June 4, 1940. J. T. ELLIS 2,202,985

PIPE CUTTER

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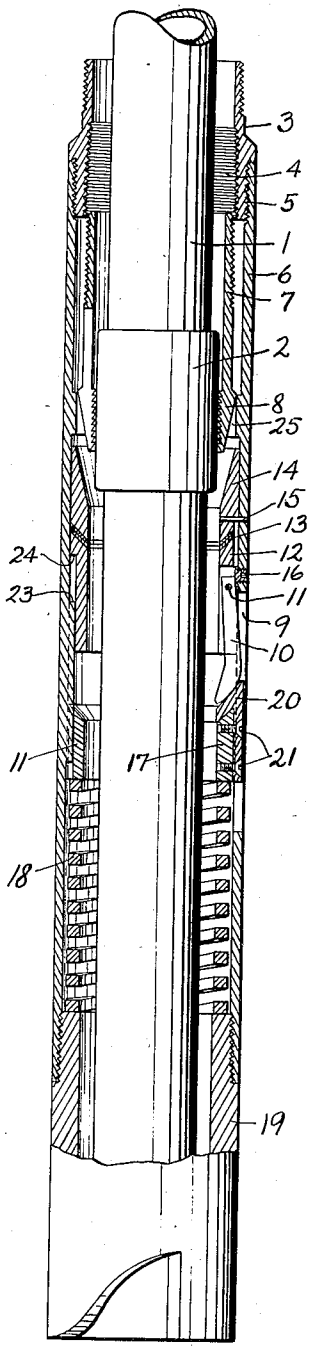


Fig. 1.

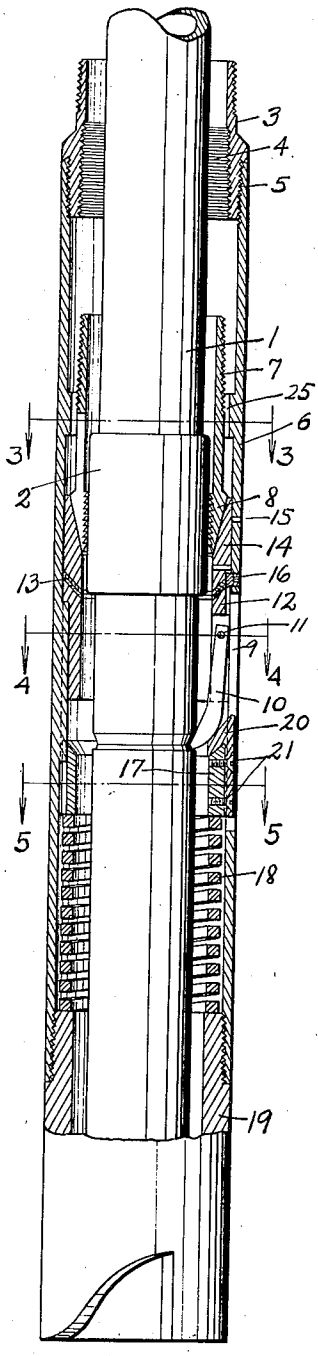


Fig. 2.

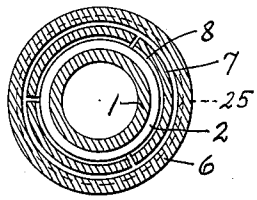


Fig. 3.

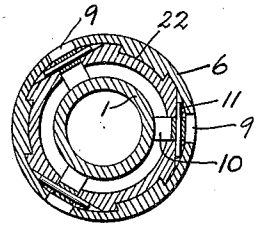


Fig. 4.

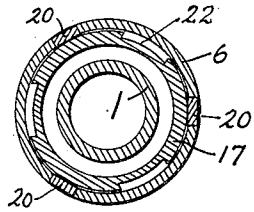


Fig. 5.

