Oct. 2, 1962 A. B. FOREMAN, JR 3,056,453

RELEASING WASHOVER OUTSIDE CUTTER

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Fig. 1

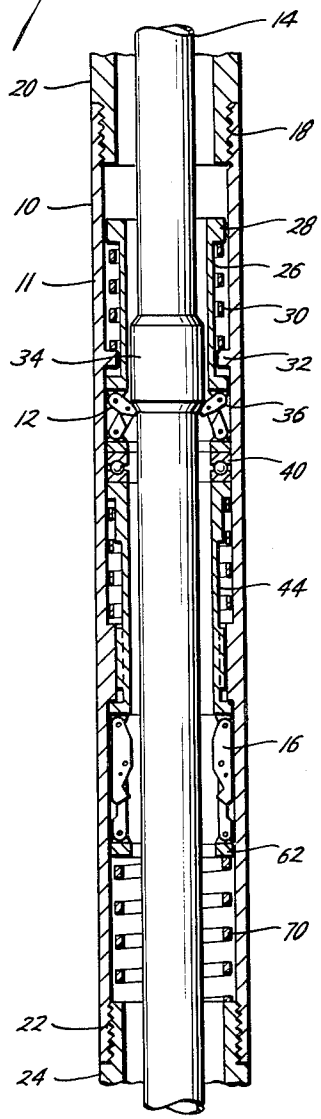
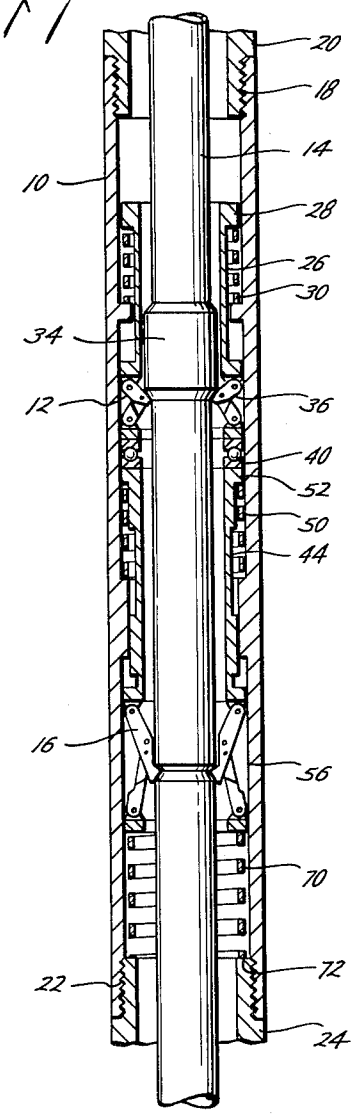


Fig. 2



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RELEASING WASHOVER OUTSIDE CUTTER

