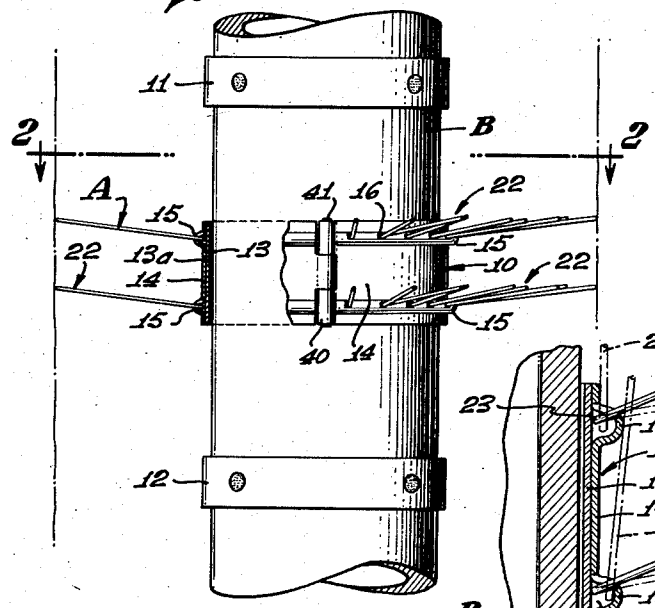
Aug. 13, 1957 J. R. BAKER 2,802,536

SCRATCHERS FOR WELL BORES

Filed May 24, 1954

Fig. 1.



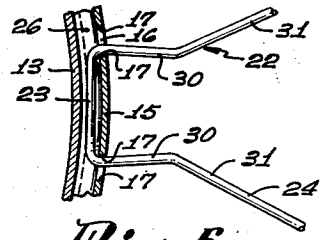


Fig. 5.

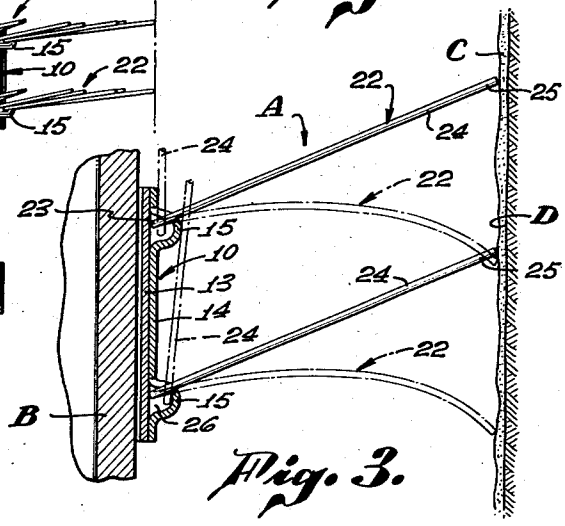
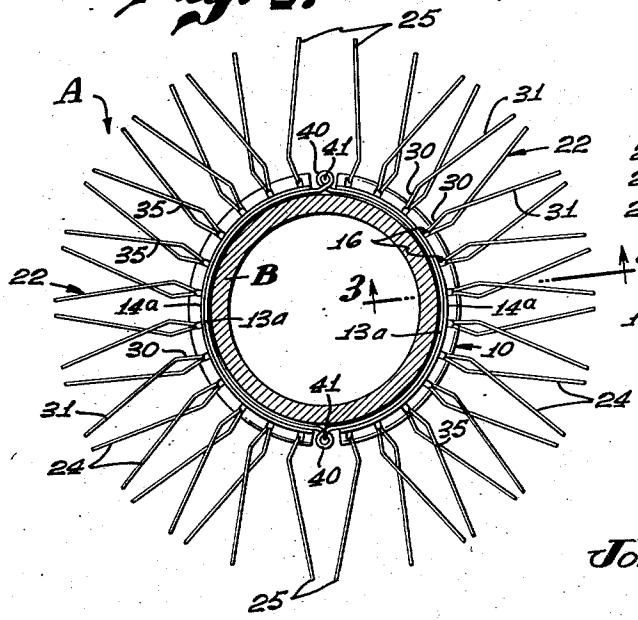


Fig. 3.

Fig. 2.



