

Aug. 24, 1937.

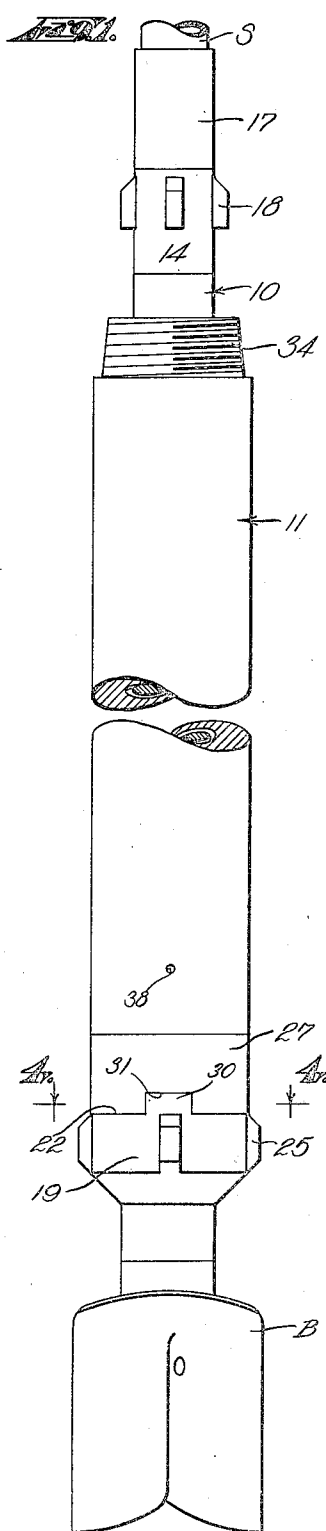
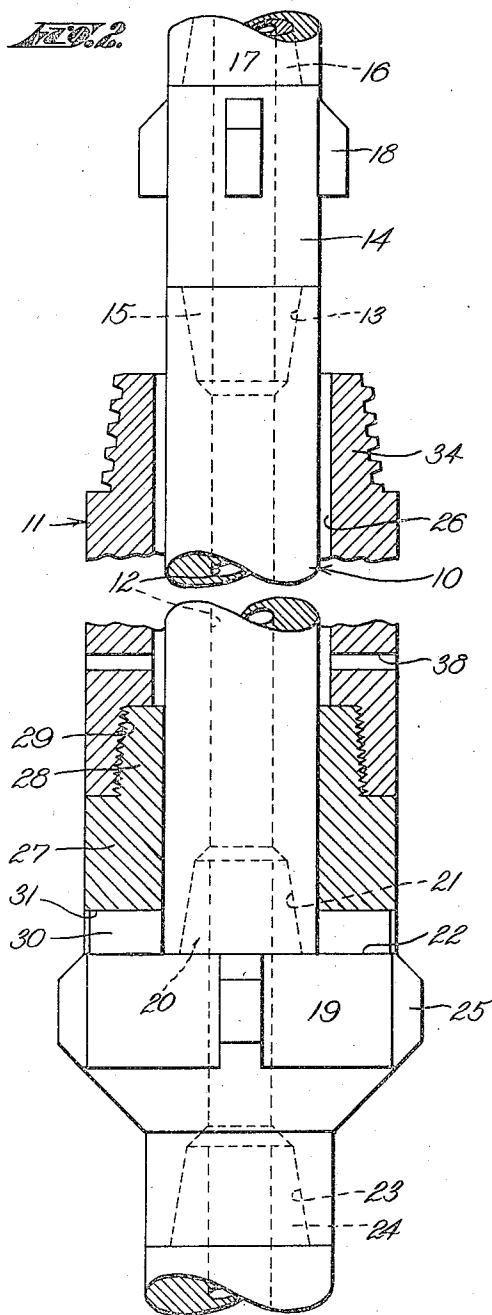
J. C. WRIGHT

2,090,822

DRILL COLLAR

Filed Oct. 2, 1936

3 Sheets-Sheet 1



Inventor
JESSE C. WRIGHT
By *J. R. Ruffell*
His Attorney

Aug. 24, 1937.

