against an exterior rearwardly-facing shoulder **114** on the holder **108** is a cylindrical guide collar **116** of substantial diameter and preferably provided with a bearing surface of synthetic plastic **118** having high wear and abrasion resistant characteristics, such as nylon. The plastic **118** may be in the form of a sleeve molded onto the collar **116** and locked thereto by interior circumferential ridges extending into complementary exterior grooves, as at **120**, in the metal portion of the collar. This guide collar **116** has a close fit within an accurately-machined cylindrical interior guiding portion **122** (Figure 1) in the flop valve housing **26**, immediately above the valve seat **38**, to maintain the tool **110** properly centered at the start of a cutting operation or the carrier **112** properly centered with a tapped opening **124** (Figures 1 and 11) at the beginning of a stop-inserting operation. Thus, the guide collar **116** and the interior cylindrical portion **122** prevent any side shifting of the tool holder **108**, during initial cutting or inserting operations, which might be occasioned by wear of the bar bearing portions of the bore **58** in the cap **48**. After the opening has been cut and during the subsequent tapping operation, the guide collar **116** may pass inwardly beyond the flop valve seat **38**, but during the tapping operation or completion of an inserting operation, it will be evident that no guiding of the bar **60** other than that provided by its bearing in the cap **48** is necessary. The exterior surface of the plastic **118** is fluted longitudinally, as at **125**. The guide collar **116** also is provided with a reduced extension **126** which depends from or projects forwardly of such collar about the lower portion of the tool holder **108**. The guide collar **116** may be retained on the tool holder **108** by a set screw **128** which passes through the extension **126** and is threaded into the tool holder. From the aforedescribed construction, it is evident that the fluted formation of the plastic **118** provides a ready hand-hold for grasping the holder **108** to either rotate the boring bar **60** or retain it against rotation, for reasons later described.

The holder **108** is provided at its lower or forward end with a tapered socket **130** for receiving the correspondingly tapered shank **132** of either of the tools **110** and **112**. Diametrically-opposed, arcuate recesses or notches **134** (Figure 3) are provided in the rim of the socket **130** for reception of the projecting ends of a transverse driving pin **136** in the tool shank **132**. The pin **136** is of a length equal to or slightly less than the maximum outer diameter of the holder **108**. The end of the tool shank **132** is provided with a coaxial threaded socket **138**, best shown in Figures 3 and 11, for engagement with the threaded end of a draw rod **140** that extends rearwardly or upwardly completely through the boring bar **60**. At its upper or rearward end, the draw rod **140** is provided with an enlarged noncircular, e.g., hexagonal, head **142**, as best shown in Figure 6. In the embodiment illustrated, such head **142** is formed by a nut threaded onto the upper end of the rod **140** and rigidly secured thereto, as by a pin **144**. The underside of the head **142** is adapted to bear against a thrust washer **146** seated against an interior shoulder in the upper end of the boring bar **60**.

From this construction, it will be seen that the tool shank **132** may be partially inserted into the socket **130** and threadedly engaged with the draw rod **140**. Rotation or tightening of the latter by its head **142** will then serve to pull the shank **132** tightly into the socket **130** and position the ends of the pin **136** in the notches **134** in the rim of the socket. Thus, the draw rod **140** can securely but detachably retain the tools **110** or **112** in the holder **108**.

The inner end of the socket **130** in the holder **108** merges with a cylindrical portion **148** of somewhat greater diameter than the interior of the boring bar **60**, which terminates at its inner end in a forwardly or downwardly facing shoulder **150**, best shown in Figure 3. Within the cylindrical portion **148** of the holder **108**, the draw rod **140** is provided with an exterior cylindrical enlargement **152**, substantially complementary to and for guiding engagement wtih the interior wall surface of the cylindrical portion. When the draw rod **140** is in secure retaining engagement with a tool, as shown in Figure 3, so that the rod head **142** bears against the washer **146**, the en-

largement 152 on the rod is spaced somewhat from the interior shoulder 150. The enlargement 152 on the rod 140 is provided with an exterior circumferential groove having an O-ring 154 therein to provide a seal between the enlargement and the interior wall surface of the cylindrical portion 148 of the holder. From this construction it will be seen that the enlargement 152 prevents loss or withdrawal of the draw rod 140 rearwardly through the boring bar 60, while the O-ring 154 prevents passage of any fluid from the chamber 54 rearwardly through the bar.

