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J. F. LOCKWOOD

2,482,985

APPARATUS FOR SCRAPING THE WALLS OF WELL BORES

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2 Sheets-Sheet 1

Fig. 1.

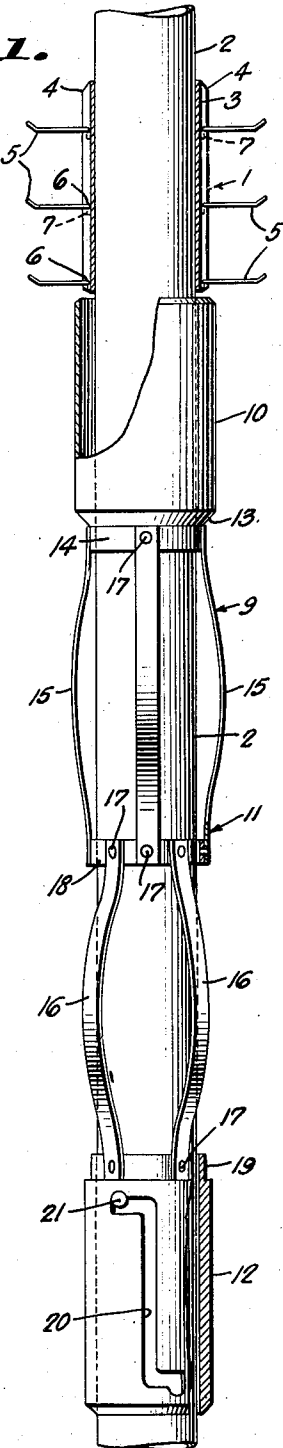
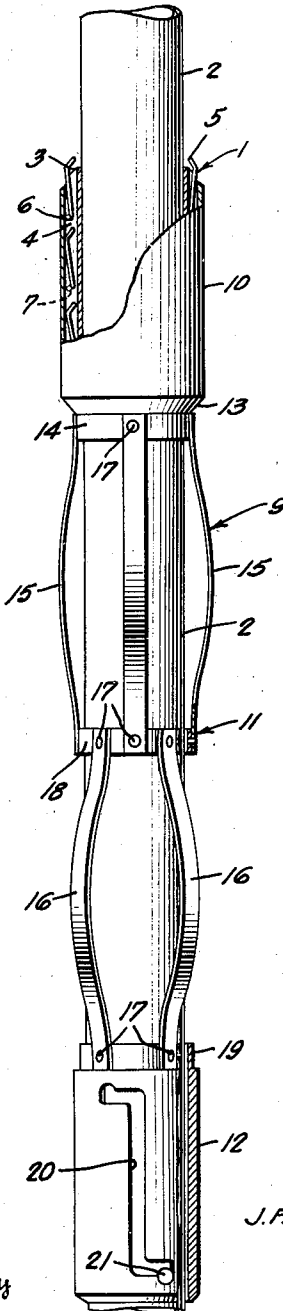


Fig. 2.



Inventor

J. F. LOCKWOOD

Almon S. Nelson
ATTORNEY

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Fig. 3.

