

Aug. 29, 1961

R. L. CASADY ET AL

2,998,074

OIL AND GAS WELL CLEANING APPARATUS

Filed Aug. 11, 1959

2 Sheets-Sheet 1

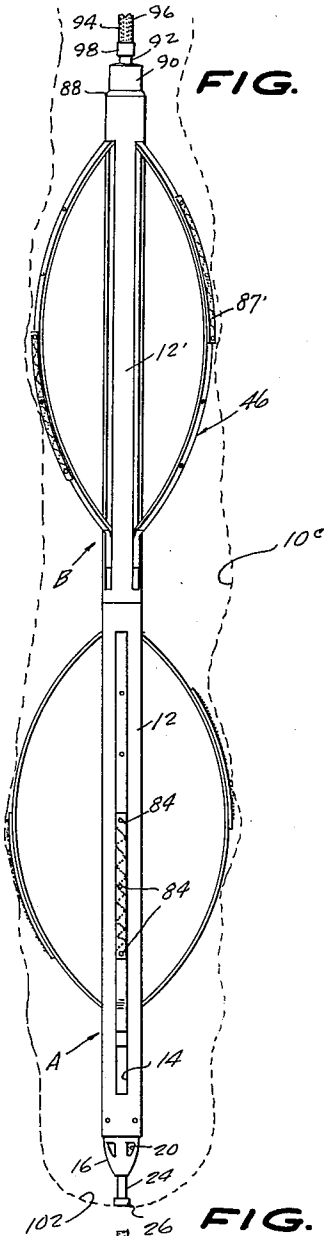


FIG. 1.

FIG. 2.

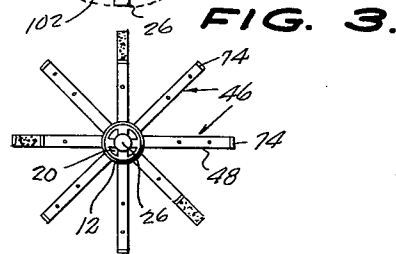
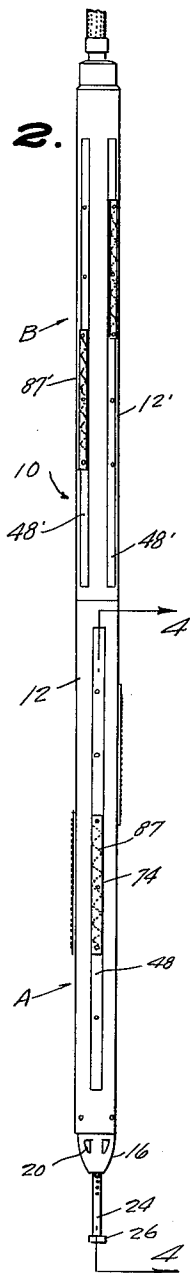


FIG. 3.

INVENTORS
RICHARD L. CASADY,
JAMES D. MOONEYHAM,
BY

McMorrow, Berman & Davidson
ATTORNEYS.