The ratchet wrench 72 embodying this invention, and which is shown best in Figures 6, 7, and 8, comprises a main body 156 provided with a bore or bearing aperture 158 extending therethrough and a detachable operating handle 160 extending generally radially of such bore. On one side the body 156 is provided with a counterbore 162 for the reception of a ratchet wheel 164 having extended cylindrical hub portions 166 and 168 and the central noncircular aperture or socket 70 that is complementary to and for reception of the square end portion 68 of the boring bar 60. The hub portion 166 fits within the body bore 158 with its outer end substantially flush with the exterior surface of the body 156. A closure or retaining plate 172 is fastened to the other side of the body 156, as by screws 174, and has an annular rib or flange 176 fitting within the counterbore 162 and bearing against one side of the wheel 164 to retain the latter in the body. The plate 172 is provided with a bore 178 in axial alignment with the body bore 158 but of somewhat greater diameter than the latter for journally mounting one end of a sleeve-like wrench member 180. At its one end the member 180 is provided with an exterior circumferential flange 184 fitting within an interior enlargement 186 at the inner end of the bore 178 in the plate 172. Consequently, the wrench member 180 is rotatably retained in or swivelly connected to, the wrench 72. Within its one end, the member 180 is provided with a cylindrical socket 188 for journally receiving the hub portion 168 of the ratchet wheel 164. Beyond the socket 188 the member 180 is exteriorly and interiorly reduced and provided with a smaller, noncircular socket 190 complementary to the enlarged head 142 on the draw rod 140 and for wrench engagement therewith. Secured to the reduced portion of the wrench member 180, as by a setscrew 191, is an enlarged handle 192 to provide a ready hand-hold for manually turning the wrench member. Mounted in a bore 194 in the body 156 extending radially of the wheel 164 is a reversible, spring-pressed ratchet pawl 196 engageable in the usual manner with notches 198 in the ratchet wheel, as best shown in Figure 8.

The chain yoke 104, on one side thereof, is laterally enlarged as at 200, and provided therein with an upwardly facing cylindrical socket 202, of a diameter only slightly greater than the maximum transverse dimension of the square end portion 68 of the boring bar 60 and of a length substantially equal to such end portion, as best shown in Figures 9 and 10. The inner end or bottom of the socket 202 is provided with a noncircular opening or socket 204 that is complementary to the enlarged head 142 on the draw rod 140 for wrench engagement therewith. The function and purpose of the sockets will be explained later.

In use of the machine embodying this invention, after the barrel 42 has been secured in place on the main 20 and before the cap 48 is connected to the barrel, the boring bar 60 while carrying the cap and the yoke 80 is disposed in an inverted position and the square end portion 69 of the bar placed in the socket 202 in the chain yoke 104 with the head 142 of the draw rod 140 engaged within the socket 204. The socket 202 will support the boring bar 60 in this position while the shank 132 of the combined drill and tap 110 is partially inserted into the tool holder socket 130 and threadedly engaged with the adjacent end of the draw rod 140. Thereupon, by manually grasping the guiding collar 116 on the tool holder 108, the boring bar 60 can be rotated relative to the head 142 in a direction to tighten the threaded engagement between the draw rod 140 and the tool shank 132.

