March 10, 1942. R. C. BAKER 2,275,939

CASING SCRAPER

Filed March 4, 1941

Fig. 1.

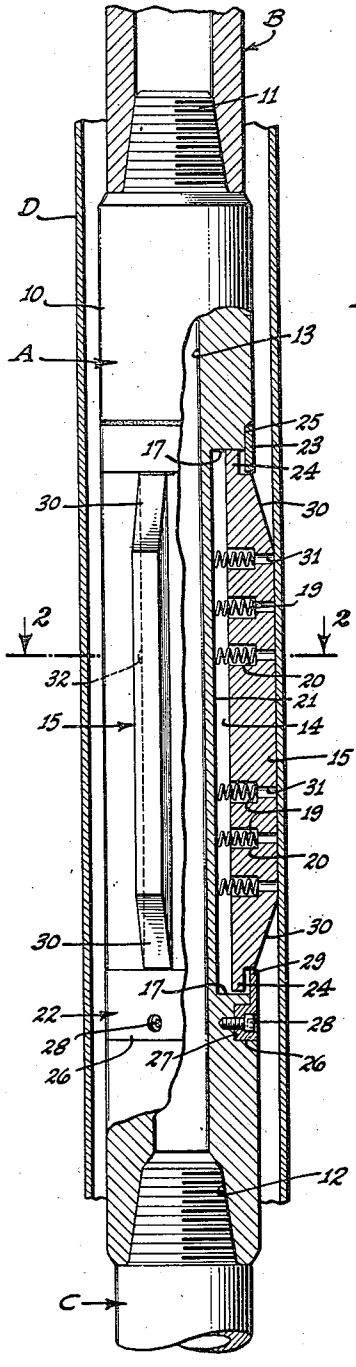


Fig. 2.

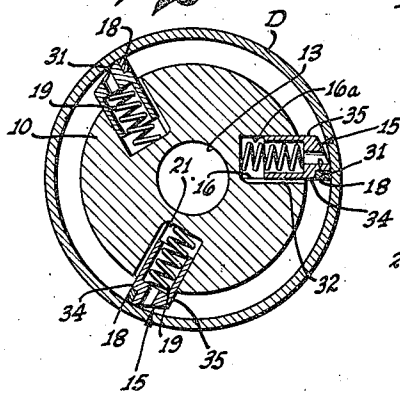


Fig. 3.

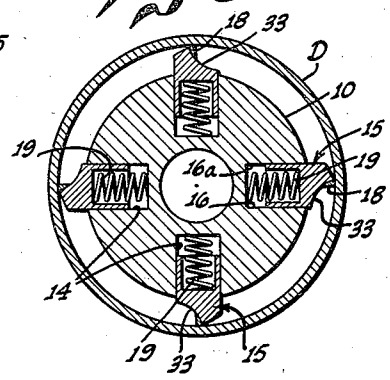
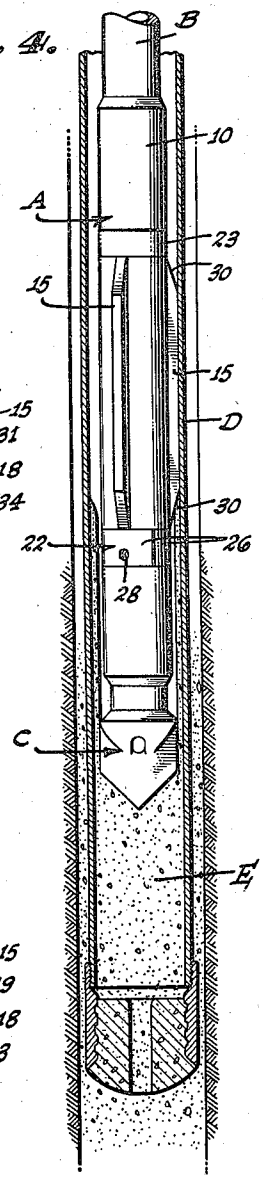


Fig. 4.



INVENTOR:
REUBEN C. BAKER,
BY
Oscar A. Mellin
ATTORNEY

Patented Mar. 10, 1942

2,275,939

UNITED STATES PATENT OFFICE

2,275,939

CASING SCRAPER

Reuben C. Baker, Coalinga, Calif., assignor to Baker Oil Tools, Inc., Vernon, Calif., a corporation of California

Application March 4, 1941, Serial No. 381,660

8 Claims. (Cl. 166—18)

This invention relates to devices for cleaning the inner walls of well casings or liners, and is more particularly concerned with a rotatable casing scraper capable of scraping a film of cement, paraffin or any type of scaly material from the inner wall of such casing string or liner.