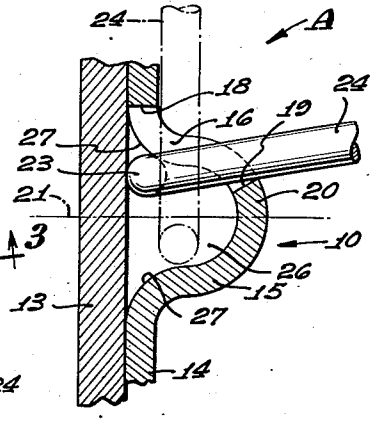


Fig. 4.

INVENTOR.
JOHN R. BAKER,
BY
Mellin and Hanscom
ATTORNEYS

United States Patent Office 2,802,536 Patented Aug. 13, 1957

2,802,536

SCRATCHERS FOR WELL BORES

John R. Baker, Pasadena, Calif., assignor to Baker Oil Tools, Inc., Los Angeles, Calif., a corporation of California

Application May 24, 1954, Serial No. 431,654

17 Claims. (Cl. 166—173)

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

An object of the present invention is to provide a wall scratcher embodying spring fingers that can collapse more fully toward the casing string on which the scratcher is mounted during lowering of the casing string in the well bore, to preclude any substantial scratching of the fingers against the wall of the well bore during such lowering movement. The spring fingers, however, are effective to engage and scratch the wall of the well bore with effective force during upward movement of the well casing therewithin.

Another object of the invention is to provide a wall scratcher of simple and rugged construction, which is easy to assemble and more economical to produce.

A further object of the invention is to provide a hinge type of wall scratcher which can be placed laterally around a well casing section, and in which the hinges can be made of stronger and sturdier construction without increasing the over-all outside diameter of the wall scratcher.

Yet another object of the invention is to provide a wall scratcher including outwardly directed spring fingers, to engage the wall of the well bore, mounted on a supporting member, in which the spring fingers do not interfere with each other at the supporting member, insuring the appropriate flexing action of the fingers during the wall scratching operation.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of 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 a wall scratcher mounted on a casing section, with portions disclosed in longitudinal section;

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

Fig. 3 is an enlarged fragmentary longitudinal section taken along the line 3—3 on Fig. 2;

Fig. 4 is an enlarged fragmentary section disclosing the manner of mounting a scratcher element on its associated supporting member;

Fig. 5 is an enlarged fragmentary cross-section of a single spring element and its associated supporting sleeve.

The wall scratcher A disclosed in the drawings is designed to be mounted upon a casing string section B for the purpose of removing the mud cake C or other material that may be coating the inner wall of a well bore D in which the casing string is to be disposed. Scratchers

are ordinarily used to remove the mud cake or sheath from a particular portion of the well bore, for the purpose of insuring a good bond between the formation wall and cement slurry, or the like, pumped down the casing string for upward passage through the annulus around the latter. It is preferred not to disturb the mud cake C in the well bore to any substantial extent, excape along the portions of the formation wall at which the cement slurry is to be deposited. For that reason, the wall scratcher A is designed to provide very little, if any, engaging force against the mud cake during lowering of the casing string in the well bore. But upon elevating of the casing string B and scratcher A in the well bore, the scratcher should have maximum effectiveness in operating upon the wall of the well bore D.

The scratcher A is mounted on the casing section B, there preferably being relative longitudinal movement to a limited extent allowed between the two devices. The wall scratcher includes a supporting sleeve structure 10 slidable on the casing section B. This sleeve structure is adapted to engage stop elements 11, 12, in the form of ring members, suitably secured, as by welding, to the casing section on opposite sides of the scratcher, the stop members 11, 12 being disposed several feet apart, or a much greater distance than the vertical length of the sleeve structure, in order to permit a limited amount of relative longitudinal movement between the casing section and the scratcher. During downward movement of the casing string B in the well bore D, the upper stop ring 11 engages the sleeve structure 10, forcing the scratcher A downwardly through the well bore. Slight upward movement of the casing string, such as occurs in lifting it out of the rotary table slips (not shown) at the top of the well bore, will not move the scratcher device in an upward direction since the lower stop element 12 will not have been moved upwardly sufficiently to engage the lower end of the sleeve structure 10. A greater extent of upward movement of the casing section will bring the lower ring 12 into engagement with the sleeve structure 10, and cause it to shift the entire scratcher device A upwardly with the casing string B within the well bore D.

