April 24, 1962 S. F. DE CORDOVA 3,031,015

PIPE CUTTER

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Fig. 1

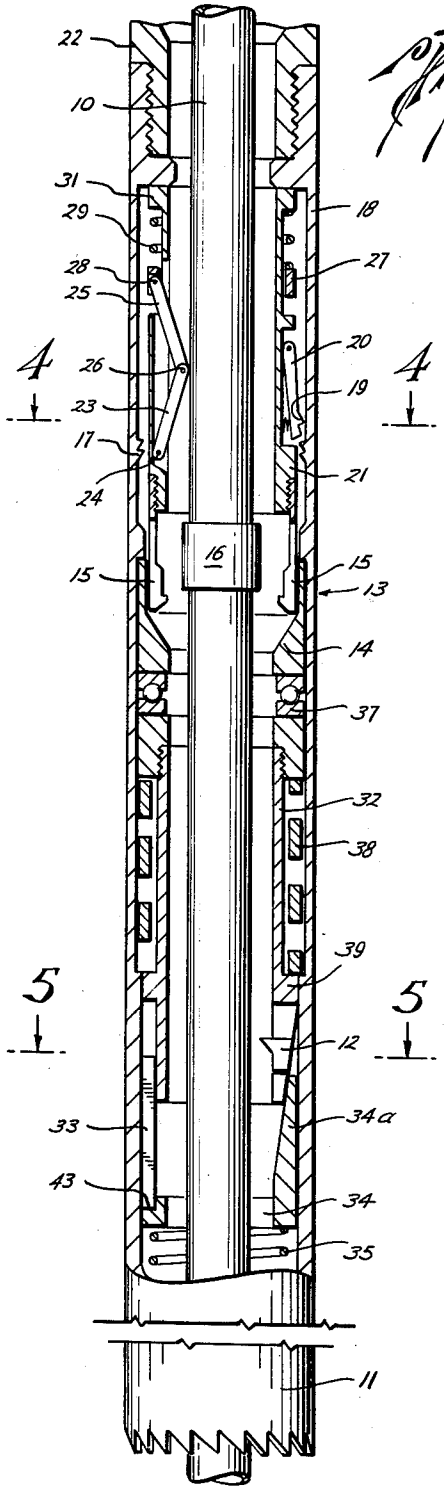


Fig. 4

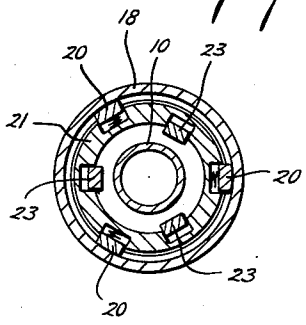
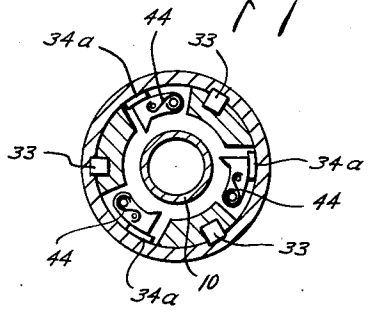