In cementing a well casing or liner in a well bore, it is necessary to drill out the hardened cement or tailings left in the lower portion of the cemented casing string. Due to the running clearance that must be allowed, the drill bit employed for removing this hardened material leaves a film or sheath of cement as a coating on the inner wall of the casing. This film oftentimes prevents the proper setting of packers within the casing, and also tends to flake off and clog testing, production and other apparatus employed in the well bore.

It is, therefore, an object of the present invention to provide a casing scraping device designed to efficiently remove the cement or other coating from the inner wall of a string of casing. The present invention is also concerned with a comparatively simple and sturdy casing scraper construction in which the scraper blades are yieldably mounted so as to automatically adjust themselves to the surface of the casing and be maintained always in proper scraping engagement therewith. These blades are held on the scraping tool body in such a manner as to facilitate their assembly and disassembly, making it necessary only to replace worn blades after each run of the tool.

A further object of the invention is to provide a scraper embodying yieldable, automatically adjustable elongate blades designed to scrape the wall of a casing. The scraper can be incorporated in a drilling string as a component part thereof, and is capable of conveying drilling fluid from the drill string to a bit positioned below the casing scraper.

The invention has other objects that will become apparent from a consideration of the embodiments shown in the drawing accompanying and forming part of the present specification. These forms will now be described in detail, but it is to be understood that such detailed description is not to be taken in a limited sense, since the scope of the invention is best defined by the claims appended hereto.

Referring to the drawing:

Figure 1 is a side elevation of a casing scraper, parts being shown in section;

Figure 2 is an enlarged transverse section, taken as indicated by line 2—2 in Figure 1;

Figure 3 is a view similar to Figure 2 of another form of the invention; and

Figure 4 is a section through a well casing and bore hole showing the casing scraper in use.

Each of the casing scrapers A disclosed in the drawing includes an elongate body 10 provided with suitable upper and lower connections for incorporating the tool in a suitable string of drill pipe or tubing. As specifically illustrated, the upper threaded pin 11 serves to couple the body to an adjoining drill collar or joint of pipe B, while the lower threaded box 12 may be used to attach a drill bit C to the scraper body. A passageway 13 extends centrally through the body for conveying drilling fluid from the drilling string B to the attached drill bit C, or, if no bit is used, for discharge from the lower end of the body into the well casing D or bore hole.

Circumferentially spaced longitudinal grooves 14 are provided in the exterior of the scraper body or shank 10 for receiving longitudinal scraper blades or cutters 15 designed to have a radially free sliding fit in connection with the side walls 16, 16a and end walls 17, 17 of the body grooves. Each of these blades 15 has a longitudinal cutting or scraping edge 18 adapted to cooperate with the wall of the casing D for operation upon any adherent scaly or cementitious material. Coil springs 19 are contained within inner sockets or pockets 20 formed in each blade with their inner ends engaging the bottom 21 of the groove 14, so as to force the cutting edge 18 of the blade outwardly against the wall of the casing, which outward movement is limited by the retainer members 22, 23 engageable with the reduced upper and lower terminals 24, 24 of the blade.

In the present instance, outward movement of the upper portions 24 of the blades under the influence of the helical springs 19 is limited by a retainer collar 23 seated within a recess 25 in the exterior of the tool shank or body 10, and welded thereto preferably flush with the external surface of the body. This collar extends over the upper ends of the grooves 14 and is engageable with the upper blade terminals 24. The lower retainer 22 consists of removable arcuate segments 26 received within a circumferential body groove 27 and secured to the main body of the tool by screws 28, whose heads are suitably recessed within the segments. Each segment 26 has an upstanding skirt 29 overlying the lower ends of the grooves 14 and capable of engagement with the lower blade terminals 24 to limit the extent of their outward movement.

Due to the arrangements of parts just described, the blades 15 may readily be assembled on and dismantled from the body 10 of the scraper tool. Each blade is inserted in its associated groove 14 with the required number of springs 19 within its sockets 20. The upper terminal 24 of each blade is placed under the upper collar 23, and the blade depressed far enough within the groove against the force of the springs until its lower reduced terminal 24 is positioned far enough within the groove to permit one of the retainer segments 26 to be placed over this terminal and secured to the body by the screws 28, which are fully tightened to complete the assembly of the blade in the tool body. The other blades 15 are mounted in the same manner.