The sleeve structure 10 of the scratcher device includes an inner sleeve 13 and an outer sleeve 14, which may be of the same longitudinal extent as the inner sleeve 13 and suitably spot welded or otherwise secured thereto. The inner sleeve 13 may be made of substantial thickness, so as to withstand relatively great strains, whereas the outer sleeve 14 may be made of somewhat thinner gauge material. The inner sleeve 13 is generally cylindrical in form. The outer sleeve 14 is also cylindrical in form, but is provided with one or more outwardly directed bead portions 15. Where more than one bead portion is provided, such bead portions 15 are longitudinally spaced from one another, each of the beads having a set of circumferentially spaced apertures 16 therethrough, the apertures in one bead preferably being staggered or disaligned with respect to the apertures of the other bead 15.

Each aperture 16 may be bounded by sides 17 that are substantially parallel to each other, the upper end 18 of each aperture terminating at the juncture of the bead 15 with the cylindrical portion of the outer sleeve 14, whereas the lower side or base 19 of the aperture or opening terminates at the central or mid-portion 20 of the bead, and preferably above the central plane 21 of the bead normal to the axis of the structure 10. Thus, the apertures 16 of each bead are provided in the upper portion of the bead 15, the lower portion of each bead being imperforate. The reasons for locating the apertures 16 in the upper portion of the bead will be described hereinbelow.

A plurality of spring wire elements 22 are carried by the sleeve structure 10. The spring wire elements and

their cooperation with the sleeve structure **10** are the same at each bead portion of the latter, so that a description of one set of spring elements **22** and one bead **15** will suffice for both. As specifically disclosed in the drawings, the apertures **16** are substantially uniformly spaced from each other. Disposed within the bead are the base portions **23** of the spring elements, each element consisting of a piece of spring-like steel wire having its central base portion disposed within the bead **15**. This base portion **23** merges at its opposite ends into a pair of spring fingers **24** extending outwardly through apertures **16** in the bead. Thus, a spring finger **24** of a spring element **22** will extend out through one aperture **16** of the bead **15**, the base portion **23** being disposed within the bead and running to the next adjacent bead aperture **16**, where it is connected to or merges into the other finger **24**, of the spring element, this latter finger extending through such adjacent aperture.

Individual spring elements **22** will be carried by the sleeve structure **10**, the base **23** of each of these spring elements being disposed within the bead **15**, the spring fingers **24** extending outwardly through bead apertures **16** on opposite sides of the base portion **23**. From the drawings, and particularly Fig. 2, it is apparent that the fingers **24** of adjoining spring elements **22** will extend outwardly through the same bead aperture **16**, the sides **17** of each aperture being spaced sufficiently apart to provide an aperture width that is greater than twice the diameter of a spring wire, to permit the spring wire elements **22** to move without interference from each other.

The spring fingers **24** are of substantial length and will extend laterally outward with their outer ends **25** engageable with the wall of the well bore, in order that the fingers will perform a scratching action on the wall during upward movement of the well casing B and scratcher A in the well bore D. During downward movement of the casing string and the scratcher device in the well bore, the spring elements **22** may fold upwardly, to avoid the imposition of any spring force on the wall of the well bore. The ability of the spring elements **22** to function in the manner described will be apparent from an inspection of the scratcher device, particularly as shown in Figs. 3 and 4. As shown most clearly in Fig. 4, the diameter of the wire from which the spring scratcher element **22** is made is much smaller than both the vertical and horizontal distances across the inner groove portion **26** of the bead **15**. That is to say, the greatest lateral distance from the periphery of the inner sleeve **13** to the outermost portion of the bead wall is much greater (two to three times greater) than the diameter of the spring wire from which the scratcher element **22** is made. This is also true of the vertical distance between the opposed inner side walls **27** of the bead **15**. Thus, the base portions **23** of each spring element **22** can move to a substantial extent vertically within and with respect to the bead **15**, as well as laterally within and with respect to the bead. The spring elements **22** may be folded upwardly in the manner shown in broken lines in Figs. 3 and 4, to lie closely adjacent the sleeve structure **10**, which will insure the lack of any substantial contact, or of no contact whatever, between the spring fingers **24** and the wall of the well bore D. The ability of the spring elements **22** to fold upwardly against the sleeve structure **10** is permitted since the base portion **23** of each element can move within the bead groove **26** downwardly into engagement with its lower side wall **27**, which will allow the fingers **24** to swing inwardly against the periphery of the outer sleeve **14**. The fact that the upper end **18** of each aperture **16** lies at the juncture between the bead **15** and the upper cylindrical portion of the sleeve **14** permits the spring elements **22** to fold against the sleeve **14** to a position substantially parallel relation to the axis of the apparatus. With respect to the lower set of spring elements **22**, their ability to fold inwardly is limited by their engagement with the upper bead **15**, as clearly indicated in Fig. 3. However, such lower set of spring elements will still be completely removed from engagement with the wall of the well bore D.

