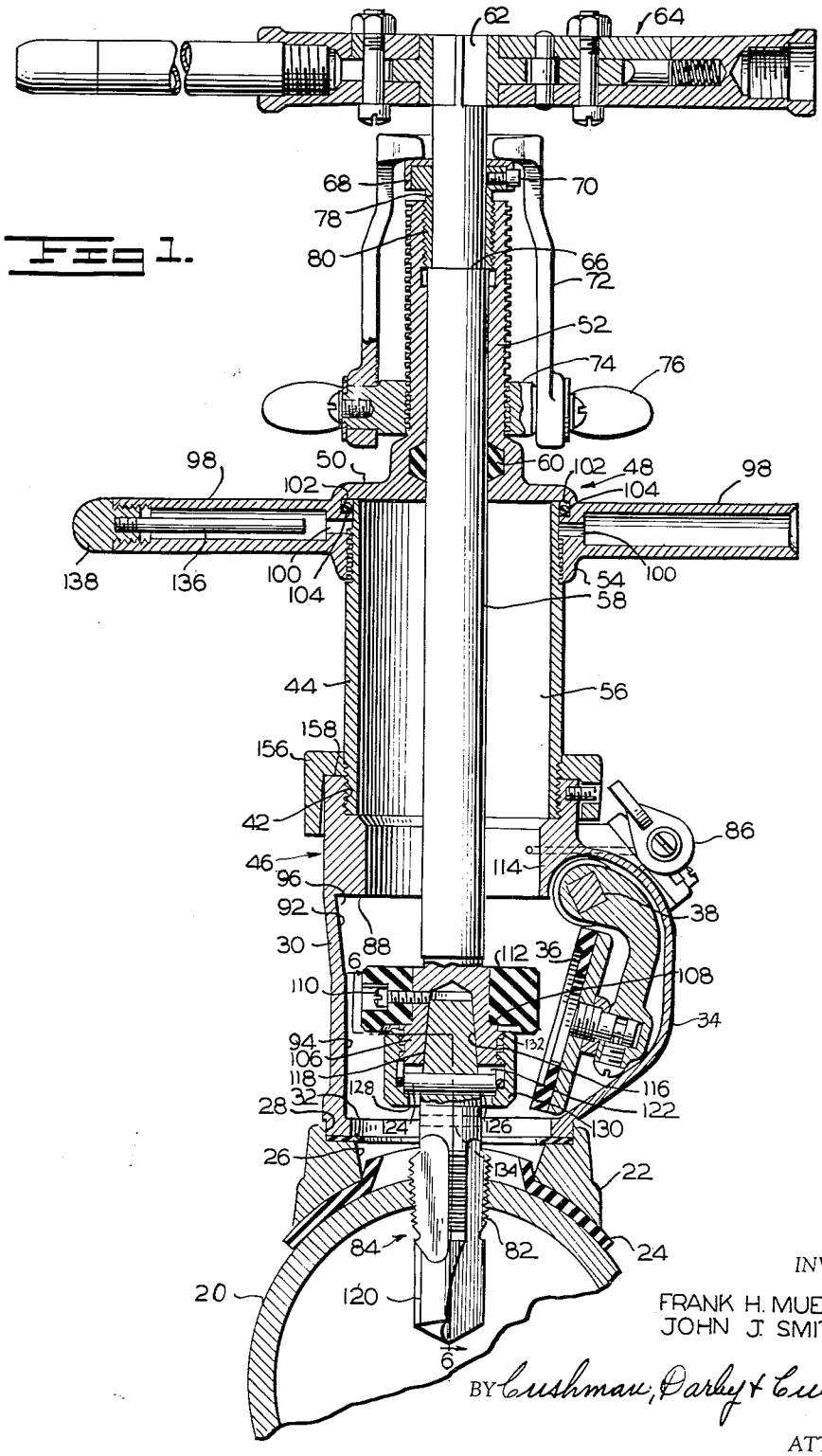
May 15, 1956 F. H. MUELLER ET AL 2,745,669

MACHINE FOR DRILLING AND TAPPING MAINS

Filed Feb. 19, 1952 4 Sheets-Sheet 1

Fig 1.



