Granville A. Humason, Inventor.

by Jesse R. Stone

His Attorney.
To all whom it may concern:

Be it known that I, GRANVILLE A. HUMASON, a citizen of the United States, residing at Houston, Harris county, Texas, have invented a certain new and useful Improvement in Rotary Boring-Drills, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in rotary boring drills of the collapsible type sometimes called underreamers. The object of my invention is to provide a drill which may be introduced into the well and again withdrawn without also removing the drill stem. Another object is to provide a drill of the character referred to, which will be collapsible and yet strong and serviceable and capable of drilling in both rock and softer formation. Another object is to provide means to hold the bit securely in expanded position but which will also allow the bit to be readily collapsed when it is desired to withdraw the same from the well.

While drilling wells in many formations it is a difficult or impossible matter to withdraw the drill stem or casing from the well without causing the walls of the well to cave in and fill up the portion of the well already dug. When the well is deep the whole well is sometimes ruined thereby. This is especially true in quicksand or heaving shale. In such formations it is usually necessary to go to great expense to freeze the walls of the well to prevent caving when the drill is withdrawn for repairs or sharpening.

The manner in which I contemplate overcoming these obstacles will be apparent in the specification which follows and will be set forth with particularity in the claims.

Referring to the drawings forming a part of this specification and in which like parts are designated by like numerals of reference throughout the several views; Figure 1 is a central longitudinal section of my device showing the bit in operative position, the central portion thereof being in elevation. Figure 2 is a similar section through the drill stem showing the bit in elevation but with the parts in collapsed position. Figure 3 is a bottom plan view of this embodiment of my invention. Figure 4 is a broken detail showing the means for locking my bit in operative position taken at right angles to the position of the same illustrated in Figure 2. Figure 5 is a transverse section taken on the line 5-5 of Figure 1. Figure 6 is a similar section taken on the line 6-6 of Figure 1. Figure 7 is a transverse sectional view of a drill stem showing the use of a different design of cutter for the drill head. Figure 8 is a bottom plan view of the bit shown in Figure 7. Figure 9 is a transverse section taken on the line 9-9 of Figure 1. Figure 10 is a transverse section of the lower end of the drill stem used with my invention.

My collapsible bit is composed of a head shaped like a flattened cylinder at the lower end and longitudinally divided to provide two side sections 1, each having a reduced upper shank 2. The two flattened sides of the reduced shank 3 extend upwardly about midway of said shank, the upper section 5 of the shank being cylindrical in shape so as to fit closely within the drill stem when expanded into the position shown in Figure 1. The construction of the said shank 2 with cylindrical upper portion 5, leaves a shoulder 4 at the lower end of the cylindrical portion, which is adapted, when the bit is expanded into operative position, to rest upon a flange 8 on the lower end of the drill stem 9 in which the bit is adapted to operate. The flange 8, as shown particularly in Figures 8 and 9, projects inwardly from the lower end of the casing to form a shoulder upon which the bit may rest. The flattened face 3 of the shank below the shoulder 4 thus fits non rotatably between the two flattened sides of the flange 8, causing the bit to rotate with the drill stem. The head 1 is divided longitudinally along a central plane 6 and has rotatable cutters 7 of which I have shown two in number on the lower end thereof. The exact shape and type of cutters which may be used can be varied and may be of any ordinary construction, the same forming no part of my invention.

The upper end of the shank 2 of the bit is beveled inwardly toward the divided plane 6, as shown at 10. This provides a wedge-shaped seat on the upper end of the bit to serve in expanding the head as will later described. The interior faces of the two side sections composing the head 1 are...
recessed inwardly at 12 to provide a sliding key-way for a mortised portion 13 of a central section 14, which constitutes an important feature of my bit.

The central removable section 14 is an elongated bar rectangular in cross section as shown in Fig. 6 and extending upwardly for some distance within the lower section of drill pipe 9. This section is pivoted at its upper end to a pin 15 and has at its lower end two downwardly projecting arms 16 which are bored to provide a seat for a pin 17 upon which are mounted a plurality of rotatable cutters 18. At a point spaced above the lower cutters 18 on said shaft is fixed a flattened block or plate 19. This block, as will be noted, is fixed at a point a sufficient distance above the cutters to accommodate the length of the head 1 of the bit so that when the central section 14 is moved downwardly between the sections 1, a sufficient distance to place the cutters 18 in operating position, the block 19 will contact with the upper surface of the head.

