Jan. 13, 1959 F. M. GIST 2,868,299

WELL BORE SCRATCHER

Filed March 5, 1956 2 Sheets-Sheet 1

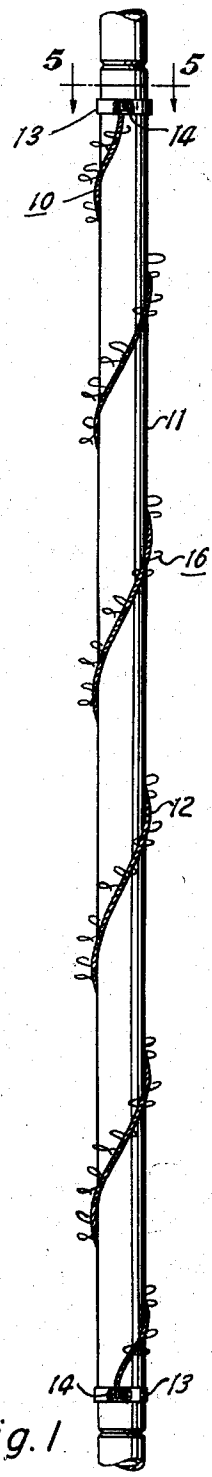


Fig. 1

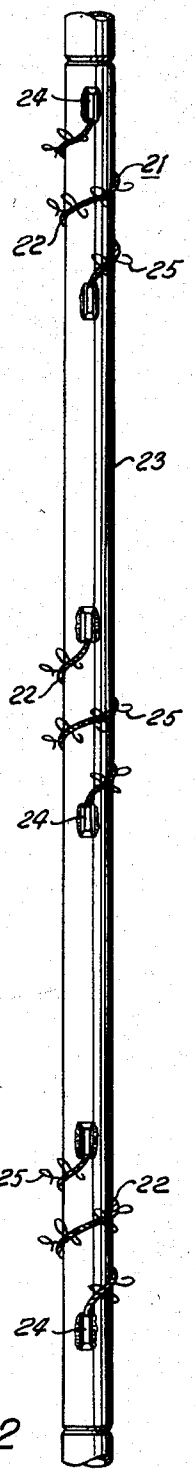


Fig. 2

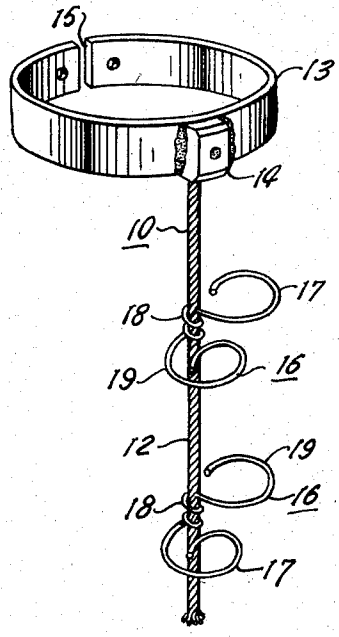


Fig. 3

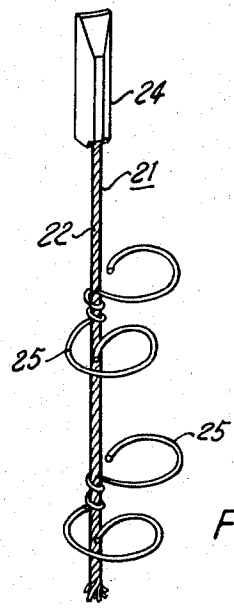


Fig. 4

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WELL BORE SCRATCHER

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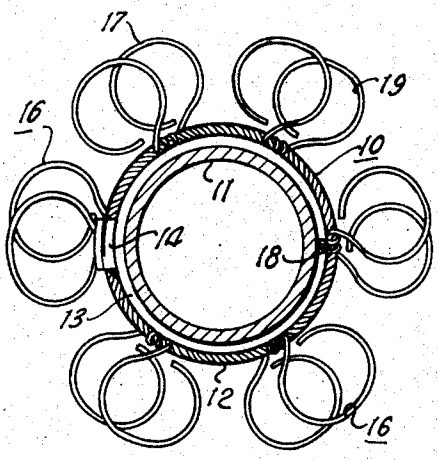


