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G. P. ELLIS
PIPE CUTTER

2,534,858

Filed June 8, 1946

2 Sheets-Sheet 1

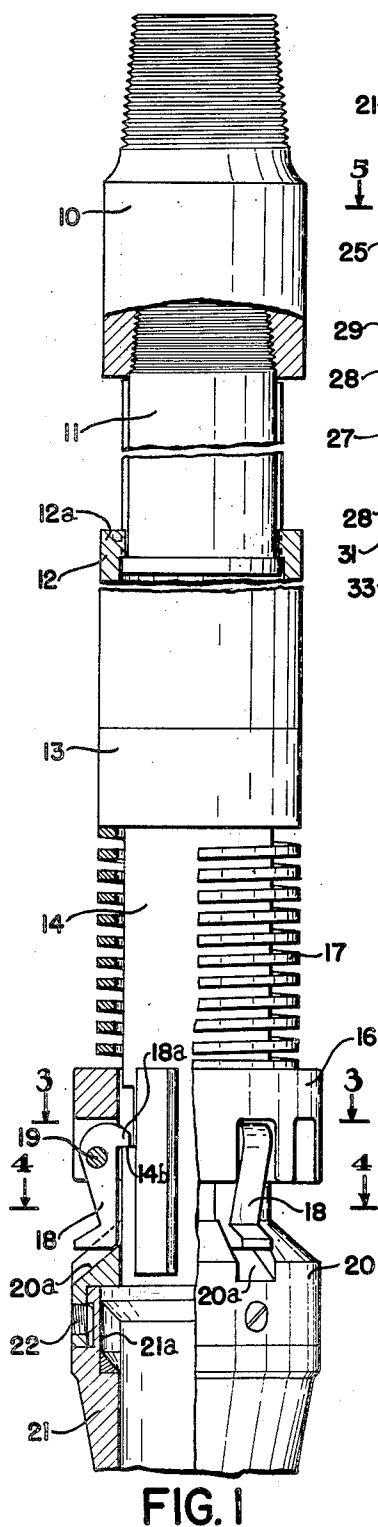


FIG. 1

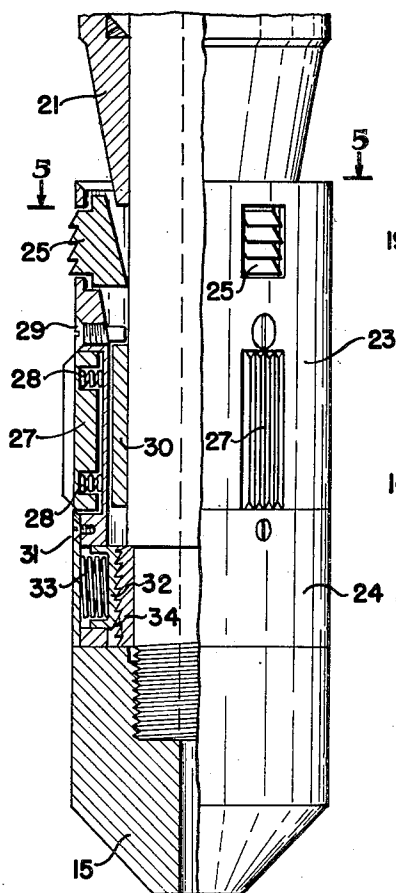


FIG. 2

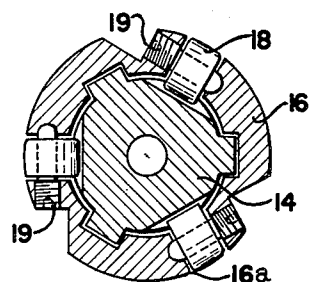


FIG. 3

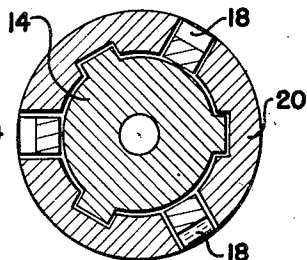


FIG. 4

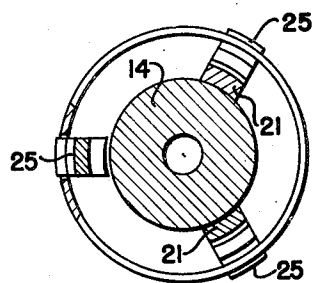


FIG. 5

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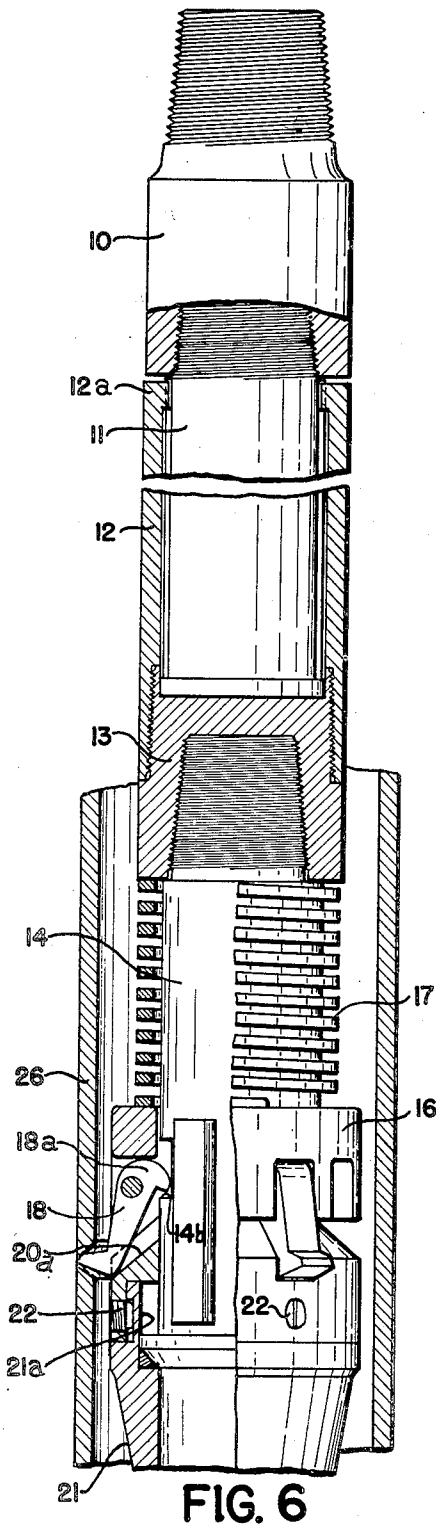
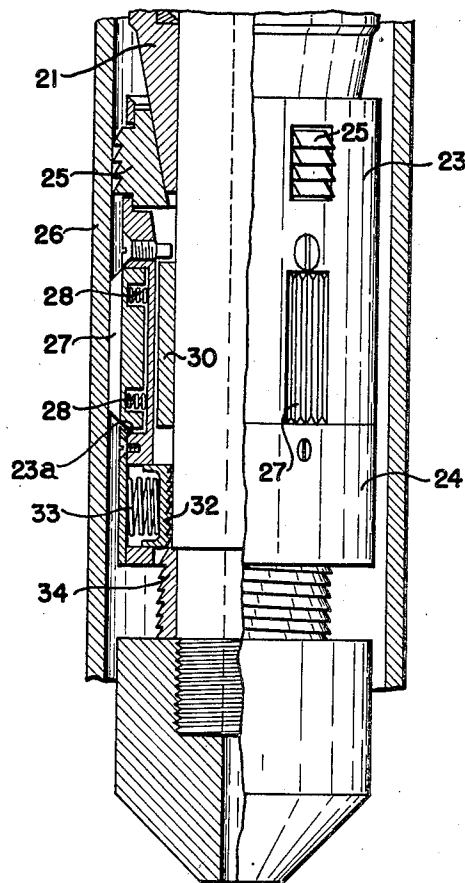
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PIPE CUTTER

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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PIPE CUTTER

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12 Claims. (Cl. 164—0.7)

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This invention relates to improvements in pipe cutting devices and refers more particularly to devices adapted to be lowered into a pipe within a well bore or the like for the purpose of severing the pipe in order that a portion of the pipe might be removed from the well.

