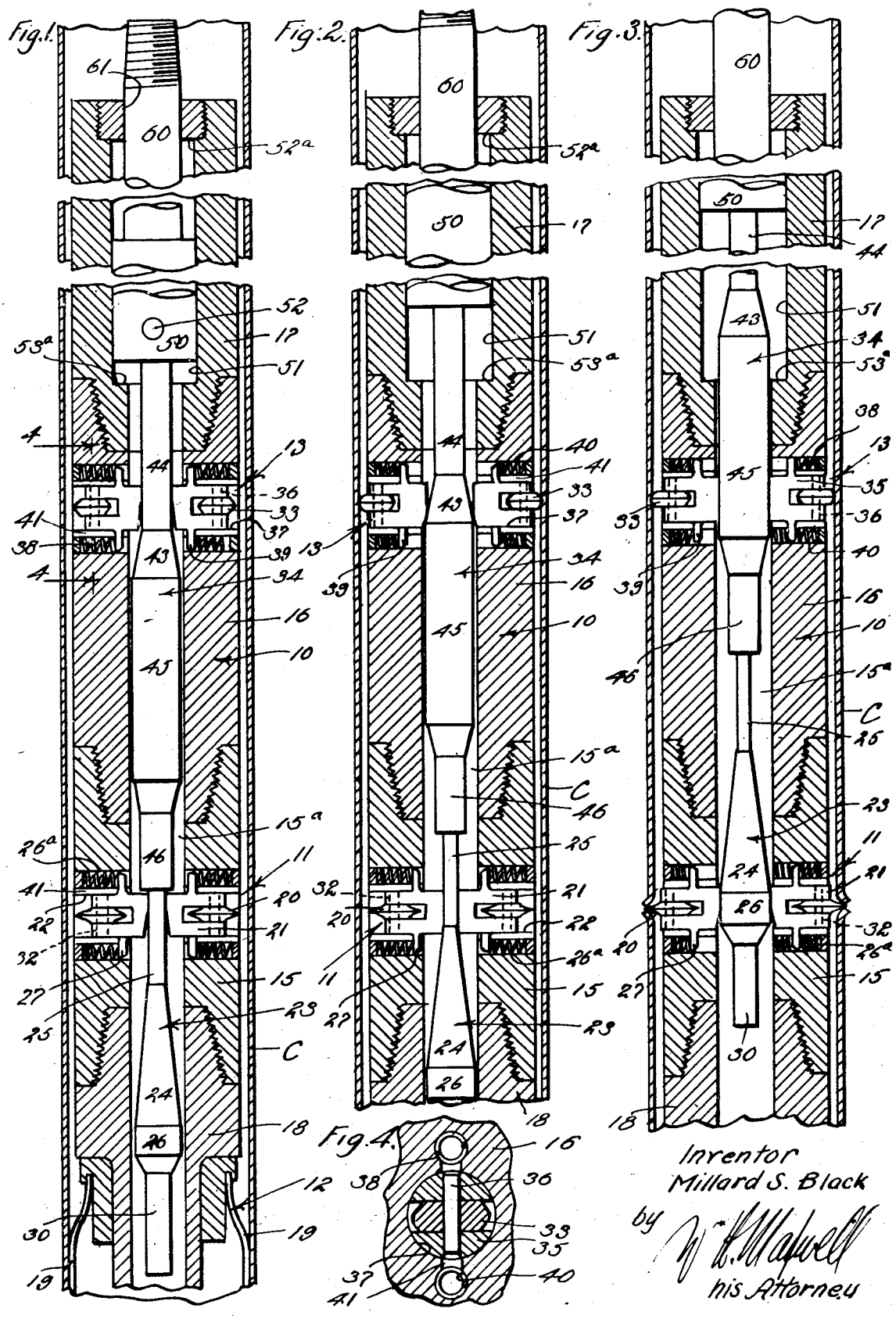
Sept. 27, 1927. 1,643,572

M. S. BLACK

CASING CUTTER

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Fig. 5.