Fig. 5

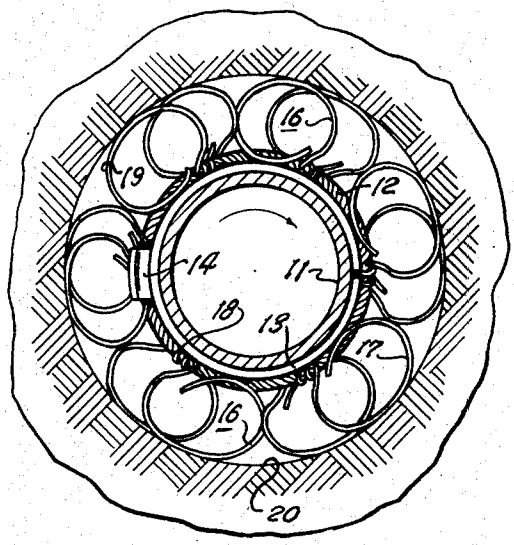


Fig. 6

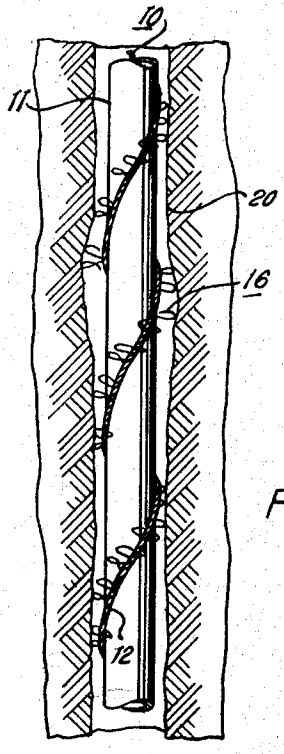


Fig. 7

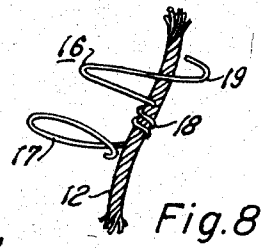


Fig. 8

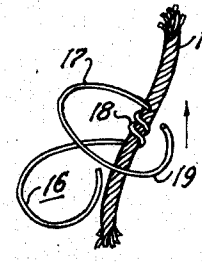


Fig. 9

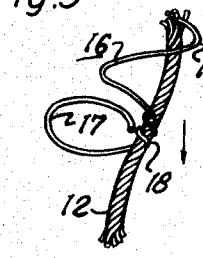


Fig. 10

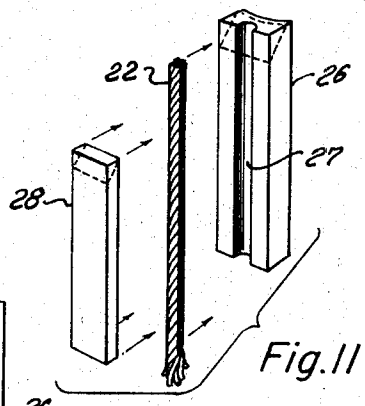


Fig. 11

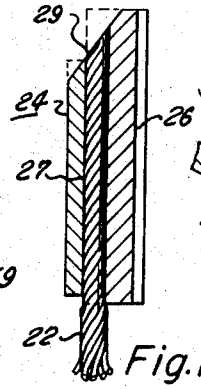


Fig. 12

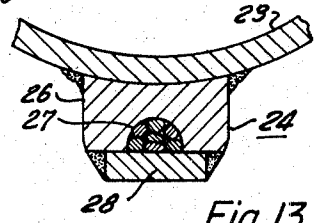


Fig. 13

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2,868,299

WELL BORE SCRATCHER

Fred Morgan Gist, Midland, Tex.