In the fully assembled scraper tool, the retaining members 22, 23 not only limit outward movement of the blades 15 under the action of the springs 19, but prevent their inadvertent removal from the tool body 10. After the blades have become worn and their replacement is desired, the lower retainer segments 26 need only be removed, which will permit withdrawal of the blades, and the insertion of another set in their place.

The assembled tool A may be placed at any desired or required point in the string of drill pipe or tubing. An example of its use is shown in the drawing, in which the scraper is disposed between the drill collar B and any suitable form of rotary drill bit C, with its upper threaded pin 11 screwed into the drill collar and its lower threaded box 12 receiving the usual pin at the upper end of the bit. This assembly of tools is run into the casing D on the usual drilling string, until the top of the hardened cement E within the casing is reached. Rotation of the drilling string at the proper speed and with the proper weight imposed upon the drill bit C is then undertaken to disintegrate the cement in the casing and effect its flushing or removal to the surface of the well bore.

Because of the running clearance necessary between the drill bit C and the wall of the casing, the former is incapable of removing all of the hardened cement, leaving a thin film coating the inner wall of the casing. This film or sheath is effectively removed by the casing scraper A, whose blades 15 are forced outwardly into intimate contact with the casing along substantially their whole length by the coil springs 19.

It is to be noted that the ends 30 of the scraper blades are inclined inwardly to the scraper axis so as to insure riding of the blades over the ends of the casing sections at the casing couplings, and prevent the tool from hanging up inside the casing. The lower tapered ends 30 facilitate entry of the tool in the casing and also operate upon the cement sheath to assist its removal. If any restrictions are encountered while running in the casing, their engagement by these tapered ends 30 forces the blades 15 inwardly against the actions of the coil springs 19, permitting the tool to move past the obstruction. If the obstruction is drillable, rotation of the tool will effect its removal from the casing in the same manner as the cement sheath is removed.

The tool A is so designed and proportioned that the terminals 24 of the blades are spaced inwardly from their collar 23 and retainer segments 26 when being operated in the casing, the casing wall forcing the blades inwardly against the action of the springs 19. As a result, each blade is capable of moving generally radially or transversely both inwardly and outwardly for the purpose of maintaining the scraper edges 18 always in contact with the casing. The blades are self-adjusting to conform to the diameter of the casing at all times, the springs 19 serving to equalize the bearing action of the blades upon the walls of the casing, and causing them to take their proper share of the load.

The movement of the blades 15 in their confining grooves 14 is facilitated by providing bleeder or breather holes 31 through the blades between their interiors and exteriors, permitting fluid to by-pass to and from each groove 14 as the blade moves inwardly and outwardly. In place of the holes 31, a notch 32 may be provided in the leading side face 16 of each groove, extending downwardly to the bottom 21 of the groove, through which fluid can pass readily between the region below the blade and the exterior of the tool body 10. If desired, for a better bleeding of the fluid, both the holes 31 and notch 32 are employable, although one expedient may be used in preference to the other.

By use of the tool A in combination with the drilling bit C, assurance is had that all of the cement is removed from the casing. The drill bit and scraper cuttings are flushed from the casing by the usual stream of drilling fluid passing downwardly through the drill pipe B, scraper body 10, and drill bit C for action upon the bit blades, and for upward passage past the casing scraper blades 15, carrying all cuttings with it to the surface of the bore and maintaining the scraper blades substantially clean.

For the most effective and efficient angle of attack on the wall of the casing, the scraping or cutting edges 18 of each blade should lie in a radial plane extending from the center line or axis of the body 10. To obtain this arrangement, each blade groove 14 can be disposed generally symmetrically of the radial plane (as shown in Figure 3), with the blade having a recess 33 to provide a cutting edge 18 lying in such plane; or each groove 14 can be disposed to one side of the radial plane, with its leading side 16 coinciding therewith to place the leading face 34 of the blade and its hardfaced longitudinal cutting edge 18 in the same radial position. This latter design is preferred since it provides a stronger cutting blade. In both embodiments, the blades 15 are bevelled toward their trailing side 35 to limit their contact with the casing or cement sheath to the leading cutting edges 18.

By use of the invention just described, no cementitious or other foreign matter is left adhering to the wall of the casing, removing a barrier and hazard to the successful operation of other well tools in the casing. Formation testers, perforation washers, packers, etc. can be set against the metal of the casing itself, and flow beans or other production equipment cannot be plugged or restricted by cement particles flaking from the casing.

