May 25, 1954 M. A. GARRISON 2,679,293

CASING SCRAPER FOR WIRE LINE OR PIPE ACTUATION

Filed Oct. 23, 1950

2 Sheets-Sheet 1

Fig. 1.

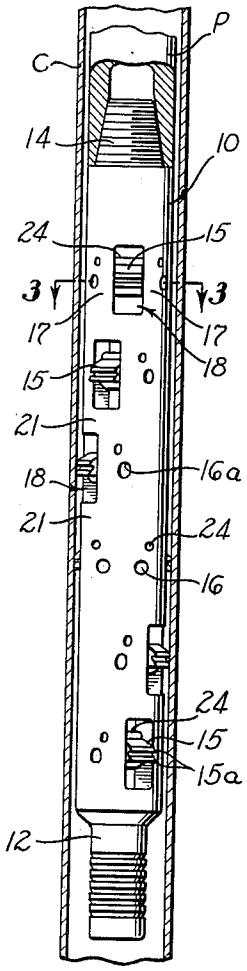

Fig. 2.

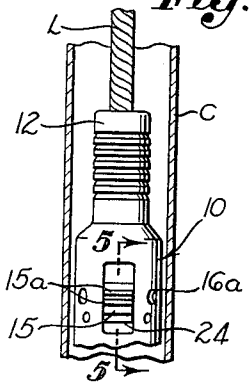

Fig. 3.

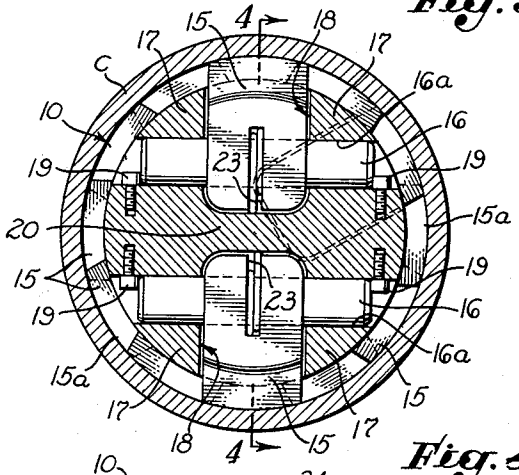

Fig. 4.

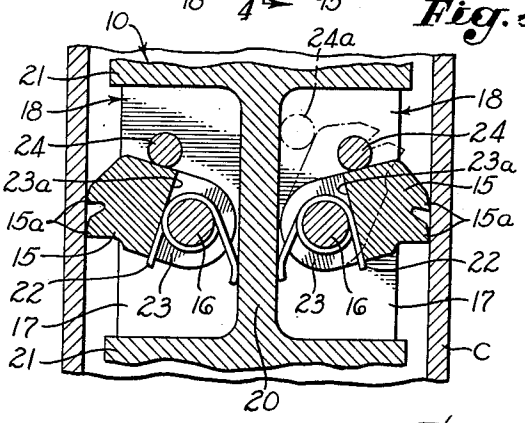

Fig. 5.

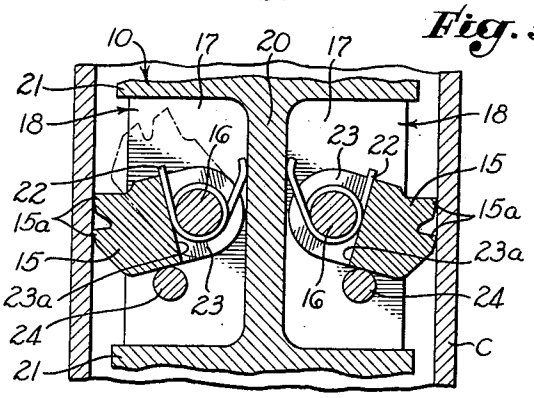

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Fig. 6.

