

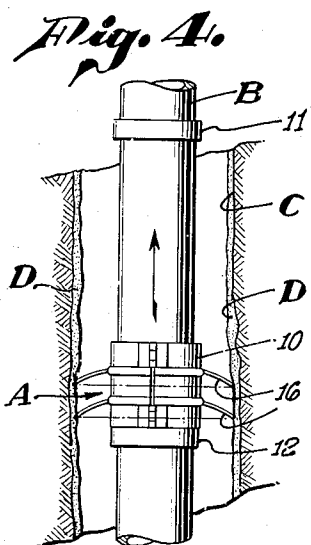
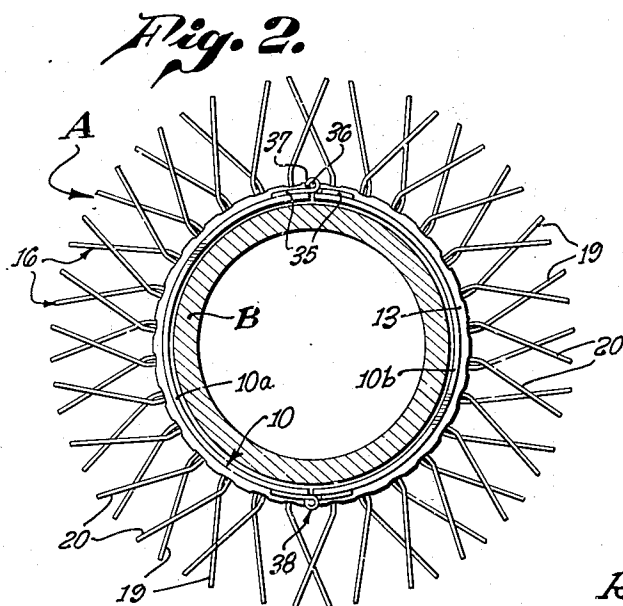
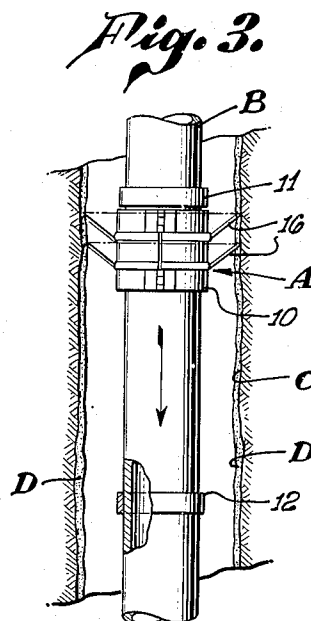
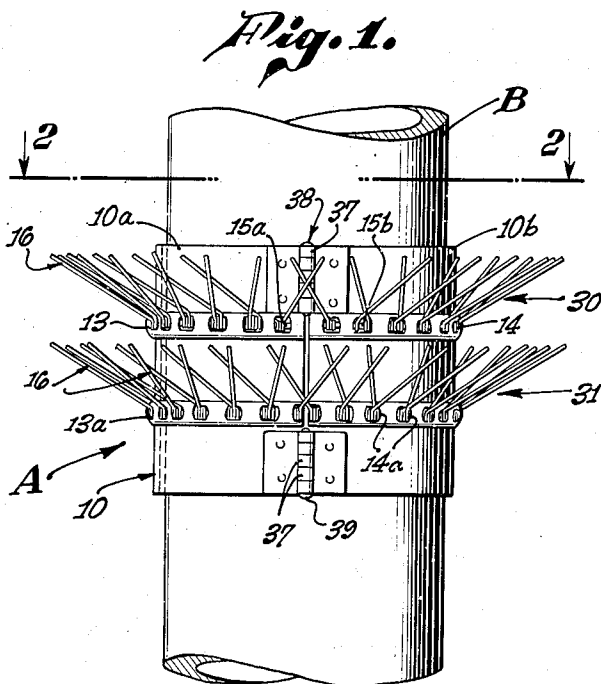
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R. C. BAKER ET AL
SCRATCHER FOR WELL BORES

