

Oct. 23, 1934.

C. L. WALKER

1,978,119

COLLAPSIBLE WELL DRILLING BIT

Original Filed May 11, 1932 2 Sheets-Sheet 1

Fig. 1.

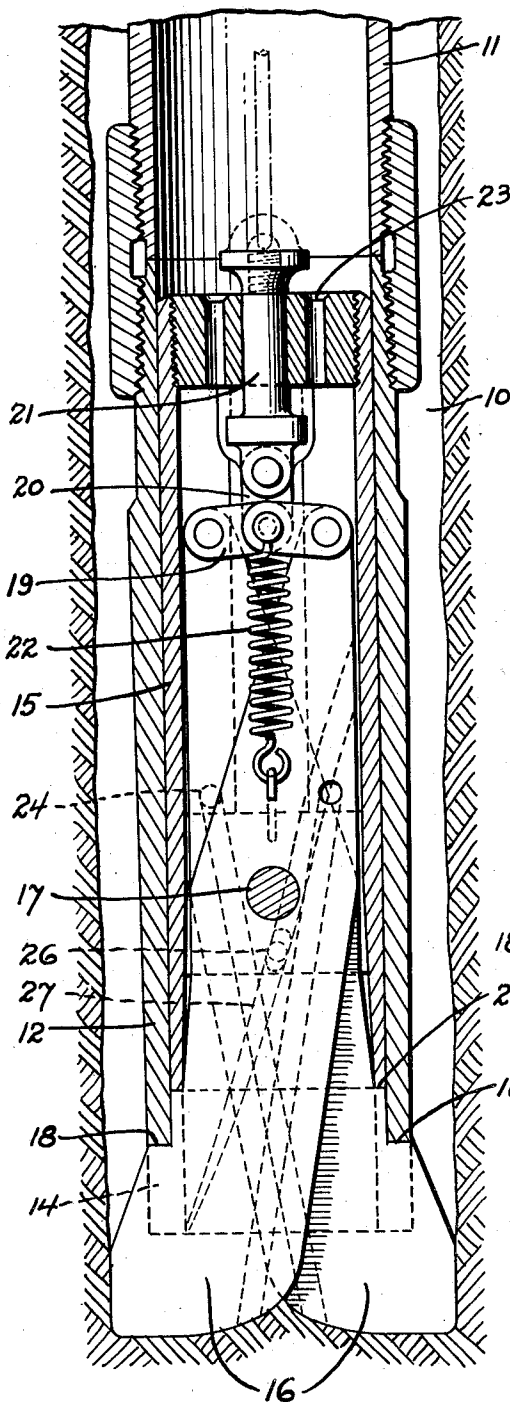
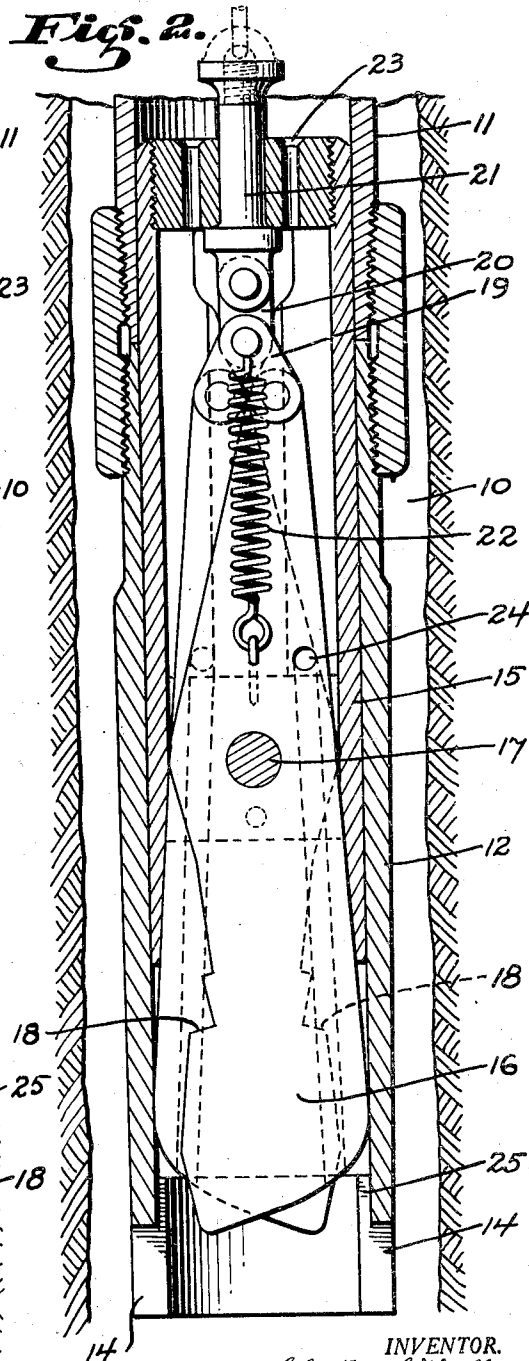