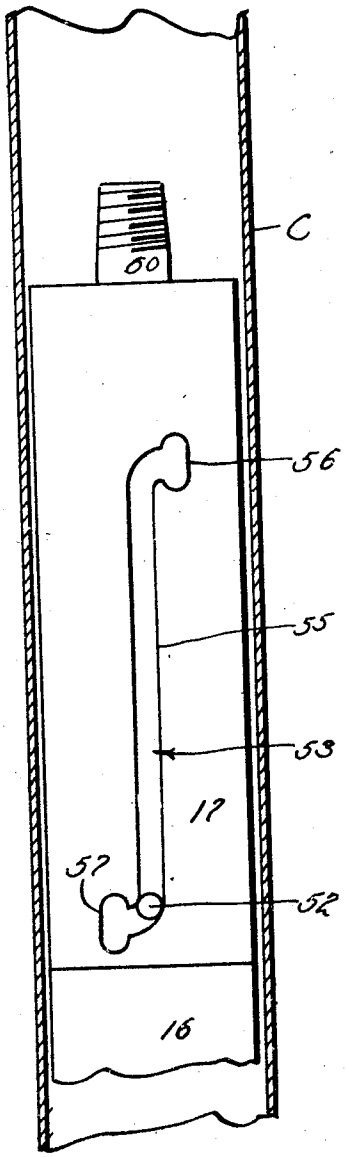


Fig. 6.

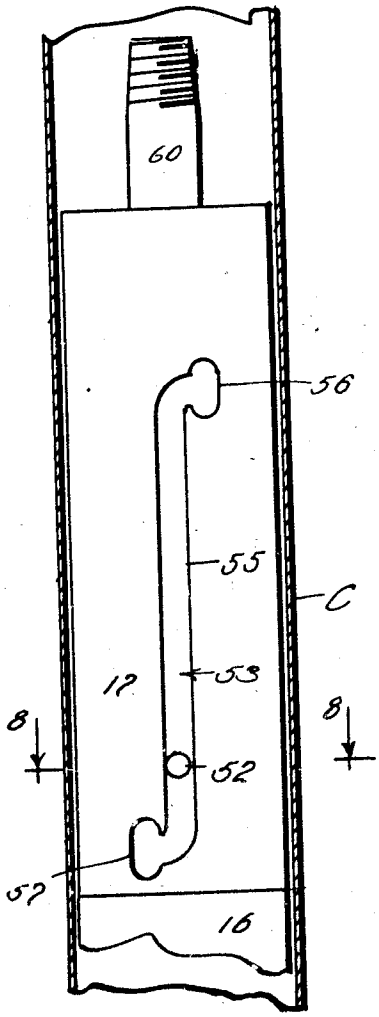


Fig. 7.

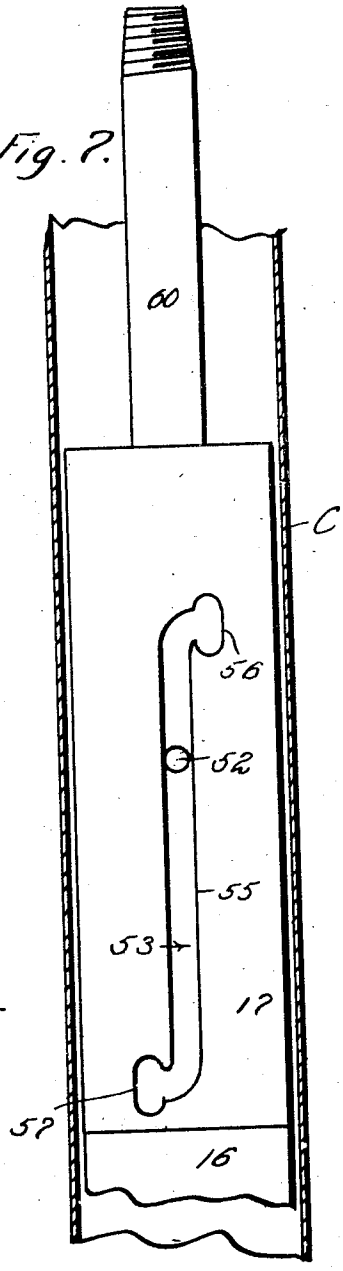
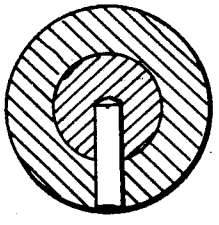


Fig. 8.



Inventor
Millard S. Black
by W. H. Maxwell
his Attorney

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UNITED STATES PATENT OFFICE.

MILLARD S. BLACK, OF HUNTINGTON PARK, CALIFORNIA.

