June 30, 1925. 1,543,903

H. S. CAMERON ET AL

CASING PERFORATOR

Filed Jan. 13, 1923 2 Sheets-Sheet 1

Fig. 1.

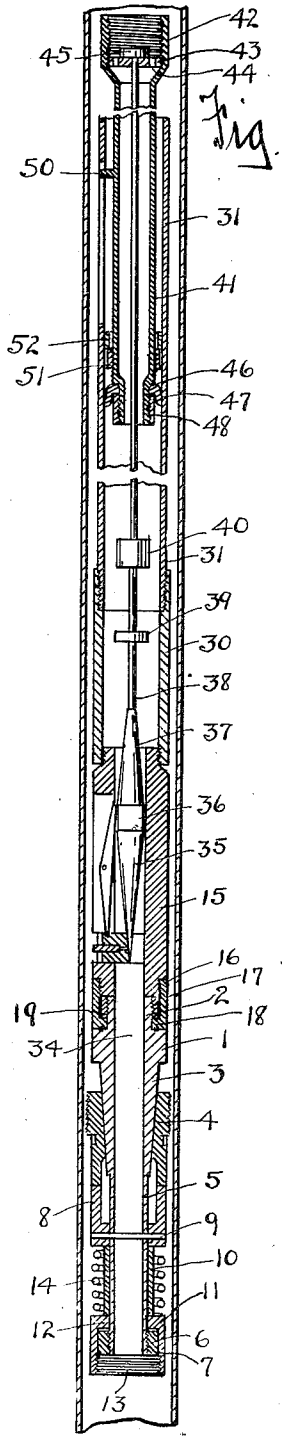


Fig. 2.

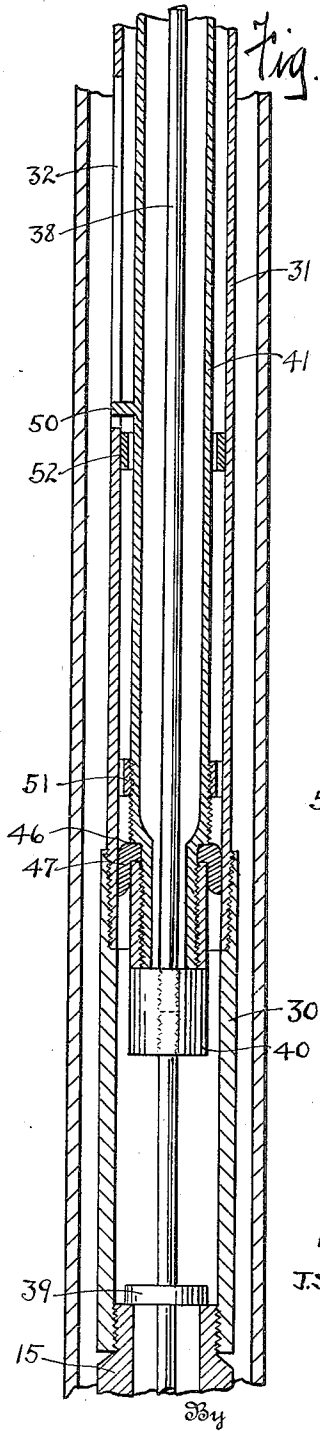
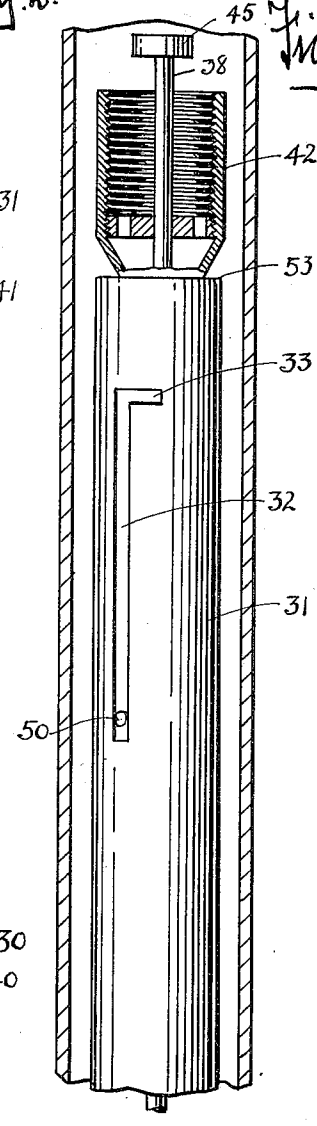


Fig. 3.