Fig. 2.



INVENTOR.
Clinton L. Walker.

BY *Townsend & Loftis.*
ATTORNEYS.

Oct. 23, 1934.

C. L. WALKER

1,978,119

COLLAPSIBLE WELL DRILLING BIT

Original Filed May 11, 1932 2 Sheets-Sheet 2

Fig. 3.

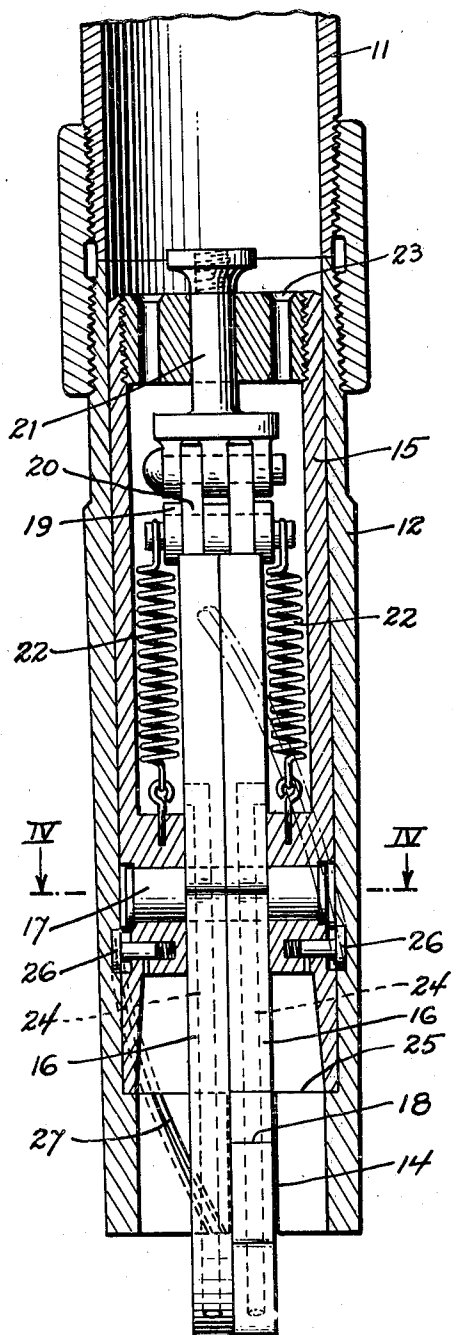
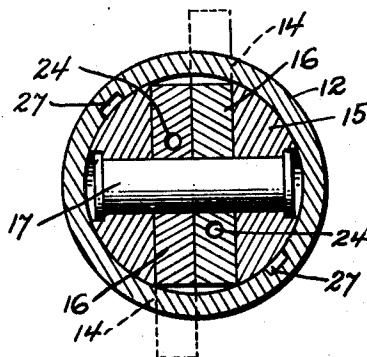


Fig. 4.



