

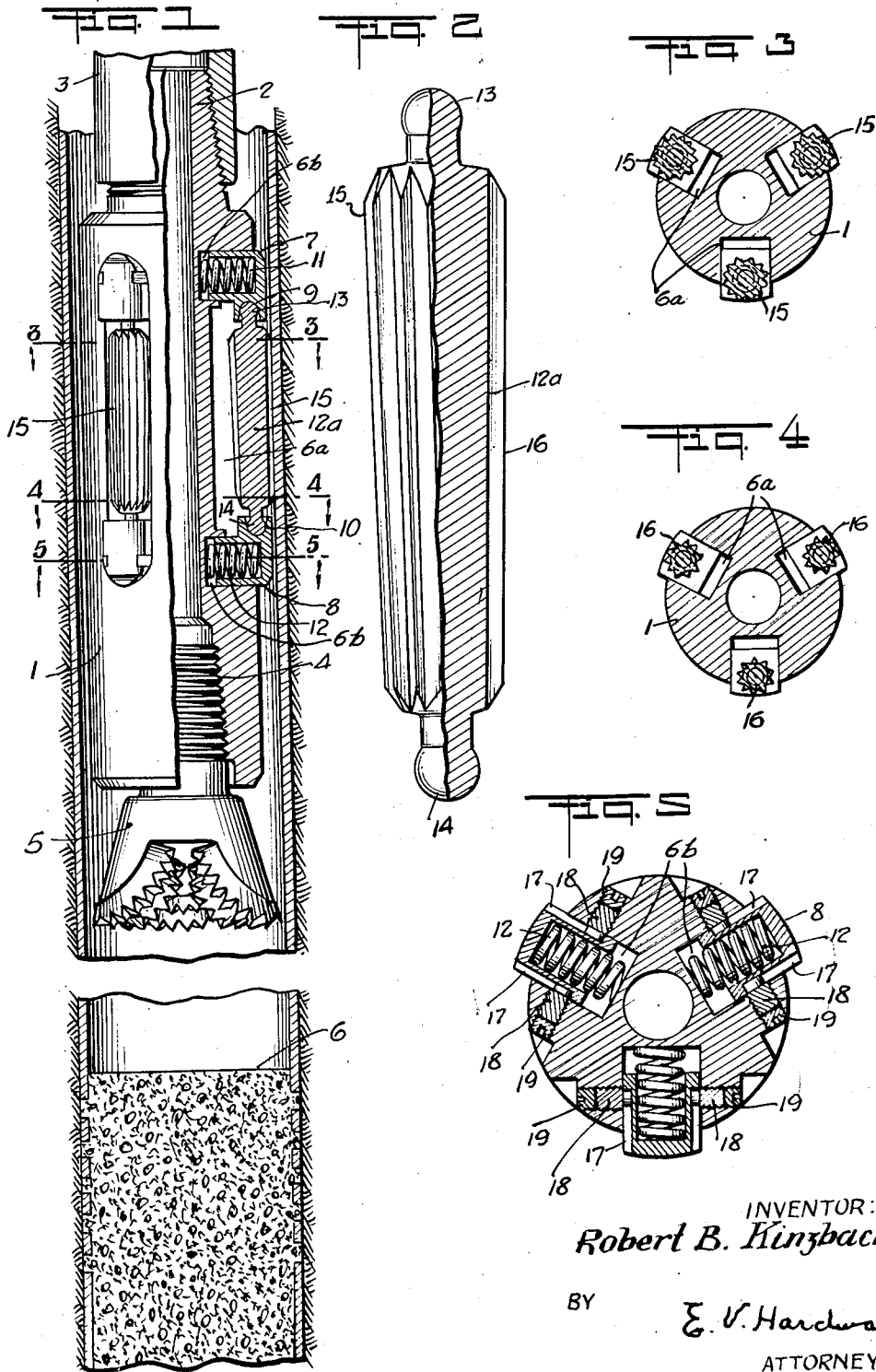
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CASING SCRAPER

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2,670,046

CASING SCRAPER

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5 Claims. (Cl. 166—18)

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This invention relates to a casing scraper.