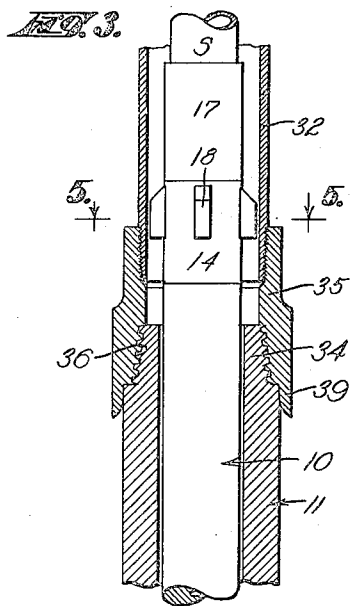
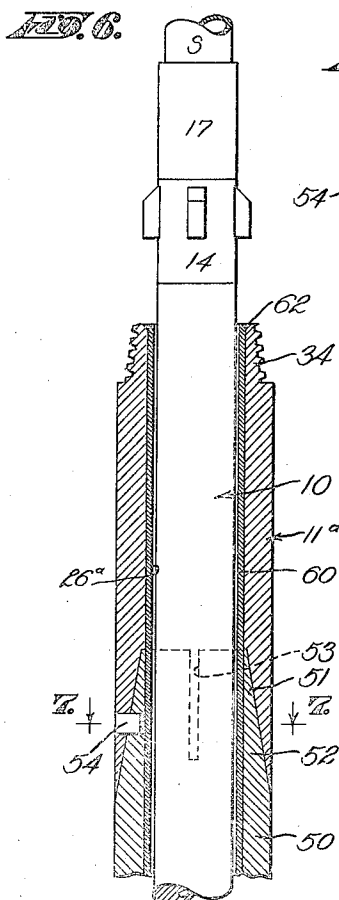
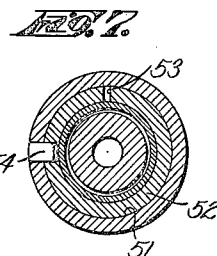
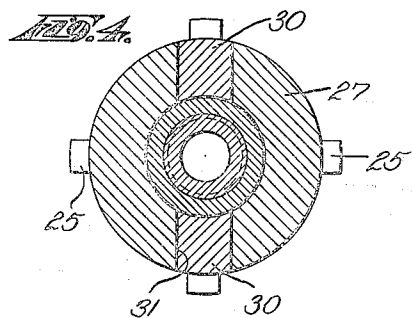
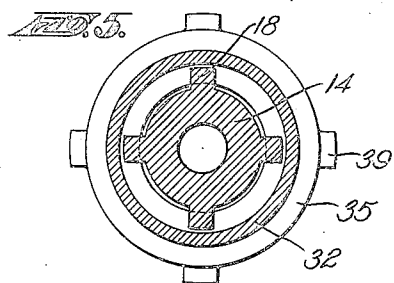
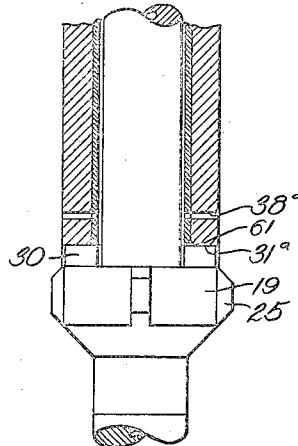
J. C. WRIGHT

2,090,822

DRILL COLLAR

Filed Oct. 2, 1936

3 Sheets-Sheet 2



Inventor
JESSE C. WRIGHT
By *[Signature]*
His Attorney

Aug. 24, 1937.