This invention is an improvement upon the cutter shown in Patent 2,262,986 issued June 4, 1940. In the patented device the cutters or knives are resiliently urged to an advanced position or retracted position. However, two springs are required to accomplish this and one of these springs interferes with the free functioning of the telescope joint. Also in the patented device the periphery of the mandrel adjacent the cutters is countersunk to provide means for actuating the cutters. In addition the mandrel at this point is further weakened by openings to receive pins to prevent relative rotation between the carrier cutter and mandrel.

It is an object of this invention to provide a pipe cutting device wherein a single resilient member resiliently urges the cutters or knives into advanced or retracted positions dependent upon the position of the mandrel relative to the anchoring assembly.

Another object is to provide a pipe cutting device having a single resilient member for advancing and retracting the cutters wherein the cutters are positively held in a retracted position while the device is lowered into and withdrawn from a well.

A further object is to provide a pipe cutting device having a single resilient member for advancing and retracting the cutters wherein in operation the knives are positively retracted to inoperative position prior to a release of the anchoring assembly.

Other and further objects will appear from the following description:

In the accompanying drawings which form a part of the instant specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views,

Figs. 1 and 2 are side elevations partially in section illustrating a tool embodying this invention, the device being shown in condition to be lowered into a well bore;

Fig. 3 is a view taken along the line 3—3 in Fig. 1 in the direction of the arrows;

Fig. 4 is a view taken along the line 4—4 in Fig. 1 in the direction of the arrows;

Fig. 5 is a view taken along the line 5—5 in Fig. 2 in the direction of the arrows; and

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Figs. 6 and 7 are elevational views of the device shown in Fig. 1 illustrating the device in an operative position within a well casing.

In general, the device comprises an elongated mandrel adapted to be lowered into a pipe or casing within a well bore and having a telescope joint at its upper end. A flow passage is provided centrally through the tool. The mandrel is attached at its upper end to the telescope joint and extends downwardly through the remainder of the device. A cutter assembly is mounted on the upper portion of the mandrel and an anchoring device is mounted adjacent the lower end of the assembly. The latter is adapted to selectively anchor the device at a predetermined level in the pipe to be cut.

Referring to the drawings, the telescope member comprises a coupling member 10 adapted to be threaded to the lower end of a tubing, not shown in the drawing, at its upper end and to receive in its lower end the splined member 11. The lower end of the splined member is mounted for axial movement within the sleeve 12. The sleeve 12 has a splined inturned flange 12a at its upper end. The splines of flange 12a register with those of member 11 to prevent relative rotation of the two parts. A coupling member 13 connects sleeve 12 to the upper end of mandrel 14.

The mandrel extends downwardly through the remainder of the device and at its foot or lower end carries a shoe 15. On the upper portion of the mandrel is slidably mounted a cutter carrier 16. Spring 17 surrounds the upper portion of mandrel 14 and is compressed between the lower end of coupling member 13 and the upper end of carrier 16. The spring serves to urge the carrier downwardly at all times during the operation of the device. This resilient member functions to resiliently urge the cutters 18 to both an advanced and retracted position as will be hereinafter more fully explained.

Cutters 18 are pivoted on pins 19 to the carrier. The carrier has slots 16a to receive the cutters as is best shown in Fig. 3. The carrier has a splined connection with the mandrel providing a slidable drive connection between the two. This splined connection between the cutter carrier and mandrel strengthens the mandrel at this critical point.

