Nov. 17, 1953

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2,659,434

INSIDE PIPE CUTTER

Filed Oct. 30, 1947

2 Sheets-Sheet 1

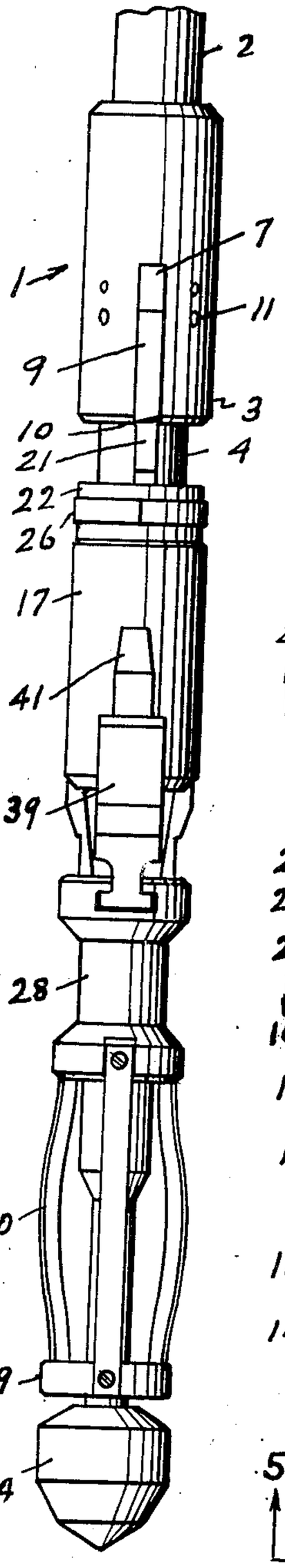

Fig. 1.

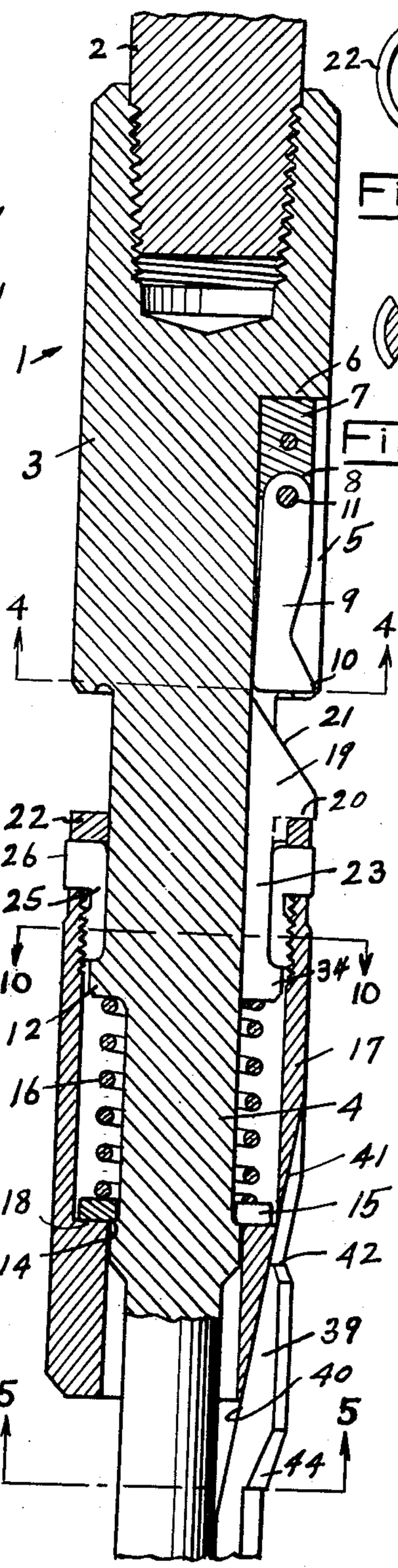

Fig. 2.

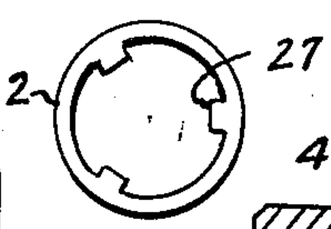

Fig. 9.