2,685,931

Filed Feb. 7, 1950

3 Sheets-Sheet 1



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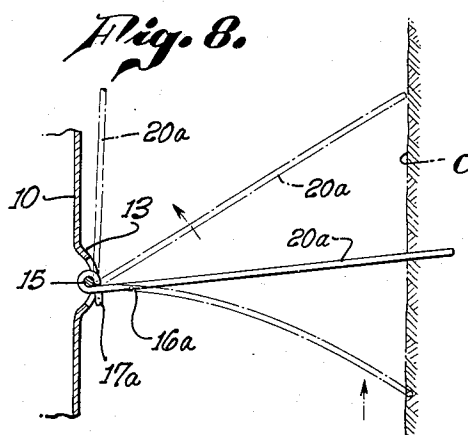
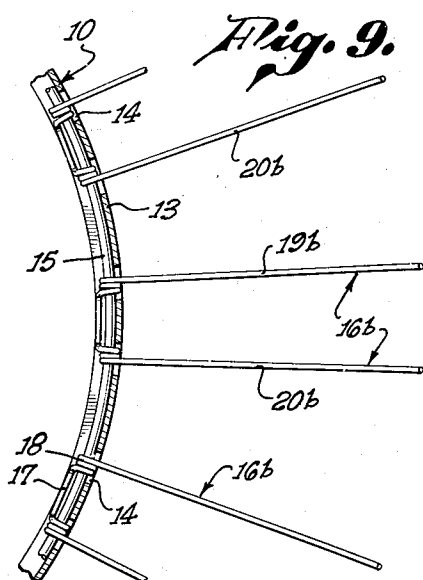
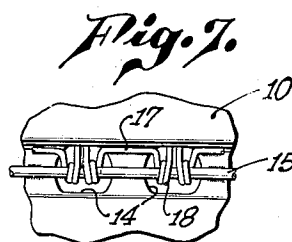
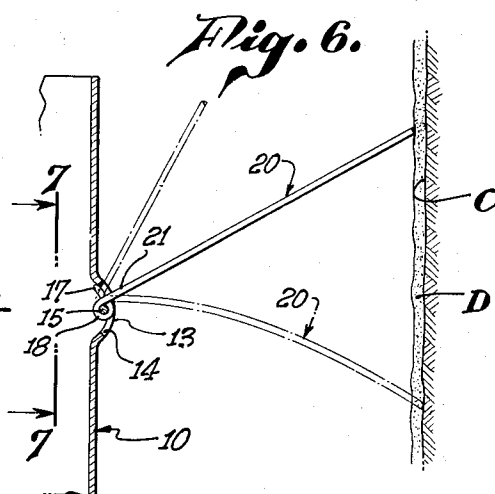
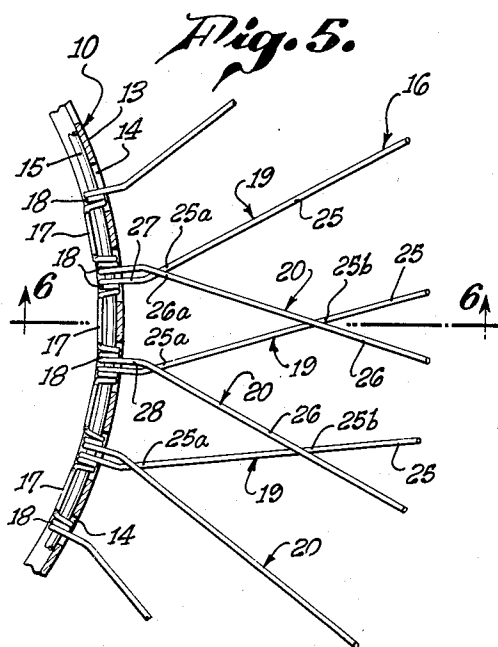
R. C. BAKER ET AL

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SCRATCHER FOR WELL BORES

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3 Sheets-Sheet 2



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SCRATCHER FOR WELL BORES

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21 Claims. (Cl. 166—173)

1

The present invention relates to subsurface well tools, and more particularly to devices for scratching or scraping the walls of open well bores, pipe disposed in well bores, and the like.

An object of the present invention is to provide improved scratcher devices for more effectively removing mud cakes and other sheaths of undesired materials from the walls of bore holes, well conduits and the like.

Another object of the invention is to provide wall scratchers having outwardly extending fingers that can engage and scrape a greater surface around the hole or pipe than in prior devices.

A further object of the invention is to provide wall scratchers that are of strong and sturdy construction, and which are economical to manufacture and easy to assemble.

