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Carlberg

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[54] **HYDRAULIC PIPE TONG APPARATUS**

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[52] **U.S. Cl.** **269/26,** 81/57.19, 269/157

[51] **Int. Cl.** **B23q 3/08**

[58] **Field of Search** 269/25, 26, 157; 81/57.16, 81/57.34, 57.19, 57.21

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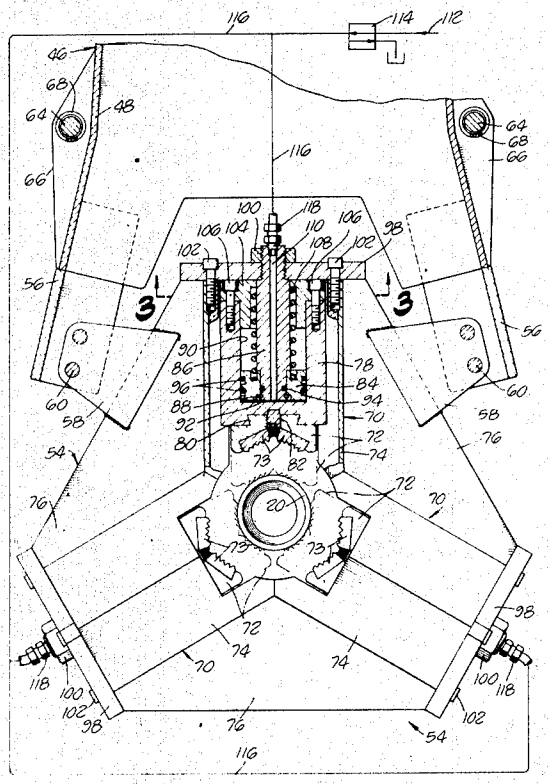
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[57] **ABSTRACT**

Pipe gripping apparatus carried by a support frame including a hydraulic piston radially supported in fixed relation within the frame through a piston rod. A movable combination blind cylinder and pipe jaw is fitted around the piston for radial movement toward and away from gripping relation with pipe. The piston and cylinder defines a fluid pressure chamber connected to pressuring means for introducing fluid under pressure into the chamber to move the cylinder and pipe jaw into gripping engagement with pipe. A retraction arrangement is provided to move the cylinder and pipe jaw away from the pipe.