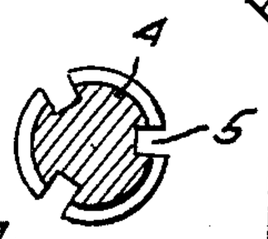

Fig. 10.

Fig. 3.

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2 Sheets-Sheet 2

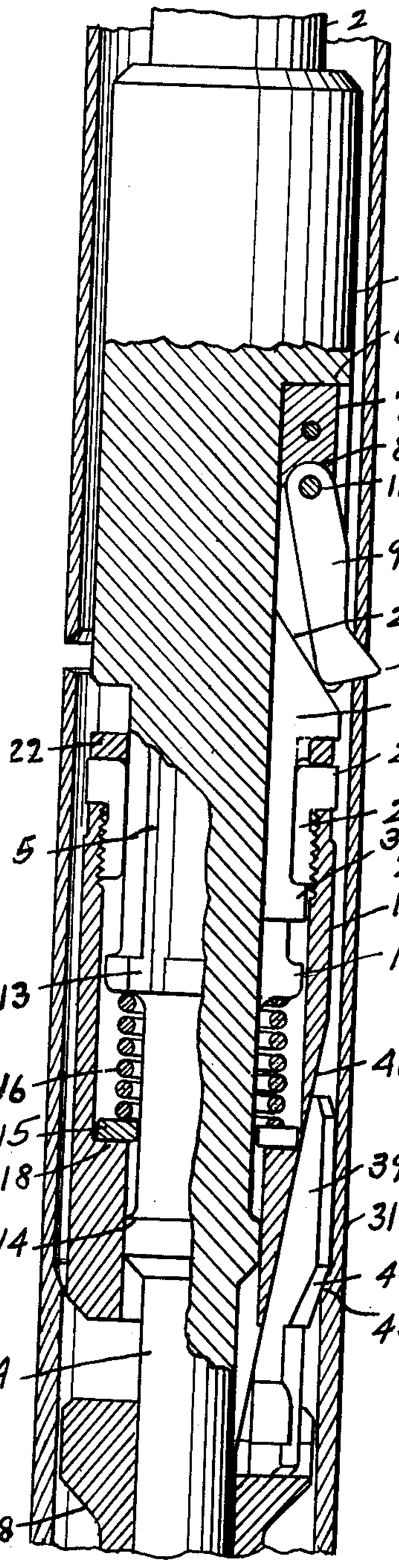

Fig. 7.

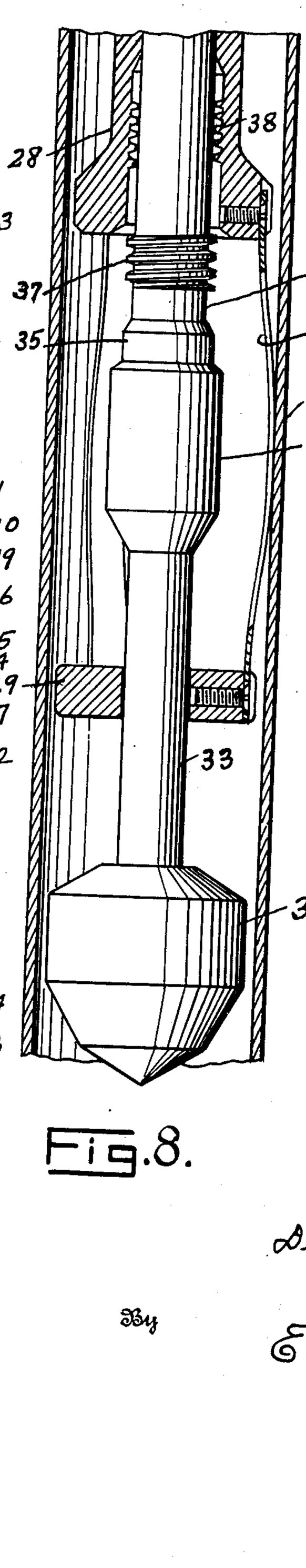

Fig. 8.