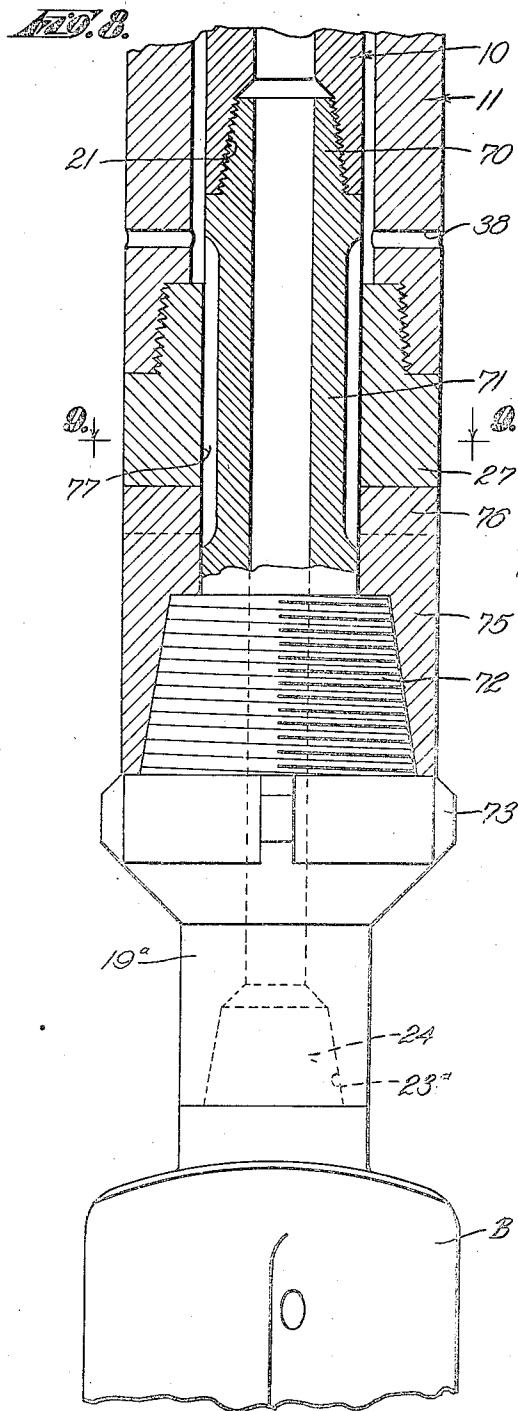
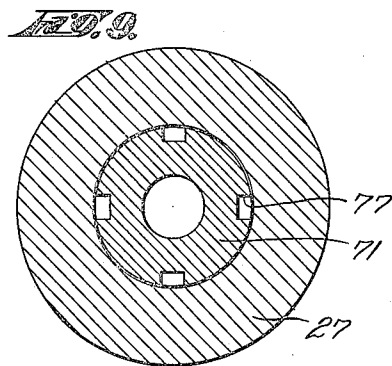
J. C. WRIGHT

2,090,822

DRILL COLLAR

Filed Oct. 2, 1936

3 Sheets-Sheet 3



Inventor
JESSE C. WRIGHT
By *J. H. All ofell*
His Attorney

UNITED STATES PATENT OFFICE

2,090,822

DRILL COLLAR

Jesse C. Wright, Los Angeles, Calif.

Application October 2, 1936, Serial No. 103,642

15 Claims. (Cl. 255—28)

This invention relates to rotary well drilling equipment and relates more particularly to a drill collar for use in a rotary well drilling string. A general object of this invention is to provide an improved and particularly efficient drill collar that is safe and dependable in operation.

In the rotary method of well drilling a drill collar is usually interposed between the drilling string and the drilling tool. A drill collar is a tubular length of steel having a substantial thickness to impose additional weight on the bit and to lend rigidity to the lower portion of the drilling string for the transmission of the torque. Where hard earth formations are encountered in a well it has been found necessary to form the drill collar of great length to impose sufficient weight on the tool or bit. A drill collar of great length has certain disadvantages, for example, its upper end has a tendency to fall over against the wall of the bore and cause the deviation of the bit. Heretofore it has been found impractical to increase the weight of a drill collar by increasing its diameter as it has been deemed necessary to leave sufficient clearance between the drill collar and the wall of the well bore to receive a washover pipe in the event the bit and drill collar are caught or lost in the well. Accordingly, where additional weight has been required it has been the practice to increase the length of the drill collar even though a long drill collar has numerous disadvantages.

Another object of this invention is to provide a drill collar of substantial weight whose weight is concentrated immediately above the drilling tool to resist the forces tending to cause deviation of the drilling tool.

Another object of this invention is to provide a drill collar of minimum length and maximum weight.

Another object of this invention is to provide a drill collar of substantial diameter to have only slight clearance in the well bore to act as a bearing guide and stabilizer for the drilling tool.