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PIPE CUTTER

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10 Claims. (Cl. 164—0.6)

This invention relates to pipe cutters, and has for its general object the provision of an improved device adapted to be lowered into a well or similar opening for cutting off a section of pipe therein and removing it therefrom.

Numerous cutting devices have been devised in the past for the purpose of cutting pipe located in a well or the like, but in the previous structures the cutting knives have been urged against their work either by some positive feed produced by lowering, raising or rotating the string of pipe on which the cutting device is carried, or by a spring feed similarly produced. In either event, however, there has been no means of positively limiting the amount of tension which can be exerted against the cutting knives during the cutting operation and of maintaining this tension substantially constant at a predetermined value during the cutting.

It is therefore a more specific object of this invention to provide a cutting device of the type set forth in which an upward pull on the pipe carrying the cutting device will exert a tension on the pipe to be cut in whatever amount may be desired and will simultaneously urge the cutting knives toward cutting position with a constant predetermined tension, which will not be increased by the exertion of a greater pull upon the pipe to be cut.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawing, wherein is set forth by way of example and illustration one embodiment of this invention. It is to be understood that this drawing and description is not to be taken by way of limitation and that the scope of this invention is to be limited only by the prior art and by the terms of the appended claims.

In the drawing:

Fig. 1 is a vertical cross section through a cutter device constructed in accordance with this invention, showing in elevation a pipe about to be cut, the parts being illustrated in the position which they occupy before the cutting operation begins.

Fig. 2 is a view similar to Fig. 1 but showing the parts in cutting position.

Fig. 3 is a horizontal cross section taken along the line 3—3 of Fig. 2.

Fig. 4 is a horizontal cross section taken along the line 4—4 of Fig. 2.

Fig. 5 is a horizontal cross section taken along the line 5—5 of Fig. 2.

Referring now more in detail to the drawing, the numeral 1 designates a section of pipe which is to be cut. It will be understood that in the usual conditions under which this invention will be employed, the pipe 1 will have become stuck in a hole so that it can not be withdrawn by ordinary pulling operations, and the present invention is utilized for the purpose of cutting it off and withdrawing a section at a time. The pipe 1 which is to be cut may or may not have couplings or tool joints such as indicated by the numeral 2.

Referring now more specifically to the cutting device, the numeral 3 indicates a fitting which will be carried on the lower end of a string of pipe by which the cutting device is lowered into the hole and operated. This fitting is internally threaded at its lower end as shown at 4 and is externally threaded at 5 to receive the sleeve member 6 which constitutes the body of the cutter.

Within the sleeve 6 there is positioned an annular member 7 having depending integrally formed slips 8 which are adapted as hereinafter described to grip the pipe to be cut, both during the cutting operation and during the removal of the pipe from the well. The annular member 7 which may be referred to as a slip ring is externally threaded to engage the internal threads 4 in the fitting 3.

Below the slips 8 the body 6 is provided with laterally opening slots 9 of a size adapted to receive cutting knives 10. These cutting knives 10 are pivotally mounted at 11 in suitable slots in the lower end of a cutter carrier ring 12. The upper end of the carrier ring 12 is provided with a suitable bearing surface 13 adapted to receive a similar bearing surface on a wedge ring 14. This wedge ring 14 is initially held in the position shown in Fig. 1 by means of a shear pin 15 so that it can move neither upwardly nor downwardly with respect to the body 6. During the time that the device is being lowered into a well, the knives 10 are held in their retracted position by means of binder screws 16 which bear against the shanks of the cutter blades 10 in such a manner as to hold the blades themselves outwardly in inactive position.

Positioned below the lower ends of the blades and slidably mounted within the body 6 is a collar or sleeve 17 supported on the upper end of a spring 18. The lower end of this spring 18 bears on a shoulder at the upper end of a guide shoe 19 which is carried by the body 6. The ring 17 is tapered at its upper edge and to this ring there are secured in each of the slots 9 a bearing mem-

ber 20 which extends up along the outside of the ring within each of the slots and has a bearing part hooked up over the edge of the ring and adapted to receive the lower ends of the respective knives. It will be seen that these bearing members 20 provide inclined surfaces for contact with the respective knives, which surfaces extend from the outer wall of the body 6 to the inner wall of the ring 17. These elements 20 are secured to the ring 17 by any suitable means such as the screws 21.