Aug. 29, 1961

R. L. CASADY ET AL

2,998,074

OIL AND GAS WELL CLEANING APPARATUS

Filed Aug. 11, 1959

2 Sheets-Sheet 2

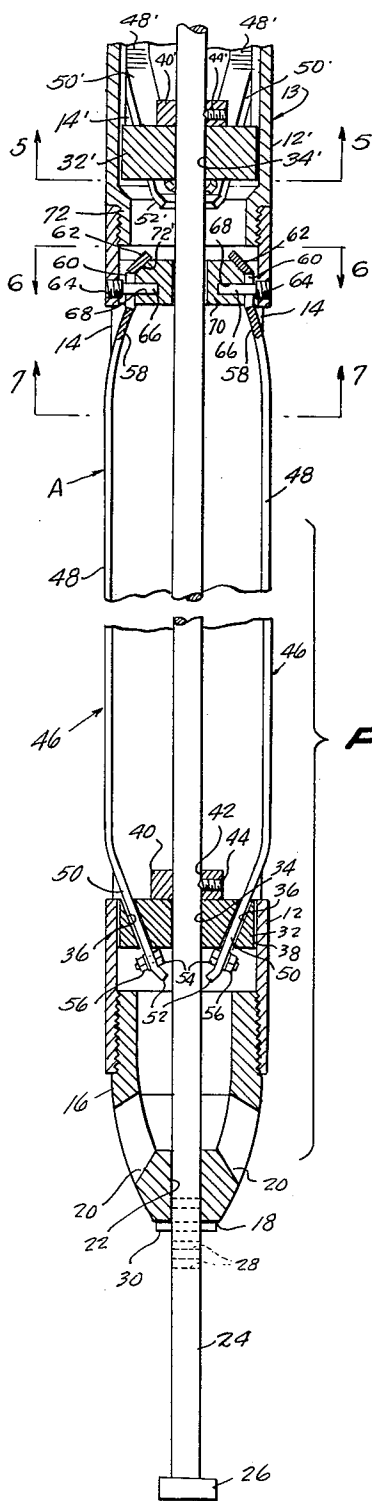


FIG. 5.

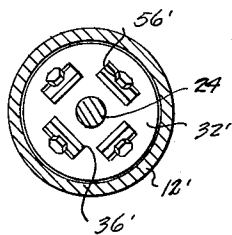


FIG. 6.

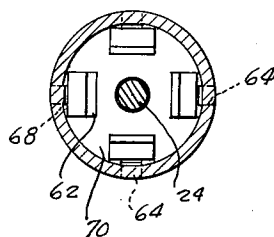


FIG. 7.

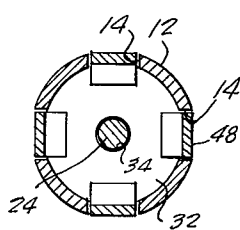
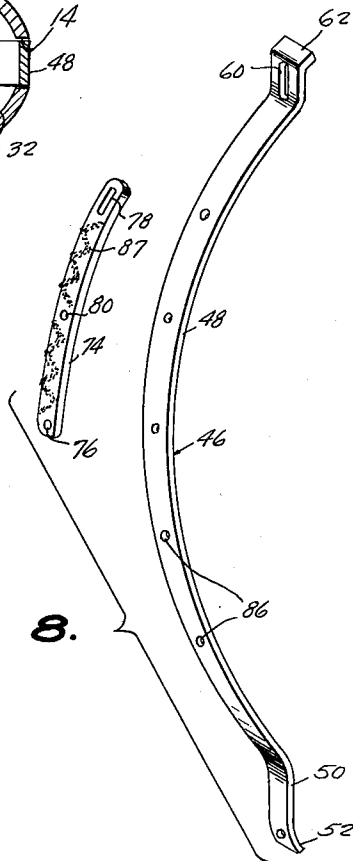


FIG. 4.

FIG. 8.



INVENTORS
RICHARD L. CASADY,
JAMES D. MOONEYHAM,
BY

McMorrow, Bertram & Davidson
ATTORNEYS

1

2,998,074

OIL AND GAS WELL CLEANING APPARATUS
Richard L. Casady and James D. Mooneyham, Liberal,
Kans., assignors to Camo Tool Company, Inc., a corporation of Kansas

Filed Aug. 11, 1959, Ser. No. 833,104

7 Claims. (Cl. 166-172)

This invention relates to the general class of earth boring tools and, more specifically, the instant invention pertains to boring apparatus primarily adapted for use in oil or gas wells to enlarge the bore opposite the oil or gas bearing stratus and to clean foreign matter from the inner surfaces of the wells.

One of the primary objects of this invention is to provide a boring or cleaning device for oil and gas wells having open formation which lends itself to rapid and efficient removal of foreign deposits on the inner wall of the well, to increase the flow of the gas or oil and thereby to increase the production thereof.