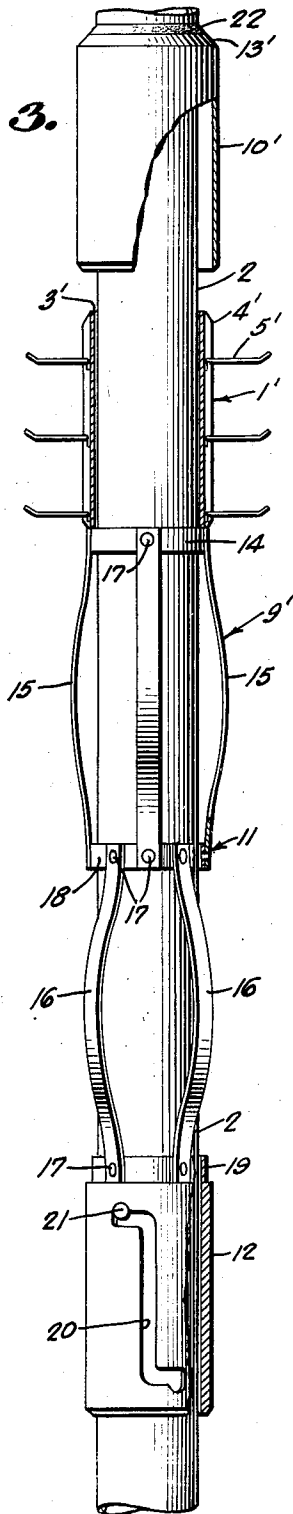
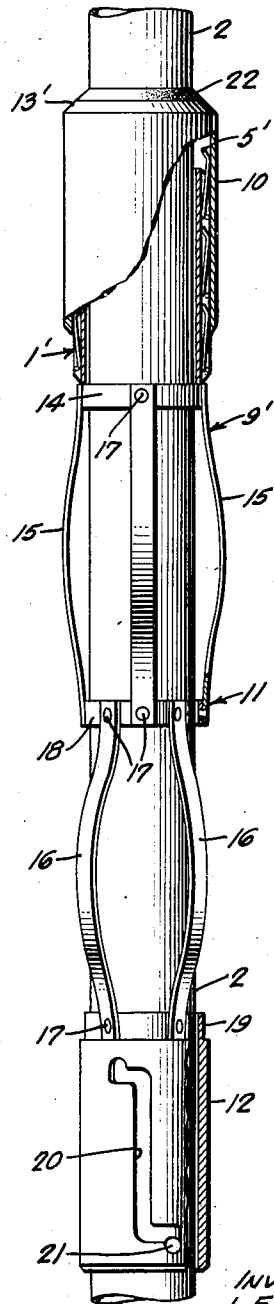


Fig. 4.



INVENTOR:
J. F. LOCKWOOD
BY *Almon S. Nelson*
ATTORNEY

UNITED STATES PATENT OFFICE

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APPARATUS FOR SCRAPING THE WALLS
OF WELL BORES

John Francis Lockwood, Shreveport, La.

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5 Claims. (Cl. 166—18)

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This invention relates to a method and apparatus for scraping the walls of well bores prior to the usual well cementing operation.

In the drilling and completion of oil and gas wells, steel casing is usually set to the bottom of the drill hole, either through or partially into the oil or gas bearing structure, and is there cemented into the hole by means of forcing cement under pressure down through the casing and up through the annular space between the outside of the casing and the walls of the open hole. The primary purpose of this cementing process is to insure against water seepage from water-bearing sands, either above or below the producing structure. During drilling operations, a drilling mud is used. One purpose of the drilling mud is to form a cake on the walls of the hole to keep it in proper shape until such time as casing is set. The colloidal content and chemical make-up of this mud cake is very often not conducive to a proper bond between the cement and the side of the hole, especially in those strata having a high water content, where a cement bond is vitally necessary.

Hence, in the past, it has been the custom in the art to employ a wall scratcher or wall scraper which is attached to that section of the casing which will be set next to the water sands. This scratcher is usually merely a sleeve with small stiff wires protruding from it which is slipped over the casing and welded or otherwise suitably secured to the casing at the proper place. When all of the casing has been run into the hole, it is then raised and lowered numerous times and/or rotated in order to scratch the sides of the hole where a cement bond is particularly necessary.

These scratchers undoubtedly do what they are supposed to do, but the difficulty is that they do more than they are supposed to do. They are scratching and scraping not only the small section of the hole that they are supposed to clean but also the walls of the entire depth of the hole from the surface down, which in many cases is more than 12,000 feet, and it has been found that this prolonged scraping very often not only ruins the walls of the drill hole, but the cake which has been scraped from the sides of the hole tends to stick or "ball-up" the casing before it has reached its total depth. These disadvantages of the scratchers so frequently outweigh the advantages thereof that many, if not most operators, refuse to use them.

The primary object of the present invention is to overcome the aforementioned difficulties by

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providing a scratcher or scraper which will scratch only that portion of the hole which the operator wants cleaned, and only that portion. In other words, to provide a scratcher which can be controlled or rendered inoperative during the running of the casing until it is needed.

Another object of the invention is to provide a means for enclosing the scratcher or scraper elements in a protective means until that portion or section of the hole is reached where a scratching operation is desired, thereby eliminating damage to all other sections of the hole or bore.

An additional object of the invention is to provide a scratcher enclosing means in combination with a centering or centralizer means for the casing.