I claim:

1. A rotary casing scraper, including a body adapted for attachment to a drilling string and having a fluid passage therethrough, said body having a plurality of circumferentially spaced longitudinal grooves in its exterior, a cutter blade slidably mounted in each groove and having an outer longitudinal scraping edge and a plurality of inner sprockets, coil springs engaging the bottoms of said grooves and received within said sockets for moving said blades bodily outwardly

and for maintaining their longitudinal scraping edges yieldably in engagement with the wall of well casing during operation of said casing scraper therewithin, and stop means engageable with said blades for limiting the extent of their outward movement.

2. A rotary casing scraper including a body adapted for attachment to a drilling string and having a fluid passage therethrough, said body having a plurality of circumferentially spaced longitudinal grooves in its exterior whose bottoms are parallel to the body axis, a cutter blade slidably mounted in each groove and having an outer longitudinal scraping edge parallel to said body axis and a plurality of inner sockets, coil springs engaging the bottoms of said grooves and received within said sockets for moving said blades bodily outwardly with their longitudinal scraping edges maintained generally parallel to said body axis and yieldably in engagement with the wall of a well casing during operation of said casing scraper therewithin, and stop means engageable with said blades for limiting the extent of their outward movement.

3. A rotary casing scraper; including a body adapted for attachment to a drilling string and having a fluid passage therethrough; said body having a plurality of circumferentially spaced longitudinal grooves in its exterior whose bottoms are parallel to the body axis; a cutter blade slidably mounted in each groove; said blade having an outer longitudinal scraping edge parallel to said body axis, a plurality of inner sockets and reduced terminal portions; coil springs engaging the bottoms of said grooves and received within said sockets for moving said blades bodily outwardly with their longitudinal scraping edges maintained generally parallel to said body axis and yieldably in engagement with the wall of a well casing during operation of said casing scraper therewithin; respective retainers secured to said body and overlying the ends of said grooves to engage said reduced terminal portions and limit the extent of outward movement of each blade, one of said retainers being readily removable to permit assembly and disassembly of said blades on said body.

4. A rotary casing scraper; including a body having a longitudinal fluid passage therethrough and upper and lower threaded joints for attaching said body to a drilling string; said body having a plurality of circumferentially spaced longitudinal grooves in its exterior whose bottoms are parallel to the body axis; a cutter blade slidably mounted in each groove; said blade having an outer longitudinal scraping edge parallel to said body axis, a plurality of inner sockets and reduced terminal portions; coil springs engaging the bottoms of said grooves and received within said sockets for moving said blades bodily outwardly with their longitudinal scraping edges maintained generally parallel to said body axis and yieldably in engagement with the wall of a well casing during operation of said casing scraper therewithin; respective retainers secured to said body and overlying the ends of said grooves to engage said reduced terminal portions and limit the extent of outward movement of each blade, one of said retainers comprising a collar welded to said body, and the other of said retainers comprising segments screw threadedly attached to said body.

5. A rotary casing scraper, including a body adapted for attachment to a drilling string, said body having a plurality of circumferentially spaced longitudinal grooves in its exterior, a cutter blade slidably mounted in each groove and having an outer longitudinal scraping edge parallel to the body axis and lying in a radial plane extending from the body axis, spring means in each groove for moving each blade bodily outwardly with its scraping edge maintained in said plane generally parallel to said axis and yieldably in engagement with the wall of a well casing during operation of said scraper therewithin, and stop means for limiting the extent of such outward movement.

6. A rotary casing scraper, including a body adapted for attachment to a drilling string, said body having a plurality of circumferentially spaced longitudinal grooves in its exterior, a cutter blade slidably mounted in each groove and having an outer longitudinal scraping edge parallel to the body axis, the leading faces of each groove and said scraping edge lying in a radial plane extending from said axis, spring means in such groove for moving each blade bodily outwardly with its scraping edge maintained in said plane generally parallel to said axis and yieldably in engagement with the wall of a well casing during operation of said casing scraper therewithin, and stop means for limiting the extent of such outward movement.

7. A rotary casing scraper, including a body adapted for attachment to a drilling string, said body having a plurality of circumferentially spaced longitudinal grooves in its exterior, a cutter blade slidably mounted in each groove and having an outer longitudinal scraping edge parallel to the body axis, the leading faces of each groove and cutter blade and said scraping edge lying in the same radial plane extending from said axis, the exterior of each blade being bevelled in a direction away from said scraping edge, spring means in each groove for moving each blade bodily outwardly with its scraping edge maintained in said plane generally parallel to said axis and yieldably in engagement with the wall of a well casing during operation of said casing scraper therewithin, and stop means for limiting the extent of such outward movement.

8. A rotary casing scraper as defined in claim 7, the leading face of each groove having a notch extending from the bottom of the groove to the exterior of the body.

REUBEN C. BAKER.