Sept. 8, 1953

F. H. MUELLER ET AL

2,651,222

DRILLING MACHINE

Filed May 17, 1951

3 Sheets-Sheet 1

Fig 1.

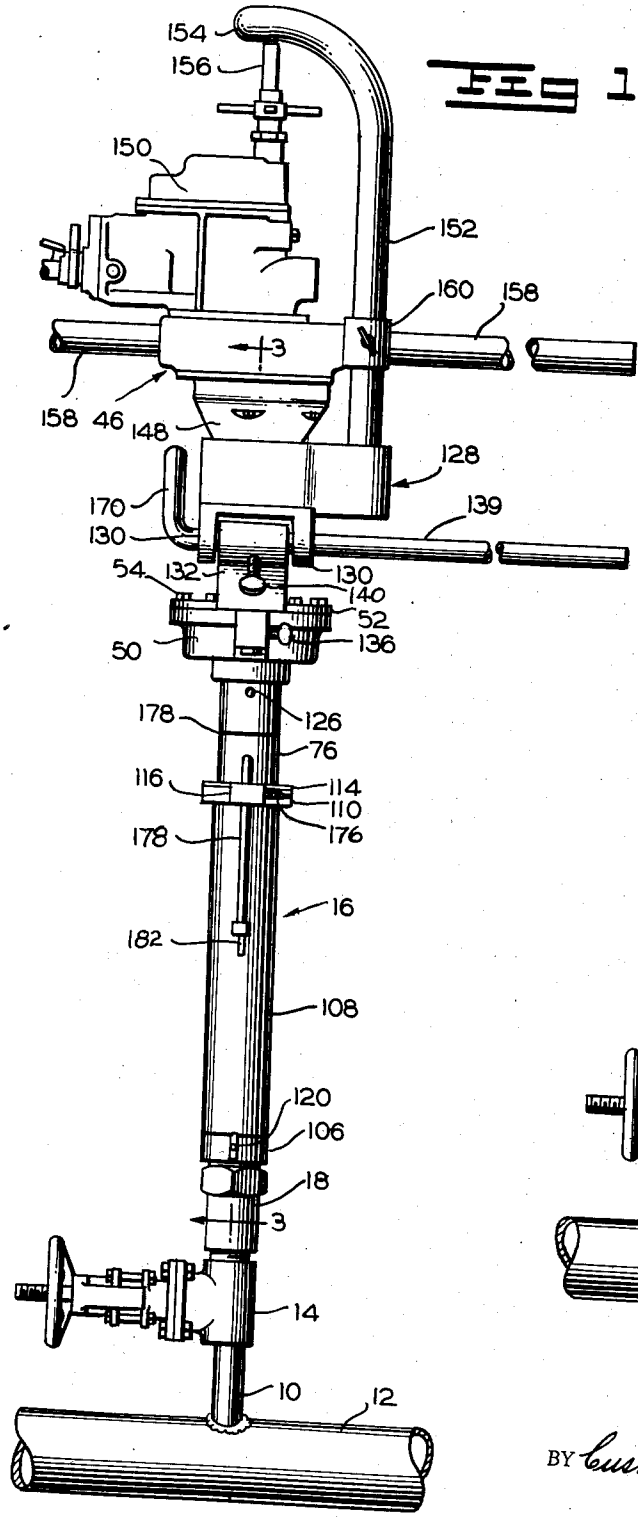
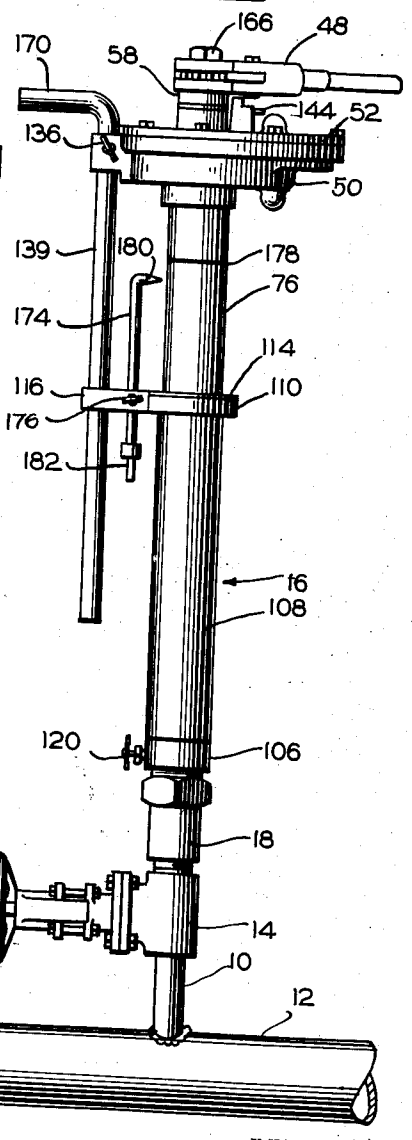


Fig 2.



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3 Sheets-Sheet 2

Fig 6.