Another object of this invention is to provide a heavy drill collar of large diameter that may be easily loosened or freed for recovery from the well in the event the drill collar and bit become caught or lost in the well.

Another object of this invention is to provide a heavy drill collar of large diameter that has provision for conducting circulation fluid to its lower end to discharge into the well bore in the event the usual circulation passage is obstructed or ineffective due to breaking of the drilling string and sanding up of the bit and drill collar. The

drill collar of the present invention is adapted to receive fluid from a fishing string and discharge the fluid into the well bore at its lower end to loosen or wash away mud or sand that may accumulate about it whereby the drill collar and bit may be fished or recovered from the well.

Another object of this invention is to provide a drill collar comprising an inner part and an outer part that may have relative longitudinal and/or rotary movement to effect the loosening and freeing of the outer part from accumulations of sand and mud to facilitate the easy recovery of the drill collar and drilling tool in the event they become caught in the well.

Another object of this invention is to provide a drill collar of the character mentioned that may be employed or operated to produce a jarring action to free or loosen the drilling tool.

Another object of this invention is to provide an attachment for a typical drill collar that materially adds to its weight and effectiveness and gives it the characteristics and capabilities mentioned above.

A further object of this invention is to provide a drill collar in which the wear receiving parts may be easily and quickly replaced or reconditioned.

The various objects and features of my invention will be fully understood from the following detailed description of typical preferred forms and applications of the invention, throughout which description reference is made to the accompanying drawings, in which:

Fig. 1 is a side elevation of one form of drill collar provided by the invention. Fig. 2 is an enlarged side elevation of the drill collar illustrated in Fig. 1 showing the outer member in longitudinal cross section. Fig. 3 is a fragmentary longitudinal detailed sectional view illustrating the washover pipe connected with the outer member. Fig. 4 is an enlarged transverse detailed sectional view taken as indicated by line 4—4 on Fig. 1. Fig. 5 is an enlarged transverse detailed sectional view taken as indicated by line 5—5 on Fig. 3. Fig. 6 is a side elevation of another embodiment of the invention illustrating the outer member in longitudinal cross section. Fig. 7 is a transverse detailed sectional view taken as indicated by line 7—7 on Fig. 6. Fig. 8 is a fragmentary longitudinal detailed sectional view of still another form of the invention with a portion in side elevation, and Fig. 9 is a transverse detailed sectional view taken as indicated by line 9—9 on Fig. 8.

The drill collar of the present invention illus-

trated in Figs. 1 to 5, inclusive, of the drawings, includes generally an inner member 10 to be connected in a drilling string S and an outer weight member 11 surrounding the inner member 10 and supported on the inner member 10.

The inner member 10 is the torque and force transmitting element of the drill collar. In practice the inner member 10 may be a typical drill collar of suitable length and of sufficient diameter to have the required rigidity and strength. The inner member 10 is an elongate cylindrical part that may be substantially uniform in diameter throughout its length. A central longitudinal fluid passage 12 extends through the inner member 10 from one end to the other for conducting the drilling fluid during drilling operations. The inner member 10 is of substantial wall thickness to have the desired strength and to be of substantial weight. A tapered threaded socket 13 is preferably provided in the upper end of the inner member 10. The invention provides a special connecting member or sub 14 for connecting the upper end of the inner member 10 with the drilling string S. The sub 14 has a pin 15 threaded in the socket 13 and may have a pin 16 threaded into a coupling section 17 on the lower end of the string S. Circumferentially spaced ears or lugs 18 are provided on the sub 14 and project outwardly or radially from the sub. The lugs 18 have flat substantially horizontal lower ends and form anvil abutments for use in jarring as will be hereinafter described.

A special sub 19 is provided for connecting the lower end of the inner member 10 with a bit B or other part of the drilling string. The sub 19 is provided with a pin 20 threaded into a socket 21 in the lower end of the inner member 10. In accordance with the invention the sub 19 is considerably larger in diameter than the inner member 10 so that its upper end forms an annular upwardly facing shoulder 22 at the lower end of the inner member. The shoulder 22 is preferably flat and substantially normal to the longitudinal axis of the drill collar. The sub 19 may have a socket 23 in its lower end receiving a pin 24 on the upper end of the bit B. In the drawings I have illustrated a typical fish-tail bit B connected with the drill collar, it being understood that the drill collar may be employed with various forms and types of drilling tools. A plurality of circumferentially spaced ribs or blades 25 project radially from the sub 19. The blades 25 may engage the wall of the well bore to assist in stabilizing the bit B and the lower portion of the drill collar. The upper and lower ends of the blades 25 may be bevelled away, as illustrated.

