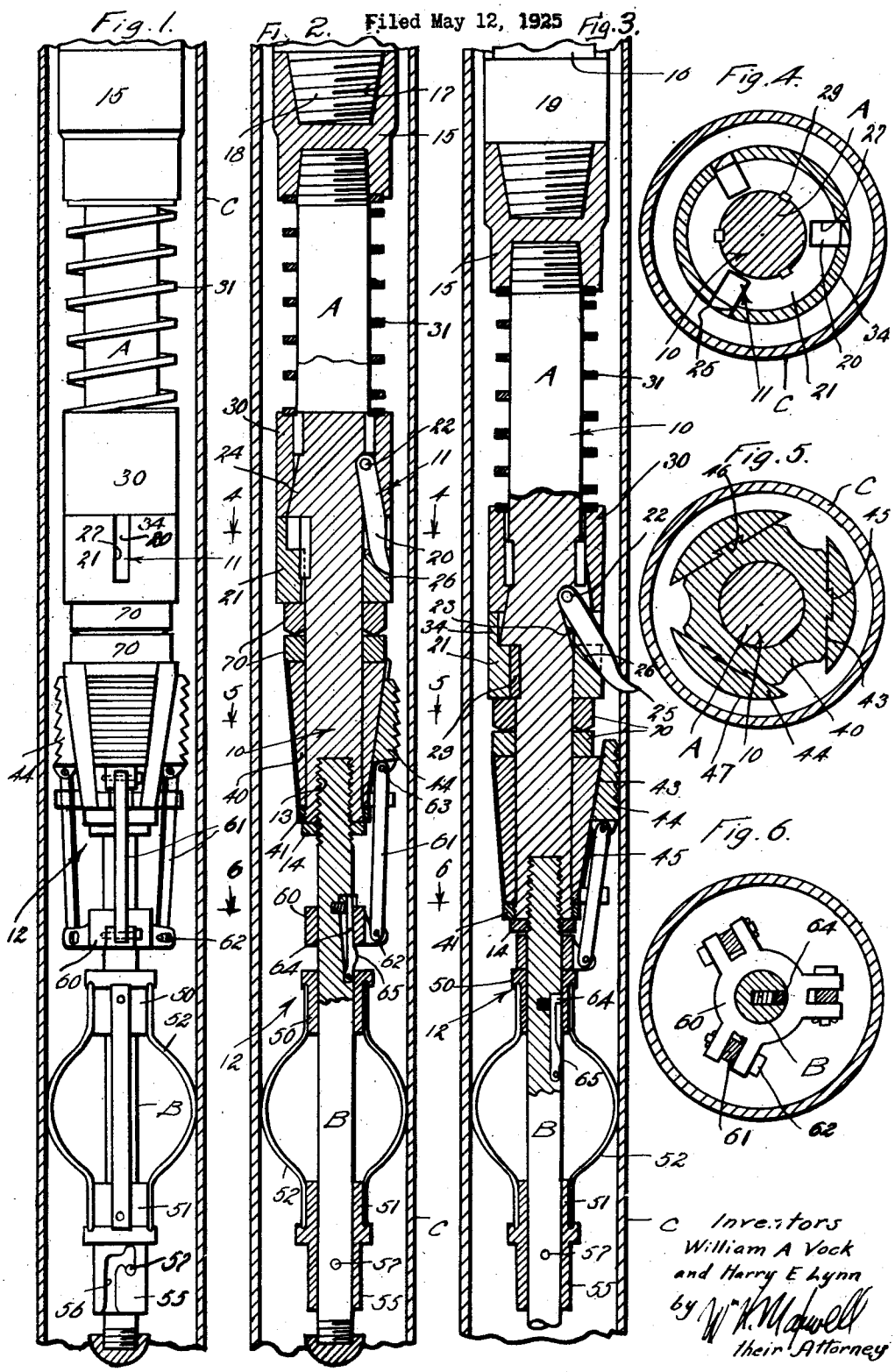
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CASING CUTTER

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CASING CUTTER.

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This invention has to do with a tool for use in well drilling and has particular reference to a tool for cutting casing in a well.

The tool provided by this invention is designed to operate in a casing to cut outwardly therethrough.

An object of this invention is to provide a practical reliable and effective casing cutter.

Another object of the invention is to provide an effective improved form of cutting means for casing cutters, and the like.

A further object of this invention is to provide an effective improved means for operating the cutting means of a casing cutter, or the like.