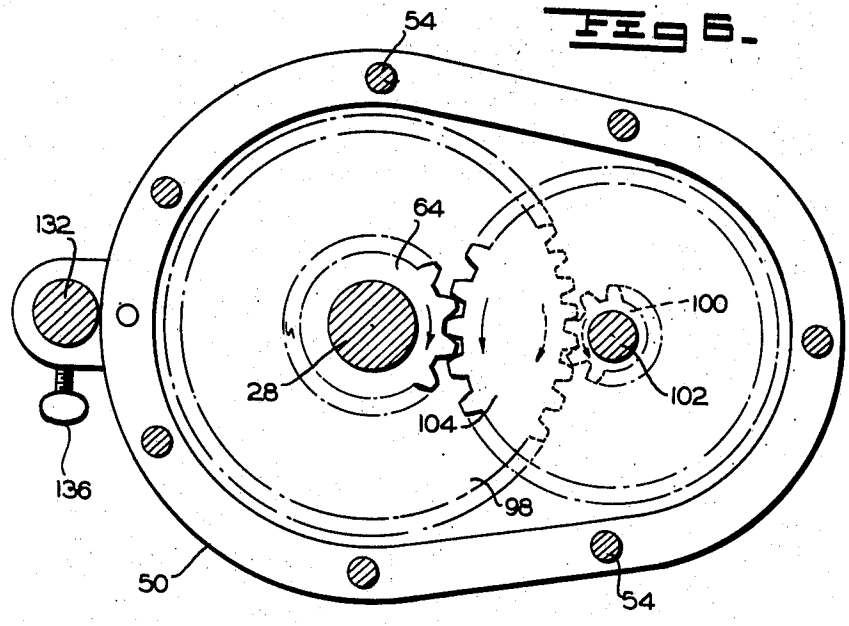
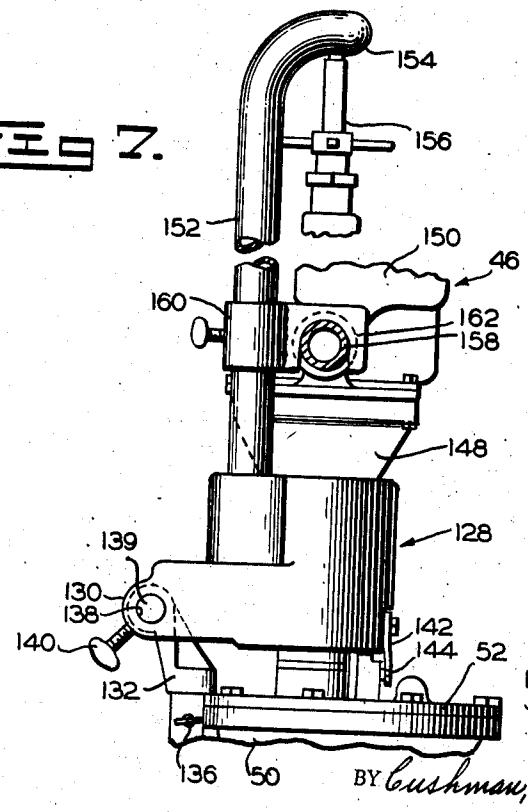


Fig 7.



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3 Sheets-Sheet 3

Fig 3.