The outer member 11 forms the weight element and stabilizing element of the device. The outer member 11 also serves as a washover pipe to conduct fluid for fishing operations as will be subsequently described. The outer member 11 is an elongate tubular part surrounding the inner member 10. In the form of the invention being described the outer member 11 is integral or one piece. The outer member 11 is formed of steel or other material having a relatively high specific gravity. In the preferred construction the outer member 11 is of sufficient length to surround the major portion of the inner member 10. The outer member 11 surrounds the inner member 10 with some clearance leaving an annular fluid passage 26. The outer member 11 is proportioned to fit the well bore with only slight clearance to permit the necessary circulation of fluid through the bore. Being proportioned in

this manner the outer member 11 acts as a bearing or stabilizer for the drilling string adjacent or immediately above the bit B. The outer member 11 has substantial wall thickness and a substantial length and, therefore, adds materially to the weight of the drill collar.

A replaceable clutch part 27 is provided on the lower end of the outer member 11 to support it on the shoulder 22. The part 27 may have a pin 28 threaded into an opening or socket 29 in the lower end of the outer member 11. The threads of the pin 28 and socket 29 are preferably left-hand threads. The clutch part 27 is preferably of the same external diameter as the outer member 11 and fits about the inner member 10 rather snugly to centralize and stabilize the outer member relative to the inner member. The lower end of the clutch part 27 is flat and rests on the shoulder 22 to support the outer member 11. Means is provided for transmitting rotation between the members 10 and 11. In the preferred structure illustrated this means includes clutch lugs 30 on the shoulder 22 cooperating with correspondingly shaped notches 31 in the lower end of the clutch part 27. When the clutch part 27 rests on the shoulder 22 its notches 31 receive the lugs 30 so that the outer member 11 turns with the inner member 10.

Means is provided on the upper end of the outer member 11 to receive and connect with a washover pipe 32. The upper end of the outer member 11 is provided with a tapered pin 34 carrying a heavy thread. The washover pipe 32, which may be employed for fishing and for freeing the drill collar and bit B from the accumulations of mud and sand, is adapted to be run downwardly over the string S. A coupling 35 is provided on the lower end of the washover pipe 32 and has a socket 36 in its lower end adapted to receive the pin 34. A heavy thread is provided on the wall of the socket 36 to mate with the thread on the pin 34 as best illustrated in Fig. 3 of the drawings. The threads of the pin 34 and the socket 36 are preferably right-hand threads. When the coupling 35 of the washover pipe 32 is threaded on the pin 34 the lower end of the washover pipe 32 is in direct communication with the passage 26 through the outer member 11. The outer member 11 is provided with ports 38 for discharging the fluid from the passage 26 into the well bore. The ports 38 are preferably located a short distance above the lower end of the outer member 11 as illustrated in the drawings. It is to be understood that the washover pipe 32 is normally disconnected from the outer member 11 and does not form a part of the drill collar during the drilling operation. The coupling 35 on the lower end of the washover pipe 32 may be provided with radially and downwardly projecting fingers 39 for clearing sand and mud from around the pin 34 when the washover pipe 32 is to be connected with the outer drill collar member 11.