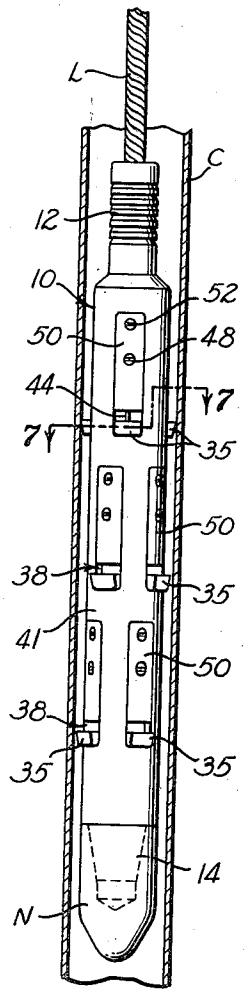


Fig. 7.

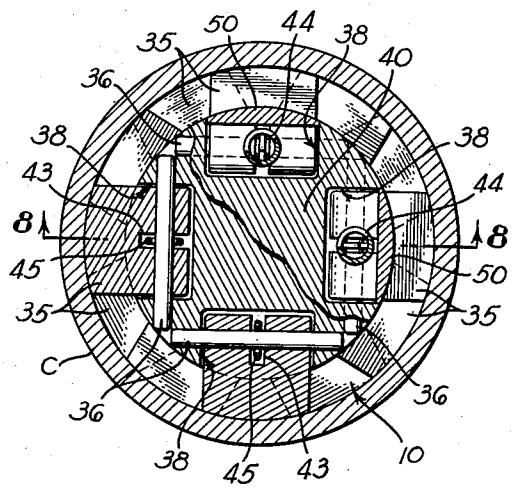


Fig. 8.

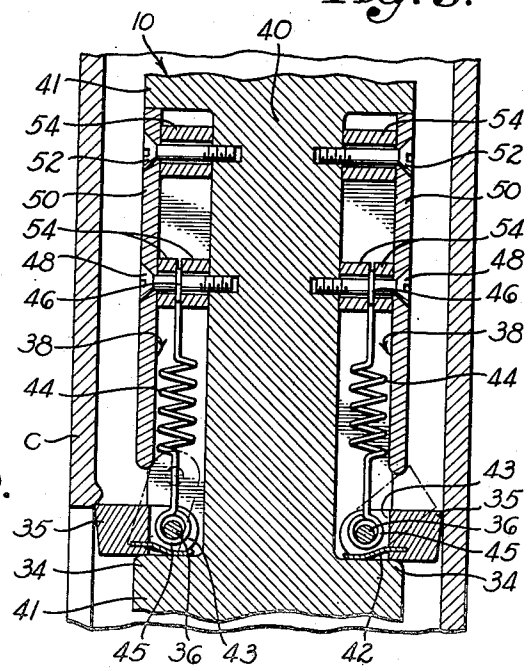
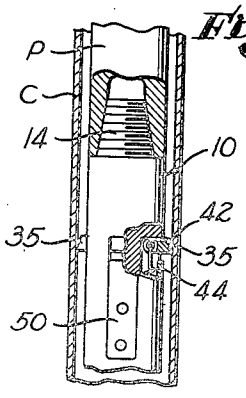


Fig. 9.



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CASING SCRAPER FOR WIRE LINE OR PIPE ACTUATION

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Application October 23, 1950, Serial No. 191,712

11 Claims. (Cl. 166—18)

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This invention relates to apparatus for use in deep wells, and more especially concerns equipment for scraping the interiors of well casings and the like to remove accumulations and irregularities.

One object of the invention is to provide scraping apparatus of the indicated type which shall be exceptionally strong and durable.

Another object is to provide a scraper construction with yielding or shearable parts which will give way upon encountering excessive resistance, whereby to prevent damage to the major parts of the apparatus and to permit its recovery.

A further object is to provide such a scraping device which may be operated by a wire line or by a drill pipe or the like, the device to perform its scraping function when being pulled out by the wire line, and to be inverted when run in on pipe so as to perform the scraping function as it is introduced into the well.

An additional object is to provide a strong scraping tool for wells wherein cutters are positioned to swing in vertical planes and to lie in such planes when functioning, each cutter to be mounted and to operate independently of each other cutter.

A still further object is to provide a scraping tool for wells wherein the scraping cutters are individually self-positioned, that is, they move to or from operative positions independently without interconnection and without intervention of operating means which must be externally actuated or actuated from the surface of a well, their positions being determined only by friction with adjacent well surfaces, such as casing, or by gravity, or by spring means controlling the respective cutters.