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Fig. 3A

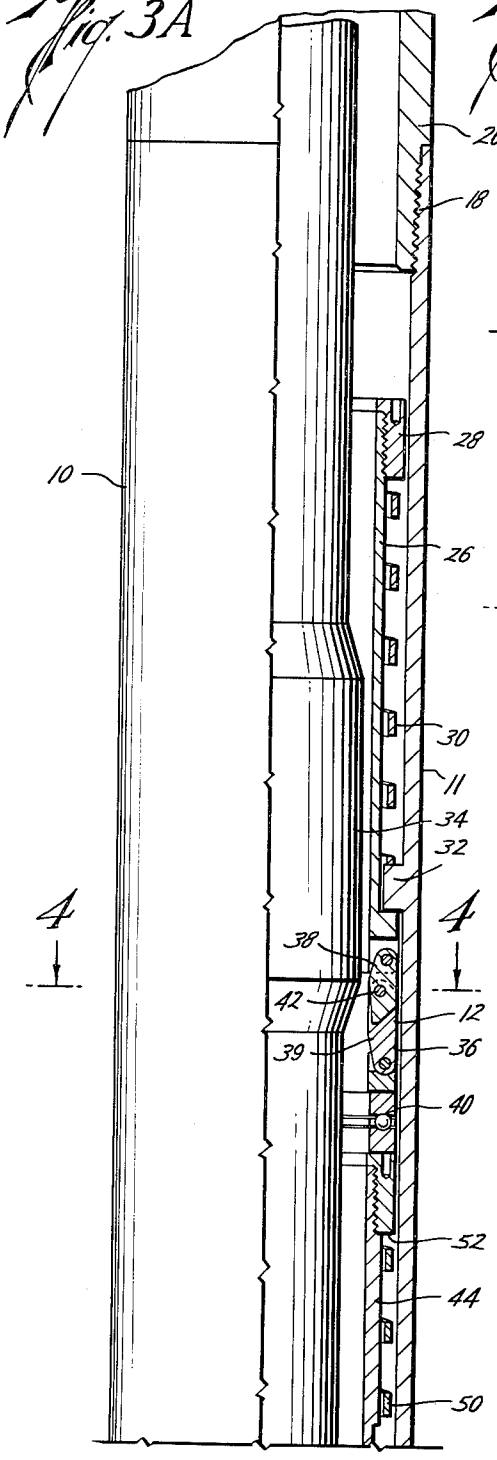
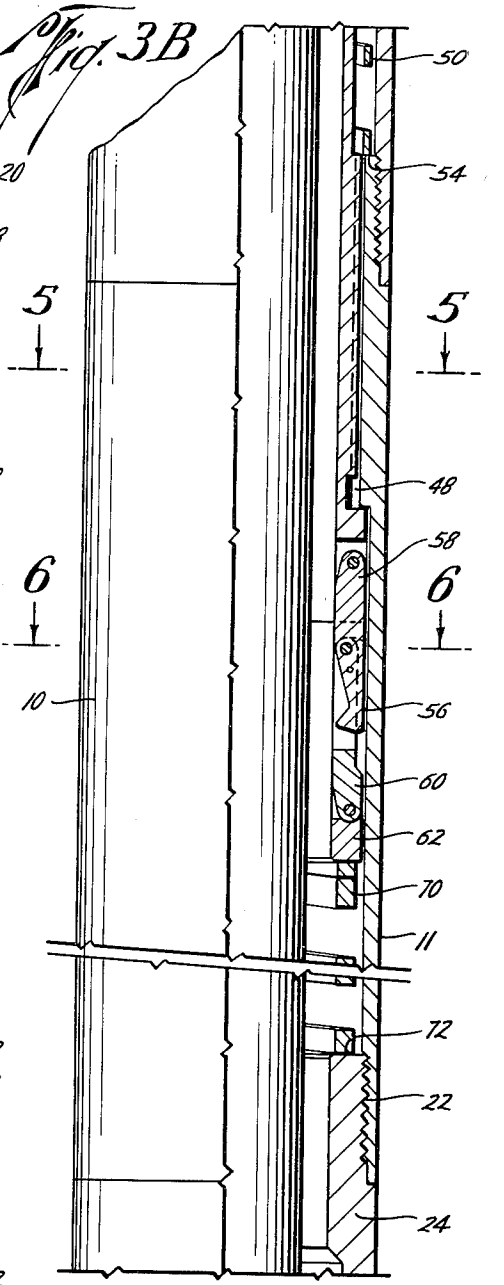


Fig. 3B



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RELEASING WASHOVER OUTSIDE CUTTER