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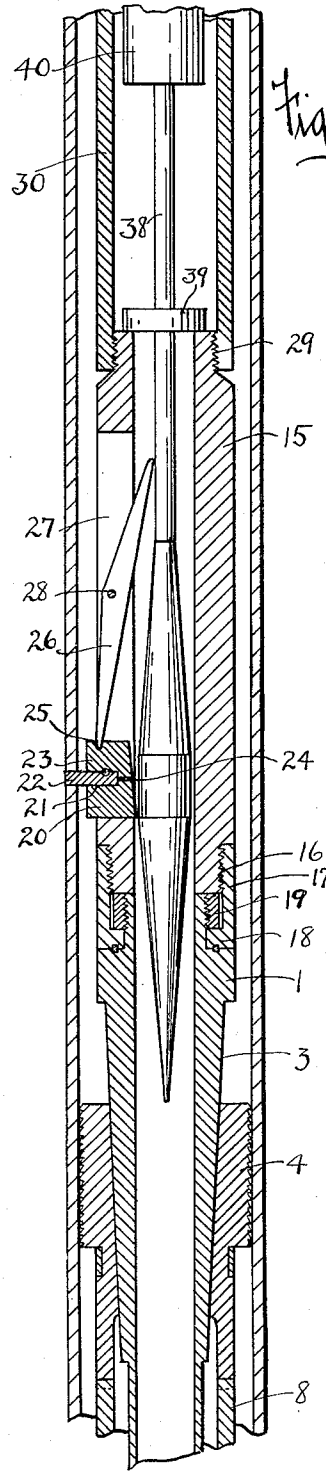


Fig 4.

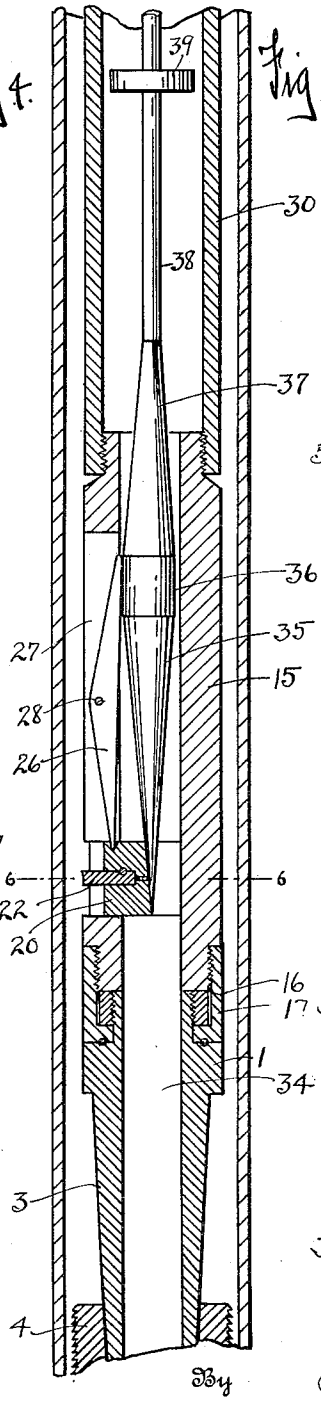


Fig. 5.

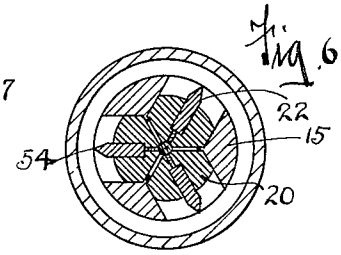


Fig. 6.