Fig. 5



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Fig. 2

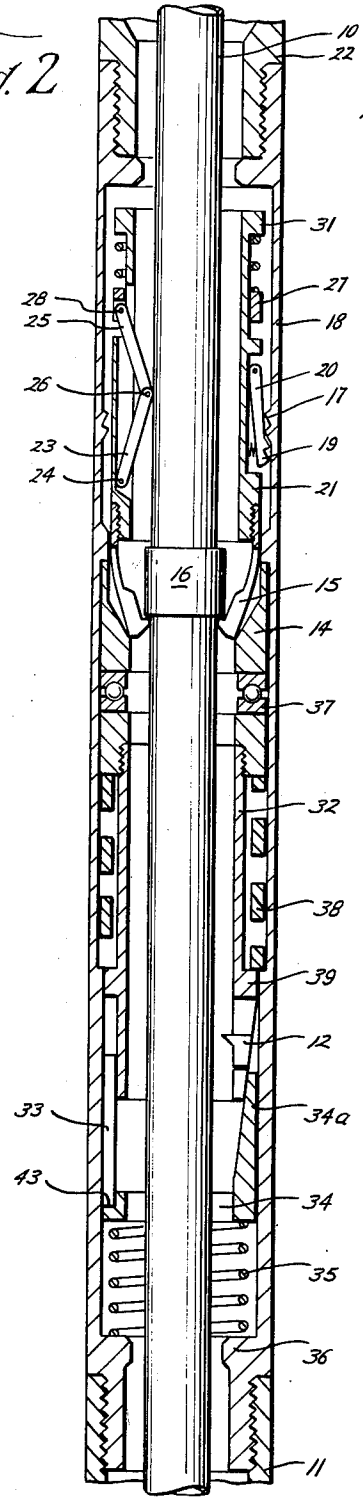
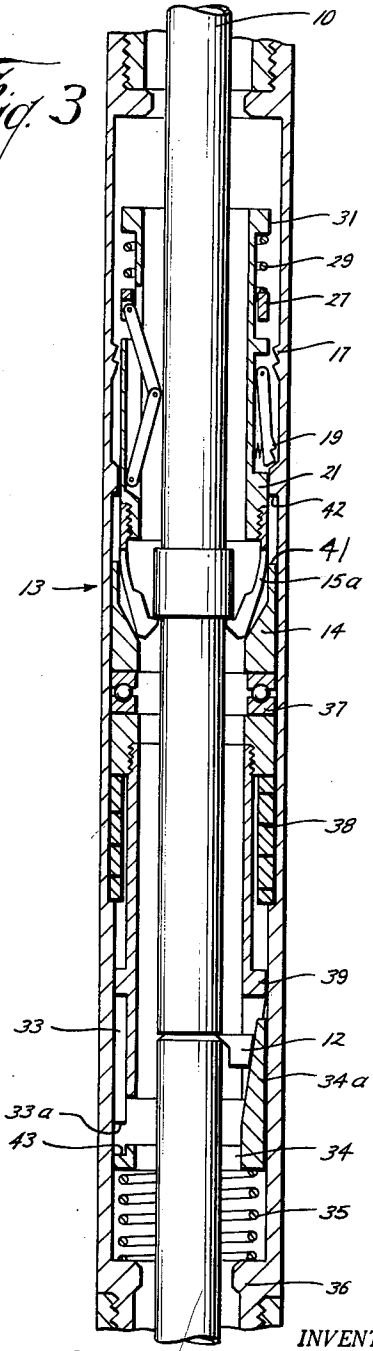


Fig. 3



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PIPE CUTTER

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This invention relates to pipe cutters, and more particularly to devices to be used in a well which wash over a section of stuck pipe, cut free a portion of the section of stuck pipe, and retrieve the freed section from the well bore, all in one run of the tool.

Drill pipe sometimes becomes stuck in a well due to cave-ins of the wall of the well, and the like, and cannot be withdrawn from the well bore. When this occurs, the drill pipe is usually parted immediately above the stuck section of pipe and efforts are made to remove the stuck section of pipe. One common method is to wash over the stuck pipe with an annular cutting tool which surrounds the pipe. After a length of the stuck pipe has been washed over and freed in the well, the wash-over tool may be withdrawn and a cutting tool run in the well to cut free and retrieve the freed section of the stuck pipe.

Due to the time involved in running pipe in the well, the wash over, cutting and retrieving operation is desirably carried out by a single tool, and many tools have been proposed for this purpose.

One of the problems encountered is that the cut is not always completed, and it is necessary to release the stuck pipe or fish and move the tool to a new position and attempt to make a new cut. It also may be desirable to retrieve the tool from the hole in the case of broken cutting knives or mal-function of the tool.

It is desirable to anchor the tool to the pipe to gain purchase in driving the knives into the pipe, and considerable difficulty is encountered in releasing the tool from the pipe when desired.

It is an object of this invention to provide an outside pipe cutter which may be utilized to wash over a stuck pipe, cut free a section of the stuck pipe, and retrieve the stuck pipe, all in a single run of the tool.

Another object is to provide an outside cutting tool in which the tool may be completely released from the stuck fish at any time.

Another object is to provide an outside cutting tool which may be released from a stuck fish and thereafter moved to a new section of the fish and a new cut begun without removing the tool from the well.

Another object is to provide an outside pipe cutter in which the means for urging the cutting knives into engagement with the pipe is automatically moved into non-operative position upon release of the tool from a pipe to permit disengagement of the knives from the pipe to be cut.