After the tool 110 is thus firmly secured to the tool holder 108, the boring bar 60 is inserted into the upper end of the barrel 42 and the cap 48 is threaded and tightened onto the barrel. The boring bar 60 may then be pushed down manually until the tip of the tool 110 engages the main 20. Thereupon, the feed collar 84 is threadedly adjusted into a position wherein the yoke 80 may be swung into detent-retained feeding engagement over the thrust collar 76 on the boring bar. The ratchet wrench 72 is then engaged with the square end portion 68 of the boring bar 60 and operated, by hand, to rotate the latter so that the tool 110 will drill a hole in the wall of the main 20. During this drilling operation, the feed collar 84 is rotated by hand to advance the tool 110 and provide the necessary axial force thereon to effect a cut in the main 20. After the main 20 has been drilled by the forward drill portion of the tool 110, the following tapping portion of the tool will engage the main, and continued operation of the ratchet wrench 72 will serve to tap the drilled opening in the main, as is best shown in Figure 1. In this connection, it will be seen that force feed of the bar 60 during the tapping operation is not necessary because the tool 110 is self-feeding during the tapping operation.

After the main 20 has thus been drilled and tapped, the yoke 80 is swung out of engagement over the collar 76 and the ratchet pawl 196 on the wrench 72 is reversed so that reverse operation of the wrench will serve to unthread the tool 110 from the tapped opening in the main. Thereupon, the boring bar 60 is pulled up manually until the tool holder 108 and the tool 110 are completely received within the upper portion of the barrel 42 above the valve seat 38. The flop valve 32 can then be closed and the cap 48, together with the boring bar 60, removed in conventional fashion. The boring bar 60 is again inverted and supported in the sockets 202 and 204 in the chain yoke 104, as aforedescribed, while the bar is manually rotated in a direction to unthread the draw rod 140 from the tool 110, whereby the latter can be removed. At this time, the stop carrier 112, best shown in Figure 11, is secured in the socket 130 in the tool holder 108, in the same manner as aforedescribed for the attachment of the drill and tap 110 therein. The stop carrier 112 has a tapered shank 132, a threaded end socket 138, and a transverse driving or locking pin 136 identical to the corresponding portions of the drill and tap 110. In place of the drilling and tapping portions of the tool 110, however, the carrier 112 is provided, at its forward end, with an interiorly threaded socket 206 for the reception of one of the threaded nipples 208 of a corporation stop 210. This stop-carrying socket 206 of the carrier may be substantially identical to that illustrated and described in the above-mentioned Patent No. 2,745,669.

With the stop 210 closed, the cap 48, together with the boring bar 60, is re-attached to the barrel 42, after which the flop valve 32 is opened and the boring bar 60 advanced, either directly by hand or by the feed collar 84 and yoke 80, until the free other nipple 208 of the stop is engaged with the tapped opening in the main 20. At this time, the boring bar 60 is again rotated by the ratchet wrench 72 to screw the stop 210 into the tapped opening in the main 20, as shown in Figure 1. The handle 192 of the ratchet wrench 72 may then be grasped by hand and rotated in a direction to unscrew the draw rod 140 from the stop carrier 112, while the bar 60 is held against rotation by grasping the wrench handle 160. In the event that the shank 132 of the carrier 112 sticks in the socket 130, after the rod 140 has been unscrewed a few turns and thereby lifts the rod head 142 off the washer 146, because of the clearance between the enlargement 152 and the shoulder 150, the head 142 can be tapped lightly

to completely free the shank of the stop carrier from the socket in the tool holder. Thereupon, further unthreading rotation of the draw rod, accompanied by a slight retraction of the bar 60, will serve to completely detach the stop carrier 112 from the tool holder 108, so that the cap 48, together with the boring bar 60, can be removed from the machine, and the chain 100 detached so that the complete machine can be removed from the main 20.

This operation will leave the stop 210, together with the carrier 112 threaded thereon, threadedly engaged in the main 20, as best shown in Figure 11. Thereupon, the stop 210 can be firmly tightened into the main 20, as by an appropriate wrench (not shown), and thereafter a special wrench 212, best shown in Figure 12, can be engaged with the stop carrier 112, while the latter is held by the aforementioned appropriate conventional wrench, to unthread the carrier from the stop and thus complete the operation of installing the stop on the main. In this connection, it will be readily understood that a service T (not shown) can be installed on the main 20 in exactly the same manner as that described for the installation of a corporation stop.