A further object of the invention is to provide an apparatus for removing the mud cake from a predetermined area of a well bore at any desired position in the bore, comprising a scraper unit including foldable scratching elements, means for retaining the scratching elements in folded position, and means for actuating the retaining means at any desired position in the well bore to release the scratching elements, said last means including a casing centralizer or centering means; and the novel subcombinations thereof.

A further object of the invention is to provide a new method of scraping or preparing well bores for a cementing operation, wherein only that section or those sections of the well bore are scraped where a cement bond is particularly necessary or desired.

In the accompanying drawings forming a part of this disclosure, wherein like numerals are used to designate similar parts, two embodiments of the invention have been chosen for illustration, and in the said drawings:

Fig. 1 is an elevational view of one form of my invention, parts being broken away to show sectional details, illustrating the scratching elements withdrawn from their retaining sleeve and in operative position;

Fig. 2 is a view similar to Fig. 1, illustrating the scratching elements enclosed within the sleeve and in inoperative position; and

Figs. 3 and 4 are views similar to Figs. 1 and 2, respectively, illustrating another form of my invention.

Referring in detail to Figs. 1 and 2 of the drawings, a scratcher or scraper unit 1 is suitably secured to the usual well casing 2 at the desired location.

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The scraper unit 1 chosen for illustration comprises a sleeve 3, welded or otherwise suitably secured to the casing 2, said sleeve being provided with a plurality of longitudinally extending, circumferentially spaced ribs 4 externally thereof, in each of which a plurality of scraping wires or elements 5 is pivotally mounted. As illustrated in Fig. 1, the elements 5, in operative position, extend generally horizontally, and the rearward portions thereof are bent to project through suitable openings 6 in the ribs 4 and are then bent downwardly, as indicated at 7, whereby the end portions 7 are adapted to engage the sleeve 3 to limit the downward rotative movement of the said elements.

Insofar as my invention is concerned, the specific construction of the scraper unit is immaterial so long as the scraper elements are foldable, i. e., either pivotally mounted or otherwise foldable, such as would be possible with flexible or resilient elements, or flexible or resilient mountings for the elements. Thus the scraper unit may be constructed in the manner disclosed in U. S. Patent No. 2,421,434, issued to C. E. Reistle, Jr., et al., on June 3, 1947, or in the manner disclosed in U. S. Patent No. 2,374,317 issued to Kenneth A. Wright, on April 24, 1945, for examples.

In order to maintain the scratching elements 5 in inoperative or folded position while the scratcher unit 1 is being lowered into the well bore, I provide a combined scratching element retaining and casing centralizer unit, generally designated by reference numeral 9, comprising a scratching element retaining sleeve 10, a bowed spring casing centering unit 11 one end of which is connected thereto, and a sleeve or sleeve means 12 which is connected to the other end of the bowed spring unit 11.

The wall of the sleeve 10 is preferably, but not necessarily, of imperforate construction and the inner diameter of the sleeve means 10 is sufficiently larger than the outer diameter of the casing 2 to receive the scratcher unit 1, as illustrated in Fig. 2, and the end portion of the sleeve 10 adjacent the spring unit comprises an annular, radially inwardly directed wall 13. The inner end portion of the wall 13 is welded or otherwise suitably connected to a bearing ring 14, preferably comprising a part of the bowed spring unit 11, and the ring 14 provides a centering means for the sleeve 9 and engages the casing rather loosely to provide for relative movement between the casing and the sleeve.

The bowed spring unit 11 additionally comprises, preferably, but not necessarily, two series of spaced, longitudinally extending, bowed springs 15 and 16. The springs 15 at one of the ends thereof are connected to the bearing ring 14 as by means of welds or rivets 17, and the other ends of the springs 15 are connected to an intermediate bearing ring 18 by similar means 17. The springs 16 are preferably staggered relative to the springs 15, and are also connected at one of the ends thereof to the bearing ring 18 by means of welds or rivets 17, the other ends thereof being connected to preferably a reduced or annularly recessed end portion 19 of the sleeve 12 by similar means 17.