6 Claims, 3 Drawing Figures



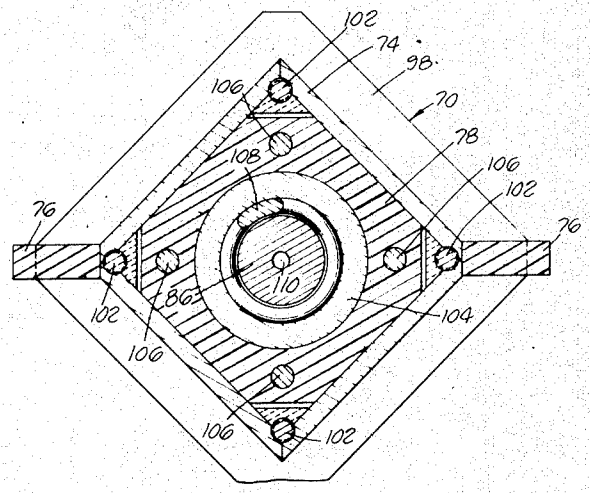
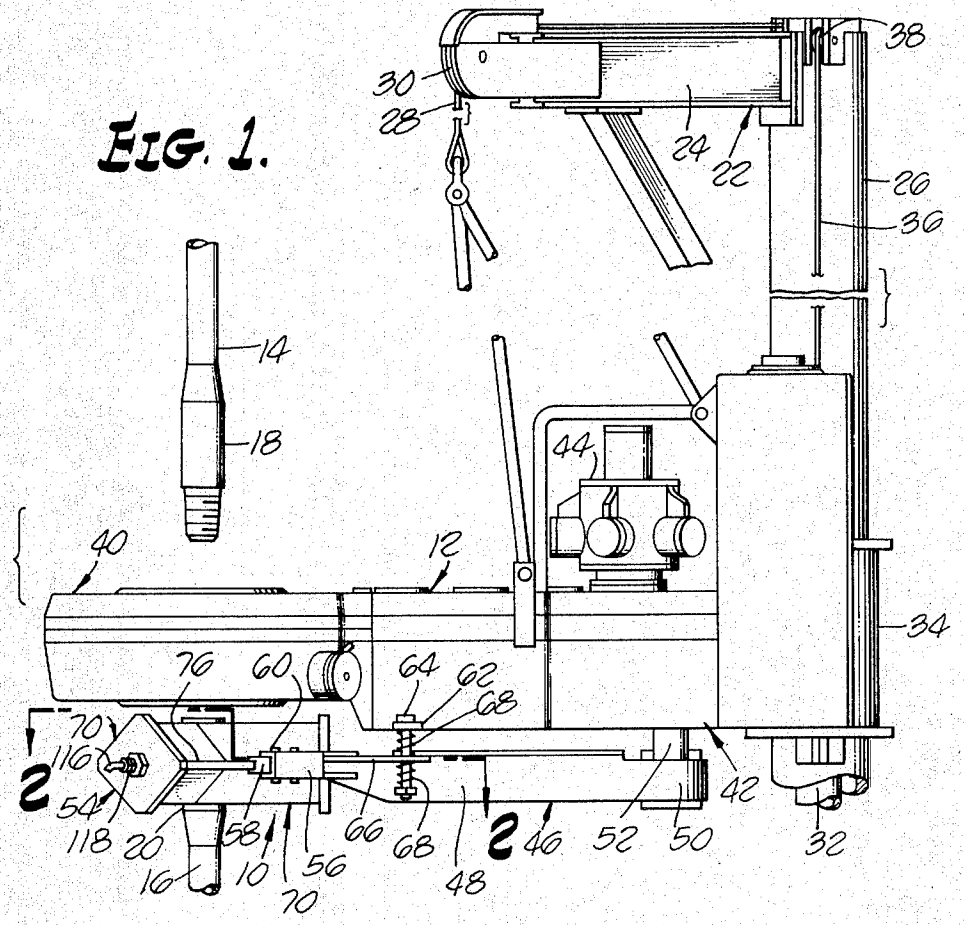


FIG. 1.


38
30
28
24
22
20
36
14
18
44
40
12
34
76
60
64
62
68
70
116
54
118
20
58
66
68
46
52
50
42
32
16
10
56
70
48

