June 10, 1941. C. S. CADY 2,244,674

EXPANDING DRILL

Filed March 25, 1940

Fig. 1.

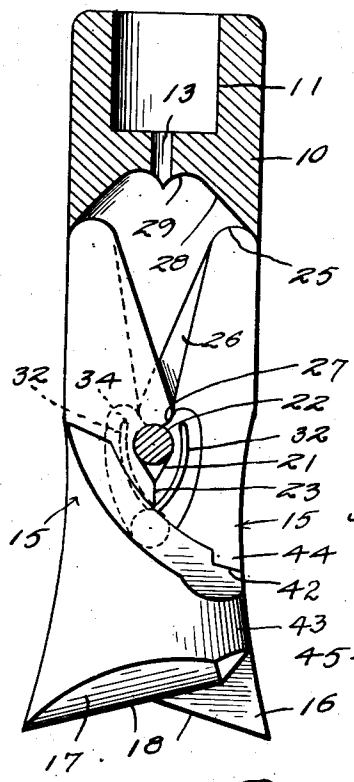



Fig. 2.

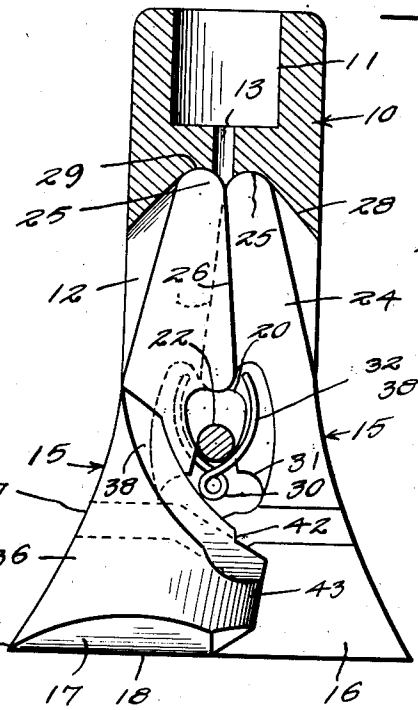



Fig. 5.

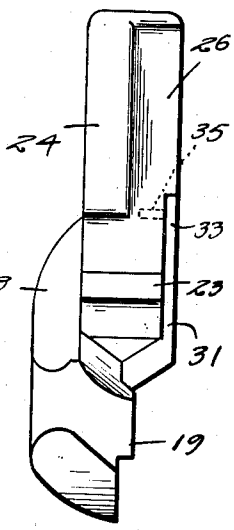
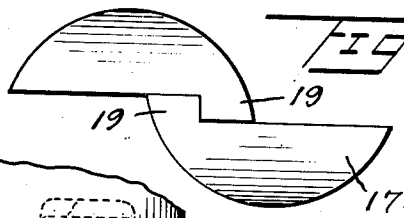



Fig. 3.



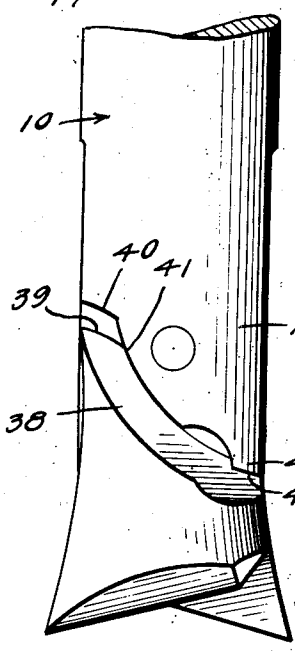




Fig. 4.

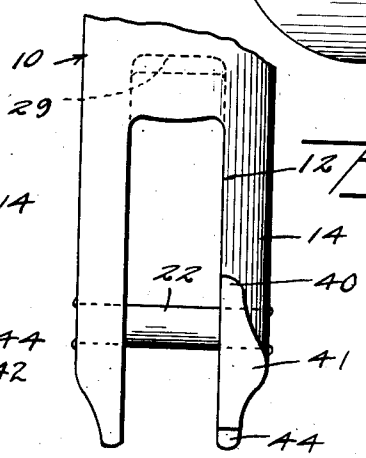



Fig. 6.

