April 6, 1965 R. R. MacGREGOR 3,176,772

DEVICE FOR REMOVING DETRITAL MATERIAL FROM A LINER, TUBING AND CASING

Filed March 29, 1963 2 Sheets-Sheet 1

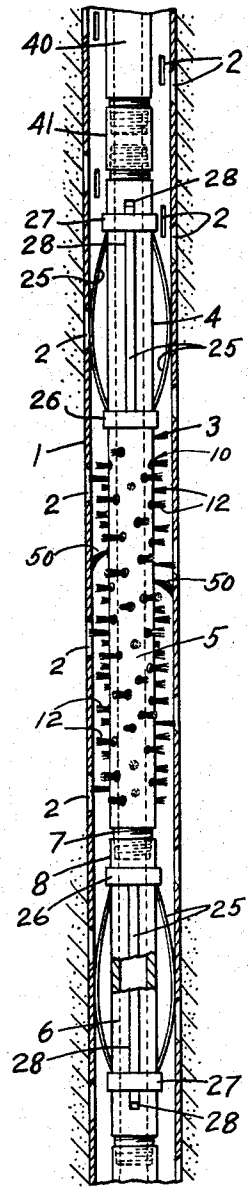


FIG. 1.

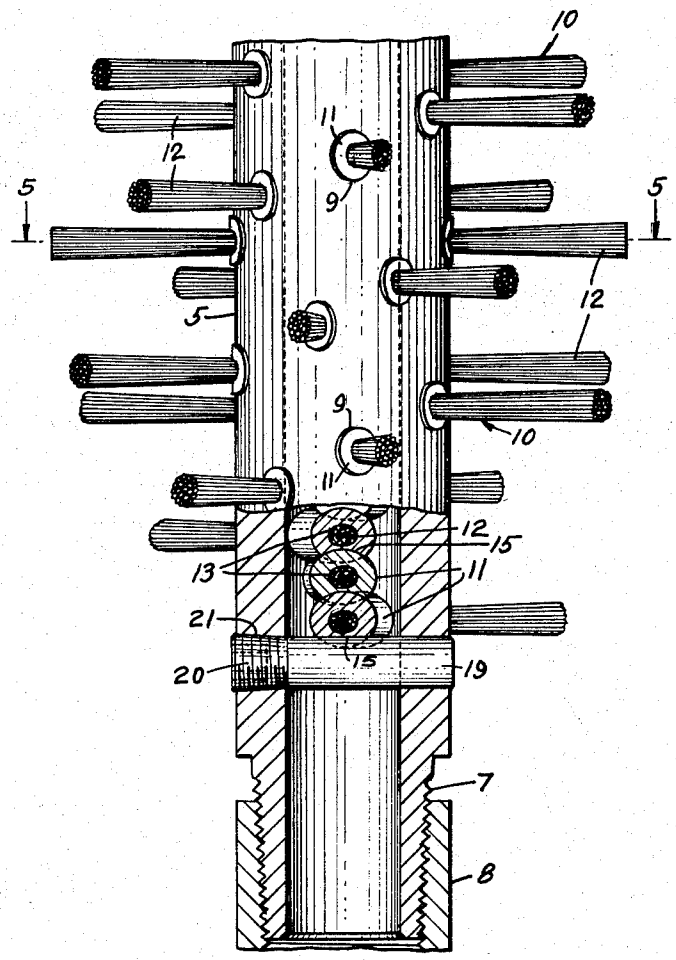


FIG. 2.

FIG. 3.

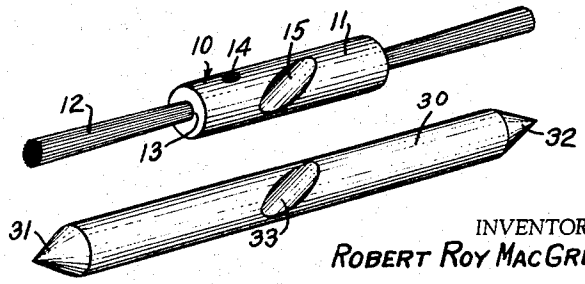


FIG. 4.

INVENTOR,
ROBERT ROY MACGREGOR;

BY

ATTORNEY

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DEVICE FOR REMOVING DETRITAL MATERIAL FROM A LINER, TUBING AND CASING

Filed March 29, 1963 2 Sheets-Sheet 2

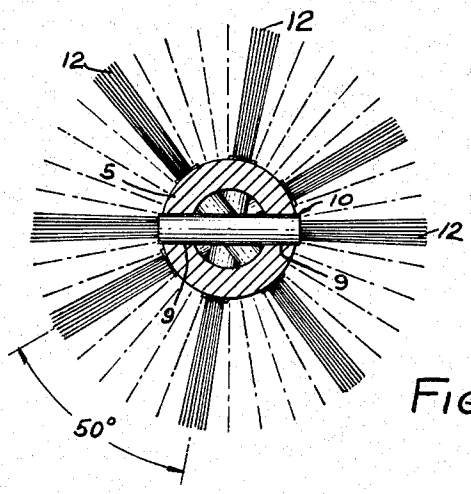


FIG. 5.