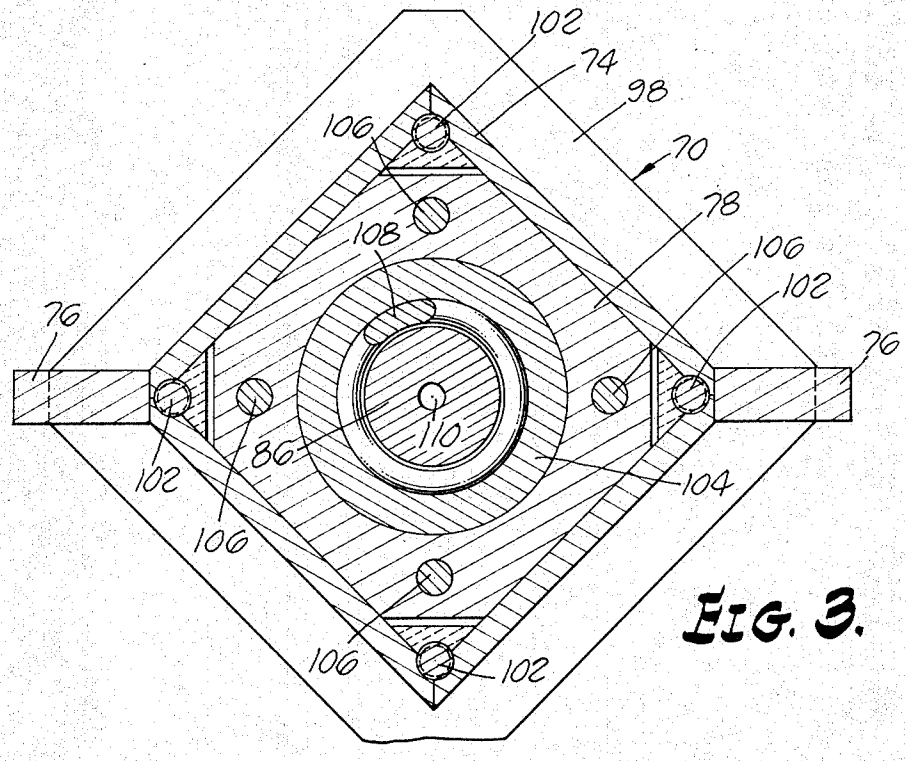

102
74
98
106
70
78
108
106
102
76
76
110
86
104
102
106
106
102

FIG. 3.

