Dec. 23, 1930. W. C. GEORGE 1,785,949

HYDRAULIC EXPANDING UNDERREAMER

Filed Dec. 5, 1928 2 Sheets-Sheet 1

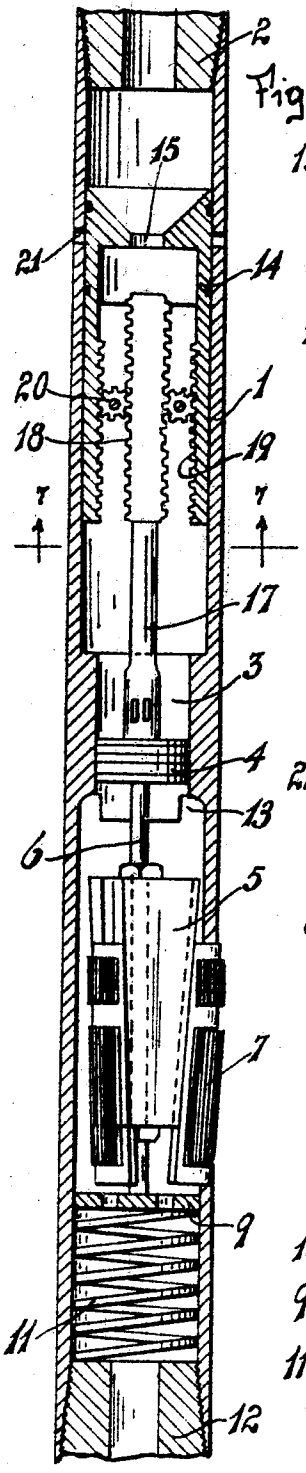


Fig. 1.

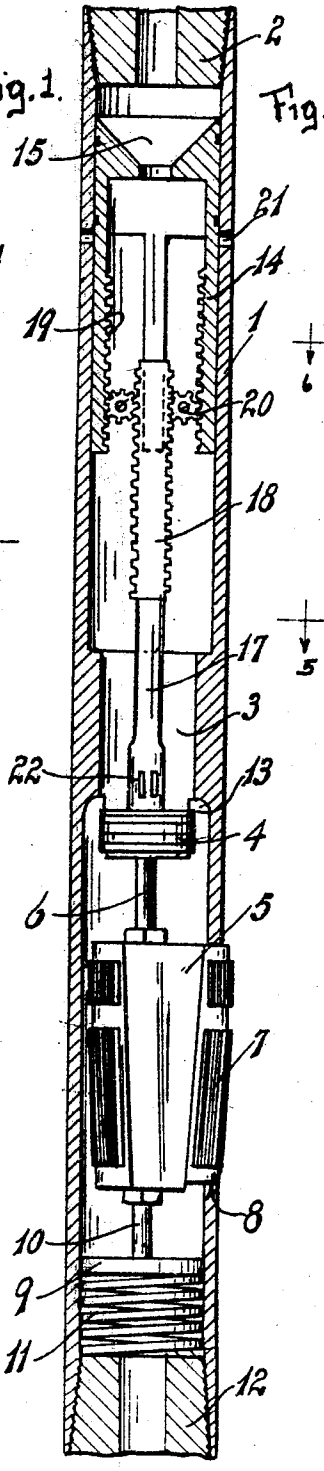


Fig. 2.