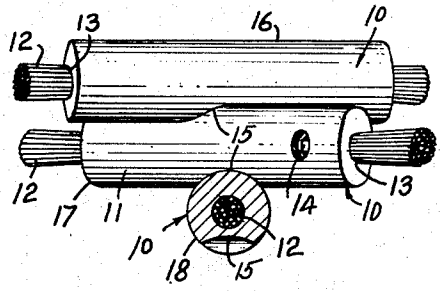


FIG. 7.

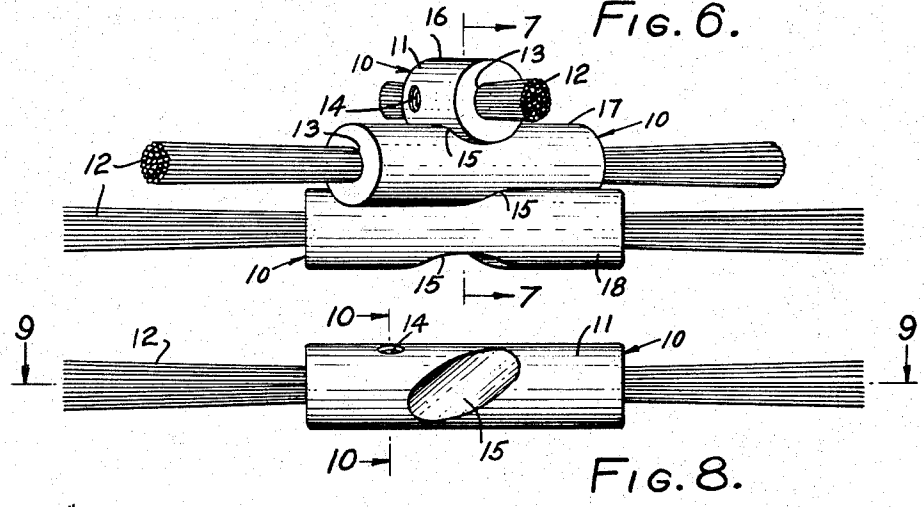


FIG. 6.

FIG. 8.

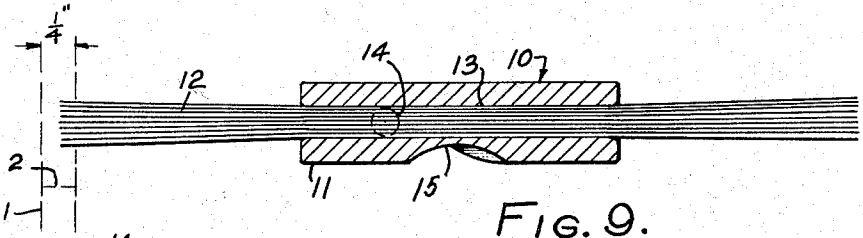


FIG. 9.

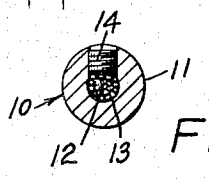


FIG. 10.

INVENTOR,
ROBERT ROY MACGREGOR;
BY
J. Calvin Brown,
ATTORNEY

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DEVICE FOR REMOVING DETRITAL MATERIAL FROM A LINER, TUBING AND CASING

Robert Roy MacGregor, 1340 Florida St., Long Beach, Calif.

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4 Claims. (Cl. 166—173)

The present invention relates to a device of particular use in the oil industry for removing from casing, liners, and tubing any type of scale, or accumulations. In the case of liners which are perforated, the perforations often fill with detrital material of different forms which may be paraffin, asphalt, fine sand, clay, shale or even precipitated salts, and when this occurs the liner slots or perforations must be cleaned, otherwise oil production is reduced or stopped.

My device is adapted to be lowered into the liner of a well and in so lowering the device will scrape the detrital material or other accumulations from the perforations and recirculate the detrital material to the well surface.

An object of my invention is to provide a device which will easily and quickly remove detrital material from liner perforations by mechanical means and which will, during said removal allow circulation of the material to the well surface.

A further object is a device which is useful for the cleaning of rust, scale and other accumulations from within a casing or tubing.

A further object is to provide a device in which the parts are readily assembled and wherein the only parts liable to wear, are easily replaced.

My device contemplates a spiral series of scrapers such as brushes extending radially from the periphery of a tubular body, and an object of my invention is to provide a positive locking means for the scrapers to maintain a proper degree of extension from the body and without any shifting of position therebetween.