Cutters 18 have inturned lugs 18a. These lugs are urged by spring 17 against shoulders 14b on the mandrel. Thus, with the mandrel in the position shown in Figs. 1 and 2 the cutters are positively held in a retracted position protecting them against breakage in lowering or raising the

device. To advance or expand the cutters into cutting position a cam element 20 having a splined connection with the mandrel is provided with cam surfaces 20a. The cam surfaces engage the lower end of cutters 18 when the mandrel is in its lowermost position relative to the carrier and cam element as illustrated in Fig. 6. Spring 17 urges cutter carrier 16 downwardly and cam surfaces 20a serve to advance the cutters 18 to cutting position. The cam element 20 has a swivel connection with the upper end of wedge 21 forming a part of the anchoring assembly. This connection permits relative rotation of the two parts and is accomplished by means of dowel pins 22 threaded to element 20 operating in a countersunk portion on the outer periphery of wedge 21 adjacent the upper end.

The anchoring assembly comprises an anchoring casing 23 and a ratchet casing 24. Casing 23 houses slips 25 adapted to be expanded by wedge 21 as best shown in Fig. 7. In expanded position slips 25 extend through openings in casing 23 and engage the casing or pipe 26 which is to be severed. In this position the anchoring assembly is secured against either rotative or longitudinal movement within pipe 26.

In the lower portion of the casing 23 are circumferentially spaced friction blocks 27. These blocks are positioned in recesses in casing 23 and are urged radially outwardly by springs 28 into frictional contact with pipe 26. Blocks 27 are held in the recesses in casing 23 by the tapered edges of dowel pins 29 and the tapered upper edge of casing 24. Collar 30 serves as a bearing permitting relative rotation between the anchoring assembly and mandrel 14.

Ratchet casing 24 is secured by screws 31 to casing 23 encasing the lower portion thereof and houses a ratchet assembly. The ratchet assembly provides a releasable connection between guide shoe 15 and the anchoring assembly. The ratchet assembly includes dogs 32 positioned in slots in casing 23 and pressed radially inwardly by springs 33 into engagement with a serrated collar 34. Collar 34 surrounds the mandrel adjacent guide shoe 15. The arrangement is such that rotation of the mandrel to the right will release dogs 32 from their threaded engagement with collar 34, as friction blocks 27 resist rotation of the anchoring assembly. When released, the mandrel is permitted to move downwardly relative to the anchoring assembly whereby wedge 21 expands slips 25 to secure the device within the pipe 26. Upward axial movement of the mandrel obviously will cause dogs 32 to engage collar 34 and raise wedge 21 releasing slips 25. When the anchor is positioned with dogs 32 released a limited axial movement of the mandrel relative to the anchoring assembly is provided by the counterbored portion 21a in the upper end of wedge 21. This limited axial movement of the mandrel permits a lowering of shoulder 14b of the mandrel out of engagement with cutter lugs 18a whereby the cutters are resiliently urged against cam surfaces 20a and advanced to cutting position.

In operation the tool in the assembled form as shown in Figs. 1 and 2 is lowered by means of a string of tubing, not shown in the drawings, into pipe 26 within a well bore. When the tool has been lowered to the desired level within pipe 26 the instrument is rotated to the right. During this rotation friction blocks 27 frictionally engage pipe 26 to retard rotation of the anchoring assembly. Thus, rotation affects an un-

screwing of dogs 32 relative to collar 34. When the ratchet has thus been released, mandrel 14 is moved downwardly. During this downward movement friction elements 27 also retard downward movement of the anchoring assembly and wedge 21 engages slips 25 to anchor the device. With the device anchored, mandrel 14 may be lowered axially relative to the anchoring assembly within the counterbore 21a of the wedge. This limited axial movement is sufficient to lower shoulder 14b on the mandrel to a position permitting full expansion or advancement of cutters 18.