The spring elements **22** can swing in a downward direction to place their spring fingers **24** in scratching engagement with the wall of the well bore D. As will be clear from Fig. 4, the downward swinging of each spring element brings each spring finger **24** into engagement with the lower or base side **20** of an aperture **16**, the base **23** of each spring element being shifted upwardly into engagement with the upper side **27** of the bead groove **26** and also against the periphery of the inner sleeve **13**. Accordingly, when the spring element **22** is swung downwardly to the full line position shown in Fig. 4, the lower side **20** of each aperture acts as a fulcrum point about which each spring element will bend or flex, the inner surface **27** of the bead groove **26** and the outer surface of the sleeve **13** preventing upward movement of the spring element base **23**. Such position of the spring elements **22** will be produced during upward movement of the casing B and sleeve structure **10**. During such upward movement, the spring elements **22** can pivot or swing in a downward direction, whereupon continued upward movement of the casing string and sleeve structure will cause the outer ends **25** of the springs to engage the wall of the well bore D and cause the spring elements to flex about their points of engagement with the lower sides **20** of the apertures **16**, the spring fingers **24**, in effect, flexing in a downward direction, as disclosed in broken lines in Fig. 3, and exerting an outward scratching force upon the wall of the well bore D during the elevating movement of the casing string B and the entire scratcher device A.

In order to increase the spring force that can be exerted by the scratcher elements **22** against the wall of the well bore D, the spring fingers **24** are caused to overlap one another, to support each other. In addition, the spring fingers **24** of the scratcher elements are so related to each other as to avoid interference with one another at the bead during their swinging movement within the bead **15**. To accomplish these purposes, the fingers **24** of each element consist of inner portions **30** which taper or converge toward each other in a direction outwardly of the bead **15**, these inner portions (which are of relatively short length) merging into outer portions **31** that diverge from each other in a direction outwardly of the bead. The fact of convergence of the inner portions **30** insures that the inner portion of one spring element will not interfere with the inner portion of an adjacent spring element extending through the same aperture **16**. The inner portion **30** of adjacent elements **22** diverge from each other, as is evident from Fig. 2.

The divergence of the outer divergent portions **31** of the fingers of each element **22** causes one outer finger portion to cross the outer finger portion **31** of an adjacent spring element, the crossing location being at a substantial distance **35** outward from the bead **15**. Accordingly, the downward swinging of one spring finger **24** will cause it to engage the outer spring portion **31** of an adjoining spring element **22** at the crossing location **35**, so that the spring fingers **24** mutually support one another and result in the transmission of the spring force from finger to finger around the entire circumference of the apparatus. It is also to be noted that the convergence of the inner finger portions **30** of each element **22** results in the crossing of the outer finger portions **31** of adjacent elements at a greater distance from the bead **15** than would occur if the inner portions **30** were made parallel. It is evident that the convergence of the inner spring finger portions **30** toward each other provides several purposes. Not only does it locate the crossing of the outer spring portions **31** at a greater distance from the bead **15**, but it also avoids interference in the swinging movement between adjacent spring elements **22**, particularly at the

common aperture **16** through which their adjacent spring finger portions **30** extend.