A further object is to provide a device for the removing of accumulations such as detrital material within a tubing or casing in a positive and efficient manner so that the tubing or casing is thoroughly cleaned of detrital material.

Other objects include a device which is simple of construction, positive in operation, inexpensive to manufacture and generally superior to devices for scraping liners, tubing and casing, now known to the inventor.

In the drawing:

FIGURE 1 is a longitudinal, partially sectional view of the invention shown within a liner;

FIGURE 2 is a fragmentary, enlarged, and partially sectional view of the scraper of the invention;

FIGURE 3 is a perspective view of one form of scraper for removing detrital material from a liner;

FIGURE 4 is a modified form of scraper;

FIGURE 5 is a sectional view on the line 5—5 of FIGURE 2;

FIGURE 6 is an enlarged view of a tier of three scrapers shown in cooperative relationship;

FIGURE 7 is a partially sectional view on the line 7—7 of FIGURE 6;

FIGURE 8 is a side elevation, on an enlarged scale, of one of the scrapers;

FIGURE 9 is a sectional view on the line 9—9 of FIGURE 8; and,

FIGURE 10 is a sectional view on the line 10—10 of FIGURE 8.

Referring now to the drawings and specifically to FIGURE 1, 1 is a liner within a well hole provided with slots or perforations 2 of the vertical type although the slots may be horizontal, the slots 2 being preferably

arranged in a spiral form as is usual practice in order not to weaken the strength of the liner 1. Referring to the drawing, the device of the invention is designated as an entirety as 3 and includes three housings or bodies 4, 5, and 6 axially interconnected at ends by pins and boxes, as shown at 7 and 8. Each body is tubular, the internal bore of each body is of the same diameter and the external diameter of each body is likewise uniform. The body 5 is provided with a series of spaced apart spirally arranged diametric bores 9, see FIGURE 5, for reception of scrapers designated generally as 10. Each scraper 10 includes a tubular holder 11 and a bundle of wires 12 constituting a wire brush which extend beyond each end of the tubular holder. The bundle of wires is closely confined within the bore 13 of the tubular holder and so held that the extended ends of the bundle of wires are of equal length, the wires being secured to the holder by means of a set screw 14 screw threaded within a radial bore leading to the bundle of wires, see FIGURE 10. Externally, the tubular holder 11 is provided with an oblique groove 15 which groove is at an acute angle to the axis of the tubular holder. It is intended that a series of scrapers should be provided in accordance with the number of diametric bores 9 in the body 5. The spacing between adjacent diametric bores 9 in the body 5 is such that the tubular wire holders may interlock in the manner shown in FIGURES 6 and 7. Thus, the spacing between the diametric bores 9 axially of the body 5 is slightly less in each instance, by the depth of a groove 15, than the diameter of the tubular wire holder. All of the tubular wire holders are so arranged that the oblique grooves 15 face downwardly and lie on the axis of body 5. Thus, in the assembly of the tubular wire holders, I may start from the top or uppermost diametric bore 9 and insert one of the wire holders so that the ends of the tubular wire holder lies adjacent the periphery of the body 5, as shown in FIGURE 5. The next adjacent tubular wire holder is inserted through the next lower diametric bore 9 so that it intersects the upper wire holder being received in the oblique groove 15 thereof. This operation is continued with the next lowermost tubular wire holder, it being received in the oblique groove 15 and so on. As shown in FIGURES 6 and 7, and assuming that the tubular wire holder 11 at 16 is uppermost, the next lower tubular wire holder 17 is received in the groove 15 of holder 16 followed by the next tubular holder 18 recieved in the oblique groove 15 of holder 17 and so on. As the diametric bores 9 are spirally arranged, as shown in FIGURES 1, 2, and 5, each tubular wire holder will intersect at an angle the tubular wire holders immediately above and below, the arrangement having the appearance of that shown in FIGURE 5. In the present instance, I have arranged the grooves 15 so that the angle between the wires which extend radially from the tubular wire holders are 50° apart, although other degrees of separation may be utilized. After the tubular wire holders have been assembled, they are interlocked in working relationship by means of a pin 19 which is received in the groove 15 of the lowermost tubular wire holder. This pin has a socketed externally threaded head 20 received in the threaded area 21 of a diametric bore in the body 5. This provides a simple and effective means for interlocking all of the tubular wire holders and the wire brushes against any movement relative to the body 5 when secured by the pin 19. Preferably the tolerances between the tubular wire holders and the oblique grooves 15 are close to prevent any shifting movement between the members. Preferably I provide from 17 to 30 wires per tubular wire holder and these wires are of the spring steel type such as music wire. The length

of the body 5 having been determined as has likewise the number of tubular wire holders with wire brushes carried thereby, the body 5 is secured between the upper and lower bodies 4 and 6 by the pin and box connections 7 and 8 provided for the bodies. Both bodies 4 and 6 are provided with a minimum of three bowed leaf friction springs 25 arranged equal degrees apart with one end of each leaf spring fixedly secured to a collar 26 for each body 4 and 6 while the opposite end of each leaf spring for each body is loosely encircled by a collar 27, the springs in each instance being received within longitudinal grooves 28 whereby the springs during compression thereof will be guided as to movement. These springs perform the usual function of stabilizing and positioning the scraper device as an entirety when received within the liner 1.