Other objects, features and advantages of the invention will be apparent from the specification, the drawings and the claims.

In the drawings, wherein there is shown an illustrative embodiment of this invention, and wherein like reference numerals indicated like parts:

FIGURE 1 is a view partially in vertical elevation and partially in vertical cross-section through a pipe-cutting tool constructed in accordance with this invention, and shown over a drill pipe;

FIGURE 2 is a view in vertical cross-section through

the tool of FIGURE 1 and illustrating the position of the parts at the time the tool is initially anchored to a pipe;

FIGURE 3 is a view similar to FIGURE 2 showing the tool in pipe-cutting position;

FIGURE 4 is a view along the line 4—4 of FIGURE 1; and,

FIGURE 5 is a view along the line 5—5 of FIGURE 1.

The drill pipe **10** will be stuck in a well bore (not shown). In the conventional manner, the outside pipe cutter will be rotated and moved downwardly over the pipe **10** to cut away the annulus of material binding the pipe to the well bore. A suitable annular bit **11** is shown at the bottom of the tool for performing this operation.

After a suitable section of pipe has been washed over, it is desirable to anchor the tool to the pipe to permit upward movement of the wash-over pipe to urge the cutting knives **12** into the pipe. For this purpose, the pipe-anchoring means **13** is provided. This means includes a slip bowl **14** which co-acts with a plurality of slips **15** to move the slips inwardly and anchor the pipe cutter to the pipe. Preferably, the slips engage the lower shoulder of a collar **16** on the pipe and prevent upward movement of the anchoring assembly.

It is desired to prevent operation of the anchoring assembly **13** before the operator is ready to cut free a section of the stuck pipe, and for this purpose means are provided to maintain the slips **15** in a position above the bowl **14** when the bowl is in its uppermost position. This means may be provided by the jump-thread arrangement shown, which includes interior threads **17** in the outer pipe **18** and threads **19** carried on a yieldable member **20**. The yieldable member **20** is mounted on the slip carrier **21**. The threads **17** and **19** are buttress-type threads and prevent downward movement of the slip carrier relative to the outer pipe **18**. However, upon upward movement of the outer pipe **18** by the wash-over string **22** and simultaneous right-hand rotation, the slip carrier **21** may be threaded through the outer pipe. To provide for relative rotation between the outer pipe **18** and the slip carrier a suitable drag arrangement is provided to hold the slip carrier against rotation. The drag arrangement may be provided by the knuckle arm arrangement illustrated. This arrangement includes an arm **23** pivoted to the slip carrier at **24**, and an arm **25** pivoted to arm **23** at **26**. Arm **25** is also pivoted to the sliding annulus **27** at **28**. A compression spring **29** is compressed between annulus **27** and a flange **31** on the slip carrier **21**. Thus, the knuckle arms **23** and **25** will always be urged into frictional engagement with the pipe **16** by spring **29** and provide sufficient drag to permit the slip **15** to be released upon simultaneous upward and rotative movement of the wash-over string **22**.

By reference to FIGURE 4 it will be noted that there are three arms **20** spaced symmetrically about the cutting tool and also three drag knuckle joints are provided. As each of these structures is identical, only one has been explained herein.

After the slip carrier has been released in the manner explained, the drag links continue to frictionally engage the pipe **10** and upward movement of the outer pipe **18** moves the bowl **14** behind the slips **15** to urge them into pipe-gripping position. This anchors the pipe-cutting tool to the pipe to be cut, as shown in FIGURE 2.

The slip bowl **14** is carried by an inner sleeve **32** which

is mounted in the outer sleeve **18** for telescoping movement and is splined against rotation relative thereto by splines **33**. The sleeve **32** carries a plurality of cutting knives **12** which are urged toward pipe **10** by a knife actuator **34**. The knife actuator **34** has an upwardly extending wedge member **34***a* behind each knife **12**, and, upon movement of the actuator and sleeve toward each other, these members **34***a* move the knives inwardly to pipe-cutting position. The knife actuator **34** is urged toward sleeve **32** by a compression spring **35** which is compressed between the knife actuator and a shoulder **36** on the lower end of the outer pipe **18**. As best shown in FIGURE 3, spring **35** is compressed by upward movement of the outer pipe relative to the sleeve **32**. As the sleeve **32** is connected to the slip-bowl **14** by ball-bearing assembly **37**, the inner sleeve cannot move upwardly with the outer pipe.