Yet another object of the invention is to provide wall scratchers than can be assembled easily on a casing or similar string to be disposed in a well bore.

Still a further object of the invention is to provide wall scratchers in which each spring scratching element supports and supplements the other, thereby providing a greater spring force for scratcher purposes than the individual scratching elements can furnish.

Another object of the invention is to provide wall scratcher devices possessing zero or light wall scratching force when the devices are moved through the well bore in one direction, as downwardly, and a maximum wall scratcher force when the devices are moved in the opposite direction, as upwardly.

Still another object of the invention is to provide wall scratchers that not only are effective in scratching the wall of the hole, but which are also capable of centering the well conduit, on which one or more of the scratchers are mounted, in the hole.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a side elevation of one form of wall scratcher mounted on a casing section;

2

Fig. 2 is a cross-section taken along the line 2—2 on Fig. 1;

Fig. 3 is a somewhat diagrammatic view of a wall scratcher mounted on a casing string during lowering of the latter in a well bore;

Fig. 4 is a view similar to Fig. 3, disclosing elevation of the casing string and scratcher in the well bore;

Fig. 5 is a fragmentary cross-section, on an enlarged scale, through part of the scratcher device disclosed in Figs. 1 and 2;

Fig. 6 is a section taken along the line 6—6 on Fig. 5;

Fig. 7 is a fragmentary interior elevation taken as indicated by the line 7—7 on Fig. 6;

Fig. 8 is a view similar to Fig. 6 of a modified form of wall scratcher;

Fig. 9 is a view similar to Fig. 5 of still another form of wall scratcher;

Fig. 10 is a plan view of one of the scratcher elements employed in the embodiment of invention disclosed in Figs. 1 to 7, inclusive;

Fig. 11 is a side elevation of the scratcher element shown in Fig. 10;

Fig. 12 is a fragmentary longitudinal section through a hinge element used in the scratcher devices;

Fig. 13 is a view similar to Fig. 6 of another embodiment of wall scratcher.

As disclosed in the drawings, a wall scratcher A is mounted on a casing or well conduit section B for the purpose of removing the mud cake from a portion of the well bore C in which the casing string is to be disposed, and also to center the casing string in the well bore. It is desired to remove the mud cake or sheath D from a particular portion of the well bore, in order to insure a proper bond between the formation wall and cement slurry, or other cementitious material, pumped down the casing string for upward passage through the annulus around the latter. However, it is preferred not to disturb the mud cake to any substantial extent, except along that portion of the formation wall at which cement is to be disposed. For that reason, the wall scratcher A should scratch the mud cake D lightly, if at all, during descent of the casing string through the well bore. However, the scratching effectiveness should be at a maximum during the upward movement of the casing scratcher in the well bore.

The wall scratcher A could be firmly secured to the casing string, but it is preferred to provide for its slidable mounting thereon. Thus, the wall scratcher includes a collar or sleeve 10 slidable on a casing section B, and adapted to

engages stop elements 11, 12, such as ring members, welded to the casing section on opposite sides of the scratcher A. These stop elements 11, 12 may be disposed a few feet apart. During downward movement of the casing string in the well bore, the upper stop element 11 will engage the collar 10 and force the scratcher device downwardly through the well casing. However, during upward movement of the casing string B to a slight extent, such as occurs in lifting the casing string out of the rotary table slips at the top of the well bore, the scratcher device need not move in an upward direction, inasmuch as the lower stop element 12 will not engage the lower end of the collar 10 during such slight upward movements of the casing string. Greater upward movements, however, will engage the lower ring with the collar and move the scratcher device upwardly with the casing string.

The collar has an outwardly directed bead portion 13 formed in it provided with a row of circumferentially spaced apertures or holes 14, that are preferably equi-distant from one another. A retainer fulcrum or assembly ring 15, which may be made of steel wire, is disposed within the bead 13 and extends substantially entirely around the interior of the collar 10. Scratcher elements 16 are mounted on the ring 15, which serves as a fulcrum about which the elements 16 may pivot.