INVENTOR

FRANK H. MUELLER
JOHN J. SMITH

BY Cushman, Darby & Cushman

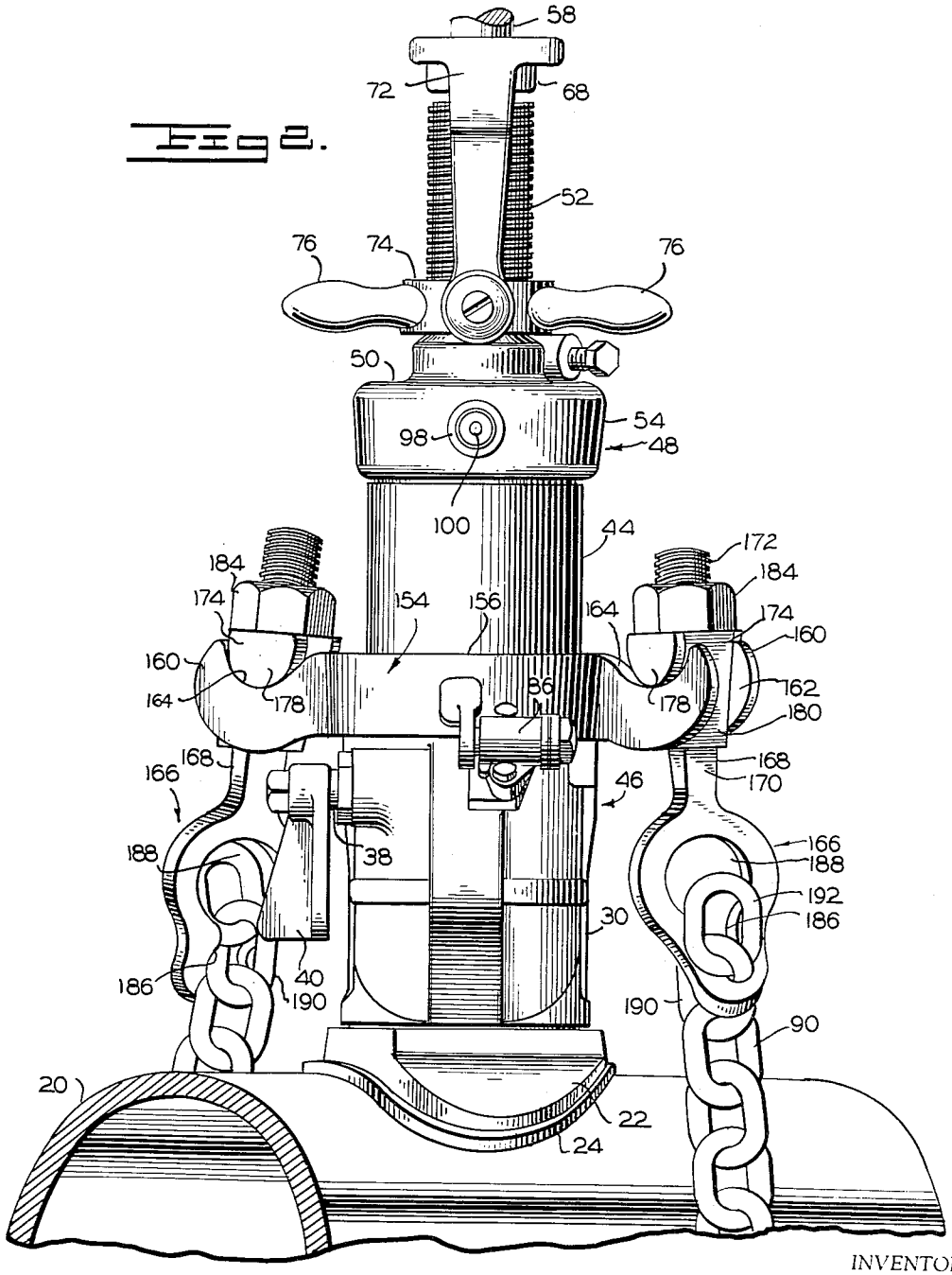
ATTORNEYS

May 15, 1956 F. H. MUELLER ET AL 2,745,669

MACHINE FOR DRILLING AND TAPPING MAINS

Filed Feb. 19, 1952 4 Sheets-Sheet 2

Fig 2.



INVENTOR
FRANK H. MUELLER
JOHN J. SMITH

BY Cushman, Darby & Cushman

ATTORNEYS

May 15, 1956 F. H. MUELLER ET AL 2,745,669

MACHINE FOR DRILLING AND TAPPING MAINS

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Fig 3.