In order that a predetermined force may be applied to the knife actuator by spring **35**, it is preferred to provide stop means limiting upward movement of the outer pipe **18** relative to the inner sleeve **32**. This may be provided in any desired manner, and when this stop is engaged the increased tension on the wash-over pipe **22** will advise the operator that the tool is ready for cutting operation. Of course, as the knife moves inwardly with penetration into the pipe **10**, the spring **35** will expand slightly and maintain a knife-expanding pressure behind the cutting knife.

While the means for limiting upward movement of the outer pipe relative to the sleeve **32** might be provided by any desired stop, it is preferably provided by the convolutions of spring **38** moving into abutment with each other.

It is sometimes desirable to release the tool from the pipe before a cut has been completed, and in this case the knives should be retracted from engagement with the pipe **10**. For this purpose, the spring **38** urges the inner sleeve **32** upwardly relative to outer pipe **18**. Thus, upon lowering of outer pipe **18** the inner sleeve will remain stationary until the compression is removed from spring **38**. It is noted that the inner sleeve **32** is provided with an outer lower flange **39** which engages spring **38** when in its uppermost position to limit further expansion of spring **38**. At this time, the upper end **41** of slip-bowl **14** will contact downwardly facing shoulder **42** in the outer pipe **18** and further downward movement of the outer pipe will move the slip bowl from behind the slips **15**. As the slips **15** are mounted on spring arms **15***a*, they will return to fully retracted position as shown in FIGURE 1.

From the structure thus far described, it will be apparent that the anchor can be released and upon further downward movement of the outer pipe **18** relative to slip carrier **21**, which is held against movement by the knuckle arms, the threads **17** in the outer pipe will jump the threads **19** carried by yieldable arm **20**. This will render the anchoring mechanism ineffective so long as the pipe is not thereafter rotated.

Inasmuch as a wedge action is present between the knives and knife-actuators, it would be possible for the actuators to hang up in a position which wound bind the knives in the cut in the pipe **10**. To avoid any possibility of this occurring, a stop is provided in the outer pipe **18** which engages the knife-actuator before the spring **38** moves into fully expanded position and in engagement with shoulder **39** on the inner sleeve **32**. This stop may be provided by the lower end **33***a* of splines **33** which, as shown in FIGURE 2, will engage a surface **43** on the knife-actuator and maintain the knife-actuator in withdrawn position when the retracting spring **38** is in engagement with shoulder **39** on the inner sleeve **32**. Thus, as the outer pipe is moved downwardly relative to the sleeve, the knife-actuator is retracted from behind the knife due to a reduction in tension of spring **35** and the weight of the knife-actuator, and if for any reason the actuator does not retract freely, the stop **33***a* forces the knife-actuator from behind the several knives. As shown in FIGURE 5, three splines **33** are spaced symmetrically about the tool and the knife-actuator will be engaged at three symmetrically spaced positions to retract it from behind the knives. Each knife is provided with a return spring **44** which urges each knife radially outwardly away from the pipe **10** and moves the several knives positively to retracted position upon withdrawal of the knife-actuator **34**.

In operation, the tool is run in with the parts in the posture illustrated in FIGURE 1. As the weight of the tool will be exerted on the annular bit **11** through the cutting tool, a downward force will be constantly exerted during rotation which will prevent release of the jump-thread mechanism. Upon reaching a desired elevation, the operator picks up slightly on the pipe **22** while continuing rotation, and as the knuckle arms **23** and **25** are dragging against the pipe **10**, the slip carrier **21** will be forced downwardly until the threads **17** and **19** are disengaged. Thereafter, further upward movement of the wash-over string will move the outer pipe upwardly relative to the frictionally held slip carrier **21** until the bowl **14** forces the slips **15** into engagement with the pipe. Further upward movement of the wash-over pipe **22** will move the slips **15** into engagement with the next collar **16** located thereabove. At this time further upward movement of the wash-over pipe **22** will compress spring **38** and simultaneously will compress spring **35**. Upon the convolutions of spring **38** moving into abutment with each other, further upward movement of the wash-over pipe will be resisted, and the operator will know that the tool is ready for cutting. While the spring **38** was being compressed, the compression of spring **35** was moving the knife-actuator **34** behind knives **12**. This movement of the parts while the springs are compressed is illustrated by the difference between FIGURE 2 and FIGURE 3. It is noted that the spline **33** moves out of engagement with the knife-actuator **34** and permits spring **35** to force the knife-actuator behind the knives.