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Fig. 4

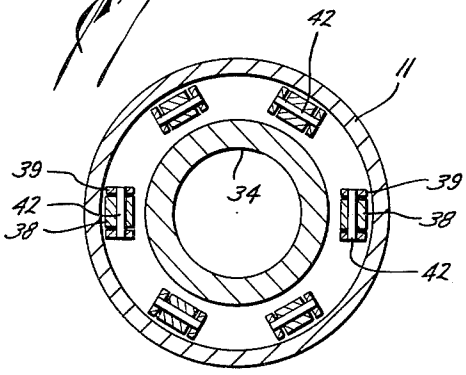


Fig. 5

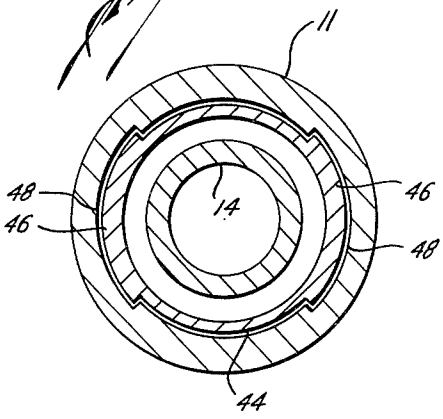


Fig. 6

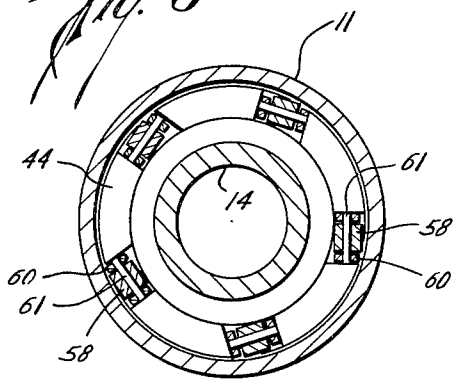


Fig. 8

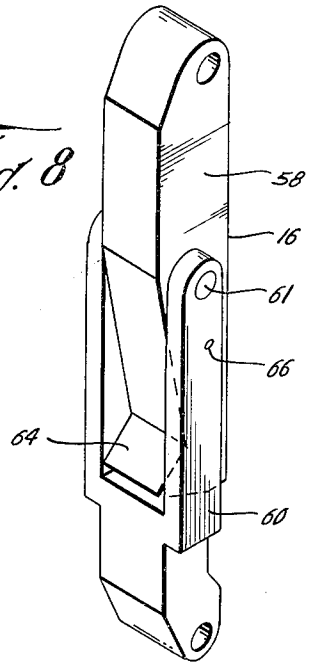
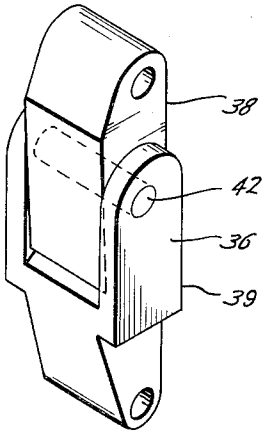


Fig. 7



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RELEASING WASHOVER OUTSIDE CUTTER