The ring 17 and the cutter carrier 12 are both permitted to slide vertically within the body 6 but are prevented from rotating within the body 6 by means of splines 22 formed in the body 6. The relative sliding movement of the cutter carrier 12 and the body 6 is limited by means of the cooperating shoulders 23 and 24 on the body and the cutter carrier respectively, so that the cutter carrier may not move toward the spring 18 by more than a predetermined amount.

It will be understood also that the wedge ring 14 is both rotatably and slidable within the body 6 once the shear pin 15 has been severed. Above this wedge ring 14 the body 6 is provided with an abutment 25 for a purpose which will presently be described.

In operation, the device is lowered into the well with the parts in the position shown in Fig. 1. When in this position, as previously explained, the binding screws 16 hold the knives in inoperative position. When in this position they are held against the bearing elements 20 so that the carrier ring 12 is prevented from moving downwardly within the body 6. When the depth is reached at which the cut is to be made, the device is pulled upwardly a short distance. In those instances where the pipe to be cut has couplings or tool joints, the device will be pulled upwardly until the slips 8 engage such coupling or tool joint. Otherwise, the slips will be so formed as to engage the pipe itself. An upward pull is then exerted upon the device causing the wedge ring 14 to engage the slips 8 and anchor them firmly against the pipe and a further upward pull will serve to shear the pins 15 and move the body 6 upwardly with respect to both the wedge ring 14 and the cutter carrier 12. This upward movement of the device with respect to the cutter carrier will cause the compression of the spring 18 until the binding screws 16 move above the upper ends of the knives, whereupon the knives will be moved inwardly by the bearing elements 20. Further upward pull on the body 6 will compress the spring 18 and move the body 6 upwardly with respect to the rings 12 and 14 until the shoulders 23 and 24 come in contact with each other. At this point, any additional upward pull on the device will be transmitted through the shoulders 23 and 24 and through the rings 12 and 14 directly to the slips and to the pipe to be cut, and no amount of additional pull will cause any additional compression of the spring 18 nor will it cause any additional force to be exerted upon the knives 10 tending to move them to cutting position. The parts are now in the position shown in Fig. 2.

The tool may now be rotated and as it is rotated the tension on the spring 18 will urge the knives against their work and cause them to cut the pipe. As heretofore stated, any additional tension placed upon the device will be transmitted directly to the pipe to be cut and will not increase the tension on the knives. A tension on the device is ordinarily maintained during the cutting operation which will be sufficient to hold the device steady and cause it to perform its work efficiently.

When the cut is complete, the severed portion of pipe may be removed from the hole by simply removing the cutter, this severed portion being held by the slips 8. During the cutting operation a tension may be taken on the pipe to be cut which is greater than the weight of the section that will be severed so that when the cut is completed there will be substantially no force exerted on the knives by the piece of pipe severed. Instead, as soon as the cut is completed this will be indicated to the operator by relief of the tension which he has been maintaining on the stuck pipe during this cutting operation.

In the event that it should be impossible to complete the cut for any reason, the cutting device here described may be released and withdrawn by first lowering the body 6 until the threads on the slip assembly 7 engage the threads 4 in the fitting 3. Right hand rotation of the operating string will then cause engagement of these threads and move the slips upwardly with respect to the body 6. As the slips move upwardly, the upper end of the wedge ring 14 will engage the abutment 25 and release this wedge ring from the slips. With the slips thus held up and out of engagement with the wedge ring 14 the device may be withdrawn from the hole.