Each scratcher element 16 includes a heel or base portion 17 extending along the ring 15 and merging into coil portions 18 at its opposite ends. Each coil portion 18 may consist of one or a plurality of turns, as desired, and is disposed opposite one of the bead apertures 14 on opposite sides of the heel or base 17. From each coil portion 18, a comparatively long wire finger 19 or 20 extends through the aperture or hole 14. Thus, one elongate finger 19 extends through one hole 14 at one side of the base 17, and another wire finger 20 extends through an adjacent hole 14 at the other side of the base.

It is evident that the coils 18 serve to mount each scratcher element on the ring 15. The parts are so arranged that the heel portion 17 of the element 16 is disposed above the ring 15 and will engage the upper inner portion of the bead 13 (see Fig. 6), to limit the extent of outward swinging of the fingers 19, 20 about the ring 15. When the heel portion 17 engages the bead 13, the fingers 19, 20 are preferably inclined in an upward and outward direction, as disclosed most clearly in Fig. 6. The spring fingers 19, 20 can swing in a downward direction about the ring 15 to a still further extent, but such action is resisted by the coil portions 18, which are wound or unwound (depending upon the direction of their coiling) to provide the spring force resisting outward swinging of the fingers. During such winding or unwinding of the coils 18, the heel portions 17 engage the inner wall of the bead 13, and offer resistance to the winding action of the coils with respect to the retainer ring 15.

Upward and inward movement of the spring fingers 19, 20 about the retainer ring 15 can take place to an extent limited by engagement of the inner portions 21 of the fingers with the sides of the collar apertures 14. Such engagement will insure the upward and outward inclination of the fingers 19, 20 to a minimum extent, which may be sufficient to bear against the wall of the well bore C relatively lightly. Any further inward force of the wall of the well bore on the springs 19, 20 will bend them inwardly about the wall defining the aperture 14.

The scratcher elements 16 are mounted on the ring 15, with their finger portions 19, 20 extending through the apertures 14 and projecting outwardly beyond the collar 10 to a substantial extent. The assembled scratcher device A is mounted on a casing section B, with the upper and lower stop elements 11, 12 welded to the latter an appropriate distance apart on opposite sides of the scratcher device. The casing string 10 is lowered through the well bore, the upper stop element 11 engaging the collar 10 and moving the scratcher A downwardly through the well casing. During such downward movement, the spring fingers 19, 20 can merely ride along the mud cake D or wall of the well bore C, exerting a light or zero force against the casing wall. The extent of inward movement of the fingers 19, 20 is determined by engagement of their inner portions 21 with the upper walls of the apertures 14. As indicated above, a small elevation of the casing string will not move the scratcher in an upward direction, inasmuch as the lower stop element 12 will not be brought into engagement with the lower end of the collar 10.

When the portion in the well bore C has been reached in which the scratching operation is to take place, the casing string is elevated the proper distance, the lower stop element 12 engaging the collar 10 and moving it in an upward direction. During such upward movement, the ends of the fingers 19, 20 engage the mud cake D, such engagement causing the fingers to tend to swing downwardly and outwardly, shifting the fingers to a position in which they penetrate the mud cake and possibly bending them downwardly through the transverse plane of the bead 13, as indicated in the lowermost broken line position shown in Fig. 6. Continued upward movement causes the fingers 19, 20 to scratch along the mud cake D, breaking it into relatively small pieces, which can be flushed from the well bore by the circulating fluid pumped downwardly through the well casing. Such downward and outward swinging of the fingers 19, 20 is resisted by the engagement of the heels 17 of the scratcher elements with the collar bead 13, and by the winding or unwinding of the coils 18 about the retainer ring 15.

Most of the spring force resisting pivoting of the fingers 19, 20 about the retainer ring 15 is supplied by the spring coils 18, a small amount being furnished by the bending of the fingers themselves.

The casing string B may be reciprocated the desired number of times to insure removal of the mud cake from the wall of the well bore along the desired length. The removal of the mud cake is evidenced by the mud particles appearing in the circulating fluid as it leaves the top of the well bore.

In the scratcher assembly disclosed in Figs. 1 to 7, inclusive, each scratcher element 16 is mounted on the ring 15, with its fingers 19, 20 passing through adjacent holes 14, 14 on opposite sides of the heel portion 17 of the element. The next adjacent scratcher element 16 is mounted on the retainer or assembly ring 15, with one of its fingers 19 extending through the same hole 14 as a finger 20 of an adjoining element. That is, the scratcher elements are so arranged that two fingers 19, 20 of different elements pass through each bead hole or aperture 14, one finger from one element and another finger from the adjacent element. Because of this arrangement, a greater number of scratcher elements 16 can be

disposed around the collar 10, multiplying the number of fingers 19, 20 available for scratching purposes on the formation wall C or on the wall of a pipe (when the device is used for scratching or scraping the wall of the pipe).