The various objects and features of this invention will be best and more fully understood from the following detailed description of a typical preferred form of the invention throughout which description we make reference to the accompanying drawings in which

Fig. 1 is an exterior view of the device provided by this invention showing it in an unactuated position within a casing.

Fig. 2 is a view similar to Fig. 1 showing the device in section.

Fig. 3 is a view similar to Fig. 2 showing the device in operative position.

Fig. 4 is an enlarged detailed transverse sectional view taken as indicated by line 4—4 on Fig. 2.

Fig. 5 is an enlarged detailed plan section taken as indicated by line 5—5 on Fig. 2, and

Fig. 6 is an enlarged detailed plan section taken as indicated by line 6—6 on Fig. 2.

The tool provided by this invention includes, generally, a central longitudinal body 10, cutting means 11 carried by the body, operating means 12 for the cutting means, also carried by the body, and various other parts, the details and functions of which will be hereinafter set forth.

In the particular form of construction illustrated in the drawings the body 10 is in general, round in cross sectional configuration and is an elongated structure formed in two separable sections, an upper or main section A and a lower or end section B. The main section A of the body carries the cutting means 11 and a part of the operating means. The section A is shown heavier and larger in diameter than the section B and the sections are connected by screw threading the upper end of the section B into an opening 13 provided in the lower end of the section A. The two sections may be set by a nut 14 screw threaded on the section B to engage the lower end of the section A. The upper end of the body A has a sub or connecting member applied to it to serve as a connection between the device and an operating element such as a string of drill pipe 16. In the particular construction shown in the drawings the connecting member 15 is screw threaded onto the upper end of the body A and is provided at its upper end with a tapered screw threaded socket 17 to receive the tapered pin 18 of a tool joint section 19 on the lower end of the drill pipe 16.

The cutting means 11 is located on the upper section A of the body at a point spaced somewhat below the upper end of the body and includes, generally, one or more cutters 20 pivotally connected to the body and a wedge ring 21 carried by the body to feed the cutters outwardly as the device is operated. We prefer in practice to use a plurality of cutters 20, for instance three, as shown in the drawings and to arrange the cutters symmetrically around the body. The cutters may be directly pivotally connected with the body section A by pivot pins 22 and when unactuated are adapted to occupy recesses 23 in the outer side of the body, so that they extend downwardly and slightly outwardly from the pivot pins 20. The body A may be provided with an enlarged part 24 at the means 11 to effectively carry the cutters. For instance, in the drawings we have shown a downwardly divergent enlargement on the body at the means 11 and have shown the cutter receiving recesses 23 formed in the part 24. The cutters 20 are made or proportioned to project the desired distance from the body when actuated and have their outer end portions dressed or finished to present cutting edges 25. The wedge ring 21 is slidably carried on the body section A below the enlarged part 24 and is provided with downwardly and outwardly extending incline parts or wedge faces 26 which extend under the outer end portions of the cutters when the cutters are in the unactuated position as shown in Fig. 2 and which operate to wedge or feed the cutters outwardly to a position such as is shown in Fig. 3 upon the ring being moved

upwardly on the body. The wedge ring is preferably provided with side walls 27, at either side of the wedge faces 26 which serve to guide and support the cutters. It is preferred to hold the wedge ring against rotation on the body so that it does not exert side strain on the cutters. This means may include a sliding key connection 29 between the ring and body.

Our invention provides means for positively retaining the cutters 20 in the unactuated position shown in Fig. 2 and to release the cutters to allow them to move to a position such as is shown in Fig. 3 only upon their being operated by the operating means 12. In the preferred form of construction we provide a retaining ring 30 on the body section A at the upper part of the cutting means 11, the upper portion of which ring is slidably carried on the body while the lower portion normally extends downwardly over the cutters 20. A compression spring 31 is arranged under compression between the retaining ring 30 and the coupling member 15 at the upper end of the body A to normally urge the retaining ring downwardly. When the cutters are in an unactuated position, or are seated in the recesses 23, the retaining ring 30 may be stopped by engagement with the cutters or with the enlarged part 24 of the body, or both. As means for releasing the retaining ring from the cutters, that is, moving the retaining ring upwardly to allow the cutters to move out as the cutters are operated we provide upwardly extending flange like parts 34 on the upper end of the wedge ring 21 to engage the lower end of the retaining ring 30. With this construction as the wedge ring 21 moved upwardly to feed the cutters 20 outwardly the upwardly extending parts 34 force the retaining ring upwardly against the resistance of the spring 31 so that the retaining ring does not interfere with the proper feeding of the cutters. The retaining ring is particularly important as it operates to positively hold the cutters in or unactuated during the lowering of the tool into proper position in the casing C, and also prevents the cutters from moving or feeding outwardly faster than they are positively fed by the wedging. This prevents the cutters from biting too deeply or quickly into the casing.