INVENTOR.
Clinton L. Walker.
BY *Townsend and Loftis*
ATTORNEYS.

UNITED STATES PATENT OFFICE

1,978,119

COLLAPSIBLE WELL DRILLING BIT

Clinton L. Walker, Piedmont, Calif.

Original application May 11, 1932, Serial No. 610,633. Divided and this application November 7, 1933, Serial No. 696,966

4 Claims. (Cl. 255—74)

This application is a division of my co-pending application entitled "Deep well drilling and coring system," filed May 11, 1932, and bearing Serial No. 610,633.

5 This invention relates to well drilling equipment, and particularly pertains to an improved rotary drilling bit for advancing deep well bores by the rotary method.

10 It is the principal object of the present invention to provide an improved collapsible rotary drilling bit of the character referred to which may be expeditiously assembled on a drill stem at the bottom of the bore, or removed therefrom without the necessity of removing the drill stem from the

15 bore.
In practicing the invention, I have provided a collapsible rotary drilling bit which may be run in through the drill stem and readily assembled on the lower end of the drill stem so that the proper
20 weight can be imposed on, and proper torque applied to, the bit through the drilling stem to effect the drilling operation. The bit is also capable of being disconnected from the drill stem while the same remains in the bore and removed upwardly
25 through the drill stem in order that bits may be replaced on the drill stem without removing the latter from the bore. When my improved drilling bit is utilized, there is no necessity of removing the drilling string from the bore until the
30 drilling operation is entirely complete and the bore is ready for casing.

One form which the invention may assume is exemplified in the following description and illustrated by way of example in the accompanying
35 drawings, in which—

Fig. 1 is a view in vertical section through a well bore, showing the drill stem disposed therein with my improved drilling bit assembled thereon for operation;

40 Fig. 2 is a view in vertical section through the lower end of the drilling stem, showing the position which the bit assumes when it is being lowered or elevated through the drill stem;

Fig. 3 is a view in vertical section through a well bore, showing the drill stem disposed therein with my improved drilling bit assembled thereon for operation, this figure being taken at 90° to Fig. 1; and

50 Fig. 4 is a transverse sectional view taken on line IV—IV of Fig. 3.

Referring more particularly to the accompanying drawings, in Figs. 1 and 2 I have illustrated a well bore 10 within which a drill stem or drilling string 11 is suspended. The upper end of this
55 drilling string in practice is fitted with a kelly bar

and operatively connected with a rotary drill table for operation. It is, of course, also associated with a rotary hose and draw works, but as all of this is standard practice, it is not illustrated.

The lower end of the drilling string or drill stem 60 is fitted with what I prefer to term a drilling shoe 12, the internal diameter of which agrees with the internal diameter of the drill stem proper. At its lower end the drilling shoe 12 is formed with two opposed slots 14 which project upwardly from
65 the lower terminal of the drilling shoe 12.

The present invention contemplates the provision of a collapsible drilling bit which agrees somewhat in form with the "fish-tail" type of drilling bit utilized in rotary drilling practice. It is to
70 be understood that although the "fish-tail" type of bit is illustrated, my bit may assume the form of a rock or roller cutter bit without departing from the invention.

Due to the fact that the bit here illustrated and
75 described is collapsible, it may be lowered through the drilling string and be assembled for operation at the lower end of the drill stem or disconnected from the latter and elevated there-
80 through without the necessity of removing the drill stem from the bore. When the bit is connected to the lower end of the drill stem for operation, the connection is such that the weight of the drill stem may be imposed on the bit and
85 torque transmitted from the drilling string to the bit in order to accomplish the drilling operation.

The form of the bit which I have illustrated includes a hollow bit body 15 within which is
90 mounted a pair of flat blades 16. These blades are pivotally disposed on a transversely arranged pintle 17, supported at its ends in the hollow bit body 15. The bit body 15 is substantially cylindrical in external contour and is of an
95 external diameter enabling it to be freely reciprocated within the drilling string 11. The pivotal point of the blades 16 is located substantially centrally between the upper and lower ends of the blades.