Application March 5, 1956, Serial No. 569,569

8 Claims. (Cl. 166—173)

This invention relates to new and useful improvements in well bore scratchers, known as casing scratchers, and is an improvement on my copending application, Serial No. 417,190, filed March 18, 1954.

One object of the invention is to provide an improved well bore scratcher of rugged construction and having maximum flexibility so as to be capable of functioning properly in the lower portion of a relatively deep well bore after being lowered therethrough in operative position.

Another object of the invention is to provide an improved well bore scratcher having resilient wall-engaging elements carried by an elongated flexible member for mounting on a well pipe or casing to clean the wall of a well bore by reciprocation and/or rotation of the well pipe prior to cementing so as to obtain a more positive bond between the cement and well bore wall, the elements being embedded in and reinforcing said cement after cleaning of said well bore wall.

An important object of the invention is to provide an improved well bore scratcher, of the character described, wherein the resilient wall-engaging elements are disposed in spaced relation and are coiled with their end portions disposed adjacent the flexible mounting member whereby the medial portions of said elements are adapted to engage the wall of the well bore and present elongated surfaces for contact with said well bore wall so as to more thoroughly clean the same.

A particular object of the invention is to provide an improved well bore scratcher, of the character described, wherein each resilient wall-engaging element is coiled in a substantially circular loop extending laterally outward of the flexible mounting member with one end attached to said mounting member and its other end portion free for bearing against the well pipe or casing to urge the medial portion of the element into engagement with the wall of the well bore and permitting limited movement of said element relative to said member whereby said element may slide or slip over obstructions so as to prevent hanging thereof and consequent fracturing or permanent deformation of said element when said well pipe is lowered, raised, rotated or moved in a reverse direction.

A further object of the invention is to provide an improved well bore scratcher, of the character described, wherein the wall-engaging elements are of sufficient resiliency to permit appreciable deformation and passage of said elements through a close well bore or other opening without permanently deforming said elements whereby the same recover their original shape for engagement with well bore wall portions of larger diameter.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, wherein examples of the invention are shown, and wherein:

Figure 1 is a side elevational view of a well casing or pipe having mounted thereon a well bore scratcher constructed in accordance with the invention,

Figure 2 is a view, similar to Figure 1, of a modified well bore scratcher,

Figure 3 is an enlarged perspective view of one end portion of the scratcher shown in Figure 1 removed from the pipe,

Figure 4 is a view, similar to Figure 3, of the modified scratcher,

Figure 5 is an enlarged, horizontal, cross-sectional view, taken on the line 5—5 of Fig. 1, showing the scratcher in plan,

Figure 6 is a view, similar to Figure 5, showing the scratcher in a well bore with its resilient elements in a deformed position,

Figure 7 is a side elevational view of a portion of the scratcher in a well bore,

Figure 8 is an enlarged, perspective view of a pair of the elements,

Figure 9 is a view, similar to Figure 8, showing the position of the elements upon upward movement of the well pipe,

Figure 10 is a view, similar to Figure 8, showing the position of the elements upon downward movement of the well pipe,

Figure 11 is an enlarged, exploded, perspective view of one of the clips for fastening the modified scratcher to the well pipe prior to assembly of said clip,

Figure 12 is an enlarged, transverse, vertical, sectional view of the assembled clip, and

Figure 13 is an enlarged, horizontal, cross-sectional view of one of the clips secured to the casing.

In the drawings, the numeral **10** designates a well bore scratcher embodying the principles of the invention and mounted on a conventional well casing or pipe **11**. The scratcher includes one or more flexible members **12**, such as wire rope or cable, the ends of which are attached to annular bands or collars **13** fixed to the casing **11** in spaced relation. Preferably, the flexible member **12** is of considerably greater length than the distance between the collars **13** and is wound in a helix around the casing **11** with the convolutions of the helix being widely spaced from adjacent convolutions. As shown most clearly in Fig. 3, each end of the flexible member is secured to one of the collars by a suitable clip **14** which is welded to the exterior of said collar. The construction and mounting of the clip is shown in my copending application, Serial No. 490,220, filed February 24, 1955. Although the collars **13** may be welded or otherwise secured to the casing, said collars are preferably fastened in position by frictional engagement with said casing. As shown by the numeral **15**, each collar is split and is adapted to be spread for clamping engagement with the casing.