When shoulders 14b are in a lowered position, spring 17 urges cutter carrier 16 and cutters 18 downwardly. Cam surfaces 20a on cam element 20 serve to expand or advance cutters 18 into cutting relation with pipe 26. The spring provides a resilient feed of the cutters as the mandrel is rotated whereby there is little likelihood of the cutters hogging the cut. In making the cut as the cutters are fed outwardly they also move downwardly somewhat making a large cut in the pipe so that there is little likelihood of the cutters being jammed in the pipe cut.

However, even though the cutters do become jammed in the cut the arrangement is such that they are positively retracted to inactive position before the anchoring assembly is released. When the cut is complete the mandrel 14 is raised axially, shoulders 14b engaging lugs 18a on the cutters force the cutters and carrier upwardly against resilient member 17. When the annular mandrel shoulder operating in the counterbore position 21a of wedge member 21 abuts the lower portion of cam element 20 the cutters are in a retracted position. Continued upward movement of mandrel 14 withdraws wedge 21 to release slips 25. Continued upward movement of the mandrel relative to the anchoring assembly causes ratchet dogs 32 to engage serrated collar 34. The device may then be withdrawn from the well bore or may be shifted to another level within the well bore to make another cut.

The telescope joint is free to operate to impart a jar both to seat and unseat wedge 21 relative to slips 25 when required whereas in the prior patented tool the spring, within the telescope joint, relied upon to resiliently feed the cutters interfered with this operation.

It will be seen that the objects of this invention have been accomplished. There has been provided a tool for cutting pipe within a well bore in which a single resilient member serves to resiliently feed the cutters into cutting position and resiliently hold the cutters in their inactive position. The arrangement of the telescope joint is such that a predetermined weight may be applied to the device and the joint provides a jarring element when this is required in operation. The construction is such that the cutters, in advancing to the retracted position are urged outwardly and somewhat downwardly to make a large cut reducing the likelihood of the cutters becoming jammed in the cut. In addition, the construction provides for positive but resilient means for retracting the cutters to an inactive position prior to the release of the anchoring assembly. This resilient means also maintains the cutters in retracted position while the tool is lowered into or withdrawn from the well bore. The splined connection and arrangement of the cutter carrier relative to the mandrel provides a heavier construction of the mandrel at this critical driving point.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having described my invention, I claim:

1. In a pipe cutting device a mandrel, a carrier splined to the mandrel providing for relative axial movement therebetween, a cutter pivoted to the carrier, a lug on said cutter, a spring connected between the mandrel and carrier urging the carrier and cutter downwardly, a shoulder on the mandrel engageable by the lug on upward movement of the mandrel to retract the cutter and means cooperable with the spring for advancing the cutter to cutting position with the cutter lug and mandrel shoulder out of engagement whereby the cutter is resiliently urged to both cutting and retracting positions by a single spring.

2. In a pipe cutting device a mandrel, an anchoring assembly carried by the mandrel, a swivel connection between the assembly and mandrel with the assembly in active position, said swivel providing for relative rotation and limited axial movement between the assembly and mandrel, a carrier slidable on the mandrel with a cutter pivoted thereto, a spring associated with the mandrel and urging the carrier downwardly upon the mandrel, a cam element secured to the anchoring assembly engageable by the cutter to advance the cutter to operative position with the mandrel in a lowered position relative to the assembly and means including said spring for retracting the cutter on upward movement of the mandrel.

3. A pipe cutting device comprising a mandrel, a cutter carrier slidably mounted upon the mandrel with a spring resiliently positioning the carrier thereon, and a cutter movably mounted upon the carrier and adapted to move into and out of cutting position dependent upon the relative position of the carrier axially of the mandrel, and means for resiliently urging and maintaining the cutter in an outward position after the mandrel and carrier have moved into a position initially expanding said cutter.