CASING CUTTER.

Application filed November 18, 1925. Serial No. 69,793.

This invention has to do with a well tool and has particular reference to a casing cutter adapted to cut casing in a well such, for instance, as an oil well.

It is common in casing cutters of the character mentioned, to employ cutting parts of hard steel shaped and proportioned so that they will cut effectively. In practice these cutting parts are frequently broken because of movement or shifting of the tool in the casing during the cutting operation; these movements being such as to put the cutters under strains which cause their failure.

It is an object of this invention to provide a tool in which the cutters may be comparatively delicate and yet operate without breaking.

Another object of my invention is to provide means for anchoring a tool at a certain point in a well so that it is fixed against longitudinal movement, but is free to rotate.

A further object of my invention is to provide a tool with anchoring means which is controllable from or through the operating member carrying the tool without impairing the operation of the tool.

The various objects and features of my invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawings in which

Fig. 1 is a longitudinal detailed sectional view of a typical form of casing cutter embodying the present invention, being a view taken showing the parts in position ready to start operation.

Fig. 2 is a sectional view similar to Fig. 1, showing the parts partially actuated, the anchoring means being fully extended or operated.

Fig. 3 is a sectional view similar to Figs. 1 and 2, showing the parts in position in which the casing cutting means as well as the anchoring means is fully operated or extended.

Fig. 4 is an enlarged detailed sectional view taken as indicated by line 4—4 on Fig. 1.

Fig. 5 is an exterior elevation of the upper portion of the tool, the parts being shown in the relative positions in which they are shown in Fig. 1.

Fig. 6 is a view similar to Fig. 5, the parts being shown in the relative positioning in which they are shown in Fig. 2.

Fig. 7 is a view similar to Figs. 5 and 6, the parts being shown in the positioning in which they are shown in Fig. 3; and

Fig. 8 is a detailed sectional view taken as indicated by line 8—8 on Fig. 6.

My present invention in its broader aspects is applicable to casing cutters of various forms and constructions and, in fact, is applicable to various well tools in which difficulties such as are common to casing cutters are encountered. I have in this application set forth a typical and commercially practical form of casing cutter which will serve to illustrate the features and advantages of my present invention and which may be referred to generally as typical of tools of this character. The particular casing cutter which I will describe is of the type embodying disc cutters made comparatively thin in order to effectively cut through the casing. It has, heretofore, been common practice to operate casing cutters of this character by applying to them or embodying in them a tail piece which engages the casing to offer resistance to longitudinal movement of the body of the tool relative to the casing. It has been found from actual practice that tail pieces will operate to hold the body sufficiently secure to enable the tool to be actuated, however, they do not hold the body in a manner to relieve the cutters of strains which frequently break them.

My present invention, as before stated, is applicable to tools such as casing cutters and may in its broader aspects be embodied in various forms, that is, it may be embodied in or built as a part of a casing cutter or other tool, or it may be in the form of an attachment applicable to a casing cutter or other tool. I have, in this case, chosen to set forth a case in which my invention is embodied in or formed as a part of a casing cutter which construction embodies several unique and advantageous features which will be apparent from the following detailed description.

The tool which I have illustrated in the drawings comprises, generally, a body 10, cutting means 11 operable to cut through a casing C, or the like, in which the tool may be operated, a tail piece 12 connected to the body to offer general frictional resistance to movement of the body in the casing C, anchoring means 13 operable to anchor the body in the casing against longitudinal movement, and various other parts, the de-

tails and functions of which will be hereinafter fully set forth.

The body 10 is a comparatively long member of a size and shape to freely pass through the casing C and having a central longitudinal opening 15^a. The body 10 may in practice be built or formed in various manners, it being preferred to form it of a plurality of separable sections as I have illustrated in the drawings. The particular body shown in the drawings includes three sections 15, 16 and 17 connected together end to end by screw threaded connections such as are common to tools of this character. The section 15 carries the cutting means 11 while the section 16 carries the anchoring means 13. In carrying out the spirit of my invention the various parts of the tool, for instance, the cutting means and anchoring means may be related in various manners as circumstances may require. In the tool shown in the drawings the anchoring means is located above the cutting means, so therefore the section 16 of the body is arranged above the section 15. The section 17 of the body is shown arranged above the section 16.