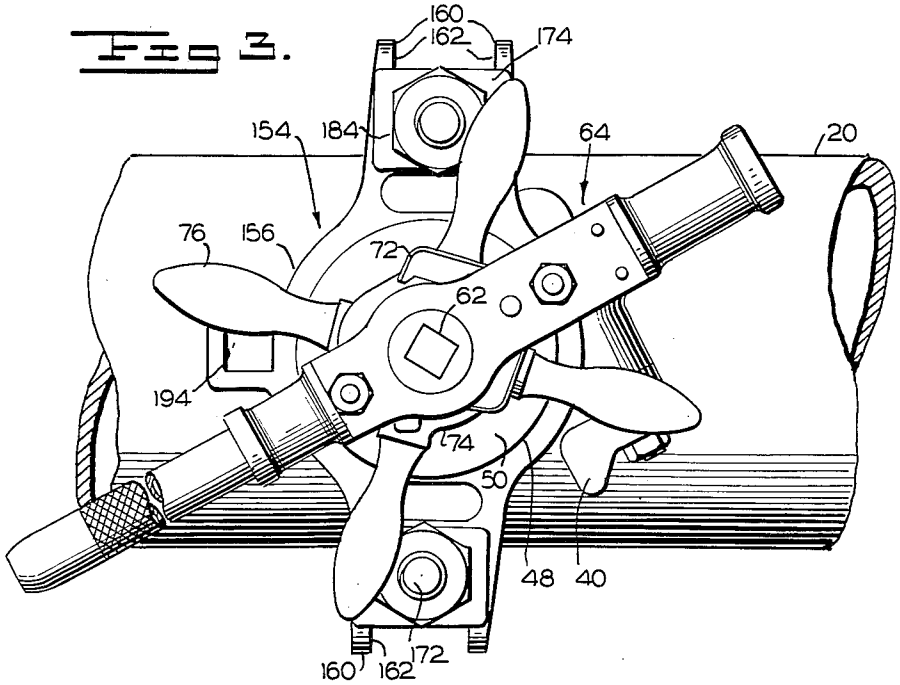
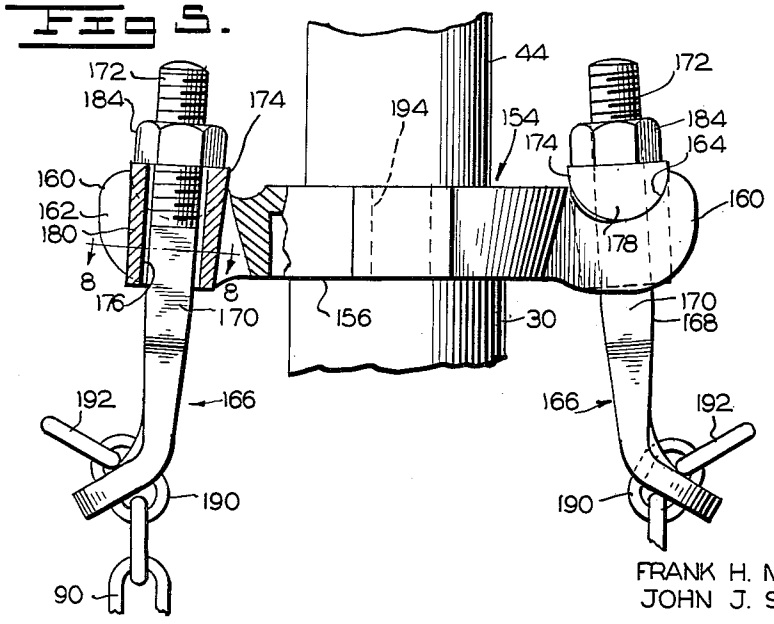


Fig 5.



INVENTOR
FRANK H. MUELLER
JOHN J. SMITH

BY Cushman, Darby & Cushman

ATTORNEYS

May 15, 1956 F. H. MUELLER ET AL 2,745,669

MACHINE FOR DRILLING AND TAPPING MAINS

Filed Feb. 19, 1952 4 Sheets-Sheet 4

Fig 4.

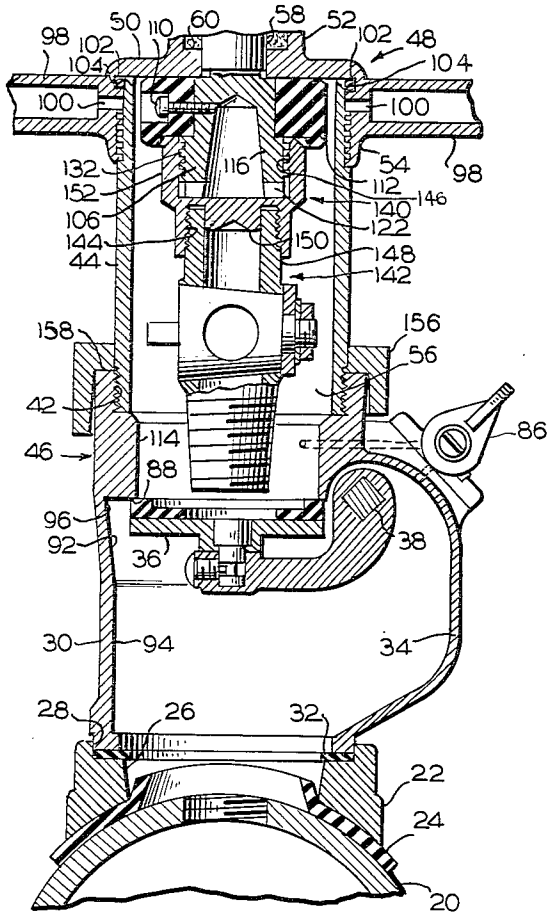


Fig 6.

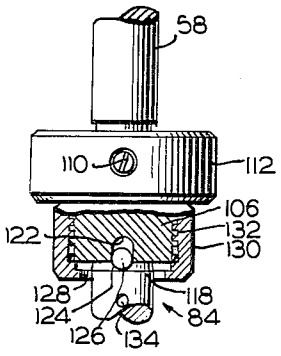


Fig 7.