In the arrangement disclosed in Figs. 1 to 7, the scratcher elements 16 are caused to support or supplement one another. This is accomplished by bending the major portion 25 or 26 of each finger with respect to its inner portion 27 or 28 adjacent the collar bead 13. As disclosed in the drawings, the fingers 19, 20 of each element are bent away from one another so as to overlie one or more fingers of adjacent elements. Thus, an inner portion 26a of a finger 20 of one scratcher element is caused to overlie and will cross the inner portion 25a of an adjacent finger 19 of another element. In addition, the same finger 20 of a scratcher element will overlie and cross an intermediate portion 25b of a finger 19 of a third scratcher element. Because of this engagement of a scratcher finger 20 with one or a plurality of fingers 19 of other scratcher elements, the latter two support the first-mentioned finger 20. As a result, during upward movement of the casing string to scratch the mud cake D from the wall of the formation, the first finger 20 will engage the wall of the hole and its downward pivoting about the retainer ring 15 will be resisted not only by its own coil spring portion 18, but also by engaging and tending to move downwardly the fingers 19 of the other two scratcher elements, the downward movement of these fingers being resisted by their respective coil spring portions 18.

It is to be noted that one finger 20 of each scratcher element 16 is supported by two fingers 19 on two other scratcher elements and that the other finger 19 of the first-mentioned scratcher element 16 furnishes the supplemental force and resistance for two other fingers 20 of two other scratcher elements.

The crossing arrangement of fingers 20, 19 not only supplements the scratcher force available for removing the mud cake from the formation wall, but also insures engagement of all of the fingers with the wall of the hole. As one finger 20 is swung downwardly and outwardly about the retainer ring 15, it moves the overlapped fingers 19 downwardly; so as to insure their engagement with and digging into the mud cake D and formation wall C.

The scratcher device can be easily assembled, each spring element 16 being placed within the collar and its opposite fingers 19, 20 disposed through a pair of bead apertures or holes 14, with the fingers appropriately overlapping one another. The wire retainer ring 15 can then be threaded through all of the coils 18, and the ring itself appropriately secured, as by welding, to the bead 13 to insure that it will remain in place.

In order to obtain a greater number of scratching elements 16 for action upon the mud cake and to insure that a much greater wall surface will be scratched, a plurality of sets 30, 31 of scratcher elements may be mounted on the collar 10. As shown in Fig. 1, an upper and a lower bead 13, 13a is formed in the collar, the apertures 14a in the lower bead 13a being offset with respect to the apertures 14 in the upper bead 13. The spring elements 16 extend through the upper and lower beads 13, 13a and are assembled in essentially the same manner, the lower scratcher elements 16 being offset slightly with respect to the upper scratcher elements, in order that the ends of the

fingers 19, 20 of the lower set 31 will engage different circumferential portions of the formation wall than the ends of the fingers of the upper set 30.

The action of the multiple set arrangement of scratcher elements disclosed in Fig. 1 is essentially the same as the single set, the multiple set offering assurance of effective removal of the mud cake from the desired region where the cement bond is to be achieved with the formation wall.

In order to facilitate mounting of the scratcher device on the casing section, it can be made of split or hinged construction. As disclosed in the drawings, the collar or sleeve 10 is made in two parts 10a, 10b, which is also true of the retainer or fulcrum ring 15a, 15b. Each retainer or fulcrum ring portion is suitably secured, as by welding, to the bead portion 13 of the collar, each ring section 15a, 15b terminating at the ends of the collar section 10a, 10b. The collar sections 10a, 10b are hinged together at one side of the device by welding or otherwise securing opposed hinge plates 35 at the ends of opposite sections, and by inserting a suitable hinge pin 36 through the interleaved hinge knuckles 37. Preferably, a hinge 35, 36, 37 is placed on the upper and lower portions of the collar sections 10a, 10b above and below the collar beads 13 (see Fig. 1). Such pair of hinges have a common axis about which they may pivot.