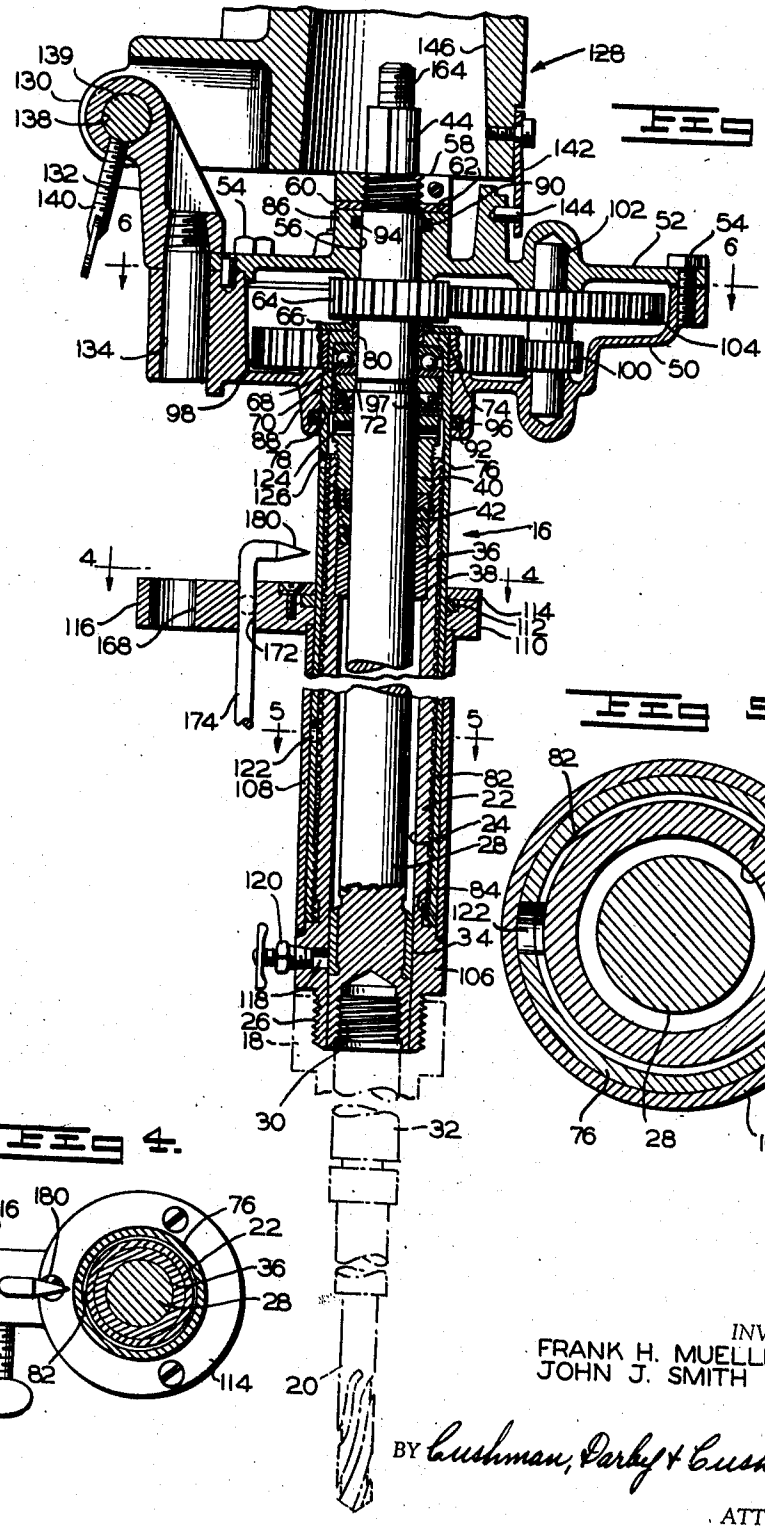


Fig 5.

Fig 4.

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UNITED STATES PATENT OFFICE

2,651,222

DRILLING MACHINE

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Application May 17, 1951, Serial No. 226,766

22 Claims. (Cl. 77—37)

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This invention relates to a drilling machine for boring or tapping a supply pipe or main, for such purposes as inserting a pipe line stopper or a valve therein or attaching a branch connection thereto. Since it usually is desirable to bore or tap such a main without discontinuing the service, this invention relates to drilling machines of the type particularly designed to be secured to a main to tap the same without shutting off the flow of fluid therethrough and without escape of fluid therefrom as a result of the tapping operation.

Drilling machines for accomplishing these purposes are known in the art, but are subject to disadvantages which this invention seeks to overcome. In particular, machines of the type described have been developed which are power driven, that is by a motor, usually electrical or air, connected directly to the machine. Such machines are also usually provided with means for automatically advancing or feeding the bit in accordance with its cutting rate. The use of a powerful motor in this type of machine, however, gives rise to a situation which may be somewhat dangerous. When such motor is not rigidly secured to the main body of the machine and the bit encounters an obstruction, the resulting excessive reaction torque on the motor housing causes it to whip about unduly, with dangerous consequences to the operator. In the event that the motor is rigidly secured against movement to the main body of the machine and the bit encounters an obstruction, the motor will either stall, with resulting damage thereto, or break the bit.

Additionally, existing power operable drilling machines are not readily convertible to hand operation and are rather complicated and cumbersome in design.

It is, therefore, an object of this invention to provide a power operable drilling machine of the type described which, in the event of the bit encountering an obstruction, utilizes the resulting excessive reaction torque on the motor to operate the bit feeding mechanism in a reverse direction, to thereby retract or withdraw the bit from the obstruction and so relieve the excessive reaction torque on the motor.

It is another object of this invention to provide a power operable drilling machine of the type described which is readily convertible or adaptable for manual operation.

It is another object of this invention to provide a drilling machine of the type described with means for readily ascertaining the state of the main after it has been tapped.

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It is another object of this invention to provide a drilling machine of the type described that is particularly adapted for use in tapping mains that are under high pressure.

It is still another object of this invention to provide a drilling machine of the type described with conveniently accessible and readily adjustable means for indicating either the extent of advance of the bit, i. e., the depth of the cut made, during a drilling operation or the extent of advance necessary to complete the cut.

It is a further object of this invention to provide an improved drilling machine of the type described which is relatively simple in construction and consequently relatively inexpensive to manufacture.

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

Figure 1 is an elevational view of a drilling machine embodying this invention and illustrating the machine mounted in position to tap a supply main, and with a driving motor operatively connected thereto.

Figure 2 is a view corresponding to Figure 1, but illustrating the machine turned through 90° and adapted for manual operation.

Figure 3 is a fragmentary longitudinal sectional view taken on line 3—3 of Figure 1, and illustrating the drill bit in its most advanced position.