During operation the drill collar is assembled or connected in the drilling string as illustrated in Figs. 1 and 2 of the drawings. The string S is rotated and fed downwardly in the usual manner to operate the bit B. The thick walled inner member 10 and the thick walled outer member 11 are of great weight so that the drill collar imposes a substantial feeding weight or pressure on the bit B. In practice the weight of the drill collar may be sufficient to feed the bit B into the earth formation without applying the weight of the drilling string S on the bit B so that the

drilling string or the major portion of the drilling string may be suspended from its upper end during the drilling operation. It will be observed that the weight of the improved drill collar is concentrated in a minimum vertical distance or height immediately above the bit B to cause the bit B to drill a straight bore and to resist the forces tending to divert the bit. The outer member 11 and the blades 25 serve to guide and stabilize the bit and the lower end of the drilling string. The outer member 11 serves as a bearing at the lower end of the drilling string to prevent excessive wobbling and lateral movement of the bit B. The usual circulation of fluid is pumped downwardly through the string S to flow through the passage 12 and discharge from the bit B. The fluid returns upwardly through the well bore passing around the outer member 11 of the drill collar. The inner member 10 transmits the torque or driving forces to the bit B. The inner member 10 is rigid to dependably transmit these forces. The outer member 11 merely rests on or imposes its weight on the inner member 10 and bit B through the sub 19 and is not subjected to any of the driving torque. The clutch lugs 30 cooperate with the notches 31 to form a rotative driving connection between the members 10 and 11. The weight of the outer member 11 is sufficient to properly hold the lower end of the clutch part 27 on the shoulder 22. The clutch part 27 and the sub 19 are the only parts of the drill collar subject to wear due to vibration of the parts. The clutch part 27 and the sub 19 may be readily replaced when worn.

In the event the bit B and drill collar become caught or sanded in the well bore or the string S parts or breaks, the wash pipe 32 carrying the coupling 35 is lowered into the well. The wash pipe 32 is adapted to pass downwardly over the string S or the portion of the string S remaining in the well. The wash pipe 32 is lowered until the coupling 35 reaches the pin 34 on the upper end of the member 11. The wash pipe 32 is rotated to thread the coupling 35 on the pin 34. The fingers 39 are operable to clear the mud and sand away from the pin 34 when the coupling is to be threaded on the pin. The weight of the outer member 11 and the engagement of the lugs 30 in the notches 31 hold the outer member 11 against turning when the coupling 35 is threaded on the pin 34. The coupling 25 connects the wash pipe 32 with the outer member 11 so that the outer member 11 may be moved vertically with the wash pipe or may be rotated with the wash pipe, or both. Further, when the wash pipe 32 is connected with the outer member 11 its interior is in direct communication with the passage 26. By moving the outer member 11 by means of the wash pipe 32 it may be possible to free the drill collar and bit for removal from the well on the wash pipe. Water or circulation fluid may be pumped downwardly through the wash pipe 32 to flow through the passage 26 and discharge from the ports 38. This fluid discharging from the ports 38 flows upwardly around the outer member 11 to cut away the accumulations of mud and sand about the outer member. The water or fluid may be pumped through the wash pipe 32 to free the outer member 11 with or without movement of the outer member. The outer member 11 providing the annular passage 26 serves as a washover pipe to conduct the water or fluid to the lower end of the drill collar to free the drill collar when the regular circulation pas-

sage through the drilling string is obstructed or disconnected from its source of supply.

If the reciprocation or rotation of the outer member 11 and the discharging of water or fluid from the ports 38 frees the outer member to permit the drill collar and bit to be withdrawn the assembly may be removed from the well on the wash pipe 32. In some instances the bit B may be tightly caught or lodged in the well and it may be deemed advisable to impart a jarring action to the bit to free it. The wash pipe 32 may be raised suddenly to bring the upper end of the pin 34 into jarring contact with the lower ends of the lugs 18. This jarring operation may be repeated until the bit B is freed or loosened. From the above it will be seen that the outer member 11 of the drill collar in addition to giving the drill collar additional weight serves as a fishing attachment to facilitate the fishing of the drill collar and bit from the well. The outer member 11 may serve as a wash over pipe to conduct the flushing fluid to a point adjacent the bit B and may be moved to loosen the accumulations of mud and sand and to impart a jarring action to the bit B.

Figs. 6 and 7 of the drawings illustrate a form of the invention embodying a sectional outer member 11^a. The inner member 10, and the subs 14 and 19 may be the same as the corresponding elements of the previously described form of the invention.