On the opposite side of the collar a like pair of hinges 38 is provided. However, the hinge pins 36 are omitted from such hinges, in order that the collar 10 may be opened, swinging its half sections 10a, 10b about the axis of the other hinge pins 36, the device then being moved transversely and placed around a casing section between the stop elements 11, 12 that may already be provided thereon. As a matter of fact, one of the stop elements may be constituted by the usual coupling (not shown) that may be employed to connect adjacent casing sections together. The collar is then closed about the casing section and pins 39 placed through the knuckle portions 37 of the opposite hinge parts. As disclosed in the drawings, such pin elements may take the form of drive screw nails which are driven through the interleaved knuckles 37, the helical threads or ribs 40 on the shank portions of the nails forming or cutting their own threads in the interior of the knuckles 37, and securely fastening the two halves of each hinge 38 together. The drive screw nails form a rapid and effective manner of closing the scratcher device A around the casing and of holding them properly mounted in position thereon, inasmuch as pivoting action of the hinges 35, 36, 37 is no longer necessary once the device has been assembled on the casing section.

In the form of invention disclosed in Figs. 1 to 7, inclusive, upward movement of the spring fingers 19, 20 is limited by engagement of their inner portions 27, 28 with the side walls of the apertures 14. In the form disclosed in Fig. 8, the spring elements 16a are inverted with respect to the positions they occupied in the other form of the invention, with the heel portions 17a disposed downwardly and exteriorly of the bead 13. With this arrangement, the heel portion 17a will engage the lower external surface of the bead 13 to limit the extent of free downward swinging of the fingers 19a or 20a. However, the inverting of the elements allows them to swing upwardly about the retainer ring 15 to a greater

extent before the finger 19a or 20a will engage the sides of the aperture 14, the fingers, in fact, being able to be collapsed to a comparatively small effective diameter and completely out of engagement with the wall of the well bore. As a result, during downward movement of the casing string in the well bore, the fingers 19a, 20a will offer no scratching force upon the formation wall or mud cake D, but upon upward movement of the casing string with the lower stop element 12 in engagement with the collar 10, the outer ends of the spring elements will engage the formation wall or mud cake and perform a scratching action in the same manner as in the other form of the invention.

In the form disclosed in Fig. 9, the fingers 19b, 20b of each scratcher element do not overlap one another, but extend substantially radially outward; so as to engage the mud cake D and scratch it from the formation wall, without the spring force of one element 19b being supplemented by the resisting spring force of adjacent elements 20b.

The scratcher element illustrated in Fig. 13 has its end portions 50 turned upwardly at an angle to the main portions of the fingers 19, 20. With this arrangement, the terminals of the portions 50 can function like claws or teeth in digging away the mud cake D during upward movement of the scratcher device, as is evident from the broken line position shown in Fig. 13.

It is apparent that scratcher elements have been devised which can effectively remove the mud cake and other sheaths from the walls of bore holes and well conduits, and in which a maximum scratcher force is available for resisting deflection of the spring fingers and for insuring removal of the toughest mud sheaths from the wall of the well bore. The provision of a plurality of rows of scratcher elements offset with respect to each other insures the coverage of a greater circumferential extent by the scratcher fingers along the wall of the well bore, and the removal of all of the mud cake from the desired region in the hole. Each scratcher finger may operate individually or may have its scratching action supplemented by the resisting force of adjacent spring fingers, which increases the strength and sturdiness of the device considerably. During downward movement of the casing string in the well casing, a small or non-existent scratching force is applied against the wall of the well bore, but during upward movement, a substantial and great force for scratching the hole wall is present. The wall scratchers can be readily assembled and can be easily mounted on a casing or similar conduit string. In addition to their scratching action, they serve to center the conduit string in the well bore, in order to insure a more uniform deposition of cement slurry around the casing string and thereby prevent channeling.

The inventors claim:

1. In a wall scratcher: a collar having a plurality of apertures extending through its side wall and adapted to be mounted on the exterior of a well conduit; a plurality of spring elements disposed adjacent each other substantially in a common plane and extending laterally outward through said collar apertures, each element having a coil portion disposed in the interior of said collar; and means inside of said collar extending through said coil portions for mounting said elements on said collar.