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

Figure 5 is an enlarged transverse sectional view taken on line 5—5 of Figure 3.

Figure 6 is an enlarged transverse sectional view taken on line 6—6 of Figure 3.

Figure 7 is a fragmentary side elevational view corresponding to Figure 1 and taken from the right-hand side of the latter figure.

Referring now to the drawings, prior to the tapping operation a nipple 10 or other suitable type of threaded fitting is mounted in upstanding position on the supply pipe or main 12 to be tapped, either by welding, as shown in Figures 1 and 2, or by suitable clamping means (not shown). Mounted on the upper end of the nipple 10 is a valve 14, usually of the gate type, but in any event of such type that, when open, a smooth walled straight bore extends between the inlet and outlet ports thereof to permit a drill bit or boring tool to pass therethrough into engagement with the pipe 12. Such valve 14 is shown as a separate element in Figures 1 and 2, but the nipple 10 and the valve 14 can be pro-

vided as a unitary fitting. In use, the drilling machine 16 is sealingly connected directly to the valve 14 by means of an adapter fitting 18 and the drill bit or boring tool 20 (see Figure 3) extends directly through the adapter 18, valve 14 and nipple 10 into engagement with the wall of the pipe 12 to be tapped. After the drilling operation has been completed and the pipe so tapped, the drill bit is withdrawn through the valve 14 and the latter closed. Thereafter the drilling machine 16 and the adapter 18 may be disconnected from the valve without escape of fluid from the main.

Referring now to Figure 3 of the drawings, a drilling machine 16 embodying this invention consists of an elongated tubular body 22 having a smooth walled bore 24 extending axially therethrough. The lower end of the body 22 is appropriately threaded, as at 26, for connection to the adapter fitting 18. Mounted for axial and rotary movement within the bore 24 is a cylindrical boring bar 28 having a threaded socket 30 at its lower end for reception of a drill chuck 32 or a like tool. The lower end of the boring bar 28 is also provided with an enlarged circular bearing surface 34 which engages the wall of the bore 24 to support the boring bar therein. The upper end of the bore 24 is provided with an annular bearing 36 for the boring bar, which bearing is seated on a shoulder 38 in the bore somewhat inwardly of its upper end. This same end of the bore 24 is internally threaded for reception of a packing gland 40 which operates to compress packing 42 interposed between the gland and the bearing 36. The upper portion of the boring bar 28 above the gland 40 is of reduced diameter and projects upwardly out of the body 22. The bar 28 is provided with a square, or otherwise suitably shaped, portion 44 adjacent its upper end for appropriate detachable connection with means to rotate the bar, such as the air motor 46 illustrated in Figure 1 or the manually-operated ratchet wrench 48 illustrated in Figure 2.

Rotatably mounted on the reduced portion of the boring bar 28 is a gear case 50 having a removable cover 52 secured thereto by means of bolts 54 and provided with a bore 56 therethrough for reception of the reduced portion of the bar 28. The gear case 50 is secured on the bar by a screw clamp 58 threaded onto the bar against a thrust washer 60 which, in turn, engages an exterior bearing surface 62 on the gear case cover 52. Splined or keyed to the boring bar 28 within the gear case 50 and bearing against the underside of the cover 52 is a drive gear 64 of relatively small diameter which bears, on its underside, against a spacer washer 66 also mounted on the boring bar. An anti-friction thrust bearing assembly 68 is mounted on the boring bar below and in spaced relation to the spacer washer 66. The thrust bearing assembly 68 bears against another washer 70 which rests on a shoulder 72 on the boring bar formed by the reduced portion thereof. Interposed between the spacer washer 66 and the bearing assembly 68 is an inwardly directed annular flange 74 of a bit-feeding sleeve 76 that is rotatably mounted on the boring bar and depends through a circular bore 78 in the bottom of the gear case 50, to extend concentrically over the body 22 for substantially the entire length of the latter. A bushing 80 is inserted between the inner edge of the flange 74 and the surface of the bar 28. The body 22 is provided with an exterior feed thread 82 extending substantially throughout its entire length, which thread 82 is engaged by an internal thread 84 on the lower end of the sleeve 76.

It will thus be seen that both the gear case 50 and the bit-feeding sleeve 76 are rotatably mounted on the reduced portion of the boring bar 28 but held against axial movement thereon by the screw clamp 58 and the shoulder 72 on the bar. Hence, rotation of the bit-feeding sleeve 76 relative to the body 22 will produce axial movement of the boring bar 28 within the body to advance or retract the bit 20 or other cutting tool carried by the chuck 32.

Preferably the annular surfaces of the gear case which bear against the boring bar 28 and against the sleeve 76 are increased by exterior annular flanges 86 and 88, respectively. Since the gear case 50 is adapted to be filled with oil, suitable oil seals 90 and 92 are disposed in interior annular grooves 94 and 96 in the walls of the bores 56 and 78, respectively. A third annular oil seal 97 is disposed immediately below the washer 70 to engage the inner surface of the sleeve 76 and the surface of the boring bar 28.