As is well known to those in the practice of this art, the surface of the cavity wall of an oil or gas well frequently becomes practically impervious to the oil or gas contained in the adjacent oil or gas bearing stratum. This sealed condition of the wall of the well is usually caused by the coating thereof with fine sand, paraffin, asphaltum or other compositions all depending upon the nature of the stratum formation. This, of course, results in the reduction in the productivity of the well and, in accordance with some practices, frequently requires that the well be "shot." Such attempts to alleviate or remove this internal coating is not generally successful inasmuch as the force of the explosion causes the pores of the gas or oil bearing stratum to become clogged with the very materials sought to be dispersed. Thus, it is another object of this invention to provide a well cleaning tool which lends itself to the rapid and efficient removal of such foreign deposits as may accumulate on the inner wall of a gas or oil well regardless of the nature thereof.

It is a further object of this invention to provide well cleaning apparatus which is positive in operation and which may be readily inserted into and withdrawn from the well.

This invention has, as a still further object thereof, the provision of gas and oil well cleaning apparatus including a plurality of cleaning blades which are expandable from their inactive contracted positions to their respective expanded operative positions upon engagement of the apparatus or tool with the bottom of the well.

Still another object of this invention is to provide apparatus of the type generally described supra, the apparatus being readily connected with a conventional drill string or tubing without the use of special tools or without making modifications therein.

This invention contemplates, as still another object thereof, the provision of drilling apparatus of the type described above, the apparatus being non-complex in construction and assembly, inexpensive to manufacture and durable in use.

Other and further objects and advantages of the instant invention will become more evident from a consideration of the following specification when read in conjunction with the annexed drawings, in which:

FIGURE 1 is a side elevational view of gas and oil well cleaning apparatus constructed in accordance with this invention, FIGURE 1 illustrating the blades of the apparatus expanded to their operative positions within a gas or oil well;

FIGURE 2 is a side elevational view of the gas or oil well cleaning apparatus shown in FIGURE 1, FIG-

2

URE 2 illustrating the apparatus with the blades thereof retracted to their inoperative positions;

FIGURE 3 is a bottom plan view of the apparatus illustrated in FIGURE 1, FIGURE 3 also showing the cleaning blades in their expanded positions;

FIGURE 4 is an enlarged fragmentary detail cross-sectional view of the gas or oil well cleaning apparatus, FIGURE 4 being taken substantially on the vertical plane of line 4-4 of FIGURE 2, looking in the direction of the arrows;

FIGURE 5 is a detail cross-sectional view taken substantially on the horizontal plane of line 5-5 of FIGURE 4, looking in the direction of the arrows;

FIGURE 6 is a detail cross-sectional view, FIGURE 6 being taken substantially on the horizontal plane of line 6-6 of FIGURE 4, looking in the direction of the arrows;

FIGURE 7 is a detail cross-sectional view, FIGURE 7 being taken substantially on the horizontal plane of line 7-7 of FIGURE 4, looking in the direction of the arrows; and,

FIGURE 8 is an exploded perspective view of one of the cleaning blade assemblies.

Referring now more specifically to the drawings, reference numeral 10 designates, in general, oil or gas well cleaning apparatus constructed in accordance with the teachings of this invention. As disclosed, the apparatus 10 includes a basic unit indicated at A and one or more secondary or intermediate units B, only one of the latter being shown to eliminate needless repetition.

The unit A is seen to comprise an elongated length of hollow cylindrical tubing 12 internally threaded adjacent its opposed upper and lower ends. The tubing 12, intermediate the ends thereof, is formed with a plurality of circumferentially spaced, axially extending, elongated substantially rectangular slots 14.