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Fig. 9

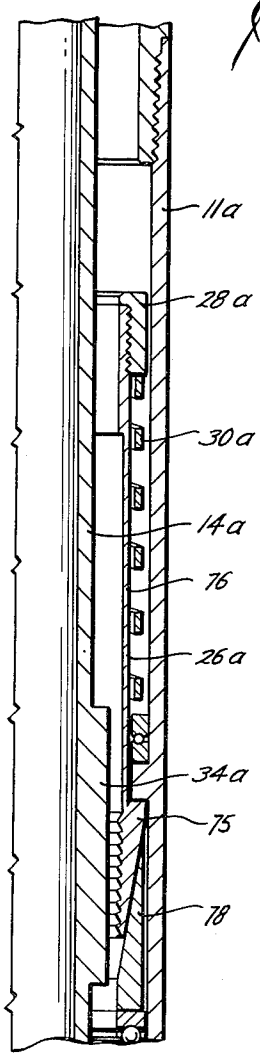


Fig. 10

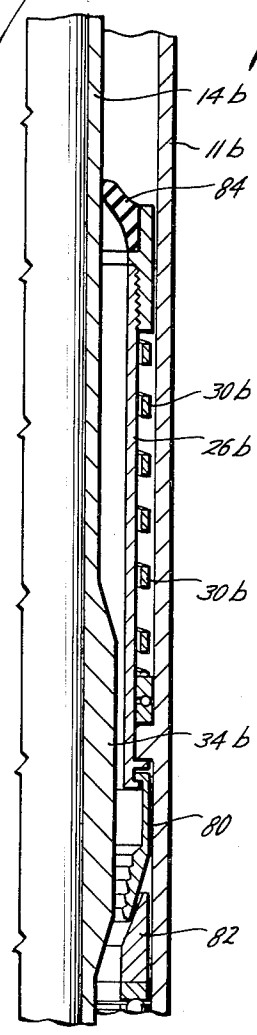


Fig. 11

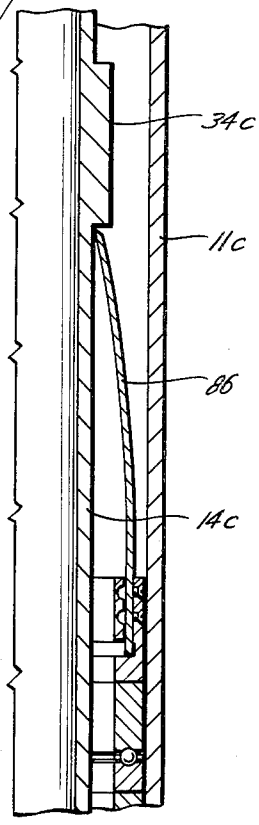
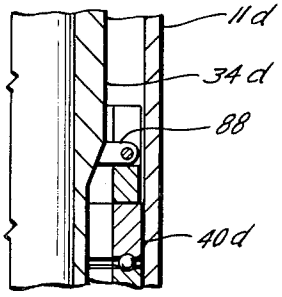


Fig. 12



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3,056,453

RELEASING WASHOVER OUTSIDE CUTTER

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Filed Nov. 20, 1959, Ser. No. 854,459
10 Claims. (Cl. 166—55.6)

The present invention relates to an apparatus for cutting and retrieving stuck pipe in a well bore, and more particularly, relates to such an apparatus in which pipe stuck in a well bore may be gripped, a cut made in the pipe, and the cut pipe recovered or in the event that the cut is unsuccessful the apparatus may be released from the stuck pipe.

Sometimes in the drilling of a well bore the drill stem may become disconnected and stuck in the well bore. This is commonly called a fish as this stuck pipe must be removed or fished out. This may be done by using an outside cutter in connection with the usual washover pipe whereby the stuck pipe is at successive intervals washed over, cut off and removed. The present invention is directed to improvements in a releasable washover outside cutter which may be used in combination with the washover pipe so as to eliminate an extra trip into the well bore to cut and remove the fish and also to provide a cutting tool which will release if the cut is not successful.

It is an object of this invention to provide a washover outside cutter which may be released from the stuck pipe if the cut is not successful.

A further object of the present invention is the provision of an improved releasing washover outside cutter in which the gripping assembly of the tool is automatically actuated by fluid pressure in the tool as the tool passes a tool joint.

Yet a still further object of the present invention is the provision of a fluid piston actuated gripping means in a washover outside cutter which actuates and releases the gripping assembly on the stuck pipe.

Yet a further object of the present invention is the provision of improved releasable washover outside cutters in which the cutting force exerted by the cutters may be varied.

Other and further objects, features and advantages will be apparent from the following description of presently preferred embodiments of the invention, given for the purpose of disclosure, and taken in conjunction with the accompanying drawings, where like character references designate like parts throughout the several views, and where,

FIGURE 1 is an elevational view, in section, illustrating an apparatus according to the invention in gripping position on the stuck pipe,

FIGURE 2 is an elevational view, in cross-section, illustrating the apparatus of the invention in position gripping and cutting the stuck pipe,

FIGURES 3A and 3B are enlarged continuation elevational views, in quarter section, of the apparatus according to the present invention going into position over the stuck pipe preparatory to gripping the stuck pipe,