The sleeve 76 is automatically rotated to advance the bit during a drilling operation by a reduction gear drive from the boring bar. To this end, that portion of the sleeve 76 disposed within the gear case 50 has a large driven gear 98 splined or keyed thereto. This gear 98 meshes with a small spur gear 100 fixed to a stub shaft 102 that is journalled in the cover 52 and bottom of the gear case 50 in spaced parallel relationship to the boring bar 28. The stub shaft 102 also has splined or keyed thereto a larger gear 104 which meshes with the small drive gear 64 on the boring bar to thereby drive the sleeve 76, upon rotation of the bar, in the same direction of rotation as the boring bar. Preferably the amount of reduction in the gear drive and the pitch of the feed thread 82 are correlated to the cutting rate of the bit in order to feed or advance the latter into the work at proper rate.

The body 22 is provided with an enlarged portion or relatively thick annular flange 106 adjacent the lower end thereof. Secured to the flange 106, as by welding or the like, and extending upwardly therefrom to provide an annular space in which the bit feeding sleeve 76 is received, is a tubular member 108 which terminates somewhat below the upper end of the body. The upper end of the tubular member 108 is provided with an exterior annular flange 110 that is recessed adjacent the sleeve 76 for the reception of a dirt seal 112, of felt or the like, that bears against the sleeve and is held in place by a removable annular cover 114. A radial lug 116 is secured to the flange 110 for purposes later described.

A radial port 118, controlled by a valve or test-cock 120, extends through the enlarged portion 106 of the body. This test-cock 120 is normally closed but can be opened to determine the absence or presence and condition of fluid within the bore 24 of the body. Such determination gives an indication of the state of the main after it has been tapped, whether the bit has penetrated the wall of the main, or whether the valve 14 is open or closed after the main has been tapped.

The bit feeeding sleeve 76 has, adjacent the lower end thereof, a radial aperture 122 that

may be aligned, by suitable relative rotation between the sleeve and the body 22, with radial tool receiving openings 124 in the packing gland 40, thus providing access to the gland for tightening or otherwise adjusting the same. The upper end of the bit feeding sleeve 76 is also provided with a radial weep hole 126 to ascertain leakage through the packing 42 and the gland 40.

When the machine is to be driven by the motor 46, as shown in Figure 1, a motor holder, indicated generally at 128, is employed. Such holder 128 is provided, on one side thereof, with a pair of apertured ears 130 for pivotally and detachably mounting the holder on a post 132 that is received within a vertical bore 134 in a solid portion of the gear case 50 and detachably secured therein by a thumb screw 136. The post 132 has a horizontal bore 138 for receiving a rod-like element 139 that extends through the ears 130 and is detachably secured in the bore 138 by a thumb screw 140. The other side of the holder 128 is provided with a pivoted hook 142 engageable with a suitable keeper pin 144 secured to the top of the gear case cover 52, to thus maintain the holder in upright position. The holder 128 has a generally funnel-shaped aperture 146 that is aligned with the boring bar 28 and adapted to receive the nose 148 of the motor housing 150 so that the motor shaft (not shown) may be detachably connected, as by an appropriately socketed member (not shown), to the complementary upper portion 44 of the boring bar. Extending vertically upwardly from the motor holder 128 at one side of the aperture 146 is an arm 152 having a curved upper end 154 which extends over the projected axis of the motor shaft. Engaged between the curved end 154 of the arm and an upper portion of the motor housing 150 is a screw-operated extensible spacer element 156 which is adapted, upon adjustment, to hold the motor 46 securely within the funnel-shaped aperture 146 of the holder.

The motor 46, illustrated in Figure 1, is of the gear reduction air-operated type since compressed air usually is the most readily available source of power at locations where tapping operations take place. It will be realized, however, that other appropriate types of motors are readily adaptable for driving the drilling machine. The motor housing 150 is provided with a pair of oppositely extending radial arms or handles 158 which are grasped by the operator during a drilling operation in order to counteract reaction torque on the motor housing. Secured for vertical adjustment on the upstanding arm is a clamping member 160, shown best in Figures 1 and 7, having a slotted arm 162 which engages over one of the handles 158 and thereby positively prevents relative rotation between the motor housing 150 and the gear case 50 by reason of the rigid but detachable connection between the motor holder 128 and the gear case.