It is another object to provide a scraping tool in which integral wall portions of the tool body enclose non-communicating pockets receiving the respective cutters so that continuous walls and a continuous central core render the tool body continuously rigid from end to end between cutter-receiving pockets and continuously rigid transversely in the zones between longitudinally spaced cutter-receiving pockets.

It is a further object to provide a scraper structure which will not only remove accumulations, such as mud, from the inner wall of a casing, but will also cut off burrs and the like resulting from shooting casing to perforate the same or from other subsurface perforating, and another object is to provide a scraping cutter arrangement and construction which will scrape

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the entire 360° inner wall expanse of a casing as the tool is moved vertically therein.

Other objects and the various features of construction of this improvement will appear from the following description and accompanying drawings wherein certain exemplary embodiments are shown.

In the drawings:

Fig. 1 is a vertical section through a deep well casing showing in elevation one form of scraping tool of this invention mounted on the lower end of a drill pipe or other tubing for operation as the tubing is lowered into the well casing;

Fig. 2 is a fragmentary view corresponding with that of Fig. 1 and indicating the scraping tool as being inverted from its position of Fig. 1 and carried on the lower end of a wire line;

Fig. 3 is a cross section on an enlarged scale taken on the line 3—3 of Fig. 1 and showing the relationship of a pair of diametrically opposed scraping cutters;

Fig. 4 is a fragmentary vertical section taken on the line 4—4 of Fig. 3;

Fig. 5 is a corresponding fragmentary vertical section on an enlarged scale taken on the line 5—5 of Fig. 2;

Fig. 6 is a vertical section and elevation corresponding to that of Fig. 1 and showing a modification;

Fig. 7 is an enlarged fragmentary section taken on the line 7—7 of Fig. 6;

Fig. 8 is a corresponding fragmentary vertical section taken on the line 8—8 of Fig. 7; and

Fig. 9 is a fragmentary inverted detail of the structure of Fig. 8.

The form of scraper illustrated comprises an elongated substantially cylindrical body 10 which carries and constitutes a housing for the operative parts. As shown in Fig. 1, the device is suitably proportioned for running into a well casing C whereby to remove from the inner walls of the casing an accumulation of mud which has been employed in drilling operations, or to remove burrs which have been formed in perforating the lower end of the casing, or to remove other objectionable materials on the inner casing wall. One end of the body 10 is provided with an integral neck 12 for a wire line socket or the like, so that a wire line L may be attached as indicated in Fig. 2 for movement of the device up and down in the casing C. As seen in Fig. 1, the upper end of the body 10 is provided with a standard threaded tool-joint pin 14 for the attachment of drill pipe or other pipe P by means of which the apparatus may be moved within the casing C.

To provide for scraping the inner wall of the causing C, a plurality of cutters 15 is provided, these being preferably arranged in pairs as illustrated, and swingingly mounted to move in vertical planes and present their swinging ends in extended positions for scraping or cutting purposes. These swinging ends are formed with transversely disposed, spaced cutting teeth or cutting edges 15*a* which preferably are formed on horizontal arcs that correspond with the curvature of the inner wall of the casing C. Each cutter 15 has its inner end pivoted upon a horizontal pivot pin 16 which extends into vertical side walls 17 of a corresponding pocket 18 extending longitudinally of the body 10. As shown in Fig. 3, the width of each of these pockets is approximately equal to the transverse thickness of the corresponding cutter 15, necessary working clearance being provided. For the purpose of retaining the positions of the pivot pins 16, which are received in corresponding bores 16*a*, the pins 16 may be somewhat shorter than the bores 16*a* so that abutment screws 19 may be set in the ends of the bores 16*a* against the extremities of the pivot pins 16, as best illustrated in Fig. 3. With this arrangement the heads of the screws 19 are disposed within the outer contour of the body 10.