It is to be noted that each spring element **22** is comparatively simple, consisting of a spring wire of the proper size that can be bent into the shape disclosed. It is a simple matter to assemble the spring elements **22** in the outer sleeve. All that need be done is to bend the fingers **24** of each element toward each other and slip the ends **25** of the fingers through the apertures **16**. When the base portion **23** is disposed within the bead **15**, the spring fingers can be released, allowing them to assume their initial shape, with the inner finger portions **30** converging toward each other and the outer finger portions **31** diverging from each other. The convergence of the inner finger portions **30** causes them to embrace the adjacent sides **17** of the two apertures **16** through which such portions extend, precluding inadvertent inward movement of the spring element **22**.

All of the spring elements **22** are assembled in the manner described, which will place the outer finger portions **31** in overlapping relation with respect to each other, whereupon the inner sleeve **13** is slipped within the outer sleeve **14** and is spot welded or otherwise secured thereto. The inner sleeve **13** will then positively prevent inward displacement of the base portions **23** of the spring elements from the interior of the bead **15**.

The scratcher device A is then mounted on a casing section B and the stop rings **11**, **12** disposed on opposite sides of the scratcher device, the latter being welded or otherwise suitably secured to the casing string. The required number of scratchers A is mounted on the casing string at the desired intervals and the casing string is lowered through the well bore D. During downward movement in the well bore, the scratcher elements **22** will swing to an upward and ineffective position, imposing substantially no scratching force upon the wall of the well bore. However, once the casing string B has been run in the well bore to the desired location, the casing can be elevated the required distance, for example, thirty feet, the upward movement causing the lower stop ring **12** for each scratcher to engage the sleeve structure **10**, moving the scratcher A in an upward direction and causing the spring elements **22** to engage the wall of the well bore D, the fingers **24** flexing about the points of contact of the inner finger portions **30** with the bead **15** defining the lower sides **20** of the apertures **16**, the fingers **24** bending in a downward direction, such as disclosed in Fig. 3, to exert an effective scratching force upon the mud cake C, or other coating, on the wall of the well bore D, removing the latter and allowing it to be flushed to the top of the hole for suitable disposition.

After the casing string B has been reciprocated the required number of times to secure the substantially complete removal of the mud cake C from the wall of the well bore in the region where the scratcher elements A are located, a proper charge of cement slurry can be pumped down and out of the casing string, such cement slurry passing upwardly through the annulus around the casing string where it will eventually set and harden. The absence of the mud cake C on the wall of the well bore will insure a good cement bond with the formation and preclude subsequent leakage through the cement annulus formed around the casing string.

For the purpose of facilitating mounting of the scratcher device A on the casing string, it is preferred that the scratcher device be made in sections that will enable the apparatus to be moved transversely or laterally onto and around the casing B. Thus, each sleeve structure **10** is made in two parts, rather than as a single circumferentially continuous annulus. Each half **13***a* of the inner sleeve **13** is formed with hinge knuckles **40** at its ends, the knuckles on one sleeve section **13***a* interleaving with the hinge knuckles of the other sleeve section **13***a*. A suitable hinge pin **41** can be inserted through the hinge knuckles **40** to complete the circumferential continuity of the sleeve structure **13**. Thus, with the hinge pins **41** removed, or at least with one of the hinge pins removed, the sleeve sections **13***a* can be opened sufficiently wide to enable them to be placed transversely around the casing section B, the sleeve halves then being moved toward each other to interleave the hinge knuckles **40** and allow the hinge pin **41** to be assembled in appropriate position through the hinge knuckles. It is only necessary for the hinge knuckles **40** and hinge pins **41** to be provided on the inner sleeve **13** of the sleeve structure. The outer sleeve **14**, which has the bead portions **15**, is made in two sections **14***a* and is welded to the inner sleeve and need not have any hinges formed thereon at all. The outer sleeve sections **14***a* terminate circumferentially at locations adjacent the outwardly directed hinge knuckles **40** of the inner sleeve **13**, to avoid interference to the opening and closing movement of the sleeve **10** around the casing section.