During operation of the motor, reaction torque on the motor housing 150 easily may be counteracted by the operator by a light pressure on the handles 158, thereby also holding the gear case 50 against rotation. Since the case is fixed against rotation, the rotation of the boring bar by the motor will cause reduced rotation of the sleeve 76, by reason of the reduction gear drive, in a direction to effect advance of the bit into the work. If, however, the bit encounters an obstruction or otherwise becomes jammed in its rotary movement, the reaction torque on the motor housing 150 will suddenly increase and

overcome the counteracting pressure of the operator on the handles 158. Hence, both the motor housing and the gear case 50 will start to turn or rotate in a direction opposite to that of the drill bit. Assuming that the boring bar 28 normally is driven in a clockwise direction, as viewed in Figure 6 and as indicated by the arrows therein, the retrogression of the gear case will swing the stub shaft 102 and the gears 100 and 104 mounted thereon counterclockwise in an arc having the boring bar 28 as its center of rotation. In other words, the result will be to effect counterclockwise planetary movement of the gears 100 and 104. With the driving gear 64 stationary, because of the arrestment of the drill bit, the counterclockwise planetary movement of the gear 104 will cause it to rotate about its own axis in its normal bit advancing direction, i. e., counterclockwise, with consequent rotation of the smaller spur gear 100 about the same axis in the same direction. The rotary movement of this latter gear 100 will rotate the larger driven gear 98 clockwise in its normal bit-advancing direction. For a given degree or arc of counterclockwise planetary movement of the spur gear 100, however, because of the reduction ratios between the gears 64 and 104 and the gears 100 and 98, the arc through which the large driven gear 98 is rotated in a clockwise direction by reason of rotation of the gear 100 is smaller than the arc traversed by the counterclockwise planetary movement of the spur gear, with the consequent result that the combined effect of the counterclockwise planetary movement and counterclockwise bit advancing rotation of the spur gear is to cause the larger driven gear 98 to rotate backwards or counterclockwise relative to the body 22. This movement of the gear 98 effects rotation of the sleeve 76 in a direction to withdraw or retract the bit from the work. Such retraction of the bit disengages the same from its obstruction and relieves the excessive reaction torque on the motor housing, thereby preventing any dangerous whip of the handles 158 which might tend to injure an operator. Upon freeing the drill bit from its obstruction, the motor will again drive the same in a drilling direction and consequently drive the gear train to advance the bit into the work. If an obstruction is again encountered, it will be evident that the aforementioned cycle will be repeated so that the motor housing and the handles will be oscillated through a relatively small arc with no tendency to injure the operator. If such oscillation continues, the operator may, of course, stop the motor.

Referring now to Figure 2 of the drawings, when it is desired to operate the drilling machine by hand, the motor 46 and its holder 128 are removed from the machine together with the detachable holder-supporting post 132. The ratchet wrench 48 may then be applied to the shaped portion 44 of the upper end of the boring bar for manual turning of the same. If desired, the upper end of the boring bar may be provided with a reduced threaded extension 164, best shown in Figure 3, for receiving a ratchet-retaining nut 166, as shown in Figure 2. For manual operation, since the gear case 50 is freely rotatable on the boring bar 28, means are provided for arresting rotation of the case relative to the body 22 so that the gear train can automatically effect appropriate bit-advancing rotation of the sleeve 76. To this end the radial lug 116 on the upper end of the tubular member 108 is provided with a vertical bore 168 alignable with the

post-receiving bore 134 in the gear case. Insertion of the rod 139 through both bores 134 and 168, as shown in Figure 2, fixes the gear case against rotation. It will be noted that the rod 139 thus serves a dual purpose. It is also pointed out that this same rod 139 has a bend at one end thereof that provides a lateral arm 170. This arm 170 may be inserted in the bore 168 in the lug 116 and the rod 139 employed as a torque wrench for screwing the body of the drilling machine into the adapter 18. In like manner, the rod can be used as a torque wrench, in conjunction with the vertical bore 134 in the gear case or the horizontal bore 138 in the post 132 (with the motor removed), to effect rotation of the gear case clockwise, and thus provide accelerated advance, or counterclockwise, and thus provide accelerated retraction, of the bit. Such accelerated advance of the bit may be desirable during some manual drilling operations wherein the design automatic feed rate is less than the capacity or cutting rate of the bit.

The radial lug 116 on the upper end of the tubular member 108 is provided with another vertical bore 172 parallel to and spaced from the bore 168. The bore 172 is adapted to receive a rod-like member 174 which is secured therein by a thumb screw 176 for adjustment longitudinally of the tubular member 108. The bit advancing sleeve 76 is provided near its upper end with an exterior circumferential indicium line 178 for association with a pointer 180 on the member 174. In use, the drilling machine is connected to the adapter 18 and the bit advanced, by rotation of the sleeve 76, until the bit contacts the pipe to be tapped. Thereupon the pointer 180 is adjusted a distance below the line 178 equal to the depth of the cut to be effected, i. e., the thickness of the pipe wall. It will thus be seen that after the drilling operation commences the distance between the line 178 and the pointer 180 will provide a ready indication of the depth of the cut still to be effected in order to penetrate the pipe. In the alternative, if the pointer 180 is set at the indicium line 178 when the bit contacts the pipe, the distance between the pointer and the line after the drilling operation commences will give an indication of the depth of the cut effected at any time during the drilling operation. A gland adjusting tool 182, for insertion through the aperture 122, may be conveniently detachably mounted on the lower end of the rod-like member 174.

It will thus be seen that the objects of the invention have been accomplished both fully and effectively by an improved drilling machine. It also will be realized that various changes and modifications may be made in the specific embodiment which has been disclosed to illustrate the principles of the invention. Therefore, this invention includes all modifications which are encompassed by the spirit and scope of the following claims.