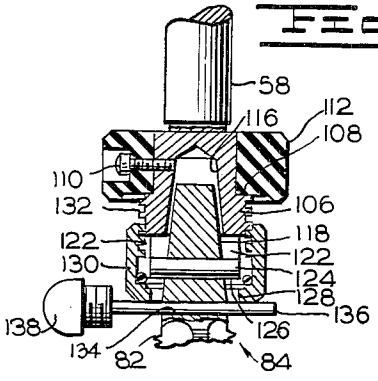


Fig 8.

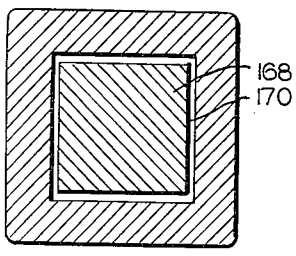
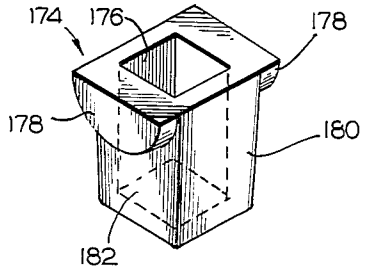


Fig 9.



INVENTOR

FRANK H. MUELLER
JOHN J. SMITH

BY Cushman, Darby & Cushman

ATTORNEYS

United States Patent Office

2,745,669

Patented May 15, 1956

2,745,669

MACHINE FOR DRILLING AND TAPPING MAINS

Frank H. Mueller and John J. Smith, Decatur, Ill., assignors to Mueller Co., Decatur, Ill., a corporation of Illinois

Application February 19, 1952, Serial No. 272,354

6 Claims. (Cl. 279—91)

This invention relates to tapping machines of the type adapted to cut an opening in a fluid chamber to provide an outlet therefrom, and to thread the cut opening to receive a valve body for controlling flow through the outlet or to receive a service T for connecting branch lines to the fluid chamber. Such operations are customary, for example, in attaching lateral or branch line connections to a fluid conduit, such as a water or a gas main.

In particular, this invention pertains to improvements in a machine of the type disclosed in U. S. Patent No. 2,291,979 to Mueller et al.

The machine disclosed in the aforementioned patent, while outstandingly successful for its intended purpose, possesses a number of operating disadvantages. Additionally, such machine is susceptible of simplification and other improvements which increase its service life and facilitate its operation. For example, it has been found that during the operation of such machine in a horizontal position, the cuttings or chips resulting from cutting and tapping operations tend to be carried between the flop valve and its seat to thereby prevent a tight closure of the valve. Further, when the cap is removed from the barrel, the rush of water therefrom tends to carry such chips against the sealing means in the cap to thereby foul the same and necessitate cleaning before replacement of the cap.

It also has been found in service operation of such machine that the construction of the harp, to which is attached the chain that secures the machine to a main, unduly wore the chain links and resulted in early breakage of the same.

It also has been found desirable to simplify the end construction of the boring bar for attaching thereto a cutting or tapping tool and also for attaching thereto an improved carrier for inserting a corporation stop or a service T into the tapped opening in a main. In this latter instance the carrier must be so designed that it will support the weight of the stop or service T, as the stop is lowered into the previously tapped opening in the main, but will be readily disconnectable therefrom by reverse rotation of the boring bar after the stop or T has been screwed into place.

Further, it has been found desirable to provide simplified means for dislodging a cutting or tapping tool from its socket in the boring bar.

Therefore, it is an object of this invention to provide an improved machine of the type described which inhibits the tendencies of cuttings to become lodged between the flop valve and its seat when the machine is operated in a horizontal position.

It is another object of this invention to provide an improved machine of the type under consideration which will prevent cuttings from fouling the seal within the barrel cap when the machine is operated in a horizontal position.

It is another object of this invention to provide an improved chain connection for a machine of the type

under consideration, which connection not only increases chain life, but also facilitates the connection and disconnection of the chain from the machine.

It is another object of this invention to provide an improved connection between a tap or cutting tool and a boring bar, such connection together with a special tool design facilitating dislodgment of the tool from its socket in the end of the boring bar.

It is another object of this invention to provide an improved connection between a carrier for a corporation stop or a service T and the end of a boring bar, the end of the boring bar being so shaped that it readily may have either a cutting tool or a stop carrier connected thereto with equal facility.

It is another object of this invention to provide an improved carrier for a corporation stop or a service T for inserting the same into a tapped opening in a main.

It is a further object of this invention to provide simple means on a machine of the type described for holding the boring bar fixed against turning, when removed from the machine, in order to facilitate the connection and disconnection of the cutting tool or the stop carrier thereto.

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

Figure 1 is a central vertical sectional view of a tapping machine embodying this invention attached to a main and showing the position of the parts at the termination of a tapping operation.