Inasmuch as the bead **15** need only contain the relatively small diameter wire bases **23** of the spring elements **22**, which bases are essentially straight, although they may curve slightly to conform to the curvature of the sleeves **13**, **14**, the bead **15** need not be large and need not extend laterally outward to any substantial degree, while still providing an inner groove **26** that is much larger in both longitudinal and transverse dimensions than the diameter of the wire base **23**. The fact that the beads **15** need not project outwardly to any substantial extent allows the inner sleeve **13** to be made of substantial thickness and possess great strength. Despite the use of the thicker inner sleeve, the over-all maximum diameter of the sleeve structure **10** across its bead portion **15** is not greater than prior beaded structures, in which the inner portions of the spring elements **22** were in the form of coil springs. The stronger and sturdier inner sleeve **13** not only insures that the sleeve structure will not be deformed, or otherwise damaged, during operation of the apparatus, but it also insures the provision of substantially stronger hinge knuckles **40** and enables stronger hinge pins **41** to be used, guarding against inadvertent disruption of the apparatus at its hinges.

The inventor claims:

1. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said structure, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; a portion of said bead adjacent each aperture being adapted to abut each finger while the intermediate portion attached to such finger engages said bead to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

2. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said structure, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; means engageable with said elements to prevent substantial movement of said elements inwardly of said structure; a portion of said bead adjacent the lower end of each aperture being adapted to abut each finger while the intermediate portion at-

tached to such finger engages said bead and engageable means to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure.

3. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein, each aperture extending from the upper portion of said bead to the medial portion of said bead; a plurality of spring elements arranged circumferentially around said structure, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; a portion of said bead adjacent the lower end of each aperture being adapted to abut each finger while the intermediate portion attached to such finger engages said bead to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

4. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said structure and including laterally outwardly projecting fingers extending through said apertures, said elements including substantially straight linear portions disposed within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; a portion of said bead adjacent the lower end of each aperture being adapted to abut each finger while the straight portion attached to such finger engages said bead to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

5. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein, each aperture extending from the upper portion of said bead to the medial portion of said bead; a plurality of spring elements arranged circumferentially around said structure and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; a portion of said bead adjacent the lower end of each aperture being adapted to abut each finger while the straight portion attached to such finger engages said bead to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

6. In a wall scratcher: an annular structure having an internal groove therein and a plurality of apertures extending through said structure from its exterior into said groove; a plurality of spring elements arranged circumferentially around said structure and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; a portion of said structure adjacent the lower end of each aperture being adapted to abut each finger while the straight portion attached to such finger engages the wall of said groove to prevent rotation of said element in the annular structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

7. In a wall scratcher: a supporting structure having an internal groove and a plurality of apertures extending through said structure from its exterior into said groove; a plurality of spring elements arranged along said structure and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; a portion of said structure adjacent one side of each aperture being adapted to abut each finger while the straight portion attached to such finger engages the wall of said groove to prevent rotation of said element in the structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

8. In a wall scratcher: a supporting structure having an internal groove and a plurality of apertures extending through said structure from its exterior into said groove; a plurality of spring elements arranged along said structure, each element including a pair of laterally outwardly projecting fingers extending through different apertures and an intermediate substantially straight linear portion disposed within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to premit rotation of said spring elements in said groove; means adapted to abut each spring element to prevent rotation of said element in the structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure, said means comprising a portion of said structure adjacent said aperture which is engaged by a portion of each spring element while said straight portion engages the wall of said groove; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

9. In a wall scratcher: a supporting structure having an internal groove and a plurality of apertures extending through said structure from its exterior into said groove; each aperture extending from one side of said groove to the medial portion of said groove; a plurality of spring elements arranged along said structure and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; the portion of said structure medially of the groove and adjacent each aperture being adapted to abut each finger while the straight portion attached to such finger engages the wall of said groove to prevent rotation of said element in the structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said structure.

10. In a wall scratcher: an outer annular member having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said member, each element including a pair of

laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; 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 in the outer member beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure, said means comprising a portion of said bead adjacent said aperture which is engaged by a portion of each spring element while said straight portion engages the wall of said groove; and an inner annular member disposed within and secured to said outer annular member and arranged across said bead to prevent substantial movement of said elements inwardly of said outer member.