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# UNITED STATES PATENT OFFICE

2,244,674

## EXPANDING DRILL

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Application March 25, 1940, Serial No. 325,860

4 Claims. (Cl. 255—78)

This invention relates to expanding drills and more particularly to an expanding drill designed for use in drilling operations to enlarge the hole at the bottom thereof. This invention is an improvement over the drill structure embodied in Patent No. 1,450,053 which issued March 27, 1923.

An object of this invention is to provide in an expanding drill of this kind, an improved pair of expanding jaws which are so constructed that they are yieldably held in closed or retracted position and are adapted to be moved relative to each other to an expanding position when endwise pressure is applied to the lower ends of the blades.

Another object of this invention is to provide in an expanding drill of this kind, an improved means for holding the expanding blades in a retracted position so that the blades or jaws will not fall out of the shank or stock while being handled.

A further object of this invention is to provide an expanding drill of this kind which is provided with an improved means for limiting the expansion of the jaws or blades so as to distribute the strain applied to the jaws in a manner to prevent breaking or bending of the conforming parts of the jaws.

A still further object of this invention is to provide in a device of this kind, means for retracting or returning the jaws to their normal closed position when endwise pressure has been released from the lower ends of the jaws, so that these jaws will not drop off of the end of the stock or shank when the drill is removed from the well.

A further object of this invention is to provide a drill structure of this kind which includes a pair of swinging jaws or blades and means whereby the pivotal mounting of the jaws or cutters is relieved of strain during the cutting operation.

To the foregoing objects and to others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and illustrated in the accompanying drawing wherein are shown embodiments of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawing:

Figure 1 is a longitudinal section partly in detail of an expanding drill structure embodying my invention, the cutters or blades being shown in retracted position.

Figure 2 is a view similar to Figure 1 but showing the cutters or blades in extended position.

Figure 3 is a bottom plan of the cutters in extended position.

Figure 4 is a detail side elevation of the drill structure in retracted position.

Figure 5 is a detail side elevation of one of the cutters embodying my invention.

Figure 6 is a fragmentary side elevation of the lower portion of the cutter supporting shank or stock.

Referring to the drawing, the numeral 10 designates generally a shank or stock which is adapted to be secured at the lower end of a drill rod or operator. The shank or structure 10 is provided with an axial recess 11 within which the lower end of an operating rod or stem is adapted to be secured in a conventional manner, and the stock or shank 10 is provided with an axial bore 13 communicating at its upper end with the lower end of the recess or socket 11. The shank or stock 10 is provided at its lower end with a downwardly opening slot 12 forming a pair of bifurcated spaced apart arms 14.

A pair of cutters or jaws generally designated as 15 are rockably disposed within the slot 12 between the two arms 14 and the jaws 15 each comprising a lower blade portion 16 provided with a bevelled edge 17 and a straight keen edge 18. The cutters 15 are each provided with a flange or lug 19 on the inner face thereof and when the two cutter members 15 are in extended position the flanges or stop members 19 are adapted to engage with each other so as to thereby limit the outward swinging movement of the two cutters 15. The cutters 15 are provided in their inner edges with a partly circular recess 20 which merges with a downwardly and inwardly inclined substantially flat face 21, and when the two cutters 15 are in retracted position, the two flat faces 21 form a substantial V extending below a transversely disposed supporting pin 22 which extends between the two arms 14.

The blade 15 is also provided with a flat substantially vertical face 23. When the two cutters 15 are in a retractive position, the two flat faces 23 are adapted to contact with each other as shown in Figure 1.

The cutter 15 is provided with an upwardly extending lever or blade operating member 24 which tapers upwardly with the smaller end thereof uppermost and the upper end of the lever or operator 24 is rounded off as at 25. The two blades 15 are also provided with interengaging recess portions 26 along the inner faces of the levers 24 and the lower ends of these recesses are

rounded off as at 27 providing a fulcrum about which the levers 24 are adapted to rock.