Referring now to Figures 13 to 15 of the drawings, there is shown an attachment for the drilling machine which will enable the bar 60 to be driven by power during the drilling operation and at the same time provide an automatic feed for the bar. The attachment includes a housing 214 having a somewhat dish-shaped main body 216 and a top cover 218, which may be secured to the body by screws 220 extending through flanged peripheries of the cover and body. Journaled in a bearing portion 222 of the cover 218 and projecting into the housing 214 is a drive shaft 224 having a square, or other appropriate noncircular, outer end 226 projecting out of the cover for driven engagement by appropriate power means (not shown). Immediately below its square outer end portion 226, the shaft 224 is threaded for the reception of a split clamping nut 228. Preferably, a washer 230 is interposed between the nut 228 and the exterior surface of the cover 218. The other end of the shaft 226 projects through a bearing portion 232 of the body 216 and is enlarged, as at 234, to form a shoulder 236 thereon facing the inner side of the cover 218. Formed in the end of the enlarged shaft portion 234 is a socket 238 that is exposed to the exterior of the housing 214 and is of the same length as and complementary to the noncircular end portion 68 of the boring bar 60 for driving engagement therewith. The bottom of the socket 238 is provided with a circular recess or socket 240 of slightly larger diameter than the major transverse dimension of the rod head 142 for free rotative reception thereof.

Journaled in the bearing portion 232 of the body 216 is a tubular yoke-driving sleeve 242 that is rotatably mounted on the enlarged portion 234 of the shaft and has an interior circumferential flange 244 at its inner end which overlies the shoulder 236 on the shaft 244. Preferably, an anti-friction bushing 246 is interposed between the sleeve 242 and the shaft 224 in order to facilitate free rotation therebetween. The sleeve 242 projects outwardly beyond the enlarged end 234 of the shaft and is provided therebeyond with an interior configuration or socket 248 of the same length as and complementary to the extension 96 on the base 86 of the yoke 80 for driving engagement therewith.

Within the housing 214 a large gear 250 is mounted on the sleeve 242 and secured thereon, as by a key 252, with one side of its hub portion bearing against the inner surface of the housing body. A smaller gear 254 is secured to the shaft 224 within the housing 214, as by a key 256, and at one side bears against the inner surface of the cap 218. Interposed between the inner end of the sleeve 242 and the gear 254 is a spacer washer 258 which also overlies and bears against the hub portion of the gear 250. From the foregoing construction, it will be seen that the clamp nut 228, together with the gear 254, spacer washer 258, and sleeve flange 244, serves to retain the shaft 224 and the sleeve 242 against axial movement relative to the housing 214, while the housing body 216 and the spacer washer 258 likewise retain the gear 250 against such movement. Preferably, the bearing portions 222 and 232 of the housing 214 are provided with interior circumferential grooves having O-rings 260 and 262 therein to serve as oil seals, while the enlarged portion 234 of the shaft has an exterior circumferential groove having an O-ring 264 therein to provide a seal between the enlarged shaft portion and the bushing 246. The housing 214 may be filled with oil through a filling opening normally closed by a threaded closure plug 266.

Journaled in appropriate, aligned bearing sockets 268 and 270 formed in the interior surfaces of the cover 218 and the body 216, respectively, is an idler shaft 272 offset from the drive shaft 224. A small gear 274 integral with the shaft 272 meshes with the large gear 250. A larger gear 276 is secured to the shaft 272, as by a key 278, and has the opposite sides of its hub portion bearing against the interior surface of the cover 218 and a shoulder 280 on the idler shaft 272, respectively. The gear 276 meshes with the smaller gear 254 on the shaft 224. From the foregoing construction, it will be seen that the gears 254, 276, 274, and 250 constitute a reduction drive for driving the sleeve 242 at a speed less than that of the shaft 224. The gear ratios are such that when the attachment is in use, as later described, the boring bar will be fed at a rate appropriate for a drilling operation.