2. In a wall scratcher: a collar having a plu-

ality of apertures extending through its side wall and adapted to be mounted on the exterior of a well conduit; a plurality of spring elements disposed adjacent each other substantially in a common plane and arranged around said collar; each element including an outwardly projecting finger extending laterally outward through an aperture and merging into a spring coil disposed inside of said collar, said coil merging into a heel contactable with said collar; and means in the interior of said collar extending through said coils for mounting said elements on said collar.

3. In a wall scratcher: a tubular collar adapted to be mounted on the exterior of a well conduit and having an inner generally cylindrical wall, said collar having a plurality of apertures extending through said wall; a plurality of spring elements disposed adjacent each other substantially in a common plane and arranged around said collar; each element including an outwardly projecting finger extending laterally outward through an aperture and merging into a spring coil disposed in the interior of said collar, said coil merging into a heel contactable with the inner wall of said collar; and means inside of and secured to said collar extending through said coils for mounting said elements on said collar.

4. In a wall scratcher: a collar having an aperture, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a finger extending through a bead aperture and a spring coil disposed in the interior of said collar and within said bead; and means within said bead extending through said coils for mounting said elements on said collar.

5. In a wall scratcher: a collar having an aperture, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a finger extending through a bead aperture, a spring coil disposed in the interior of said collar and within said bead, and a heel secured to said coil and contactable with said collar; and means within said bead extending through said coils for mounting said elements on said collar.

6. In a wall scratcher: a tubular collar adapted to be mounted on the exterior of a well conduit and having a plurality of apertures extending through its side wall; a plurality of spring elements disposed adjacent each other substantially in a common plane and arranged around and extending laterally through said collar apertures; each element including a pair of outwardly projecting fingers separate from each other, spring coils in the interior of said collar and secured to said pair of fingers, and a heel secured to said coils and contactable with said collar; and means extending through said coils for mounting said elements on said collar.

7. In a wall scratcher: a tubular collar adapted to be mounted on the exterior of a well conduit and having an inner generally cylindrical wall, said collar having a plurality of apertures extending through its side wall; a plurality of spring elements arranged around and extending laterally through said collar apertures; each element including a pair of outwardly projecting separate fingers, spring coils in the interior of said collar and secured to said pair of fingers and disposed within said collar, and a heel secured to said coil and contactable with the inner wall of said collar; and means within and secured to said collar extending through said coils for mounting said elements on said collar.

8. In a wall scratcher: a collar having an apertured, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a pair of outwardly projecting fingers extending through said bead apertures, spring coils secured to said pair of fingers and disposed in the interior of said collar and within said bead, and a heel secured to said coils and contactable with the inner wall of said collar; and means within said bead extending through said coils for mounting said elements on said collar.

9. In a wall scratcher: a collar having a plurality of apertures extending through its side wall; a plurality of spring elements disposed circumferentially around said collar substantially in a common plane and extending laterally through said collar apertures, said elements having fingers separate from each other and overlapping and contacting fingers of adjacent elements in a direction circumferentially around said collar, said fingers extending laterally outward of said collar to a substantial extent; and means mounting said elements on said collar.

10. In a wall scratcher: a collar having a plurality of apertures extending through its side wall; a plurality of spring elements arranged circumferentially around and extending laterally through said collar apertures; each element including a lateral and outwardly projecting finger merging into a spring coil disposed in the interior of said collar, said coil merging into a heel contactable with said collar; the finger of one element overlapping and contacting a finger of an adjacent element in a direction circumferentially around said collar; and means within said collar extending through said coils for mounting said elements on said collar.

11. In a wall scratcher: a collar having a plurality of apertures extending through its side wall; a plurality of spring elements arranged circumferentially around and extending laterally through said collar; each element including a pair of lateral outwardly projecting fingers, spring coils secured to said pair of fingers and disposed in the interior of said collar, and a heel secured to said coils and contactable with said collar; a finger of each element overlapping and contacting one or more fingers of other elements in a direction circumferentially around said collar; and means extending through said coils for mounting said elements on said collar.

12. In a wall scratcher: a collar having an apertured, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a pair of outwardly projecting fingers extending through adjacent bead apertures, spring coils secured to said pair of fingers, and a heel secured to said coils and contactable with said collar between the apertures through which the fingers project; the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent spring elements; and means within said bead extending through said coils for mounting said elements on said collar.

