This invention relates to a novel and useful casing centralizer provided with well bore and casing scraping means. The centralizer of the instant invention includes a mounting ring having a plurality of elongated fingers secured thereto which are constructed in a manner to scratch the internal surfaces of the well bore and also the external surfaces of a casing section to which the centralizer is secured upon reciprocation of the centralizer in the well bore. However, the centralizer and scraping fingers are constructed in a manner whereby they will impart very little scratching action to the well bore during the period in which the casing section to which the centralized is secured is being initially run in the well bore. The centralizer of the instant invention is secured is being run in the well bore, very little of the filter cake and other material clinging to the surfaces of the well bore will be baled to the bottom of the bore prior to reciprocation of the casing centralizer and the performing of a cementing operation.

The main object of this invention is to provide a casing centralizer with well bore and casing scraping means which may be readily inserted and run downwardly in a well bore without raising filter cake and the like from the sides of the well bore to the bottom of the well bore and with the casing centralizer constructed in a manner whereby reciprocation of the casing centralizer within the well bore will effect a raking and scratching action on the surfaces of the well bore adjacent that area in which a cementing operation is to be performed.

A further object of this invention is to provide a centralizer which will also provide a means for scraping and scratching the external surfaces of the casing section to which the centralizer is secured upon reciprocation of the casing section relative to the centralizer.

Yet another object of this invention is to provide means carried by the centralizer for imparting a swirling action to the cementitious material being utilized during a cementing operation.

A final object of this invention to be specifically enumerated herein is to provide a casing centralizer in accordance with the preceding objects which will conform to conventional forms of manufacture, be of simple construction and easy to use so as to provide a device that will be economically feasible, long lasting and relatively trouble free in operation.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part thereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevational view of the casing centralizer shown mounted upon a casing section and showing the resilient fingers of the casing centralizer in the positions they assume when the casing centralizer is being moved downwardly through the well bore, the normal position of the resilient fingers being shown in phantom lines;

FIGURE 2 is an elevational view similar to that of FIGURE 1 but showing the resilient fingers of the casing centralizer in positions they would assume upon upward movement of the casing centralizer in the well bore;

FIGURE 3 is a fragmentary enlarged horizontal sectional view taken through the casing section illustrated in FIGURE 1 and looking downward from above the uppermost ends of the resilient fingers of the centralizer;

FIGURE 4 is a fragmentary horizontal sectional view similar to that of FIGURE 3 but showing the resilient fingers in the positions they would assume upon upward movement of the centralizer in the well bore; and

FIGURE 5 is an enlarged perspective view of one pair of resilient fingers of the centralizer showing the manner in which they may be formed integrally.

Referring now more specifically to the drawings the numeral 10 generally designates a well bore in which there is disposed a casing string generally referred to by the reference numeral 12 including a casing section generally referred to by the reference numeral 14.

The casing centralizer of the instant invention includes a mounting ring generally referred to by the reference numeral 16 and the mounting ring 16 is provided with a plurality of circumferentially spaced openings 18. The centralizer 16 includes a plurality of scraper assemblies generally referred to by the reference numeral 20 and each scraper assembly 20 includes a pair of elongated fingers 22 and 24.

Each of the fingers 22 and 24 includes first and second end portions 25 and 28 and its will be noted that the first and second end portions 25 and 28 of each finger are angulated relative to each other. The ends of the first end portions 26 remote from the end portions 28 have formed integrally therewith at least one convolution 30 and the convolutions 30 are interconnected by means of an integral bight portion generally referred to by the reference numeral 32 which includes a laterally offset loop portion 34.

The ends of the second end portions 28 remote from the end portions 26 are each provided with outturned terminal end portions 36.

A second ring generally referred to by the reference numeral 40 may be secured to the mounting ring 16 in any convenient manner such as by welding 42 and it will be noted that the ring 40 includes a plurality of inclined and outwardly extending vanes 44 which are secured to the outer surfaces of the ring 40 in any convenient manner such as by welding 46. The vanes 44 are spaced circumferentially about the ring 40 and are utilized to impart a swirling motion of the cementitious material being utilized during cementing operations.

It will be noted that the bight portions 32 of the scraper assemblies 20 are arranged so as to be inwardly adjacent of the diametrically enlarged portion 48 of the mounting ring 16 between the internal surfaces of the diametrically enlarged portion 48 and the external surfaces of the casing section 14. The loop portion 34 is held captive between the external surfaces of the casing section 14 and the internal surfaces of the diametrically enlarged portion 48 of the mounting ring 16 and thereby prevents the bight portion 32 from being rotated about its longitudinal axis. The convolutions 30 are disposed immediately outwardly of the openings 18 formed in the mounting ring 16 and the ends of the fingers 22 and 24 immediately adjacent the bight portion 32 extend through the openings 18.