On the upper side of the cover 118 is an upstanding lug 282 provided with a transverse bore 284 for the reception of a pivot pin (not shown) that can be retained in such bore by a thumb screw 286. This arrangement may serve to pivotally support a motor holder (not shown) on the attachment. Such motor holder may be of the type illustrated in United States Patent No. 2,651,-222. In general, such holder may serve to properly position and hold an air motor (not shown) in position for driving engagement with the outer end 226 of the shaft 224.

In use, the attachment is positioned on top of the boring bar 60, with the yoke 80 in its feeding position, and manipulated until the upper square end portion 68 of the bar is received, at least partially, in the socket 238 of the attachment. In the event that both sockets 238 and 248 of the attachment are not correctly oriented with respect to the end 68 of the boring bar and the projection 96 on the yoke, the latter can be rotated slightly by hand until the yoke projection becomes properly aligned with the socket 248 in the sleeve 242. At this time, both of the sockets 238 and 248 of the attachment will properly receive and drivingly engage the end 68 of the boring bar and the projection 96 on the yoke, respectively. The motor holder and its motor (not shown), or other type of power drive, can then be fastened to the attachment, and the motor can be operated to drive the shaft 224 to thereupon drive the boring bar 60 to drill a hole in a main. At the same time, it will be seen that the yoke 80 will be driven at a rate of speed less than that of the boring bar 60. This rate of rotation of the yoke 80 serves to rotate the collar 84 to feed the boring bar 60 automatically at a rate appropriate for a drilling operation.

It will be evident that this power drive of the bar 60, together with the automatic feed thereof, will greatly reduce the time necessary for an operator to initially drill a main as well as greatly reduce the time necessary to complete such drilling operation. After the main has been drilled by power, the attachment can be removed and the wrench 72 used to rotate the boring bar 60 for the tapping operation. In this connection, it is well known that a tapping operation can be carried on

quite rapidly and with considerably less effort required than for a drilling operation.

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 drilling machine the combination comprising: a tubular boring bar having a tapered socket at one end thereof to receive the tapered shank of a tool, an interior shoulder facing said one bar end, and noncircular means on said bar for interfitting engagement with complementary means on the tool shank to drive the tool; a draw rod extending through said bar and having a threaded end disposed adjacent the inner end of said socket for engagement with a threaded socket in the end of the tool shank to retain the tool in said bar socket; an enlargement on said rod within said bar engageable with said interior shoulder to retain said rod in said bar; and a wrench-engageable head on the other end of said rod for bearing against the other end of said bar.

2. The structure defined in claim 1 including packing means between the rod and the interior of the bar.

3. In a drilling machine the combination comprising: a tubular boring bar having a tapered socket at one end thereof for receiving the shank of a tool, the inner end of said socket merging into a cylindrical bore section that terminates at its inner end in an annular shoulder; a tool having a tapered shank receivable in said socket, the end of said shank being provided with a coaxial threaded socket; mechanically interfitting means on said bar and on said tool shank for driving said tool by said bar; a draw rod extending through said bar and having one end threadedly engaging said shank socket; a wrench-engageable head on the other end of said rod for bearing against the other end of said bar; and an enlargement on said rod disposed in said bore section and engageable against said shoulder.

4. The structure defined in claim 3 including packing means between the enlargement and the bore section.

5. In a drilling machine the combination comprising: a tubular boring bar having a tapered socket at one end thereof to receive the tapered shank of a tool and noncircular means on said bar for interfitting engagement with complementary means on the tool shank to drive the tool; a draw rod extending through said bar and having a threaded end disposed adjacent the bottom of said socket for engagement with a threaded socket in the end of the tool shank to retain the tool in said bar socket; a noncirculr head on the other end of said rod for bearing against the other end of said bar; a cylindrical enlargement on said bar adjacent said one end thereof for guiding engagement with a complementary bearing surface on the machine; and noncircular means on said bar adjacent said one end thereof for manual engagement to rotate said bar relative to said rod head.