FIGURE 4 is a full cross-sectional view taken along the line 4—4 of FIGURE 3A,

FIGURE 5 is a full cross-sectional view taken along the line 5—5 of FIGURE 3B,

FIGURE 6 is a full cross-sectional view taken along the line 6—6 of FIGURE 3B,

FIGURE 7 is a perspective view of a knuckle joint type gripping means,

FIGURE 8 is a perspective view of a preferred form of a cutter,

FIGURE 9 is a partial elevational view, in quarter section, illustrating a modification of the present invention utilizing a spring slip type gripping means,

FIGURE 10 is a partial elevational view, in quarter section, illustrating a modification of the present invention having a wedge slip type gripping assembly,

FIGURE 11 is a partial elevational view, in quarter section, illustrating a nonreleasable type of gripping assembly such as a slip dog that may be used, and

FIGURE 12 is a partial elevational view, in quarter section, illustrating still another modification of a nonreleasable flipper dog type gripping assembly.

Referring now to the drawings, and particularly to FIGURES 1, 2, 3A and 3B, the reference numeral **10** generally designates the releasable washover outside cutter of the present invention and generally includes a tubular body **11**, a gripping assembly **12** for gripping and holding the stuck pipe **14**, and a cutter assembly **16** for cutting the stuck pipe **14** so that the cut section of pipe may be removed from the well bore.

The tubular body **11** is provided with threads **18** at the top which are connected to an operating string of pipe **20** which leads to the surface of the well by which the apparatus **10** may be manipulated in the well bore (not shown). At the bottom of the tubular body **11** threads **22** are provided for connection of another joint or of a conventional washover pipe **24**.

Referring now to FIGURES 1, 2, and 3A, the structure for the operation of the gripping assembly **12** is best seen. A sleeve **26** is provided which is slidably disposed in the upper portion of the body **11** and has an inside diameter sufficient to telescope over the stuck pipe **14**. An annular piston **28** is secured to the upper end of the sleeve **26** and is slidable in the body **11**. A compression spring **30** which is stopped at one end by the stop member **32** acts against the lower side of the piston **28** tending to move the piston **28** upwardly. It is noted that the sleeve **26** and the piston **28** extend inwardly from the tubular body **11** and constrict the fluid passageway through the body **11**. Thus, as fluid pressure is applied to fluid within the well bore and when a restriction passes through the piston **28**, such as an enlarged tool joint **34**, there is a choking of the drill fluid and a build up of pressure behind this choked area which forces the piston **28** and the sleeve **26** downwardly against the compression of the spring **30**. Of course, the piston **28** may be actuated downwardly without a restriction in the passageway by increasing the fluid pressure in the body **11**.

The gripping assembly **12** is provided to grip the stuck pipe **14** and is here shown as a knuckle joint **36** which can be operated to grip the underside of the tool joint **34**. As best seen in FIGURES 3A, 4 and 7, the knuckle joint **36** includes two arms or dogs **38** and **39**, the upper arm **38** is pivotally connected to the lower end of the sleeve **26** and the lower arm **38** being pivotally connected to an antifriction assembly **40**. As is conventional the knuckle joint arms **38** and **39** are joined together and pivot about pivot member **42** and thus upon downward movement of the sleeve **26** relative to the body **11** the knuckle joint **36** knuckles the arms **38** and **39** outwardly and engages and holds the underside of the tool joint as shown in FIGURE 1. As best seen in FIGURE 4, six knuckle joint assemblies **36** are provided although any desired number may be provided. It is noted that as the gripping assembly **12** grips the pipe and the body **11** is rotated the gripping assembly does not rotate but rides on the antifriction assembly **40**.

Referring now to FIGURES 1, 2 and 3A and 3B, a second sleeve **44** is provided which is slidable in the body **11** below the antifriction assembly **40**. As best seen in FIGURES 3B and 5 interfitting keys **46** and keyways **48**

are provided on the sleeve 44 and the body 11, respectively, whereby the sleeve 44 may be rotated as the body 11 is rotated thereby rotating the cutter assembly 16 as hereinafter described after the gripping assembly 12 has a secure hold on the stuck pipe 14. A spring 50 is provided which bears against an upper stop member 52 secured to the upper end of sleeve 44 and against the shoulder 54 forming a part of the body 11. Thus in its normal position the spring 50 yieldably urges the sleeve 44 upwardly.