Threaded into the lower end of the tubing 12 is an inverted substantially hollow, elongated, ogive-shaped push rod guide 16 truncated at the apex end 18 thereof. To serve functions to be described infra, the push rod guide 16 is formed with a plurality of circumferentially spaced, transversely extending, and downwardly opening passages 20, and an axially extending bore 22. The guide 16 and the tubing 14 together with its associated component elements are mounted for reciprocation on a push rod 24 which extends through the bore 22 into and beyond the upper end of the tubing 12 and is coaxial with respect thereto. The lower end of the push rod 24 terminates in an enlarged ground engaging abutment head 26, and adjacent the truncated end of the guide 16 the push rod 24 is formed with a plurality of axially spaced diametrically extending passages 28 adapted to selectively receive a shear pin 30 therethrough.

As is seen in the drawings, a substantially solid cylindrical disc 32 is constructed with a centrally positioned bore 34 extending transversely therethrough to slidably receive a portion of said push rod 24. To serve a function to be described, the disc 32 is also provided with a plurality of circumferentially spaced substantially rectangular cutting blade guide passages 36 which open into the plane of the upper side of the disc 32 adjacent the circumferential marginal edge thereof and extend downwardly at an acute angle with respect to the longitudinal axis of the push rod 24 to open into the plane of the lower side of the disc 32 intermediate the side 38 and the bore 34. Superimposed on the upper side of the disc 32 is a cylindrical stop collar 40 having a central bore 42 extending therethrough in which is received the push rod 24. The collar 40 is releasably secured to the push rod 24 by a set screw 44.

Reference numeral 46 denotes one of a plurality of elongated substantially rectangular cutting blades 46

formed of a flexible resilient material such as, for example, spring steel, and each cutting blade includes an elongated bight portion 48 having integrally connected to the lower end thereof a laterally offset arm 50 which is loosely received within, respectively, the blade guide passages 36 and extend at an acute angle with respect to the longitudinal axis of the push rod 24. The outer ends of each of the arms 50 terminate in tongues 52 bent inwardly towards the push rod 24.

As is clearly shown in FIGURE 4, each of the arms 50 are apertured adjacent its tongue 52 and receive there-through a stop bolt 54 secured thereon by a nut 56. The stop bolts 54 serve to prevent the upward withdrawal of the blades 46 through the passages 36.

The upper ends of the bights 48 of the blades 46 are integral with arms 58 laterally offset from the former in the opposite direction with respect to arms 50 and are inclined towards the axis of the push rod 24 at an acute angle. The upper ends of the arms 58 are bent substantially parallel to the axis of the push rod 24 and are apertured at 60 to serve in a manner to be described. The outer upper ends of the arms 58 terminate in inwardly projecting tongues 62 which are also inclined at an acute angle with respect to the axis of the push rod 24.

The tubing 12 adjacent its upper end is formed with a plurality of tapped circumferentially spaced openings which threadedly receive the externally threaded heads 64 of a plurality of bolts having smooth shanks 66, the latter loosely traversing the apertures 60 and extend into cylindrical sockets 68 which radiate at circumferentially spaced intervals in a second disc 70 having a chamfered upper peripheral side 72' adapted to seat against the inner sides of the tongues 62.

The unit B is similar in construction with respect to the unit A with but few exceptions, and to avoid needless iteration, elements thereof having counterparts in the unit A have been assigned the same reference numerals to which a prime mark has been added to differentiate one from the other.

As is illustrated clearly in FIGURE 4, the lower end of the tubing 12' instead of receiving an ogive-shaped push rod guide, is necked down to form an axially externally threaded extension 72 that is threadedly connected to the internally threaded upper end of the tubing 12. In all other respects the two units A and B are identical.

It should be here noted that while the drawings illustrate the use of only one of the units B, it is to be understood, of course, that two or more of these units could be threadedly connected together if so desired.

Referring now again more specifically to FIGURES 1, 2 and 8 of the drawings, it is seen that each of the cutting blades 46 is provided with an elongated substantially rectangular scraper plate 74 constructed of a flexible resilient material. One end of the scraper 74 is provided with a bolt hole 76 while the opposed end is formed with a longitudinally extending substantially rectangular bolt receiving slot 78. The scraper 74, substantially centrally of the ends thereof, is provided with a second bolt hole 80. A plurality of bolts 84 (see FIGURE 1) extend through the bolt holes 76, 78 and 80 and are selectively engaged within any sequential series of bolt holes 86 formed in the blade 46, the bolt holes 86 being disposed in longitudinally spaced relation relative to each other. Each of the plates 74 are formed with zigzag raised roughened ribs 87 to abrade the side of the well.