A plurality of resilient, wall-engaging elements or scratching fingers **16** are carried by the flexible member **12** in spaced relation to one another. The resilient, wall-engaging elements or fingers are formed of suitable spring wire of relatively small gauge and preferably are arranged in spaced pairs as shown most clearly in Figs. 3, 5, and 6. In fact, each pair of resilient fingers **16** is formed of a single elongated wire **17** having its medial portion extending through and wrapped around the flexible member **12** as shown by the numeral **18**. Each element or finger is in the form of a substantially circular loop **19** which extends laterally outward of the member and casing and which is provided by coiling the ends of the wire **17**.

It is noted that the ends of the fingers or their loops **19** are free and unattached and terminate adjacent the flexible member **12** for bearing against the casing (Fig. 5) so as to urge the medial portions of the loops outwardly

into engagement with the wall of a well bore **20** as shown in Figs. 6 and 7. Preferably, the fingers **16** are coiled in the same direction and opposite to the convolutions of the helically-wound member **12**, with the loops of each pair of fingers being spaced from each other. As shown in Figs. 6, 9 and 10, the free ends of the fingers or their loops permit deformation and limited movement of said finger relative to the member when the casing is rotated or reciprocated. Also, the free ends of the fingers or their loops prevent said fingers from hanging on obstructions and consequently damaging the same.

A modified casing scratcher **21** is shown in Figs. 2 and 4 and includes a plurality of flexible members, wire rope or cable **22**, of less length than the flexible member **12**, mounted on a well pipe or casing **23** in spaced, superimposed relationship. Each member **22** is wound in a helix around the casing **23** and has its ends secured thereto by suitable clips **24**. It is noted that the helically-wound members are widely spaced from one another, as are the convolutions of each helix, and that the clips may be axially alined.

A plurality of resilient, wall-engaging elements or scratching fingers **25**, identical to the fingers **16**, are connected to each member **22** in the same manner. As shown in Figs. 11–13, each clip **24** includes an elongated, rectangular block **26** having a coextensive semi-cylindrical groove **27** for receiving one end of one of the members **22**. A substantially complementary plate **28**, of less length, is welded to the outer surface of the block **26** in overlying relation to the groove **27** for confining one end of the member **22** therein, said groove being of a depth less than the diameter of said member whereby the confined end is deformed and clamped between the plate and block. As shown by the numeral **29** in Fig. 12, the upper or outer ends of the block and plate member are beveled after the member is secured in the groove to provide an inclined surface which prevents the clip from hanging on obstructions.

The well bore scratchers **10** and **21** function in substantially the same manner and are adapted to scrape and remove the drilling mud which coats the wall of a well bore prior to cementing in order to obtain a more positive bond between the cement and bore wall. Due to the flexible members or wire ropes **12** and **22**, a rugged construction is provided for readily and economically mounting the scratching fingers **16** and **25** on the casing. Although the illustrated mountings of the well bore scratchers are preferred, it is manifest that the same is subject to variation as shown in my copending application, Serial No. 417,190. It is noted that the spaced convolutions of the helically-wound flexible members or wire ropes provide flow spaces or paths to permit the circulation of fluid for carrying off the dislodged or removed material which may include some loose formation. Of course, the spacing of the resilient elements or fingers **16** and **25** from one another prevents accumulation of the dislodged material and facilitates the carrying off of said material by circulated fluid.