Pivotally secured to the lower end of the sleeve 44 and in the slots 56 is the cutter assembly 16. As best seen in FIGURES 3B, 6 and 8 the cutter assembly may be in the form of a knuckle arrangement including arms 58 and 60, the arm 58 being pivotally secured to the lower end of the sleeve 44 and the arm 60 being pivotally secured to an annular ring 62. Arms 58 and 60 are joined together about pivot 61. The arm 58 has a cutter element 64 and as conventional in knuckle joints as the arms 58 and 60 are moved toward each other, pivoting about pin 61, and the cutter element 64 is moved inwardly so as to engage and cut the stuck pipe 14. As best seen in FIGURE 6, five cutter assemblies 16 may be provided although any desired number can be used.

In order to securely hold the cutting assembly 16 in the retracted position while going into position and setting the gripping assembly shear pins 66 may be provided to secure the arms 58 and 60 together until the cutting operation is started at which time the shear pins 66 are sheared releasing the cutter 16. However, spring 50 normally acts to keep the cutter 16 in the retracted position.

Referring now to FIGURES 1, 2 and 3B a compression spring 70 is provided to give a resilient and constant pressure drive to the cutter assembly 16 so that an even pressure will be applied to the knives at all times during the cutting operation. The spring 70 bears against the underside of the ring 62 and may be secured to the body 11 or bear against the shoulder 72 of the washover shoe 24. Thus, when the gripping means 12 is in engagement with the pipe 14 an upward movement of the tubular body 11 will move the stop 72 upwardly and compress the spring 70 whereby the shear pins 66 will be sheared and the cutting assembly 16 pivoted into engagement with the pipe 14. Of course, spring 70 may be omitted and the lower leg 60 of the cutter assembly 16 may be pivotally connected to the body 11 and thus be actuated upon upward movement of body 11.

Of course, various modifications of the gripping means 12 may be used for gripping the stuck pipe 14. FIGURES 9, 10, 11 and 12 illustrate modifications of the gripping means according to the invention, the letters "*a*," "*b*," "*c*," and "*d*" being applied to the parts corresponding to those in FIGURES 1–8, inclusive, for convenience of reference. FIGURE 9 illustrates a slip member 75 which is held outwardly and against the tubular body 11*a* by a spring sleeve 76 and is moved into engagement with the pipe 14*a* as the slip member 75 is moved downwardly and over the wedge member 78 and into contact with the stuck pipe 14*a* by the piston 28*a* and the sleeve 26*a*. FIGURE 10 illustrates another slip 80 having a gripping face which is adapted to be slid over a wedge member 82 as the sleeve 26*b* is moved downwardly by a pack-off type piston 84. It is noted that both of the modifications illustrated in FIGURES 9 and 10 are of a releasable type gripping assembly.

FIGURE 11 illustrates a nonreleasable type gripping assembly using a conventional spring dog 86 which moves over the tool joint 34*c* as the body 11*c* is moved downwardly over the stuck pipe. In this modification the setting mechanism of the piston and movable sleeve are omitted. The spring dog catches on the underside of the tool joint 34*c* and is able to bring the cut pipe to the surface. FIGURE 12 illustrates another type of nonreleasable gripping means utilizing a flipper dog 88 which is pivoted about the antifriction assembly 40*d* and moves

downwardly over the tool joints and on upward movement of the tubular body 11*d* the flipper dog 88 engages the bottom of the tool joint 34*b* and thus grips the stuck pipe.

In operation, the apparatus 10 is incorporated in a washover string as shown in FIGURES 3A and B which includes the operating string 20 extending to the surface and includes a washover or cutting tool 24 at the bottom of the apparatus 10 for washing over the stuck pipe 14 and cutting away the formation from the stuck pipe.