It will be seen from the foregoing that a device has been provided which is capable of being lowered into a hole and engaging a pipe and cutting the same. It will be seen that during the cutting operation as much tension as desired may be placed upon the pipe to be cut without placing any more tension than is necessary upon the knives which do the cutting. On the contrary, the knives which do the cutting will be urged toward their cutting position by a predetermined and substantially constant force and this force will be unaffected by the amount of tension exerted upon the pipe to be cut. It will also be seen that this device may be readily released and withdrawn in the event a completion of the cut is for any reason impossible. A device has therefore been provided which is capable of carrying out all of the objects and advantages sought by this invention.

Having described my invention, I claim:

1. In an outside pipe cutter, a body, a cutter carrier slidably and non-rotatably carried by said body, cutter knives on said cutter carrier, which are inwardly movable, means for anchoring said carrier against longtitudinal movement with respect to a pipe to be cut, and resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier.

2. In an outside pipe cutter, a body, a cutter carrier slidably and non-rotatably carried by said body, cutter knives on said cutter carrier which are inwardly movable, means for anchoring said carrier against longitudinal movement with respect to a pipe to be cut, resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier, and means on said carrier and body for limiting such longitudinal movement.

3. In an outside pipe cutter, a body, a cutter carrier slidably and non-rotatably carried by said body, cutter knives on said carrier which are inwardly movable, means for anchoring said car-

rier against longitudinal movement with respect to a pipe to be cut, resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier, means for limiting such longitudinal movement, and means for transmitting force from said body directly to said carrier after the limit of such longitudinal movement has been reached.

4. In an outside pipe cutter, a body, a cutter carrier slidably and non-rotatably carried by said body, cutter knives on said carrier which are inwardly movable, means for anchoring said carrier against upward movement with respect to a pipe to be cut, resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon movement of said body upwardly with respect to said carrier, means for limiting such longitudinal movement, and means for transmitting an upward force of said body directly to said carrier after such limit of movement has been reached.

5. In an outside pipe cutter, a body, a cutter carrier slidably and non-rotatably carried by said cutter body, cutter knives on said carrier which are inwardly movable, means for anchoring said carrier against longitudinal movement with respect to a pipe to be cut, resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier, and means for holding said cutter knives in non-cutting position prior to such movement.

6. In an outside pipe cutter, a cylindrical cutter body, a cutter carrier slidably and non-rotatably carried by said cutter body, inwardly movable cutter knives on said carrier, means for anchoring said carrier against upward movement with respect to a pipe to be cut, and resilient means carried by said body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier.

7. In an outside pipe cutter, a cylindrical cutter body, a cutter carrier slidably and non-rotatably carried by said cutter body, inwardly movable cutter knives on said carrier, means for anchoring said carrier against upward movement with respect to a pipe to be cut extending therethrough, and resilient means carried by said cutter body for resiliently urging said cutter knives inwardly into cutting position upon longitudinal movement of said body with respect to said carrier, and means for releasing said anchoring means from the pipe to be cut.

8. In an outside pipe cutter, anchoring means for engaging a pipe to be cut, a body movable with respect to said anchoring means to contact said anchoring means and transmit to said pipe to be cut any desired amount of force, cutter knives inwardly movable to cutting position, and means for applying a predetermined force to said knives urging them inwardly toward cutting position upon movement of said body into contact with said anchoring means.

9. In an outside pipe cutting device, means for engaging a pipe to be cut and applying a pulling force thereto, and including a lost motion connection, cutter knives movable inwardly to cutting position with respect to the pipe to be severed, and means operable upon take up of the slack in said lost motion connection to apply a predetermined force to said cutter knives urging them inwardly toward cutting position.

10. In an outside pipe cutter, cutter knives movable inwardly to cutting position with respect to a pipe to be cut, means for engaging the portion of pipe to be severed and applying an unlimited pulling force thereto, means rotatable with respect to said pulling means for rotating said knives during the application of said force, means for applying a force to said knives urging them inwardly toward cutting position and means for limiting the amount of said force.

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