The inner diameters of the ring 14 and the sleeve 12 are substantially equal, are smaller than the inner diameter of the sleeve 10, and are slightly greater than the external diameter of the casing 2 so as to loosely engage the same and provide for relative movement therebetween, and the sleeve 12 is provided with a Z-slot 20 engaged by

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a pin 21 which is welded to the casing. The pin 21 controls the movement of the combined scratching element retaining and casing centralizer unit 9 relative to the casing 2 and the scratcher unit 1 in a manner to be presently described.

In assembly, the scratcher unit 1 is slipped over an end of a section of the casing 2, moved to position, and welded or otherwise suitably secured to the casing. The unit 9 (previously assembled except for the pin 21) is then slipped over the proper end of the casing, moved to the position illustrated in Fig. 2, during which movement the scratching elements 5 are automatically folded inwardly by and received in the protective or retaining sleeve 10, and the pin 21 is welded to the casing in the position shown in Fig. 2, i. e., in the end portion of the Z slot removed from the sleeve 10 or scratcher unit 1, thereby locking the unit 9 in its top position.

In operation, the casing is then run into the well as it normally is, the spring unit 11 functioning to center the casing in the bore, and when the desired depth is reached, the casing is turned slightly clockwise from the usual rotary table, thus freeing the pin 21. The casing is then raised so that the pin 21 slides up through the Z slot 20, and is then again rotated clockwise whereby the pin 21 locks the unit 9 in its bottom position as illustrated in Fig. 1. During the above mentioned movements of the casing relative to the unit 9, the unit 9 is kept from moving or held stationary by means of the centralizer unit 11, the springs 15 and 16 of which grip the sides of the hole. Referring to Fig. 1, it will be seen that the above described movements of the casing relative to the unit 9 have freed or released the scratcher wires 5 from the protective sleeve 10, and they are ready to do the work that was intended for them, i. e., to scratch a predetermined area of the bore, and no other section of the bore has been or need be damaged.

With the scratcher unit 1 illustrated, the scratcher wires or elements 5 are gravity actuated to operative position, and the casing is reciprocated, and rotated from time to time, to clean the hole. It will be obvious, however, that with other types of scratcher elements, the actuation to operative position may be assisted by or entirely due to other means, such as spring means.

After the particular and desired section of the bore has been cleaned, the cementing operation is performed in the usual manner.

The modified form of my invention illustrated in Figs. 3 and 4, insofar as the construction of the component parts is concerned, is substantially identical with the form of the invention illustrated in Figs. 1 and 2. In this modified form of the invention, however, the arrangement of the protective or retaining sleeve 10' is reversed relative to the scratcher unit 1' in that the scratcher unit is welded or otherwise suitably secured to ring 14 of the centralizer unit 11 and moves therewith relative to the casing 2, and the retaining sleeve 10' is inverted and secured to the casing 2 as by means of a weld 22 at the inner edge of the wall 13'.

The scratcher unit 1' is identical with the scratcher unit 1 except that it may be necessary to increase the inner diameter of the sleeve 3' slightly to assure ease of relative movement between the casing and the sleeve. The construction of the ribs 4' and scratcher wires 5' is identical with the construction of the ribs 4 and wires 5, respectively.

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Similarly, the construction of the centralizer unit 11 including the sleeve 12 and pin 21 is identical in both forms of the invention and hence like reference numerals are used in Figs. 1 to 4 to designate similar parts.

In the modified form of my invention it will thus be seen that I have provided a combined scratching or scraping and casing centralizer unit 9', comprising the scratching unit 1', the bowed spring casing centering unit 11, and the sleeve 12.

In assembly of this form of the invention, the retaining sleeve 10' is slipped over one end of the casing 2, moved to position, and welded to the casing as indicated at 22. Obviously other means of securing this sleeve to the casing may be used if desired. The unit 9' (previously assembled except for the pin 21) is then slipped over the proper end of the casing, the wire scratchers 5' are folded into the sleeve 10' by hand or any other suitable means, and the pin 21 is welded to the casing as previously described in connection with the first form of the invention.

The operation of the modified form of the invention is identical with that of the first form of the invention previously described, so that upon rotation and upward movement of the casing, the unit 9' is held stationary by means of the casing centering spring unit 11, and the scratcher wires 5' are freed or released from the protective or retaining sleeve 10'. Upon the final clockwise rotative movement of the casing, the pin 21 locks the unit 9' in its bottom position, illustrated in Fig. 3, and the scratcher unit 1' will thus be moved with the casing to perform its desired function of scraping a limited, desired area only of the walls of the bore. After the scraping operation, the cementing operation may be performed in the usual manner as previously described in connection with the first form of the invention disclosed.