It will be noticed that the lower ends of the
100 blades 16 are flared outwardly and are provided with cutting lower and side edges. The blades 16 are each provided with a lateral shoulder 18 at a point just above the flared lower ends. When the flared lower ends of the blades 16 are projected
105 radially outwardly through the slots 14 in the drilling shoe 12, the shoulders 18 engage the top of the slots 14 so as to form an abutment through which the weight of the drill stem may be imposed on the blades. As the flared ends of the
110

blades project through the slots 14, a keyed or torque-transmitting connection is provided between the blades and the drilling string in order that torque may be transmitted from the drilling

5 string to the blades.

At their upper ends, the blades are connected to toggle links 19, which links are connected together centrally between the upper ends of the blades and at this point they are connected to

10 a vertical link 20. The link 20 is pivotally connected to the lower end of a trip member 21, which is mounted for reciprocation co-axially of the body 15 in the upper head of the body. When this trip member 21 is moved to its uppermost

15 position, a toggle action will result which will collapse the bit by drawing the upper ends of the blades 16 toward each other and consequently withdraw the lower ends of the blades 16 to a position where they may freely pass through the

20 drill stem, as is illustrated most clearly in Fig. 2.

Coil springs 22 are provided and arranged within the body 15 and connected at their upper ends to the toggle mechanism at the point of connection between the toggle links 19. The

25 lower ends of the springs 22 are anchored to the hollow body 15, as most clearly illustrated in Fig. 3. It is obvious that inasmuch as these springs 22 exert a constant downward pull on the toggle mechanism, they will constantly tend to maintain

30 the drilling bit expanded to drilling position.

In order to deliver circulating fluid to the cutting edges of the blades 16, the upper head of the hollow drill body 15 is provided with circulating passageways 23. The blades 16 are likewise

35 formed with circulating passageways 24. The arrangement of these passageways is such that fluid pumped downwardly through the drilling stem will pass through the passageways 23 into the hollow drill body 15, and thence through the

40 passageways 24 to the cutting surfaces at the lower ends of the blades.

In order properly to position my improved bit at the bottom of the drilling string, the same may be run downwardly through the drilling string on

45 a cable, as illustrated in dotted line in Fig. 1; or it may be forced to this position by means of a method and apparatus described and claimed in my co-pending application entitled "Drilling apparatus", filed November 7th, 1933, Serial No. 696,967.

50

It will be noticed that the drilling shoe 12 is provided with an internal annular shoulder 25 at the lower end, against which the lower end of the hollow drill body 15 will abut when the bit is positioned properly for expansion to a drilling position. To collapse the bit and withdraw it from

55 the drilling stem, a pull may be exerted on the trip member 21 either through the medium of a cable, as illustrated in dotted lines in Fig. 1, or through the medium of an apparatus such as described in my co-pending application just referred to. It will suffice to say that when an upward pull is exerted on the trip member 21, the springs 22 will first be overcome through the toggle mechanism and the latter will cause the upper

65 ends of the blades to move toward each other. This movement will withdraw the lower ends of the blades to a position disengaging them from the slots 14 and enabling them to pass upwardly

70 into the drill stem. When the trip member 21 has been moved upwardly to the limit of its movement, a continued pull thereon will move the drill body 15, together with the blades 16, upwardly through the drilling string.