Due to the coiling of the resilient fingers in substantially circular loops, said fingers are more flexible and will more readily conform to the irregular contour of the well bore. Also, there is greater surficial contact between the fingers and the wall of the well bore due to the circular shape of said fingers whereby the arcuate medial portions thereof engage the circular bore wall. As shown in Figs. 6 and 7, the smaller the annulus between the casing and well bore, the greater the surficial contact of the scratching fingers. Since the fingers are formed of spring wire, the same may undergo considerable deformation without being permanently bent or distorted out of their desired shape. It is pointed out that the free end portions of the fingers bear against the casing for urging the medial portions thereof into scraping contact with the bore wall. Also, the free end portions prevent hanging of the fingers upon obstructions and permits threading of said fingers through the relatively-small diameter openings of the surface equipment of the well.

Since the substantially circular fingers are more flexible than straight scratching elements, there is less danger of damaging said fingers upon reversing the direction of movement of the casing. Since the depth of wells are continually increasing and since well bore scratchers are used in the lower portion of wells, a rugged construction with maximum flexibility is essential in order that the scratching fingers will have maximum efficiency at the point of use after being lowered through the major portion of a well bore. These requirements are met by the mounting of substantially circular, resilient fingers on a casing by means of a wire rope or other flexible member of sufficient strength as shown and described hereinbefore. In addition to removing the undesirable mud cake from the bore wall so that a better bond is obtained between the cement and bore wall, the well bore scratchers of the present invention function to reinforce the cement. Although the flexibility of the scratching fingers is necessary, the limited movement permitted by the free ends of said fingers is of primary importance since it increases the flexibility of the fingers and prevents damaging thereof.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A well bore scratcher including an elongated flexible member extending longitudinally of a well casing, mounting means securing the ends of the member to the well casing, and a plurality of independent resilient elements connected to said member in spaced relation to one another, each resilient element being coiled in a substantially circular loop extending laterally outward of said member and casing for engagement with the wall of a well bore, the spaced relationship of the elements providing flow paths therebetween.

2. A well bore scratcher as set forth in claim 1 wherein the mounting means includes a pair of collars fixed in spaced relation on the well casing.

3. A well bore scratcher as set forth in claim 1 wherein the mounting means includes a pair of clips secured to the ends of the flexible member and fastened in spaced relation to the well casing.

4. A well bore scratcher including an elongated wire rope wound in a helix having spaced convolutions around a well casing with its ends attached thereto, and a plurality of independent resilient fingers carried by the rope in spaced relation to one another, each finger including an elongated wire of relatively small gauge having its end portions coiled to provide a pair of substantially circular loops extending laterally outward of said rope for engagement with the wall of a well bore, each wire having its medial portion connected to said rope, the spaced convolutions of said rope and the spaced relationship of the fingers providing flow paths therebetween.

5. A well bore scratcher as set forth in claim 4 wherein each loop has a free end portion for bearing against the well casing to urge the medial portion of the loop outwardly into engagement with the wall of the well bore and for permitting limited movement of said loop relative to the wire rope.

6. A well bore scratcher including a plurality of independent resilient fingers, and a supporting member for mounting on a well casing and having the fingers attached thereto in spaced relation to one another, each finger being coiled in a substantially circular loop of relatively large diameter extending laterally outward of the member and casing for engagement with the wall of a well bore,

the loops of the fingers being spaced from one another to provide flow paths therebetween.

7. A well bore scratcher as set forth in claim 6 wherein the loop of each finger has a free end portion for bearing against the well casing to urge the medial portion of said loop outward into engagement with the wall of the well bore and for increasing the flexibility of the finger.

8. A well bore scratcher including a plurality of independent resilient fingers, and a supporting member for mounting on a well casing, each finger having its medial portion attached to the member in spaced relation to the attachment of adjacent fingers and its end portions coiled to provide a pair of substantially circular

loops of relatively large diameter extending laterally outward of said member and casing for engagement with the wall of a well bore, each loop being spaced from adjacent loops to provide flow paths therebetween.

References Cited in the file of this patent

UNITED STATES PATENTS

220,572	Burgess	Oct. 14, 1879
675,720	Deemer	June 4, 1901
1,442,670	Korner	Jan. 16, 1923
1,484,027	Jacobs	Feb. 19, 1924
2,671,515	Hall	Mar. 9, 1954