The shank or stock 14 at the upper end of the slot 12 is provided with an upwardly and inwardly curved cam face 28 terminating in a seat 29 which is arcuate in configuration and is drawn on a relatively short radius. The head 25 of the lever 24 is adapted to engage in the seat 29 when the two blades 15 are in extended position as shown in Figure 2 so that the stock 10 will limit the inward swinging movement of the two levers or arms 24 at the upper ends of the arms 24. In addition, when the two levers 24 are in a blade or cutter expanding position, the interengaging portions 26 will be in fully engaged position with the inner confronting faces of the two levers 24 contacting with each other.

In order to provide a means whereby the two cutter members 15 may be yieldably held in a retracted position, I have provided a spring structure including a coil 30 which is adapted to engage in a recess 31 formed in the inner face of each blade member 15. The coil 30 is provided with a pair of upwardly directed arcuate arms 32 which engage in an upwardly extending arcuate recess 33 formed in the inner face of the blade 15 and extending upwardly into the lower portion of the lever or arm 24. The upper end of each spring arm 32 is provided with a right angular anchoring part 34 which tightly engages in a socket or recess 35 formed in the arm 24 and within the recess 33 adjacent the upper end thereof.

The two arms 32 are extended upwardly from the coil 30 with the concave side thereof innermost so that the arms 32 will at all times lie substantially within the recesses 33.

Each blade 15 comprises a body 36 which at its outer edge is provided with a concave portion 37 and the body 36 is formed with a downwardly and arcuately disposed bevelled face 38 at its upper edge. The upper end of the bevelled face 38 terminates in an outwardly extending end portion 39 which when the blade 15 is in an extended position, is adapted to engage a stop 40 formed in an arm 14. The arm 14 is also provided with a convex downwardly inclined lower portion 41 which is complementary to the concave bevelled face 38 and each body member 36 at the side thereof opposite from the concave side 37 is provided with a rabbet 42 which extends inwardly from the opposite or short side 43. The shank or stock 10 is provided with a lug or stop member 44 at its lower end which is adapted to engage in the rabbet 42 when the blades 15 are in a retracted position so as to provide a stop member to limit the rocking of the blades 15 when these blades are in a retracted position. This stop member 44 also provides a means whereby the spring structure embodying the coil 30 and the spring arms 32 will not force the blades 15 out from between the two arms 14 when the drill is being handled above the well or when the drill is being withdrawn from the bottom of the well. When the blades 15 engage the stop member 44, the arms 24 will have their outer edges substantially flush with the periphery or outer surface of the stock or shank 10 as shown in Figure 1.

In the use of this expanding drill, the shank 10 is initially mounted on the lower end of a drill rod or stem and the two cutter blades 15 will be yieldably held in a retracted position by the spring structure including the coil 30 and the upwardly extending arcuate arms 32. The lower straight edges 18 of the two blades 15 will at this time be disposed in an upwardly directed position forming an obtuse angle as shown in Figure 1 and the provision of the arcuate outer portion 37 of each blade 15 will dispose the points 45 in outwardly extended position with respect to the periphery of the stop or shank 10.

When endwise pressure is applied from above to the stock 10, the two blades 15 will be swung outwardly to an extended position similar to that shown in Figure 2 and at the same time the blades 15 will move upwardly relative to the stem 10 with the rounded heads 25 thereof riding upwardly and inwardly along the arcuate cam faces 28 until the heads 25 engage the seat 29. In this position the pin 22 will be disposed substantially between the two flat faces 23 and during the movement upwardly of the two plates 15 relative to the shank 10, the pin 22 will move downwardly between the two downwardly and inwardly inclined faces 21 which merge with the arcuate pin seat 20 so that the pin 22 will also assist in effecting an expansion of the lower ends of the two blades 15. When the two blades 15 are in their fully extended position, the stop members 19 carried by the inner faces of each blade 15, will engage each other so as to assist the heads 25 in holding the blades 15 against further extension.