I have shown in FIGURE 4 a further form of scraper which is of the solid pin type and has the same diameter as the diameter of a hole 9, the body 30 being cylindrical in form and provided with conical or pointed ends 31 and 32. The body 30 is provided with an oblique groove 33 of the type shown as 15. The pin type scraper is of use when the wire brush type scraper is ineffective to dislodge the detrital matter within the liner or casing.

The operation, uses and advantages of my invention, are as follows.

Assuming that the housings 4, 5, and 6 are all interconnected, the housing 5 has the tubular wire holders assembled with the wires therein and projecting from ends thereof, the wire holders being arranged in the bores 9 and finally interlocked by the pin 19, the assembled units may be lowered within the liner by tubing 40 which extends to the surface of the well. The tubing 40 is connected by means of coupling 41 to the pin of the housing 4 and upon raising or lowering of the tubing, the scraper device as an entirety is raised or lowered within the liner. In so doing, the brushes 12 not only engage the interior of the liner, but are received within the slots or perforations of the liner. Preferably the ends of the wire brushes only partly pass through a slot or perforation. While a liner may be of varying thickness, say one-quarter inch, the brush ends extend only half-way through the slot or perforations, which in this instance, would be one-eighth of an inch, see FIGURE 9. As the scraper is raised and lowered, the brush ends sweep the slot or perforations, the brush ends flexing in so doing, as shown in FIGURE 1 at 50. This assures that all detrital matter within a perforation or slot is reduced in thickness and external liquid or gas pressure from the formation is generally sufficient to loosen the remaining detrital matter.

The circulation feature is important in my invention, and prior to inserting or lowering the scraper device within the casing and liner, both the casing and the liner are filled with a liquid which in some instances, may be water although preferably oil. It often requires considerable pressure to move the scraper device within the liner when filled with liquid and in some instances as much as one to two tons pressure is required. The pumps are started at the surface of the well, so that when the scraper device is moved upwardly and downwardly to scrape detrital material from the perforations or slots, there is an inward flow of liquid which carries

the detrital material and liquid through the tubular bodies 4, 5, and 6, into the tubing 40 to the well surface under pump pressure. The spiral arrangement of the wire brushes results in a curved or spiral application of the brushes to the detrital material or rust in the liner and is equivalent to rotary movement of the brushes.

Oftimes the incrustation of a liner or tubing may be such that the brushes cannot dislodge the same and in such cases I may use the solid or pin type scraper of FIGURE 4, the pointed or conical ends 31 and 32 engaging the interior of the tubing, casing or liner in a spiral or curved manner and when the scraper device is raised or lowered, as has been set forth, the solid pins will remove the incrustations whether rust or other material.

In the event that any of the scraper elements such as the brushes or the solid pins are damaged, replacement with new wire brushes or pins is easy of accomplishment by simply releasing the pin 19 and removing the defective scraper and inserting a new scraper followed by re-engagement of the locking pin 19 with the body 5. Only one form of tubular wire holder or pin type scraper with its oblique groove is required, as all wire holders and pin type scrapers are of identical construction.

I claim:

1. A device for removing detrital material from a liner, tubing and casing, including: a tubular body provided with a series of diametric bores spaced apart both axially of and spirally of the body, and scraper members positioned in each diametric bore and extending radially outwardly thereof for contact with the liner, tubing, and casing, each scraper member provided on its periphery with an oblique groove for receiving therein an intersecting scraper member.

2. The device of claim 1, said oblique groove being intermediate the length of the scraper member.

3. A device for removing detrital material from a liner, tubing and casing, including: a tubular body provided with a series of diametric bores equidistantly spaced apart both axially of and spirally of the body, and scraper members received in each diametric bore, each scraper member comprising a tubular holder and a bundle of wires forming a brush extending from each end of each tubular holder, each tubular holder provided with an oblique groove on the periphery thereof and intermediate ends of the holder; each adjacent tubular holder being received in an oblique groove of the next adjacent tubular holder with all of the oblique grooves lying on the axis of the tubular body.

4. The device as set forth in claim 3, and means for interlocking said scraper members against movement relative to the tubular body.

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CHARLES E. O'CONNELL, *Primary Examiner.*