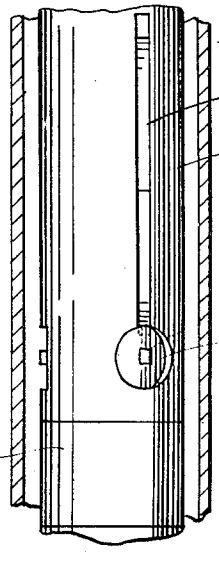


Fig. 7.

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UNITED STATES PATENT OFFICE.

HARRY S. CAMERON AND JAMES S. ABERCROMBIE, OF HOUSTON, TEXAS.

CASING PERFORATOR.

Application filed January 13, 1923. Serial No. 612,554.

To all whom it may concern:

Be it known that we, HARRY S. CAMERON and JAMES S. ABERCROMBIE, citizens of the United States, residing at Houston, Harris County, Texas, have invented a certain new and useful Improvement in Casing Perforators, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to devices for perforating pipe or casing in a well. In the operation of well drilling and pumping it quite frequently happens that it is desirable to perforate a pipe or casing after it has become fixed in the well. This may be to relieve pressure from the outside of the casing or to provide an opening from a producing stratum outside the casing to the interior of the well. While perforating devices have previously been used, the present types of perforators are more or less unsatisfactory.

It is the object of our invention to provide a means for perforating the pipe or casing within the well, which may be operated positively and exactly after it has been introduced into the well.

Another object is to provide a supporting means for the perforating device, which will firmly support the device at the point desired, and which will again release it when it is desired to change the position of the cutters.

Another object is to provide a means for indicating accurately when the operation of perforating the casing has been accomplished.

Various other objects and advantages of the improved device will more clearly appear in a specification which follows, and the points of novelty thereof will be pointed out with particularity in the claims appended hereto.

Referring to the drawings, wherein the preferred embodiment of our invention is disclosed, Fig. 1 is a central longitudinal section through our improved pipe perforator shown in position within the pipe; Fig. 2 is a similar section somewhat enlarged showing certain details of the construction; Fig. 3 is a broken detail showing part of the device in elevation; Figs. 4 and 5 are details of the invention showing the cutter operating means, the parts being in different positions in the two views; Fig. 6 is a transverse section on the line 6—6 of Fig. 5; Fig. 7 is a broken elevation of the cutting tool. Like numerals of reference are applied to like parts in all the views.

In working out our invention, we have found that it is necessary for the accurate operation of a perforating device, to support it upon a firm anchor in order that the cutters may be expanded and forced through the casing in a positive and accurate manner. We have, therefore, devised an anchoring means therefor comprising a head, 1, having a reduced upper threaded shank 2 thereon and having the central portion 3 tapered downwardly to provide a seat for expanding slips or jaws 4 formed to fit on said tapered portion. Below the tapered portion 3 there is a cylindrical extension 5 having a threaded portion 6 at the lower end to accommodate a nut 7 adapted to screw thereon. The jaws or slips 4 have connection with the upper end of a sleeve 8 which is slidable upon the pipe 5 and may be secured in a fixed position upon said pipe by means of a diametrical pin 9 of soft or brittle material which may be sheared off when desired. Below the sleeve 8 is a spacing collar 10 which bears at its upper end against the sleeve 8 and at its lower end against a slidable sleeve 11. This sleeve has an inwardly projecting flange 12 at its upper end adapted to contact against the upper face of the nut 6. The lower end of the sleeve 11 extends downwardly and is threaded at 13 for attachment to a length of pipe of any desired measurement. Between the collar 11 and the sleeve 9 and outside of the spacer 10 is a resilient spring 14 which is under tension and acts to force the sleeve 8 and the jaws 4 upwardly along the tapered mandrel 3 into active position. When the device is introduced into the well the end of the sleeve 11 or an extension thereon, comes in contact with the bottom of the well, and the force of the contact will drive the spacer 10 upwardly against the sleeve 8 and shear off the pin 9, thus allowing the springs to throw the jaws into active position.