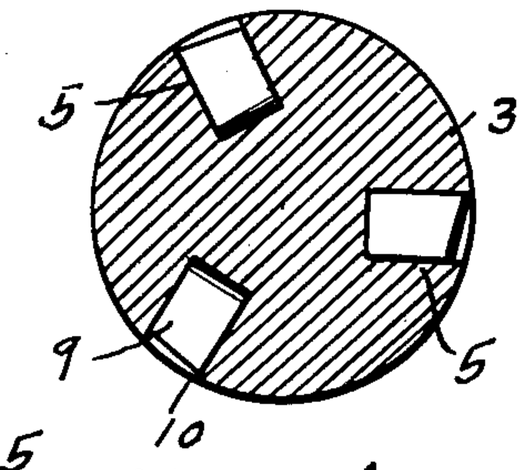

Fig. 4.

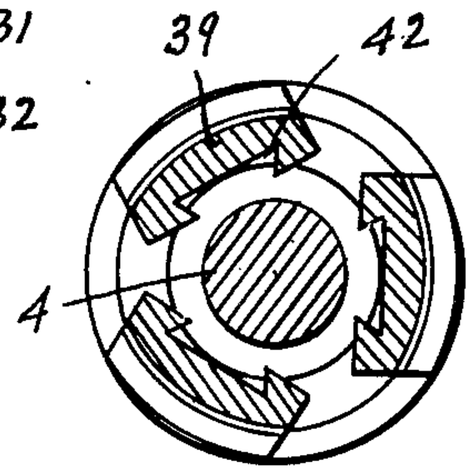

Fig. 5.

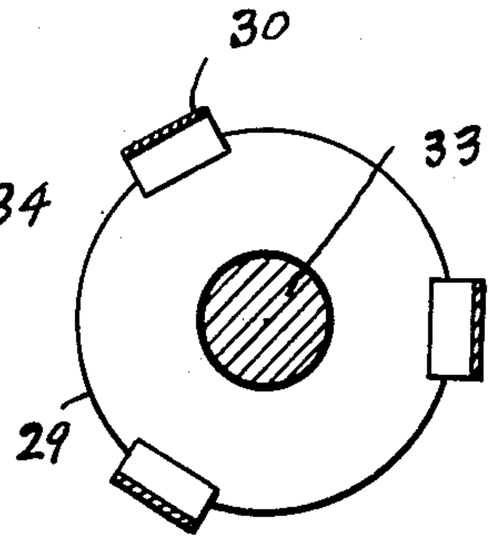

Fig. 6.

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INSIDE PIPE CUTTER

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2 Claims. (Cl. 164—0.7)

1

This invention relates to an inside pipe cutter.

An object of the invention is to provide a tool of the character described adapted to be lowered into a pipe stuck in a well and which, when located at the desired elevation, may be operated to sever the pipe so that the cut off section may be removed from the well.

Another object of the invention is to provide, in a pipe cutter of the character described, novel means for retaining the cutter in inactive position with the bits, or cutters, retracted while going in and which may be released by manipulation of the operating string to allow said cutters, or bits, to be expanded into contact with the pipe to be cut whereby the pipe may be severed by the rotation of the operating string and cutter body.

The tool also embodies a novel type of expander, assembled in a novel manner with the cutter body and which may be readily assembled with said body or readily removed from the body for replacements or repairs.

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 shown in inactive position.

Figure 2 is an enlarged, fragmentary, vertical sectional view of the upper end of the tool shown in inactive position.

Figure 3 is an enlarged, fragmentary, vertical sectional view of the lower end of the tool shown in inactive position.

Figure 4 is a cross-sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a cross-sectional view taken on the line 5—5 of Figure 2.

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 3.

Figure 7 is a side view, partly in section, of the upper end of the tool shown in active position.

Figure 8 is a side view of the lower end of the tool in active position and shown partly in section.

Figure 9 is a plan view of a locking ring employed, and

Figure 10 is a sectional view of the cutter body taken on the line 10—10 of Figure 2.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates the cutter body as a whole whose upper end is attached to an operating

2

string 2. This string extends to the ground surface and may be tubular if desired.

At its upper end the body is of a maximum diameter forming the elongated cylindrical head 3 and beneath said head the body is reduced in diameter forming a stem 4.

The lower end of the head is provided with a plurality of longitudinal side slots 5 forming cutter seats which extend down to the lower end of the head but whose upper ends terminate in radial shoulders 6.

Pinned in the upper ends of the slots 5 and abutting the corresponding shoulder 6 are the bearing blocks 7 whose lower ends are formed with arcuate bearing faces 8.