The tail piece 12 which may, as far as my invention is concerned, be of any desired form or construction, is applied to a suitable part of the tool so that it operates on the casing C to offer frictional resistance to movement of the tool in the casing. In the tool illustrated in the drawings, the tail piece is secured to the lower end of the body and comprises a frame 18 carrying spring arms 19 which expand against the casing in the manner usual to devices of this character. It will be apparent to those skilled in the art that the tail piece 12 may be of any desired construction and may include any desired control or tripping means whereby it is thrown into and out of operation at the proper time with relation to the operation of the other parts of the tool.

The cutting means 11 comprises a plurality of disc cutters 20 mounted in carriers 21 arranged symmetrically in the section 15 of the body 10. The carriers 21 are slidably carried in radially disposed guide ways 22 and are adapted to be actuated by an operating member 23 to carry the cutters 20 outwardly to feed them through the casing C as the tool is rotated. The cutters 20 are in the form of comparatively thin discs rotatably mounted in the carriers on pivot pins 32. The peripheries of the discs are sharpened and are made as thin as practical so that they will effectively cut through the casing C when the tool is actuated as hereinabove described.

The operating member 23 for the cutters, is carried in the opening 15^a in the body 10 and may comprise a comparatively long tapered or conical part 24 terminating at its small end in a straight part 25, comparatively small and uniform in diameter, and at its large end in a straight part 26, comparatively large and uniform in diameter. The carriers 21 are normally yieldingly held in by means of springs 26^a operating on fingers 27 extending from the carriers so that they normally engage the operating member. When the operating member is positioned so that the small part 25 is opposite the carriers 21 the carriers are in or unactuated, in which position the cutters 20 are within the body. As the operating member 24 is moved relative to the carriers to bring the tapered part 24 into engagement with the inner ends of the carriers, the carriers are moved or fed outwardly, causing the cutters to move outwardly into operating engagement with the casing C. When the operating member has been moved to a position where the large part 26 is opposite, or in engagement with, the carriers, the carriers are fully actuated, and the cutters are in position where they extend completely through the casing C. I may provide the operating member with a second part 30 of small diameter immediately adjacent or at the other end of the large part 26 so that the operating member may be operated beyond the position where the large part 26 is opposite the carriers 21 so that the carriers are retracted by the springs 26^a to a position where the cutters 20 are clear of the casing.

The anchoring means 13 may, in accordance with my invention, comprise one or more casing engaging members 33 and an operating member 34 operable to cause movement of the members 33 into proper operating engagement with the casing C. In practice, I prefer to use a plurality of casing engaging members 33 and to make the members in the form of rollers, the peripheries of which are shaped and finished so that they effectively engage the casing C to resist longitudinal movement relative to the casing and allow free rotation relative to the casing. The members 33 may be mounted on suitable pivot pins 36 in carrier 35, the parts being related so that the pivotal axes of the members 33 are parallel with the longitudinal axis of the casing C in which the tool is operated. The carriers 35 may be slidably carried in radially disposed guide ways 37 provided in the body section 16 and may be normally yieldingly held in, or in an unactuated position by a spring 38, engaging fingers 39 extending from the carriers. The springs 38 may be carried in openings 40 adjacent to the guide ways 37 and the fingers 39 may project into the openings 40 through suitable slots 41 as clearly shown throughout the drawings. The fingers 39 in this construction operate not only as parts against which the springs 38 may react, but also to prevent rotation of the carriers in the guide ways. The operating member 34 may re-

semble generally the operating member 23 provided for the cutting means 11, for instance, it may be mounted to operate in the opening 15 of the body and may comprise a tapered or conical part 43 terminating at its small end in a straight part 44 of small diameter and at its large end at a straight part 45 of large diameter. The parts may be arranged and proportioned so that the casing engaging members 33 are within the body 10 when the parts are related so that the carriers 35 are in engagement with the straight part 44 of small diameter. As the operating member is moved relative to the carriers to move the tapered part 43 into engagement with the carriers, the carriers are moved outwardly causing the members 33 to engage the casing. When the carriers have been actuated so that the members 33 are in proper engagement with the casing the part 45 of large diameter comes into engagement with the carriers to hold them thus actuated or extended. A second part 46 of small diameter may be provided adjacent the part 45 of large diameter to receive and come opposite the carriers 35 upon continued operation of the operating member to cause the part 35 to pass beyond the carriers.