We claim:

1. In a drilling machine, the combination comprising: a hollow tubular body adapted to be fixedly mounted during drilling operations; a boring bar mounted for axial and rotary movement within said body, said bar having one end thereof adapted for connection to a drilling tool and the other end thereof projecting out of said body for connection to a driving motor; rotatable tool feeding means operatively connecting said bar and said body for axial movement of said bar by rotation of said means; gear carrying means mounted for rotation about the axis of said bar; gear means carried in part by said gear carrying means and operatively connecting said bar to said tool feeding means for reductively driving the latter from the former and for effecting accelerated tool-advancing rotation of said tool feeding means by rotation of said gear carrying means in the direction of drilling rotation of said bar; and means for mounting a bar-driving motor on said gear carrying means with the motor housing in fixed relation thereto, said gear carrying means being adapted to be yieldably restrained against rotation during operation of the motor to drive said boring bar.

2. The structure defined in claim 1 in which the tool feeding means is rotatable about an axis aligned with the axis of the boring bar.

3. The structure defined in claim 1 in which the gear carrying means is mounted for rotation on the projecting end of the boring bar.

4. The structure defined in claim 1 in which the gear carrying means comprises a gear case mounted for rotation on the projecting end of the boring bar and the gear means comprises a stub shaft journalled within said case parallel to and spaced from said bar, a pair of gears fixed to said shaft, and a pair of gears fixed to said bar and the tool feeding means, respectively, and meshing with said first mentioned pair of gears.

5. The structure defined in claim 1 in which the tool feeding means comprises a sleeve concentric with the body, threadedly engaged therewith, and swivelly connected to the boring bar.

6. The structure defined in claim 1 in which the motor-mounting means comprises a post removably mounted in an aperture in the gear carrying means, said aperture being parallel to the axis of the boring bar.

7. The structure defined in claim 1 in which the motor-mounting means comprises a post removably mounted in an aperture in the gear carrying means and including means fixed to the body and having an aperture alignable with said first mentioned aperture, whereby said gear carrying means may be locked against rotation for hand operation of the boring bar by inserting a rod through both said apertures.

8. The structure defined in claim 1 including means defining alignable apertures in the gear carrying means and in the body, and rigid means for insertion through both said apertures to block said gear carrying means against rotation for hand operation of the boring bar.

9. A drilling machine for tapping a supply pipe or main comprising: a hollow tubular body adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto, one end of said bar sealingly projecting out of said body and being adapted for connection to a driving motor and the other end of said bar being connectable to a drill bit; a rotatable bit feeding sleeve swivelly connected to said one bar end and threadedly engaged with said body for effecting axial movement of said bar upon rotation of said sleeve; a gear case rotatably mounted on said projecting end of said bar; a reduction gear train mounted in part on said case and operatively connecting said bar to said sleeve for rotation of the latter to advance the bit upon drilling rotation of said bar, said gear train also being effective to rotate said sleeve in a bit-advancing direction upon rotation of said case in the direction of drilling rotation of said bar; and means for detachably mounting a motor on said case, with the motor housing in

fixed relation thereto, for driving connection to said bar, said case being adapted to be yieldingly restrained against rotation during operation of the motor, whereby when the reaction torque of the motor suddenly becomes excessive, as by the drill bit encountering an obstruction, said gear case will rotate in a direction to effect, by means of said gear train, bit-retracting rotation of said sleeve to thereby relieve the excessive reaction torque without undue whipping of the motor and said gear case.

10. A drilling machine for tapping a supply pipe or main comprising: a hollow tubular body adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto, one end of said bar sealingly projecting out of said body and being adapted for connection to a driving motor and the other end of said bar being connectable to a drill bit; a rotatable bit feeding sleeve swivelly connected to said one bar end and threadedly engaged with said body for effecting axial movement of said bar upon rotation of said sleeve; a gear case rotatably mounted on said projecting end of said bar; a reduction gear train mounted in part on said case and operatively connecting said bar to said sleeve for rotation of the latter to advance the bit upon drilling rotation of said bar, said gear train also being effective to rotate said sleeve in a bit-advancing direction upon rotation of said case in the direction of drilling rotation of said bar; and a motor detachably mounted on said case, with the motor housing in fixed relation thereto, and operatively connected to said bar for driving the same, said case being adapted to be yieldingly restrained against rotation during operation of said motor, whereby when the reaction torque of said motor suddenly becomes excessive, as by the drill bit encountering an obstruction, said gear case will rotate in a direction to effect, by means of said gear train, bit-retracting rotation of said sleeve to thereby relieve the excessive reaction torque without undue whipping of said motor and gear case.

11. In a drilling machine for tapping a supply pipe or main under pressure, the combination comprising: a hollow tubular body having one end thereof adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto, one end of said bar projecting out of the other end of said body for connection to means to rotate said bar and the other end of said bar being connectable to a drill bit; a rotatable bit-feeding sleeve swivelly connected to said projecting end of said bar and threadedly engaged over said body; means for rotating said sleeve; packing interposed between said body and said bar adjacent said projecting end of the latter; a gland nut threadedly engaging said body for compressing said packing and having adjusting-tool engageable means; and means defining an aperture in said sleeve alignable with said tool engageable means on said nut for insertion of a nut-adjusting tool through said aperture into operative engagement with said nut.