To utilize the apparatus described immediately above, the upper end of the tubing 12' is fixedly connected to a collar 88 which is, in turn, threadedly connected with the lower end of a swedge 90 having an externally threaded upwardly projecting neck 92. Reference numeral 94 denotes an elongated substantially hollow tubular member formed with a plurality of fluid outlet perforations 96, the element 94 being known in the art as a "pup joint" or "fishing neck." The lower end of the

pup joint 94 is connected to the neck 92 by means of a conventional coupler member 98.

The pup joint 94 is constructed in a conventional manner with a one-way check valve at the lower end thereof (not shown) and the upper end of the pup joint 94 is threadedly connected to the lower end of a drill string (not shown) which is, in turn, connected with a source of drilling fluid under pressure. Conventional means are also provided and are shown herein for effecting the rotation of the drill string and consequently of the two tubing members 12, 12'.

The well cleaning and scraping apparatus 10 is adapted to be lowered through a well casing to a point below the lower end thereof, the blades 46, while this operation is being carried out, being disposed in their retracted positions as is illustrated in FIGURES 2 and 4 of the drawings. To retract the cutting blades from their extended positions as is illustrated in FIGURE 1 to their retracted positions of FIGURES 2 and 4, the push rod 24 is moved outwardly and downwardly away from the push rod guide 16 until the desired one of the diametrically extending passages 28 is drawn beyond the truncated apex end 18 after which the shear pin 30 is inserted therethrough. The tension of the blades 46 is such as to cause the shear pin 30 to engage tightly against the truncated end 18 upon release of the push rod 24. In moving the push rod 24 downwardly, the collar 40 exerts a pressure on the upper side of the disc 32 causing the same to move downwardly relative to the tubing 12 until the push rod 24 is locked against movement in the manner described above.

After the apparatus 10 passes below the lower end of the well casing it enters the gas or oil well bearing stratum 100, and the enlarged abutment head 26 is caused to engage against the bottom of the well 102 (see FIGURE 1). The weight of the apparatus 10 plus the weight of the drill stem (not shown) is sufficiently great to cause the units A, B to move downwardly and axially with respect to the push rod 24 and shears the pin 30. After the pin 18 has been sheared continued downward movement of the tubing 12, 12' causes the blades 46 to bow outwardly and to project beyond the slots 14.

It should be here observed that when the disc 32 has been moved downwardly to its lowermost position and secured therein by means of the shear pin 30, the disc 32' has also been moved downwardly under the force exerted by the collar 40' which is also secured to the push rod 24. Thus the shear pin 30 holds the rod 24 stationary with both sets of blades 48, 48' disposed in their retracted position. At the same time, and upon shearing of the pin 30, both sets of blades 48, 48' are caused to expand through their respective slots in the manner described above.

When the blades 48, 48' have been released, fluid is transmitted through the drill stem and is sprayed through the pup joint and fishing neck 94 to wash the face of the gas or oil bearing stratum. The tubing 48, 48' being rotatably driven causes the blades 48 and the scraper blades 74 to cut and abrade the side wall of the well thereby freeing the same of its accumulated hardened debris and restoring the normal flow of the gas and/or oil.

Upon completion of the cleaning operation the tubing 12, 12' is drawn through the well casing together with the drill string in the conventional manner.

Having described and illustrated one embodiment of this invention, it is to be understood that the same is offered merely by way of example, and that this invention is to be limited only by the scope of the appended claims.