4. A pipe cutting device comprising a mandrel, a cutter carrier slidably mounted upon the mandrel with a spring resiliently positioning the carrier thereon, and a cutter movably mounted upon the carrier, an anchoring means mounted for limited sliding movement upon the mandrel and adapted to be anchored at a selected level within a pipe, and a part carried by the anchoring means and engageable by the cutter upon relative axial movement in one direction between the mandrel and anchoring means to advance the cutter to cutting position, and resilient means for urging the cutter into contact with said part on the anchoring means for resiliently maintaining the cutter in expanded position after the anchoring means has been anchored within the casing.

5. A pipe cutting device including, a mandrel, a cutter carrier slidably mounted upon the mandrel, a cutter movably mounted upon the carrier, resilient means surrounding the mandrel and engaging the carrier for constantly urging said

carrier in one direction axially of the mandrel, means on the mandrel for limiting the movement of the carrier and cutter in the direction in which the cutter is urged by the resilient means, and anchoring assembly below the cutter detachably secured to and movable with the mandrel and having means for anchoring said assembly within a well bore, whereby the assembly may be detached from the mandrel and the mandrel may be moved axially thereof, and means on the anchoring assembly co-acting with the cutter when the mandrel and cutter mounted thereon are moved relative to the assembly to effect an expansion of the cutter.

6. A pipe cutting device as set forth in claim 5, wherein the axial movement of the mandrel relative to the anchoring assembly results in axial movement of the mandrel relative to the cutter carrier after the cutter engages the co-acting means on the assembly, whereby the limiting means on the mandrel is moved away from the carrier and cutter and the subsequent pressure applied to the carrier and cutter is the pressure of the resilient means.

7. A pipe cutting device as set forth in claim 5, wherein the limiting means is a shoulder on the mandrel engageable by an inwardly directed portion of the cutter and also wherein the cutter is in a retracted position when the shoulder is engaged by the inwardly directed portion.

8. A pipe cutting device including, a mandrel, a cutter carrier slidably mounted upon the mandrel, a cutter movably mounted upon the carrier, a spring surrounding the mandrel and urging the cutter carrier downwardly on the mandrel, means on the mandrel for limiting downward movement of the carrier relative to the mandrel, and an anchoring assembly detachably secured to the mandrel having means for anchoring the same within a well bore, with said assembly being independent of and unattached to the cutter carrier, and means on the anchoring assembly engageable by the cutter for co-acting therewith to expand said cutter when the cutter carrier is moved relative to the anchoring assembly upon anchoring of the latter within a well bore.

9. A pipe cutting device as set forth in claim 5, together with means on the mandrel and anchoring assembly for limiting the axial movement of the mandrel relative to the assembly, whereby the weight of the mandrel may be transferred to the assembly after the latter is locked in position.

10. A pipe cutting device as set forth in claim 8, together with means on the mandrel and anchoring assembly for limiting the axial movement of the mandrel relative to the assembly, whereby the weight of the mandrel may be transferred to the assembly after the latter is locked in position.

11. A pipe cutting device including, an axial support, an anchoring assembly detachably secured to the support and having means for anchoring the same within a well casing, whereby the support may be moved downwardly relative to the assembly, means for limiting downward movement of the support relative to the assembly so that the weight of the support may be imposed upon the assembly when the latter is in an anchored position, a cutter carrier slidable axially on the support, a cutter movably mounted on the carrier, resilient means for urging the carrier downwardly on the support toward the anchoring assembly, means on the support for

maintaining the cutter in a retracted position when the support is connected with the anchoring assembly, said last named means being rendered inactive to hold the cutter retracted when the support is moved downwardly relative to the anchoring assembly, whereby the resilient means may move the cutter into engagement with the upper end of the assembly, and cam means on the anchoring assembly adapted to co-act with the cutter to expand said cutter into cutting position.

12. A pipe cutter as set forth in claim 11, wherein the means for maintaining the cutter retracted comprises an enlargement on the support and an inwardly directed projection on the cutter.

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The following references are of record in the file of this patent:

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