Figure 2 is a fragmentary perspective view of the machine shown in Figure 1.

Figure 3 is a top plan view of the machine shown in Figure 1.

Figure 4 is a fragmentary vertical sectional view of the machine shown in Figure 1, but showing the apparatus in condition when a valve body, such as a corporation stop, is being inserted through the apparatus toward a previously cut and tapped opening in the main.

Figure 5 is a fragmentary elevational view of the machine illustrating the chain yoke and the connection of the ends of the machine-supporting chain thereto. Parts are broken away to illustrate details more clearly.

Figure 6 is a fragmentary elevational view, partly in section, and taken substantially on the line 6—6 of Figure 1.

Figure 7 is a fragmentary elevational view corresponding to Figure 1, but illustrating the tool knock-out pin in position and the tool partially dislodged from its socket in the end of the boring bar by engagement of the retaining nut with the knock-out pin.

Figure 8 is a fragmentary cross-sectional view taken substantially on the line 8—8 of Figure 5.

Figure 9 is a perspective view of the washer interposed between the chain yoke and the tension nut on the chain harp.

Referring now to the drawings, there is shown in Figure 1 a curved wall chamber, such as a gas or water main 20, having mounted thereon the usual malleable iron saddle 22 with a gasket 24 interposed therebetween. The saddle 24 has an opening 26 therethrough that is counterbored at its outer end as at 28 to receive a flop valve housing 30. A gasket 32 is interposed between the saddle 22 and the housing 30.

The housing 30 is hollow and bulges outwardly at one side thereof to form a lateral enlargement 34 for reception of a flop valve 36 when the latter is in its open or inoperative position, as best shown in Figure 1. The flop valve 36 is carried by a shaft 38 journalled in the walls of the housing 30 so that when the shaft is turned by an exterior handle 40 the flop valve is moved between open and closed positions. The upper end of

the flop valve housing is interiorly threaded as at 42 for reception of one end of a cylinder 44 which, together with the valve housing 30, constitutes the barrel 46 of the machine. The upper end of the cylinder 44 is closed and sealed by a gasketed bonnet or cap 48 having a top 50 from which projects a cylindrical upward extension 52 and a depending annular skirt 54 that is interiorly threaded for engagement with outer threads on the upper end of the cylinder. Thus, the barrel 46 and the cap 48 form an interior fluid chamber 56.

Extending through the cylindrical extension 52 of the bonnet 48 is a boring bar 58 which is adapted for rotary and axial movement within the fluid chamber 56. Suitable packing 60 is interposed between the boring bar 58 and the cap extension 52. The upper end of the boring bar 58 is squared as at 62 for reception of a ratchet wrench 64 for rotating the bar and is provided, below its squared end, with a shoulder 66 against which seats a feed regulating thrust collar 68 conventionally retained on the bar by a locking set screw 70. A yoke 72 of well known construction is pivotally carried by a feed collar 74 threadedly mounted on the cylindrical extension 52 of the cap, and the upper end of the yoke contacts the top of the thrust collar 68 to thereby impart a downwardly longitudinal force thereto when the feed collar is rotated by radial handles 76 thereon. The upper end of the yoke 72 is substantially U-shaped, as best shown in Figure 1, to embrace the bar 58 when in engagement with the thrust collar 68.

The thrust collar 68 has a depending cylindrical sleeve 78 having relatively fine regulating threads 80 thereon which are engageable with complementary inner threads in the upper end of the cylindrical cap extension 52. These threads 80 are of the same pitch as the threads 82 on the cutting and tapping tool 84 (later described) carried by the inner end of the boring bar 58 and are much finer than the threads on the exterior of the extension 52. In use, the yoke 72 and feed collar 74 are employed to impart a longitudinal thrust to the tool 84 during the operation of the latter to cut an opening in the main 20. After such opening has been cut, the threads 80 on the thrust collar 68 and in the cap extension 52 are engaged and the operation of tapping the opening by the tool 84 proceeds.

A by-pass valve 86 is mounted on the flop valve housing 30 and is employed to control communication between the portions of the fluid chamber 56 above and below the flop valve seat 88 to facilitate both tight engagement of the flop valve 36 with its seat and subsequent opening of such valve.

The barrel 46 is held against the saddle 22 by means of a chain 90 extending about the main 20 and having its opposite ends secured to the barrel.

The construction thus far described is relatively conventional and since its operation is set forth in detail in the aforementioned Mueller et al. patent, no further description is necessary.

In the operation of prior machines of this nature it has been found that when such machine is operated in a horizontal position, chips or cuttings tend to climb up the flop valve seat 88 to thereby lodge between the valve 36 and such seat. In order to overcome this difficulty, the flop valve housing 30 is interiorly enlarged adjacent the seat 88 to provide a section having an inner wall 92 which converges toward the inner end of the barrel 46 and smoothly merges with a section having a cylindrical inner wall 94. As a result of this construction, the flop valve seat 88 extends radially outwardly for an appreciable distance beyond the periphery of the flop valve 36, when the latter is seated, so that a pocket 96 is formed that collects cuttings and prevents the same from lodging between the flop valve and its seat.