A shoulder 11 is also provided in such position as to contact with the flange 8 of the pipe 9, when the bit is operating. Projecting upwardly from the two side sections of the head 1 are bolts or rods 20 having enlarged heads 21 thereon. These rods 20 are adapted to fit slidably within openings 22 within the plate 19. The holes 22 are somewhat elongated laterally to provide space for movement inwardly of the two sides of the head when the bit is collapsed. The two lateral faces of the central section 14 are recessed slightly immediately above the plate 19, as shown at 23, thus providing a space to accommodate the heads 21 of the two rods 20 when the bit is in collapsed position, shown in Fig. 2.

The upper end of the lower pipe section 9 of the drill stem is threaded with a special coupling 24 which serves to connect the said lower section with an ordinary drill stem 25. The coupling member 24 is somewhat elongated and has an intermediate annular recess 26 therein to accommodate the expansion of a toggle joint by which the central section 14 of the bit is operated and secured.

This toggle joint is composed of two short sections 27 pivoted at their lower ends to the pin 15 on the section 14 and, at a point somewhat spaced from their upper ends, to pins 28. The pins 28 serve also for the pivotal connection of two somewhat similar upper arms 29 of the said toggle joint. The upper ends of the sections 29 are pivoted to the pin 30 connecting the said sections 29 with the upper attaching block 31 which serves to connect the said toggle with a supporting means not shown, an upper threaded nipple 32 being provided for said attachment. The attaching block 31 is cylindrical in shape and provided with longitudinal water passages 33 to allow a channel for the downward flow of flushing water to the bit. The block 31 also serves as a piston in that excessive water pressure upon it will force it and the bit downwardly.

The flushing water passes downwardly through the bit to issue in the neighborhood of the rotating cutters, through channels 34 in the two opposite keys 13 on the side of the central section 14 of the bit.

When my improved bit is to be inserted within the casing or drill stem within the well it is lowered downwardly therein by means of a cable or rod having a means for detachable connection with the threaded nipple 32 of the bit and allowed to pass downwardly to the end of the said drill stem. When being inserted within the well, the bit will be supported in the position shown in Fig. 2. The toggle joint connection between the supporting block 31 and the central section 14 will be collapsed as shown above and the lower sections 1, of the bit, will be supported by means of the rods 20 upon the block 19. When the bit has reached the lower end of the casing it will be adjusted so that the flattened head will pass between the two flanges 8 upon the drill stem. This operation may be readily performed by giving the head a partial rotation (provided it does not readily pass between the said flanges 8) until it assumes the proper position to drop downwardly between the same, thus allowing the shoulder 4 on the shank of the bit to rest upon the upper face of the flanges 8. When in this position, the central section 14 may be dropped downwardly with some force against the beveled seat 10 in the upper end of the shank 2 of the bit, thereby forcing the two side sections laterally and passing downwardly between the same until the plate 19 contacts with the upper end of the shank 2 and the shoulder 11 rests on the flange 8. When in its lowest position the keys 13 fit within the key-ways 12 in the inner faces of the two side sections of the bit as shown in section in Fig. 1. When in this position the weight of the attaching block 31 and the cable attached thereto will force the said block downwardly expanding the toggle connection between the block and the section 14 of the bit and will force the outer ends of the sections 27 of the toggle into the seat 26 in the coupling 24. When in this position upward movement of the section 14 against the toggle will be impossible and the toggle will thus serve to retain the parts of the bit firmly in operative position. Downward force may be exerted upon the bit at any time by pumping an excess of water down against the attaching block 31 in an obvious manner.

When the bit is to be withdrawn from the well the cable attached to the block 31 will pull upwardly on the toggle, thus serving to
collapse the same into the position shown in Fig. 2 and will exert an upward pull on the section 14 of the bit. This will serve to draw the section 14 upwardly from between the expanded sections thereof until the block 19 strikes against the heads 21 of the rods 20, thereby exerting an upward pull upon the expanded sections of the bit. In order that the expanded sections may be forced together when the central section 14 is withdrawn from between them, a coiled spring 44 may be set in the outer rounded face of each of the side sections of the bit at a point thereon immediately above the upper head 1 of the bit. These coiled springs 44 are housed in recesses in the sides of the bit at the point described and are provided with a protecting cap 35 to prevent sand or earth from clogging the action of the springs.