Although two embodiments of the invention have been particularly shown and described and a particular method of use described, it is to be understood that it is not intended to limit the invention to the exact construction shown and described or the uses suggested, but it is intended to cover all such changes as come within the spirit of the invention.

I claim:

1. A scraping device for well bores comprising casing for the well bore, a scratcher means including foldable scratcher elements on said casing, a protective sleeve means on said casing, and a casing centering unit on said casing, one of said means being secured to the casing and the other of said means being secured to one end of said casing centering unit, said casing centering unit being adapted to engage the walls of the well bore, a second sleeve means on said casing connected to the other end of said casing centering unit, a Z-slot in said second sleeve means, and a pin secured to said casing and positioned in said slot, said protective sleeve having an inner diameter sufficiently larger than the outer diameter of said casing to receive said scratcher means therein with said scratcher elements in folded position, whereby said scratcher means may be positioned in said protective sleeve means and rendered inoperative until a desired position in the well bore is reached, and then rendered operative by manipulating the casing to move the said pin through said Z-slot to free said scratcher means from said protective sleeve means.

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2. In a scraping device for use in connection with casing for well bores, said casing having a scratcher means including foldable scratcher elements thereon and a pin secured to said casing; a combined scratching element retaining and casing centering unit comprising a scratching element retaining sleeve means, a bowed spring casing centering unit connected at one end thereof to said retaining sleeve means, a second sleeve means connected to the other end of said casing centering unit, the inner diameter of said retaining sleeve means being larger than the inner diameter of said second sleeve means and also sufficiently large to receive said scratcher means with the scratcher elements in folded position, and a slot in said second sleeve means, whereby said scratcher means may be positioned in said retaining sleeve means and rendered inoperative until a desired position in the well bore is reached, and then rendered operative by manipulating the casing to move the pin through said slot to free the scratcher means from said retaining sleeve means.

3. In a scraping device for use in connection with casing for well bores, said casing having a scratcher means including foldable scratcher elements thereon and a pin secured to said casing; a combined scratching element retaining and casing centering unit comprising, a scratching element retaining means, a casing centering unit connected at one end thereof to said retaining means, a sleeve means connected to the other end of said casing centering unit, the inner dimension of said retaining means being larger than the inner dimension of said sleeve means and also sufficiently large to receive said scratcher means with the scratcher means in folded position, and a slot in said sleeve means, whereby said scratcher means may be positioned in said retaining means and rendered inoperative until a desired position in the well bore is reached and then rendered operative by manipulating the casing to move the pin through said slot to free the scratcher means from said retaining means.

4. In a scraping device for use in connection with casing for well bores, the casing having a scratching element retaining means secured thereto and a pin mounted on said casing, said retaining means having an inner dimension greater than the outer diameter of the casing; a combined scratching and casing centering unit comprising a sleeve means having an outer dimension which is less than the inner dimension of said retaining means, a plurality of foldable scratching elements on said sleeve means, a bowed spring casing centering means connected at one end thereof to said sleeve means, a second sleeve means connected to the other end of said casing centering means, and a slot in said second sleeve means, whereby said scraping elements may be positioned in the retaining means and rendered inoperative until a desired position in the well bore is reached, and then rendered operative by manipulating the casing to move the pin through said slot to free said scratching elements from the retaining means.

5. A scraping device for well bores adapted to be associated with well casing having a pin secured thereto, said device comprising a scraper means adapted to be positioned on the casing and including foldable scratching elements, scratching element retaining means having an inner diameter larger than the outer dimension of said scraper means with the scratching elements in folded position and adapted to be positioned on

the casing for receiving and retaining the scratching elements in folded position, a casing centering unit having one end thereof connected to one of said means and adapted to be positioned on the casing, said casing centering unit including a Z-slot adapted to receive the casing pin whereby the scratching elements may be locked in folded inoperative position in said retaining means, released from said retaining means, and locked in position with the scratching elements in operative position by manipulating the well casing.

JOHN FRANCIS LOCKWOOD.

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