In the preferred arrangement of parts which I have illustrated in the drawings, the operating members 23 and 34 of the means 11 and 13 are connected together end to end and are in fact preferably formed of a single continuous bar or rod. Further, the operating members 23 and 34 are arranged in the same general manner with relation to the carriers 21 and 35 respectively, that is, the tapered parts 24 and 43 of the two members taper or converge upwardly so that the operations above described are had by movement of the operating members upwardly from the positions illustrated in Fig. 1. In accordance with my invention I prefer to make the straight part 25 of small diameter of the member 23 comparatively long and to relate the parts, that is, the carriers 21 and 35 in the body 10 and the various parts of the two operating members so that the part 25 of the operating member 23 continues in engagement with the carriers 21 during the time that the tapered part 43 of the operating member 34 passes into engagement with the carriers 35 causing them to engage the casing C so that the members 33 are actuated into engagement with the casing C to grip the casing and prevent longitudinal movement of the body 10 in the casing before the carriers 21 have been actuated, or at least before the carriers 21 have been actuated sufficiently to bring the cutters 20 into engagement with the casing. I further relate and proportion the parts so that the straight part 45 of large diameter of operating member 34 is comparatively long and continuous in engagement with the carriers 35 to maintain the members 33 in gripping engagement with the casing during the movement of the tapered part 24 of the operating member 23 in engagement with the carriers 21 and until the part 26 of large diameter of the operating member 23 is in engagement with the carriers 21. The second part 30 of small diameter of the operating member 23 and the second straight part 46 of the operating member 34 may be related so that continued operation of the operating members after the cutting means has been completely actuated will bring them into position where they are both in engagement with the carriers 31 and 35, respectively.

It is necessary to provide a driving connection between the operating members 23 and 34 and the body whereby the operating members and body are rotatable together and also to provide means for generally controlling or limiting relative longitudinal movement between the operating members and body. This may be accomplished by providing a stem 50 on the upper end of the uppermost operating member to operate in a suitable opening 51 provided in the upper section 17 of the body and by providing a projection or pin 52 on the stem 50 to cooperate with a suitable slot 53 provided in the section 17. The stem 50 is limited in its general longitudinal movement in the opening 51 by shoulders 52^a and 53^a at the upper and lower ends of the openings, respectively. The pin 52 extends radially from the stem 50 into the slot 53. The slot may be shaped, generally, in the form of a double ended bayonet slot having a comparatively long straight vertical part 55 the ends of which terminate in comparatively short offset parts 56 and 57. The parts of the slot 53 are arranged and proportioned with relation to the parts of the operating members 23 and 34 so that the parts 25 and 44 of the operating members are in engagement with the carriers when the pin 52 is in the offset part 57 at the lower end of the slot, while the parts 30 and 46 of the operating members are in engagement with the carriers when the pin 52 is in the offset part 56 at the upper end of the slot. During the times that the carriers are being actuated by the slotted members the pin 52 is in the main part 55 of the slot as will be apparent from comparison of Figs. 2 and 3 with Figs. 6 and 7 of the drawings.

The particular tool illustrated in the drawings is adapted to be connected with suitable operating means, for instance, a string of drill pipe, or the like, through an extension 60 projecting upwardly from the upper end of the stem 50 through an opening 61 in the upper end of the body section 17. The extension may be screw threaded at its upper end as shown in the drawings

to receive a sub or other part of the operating means.