Supported upon the anchor thus provided is a cutter comprising a head 15. This head is tubular in shape, as is the anchoring device and has a fairly thick outer wall. The lower end is reduced in diameter and threaded at 16 for connection to a collar 17. Said collar extends downwardly from the head around the upper shank of the

cutter 1 and has an inwardly projecting flange 18 thereon above which may be threaded a ring or nut 19. A rotatable connection between the cutter head 15 and the anchor is thus provided. The cutter head has a plurality of radially slidable blocks, 20, of which we have shown 3, as best illustrated in Fig. 6. Each of these blocks is provided with a central recess 21 therein to receive a perforating cutter 22 which is secured in position against removal in said recess by means of a locking pin 23 which extends laterally through the cutter block 20 and fits within a semi-cylindrical groove in the side of the cutter. The cutters 22 have a flattened cutting edge 54 presented longitudinally of the pipe or casing which is to be perforated. The forward edge of the cutter is also slightly curved longitudinally, as will be noted from Figs. 4 and 5, thus enabling a better contact with the casing for cutting purposes. A reduced extension 24 of the recess 21 is provided so that a punch may be used to drive the cutter from its seat when the pin has been removed.

A small recess 25 in the upper side of each of the blocks 20 provides a seat for the lower end of a lever 26 fitting within a slot 27 in the head of the cutter above each of the blocks. These levers are pivoted on cross pins 28 extending transversely of the walls of the slot and allowing a swinging movement of the lever thereon. The upper end of the cutter head has a threaded shank 29 by means of which it is attached to a nipple 30. This nipple is relatively short in length, and is internally threaded for attachment at its upper end, to a length of pipe 31. This pipe 31 as shown in Fig. 3, is provided, adjacent its upper end, with a longitudinal slot 32 having an offset portion 33 at its upper end.

The cutter head and the anchoring means both have a longitudinal channel 34 therein for the passage of liquid. This channel also allows the insertion into the head, from above, of an expanding mandrel. This mandrel has a forward downwardly tapered end 35, a central cylindrical portion 36 and an upwardly tapered portion 37. The upper portion terminates in a rod 38 which extends upwardly for some distance through the pipe 31. Spaced upwardly on the rod from the mandrel is a disk-shaped valve plate 39, and, at a predetermined distance above said valve plate is a block 40 against which a driving pipe may be forced to operate the expanding mandrel. Above this block, the rod extends upwardly for some distance within a telescoping pipe 41 which fits loosely within the pipe 31 and has at its upper end a swedged nipple or coupling, 42, for attachment to a pipe or drill stem, not shown. Within the enlarged upper end of said pipe 41 is a diaphragm or disk 43 perforated as shown at 44 to allow the passage of liquid therethrough. There is also a central opening in said disk to allow the sliding therethrough of the upper end of the rod 38. The downward movement of the said rod through said disk is limited by a flattened head, 45. The telescoping pipe 41 is reduced somewhat in diameter adjacent the lower end to provide a shoulder 46 for a flexible packing cup 47, held in place by a lower nut or ring 48. The ring 48 is threaded into position and is made somewhat heavy to strengthen and reinforce the lower end of the pipe 41 so that said pipe may act as a hammer, or driving member for contact with the block 40 upon the mandrel. A laterally projecting pin 50 on the pipe 41 fits within the slot 32 in the outer pipe and allows a sliding movement of the inner pipe 41 relative to the pipe 31 and furnishes a means of rotating the pipe 31 as will be obvious.

It is not our intention to take up the load of the tool upon the pin 50 and, to prevent the load falling upon this pin we have formed a ring 51 toward the lower end of the pipe 41 in such position that it will contact with an inwardly projecting ring 52 upon the outer pipe 41 when the pin 50 is at the upper end of the slot 32, in such position that it may fit within the offset portion 33.