An expanding drill constructed according to this invention will remain on the end of the drill stem or rod and when the stem or rod is withdrawn from the well and pressure is thereby relieved on the lower ends of the blades or cutters 15, the spring structure embodying the coil 30 and the spring arms 32 will assist in swinging the cutters or blades 15 to a retracted position. Through the provision of the recess or rabbeted portions 43 in each blade 15, the rabbeted portions 43 will engage the stop members 44 carried by the shank arms 14 so that the two blades 15 will be locked together in their retracted position and thus prevented from dropping off of the end of the stem or stock 10.

The expanding drill hereinbefore described can be manufactured out of forged material, and a drill constructed according to this invention will be stronger than drills which have been in use heretofore. This drill structure may be manufactured at a relatively small cost and at substantially the same or a smaller cost than drills heretofore in use, while at the same time, the expanding blades will be yieldably retained within the stock or shank of the drill so that these blades or cutters will not drop off at any time during the positioning or removal of the blades on the drill stem or rod or the positioning or removal of the drill structure within a well.

The pin 22 which extends between the arms 14 is preferably welded to the arms and provides a reinforcing means to prevent spreading of the arms. This pin may be removed by cutting or otherwise releasing the pin from the arms 14 where replacement of the pin is necessary.

What I claim is:

1. An expansion drill bit comprising a shank provided with a bifurcated lower end forming a pair of spaced supporting arms, a pin secured to and engaging between said arms for holding said arms against spreading, a pair of cutter members engaging between said arms, each of said cutter members comprising a lower blade and an upwardly tapering lever formed therewith and terminating at its upper end in a rounded head, each lever adjacent the lower end thereof being

formed with a recess to receive said pin, said recess having an arcuate upper seat portion and a downwardly and inwardly inclined substantially straight portion, said pin engaging with said recess, and a spring engaging said levers and constantly urging said levers to a blade retracting position.

2. An expansion drill bit comprising a shank provided with a bifurcated lower end forming a pair of spaced supporting arms, a pin secured to and engaging between said arms for holding said arms against spreading, a pair of cutter members engaging between said arms, each of said cutter members comprising a lower blade and an upwardly tapering lever formed therewith and terminating at its upper end in a rounded head, each lever adjacent the lower end thereof being formed with a recess to receive said pin, said recess having an arcuate upper seat portion and a downwardly and inwardly inclined substantially straight portion, said pin engaging with said recess, a pair of longitudinally arcuate spring arms fixed at one end thereof to said levers, and a coil integral with said spring arms and coacting therewith to constantly urge said levers to a blade retracting position.

3. An expansion drill bit comprising a shank provided with a bifurcated lower end forming a pair of spaced supporting arms, a pin secured to and engaging between said arms for holding said arms against spreading, a pair of cutter members engaging between said arms, each of said cutter members comprising a lower blade and an upwardly tapering lever formed therewith and terminating at its upper end in a rounded head, each lever adjacent the lower end thereof being formed with a recess to receive said pin, said recess having an arcuate upper seat portion and a downwardly and inwardly inclined substantially straight portion, said pin engaging with said recess, a pair of longitudinally arcuate spring arms fixed at one end thereof to said levers, a coil integral with said spring arms and coacting therewith to constantly urge said levers to a blade retracting position, and coacting stop means carried by said first arms at the lower ends thereof and by said blades at the upper ends thereof limiting the movement of said blades to a retracted position.

4. An expansion drill bit comprising a shank provided with a bifurcated lower end forming a pair of spaced supporting arms, a pin secured to and engaging between said arms for holding said arms against spreading, a pair of cutter members engaging between said arms, each of said cutter members comprising a lower blade and an upwardly tapering lever formed therewith and terminating at its upper end in a rounded head, each lever adjacent the lower end thereof being formed with a recess to receive said pin, said recess having an arcuate upper seat portion, said pin engaging with said recess, a pair of longitudinally arcuate spring arms fixed at one end thereof to said levers, a coil integral with said spring arms and coacting therewith to constantly urge said levers to a blade retracting position, coacting stop means carried by said first arms at the lower ends thereof and by said blades at the upper ends thereof limiting the movement of said blades to a retracted position, each of said blades having a downwardly and outwardly curved outer edge and having a lower cutting edge substantially greater in length than the diameter of said shank.

CARL S. CADY.