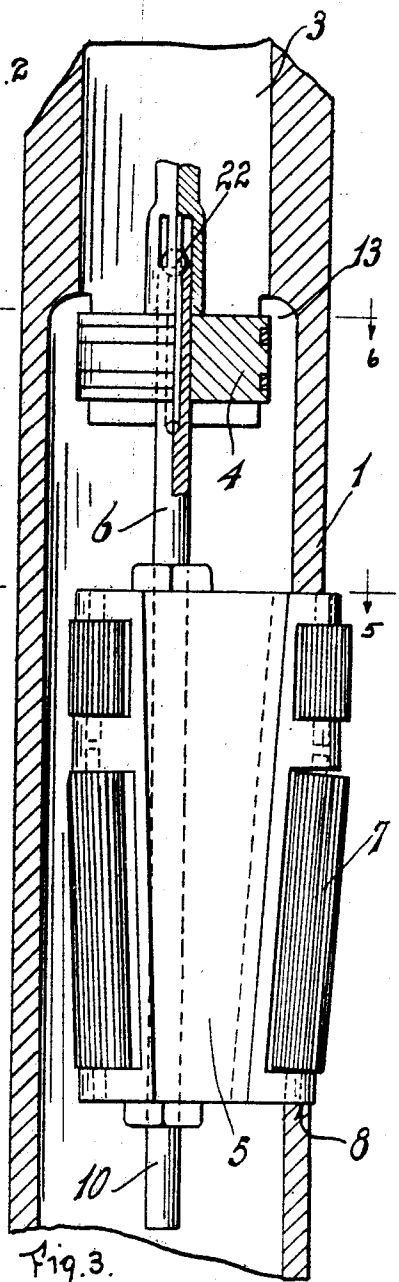


Fig. 3.

INVENTOR.
WILLIS C. GEORGE
by. H. A. Dieckman
ATTORNEY.

Dec. 23, 1930. W. C. GEORGE 1,785,949

HYDRAULIC EXPANDING UNDERREAMER

Filed Dec. 5, 1928 2 Sheets-Sheet 2

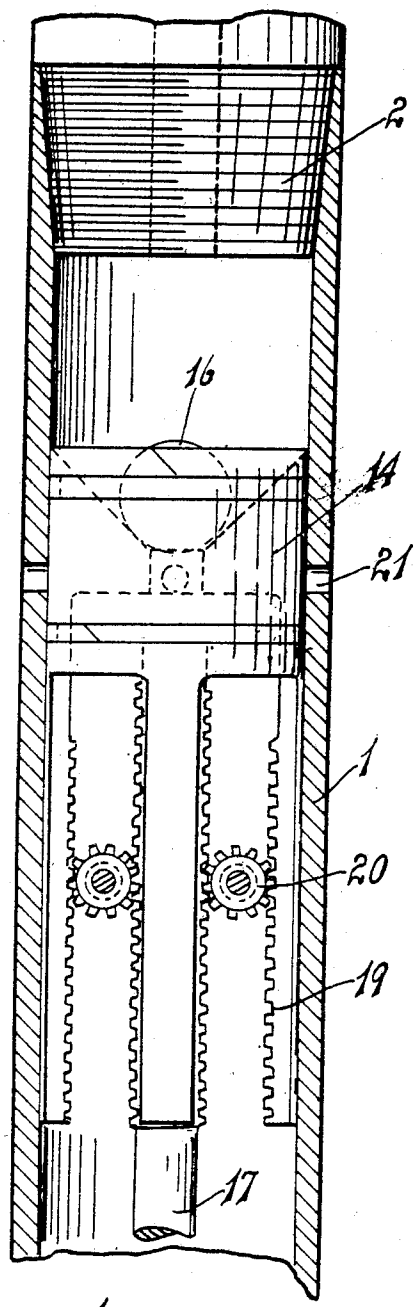


Fig. 4.

Fig. 5

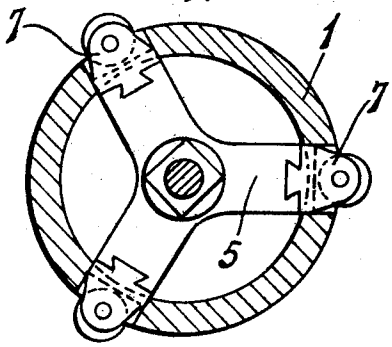


Fig. 6.

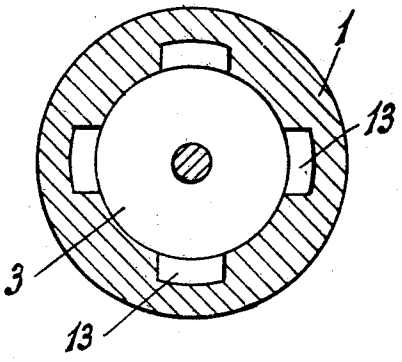
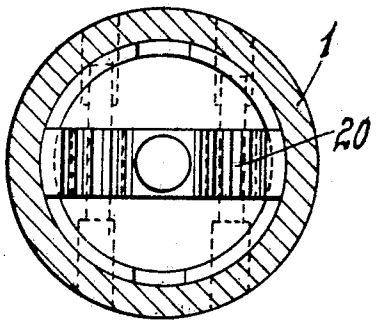


Fig. 7.