In going into the hole where the drill stem is used to push the tool downwardly into the casing, the pin 50 is turned so as to fit within the offset part 33 of its slot and thus hold the mandrel head 35 away from the cutters. When desired, a lateral turn will move the pin into the slot 32 for longitudinal movement.

In the operation of our device, the tool will be introduced downwardly at the end of the drill stem into the casing to be perforated. The tool may be introduced to the bottom of the hole under ordinary circumstances, or if the point to be perforated is some distance above the end of the hole an extension of pipe may be secured upon the lower collar 7, and when the collar, or the pipe extension thereon, strikes the bottom of the hole, enough pressure may be exerted upon the tool to break the pin 9 on the anchor, allowing the spring 14 to throw the slips up along the tapered surface at 3 and thus expand the slips into gripping contact with the casing. The weight of the tool may then be lowered upon this anchor, which will sustain the weight of the portion below the drill stem. The drill-stem will be lowered sufficiently so that the tapered mandrel will exert its weight upon the cutters and tend to force them radially outward against the casing. In this position the drill-stem and pipe may be dropped abruptly so that the

hammer end 48 may come in contact with the block 40 and exert a blow to drive the mandrel downwardly and force the cutters outwardly against the casing so as to perforate it. Repeated blows upon the mandrel will thus serve to pierce the casing. When the blocks have been forced completely through the pipe the cylindrical portion 36 will come in contact with the blocks and will allow the mandrel to drop somewhat abruptly into the position shown in Fig. 4, and the valve disk 39 will close the opening at the upper end of the cutter head and thus shut off the water circulation downwardly through the tube. This will immediately stop the pumps and indicate to the operator that the pipe has been perforated.

Attention is now called to the lever 26 which serves to withdraw the cutter blocks. When the mandrel is in the position as shown in Fig. 5 the upper end of the lever 26 will be bearing against the lower part of the upper tapered portion 37. As the mandrel is forced downwardly the upper end of the said lever will move inwardly at the same rate as the block moves outwardly and when the cylindrical portion of the mandrel is in contact with the block the upper end of the lever will slide upon a cylindrical lower end of the rod. When the mandrel is withdrawn by raising upwardly on the drill stem and thus bringing the head 45 of the mandrel against the disk 43, the upper end of the lever will be caught by the tapered upper portion 37 of the mandrel, forcing the upper end of said lever outwardly and thus positively moving the cutter block and cutter inwardly, and so withdrawing the cutter. If it is desired to perforate the casing further in the same plane, the cutter head may be rotated without moving the anchor, in an obvious manner, and the pipe may be again perforated at this level.

When it is desired to raise the tool and perforate the pipe at a somewhat higher the drill stem is pulled upwardly until the two rings 51 and 52 contact with each other and the tool may be thus raised upwardly, releasing the slips 4 and allowing the whole device to be elevated to the point to be perforated. The spring 14 will keep the slips in contact with the casing so that when a downward movement of the drill stem is made the slips 4 will immediately grip the casing and support the weight of the tool so that the pipe may be again perforated. The use of a positive anchor of this kind so that heavy blows may be made upon the mandrel to expand the cutters, is of material advantage. There will be no danger of the tool moving downwardly while the cutters are perforating the pipe. The perforations will therefore be exact and there will be no danger of breaking the cutters by resting the weight of the tool thereon.

Further, the tool may be inserted into the casing and, if obstructed, or for other reason it is necessary to withdraw the tool, the withdrawal may be accomplished without perforating the casing. This is a great improvement over the present devices.

While we have shown and described the preferred embodiment of our invention, it is obvious that various changes and modifications may be made in the working parts of this tool without departing from the spirit of our invention. The various objects and advantages to be gained by the construction will be clear to one skilled in the art without further description.