11. In a wall scratcher: an outer supporting member having an inner groove therein and a plurality of apertures extending through said member from its exterior into said groove, each aperture extending from one side of said groove to the medial portion of said groove, a plurality of spring elements arranged along said member and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; a portion of said member adjacent the medial portion of said groove being adapted to abut each finger while the straight portion attached to such finger engages the wall of said groove to prevent rotation of said element in the outer member beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure; and an inner member disposed within and secured to said outer member and arranged across said groove to prevent substantial movement of said element inwardly of said outer member.

12. In a wall scratcher: an outer annular member having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said member, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; 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 in the outer member beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure, said means comprising a portion of said bead adjacent said aperture which is engaged by a portion of each spring element while the straight portion attached to such finger engages said bead; an inner annular member disposed within and secured to said outer annular member and arranged across said bead to prevent substantial movement of said elements inwardly of said outer member, said inner and outer annular members each comprising a plurality of sections; and hinge means detachably securing said inner member sections together.

13. In a wall scratcher: an annular structure having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said structure, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and intermediate portions 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 structure beyond a predetermined point, said means comprising a portion of the bead adjacent said aperture which is engaged by a portion of each spring element; the fingers of each element having inner portions converging in an outward direction with respect to each other and outer portions 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 supporting structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said supporting structure.

14. In a wall scratcher: a supporting structure having an internal groove and a plurality of apertures extending through said structure from its exterior into said groove; a plurality of spring elements arranged along said structure, each element including a pair of laterally outwardly projecting fingers extending through different apertures and an intermediate portion disposed within said groove; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; means adapted to abut each spring element to prevent rotation of said element on the supporting structure beyond a predetermined point, said means comprising a portion of the supporting structure adjacent said aperture which is engaged by a portion of each spring element; the fingers of each element having inner portions converging in an outward direction with respect to each other and outer portions diverging in an outward direction with respect to each other so as to overlap and contact the fingers of adjacent elements in a direction along said supporting structure; and means engageable with said elements to prevent substantial movement of said elements inwardly of said supporting structure.

15. In a wall scratcher: an outer annular member having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said member, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed within said bead and merging into said fingers; each aperture extending from the upper portion of said bead to the medial portion of 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; a portion of said bead adjacent the lower end of each aperture being adapted to abut each finger to prevent rotation of said element in the annular member beyond a predetermined point; the fingers of each element having inner portions converging in an outward direction with respect to each other and outer portions 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 outer member; and an inner annular member disposed within and secured to said outer annular member and arranged across said bead to prevent substantial movement of said elements inwardly of said outer member.

16. In a wall scratcher: a supporting structure having an internal groove and a plurality of apertures extending through said structure from its exterior into said groove; a plurality of spring elements arranged along said structure and including laterally outwardly projecting fingers extending through said apertures and substantially straight linear portions disposed lengthwise within said groove and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said groove; means engageable with said elements to prevent substantial movement of said elements inwardly of said structure; a portion of said structure adjacent one side of each aperture being adapted to abut each finger while the straight portion attached to such finger simultaneously engages the wall of said groove and said engageable means to prevent rotation of said element in the structure beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said structure.

17. In a wall scratcher: an outer annular member having an apertured, outwardly directed bead formed therein; a plurality of spring elements arranged circumferentially around said member, each element including a pair of laterally outwardly projecting fingers extending through different bead apertures and an intermediate substantially straight linear portion disposed lengthwise within said bead and merging into said fingers; said apertures being of a greater area than the area of said fingers to permit rotation of said spring elements in said bead; an inner annular member disposed within and secured to said outer annular member and arranged across said bead to prevent substantial movement of said elements inwardly of said outer member; means adapted to abut each spring element to prevent rotation of said element in the outer

member beyond a predetermined point, at which point the outer end of each finger extends at substantially its maximum distance laterally outward from said annular member, said means comprising a portion of said outer member adjacent said aperture which is engaged by a portion of each spring element while said straight portion simultaneously engages the wall of said groove and said inner annular member.

References Cited in the file of this patent

UNITED STATES PATENTS

2,374,317	Wright	Apr. 24, 1945
2,421,434	Reistle, Jr. et al.	June 3, 1947
2,683,491	Gassaway	July 13, 1954