When it is desired to make a cut, fluid pressure is applied to the fluid in the body 11. Thus, as the tool 10 is lowered and the sleeve 26 and piston 28 pass over a tool joint 34 below which the cut is desired to be made the fluid flow is restricted and the fluid pressure in the tool is thus increased forcing the piston 28 and the sleeve 26 downwardly causing the knuckle joint arms 38 and 39 to pivot outwardly around the pivot 42 toward the pipe and engage the lower end of the pipe joint 34. At this point the tool 10 is in engagement and gripping the stuck pipe 14 (FIGURE 1). This operation may be performed solely by increasing the fluid pressure in the body 11 and thus actuating the piston regardless of the position of the pipe joint 34. However, the actuation of the gripping assembly by the action of the tool joint 34 restricting the fluid passage through the piston 28 and the sleeve 26 acts to insure that the gripping assembly 12 will be properly spaced to engage the bottom of the tool joint 34 and securely grip the stuck pipe 14.

The operating string 20 is then lifted up causing the tubular body 11 to be raised causing the gripping assembly 12 to grip the stuck pipe 14 more securely. As the body 11 is picked up the shoulder 72 causes the cutter spring 70 to be compressed against the ring 62 and thus against the lower legs 60 of the cutters 16 as the other end of the cutters, legs 58, are set in position through the sleeve 44 against the gripping assembly 12. After a predetermined pressure is exerted against the cutter assembly 16 the shear pins 66 are sheared thereby releasing the cutters and the cutting elements 64 are urged inwardly by the spring 70 and engage the pipe 14. Of course, the spring 70 may be omitted and the lower end of the cutters 16 pivotally connected to the body 11. However the spring 70 provides a less rigid type drive on the cutters. The operating string is then rotated at the surface as is conventional and the cutters are rotated about and cut the pipe 14 (FIGURE 2). After the cut through the pipe has been made, the tool 10 is pulled from the well bore and the gripping assembly 12 carries and thus removes the cut portion of the pipe 14.

In the event that the cut fails, the tool is released by decreasing the fluid pressure, and lowering the tool thereby releasing the gripping assembly 12 from the pipe. The spring 30 moves the piston 28 and the sleeve 26 upwardly thereby retracting the gripping assembly 12. At the same time the spring 50 moves the sleeve 44 upwardly and the pressure on the spring 70 is released thereby allowing the cutter assemblies 16 to be retracted by the spring 50 and sleeve 44 and the spring 70. The apparatus 10 may then be moved to the surface or moved to a new location in an effort to make another cut.

The modifications of the gripping assemblies shown in FIGURES 9 and 10 operate in a similar manner as described. The gripping assemblies such as the spring dog 86 in FIGURE 11 and the flipper dog 88 in FIGURE 12 are merely set by movement past the tool joint 34*c* and 34*d*, respectively, whereupon the tool is raised engaging the lower edge of the tool joint. However, neither of these latter types of gripping assemblies are releasable in the event that the cut cannot be made.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein. While presently preferred embodiments of the invention are given for the purpose of disclosure, numerous changes in

the details of construction, and arrangement of parts may be made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A releasing washover outside cutter for cutting and removing stuck pipe from a well bore comprising an elongate tubular body connected to an operating string, an annular piston in said body, said piston being responsive to fluid pressure in the body, a first spring means connected between the body and said piston yieldably urging said piston upwardly, a first sleeve connected to said piston and slidably disposed in the body, pipe gripping means, one end of said pipe gripping means connected to the first sleeve, an anti-friction assembly rotatably mounted in said body, the second end of said pipe gripping means supported on said anti-friction assembly, a second sleeve slidably disposed in said body below the anti-friction assembly, interfitting key and keyway means connected between said second sleeve and the body, a second spring connected between said body and said second sleeve yieldably urging said second sleeve upwardly, and cutting means connected to said second sleeve, said cutting means supported by said body and actuated by upward movement of said body.

2. The invention of claim 1 wherein said annular piston includes a flexible piston extension connected to and extending inwardly therefrom.