What is claimed is:

1. A tool of the character described comprising an elongated cylindrical tube having an open upper end and a closed lower end, means on said upper end for connecting said tube with rotating means, an elongated push rod mounted for reciprocation through said lower end, said push rod having a portion disposed internally of said

tube and a lower end portion extending below said closed end, a disc mounted for free reciprocation on said push rod adjacent said closed end and being free to reciprocate within said tube, a collar fixedly secured to said push rod and normally engaging the upper side of said disc, said disc having a plurality of guide passages extending vertically therethrough, said passages being angled inwardly toward said closed end at acute angles relative to the axis of the push rod, the side wall of said tube having a plurality of longitudinal slots therein, an arcuately shaped spring blade disposed in each of said slots, said blades having main portions normally extending beyond the exterior of the tube, said blades having lower ends extending through said guide passages, means on said lower ends engaging the lower side of said disc to prevent upward withdrawal from said guide slots, a second disc having a bore slidably receiving said push rod, said second disc being disposed adjacent said upper end of the tube, said blades having upper ends connected with said second disc, said closed lower end having a plurality of passages extending therethrough for passing material cut by said blades into the tube.

2. A tool of the character described comprising an elongated cylindrical tube having an open upper end and a closed lower end, means on said upper end for connecting said tube with rotating means, an elongated push rod mounted for reciprocation through said lower end, said push rod having a portion disposed internally of said tube and a lower end portion extending below said closed end, a disc mounted for free reciprocation on said push rod adjacent said closed end and being free to reciprocate within said tube, a collar fixedly secured to said push rod and normally engaging the upper side of said disc, said disc having a plurality of guide passages extending vertically therethrough, said passages being angled inwardly toward said closed end at acute angles relative to the axis of the push rod, the side wall of said tube having a plurality of longitudinal slots therein, an arcuately shaped spring blade disposed in each of said slots, said blades having main portions normally extending beyond the exterior of the tube, said blades having lower ends extending through said guide passages, means on said lower ends engaging the lower side of said disc to prevent upward withdrawal from said guide slots, a second disc having a bore slidably receiving said push rod, said second disc being disposed adjacent said upper end of the tube, said blades having upper ends connected with said second disc, said closed lower end having a plurality of passages extending therethrough for passing material cut by said blades into the tube, said closed end of the tube comprising a substantially hollow downwardly tapered guide having a central bore receiving said push rod.

3. A tool of the character described comprising an elongated cylindrical tube having an open upper end and a closed lower end, means on said upper end for connecting said tube with rotating means, an elongated push rod mounted for reciprocation through said lower end, said push rod having a portion disposed internally of said tube and lower end portion extending below said closed end, a disc mounted for free reciprocation on said push rod adjacent said closed end and being free to reciprocate within said tube, a collar fixedly secured to said push rod and normally engaging the upper side of said disc, said disc having a plurality of guide passages extending vertically therethrough, said passages being angled inwardly toward said closed end at acute angles relative to the axis of the push rod, the side wall of said tube having a plurality of longitudinal slots therein, an arcuately shaped spring blade disposed in each of said slots, said blades having main portions normally extending beyond the exterior of the tube, said blades having lower ends extending through said guide passages, means on said lower ends engaging the lower side of said disc to prevent upward withdrawal from said guide slots, a second disc having a bore slidably receiving said push

rod, said second disc being disposed adjacent said upper end of the tube, said blades having upper ends connected with said second disc, said closed lower end having a plurality of passages extending therethrough for passing material cut by said blades into the tube, said closed end of the tube comprising a substantially hollow downwardly tapered guide having a central bore receiving said push rod, the lower end of said push rod being provided with an elongated well bottom engaging head.