At this time the tool may be rotated to cut the pipe **10** in two. Upon severing of the section of pipe, the wash-over string **22** may be withdrawn with the severed section of pipe supported upon the slip **15**.

If for some reason it is impossible to complete the cut, and it is desirable to release the tool, the operator lowers string **22** and merely by straight downward movement the tool is completely released from the pipe and all parts placed in inoperative position. As the outer pipe **18** moves downwardly, the spring **38** expands to support the knife carrier in its upper telescoped position. As the spring **38** reaches fully expanded position, the shoulder **42** engages the upper end of the bowl **14** and drives the bowl from behind the slips. Meanwhile, the spring **35** has been expanded to remove the force urging knife-expander **34** upwardly, and splines **33** engage the knife-actuator to move it downwardly relative to the knives and release the knives before spring **38** has been completely expanded. As the knife-actuator moves from behind the knives, the individual springs **44** retract the knife into non-cutting position. The threads **17** move over threads **19** and hold the slip carrier in its upper position so that the slips will be inactive upon a later upward movement of the wash-over string.

The pipe cutter is now free from the pipe and may be moved to another position and operated in the manner previously explained to make a new cut, or the tool may be withdrawn from the hole completely.

The foregoing disclosure and description of the invention is illustrative and explanatory thereof and various changes in the size, shape and and materials, as well as in the details of the illustrated construction, may be made within the scope of the appended claims without departing from the spirit of the invention.

What is claimed is:

1. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, means urging the sleeve upwardly in the pipe, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient means carried by the outer pipe urging the actuator means toward engagement with the knives, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

2. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, means urging the sleeve upwardly in the pipe, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient means carried by the outer pipe urging the actuator means toward engagement with the knives, a stop preventing contact between the knives and actuator means when the inner sleeve is in its uppermost position, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

3. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, means urging the sleeve upwardly in the pipe, means limiting downward movement of the sleeve in the pipe, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient means carried by the outer pipe urging the actuator means toward engagement with the knives, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

4. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, means urging the sleeve upwardly in the pipe, means limiting downward movement of the sleeve in the pipe, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient means carried by the outer pipe urging the actuator means toward engagement with the knives, a stop preventing contact between the knives and actuator means when the inner sleeve is in its uppermost position, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

5. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, a spring urging the sleeve upwardly in the pipe, said spring when collapsed limiting upward movement of the pipe relative to the sleeve, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient means carried by the outer pipe urging the actuator means toward engagement with the knives, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

6. An outside pipe cutter comprising, an outer pipe adapted to be carried by a washover pipe string, an inner sleeve splined and telescoped in the pipe, a spring urging the sleeve upwardly in the pipe, said spring when collapsed limiting upward movement of the pipe relative to the sleeve, anchoring means including slips and a bowl for contracting the slips, said bowl rotatably carried by the inner sleeve, yieldable means carried by one of the slips and outer pipe, jump thread means on said yieldable means and the other of said slips and pipe, said jump thread means releasably supporting the slips in the outer pipe above the bowl when the bowl is in its uppermost position, said jump thread means permitting release and downward movement of the slips into engagement with the bowl upon upward movement and rotation of said pipe and re-engagement of the pipe and slips upon downward movement of the pipe relative to the slips, cutting knives carried by the inner sleeve, knife actuator means for urging the cutting knives into a pipe to be cut, resilient

means carried by the outer pipe urging the actuator means toward engagement with the knives, a stop preventing contact between the knives and actuator means when the inner sleeve is in its uppermost position, said inner sleeve when secured to the pipe by the anchoring means holding the knives against longitudinal movement along the pipe to be cut whereby upon upward movement of the outer pipe the actuator means urges the knives into cutting position.

7. The outside pipe cutter of claim 6 wherein means

are provided for urging the knives into non-cutting position at all times.

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