3. A releasing washover outside cutter for cutting and removing stuck pipe from a well bore comprising, an elongate tubular body connected to an operating string, an annular piston in said body, said piston being responsive to fluid pressure in the body, a first spring means connected between the body and said piston yieldably urging said piston upwardly, a first sleeve connected to said piston and slidably disposed in the body, pipe gripping means, one end of said pipe gripping means connected to the first sleeve, an anti-friction assembly rotatably mounted in said body, the second end of said pipe gripping means supported on said anti-friction assembly, a second sleeve slidably disposed in said body below the anti-friction assembly, interfitting key and keyway means connected between said second sleeve and the body, a second spring means connected between said body and said second sleeve yieldably urging said second sleeve upwardly, cutting means in said body, one end of said cutting means connected to said second sleeve, and a third spring means connected between said body and said cutting means yieldably urging said cutting means into engagement with said pipe.

4. The invention of claim 3 including shear means connected to the cutting means releasably holding the cutting means out of engagement with the pipe.

5. A releasing washover outside cutter for cutting and removing stuck pipe from a well bore comprising an elongate tubular body connected to an operating string, releasable pipe gripping means in said body, an anti-friction assembly rotatably mounted in said body, said assembly supporting the lower end of said releasable pipe gripping means, a sleeve slidably disposed in said body and connected to said pipe gripping means whereby on downward movement of said sleeve the pipe gripping means is actuated to grip and hold the pipe, an annular piston secured to the upper end of said first sleeve, said piston forming a fluid restriction in said body and being responsive to fluid pressure whereby when a pipe coupling passes said piston fluid pressure in said body is increased thereby moving said piston and sleeve downwardly thereby actuating said pipe engaging means, a first compression spring connected between the body and said piston yieldably urging said piston upwardly, a second sleeve slidably mounted in said body below and adjacent said anti-friction assembly, interfitting key and keyway means connected between said second sleeve and body, a second spring connected between said body and said second sleeve yieldably urging said second sleeve upwardly, and pipe cutting means connected to said second sleeve, the lower end of said pipe cutting means supported by said body.

6. The invention of claim 5 including a third spring means connected between said body and said pipe cutting means yieldably urging said cutters inwardly into engagement with the pipe.

7. A releasing washover outside cutter for cutting and removing a stuck pipe from a well bore comprising, an elongate tubular body connected to an operating string, releasable pipe gripping means disposed in said body, said gripping means adapted to grip said pipe on compressive movement of the ends of said gripping means, a first sleeve slidably disposed in said body and connected to the upper end of said pipe gripping means, an anti-friction assembly mounted in said body below the pipe gripping means, the lower end of said pipe gripping means supported on said anti-friction assembly, an annular piston secured in the body to the first sleeve, said piston forming a restriction in the body and being responsive to fluid pressure in said body, a first spring means connected between the body and said piston yieldably urging said piston upwardly thereby urging said first sleeve upwardly and said pipe engaging means upward and out of engagement with said pipe whereby when fluid is applied in the body and a pipe joint passes by the piston restricting the fluid flow therethrough pressure is built up in the body and on the piston moving the piston, sleeve and pipe gripping means downwardly and into engagement with the pipe, a second sleeve slidably mounted in said body below the anti-friction assembly, interfitting key and keyway means connecting said second sleeve and body whereby rotary motion may be transmitted from the body to said second sleeve, a second spring means connected between said body and said second sleeve yieldably urging said second sleeve upwardly against said pipe gripping means, releasable pipe cutting means connected to said second sleeve, a third spring means connected between said body and said cutting means yieldably urging said cutting means inwardly into engagement with said pipe whereby when said pipe gripping means engage the pipe and the body is moved upwardly the third spring means is compressed urging the pipe cutting means into engagement with said pipe.

8. The invention of claim 7 including shear means connected to said cutting means releasably holding said cutting means out of engagement with the pipe.

9. The invention of claim 5 including releasable means connected to said pipe cutting means which when released allow the cutters to move into engagement with the pipe.

10. The invention of claim 7 wherein the releasing pipe gripping means includes a knuckle joint one end of which is pivotally connected to the body and a second end of which is pivotally connected to said first sleeve.

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