Additionally, as previously stated, it has been found that when a prior machine of this nature is operated in a horizontal position chips or cuttings are carried against the gasket seal in the cap 48, when the latter is removed from the barrel 46, to thereby foul such seal and necessitate cleaning thereof before replacement of the cap. In order to overcome this difficulty the skirt 54 is provided with a plurality of radially arranged tubular handles 98 that are open to their outer ends. Ports 100 in the skirt 54 aligned with the inner ends of the tubular handles 98 provide communication between the interior of such handles and the inner side of the skirt. The skirt 54 is provided with an inner circumferential groove 102 adjacent the top portion 50 of the cap 48 and in such groove is disposed an O-ring 104 for sealing engagement with the outer sides of the outer end of the barrel 46 when the cap is threaded thereon.

By means of this construction it will be seen that when the cap 48 is slowly unthreaded by the handles 98, liquid in the chamber 56 will drain slowly through the ports 100 for escape through the tubular handles 98 without a sudden rush of liquid which would carry chips into the O-ring groove 102 to thereby foul the O-ring 104. Additionally, this construction serves as an auxiliary drain if the flop valve 36 is defective and fails to close entirely in order to permit the establishment of a greater pressure differential to close the flop valve. The draining function of the skirt ports 100 also augments the action of the by-pass valve 86 when the latter is in its drain position.

The lower end of the boring bar 58 has an enlarged holder 106 for removably carrying the cutting and tapping tool 84. Resting on an exterior shoulder 108 on the holder 106 and secured thereto by a set screw 110 is a guide collar 112 of substantial diameter and which may be made of metal, rubber, or leather. This guide collar 112 cooperates with an accurately machined guiding cylindrical portion 114 in the flop valve housing 30 to properly maintain the bit or tool 84 in accurate alignment during the initial cutting of an opening in the curved wall of the main 20 and also prevents side shifting of the bar 58 during this cutting operation. After the opening has been cut, and during the subsequent tapping operation, the guide collar 112 passes inwardly beyond the flop valve seat 88, but during the tapping operation it will be evident that no guiding of the bar 58 is necessary.

The holder 106 is provided with a tapered socket 116 for receiving the correspondingly tapered shank 118 of the tool 84 which has a forward cutting portion 120 and the rearward threaded tapping portion 82. Diametrically opposed arcuate recesses or notches 122 are provided in the rim of the socket 116 for reception of a transverse locking pin 124 in the tool shank 118. The pin 124, which is of a length equal to or slightly less than the outer diameter of the holder 106, is not completely received within the notches 122. Hence, a side portion 126 of such pin protrudes outwardly beyond the inner end of the boring bar 58, that is, outwardly beyond the rim of the socket 116, for engagement by the inwardly extending flange 128 of a retaining nut 130 threaded onto the tool holder 106. The threads 132 on the tool holder 106 and in the nut 130 are of a particular construction, being heavy four-pitch double Acme threads, i. e., four threads to the inch and these being made up of two thread courses. The adjacent sides of adjacent threads, if extended, would join one another at an angle of approximately 29°, but the base of the groove between these adjacent threads is flat. Hence, the threads 132 in cross section may be said to be of modified, or practically square, design. The tangent of the helix angle of the threads is less than the coefficient of friction between the thread materials, which coefficient usually is computed as the tangent of the angle of an inclined plane down which a weight would begin to slide by gravity. In the case of a helical thread, the

helix angle heretofore referred to is that which the side surface of the thread would make with a lateral plane passing through the end of the boring bar on which the threads are formed. It is obvious that if the helix angle is as great as the angle of which the tangent is the coefficient of friction, the retaining nut **130** will unscrew of its own weight. Hence, by making the helix angle less than the angle of which the tangent is the coefficient of friction, this event is impossible. For reasons later described, however, the tangent of the helix angle is greater than about one-third of the coefficient of friction.

This type of coarse thread **132** has the advantage of a long life and the fact that the same does not collect as much dirt as finer threads. These features are important in a machine of this type.

The tool **84** is provided, rearwardly of its tapping portion **82** and forwardly of its locking pin **124**, with a transverse bore **134** for reception of a knock-out pin **136** that may be conveniently carried, when not in use, within one of the tubular handles **98**, as by means of an enlarged portion **138** on one end of such pin that is threadedly engageable within the outer end of such handle. In use, the knock-out pin **136** is inserted through the tool bore **134** and when the retaining nut **130** is unscrewed, the outer or forward end thereof engages the knock-out pin and dislodges the tapered shank **118** of the tool from the correspondingly tapered socket **116** of the tool holder. Thereupon, the knock-out pin **136** may be withdrawn from the transverse bore in the tool and the retaining nut **130** completely unscrewed and slipped over the tool **84** so that the latter may be removed from the socket **116** in the end of the boring bar. In this connection it is pointed out that the inner diameter of the flange **128** on the retaining nut **130** is greater than the maximum diameter of the tool **84** (i. e., the tapping portion **82**) so that the tool may be inserted in its socket **116** and the nut then slipped over the tool and threaded into engagement with the heavy threads **132** on the tool holder to rigidly retain the tool thereon.