In the slots 5 are the swinging cutters 9 whose lower ends terminate in outwardly directed cutting bits 10.

The upper ends of the cutters 9 are shaped to fit closely against the bearing faces 8 and are pinned in position by means of the pins 11. Therefore the thrust taken by the cutters will be sustained by the bearing faces 8 rather than by the pins 11 so that said pins will not be liable to be broken.

Spaced beneath the lower end of the head 3 and formed integrally with the stem 4 there is an external annular rib 12. The slots 5 continue on down the stem 4 and through the rib 12 thus forming notches, as 13, through said rib.

Any selected number of slots 5 and cutters 9 may be employed. Preferably there will be three, as indicated in Figure 4.

Beneath the rib 12 the stem 4 is slightly reduced in diameter and is formed with an external, annular, upwardly facing shoulder 14 on which a split ring 15 is located which forms a seat, or supporting base, for a strong coil spring 16 which surrounds said stem and is interposed between the rib 12 and the ring 15.

The numeral 17 designates a tubular housing whose lower end is reduced internally, in diameter forming an internal annular shoulder 18 on which the ring 15 rests when the tool is in its inactive position.

There are the cutter expanders 19 which are seated in the slots 5 beneath the cutters 9. Their upper ends are widened outwardly thus forming the downwardly facing shoulders 20 and above said shoulders the expanders are formed with the upwardly and inwardly tapering faces 21 to engage behind the cutters to expand them. These shoulders 20 rest on the locking ring 22 which surrounds the stem 4.

The expanders have the downwardly extended

shanks 23 whose lower ends are outwardly widened forming the shoulders 24 which register with the rib 12 when the parts are assembled.

Surrounding the shanks 23 there is a split bushing 25 which is formed in two similar halves fitted together and whose lower ends are outwardly threaded. The upper end of the split bushing is formed with an outwardly widened flange 26 which fits between the locking ring 22 and the upper end of the housing 17, as shown in Figure 2.

In assembling this expander assembly the expanders 19 are fitted into the corresponding slots 5 and the locking ring 22 is then passed upwardly over the stem 4 and positioned so that the inwardly extended projections 27 of the ring 22 will pass through the notches 13 and said ring may then be turned so that the projections 27 will be out of alignment with the slots 5. The shanks of the expanders 19 may then be fitted down through the ring 22 and located in the slots 5 and the split bushing 25 may then be assembled resting on the shoulders 24. The upper end of the housing 17 may then be screwed onto the lower end of the split bushing 25 up against the flange 26 thereof so as to secure said parts in assembled relation with the spring 16 assembled within the housing, as hereinabove explained.

Mounted on the stem 4 and spaced beneath the housing 17 there is a spool shaped anchor 28 and spaced beneath the anchor 28 there is an anchor ring 29.

Outwardly bowed springs 30 are secured at their upper ends to the anchor 28 and at their lower ends to the anchor ring 29. These bow springs frictionally engage the stuck pipe 31 as the tool is lowered therein, as shown in Figure 8.

The lower end of the stem 4 is reduced in diameter and externally threaded and screwed into the enlarged upper end 32 of the guide rod 33. This guide rod is slidable through the anchor ring 29 and secured on its lower end there is a guide 34 which is of a diameter to fit, rather closely, within the pipe 31.

Screwed onto the reduced lower end of the stem 4 there is a bushing 35 whose upper end is in abutting relation with an external shoulder 36 formed by the reduction of the lower end of the stem 4, and whose lower end is in abutting relation with the enlarged upper end 32 of the rod 33 when the tool is assembled and in inactive position.

This bushing 35 is formed with coarse external threads 37 which are threaded into corresponding internal threads 38 in the lower end of the anchor 28 so as to hold the stem 4 in its upper position relative to the anchor 28 when the tool is in inactive position.

Loosely connected to the upper end of the anchor 28 and upstanding therefrom there are the pipe engaging, wedge shaped slips 39, three of said slips being shown in the present illustration. Their outer sides are curved to conform to the contour of and to fit against the pipe 31 and their inner sides are formed with the upwardly and outwardly tapering faces 40.