In operation, the tool may be lowered into the well to the desired point with the pin 52 carried in the offset part 57. With this relationing of the parts the operating member may be moved vertically to move the body 10 with it, if it is necessary to work the tool in the casing to get it to the desired point. With the tool at the desired point in the casing, operation is started by pulling up on the operating means and at the same time rotating it to move the pin 52 into the main part 55 of the slot to a position such as is shown in Fig. 5 of the drawings. It is to be understood that the tail piece 12 offers sufficient frictional resistance to permit of this movement between the operating means and the body. With the pin 52 in the main part of the slot the operating means is pulled straight up causing the tapered part 43 of the operating member 34 to actuate the carriers 35 until the members 33 are in gripping engagement with the casing. During this portion of the operation the operating means may or may not be rotated as the circumstances may require. With the carriers 35 completely actuated the straight part 45 of large diameter of the operating member 34 engages the carriers 35 to hold them completely actuated. Upon further upward movement of the operating means accompanied by rotation thereof the tapered part 24 of the operating member 23 operates on the carriers 21 moving them outwardly so that the cutters 20 engage the casing. The rotation of the operating means connected with the extension 60 causes rotation of the entire tool, the body 10 being rotated with the part connected with the operating means through the pin 52. As the cutters 20 are thus moved outwardly into engagement with the casing and around in the casing they operate to effectively cut through the casing to a position such as I have illustrated in Fig. 3. During the time that the cutters are operating on the casing the gripping members 33 are maintained in engagement with the casing and operate to hold the body 10 firmly in the casing against vertical movement. The members 33 operate to effectively resist the tendency and the body 10 to move upwardly due to the operating means being pulled or moved upwardly. The gripping members 33 being in the form of rollers mounted as I have described allow the body to rotate freely in the manner required for proper operation of the cutting means. With the parts actuated to the position shown in Fig. 3, in which case the casing C is cut into two sections, the operating means may be lowered and suitably rotated to return the pin 52 to the offset part 57 of the slot 53 or the operating means may be continued or moved further upwardly until the parts 30 and 46 are opposite the carriers 21 and 35 respectively in which case the carriers return to an in position where the tool is free of the casing and in which position the pin 52 may be moved into the opposite part 56 of the slot 53. With the tool actuated to a position with which the carriers are retracted it may be withdrawn from the casing by means of the operating means.

Having described only a typical preferred form of my invention I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. In a tool to be operated in a casing, a body, a part carried by the body operable to act on the casing, a tail piece connected with the body to frictionally engage the casing, an operating part movably related to the body to actuate said first mentioned part, and anchoring means operable to hold the body in position in the casing during operation of said part, said anchoring means including a roller movable into pressure engagement with the casing.

2. In a tool to be operated in a casing, a body, a part carried by the body operable to act on the casing, a tail piece connected with the body to frictionally engage the casing, an operating part movably related to the body to actuate said first mentioned part, and anchoring means operable to hold the body in position in the casing during operation of said part, said anchoring means including a roller movable into pressure engagement with the casing, and operating means for the roller operable from said operating part.

3. In a tool to be operated in a casing, a body, a part carried by the body operable to act on the casing, a tail piece connected with the body to frictionally engage the casing, an operating part movably related to the body to actuate said first mentioned part, and anchoring means operable to hold the body in position longitudinally in the casing during operation of said part, said anchoring means including a roller, a carrier for the roller movable radially relative to the body, and means for operating the carrier.

4. In a tool to be operated in a casing, a body, a part carried by the body operable to act on the casing, a tail piece connected with the body to frictionally engage the casing, an operating part movable relative to the body to actuate said first mentioned part, and anchoring means operable to hold the body in position in the casing during operation of said part, said anchoring means including a roller, a carrier for the roller slid-

able in a radially disposed opening in the body, and operating means for the carrier operable from said operating part.

5. A tool for cutting a well casing by rotation including a body, two members carried by the body, one operable to cut the casing and the other to hold the body against longitudinal movement in the casing, and a part movable longitudinally of the body to operate said members and adapted to be rotated to rotate the body in the casing.

6. A tool for cutting a well casing including a body, two members carried by the body one operable to cut the casing and the other to hold the body against longitudinal movement in the casing, a part movable longitudinally of the body to operate said members, and a driving connection between said part and body allowing longitudinal movement of the part relative to the body, said driving connection including a projection on said part operating in a longitudinal opening in the body.

7. A tool for cutting a well casing including a body, two members carried by the body one operable to cut the casing and the other to hold the body against longitudinal movement in the casing, a part movable longitudinally of the body to operate said members, and a driving connection between said part and body allowing longitudinal movement of the part relative to the body, said driving connection including a projection on said part operating in a longitudinal opening in the body, the opening having offset parts at its ends to receive the projection.

8. In a tool to be operated in a casing a body having a central longitudinal opening and comprising a plurality of separable sections, a member carried by one section operable to cut the casing, a member carried by another section operable to hold the body against longitudinal movement in the casing, an operating part extending into the body and adapted to be moved longitudinally of the body to actuate said members, and a rotary driving connection between said part and another section of the body.

In witness that I claim the foregoing I have hereunto subscribed my name.

MILLARD S. BLACK.