13. In a scratcher: a collar having an apertured, outwardly directed circumferential bead formed therein, said collar comprising a plurality of sections; longitudinally spaced hinge means on opposite sides of said bead securing said sections together at one side of said collar; longitudinally spaced detachable means on opposite sides of said bead securing said sections together at the opposite side of said collar; a plurality of spring ele-

ments arranged around said collar, each element including a finger extending through a bead aperture and a spring coil disposed within said bead; and an annular member secured to said collar and extending through said coils to mount said elements on said collar, said annular member comprising a plurality of sections conforming to the collar sections.

14. In a wall scratcher: a collar having an apertured, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a pair of outwardly projecting fingers extending through different bead apertures, spring coils secured to said pair of fingers, and a heel secured to said coils and contactable with said collar between the apertures through which the fingers project; the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent spring elements in a direction circumferentially of said collar.

15. In a wall scratcher: a collar having an apertured, outwardly directed circumferential bead formed therein; a plurality of spring elements arranged around said collar, each element including a pair of outwardly projecting fingers extending through different bead apertures, spring coils disposed within said bead and secured to said pair of fingers, and a heel secured to said coils and contactable with said collar between the apertures through which the fingers project, the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent spring elements in a direction circumferentially of said collar.

16. In a wall scratcher: a collar having a plurality of apertures disposed circumferentially therearound; a plurality of spring elements arranged around said collar, each element including a pair of outwardly projecting fingers extending through different collar apertures, spring coils on the inside of said collar and secured to said pair of fingers, and a heel secured to said coils and contactable with said collar between the apertures through which the fingers project; the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent spring elements in a direction circumferentially of said collar.

17. In a wall scratcher: a member having an apertured, outwardly directed bead formed therein; a plurality of spring elements disposed along said bead, each element including a pair of outwardly projecting fingers extending through different bead apertures, spring coils disposed within said bead and secured to said pair of fingers, the axes of said coils extending generally along the length of said bead, and a heel secured to said coils and contactable with said member between the apertures through which the fingers project; the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent spring elements.

18. In a wall scratcher: a member having an apertured, outwardly directed bead formed therein; a plurality of spring elements disposed along said bead, each element including a pair of outwardly projecting fingers extending through different bead apertures, spring coils disposed within said bead and secured to said pair of fingers, the axes of said coils extending generally along the

length of said bead, and a heel secured to said coils and contactable with said member between the apertures through which the fingers project.

19. In a wall scratcher: a member having an apertured and outwardly directed bead formed therein; a plurality of spring elements disposed along said bead, each element including an outwardly projecting finger extending through a bead aperture, a spring coil disposed within said bead and secured to said fingers, and a heel secured to said coil and contactable with said member; the axes of said coils extending generally along the length of said bead.

20. In a wall scratcher: a member having an internal groove therein and a plurality of spaced apertures; a plurality of spring elements disposed along said groove, each element including a pair of outwardly projecting fingers extending through different apertures, spring coils disposed within said groove and secured to said pair of fingers, and a heel secured directly to said coils and contactable with said member; the axes of the coils of said spring elements extending generally lengthwise of said groove.

21. In a wall scratcher: a collar having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said collar, each element including a pair of lateral and outwardly projecting fingers extending through different bead apertures and also including an intermediate portion disposed within said bead; said apertures

being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; means adapted to abut each spring element to prevent rotation of said element on the collar beyond a predetermined point, said means comprising a portion of the collar adjacent said aperture which is engaged by a portion of each spring element, the fingers of each element diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent elements in a direction circumferentially around said collar; and means engageable with said elements to prevent substantial movement of said elements inwardly of said collar.

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	574,972	Wiens	Jan. 12, 1897
	1,040,118	Batt	Oct. 1, 1912
	1,371,425	Jones	Mar. 15, 1921
	1,557,166	Horn	Oct. 13, 1925
25	2,298,985	Still et al.	Oct. 13, 1942
	2,315,069	McKean et al.	Mar. 30, 1943
	2,362,198	Gibson	Nov. 7, 1944
	2,412,876	Edwards	Dec. 17, 1946
	2,421,434	Reistle et al.	June 3, 1947
	2,427,632	Stephens	Sept. 16, 1947
	2,506,405	Wright	May 2, 1950