12. The structure defined in claim 11 in which the aperture is disposed adjacent that end of the sleeve remote from the swivel connection thereof with the bar.

13. In a drilling machine for tapping a supply pipe or main, the combination comprising: a hollow tubular body adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto; one end of said bar projecting from said body for connection to means to rotate said bar and the other end of said bar being connectable to a drill bit; a sleeve connected to said bar for axial movement therewith and disposed over said body, said sleeve being provided with a circumferential indicium line; and pointer means mounted on said body for adjustment axially of said sleeve for indicating, in association with said indicium line, the extent of axial movement of the bit during tapping operations.

14. In a drilling machine for tapping a supply pipe or main the combination comprising: a hollow tubular body having one end thereof adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto; one end of said bar projecting out of the other end of said body for connection to means to rotate said bar and the other end of said bar being connectable to a drill bit; a bit feeding sleeve swivelly connected to said projecting end of said bar and threadedly engaged over said body; means for rotating said sleeve; and a tube secured at one end thereof to said one end of said body and enclosing said sleeve, the other end of said tube being disposed adjacent said other end of said body.

15. The structure defined in claim 14 including means on the other end of said tube for rotating the body in order to secure the same in fixed relation to a pipe to be tapped.

16. The structure defined in claim 14 including a gear case rotatably mounted on the projecting end of the bar and a gear train mounted in part on said case and operatively connecting said bar to the bit feeding sleeve for rotation of the latter upon rotation of said bar.

17. The structure defined in claim 14 including a gear case rotatably mounted on the projecting end of the bar; a gear train mounted in part on said case and operatively connecting said bar to the bit feeding sleeve for rotation of the latter upon rotation of said bar; and rigid means adapted to detachably connect said gear case to the other end of the tube against relative rotation therebetween.

18. The structure defined in claim 14 including a gear case rotatably mounted on the projecting end of the bar; a gear train mounted in part on said case and operatively connecting said bar to the bit feeding sleeve for rotation of the latter upon rotation of said bar; a radial lug on the other end of the tube; and means defining alignable apertures through said lug and said gear case for reception of bar-like means to prevent relative rotation between said case and said body.

19. The structure defined in claim 14 including a radial lug on the other end of the tube; and a pointer mounted on said lug for adjustment axially of the sleeve, said sleeve having a circumferential indicium line thereon for indicating, in association with said pointer, the extent of axial movement of the bit during tapping operations.

20. In a drilling machine for tapping a supply pipe or main the combination comprising: a hollow tubular body having one end thereof adapted to be fixedly secured to a pipe to be tapped; a boring bar extending axially within said body and mounted for rotative and axial movement relative thereto; one end of said bar projecting from the other end of said body for connection to means to rotate said bar and the other end of

said bar being connectable to a drill bit; a bit feeding sleeve swivelly connected to said projecting end of said bar and threadedly engaged over said body; means for rotating said sleeve; and a tube secured at one end thereof to said one end of said body and enclosing said sleeve, the other end of said tube terminating adjacent said other end of said body; a radial lug on the other end of said tube and having an aperture therethrough parallel to the axis of said bar; and a pointer mounted in said aperture for adjustment axially of said bar, said sleeve having a circumferential indicium line thereon for indicating, in association with said pointer, the extent of axial movement of the bit during tapping operation.

21. A drilling machine for tapping a supply pipe or main comprising: a hollow tubular body having one end thereof adapted to be fixedly secured to a pipe to be tapped; a boring bar concentrically mounted for axial and rotative movement within said body, one end of said bar sealingly projecting from the other end of said body for connection to means to rotate said bar and the other end of said bar being connectable to a drill bit; a bit feeding sleeve threadedly engaged over said body and having one end thereof swivelly connected to said projecting bar end for advancing and retracting the bit by rotation of said sleeve; a gear case rotatably mounted on said projecting bar end against axial movement thereon and enclosing said swivelly-connected sleeve end; a pair of axially-spaced gears fixed to said bar and said sleeve, respectively, within said case; a rotatable shaft mounted within said case parallel to said bar; a pair of axially-spaced gears carried by said shaft and meshing with said first-mentioned pair of gears for rotating said sleeve by rotation of said bar, all of said gears constituting a reduction drive for said sleeve; and bracket means for detachably mounting a motor on said case, with the motor housing in fixed relation thereto, for driving connection to said projecting bar end.

22. The structure defined in claim 21 including a tube having one end thereof fixed to the said one end of the body and extending substantially the length of the same in enclosing relationship with the bit-feeding sleeve; a radial lug on the other end of said sleeve; means defining alignable apertures in said lug and the gear case; and rod-like means insertable through said apertures for securing said case against rotation.

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