The operating means 12 includes, generally, means for gripping or engaging the casing C to form a fixed stop or abutment with reference to which the body may be operated to cause movement of the wedge relative to the body in order to operate the cutters. In accordance with the broader aspects of our invention this means may be carried out in several ways, however, it is preferred that it comprises a slip mechanism to tightly grip the casing and a tail piece for controlling operation of the slip mechanism. In the preferred construction the slip mechanism includes a sleeve 40 slidably carried on the lower end of the body section A between a stop nut 41 on the lower end of the body section A and the wedge ring 21. The exterior of the sleeve 40 is provided with a plurality of flat wedge faces 43 on which are mounted slips 44. The slips may be retained in position on the faces by ribs 45 formed longitudinally on the faces to operate in recesses 46 formed in the slips. The outer faces 47 of the slips are curved to conform to the curvature of the interior of the casing C and are finished or roughened so that they are effective in gripping the interior of the casing. The wedge faces 43 on the sleeve are pitched so that the slips are clear of the casing when at the lower end of the sleeve and engage and grip the casing when at the upper end of the sleeve. A bearing is provided between the upper end of the sleeve 40 and the wedge ring 21 to allow free rotation of the slip mechanism relative to the wedge ring and cutting means. This bearing may include two bearing rings 70 arranged between the sleeve 40 and wedge ring 21 one of them being provided with projecting bearing part which engages the flat face of the outer part.

The tail piece which controls the operation of the slip mechanism is carried on the lower section B of the body and includes two spaced collars 50 and 51 connected by a plurality of outwardly bowed leaf springs 52 which normally frictionally engage the interior of the casing C. The collars 50 and 51 are slidably carried on the section B of the body. We provide an extension 55 on one of the collars of the tail piece. There is a bayonet slot 56 in the extension to receive a projection or pin 57 extending from the body section B forming means for releasably connecting the tail piece and the body so that the tail piece can be operated or slid through the casing by the body. When the parts are in the position shown in Fig. 1 where the pin 57 is in the inner part of the bayonet slot the tail piece is movable with the body however, when the body has been rotated relative to the tail piece to move the pin into the outer part of the bayonet slot or completely out of the bayonet slot the body and tail piece are released so that a certain amount of relative longitudinal movement can take place between them. An operating connection is provided between the tail piece and slip mechanism whereby the slips 44 may be operated to grip the casing by movement of the body relative to the tail piece. This connection may include a ring 60 slidably carried on the upper portion of the body section B and connecting links 61 connected to the ring 60 and slips 44 by pivot pins 62 and 63 respectively, so that the slips may be moved by the ring

60. The ring 60 is normally held in a down position where the slips are unactuated, as shown in Figs. 1 and 2, by a spring latch 64 pivotally mounted in the body section B. The latch 64 has a projecting part 65 adapted to be engaged by the uppermost collar of the tail piece upon the mechanism being operated so that the body is moved downwardly relative to the tail piece. When the uppermost collar of the tail piece engages the projecting part 65 the latch releases the ring so that the collar of the tail piece can engage the ring and move it upwardly on the body to actuate the slips.

In operating the device, it is lowered into the casing C on the lower end of the drill pipe 16, the cutters being held in the unactuated position shown in Figs. 1 and 2 by the retaining ring 30 and the tail piece being connected with the body to move therewith due to the engagement of the pin 57 in the inner part of the bayonet slot 56. When the device has reached the point at which the cut is to be made the body is operated or manipulated through the drill pipe to disengage the pin 57 from the inner part of the bayonet slot so that the body is free to be moved downwardly relative to the tail piece. The springs 52 frictionally engage the casing to hold the tail piece so that the body can be manipulated to disengage the pin 57 from the bayonet slot. As the body is moved downwardly relative to the tail piece the uppermost collar 50 of the tail piece first depresses the projecting part 65 of the latch causing the latch to release the ring 60 and it then engages the ring 60 and moves it upwardly on the body causing the slips to be moved upwardly relative to the sleeve 40 until they engage the casing C. When the slips have engaged the casing C the sleeve 40 is held against further or in this case, downward, movement so that as the body continues to move downwardly the sleeve causes the wedge ring 21 to actuate the cutters and release the retaining ring so that the cutters feed outwardly from the position shown in Figs. 1 and 2 to that shown in Fig. 3. During the actuation of the cutters between the positions shown in Figs. 2 and 3 the body is rotated so that the cutters operate around in the casing as they are fed outwardly and thus operate to cut completely through the casing. When the cut has been made and it is desired to withdraw the device, or at any time when it is desired to withdraw the device, the body is moved upwardly causing the tail piece to move to the lower end of the body section B thus allowing the slips to release the casing and the wedge ring to lower away from the cutters so that the cutters move inwardly to their unactuated position by gravity and the action of the spring on the retaining ring.