With attention directed to FIGURE 1 of the drawings the normal positioning of the fingers 22 and 24 may be seen to be illustrated in phantom lines. Upon movement of the casing section 14 downwardly in the direction of the arrows at the upper portion of FIGURE 1, the fingers 22 and 24 will be pivoted slightly adjacent the convolutions 30 and extend generally longitudinally of the casing section 14. Then, as the casing section 14 is being run down in the well bore 10, the apices 50 of the fingers 22 and 24 will contact the inner surfaces of the bore 10 and will not impart a severe scratching action thereon. However, after the casing section 14 has been lowered to its
lowermost position and reciprocal movement is imparted thereto, the reciprocation of the mounting ring 16 within the bore 10 will cause the resilient fingers 22 and 24 to be swung from the positions illustrated in solid lines in FIGURE 1 to the positions illustrated in solid lines in FIGURE 2. From FIGURE 4 of the drawings it will be noted that this second position will cause a strong scratching action on the surfaces of the bore 10. It will be noted that the free ends of the fingers 22 and 24, when disposed in the scratching position illustrated in FIGURE 4, are engaged with the outer surfaces of the diometrically enlarged portion 48 of the mounting ring 16. Thus, the apices 50 of the fingers 22 and 24 will be urged into tighter frictional engagement with the internal surfaces of the bore 10. However, when the casing section 14 is moved downwardly, the free ends of the fingers 22 and 24 engage the smaller diameter of casing section 14 and thus effect a very light frictional engagement with the internal surfaces of the bore 10. Accordingly, it may be seen that the fingers 22 and 24 do not effectively scratch any of the cake from the internal surfaces of the bore 10 upon initiation of upward movement of the casing section 14 within the bore 10. However, as the casing section 14 and thus the mounting ring 16 are reciprocated after being positioned in the bore 10, the resilient fingers 22 and 24 intermentently effect a heavy scratching action on the internal surfaces of the bore 10 to remove any mud cake which may be clinging thereto.

It will be noted that as the mounting ring 16 is moved downwardly, that the fingers 22 and 24 extend substantially longitudinally of the bore 10 and that they thereby provide little resistance to the flow of drilling fluid or cementing fluid upwardly through the well bore 10. However, when the casing section 14 is being moved upwardly and the resilient fingers 22 and 24 are disposed in positions as illustrated in FIGURE 2 and 4, the resilient fingers 22 and 24 interlock with each other to assist in pumping the well fluid upwardly through the bore 10 as well as providing a means for scraping the cake from the internal surfaces of the well bore 10.

Finally, it may be observed that the free ends of the fingers 22 and 24, when disposed in positions similar to that illustrated in FIGURE 2 of the drawings, are prevented against further movement downwardly relative to the mounting ring 16 by the engagement of the free ends of the fingers 22 and 24 with the inner ends 26 of the adjacent fingers.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A casing centralizer with well bore and casing scraping means comprising a mounting ring adapted to be disposed about a section of well casing in any convenient manner for reciprocation with said casing section through at least portions of the reciprocal strokes of said casing section, a plurality of elongated stiff and resilient fingers including first and second angulated end portions, means resiliently mounting the ends of the first end portions of said fingers remote from said second end portions to said ring at points spaced circumferentially thereabout with each of said fingers normally disposed in a plane extending through and slightly inclined similarly relative to the longitudinal axis of said ring, said fingers being normally disposed with said first end portions extending outwardly from said ring and said second end portions extending inwardly from the outer ends of the corresponding first end portions to points closely adjacent a surface generated by a line swung about an axis parallel thereto and at a distance substantially equal to the radius of said ring.

2. The combination of claim 1 wherein the free end portions of said second end portions each include a slightly outturned angulated terminal end portion.

3. The combination of claim 1 wherein said fingers are arranged in pairs with the fingers of each pair of fingers interconnected at the inner ends of said first end portions.

4. The combination of claim 1 including means connected to said ring adapted to impart a swirling motion to drilling fluid moving past said ring when disposed in a well bore.

5. A casing centralizer with well bore and casing scraping means comprising a mounting ring adapted to be disposed about a section of well casing in any convenient manner for reciprocation with said casing section through at least portions of the reciprocal stroke of said casing section, a plurality of elongated stiff and resilient fingers including first and second angulated end portions, means resiliently mounting the ends of the first end portions of said fingers remote from said second end portions to said ring at points spaced circumferentially thereabout with each of said fingers normally disposed in a plane extending through and slightly inclined similarly relative to the longitudinal axis of said ring, said fingers being normally disposed with said first end portions extending outwardly from said ring and said second end portions extending inwardly from the outer ends of the corresponding first end portions, said fingers being arranged in pairs with the fingers of each pair interconnected by means of an integral bight portion, said ring including a diometrically enlarged portion having a plurality of pairs of circumferentially disposed openings formed therein, said bight portions each being disposed in said diometrically enlarged portion and extending between the openings of the corresponding pair of openings, the innermost ends of said first end portions extending through corresponding openings and each including at least one convolution disposed immediately adjacent and outwardly of said ring.

6. The combination of claim 5 including a second ring axially aligned with the first-mentioned ring and secured thereto, said second ring having a plurality of outwardly projecting vanes secured thereto and inclined alike relative to the longitudinal axis of said second ring for imparting a swirling motion to drilling fluid moving past said second ring when disposed in a well bore.

7. The combination of claim 5 wherein each of said bight portions includes a laterally offset loop portion.

8. The combination of claim 7 including means connected to said ring adapted to impart a swirling motion to drilling fluid moving past said ring when disposed in a well bore.

9. The combination of claim 8 wherein the free end portions of said second end portions each include a slightly outturned angulated terminal end portion.

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