The lower end of the housing 17 has the external upwardly flared faces 41 against which the inner faces 40 slide, as is indicated in Figure 2, and the slips 39 have sliding dovetailed connections, as 42, with the expander faces of the housing 17.

The tool may be assembled as illustrated in Figures 1, 2 and 3, and as so assembled may be lowered into the well bore and into the pipe 31 to be severed. While being lowered the friction springs 30 will ride in frictional contact with the pipe 31 but the cutter expanders 19 will be maintained in their lower, inactive position.

As will be observed from an inspection of Figure 7, the joints of the pipe 31 are internally upset thus forming an inside downwardly tapering shoulder 43.

When a point has been reached at which it is desired to make a cut the operating string 2 together with the stem 4 may be turned to the right and the bushing 35 will be unscrewed from the anchor 28, said anchor being held against turning by the springs 30 and thereupon the operating string and stem may be lowered. As the string and stem are lowered the slips 39 will be forced downwardly in the pipe 31 until the external downwardly and inwardly tapering faces 44 of said slips land on the shoulder 43 at the coupling whereupon the downward movement of said slips will be stopped but the housing 17 will move on downwardly until its downwardly tapering faces 41 expand the slips 39 into secure engagement with the pipe 31. This will stop the downward movement of the housing 17 and, upon further downward movement of the head 3 and stem 4, the cutter expanders 19 and the expander faces 21 will act against the lower ends of the cutters 9 to force said cutters gradually outwardly.

Meanwhile the tool is being rotated and as the cutters are forced outwardly they will gradually sever the pipe 31, as shown in Figure 7.

During the operation above described the bits 10 will be held out of contact with the pipe 31 until the slips 39 have been securely engaged with the pipe 31 by downward movement of the stem 4 in the housing against the pressure of the spring 16 so that said bits will not be brought into cutting engagement with the pipe until the housing has first been securely anchored against downward movement in the pipe.

Upon completion of the cut the operating string may be pulled upwardly thus releasing the cutters 9 from the cutter expanders 19 and the expansion of the spring 16 will move the housing 17 upwardly permitting contraction of the slips 39 and the tool may then be withdrawn through the cutoff section of pipe above and said severed section may then be removed from the well.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. In an inside pipe cutter having a head, a reduced stem depending from the head and outwardly movable cutters pivoted on the head, a cutter expanding assembly on the stem comprising, a housing around the stem, longitudinally extending cutter expanders slidably mounted on said stem, said expanders having reduced shanks and outwardly thickened portions forming downwardly facing shoulders, a ring around said shanks whose upper face is engageable with said shoulders, a cylindrical bushing comprising a plurality of arcuate parts around the shanks and onto which the upper end of the housing is threaded, the upper end of said bushing being engageable with the lower face of said ring to clamp the ring between the bushing and said shoulders, an anchor beneath the housing having a threadable connection with the stem, means on the anchor engageable with the pipe to hold the anchor against rotation upon rota-

tion of the stem whereby the stem may be unscrewed from the anchor and moved downwardly relative to the anchor, means engageable with the pipe, upon such downward movement and supporting said housing against downward movement in the pipe, and resilient means carried by the housing and engageable with the stem to yieldingly resist downward movement of the stem in the housing, said expanders being engageable with the cutters to move the cutters outwardly of the stem upon downward movement of the stem in the housing to expand the cutters into cutting engagement with the pipe.

2. In an inside pipe cutter having a head, a reduced stem depending from the head and outwardly movable cutters pivoted on the head, a cutter expanding assembly on the stem comprising, a housing around the stem, longitudinally extending cutter expanders slidably mounted on said stem, said expanders having reduced shanks, a ring around the shanks, a cylindrical bushing comprising a plurality of arcuate parts around the shanks and onto which the upper end of the housing is threaded, an anchor beneath the housing having a threadable connection with the stem, means on the anchor engageable with

the pipe to hold the anchor against rotation upon rotation of the stem whereby the stem may be unscrewed from the anchor and moved downwardly relative to the anchor, means engageable with the pipe upon such downward movement and supporting said housing against downward movement in the pipe, and resilient means carried by the housing and engageable with the stem to yieldably resist downward movement of the stem in the housing, said expanders being engageable with the cutters to move the cutters outwardly of the stem upon downward movement of the stem in the housing to expand the cutters into cutting engagement with the pipe.

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