The pockets 18, which receive and house the cutters 15 when in inoperative positions, preferably are arranged in pairs, the pockets of each pair being at the same level and being diametrically opposed so that they are positioned back-to-back as best illustrated in Figs. 4 and 5. In order to insure adequate strength in the body 10 and to brace the same in directions at right angles to the respective side walls 17, the pockets 18 of each pair are separated by an integral, vertically disposed strengthening back wall 20 which thus extends longitudinally of the body 10 as do the side walls 17. To insure further strengthening of the body 10, each pair of pockets 18 is longitudinally spaced an appreciable distance from each adjacent pair of pockets 18, thereby providing an intervening transverse web 21 of extent equal to the full cross section of the body 10 and integral with all wall portions 17 and 20 which enclose the pockets 18 both above and below. This maintains a very rigid body construction. These separating parts between the various pockets 18 are imperforate and therefore render the pockets 18 non-communicating. In this respect it will be observed that the bores 16*a*, which receive the pivot pins 16, open exteriorly, do not extend from one pocket to another, and do not provide pocket communication.

For the purpose of positioning the cutters 15 in operative scraping position for movement of the tool in one direction, while at the same time permitting them to retract for movement of the tool in the opposite direction, coil springs 22 are mounted about the pivot pins 16 in slots 23 provided in the middle portions of the inner ends of the cutters 15, one end of each spring 22 bearing against the back wall 20 of the respective pocket 18 and the other end bearing against the back wall 23*a* of the slot 23. With this construction the springs 22 urged the cutters 15 outward into operative position where they are retained by means of stop pins 24 extending across the respective pockets in positions parallel to the pivot pins 16 and in locations to stop the cutters 15 in the full line positions shown in Figs. 4 and 5. In this form of the invention, the stop pins 24 conveniently serve also as shear pins, being made of such metal as will shear off should forces exerted on the transverse cutter teeth 15*a* at the outer ends of the cutters 15 reach any predetermined value, thereby protecting the apparatus against damage from such forces. Should such a shearing action take place, the sheared out portion will be moved through the accumulated mud to a position such as indicated in broken lines at 24*a* in Fig. 4. When the corresponding cutter 15 has been so moved, it may assume the broken line position at the right of Fig. 4. If moved in the opposite direction such cutter 15 may assume the broken line position shown in Fig. 5.

Thus, whether the apparatus be run into the casing C on drill pipe P, as indicated in Fig. 1, wherein the cutters 15 will assume the operative positions shown in full lines in Fig. 4, or whether the apparatus first be run into the casing C on a wire line L as indicated in Fig. 2, during which operation each cutter 15 is retracted toward the position indicated in broken lines in Fig. 5, the cutters 15 thereafter assuming the full line operative position of Fig. 5 as the device is drawn upward by the wire line L, the inside of the casing C is scraped clean by the cutting teeth 15*a* by reason of the fact that the teeth 15*a* are properly positioned by the stops 24. By these means mud or other deposit is readily removed from the interior of the casing C, and also obstructions such as burrs formed on the inside of the casing C by shooting or otherwise perforating the latter in the well hole will be cut away.

In order that the entire internal circumferential wall of the casing C may be cleaned or otherwise smoothed, several pairs of cutters 15 are employed, preferably in slightly overlapping relationship as best indicated in Fig. 1, and these pairs are staggered or helically arranged at successively lower levels as also illustrated in Fig. 1. This arrangement assures adequate strength in the body 10 of the instrument and also insures scraping of the entire inner wall. If, during the scraping operation, the cutting teeth 15*a* of the cutters 15 encounter a high resistance sufficient, for example, to cause other injury to the device, the stop pins 24, which as has been indicated above are also shear pins, will have their engaged portions sheared off, whereby the strain on the respective cutters is relieved by movement thereof into a position such as is indicated by broken lines at the right of Fig. 4, accumulated mud or the like yielding sufficiently readily to permit the necessary retraction.

A modified form of scraping apparatus is shown in Figs. 6 to 9. This comprises approximately the same body 10 adapted to be lowered into a well casing C on the end of a wire line L received in the same rope socket 12 at one end of the body 10 as in the other form, the body 10 also carrying at its opposite end the same tool-joint pin 14 to which may be attached either a nose piece N as shown in Fig. 6 or drill pipe P as shown in Fig. 9. With this construction, the same type of cutter 15 used in the form of Figs. 1 to 5 may be employed, or a slightly modified form of cutter 35 as illustrated in Figs. 6 to 9 may be used. These cutters 35 (or 15) have their inner ends pivoted upon pivot pins 36, which, in this form are also shear pins. Here, instead of having the cutters 35 bear upon pins like the pins 24 of Figs. 1 to 5, they bear upon shoulders 34 (Fig. 8) at the corresponding circumferential portions of the body 10 which thereby act as fulcrum points.