4. A tool of the character described comprising a tube having open upper and lower ends, means on said upper end for connection to rotating means, an upper disc disposed in said tube adjacent to and spaced from the upper end and secured to said tube, a lower disc mounted slidably in the tube at the lower end of the tube, said discs having axial openings, a push rod axially mounted in the tube and extending through the disc openings for endwise reciprocation, said rod having a lower end portion extending below the lower end of the tube and terminating in a well bottom engaging head, the side wall of the tube being formed with circumferentially spaced closed vertical slots, outwardly bowed resilient blades having main portions normally extending out through said slots, said blades having upper end portions fixed to the upper disc and lower end portions secured to the lower disc for limited vertical movement relative to the lower disc, and stop means on the push rod immediately above the lower disc, a hollow rod guide secured on the lower end of the tube, said rod guide having a perforated side wall and a lower end formed with an axial bore slidably receiving the push rod.

5. A tool of the character described comprising a tube having open upper and lower ends, means on said upper end for connection to rotating means, an upper disc disposed in said tube adjacent to and spaced from the upper end and secured to said tube, a lower disc mounted slidably in the tube at the lower end of the tube, said discs having axial openings, a push rod axially mounted in the tube and extending through the disc openings for endwise reciprocation, said rod having a lower end portion extending below the lower end of the tube and terminating in a well bottom engaging head, the side wall of the tube being formed with circumferentially spaced closed vertical slots, outwardly bowed resilient blades having main portions normally extending out through said slots, said blades having upper end portions fixed to the upper disc and lower end portions secured to the lower disc for limited vertical movement relative to the lower disc, and stop means on the push rod immediately above the lower disc, a hollow rod guide secured on the lower end of the tube, said rod guide having a perforated side wall and a lower end formed with an axial bore slidably receiving the push rod, said lower end portion of the push rod having vertically spaced transverse bores therethrough, and a shear pin engaged in a selected transverse bore and bearing against the lower end of the slot guide with the blades in elongated condition wherein the main portions of the blades are retracted into said slots.

6. A tool of the character described comprising a tube having open upper and lower ends, means on said upper end for connection to rotating means, an upper disc disposed in said tube adjacent to and spaced from the upper end and secured to said tube, a lower disc mounted slidably in the tube at the lower end of the tube, said discs having axial openings, a push rod axially mounted in the tube and extending through the disc openings for endwise reciprocation, said rod having a lower end portion extending below the lower end of the tube and terminating in a well bottom engaging head, the side wall of the tube being formed with circumferentially spaced closed vertical slots, outwardly bowed resilient blades having main portions normally extending out through said slots, said blades having upper end portions fixed to the upper disc and lower end portions secured

7

to the lower disc for limited vertical movement relative to the lower disc, and stop means on the push rod immediately above the lower disc, and vertically elongated scraper plates removably secured to the outer sides of the main portions of the blades.

7. A tool of the character described comprising lower and upper sections, said sections comprising tubes having upper and lower ends, means reciprocally connecting the lower end of the upper tube to the upper end of the lower tube, upper discs disposed in said tubes adjacent to and spaced from the upper ends of said tubes and secured to said tubes, lower discs slidably mounted in the tubes at their lower ends, said discs having aligned axial openings therethrough, a push rod extending slidably through the disc openings, said rod having a lower end portion extending below the lower end of the lower tube and terminating in a well bottom engaging head, stops fixed on the rod immediately above the lower discs, the side-walls of the tubes having therethrough circumferentially spaced closed vertical slots, outwardly bowed resilient blades having main portions positioned in and normally

8

expanded outwardly through the slots, said blades having upper end portions secured to the upper discs and lower end portions securably and slidably engaged with the lower discs, said upper discs having peripheral edges spaced from the tube sidewalls, and a hollow rod guide secured on the lower end of the lower tube, said rod guide having openings in its sidewall communicating with the interior of the lower tube, said rod guide having a lower end formed with an axial bore through which the push rod slides.

References Cited in the file of this patent

UNITED STATES PATENTS

15	235,319	Watrous	Dec. 7, 1880
	1,402,503	Krause	Jan. 3, 1922
	1,402,786	Muehl	June 10, 1922
	1,764,373	Wells et al.	June 17, 1930
	1,823,367	Lorenz	Sept. 15, 1931
20	2,296,514	Gibson	Sept. 22, 1942