INVENTOR
WILLIS C. GEORGE.
by H. A. Duckman
ATTORNEY.

Patented Dec. 23, 1930 1,785,949

UNITED STATES PATENT OFFICE

WILLIS C. GEORGE, OF LONG BEACH, CALIFORNIA

HYDRAULIC EXPANDING UNDERREAMER

Application filed December 5, 1928. Serial No. 323,912.

This invention relates to a hydraulically expanded under reamer an object of which is to expand the cutters by means of the pressure exerted by the circulating fluid in the well.

Another object is to provide a novel hydraulically actuated means for contracting the cutters in event that the spring means is not sufficient to contract said cutters.

Still another object is to provide a hydraulically expanding under reamer the cutters of which are positively expanded or contracted.

Other objects, advantages, and features of invention may appear from the accompanying drawing, the subjoined detailed description, and the appended claims.

In the drawing:

Figure 1 is a longitudinal sectional view of my reamer in contracted position.

Figure 2 is a longitudinal sectional view of the same in expanded position.

Figure 3 is a fragmentary longitudinal sectional view of the cutter mounting in expanded position.

Figure 4 is a fragmentary longitudinal sectional view of the contracting piston.

Figure 5 is a sectional view taken on line 5, 5 of Figure 3.

Figure 6 is a sectional view taken on line 6, 6 of Figure 3.

Figure 7 is a sectional view taken on line 7, 7 of Figure 1.

Referring more particularly to the drawing, the numeral 1 indicates a barrel which is mounted on the bottom of the drill pipe, said drill pipe screwing into the top thereof, as shown at 2. A cylinder 3 of smaller diameter than the inside of the barrel 1 is provided approximately midway in said barrel and a piston 4 is positioned in the cylinder. A multiple legged cam member 5 is secured to the piston 4 by a rod 6, or the like, and is adapted to reciprocate with the piston. A reaming cutter 7 is slidably secured to each of the legs of the member 5 and it will be evident that as the member 5 is raised or lowered the cutters will be contracted or expanded relative to the barrel 1. The cutters each extend through a slot 8 cut in the wall of the barrel 1.

A perforated plate 9 is secured to the member 5 and at the lower end thereof to a post 10 depending from said member. A coil spring 11 bears against the plate 9 and against a suitable shoulder in the barrel, such as the top of the pin of the drill, as shown at 12. Thus it will be seen that the member 5 is constantly urged upwardly by the spring 11 tending to retract the cutters 7.

At the lower end of the cylinder 3 I provide a plurality of vent ports 13 through which the fluid is adapted to pass when the cylinder 4 is in the lower-most position, and thus stop the downward movement of the piston, as will be further described.

A retracting piston 14 is mounted in the barrel 1 and this piston has a central opening 15 therethrough so that the fluid normally passes downwardly through the piston to actuate the piston 4. The opening 15 is constricted and may be closed by a ball 16, as will be further described. A rod 17 rises from the top of the piston 4 and is provided with a rack 18 at the top thereof. Racks 19 are cut in the skirt of the piston 14 and gears 20 are journaled in the barrel 1 and mesh with the racks 18, 19. Vent ports 21 are provided in the barrel 1, the purpose of which is to prevent the by-passing of the fluid under pressure when the cylinder 14 passes below these ports. A check valve 22 is provided at the lower end of the rod 17 and above the cylinder 4 permitting upward movement of fluid through the cylinder and prohibiting the downward passage of fluid through the cylinder.

The operation of my invention is as follows: Fluid under pressure is pumped downwardly in the drill pipe and passes through the cylinder 14 exerting pressure on the top of the cylinder 4. The cylinder 4 then moves downwardly until it opens the exhaust ports 13 at which time its downward movement is stopped. The downward movement of the piston 4 carries the cam member 5 downwardly, thus expanding the cutters 7. The spring 11 is compressed during this action, as shown in Figure 2.