The cutters 35 work in the ends of elongated pockets 38 which, as seen in Figs. 6 and 8, are

open at their lower ends to receive the inner end portions of the cutters 35. The pockets 38 are arranged back to back in pairs so as to leave a solid back wall 40 between each pair which in effect is a core extending the full length of the body 10. If desired, there may be at each level only one pair of pockets 38 as in the form of Fig. 1 and Fig. 3, but, by making the cutters 35 sufficiently short as illustrated especially in Fig. 7, two pairs of pockets 38 may be arranged at each level. In either arrangement there is no intercommunication between any of the pockets 38, and pockets at any given level are sufficiently spaced from pockets 38 above or below to provide a solid transverse web 41 integral with the back wall or core 40, so that, as in the other form, the body 10 is comprised of a rigid integral structure formed by the core 40 and webs 41, there being no communication through these parts between pockets 38 either at the same level or at different levels.

When lowering the device on the wire line L or the like, with the parts in the relative positions shown in Figs. 6 and 8, each cutter 35 may retract toward the broken line position shown at the right of Fig. 8 against a respective spring 42 which may be disposed in a slot 43 in the inner portion of the respective cutter 35, one end of each spring 42 being imbedded in the cutter body 35 and its opposite end bearing on the adjacent bottom wall of the respective pocket 38.

For the purpose of withdrawing any cutter 35 whose pivot pin 36 may have been sheared upon encountering excessive resistance as the device is being withdrawn by the wire line L and by reason of its fulcruming action on a bearing shoulder 34, a coil spring 44 is positioned in a partially enclosed portion of the respective pocket 38, one end thereof being in the form of an eye 45 receiving the respective pivot pin 36 and the other end thereof extending upwardly and forming an eye 46 which receives an anchor screw 48. The inner end of the anchor screw 48 is threaded into the back wall portion 40 of the body 10 and serves to carry and position an outer closure plate 50 in conjunction with a second anchor screw 52. Proper spacing of the closure plate 50 is accomplished through the means of spacers 54 having bores through which the screws 48 and 52 pass. The sides of the closure plates 50 fit flush into the peripheral portions of the respective elongated pockets 38, their upper ends, as seen in Fig. 8, fitting against the top walls of the pockets 38. In this manner each pocket 38 is closed except in the region of the respective cutter 35.

When installed in the operating position shown in Fig. 8, each spring is expanded sufficiently to pull a sheared pin 36 and its cutter 35 up into the broken line position shown at the left of Fig. 8 so that such cutter 35 may clear any obstruction on the inner walls of the casing C which caused the application of the shearing strain. This might have resulted, for example, by engagement with an excessively large or strong burr or other inwardly directed projection produced by denting or perforating with an externally applied force. As indicated in Figs. 6 and 8, scraping of the inner walls of the casing C will be effected by upward draft on the wire line L following introduction of the instrument into the lower portion of the casing as required. However, by inverting the instrument from the position of Figs. 6 and 8 to the position indicated in Fig. 9, and attaching to the threaded pin 14 an appropriate length of the drill pipe P, scraping may be effected by lowering of the device on the lower end of the drill pipe P, or similar pipe, the springs 42 being relied upon to project the respective cutters 35 into operative position as indicated.

With either of the forms illustrated, the shaving instrument is moved to form a scraping function by operation of the wire line L or the drill pipe P, in accordance with which end of the instrument is directed upward, the cutters 15 and 35 being respectively movable into operative scraping position as shown and as above described. Should excessive resistance be encountered when operating a device of Figs. 1 to 5, the respective shear pins 24 will be sheared so as to permit the respective cutters to move back into the respective pockets 18, such as the position indicated in broken lines at the right of Fig. 4. In the case of the meeting of such resistance by cutters of the form of Figs. 6 to 9, the respective pivot pins 36 will shear so that the respective springs 44 will pull the cutters up into the pockets 38 as illustrated at the left of Fig. 8 in broken lines.