After the drilling and tapping operation has been accomplished, the boring bar **58** is withdrawn into the upper portion of the chamber **56** above the valve seat **88** and the flop valve **36** closed. The cap **48** is thereupon unscrewed from the barrel **46** and the boring bar withdrawn therefrom. The cutting and tapping tool **84** is removed from the tool holder **106**, as described above, and a carrier **140** for a corporation stop **142** or for a service T (not shown) is connected thereto. This carrier **140**, which is best shown in Figure 4, is also of a special construction to facilitate its connection to the tool holder **106**. The carrier **140** consists of a fitting having coaxial sockets **144** and **146** in its opposite ends. The socket **144** is provided with relatively fine threads for engagement with complementary iron pipe threads on the tapered nipple **148** of the corporation stop **142** (or like threads on a service T). The socket **144** is also provided with the usual central inner boss **150**. The other socket **146** has inner threads that are complementary to the exterior threads **132** on the tool holder **106** and has a hexagonal wrench-receiving exterior surface **152**. Hence, when the corporation stop **142** (or a service T) is supported on the end of the boring bar **58** by means of this carrier **140**, rotation of the boring bar in the threading direction of the stop readily screws the latter into the threaded opening in the main **20**.

By reason of the hereinbefore described construction of the heavy threads **132** on the tool holder and in the mating socket **146** of the stop carrier **140**, reverse rotation of the boring bar **58**, after insertion of the stop **142**, readily disengages these threads so that the boring bar may be lifted away from the carrier, leaving the stop threaded into the main, and pulled upwardly into the chamber **56** above the flop valve seat **88**. After the flop valve **36** is closed, the entire machine may be removed

from the main **20**, by detaching anchoring means later described, and an appropriate wrench may be applied to the corporation stop **142** and to the hexagonal exterior portion **152** of the carrier **140** for unthreading and removing the latter from the stop. It will be noted that the design of the heavy threads **132** is of pronounced usefulness for the above described operation. The helix angle of the threads is such that the carrier, and the stop supported thereby, may be supported on the boring bar without danger of unscrewing or disconnection while being lowered and threaded into the opening in the main, yet the frictional engagement between the threads is low enough to permit ready disengagement between the carrier and the bar upon reverse rotation of the latter without the possibility of the inserted stop following the bar.

In order to securely hold the machine in operative position on a main **20**, there is provided a chain yoke **154** comprising a collar **156** which rests against an upwardly facing exterior shoulder **158** on the barrel **46** provided by one end of the flop valve housing **30**. On diametrically opposite sides of the collar **156** there are provided parallel pairs of outwardly extending lugs **160** having opposed flat inner side faces **162** and arcuately recessed upper surfaces **164**. The chain **90** is adapted to pass around the main **20** and to have its opposite ends detachably connected to these lugs **160** on the chain yoke **154**. Since the fastening means for each end of the chain are identical, a description of the fastening means on one end will suffice for both.

A chain harp **166** has a stem **168** projecting therefrom, which stem has an inner square portion **170** and an outer threaded portion **172**, the latter portion being contained within the longitudinal projection of the inner square portion, that is, the threaded portion **172** does not project laterally beyond the square portion **170**. A washer **174** having a square opening **176** therein, complementary to the square portion **170** of the harp stem, is mounted on the latter. The washer **174** is provided with projections **178** on opposite sides thereof that have arcuate surfaces complementary to and seating in the arcuate recesses **164** in the upper sides of the lugs **10** to permit rocking adjustment of the stem **168**. The washer **174** also has a portion **180** which depends between the lugs **160** and is provided with opposed flat sides **182** that cooperate with the inner flat side faces **162** of the lugs to prevent turning of the washer between the lugs. Likewise, it will be seen that the square opening **176** in the washer **174** cooperates with the square portion **170** of the stem to prevent turning of the stem therein. A tension nut **184** is mounted on the threaded portion **172** of the stem and engages against the upper surface of the washer **174** for applying tension to the harp **166**, and to the chain **90**, to tightly seat the drilling machine on the saddle **22**. It will be noted that the depending portion **180** of the washer completely encloses the threaded portion **172** of the stem positioned between the lugs **160**, to thereby protect the stem threads against engagement with the lugs.