The outer member 11^a of the drill collar illustrated in Figs. 6 and 7 comprises a plurality of tubular sections 50. The several sections 50, with the exception of the uppermost section and the lowermost section, may be identical. The sections 50 are tubular members having relatively thick walls and formed of steel or the like. Each of the sections 50, with the exception of the lowermost section, has a tapered socket 51 in its lower end. Each section 50, with the exception of the uppermost section, has a tapered pin 52 on its upper end fitting the socket 51 in the adjacent section. The pins 52 may be slotted at 53 to accurately or tightly fit the sockets 51 when the sections 52 are assembled. Dowel pins 54 may be arranged through openings in the telescoping parts of the sections 50 to lock them against relative movement. The outer member 11^a may be of substantially the same wall thickness as the above described member 11 and surrounds the inner member 10 with substantial clearance. To facilitate the assembling and handling of the sections 50 it may be preferred to arrange them around a carrier tube 60. The tube 60 is adapted to surround the inner member 10 with clearance to leave a fluid passage 26^a. The tube 60 may be welded to the lowermost section 50 at 61 and to the uppermost section 50 at 62 whereby the assembly of sections 50 may be handled as a unit. Ports 38^a are provided in the lower portion of the lowermost section 50 to discharge the fluid passed downwardly through the passage 26^a. The lowermost section 5 may be provided with notches 31^a in its lower end to receive the clutch lugs 30 on the sub 19. A pin 34^a is provided on the upper end of the uppermost section 50 and carries a heavy thread to cooperate with the thread on the coupling 35 of the washover pipe.

The drill collar illustrated in Figs. 6 and 7 operates in the same manner as the previously described form of the invention. The sectional outer member 11^a is easy to handle and assemble and may be made up in various lengths to adapt it for use on various typical drill collars.

Figs. 8 and 9 illustrate a modified or alternative construction for the lower portion of the drill collar. The construction illustrated in Figs. 8 and 9 may be embodied in the form illustrated in Figs. 1 to 5, inclusive, or in the form illustrated in Figs. 6 and 7. As shown, the construction of Figs. 8 and 9 includes an inner member 10 identical with the above described member 10 and an outer member 11 identical with the above-described outer member 11. A special sub 19^a is connected with the lower end of the inner member 10. The sub 19^a has a pin 70 on its upper end threaded into the socket 21 in the lower end of the inner member 10. The upper portion 71 of the sub 19^a may extend upwardly into the outer member 11 and is of substantially the same diameter as the member 10. The sub 19^a is enlarged intermediate its ends to have a tapered threaded pin 72. The pin 72 faces upwardly and carries a lefthand thread. Projecting lugs or wings 73 may be provided at the base of the pin 72. The lower portion of the sub 19^a is smaller in diameter than the pin 72 and has a threaded socket 23^a receiving the pin 24 of the bit B. The lower end of the outer member 11 carries the clutch part 27 described above. In accordance with the invention, as illustrated in Figs. 8 and 9, a releasable and replaceable clutch part 75 is threaded on the pin 72. The clutch parts 27 and 75 have meshing teeth 76 for transmitting rotation between the members 10 and 11. The reduced portion 71 of the sub 19^a extends upwardly through the clutch parts 75 and 27 and has a plurality of spaced longitudinal grooves 77. The grooves 77 are adapted to carry the flushing fluid downwardly from the lower end of the space 26 to the meshing teeth 76 where it may discharge into the well bore. The clutch part 75 may be of the same external diameter as the part 27 and the member 11.

The construction illustrated in Figs. 8 and 9 has the same mode of operation as the previously described forms of the invention except that the outer member 11 may be backed off or unthreaded in the event that it cannot be easily raised. The lefthand threads of the pin 72 and the clutch part 75 are not loosened during drilling because the drag of the outer part 11 on the wall of the well tends to tighten the lefthand threads. The washover pipe 32 may be connected with the outer part 11 by the coupling 35 without prematurely loosening the threads of the part 75 and pin 72 as the threads of the socket 36 and the pin 35 are right-hand threads. When the washover pipe 32 has been properly connected with the outer part 11 it may be rotated to unthread the part 75 from the pin 72 to free the outer member 11 for free rotation and vertical movement. Following this freeing of the outer part 11 it may be moved by means of the wash pipe 32 so that the flushing fluid may wash away the accumulation of mud about it.

Having described only typical preferred forms and applications of the invention I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art or fall within the scope of the following claims.