An object of the invention is to provide a tool of the character described for smoothing and conditioning the inside of a casing, or other pipe, set in a well bore.

In carrying on operations in a well, the interior of the casing should be kept as smooth and as nearly round as possible so as not to interfere with said operations nor to injure the tools or equipment by means of which the operations are carried on; for example, well casing is often perforated opposite potentially productive strata by what is commonly known as a well shooting gun, and if no oil is produced therefrom the perforations are cemented up by filling the casing with cement opposite said perforations and allowing it to set around and within the casing. Thereafter, the cement is often drilled out of the casing in order to carry on operations beneath, and the casing should be smoothed, interiorly, in order to condition it for the carrying on of such operations through it.

It is the object of the present invention to provide a casing scraper which can be incorporated into the drill stem adjacent the drill and by means of which the casing may be scraped, smoothed and conditioned simultaneously with the drilling out process.

Another object is to provide a tool of the character described which will remove inwardly extending projections from the pipe such as burrs or bullets or the like.

Of course, the tool may be used in tubular objects anywhere for the purpose indicated.

Other objects and advantages will be apparent from the following specification, which is illustrated by the accompanying drawings, wherein:

Figure 1 is a side elevation of the tool, partly in section, shown connected into a drill stem and associated with a drill used in drilling out the well casing;

Figure 2 is a side elevation, partly in section, of a cutter;

Figure 3 is a cross-sectional view of the scraper taken on the line 3—3 of Figure 1;

Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 1; and

Figure 5 is an enlarged, cross-sectional view taken on the line 5—5 of Figure 1.

Referring now more particularly to the drawings, wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates the scraper body, which, in the present illustration, is of a general cylindrical shape and whose upper end is formed with a reduced, outwardly threaded, tapering pin 2 for the connection of an operating string 3 to the body. This string 3 may extend to the ground surface.

The lower end of the body 1 may be provided

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with an internally threaded, downwardly flared box 4 to receive the externally threaded shank of a drill 5.

Of course, the drill may be employed only when the well has become obstructed by cement, as 6, or otherwise.

The body is provided with vertically elongated deep pockets 6a.

Seated in sockets 6b forming bearing recesses adjacent each pocket there are the independently radially movable cup-shaped upper and lower bearing members or housings 7 and 8, respectively, whose outer ends have the opposing sockets 9 and 10.

Within the bearing members or housings are the upper and lower yieldable elements 11, 12 which react against the bottom of the respective bearings and the outer ends of the housings 7, 8 so as to independently hold said housings yieldably outwardly. These elements may vary in resistance, the stronger elements being so located as to hold the driving teeth most firmly against the inside wall of the casing.

The upper and lower ends of each tapered cutter 12a are reduced and formed into extended necks which terminate in ball joints 13, 14 that work independently in the opposing sockets 9, 10, as shown in Figure 1. These tapered cutters work in the pockets 6a but project out beyond the surface of the body so as to contact the inner wall of the casing when inserted therein, and the independently yieldable housings 7 and 8 cause them to cant their axes to that of the body until line contact is secured between the periphery of the cutters and the pipe wall to be scraped.

Each cutter includes the driving and scraping teeth 16, which may be helical, and these teeth may be spaced the required distance apart around the body, and the teeth extend longitudinally of the body.

The housings 7, 8 have side keyways 17, 17, which extend out radially, and keys, as 18, are threaded into the body 1 at right angles to said keyways and with their inner, smooth ends projecting into the keyways so as to retain the housings against detachment, and these keys are locked in place by means of locknuts 19.

In operation, the body 1 is rotated, causing a corresponding rotative movement of the cutters due to the pressure contact between their teeth and the pipe wall. Inasmuch as the circumferences of the cutters vary from end to end, while that of the pipe it contacts is constant, the rotative speed of the cutters will correspond to that of only one diameter (usually the largest because of the greater torque at this point) and relative slippage must occur throughout the balance of the length of the cutter. The magnitude of this slippage is controlled by the difference in cutter

diameters. This slippage provides the wall scraping action.

Due to independent radial movement of end bearings, the cutters are yieldably forced into line contact with the inner wall of the casing. In this position the cutter axis is canted to the body axis by half the included angle of the tapered cutter.