75 In the operation of the bit, it is lowered down-

wardly through the drilling string, assuming, of course, that the latter is in place in the bore, either by means of a cable or otherwise. During the lowering movement the blades 16 will be in a collapsed condition so that they may pass

80 downwardly through the string. As the hollow drill barrel carrying the blades 16 reaches the lower end of the drilling string, and is positioned in the drilling shoe 12, two spring pressed dogs 26, which are mounted at the exterior of

85 the hollow drill body 15, will engage helical grooves 27 formed in the bore of the drilling shoe 12. Engagement of the dogs 26 with these grooves will cause the blades 16 to properly register with the slots 14 in the drilling shoe when the latter reach the proper position for expansion. When the blades come in register with the slots 14 and the lower end of the drill barrel engages the internal shoulder 25, the springs 22

90 will cause the bit to expand and the blades 16 will move radially outwardly through the slots 14 with the shoulders 18 on the blades abutting the tops of the slots 14, as illustrated in Fig. 1. Engagement of the blades 16 with the slots 14 completes a weight- and torque-transmitting connection between the blades and the drilling string, and the bit is then ready for operation.

95

Should the bit become dull or if, for any other reason, it should be desired to replace the bit, an upward pull is exerted on the trip member

100 21 so that the same will move upwardly relative to the drill body 15. This movement of the trip member will be accompanied by collapsing of the bit or radial inward movement of the blades 16. When the trip member reaches the

110 upper limit of its movement relative to the drill body 15, a further pull exerted thereon will cause the drill body 15 and the blades 16 carried thereby to move upwardly through the drilling string.

It is obvious from the foregoing that my improved drilling bit may be replaced expeditiously when it becomes dull, or replaced by a different type bit, when a different formation is encountered, without the necessity of removing

115 the drill stem from the well bore.

While I have shown the preferred form of my invention, it is to be understood that various changes may be made in its construction by those skilled in the art without departing from the spirit of the invention as defined in the appended

120 claims.

Having described my invention, what I claim and desire to secure by Letters Patent is—

1. A drilling apparatus of the character described including a drill stem, a drilling bit including a bit body, a pair of centrally pivoted blades capable of relative pivotal movement mounted in the body, a toggle mechanism connecting the upper ends of the blades, spring means connecting the toggle mechanism to the

130 body and constantly tending relatively to expand the blades through the toggle mechanism.

2. A drilling apparatus of the character described including a drill stem, a drilling bit including a bit body, a pair of centrally pivoted blades capable of relative pivotal movement mounted in the body, a toggle mechanism connecting the upper ends of the blades, spring means connecting the toggle mechanism to the

140 body and constantly tending relatively to expand the blades through the toggle mechanism, and complementary means on the bit and drill stem forming a weight- and torque-transmitting connection between the stem and bit when the lat-

145

150

ter is positioned and expanded for operation at the lower end of the stem.

3. A drilling apparatus of the character described including a drill stem, a collapsible drilling bit including a bit body, a pair of centrally pivoted and relatively movable blades mounted in the body, a toggle connection between the upper ends of the blades, spring means connecting the toggle connection to said body and constantly tending to move the lower ends of the blades radially outward through the toggle connection, means connected with said toggle connection enabling a pull to be exerted thereon from above the body to overcome the influence of said spring means, and complementary means on the bit and stem forming a weight- and torque-transmitting connection between the stem and bit when the latter is expanded and properly positioned at the lower end of the stem, said bit being capable of passing through the stem when the bit is collapsed.

4. A drilling apparatus of the character described including a drilling stem, a collapsible drilling bit including a hollow cylindrical bit

body of a diameter somewhat less than the internal diameter of the drilling stem, a pair of centrally pivoted blades carried by the bit body, a toggle connection between the upper ends of the blades, spring means interposed between the toggle connection and the bit body and constantly tending to move the lower ends of the blades radially outward in opposition to each other, a member carried by the bit body and projecting above the upper end thereof and connected with said toggle connection to cause relative radial inward movement of the lower ends of the blades when an upward pull is exerted on said member, said drill stem having slots formed in its lower end through which said blades are adapted to project when the blades are moved radially outward, and means for positively placing said blades in register with said slots when the bit has been lowered in the drill stem to operative position relative to the stem, said bit being capable of passing through the drill stem when the blades are moved to their innermost position.

CLINTON L. WALKER.

25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150