6. In a drilling machine having a tubular boring bar provided with a noncircular configuration at one end thereof for engagement and rotation by a wrench device and a tool-receiving socket in the other end thereof, a draw rod extending through the bar and provided with a threaded end disposed in the socket for threaded engagement with a tool to retain the latter in the socket, and a noncircular head on the other end of the rod for bearing against the one bar end, the combination comprising: means defining an upwardly facing exterior recess in a fixed part of the machine, said recess having an outer cylindrical section for snug rotative reception of the one bar end to support the bar in an upright position, while permitting the latter to be rotated manually, and an inner noncircular section of reduced size complementary to and for reception of the rod head to hold the rod against rotation on rotation of the bar.

7. The structure defined in claim 6 including a noncircular enlargement on the bar adjacent the socket to provide a hand hold for facilitating manual rotation of the bar.

8. In a drilling machine having a tubular boring bar provided with a noncircular end, a tool-retaining draw rod extending thorugh the bar, and a noncircular head on one end of the rod bearing against and smaller than the noncircular bar end, the combination of means defining an upwardly-facing, accessible, exterior recess in a fixed part of the machine, said recess having an outer cylindrical section for snugly rotatively receiving and supporting the noncircular end of the boring bar, and said recess also having an inner noncircular section complementary to and for reception of the rod head to hold the rod against rotation on rotation of the bar.

9. In a drilling machine the combination comprising: a boring bar having a noncircular driving end and a shoulder facing said end; a feed collar concentric with said bar and threadedly engaged with a fixed part of the machine; a yoke pivotally mounted on said collar and swingable into engagement with said shoulder to feed said bar on rotation of said collar and yoke, said yoke having a noncircular portion projecting toward said bar end when said yoke is engaged with said collar; and an attachment engageable with said bar end and said yoke portion to effect automatic feed of said bar, said attachment comprising a housing, a bar-driving member journaled in said housing and having a socket accessible exteriorly thereof and complementary to said bar end for driving engagement therewith, a tubular yoke-driving member journaled in said housing concentrically about said bar-driving member and having a socket disposed outwardly beyond said bar-driving member socket and complementary to said yoke portion for driving engagement therewith, shaft means journalled in and accessible exteriorly of said housing for driven engagement by exterior driving means, means connecting said shaft means to said bar-driving member for drive of the latter by the former, and gear means journaled in said housing and connecting said shaft means to said yoke-driving member for drive of the latter by the former at a reduced rate from that of said bar-driving member.

10. The structure defined in claim 9 wherein the means connecting the shaft means to the bar-driving member forms a direct drive for the latter by the former.

11. The structure defined in claim 9 wherein the effective depth of the socket in the bar-driving member is greater than that of the socket in the yoke-driving member.

12. An automatic feed attachment for use with a drilling machine having a boring bar provided with a driving end, a feed collar concentric with the bar and threadedly engaged with a fixed part of the machine, a feed yoke pivotally connected to the collar and swingable into and out of engagement with a shoulder on the bar to feed the latter on rotation of the collar, the combination comprising: a housing; a bar-driving member journaled therein and having a socket exposed exteriorly thereof for drivingly engaging the driving end of the bar; a tubular yoke-driving member journaled in said housing concentrically about said bar-driving member, said yoke-driving member having a portion projecting outwardly of said housing beyond said bar-driving member and shaped for interfitting driving engagement with the yoke; shaft means journalled in and accessible exteriorly of said housing for driven engagement by exterior driving means and connected to said bar-driving member for driving the latter; and gear means journaled in said housing and connecting said shaft means with said yoke-driving member to drive the latter by the former at a reduced rate from that of said bar-driving member.

13. The structure defined in claim 12 wherein the shaft means and the bar-driving member are of integral one-piece construction.

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