As the body is rotated with the cutters in this position, they are caused to rotate about their axes by the drag of their teeth against the stationary wall of the casing.

Since the cutters are conical in shape, their larger diameter end will tend to control their rotative speed to a valve corresponding to the circumferential casing surface traversed divided by the circumference of the cutter at its larger end. Since the circumference of the smaller end of the cutter cannot cover this same circumferential distance in the casing at this speed relative slippage must occur, starting at zero at the large diameter end and increasing to a maximum at the small diameter end. By the same reasoning, if the smaller end of the cutter happens to control cutter rotative speed, due to its encountering irregularities of sufficient drag to overcome the torque drag at the larger end, then cutter rotative speed will be controlled as a function of this diameter, and slippage will occur to a maximum value at the larger diameter end.

In effect this design provides a combination of circumferential chipping and sliding action against the casing wall for the removal of burrs, cement coating, and the like.

The housings 7, 8 will break major obstructions in the casing, and the cutters in rolling will scrape the wall smooth. Each cutter is tapered and frusto-conical in shape and has longitudinal teeth spaced about its periphery.

The drawings and description are illustrative merely, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A tool of the character described comprising, a body, rolling cutters, end bearings mounted on the body for supporting said cutters, at their opposite ends for independent angular movement relative to the bearings and independent radial movement relative to said body, and yieldable means cooperable with said bearings and body to yieldingly hold said bearings outwardly with respect to the body, said bearings also shaped to form bumpers for the removal of major obstructions ahead of roller contact.

2. A tool of the character described comprising a body adapted to be connected to an operating string for rotation with the string and having outwardly opening pockets therein, outwardly opening aligned recesses above and below each of said pockets, a bearing member in each of said recesses extending outwardly beyond the body and movable inwardly and outwardly thereof, a frusto-conical rolling cutter rotatably mounted at its opposite ends between the bearing members of each of the pockets for independent angular movement relative thereto, resilient means in the recesses in engagement with the body and said bearing members and urging said members outwardly of said recesses and stop means on the body engageable with said bearing members to limit outward movement of the bearing members.

3. A tool of the character described comprising a cylindrically shaped body adapted to be connected at one end to an operating string for rotation with the string, said body having peripher-

ally-spaced, vertically-elongated outwardly-opening pockets therein and an outwardly-opening radially-extending bearing recess beyond each end of each of said pockets and in alignment therewith, a bearing member positioned in each of said recesses and extending outwardly thereof, said bearing members being movable inwardly and outwardly of the recesses, a rolling cutter rotatably mounted at its opposite ends in the bearing members of each pocket for independent angular movement relative thereto, and resilient means in said recesses between said body and said bearing members and cooperable with the body and said members to urge said members outwardly of the recesses.

4. A tool of the character described comprising a cylindrically shaped body adapted to be connected at one end to an operative string to rotate with the operating string said body having radially-disposed vertically-elongated outwardly-opening pockets therein, and a radially-extending outwardly-opening bearing recess above and beneath each of said pockets and aligned therewith, a bearing member positioned in each of said recesses and substantially closing the same, said bearing members extending outwardly beyond the body and being independently movable inwardly and outwardly of the recesses, a rolling cutter positioned between and rotatably mounted at its opposite ends in the bearing members of each pocket for independent angular movement relative thereto, resilient means in said recesses, engageable with said body and said bearing members to yieldingly resist movement of said members inwardly of said recesses, and stop means on the body engageable with said members to limit outward movement of said members in said recesses.

5. A tool of the character described comprising a cylindrically shaped body adapted to be connected at one end to an operating string for rotation with the string and having outwardly-opening vertically-elongated, pockets therein, and aligned, outwardly-opening bearing recesses beyond the ends of each of the pockets, a bearing member positioned in each recess for movement inwardly and outwardly thereof and extending outwardly beyond the body, a frusto-conical rolling cutter rotatably mounted at its opposite ends in the bearing members of each pocket for independent angular movement relative thereto, resilient means positioned in said recesses and engageable with said body and said bearing members to urge said cutters away from said body, and stop means on the body engageable with the bearing members to limit outward movement of the members.

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