What we claim is new and desire to protect by Letters Patent is:

1. In a pipe perforator, an operating and supporting stem, a head thereon, perforating teeth movable outwardly in said head, means below said head to anchor said head in the pipe, a downwardly tapered expanding mandrel in said head, means to force said mandrel downwardly to extend said teeth outwardly comprising a telescoping pipe in said stem having a hammer head at the lower end and a block on said mandrel against which said hammer head is adapted to contact.

2. In a pipe perforator, a supporting and operating stem, a head, perforating teeth movable outwardly therein, means below said head to anchor said head in the pipe, a downwardly tapered expanding mandrel in said head, means to force said mandrel downwardly to extend said teeth outwardly comprising a telescoping pipe section connected with said stem and having a hammer head at the lower end, a block on said mandrel against which said hammer head is adapted to contact, means on said telescoping pipe to withdraw said mandrel, and means in said head actuated by the withdrawal of said mandrel to withdraw said teeth.

3. In a pipe perforator, a head, perforating teeth movable outwardly therein, means below said head to anchor said head in the pipe, an operating and supporting pipe secured to said head, a telescoping connection therein above said head, an expanding mandrel in said head, means on said operating pipe to hold said mandrel in inoperative position, means including said telescopic connection to force said mandrel downwardly to extend said teeth, and means to indicate when said teeth are fully extended.

4. In a pipe perforator, a head, perforating teeth movable outwardly therein, means to anchor said head in the pipe, an operating pipe secured to said head, a telescoping connection therein above said head, an expanding mandrel in said head, means on said operating pipe to hold said mandrel in inoperative position, means on said operating pipe to force said mandrel downwardly to extend

said teeth, there being a water passage through said pipe and head, and means on said mandrel to close said passage when said teeth are completely extended.

5. In a pipe perforator, a head, perforating teeth movable outwardly therein, an operating pipe on said head, a telescopic connection therein above said head, an expanding mandrel in said head and slidable thereon, means on said operating pipe to hold said mandrel in inoperative position, means on said operating pipe to force said mandrel downwardly to extend said teeth.

6. In a pipe perforator, a head. outwardly adjustable perforating teeth thereon, means to anchor said head firmly at any desired point in the pipe, a tapered mandrel, means to strike and drive said mandrel downwardly and force said teeth outwardly, means to indicate when said teeth are fully extended outwardly, means to withdraw said mandrel, means actuated by the withdrawal of said mandrel to withdraw said teeth and means to rotate said head on said anchor.

7. In a pipe perforator, a head formed to fit inside the pipe, perforating teeth movable outwardly in said head, an anchoring means below said head adapted to support said head at any desired point in said pipe, a mandrel in said head, means unconnected with said mandrel to force said mandrel downwardly and move said teeth outwardly, and means operated by said mandrel to withdraw said teeth when desired.

8. In a pipe perforator, a supporting stem, a head thereon formed to fit inside the pipe, perforating teeth movable outwardly in said head, an anchoring means separate from said stem adapted to support said head at any desired point in the said pipe, an expanding mandrel for said teeth, means to strike a blow on said mandrel to force said mandrel downwardly, means above said cutters operated by the withdrawal of said mandrel to withdraw said teeth and means to indicate when said teeth have been fully expanded.

9. In a pipe perforator, a head, means to support said head in the pipe, extensible teeth in said head, an expanding mandrel above said teeth, means separate from said mandrel to drive said mandrel downwardly and expand said teeth to perforate said pipe and rigid levers pivoted in said head connected with said teeth and adapted to bear against said mandrel and withdraw said teeth when said mandrel is raised.

10. In a pipe perforator, a supporting pipe, a head, teeth movable radially therein, a tapered expanding mandrel adapted to be driven downwardly through said head to extend said teeth a telescopic joint in said pipe whereby a blow may be struck on said mandrel by said pipe, and a substantial anchoring means below said head to support said head when said mandrel is operated.

In testimony whereof, we hereunto affix our signatures this the 8th day of January, A. D. 1923.

HARRY S. CAMERON.
JAMES S. ABERCROMBIE.