70 Having described my invention, I claim:

1. A drill collar for connection in a tubular drilling string including, an inner member to be connected in the string for the transmission of torque and having a passage for conducting fluid during drilling, and an integral tube sur-

rounding the inner member with clearance to leave a passage for conducting fluid when the first named passage is inoperative and having a coupling means formed on its upper end for connecting with a wash-over pipe passed downwardly over the string.

2. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string between adjacent parts thereof, a weight element supported on the member for longitudinal movement thereon, and a projection on the inner member engageable by the element to impart an upward jarring action to the string.

3. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string as a rigid part thereof, a shoulder on the member, a projection on the member above the shoulder, and a weight element normally supported on the shoulder and movable on the member to jar against the projection.

4. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string as a rigid part thereof, a shoulder on the member, a projection on the member above the shoulder, and a tubular weight element surrounding the member where it is normally supported on the shoulder and movable vertically to jar against the projection.

5. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a shoulder on the inner member, a thick walled tube of steel surrounding the inner member and supported on the shoulder, there being a space between the inner member and the tube for passing fluid, the tube having a discharge port in its lower portion communicating with the space, and a coupling on the upper end of the tube for connecting with a pipe for conducting fluid downwardly to said space.

6. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a replaceable sub connecting the lower end of the inner member in the string, a tubular weight element surrounding and shiftable longitudinally on the inner member, and a replaceable part on the lower end of the element resting on the sub.

7. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string as a rigid part thereof, a shoulder on the inner member, a thick walled tube of steel shiftable surrounding the inner member and supported on the shoulder, a stop on the inner member spaced above the shoulder to limit the upward movement of the tube on the inner member, the tube being materially larger in diameter than the string to form a bearing stabilizer in the well, and coupling means on the upper end of the tube for connecting with a wash-over pipe.

8. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a replaceable sub connecting the lower end of the inner member in the string, stabilizing lugs on the sub for engaging the wall of the well, a tubular weight element surrounding and shiftable on the inner member, and a replaceable part on the lower end of the element resting on the sub.

9. A drill collar for connection in a drilling string including, an inner torque transmitting

member to be connected in the string, a replaceable sub connecting the lower end of the inner member in the string, a tubular weight element surrounding and shiftable on the inner member, a replaceable part on the lower end of the weight element resting on the sub, and clutch surfaces on the sub and part preventing relative turning between the inner member and the weight element releasable by relative longitudinal movement between the member and element.

10. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a tubular weight element surrounding and supported on the inner member, the element including, tubular sections having telescopically assembled end portions, and coupling means on the upper end of the tubular element for connecting with a wash-over pipe.

11. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a tubular weight element surrounding and supported on the inner member, the element including, tubular sections having telescopically assembled end portions, and means for securing the sections against separation, and coupling means on the upper end of the element for connecting with a wash-over pipe.

12. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, and a tubular weight element surrounding and supported on the inner member, the element including, tubular sections, one section having a tapered socket in its end, and a tapered pin on the adjacent section cooperating with the socket.

13. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a thick

walled tubular weight element surrounding and supported on the inner member, the element comprising a plurality of superimposed longitudinal sections, and coupling means on the upper end of the element for connecting with a wash-over pipe.

14. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a replaceable sub connecting the lower end of the inner member in the string, a tubular weight element surrounding and shiftable on the inner member, a replaceable part on the lower end of the weight element resting on the sub, left hand threads connecting the replaceable part with the weight element, clutch surfaces on the sub and part releasable by relative longitudinal movement between the member and element, and a right hand thread on the upper end of the weight element adapted to mate with a thread on the fishing string whereby the weight element may be backed off by the string.

15. A drill collar for connection in a drilling string including, an inner torque transmitting member to be connected in the string, a replaceable sub connecting the lower end of the inner member in the string, a tubular weight element surrounding and shiftable on the inner member, a clutch part on the lower end of the outer member, a clutch part on the sub, lefthand threads connecting the second mentioned clutch part with the sub, the clutch parts being operable to transmit rotation between the outer member and the weight element, and a righthand thread on the upper portion of the weight element to mate with a thread on a fishing string whereby the weight element may be freed by unthreading the said lefthand threads.

JESSE C. WRIGHT.