We have set forth only one arrangement of parts and manner of operating the device, but do not wish our invention understood as limited thereby. It will be apparent from our disclosure how the various parts of the device can be rearranged and varied in features of construction and that the parts can be arranged and related so that the operation of the device is the reverse of that described.

Having described our invention, we claim:

1. In a well casing cutter operable to cut by rotation, a body, a cutter carried by the body, a retaining member for the cutter, and means normally yieldingly holding the member in position to hold the cutter unactuated.

2. In a well casing cutter operable to cut by rotation, a body, a cutter pivotally carried by the body, a retaining member slidably carried by the body normally extending over the cutter to hold it in an unactuated position, and means for simultaneously releasing the retaining member and actuating the cutter.

3. In a well casing cutter operable to cut by rotation, a body, a cutter pivotally carried by the body, a retaining member slidably carried by the body normally holding the cutter unactuated, and a member slidably carried by the body separate from the first mentioned member for simultaneously releasing the retaining member and actuating the cutter.

4. In a well casing cutter operable to cut by rotation, a body, a cutter pivotally carried by the body, a retaining ring slidably carried by the body normally engaging over the cutter to hold it in an unactuated position, and means for simultaneously releasing the retaining ring and actuating the cutter.

5. In a well casing cutter operable to cut by rotation, a body, a cutter pivotally carried by the body to be movable between an in position where it is close to the body and an out position where it projects from the body, a retaining ring slidably carried by the body and engaging the cutter to retain it against outward movement and an operating ring slidably carried on the body operable to move the cutter outwardly and at the same time move the retaining ring so that it releases the cutter as it is moved outwardly.

6. In a well casing cutter operable to cut by rotation, a body, a cutter pivotally carried by the body, a spring actuated retaining ring carried by the body to normally hold the cutter unactuated.

7. In a tool of the character described, a body, a cutter pivotally carried by the body to be movable between a position close to the body to a position where it projects from the body, a retaining ring slidably carried

on the body, a spring carried on the body normally holding the retaining ring in position where it extends over the cutter to retain it in the in position, and an operating ring carried by the body having a part engagable with the cutter to feed it outwardly, parts engaging the cutter to brace it and a part engaging the retaining ring to move it out of engagement with the cutter as the cutter is fed outwardly.

8. In a well casing cutter operable to cut by rotation, a rigid body, a slip mechanism carried by the body, a tail piece slidably carried on the body, an operating connection between the tail piece and slip mechanism, and control means in connection with the tail piece whereby it is operable to actuate the slip mechanism.

9. In a well casing cutter operable to cut by rotation, a rigid body, a slip mechanism carried by the body, a tail piece slidably carried by the body, a connection between the slip mechanism and tail piece whereby the slip mechanism is operated by movement of the tail piece relative to the body, and means for controlling movement of the tail piece relative to the body.

10. A tool to be operated in a casing including an elongated body, a cutter pivotally carried by the body to be movable between a position where it is close to the body to a position where it projects from the body through the casing, a retaining ring slidably carried on the body at the cutter, a spring carried on the body normally holding the retaining ring in position to retain the cutter in an in position, an operating ring slidably carried on the body having a wedge part to feed the cutter outwardly, guide parts for bracing the cutter and a part engaging the retaining ring to move it to release the cutter as the cutter is fed outwardly, a sleeve slidably carried on the body operatively engaging the operating ring, the sleeve having wedge faces, slips carried by the wedge faces operable to grip the casing, a tail-piece slidably carried on the body, links connecting the tail-piece and slips, and means controlling the movement of the tail-piece relative to the body.

In witness that we claim the foregoing we have hereunto subscribed our names this 11th day of April, 1925.

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