When it is desired to retract the cutters in order that the tool may be removed from the

well the fluid under pressure is stopped at which time the spring 11 will expand, carrying the cam member 5 upwardly and contracting the cutters 7. However, if the spring 11 is not sufficiently strong to contract the cutters or if for any other reason these cutters will not contract, I may positively contract them as follows: The ball 16 is dropped into the drill pipe and will lodge in the opening 15 through the cylinder 14, thus sealing this opening. Now, when the fluid under pressure is again passed through the drill pipe, the piston 14 will be pumped downwardly until the exhaust ports 21 are opened, at which time the piston will stop. The downward movement of the piston 14 will cause the rod 17 to move upwardly by reason of the racks 18, 19 and gears 20 and this upward movement of the rod pulls the piston 4 and cam member 5 upwardly to retract the cutters.

Having described my invention, I claim:

1. A hydraulic expanding reamer comprising a barrel, a plurality of cutters mounted in said barrel, hydraulic means operably connected to said cutters and adapted to expand the same, and spring means urging the cutters into contracted position, and hydraulically actuated means connected to said cutters and adapted to contract said cutters.

2. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston.

3. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, and spring means bearing against said cam member to raise the same whereby the cutters are retracted.

4. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, and hydraulic means connected to said cam member whereby the cam member is raised to retract the cutters.

5. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, a retracting piston in the barrel, said last named piston having a port therethrough to permit the fluid to pass, a ball adapted to rest in the port to close the same, and means connecting said last named piston and the first named piston whereby the first named piston and cam member are raised as the retracting piston lowers.

6. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, a retracting piston in the barrel, said last named piston having a port therethrough to permit the fluid to pass, a ball adapted to rest in the port to close the same, and means connecting said last named piston and the first named piston whereby the first named piston and cam member are raised as the retracting piston lowers, said means comprising a rod extending from the first named piston, a rack on the rod, gears cut in the last named piston, and spur gears meshing with said gears and rack whereby the first named piston and cam member are raised.

7. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, a retracting piston in the barrel, said last named piston having a port therethrough to permit the fluid to pass, a ball adapted to rest in the port to close the same, and means connecting said last named piston and the first named piston whereby the first named piston and cam member are raised as the retracting piston lowers, said means comprising a rod extending from the first named piston, a rack on the rod, gears cut in the last named piston, and spur gears meshing with said gears and rack whereby the first named piston and cam member are raised, and said barrel having exhaust ports therein adapted to be opened by the last named cylinder when

the cylinder is in the lower-most position, thus limiting the downward movement of said cylinder.

8. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, a retracting piston in the barrel, said last named piston having a port therethrough to permit the fluid to pass, a ball adapted to rest in the port to close the same, and means connecting said last named piston and the first named piston whereby the first named piston and cam member are raised as the retracting piston lowers, and a spring in the barrel adapted to bear against the bottom of the cam member to assist in elevating the same.

9. A hydraulic expanding under reamer comprising a barrel, a plurality of cutters in the barrel, a cam member in which the cutters are slidably mounted, a cylinder in the barrel, a piston in the cylinder, said piston being connected to the cam member, said barrel having by-pass ports at the lower end of the cylinder, said ports being adapted to be opened by the piston to limit the downward movement of said piston, a retracting piston in the barrel, said last named piston having a port therethrough to permit the fluid to pass, a ball adapted to rest in the port to close the same, and means connecting said last named piston and the first named piston whereby the first named piston and cam member are raised as the retracting piston lowers, said means comprising a rod extending from the first named piston, a rack on the rod, gears cut in the last named piston, and spur gears meshing with said gears and rack whereby the first named piston and cam member are raised, and said barrel having exhaust ports therein adapted to be opened by the last named cylinder when the cylinder is in the lower-most position, thus limiting the downward movement of said cylinder, and a spring in the barrel adapted to bear against the bottom of the cam member to assist in elevating the same.

In testimony whereof, I affix my signature.

WILLIS C. GEORGE.