When the two side sections of the bit are forced outwardly by the central section 14 these springs are compressed, but when the central section 14 is withdrawn, the springs 44 will serve to force the said side sections toward each other into the position shown in Fig. 2, thus allowing the bit to be drawn upwardly through the drill stem. The bit may be provided with reaming cutters 36, housed in the rounded sides thereof, if desired, said reaming cutters being, however, no part of my invention. The flushing water finds its way downwardly through the channels 33 and the channels 34 in the key 13 to the cutters on the lower end of the bit, thus serving to wash away the cuttings in the usual manner. The keys 13, fitting within the key-ways 12 in the inner faces of the side sections serve to hold the three sections of the bit more firmly together.

In the modified embodiment of my improved bit, illustrated in Figs. 7 and 8, the operative parts are identical in every way with that shown in the embodiment just described, except as to the lower parts of the bit itself illustrated in these two figures. The upper shank 2 of the bit is composed of two sections to the lower inner faces of which are detachably connected the cutting blades 7'. These blades are adapted to fit within irregular recesses 37 in the inner lower faces of the section to which they are detachably connected by means of dovetail keys 38 fitting partly within the blades 7' and partly within the sections of the shank.

They are also held in assembled position with the sections by means of bolts 39 threaded through the sections in the manner shown in Fig. 7. The two side sections may be expanded in the same manner as described in the embodiment shown in Figs. 1 to 6 by means of a central longitudinally movable section 14' having a fish tailed blade 40 on the lower end thereof. In this embodiment of my invention, the springs 34 are dispensed with, it being found that when the upper shoulders of the blades 7' are beveled inwardly as shown at 41 on the upper outer faces thereof, upward tension upon the rods 20, when the section 14' has been removed, will cause the two side sections to move inwardly and thus allow an upward movement of the head within the drill stem.

The type of bit illustrated in this embodiment is adapted to operate in soft materials such as clay, sand or gumbo, and is shown here simply to illustrate the fact that the novel idea constituting my invention may be applied to bits with roller cutters, such as shown in Figs. 1 to 3, inclusive, or with the fish tail blade illustrated in Figs. 7 and 8, with equal facility. A device is thus provided which is simple and rugged in structure and which may not be easily damaged or broken and which is adapted to operate accurately at all times to expand or contract as desired.

Having thus described my invention, the advantages and objects of which will be apparent without further description, what I claim as new, and desire to protect by Letters Patent, is:

1. In a collapsible bit, a drill stem, a divided head, cutters on the lower end thereof, a separate flattened central section, cutters on the lower end thereof, means connected with said central section to introduce the head downward into the drill stem and through the lower end thereof, said central section adapted to then expand the head by wedging between the sections of the divided head in the manner described.

2. In a collapsible bit, a drill stem, a flanged section on the lower end thereof, a flattened divided head the shank of which has a cylindrical upper end forming a shoulder adapted to rest on said flange, a central section, means to force the central section into operative position to expand said head and cutters on said head and said central section.

3. In a collapsible drill bit, a divided head, comprising three longitudinal sections, cutters on said sections, the central section adapted to be withdrawn from said head, and means to then collapse said remaining sections.

4. A collapsible bit comprising two side sections with a reduced upper shank, a drill stem, opposite inwardly projecting flanges thereon, shoulders on said shank adapted to rest on said flanges, and a slidable central section adapted to wedge the side sections into expanded position and retain them in that position.

5. A cross roller bit comprising a central cross roller mounted on a separate slidable section, two opposite inclined side cutters mounted on separate sections, means to withdraw the central section from between
the side sections and means to collapse the side sections so that they may be withdrawn from the drill stem.

6. In a collapsible bit, a head comprising two side sections and a removable central section, said central section being relatively elongated, a toggle joint pivoted thereto at its upper end, said toggle serving when expanded to fix said bit in the drill stem.

7. A collapsible bit comprising two side sections, means to expand the same comprising a central section, adapted to wedge between said side sections, and means to contract said bit when the central section is withdrawn comprising two springs in said side sections adapted to bear against the drill stem.

8. In a collapsible bit, a head comprising two side sections and an interfitting removable central section, means to withdraw said central section, a block on said central section, and headed rods on said side sections slidably in said block to withdraw said side sections after said central section.

9. In a collapsible bit, a drill stem, a head, the opposite walls of said stem being thickened to provide opposite flat inner faces, shoulders above said thickened walls, said head being flattened to pass between said walls and provided with projecting shoulders to contact with said first mentioned shoulders to support said head non-rotatably in said drill stem.

In testimony whereof I hereunto affix my signature this the 19th day of December, 1918.

GRANVILLE ALLISON HUMASON.