From service use of the chain harp shown in the aforementioned patent, No. 2,291,979, it has been found that the chain link which is engaged in the slot in the harp is under an excessive bending or compressive strain and also tends to wear unduly at its point of engagement with the bottom of the slot, with the result that the link ultimately breaks at this point. In order to eliminate this disadvantage, the harp **166** shown therein is bent in its plane at an obtuse angle, preferably about 120°, substantially at the junction of the narrow slot **186** with the large opening **188**. Hence, that link **190** of the chain **90** which passes through the slot **186** is under no excessive bending or compressive strain. The link **192** immediately above the slot **186** is under a bending strain but since this link engages the harp **166** on opposite sides of the narrow slot and also since such strain is exerted on

the link **192** at its strongest point, i. e., its curved end portion, no undue wear or breakage of the link occurs.

In order to facilitate connection and disconnection of the cutting tool **84** or the stop carrier **140** to the tool holder **106** of the boring bar **58**, there is provided on the chain yoke **154** a lateral enlargement having a square socket **194** for reception of the upper square end **62** of the boring bar. Hence, when the cap **48** is unscrewed from the barrel **46**, the ratchet wrench **64** may be removed from the boring bar **58** and the latter inverted to place its square end **62** within the socket 194 to fixedly hold the boring bar while an appropriate wrench is applied to the retaining nut **130** or to the stop carrier **140** to connect or disconnect the same to or from the tool holder **106**.

It will thus be seen that the objects of this invention have been fully and effectively accomplished by the provision of a drilling machine of improved design. It will be realized, however, that the specific embodiment of the invention which has been disclosed to illustrate the principles of the latter is susceptible of changes without departing from such principles. Therefore, this invention includes all modifications encompassed by the spirit and scope of the following claims.

We claim:

1. In a drilling machine the combination comprising: a boring bar having a circular socket at one end thereof to receive the shank of a tool and notch means in the rim of said socket; a tool having a circular shank receivable in said socket; a lateral locking projection on said shank receivable in said notch means and having a side surface portion disposed outwardly of said one end of said bar; a retaining nut threadable on said one end of said bar and having an uninterrupted inwardly-extending circumferential flange engageable with said side surface portion, the inner diameter of said flange being greater than the maximum transverse dimension of said tool outwardly of said projection; and means defining a recess in said tool adjacent and outwardly of said lateral projection for reception of a removable abutment implement engageable by said nut flange, on unthreading said nut, to dislodge said tool from said socket.

2. The structure defined in claim 1 in which the recess means comprises a transverse bore in the tool for reception of a knock-out pin.

3. In a drilling machine the combination comprising: a boring bar having a circular socket at one end thereof to receive the shank of a tool, said socket having a recess in the rim thereof; a tool having a tapered circular shank fitting in said socket; a locking lateral projection on said shank fitting in said recess and having a side surface portion disposed outwardly of said one end of said bar; a retaining nut threadable on said one end of said bar; an inner uninterrupted circumferential flange on said nut engageable with said side surface portion of said tool projection, the inner diameter of said flange being greater than the maximum transverse dimension of said tool outwardly of said projection; and recess means in said tool outwardly of said projection defining an axially inwardly facing surface for engagement with a removable knock-out implement engageable by said nut flange, when said nut is unthreaded, to facilitate dislodging said tool from said socket.

4. In a drilling machine the combination comprising: a boring bar having a tapered circular socket at one end thereof to receive a tool shank, said socket having a pair of diametrical recesses in the rim thereof; a tool having a tapered circular shank fitting in said socket; a locking pin extending through said shank and fitting in said recesses, said pin being of a diameter greater than the depth of said recesses and of a length less than the diameter of said one end of said bar; a retaining nut threadable on said one end of said bar and having an inner uninterrupted circumferential flange engageable against said locking pin, the inner diameter of said flange being greater than the maximum transverse dimension of said tool outwardly of said projection; and a transverse bore in said tool shank outwardly of said projection for reception of a removable knock-out pin engageable by said nut flange, when said nut is unthreaded, to dislodge said tool from said socket.

5. A cutting tool comprising: a cutting portion and a tapered circular shank for reception in a mating socket of a tool holder; a lateral projection on said shank for fitting in a corresponding notch in the rim of the socket and for engagement by a retaining nut threaded on the tool holder, the maximum transverse dimension of said tool forwardly of said projection being less than the inner diameter of the nut; and means defining a recess in said tool forwardly of said projection and rearwardly of said cutting portion for reception of a removable abutment implement engageable by the retaining nut, when unthreaded, to dislodge said tool from the socket.

6. A cutting tool comprising: a cutting portion and a tapered shank adapted to be received in a complementary socket in a tool holder; a laterally extending projection on said shank; outwardly of that portion thereof receivable within the socket, for engagement by the inwardly extending flange of a retaining nut threaded on the tool holder, the maximum transverse dimension of said tool forwardly of said projection being less than the inner diameter of the nut flange; and a side socket in said tool between said projection and said cutting portion for reception of a removable knock-out pin engageable by the nut flange when the nut is unthreaded to dislodge said tool from the tool holder socket.

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