From the foregoing it will be obvious to those skilled in the art that the structures of this invention may be readily lowered into a well casing and withdrawn therefrom, by using either a wire line or a drill pipe as the actuating agent, the shear pins 24 or 36 yielding to protect the apparatus against loss or breakage if excessive resistance is encountered by the cutting edges of the cutters 15 and 35. It will also be apparent that by arranging the various groups of cutters in staggered relationships as illustrated in Figs. 1 and 6 in particular, the entire circumference of the interior of the casing C may be engaged by the cutters and properly scraped or cleaned.

I claim as my invention:

1. In combination in a casing scraper: an elongated housing providing a plurality of longitudinally extending pockets opening upon the side of the housing; transverse pivot means mounted in said housing and extending across said pockets; cutters having inner portions mounted on said transverse pivot means and adapted for projection of outer cutting portions laterally from said pockets in longitudinal planes into cutting positions beyond said housing, said pockets being of sizes to enclose completely their respective cutters when their cutting portions are in retracted positions; and bearing means carried by said housing at each of said pockets and adjacent the respective pivot means and in position to be engaged by the respective cutter when in projected cutting position, one means of said bearing and pivot means for each cutter being shearable under application of excess force to the respective cutter and being located in the respective pocket, each cutter having means for retaining such cutter in a withdrawn position in its pocket upon shearing of said shearable means.

2. A combination as in claim 1 wherein each bearing means is a shearable bearing member extending across the respective pocket adjacent said pivot means and constitutes said shearable means.

3. A combination as in claim 2 including spring means connected to each cutter to withdraw the respective cutter into its pocket upon shearing of said shearable bearing member.

4. A combination as in claim 1 including means with which each cutter is connected to withdraw the respective cutter into its pocket upon shearing of its shearable means.

5. A combination as in claim 1 including at-

tachment means at opposite ends of said housing for running said scraper with either end lowermost.

6. A combination as in claim 2 wherein each bearing means is a shearable pin extending across its pocket adjacent and outwardly from the respective pivot means.

7. A combination as in claim 1 wherein the pivot means for each cutter constitutes the shearable means therefor, the combination including spring means operatively connected to each cutter for withdrawing the respective cutter into its pocket upon shearing of the respective pivot means.

8. In combination in casing scrapers and the like: an elongated housing providing a plurality of longitudinally extending pockets opening laterally outward from the side of said housing; transverse pivot means mounted across said pockets; a plurality of cutting devices positioned respectively in said pockets with inner portions thereof mounted on said pivot means for swinging movement of outer cutting portions thereof in longitudinal planes to extended cutting positions beyond said housing; and fulcrum means for each cutting device and carried by said housing to limit outward swinging movement of the respective cutting device, each fulcrum means being a shear pin shearable upon application of excessive force to the outer cutting portion of the respective cutting device, such shear pin being engageable by the respective cutting device for positioning the respective outer cutting portion in its extended cutting position, the respective pivot means serving to retain the respective cutting device in its pocket both before and after shearing of its shear pin.

9. A combination as in claim 8 wherein each cutting device has spring biasing means urging

such device into engagement with said shear pin for said positioning of the respective outer cutting portion in its extended cutting position.

10. In combination in a scraper tool for well casing: a body having elongated pockets; diametrically opposed elongated rigid cutting bars mounted in said pockets; fulcrum bearing means and pivot bearing means which are fixed in positions on said body, said cutting bars being mounted on such pivot bearing means to move in given planes to predetermined diametrically extended cutting positions and having cutting edges at their outer ends transverse to said planes to cut the sides of well casing upon movement of said body and cutting bars in one direction; and biasing means engaging said bars and acting in another direction to extend said bars to predetermined diametrical dimensions in cutting positions, said bearing means for said bars maintaining said bars in cutting positions and one bearing means for each bar being yieldable on application of predetermined load in said other direction to yield and relieve said bar.

11. A combination as in claim 10 wherein said yieldable means is a shearable cross pin.

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