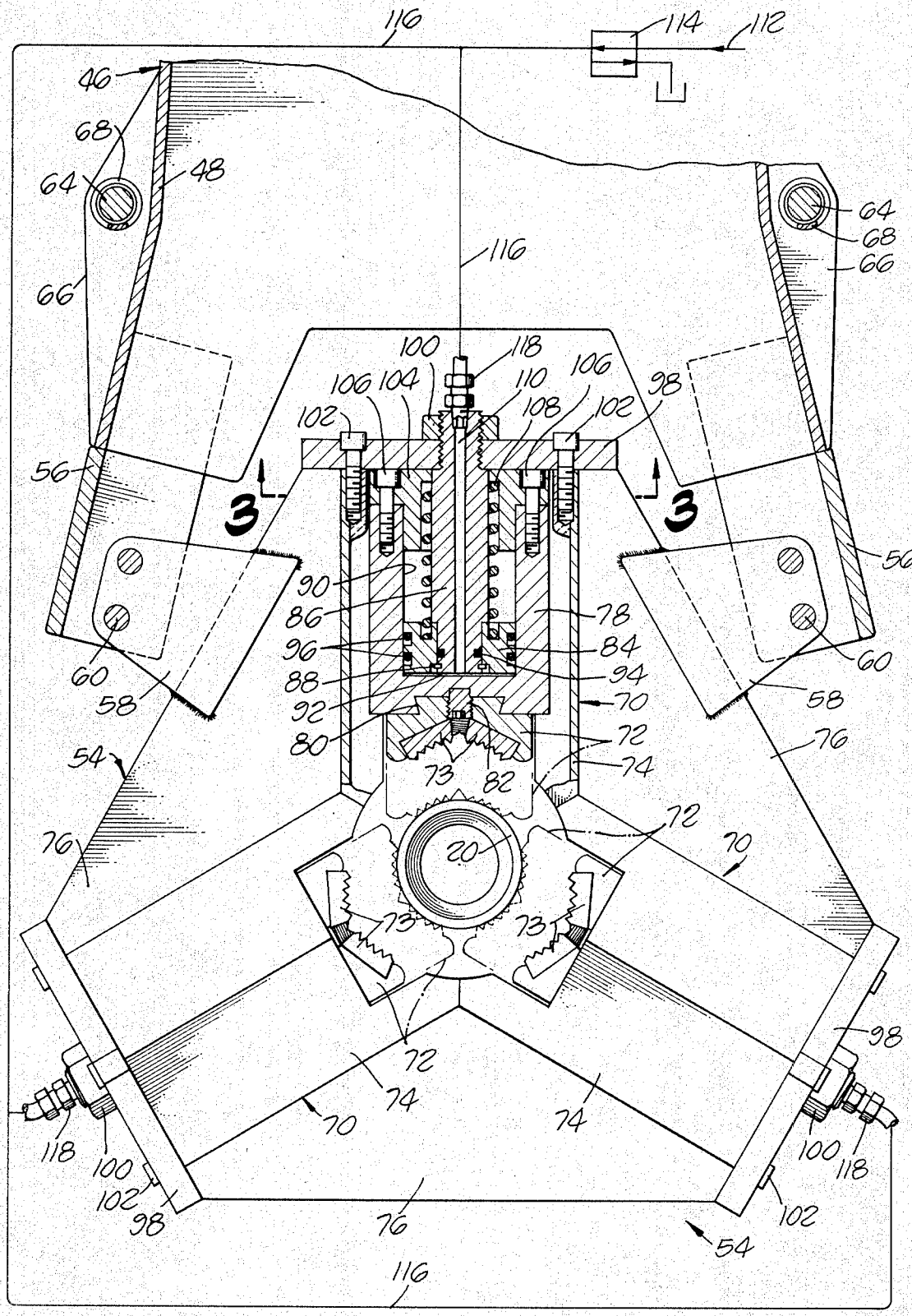

116
114
112
46
68
64
48
66
100
118
106
104
110
108
102
98
56
3
90
86
96
88
92
80
78
84
94
70
72
74
73
82
60
58
54
76
20

FIG. 2.

HYDRAULIC PIPE TONG APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to pipe tongs, and more particularly to an improved hydraulic pipe gripping back-up tong adapted to be employed in combination with a power driven tong so that the parts of a well pipe may be connected or disconnected, the pipe gripping means of the back-up tong having application as well to other pipe tongs. The pipe gripping means employs a fixed piston unit cooperating with a movable combination cylinder and jaw carrying unit equipped with pipe gripping jaws.

The present invention pertains to improvements in back-up tongs such as disclosed in U.S. Pats. No. 3,246,547, No. 3,302,496 and No. 3,507,174, and which may be utilized with pipe handling apparatus such as disclosed in U.S. Pats. No. 3,505,913, No. 3,516,308 and No. 3,540,326, for example.

SUMMARY OF THE INVENTION

The present invention provides pipe gripping apparatus wherein the pipe gripping force may be varied independently of torque applied to connect or disconnect pipe.

The present invention also provides pipe gripping apparatus of relatively simple and inexpensive construction.

The present invention further provides pipe gripping apparatus wherein the size and number of pipe gripping units employed in the apparatus may be readily varied within specified dimensional limits to accommodate different torque requirements.

The foregoing and other provisions and advantages reside in pipe tong apparatus of the present invention comprising a support frame having a center adapted to receive pipe and pipe gripping means carried by the support frame including a hydraulic piston disposed radially toward said center and supported in fixed relation within the frame through a piston rod. A movable combination cylinder and pipe jaw is fitted around the piston for radial movement toward and away from gripping relation with the pipe. The piston and cylinder defines a fluid pressure chamber communicating with pressuring means for introducing fluid under pressure into said chamber to move said cylinder and pipe jaw into gripping engagement with said pipe. Retraction means is provided to move the cylinder and pipe jaw away from the pipe.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is an elevational view showing a power tong and a back-up tong adapted to be utilized with pipe being inserted and withdrawn from a well bore;

FIG. **2** is a partially sectional and fragmentary plan view of the back-up tong as taken along the line **2—2** of FIG. **1**, and

FIG. **3** is a fragmentary sectional view taken along the line **3—3** of FIG. **2**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. **1**, there is generally illustrated a back-up tong assembly **10** and a power tong assembly **12** adapted to be supported above the floor (not shown) of the usual well drilling unit mounted above a well bore. Pipe, such as drill pipe or casing, is adapted to be run into and pulled from the well bore. Such a pipe is illustrated in FIG. **1** as including an upper stand of pipe **14** in the illustrative form of a stand of drill pipe having a tool joint pin end **18** thereon adapted to be threadedly connected by the tong **12** to the box end **20** of a length or stand of the pipe **16** disposed in the well bore. In order to support the tong assembly **12** in an operative position above the well bore so that the stand of pipe **14** may be lowered therethrough for engagement with the pipe **16,** a suitable crane **22** is provided, including a boom **24** projecting from a vertically disposed post **26.** A cable **28** extends over sheaves **30** and is connected to a pressure operated cylinder mechanism **32** disposed within the post **26,** whereby the tong assembly **12** may be raised and lowered relative to the post **26** and thereby relative to the well bore into which or from which pipe is being removed. Also forming a part of the crane **22** is a counterweight **34** slidable vertically along the post **26,** there being a second cable **36** also connected to the upper end of cylinder **32,** extending over a sheave **38,** and connected also to the counterweight **34** so that the mass of the tong assembly may be properly supported. This crane assembly may be of any desired type such as herein shown and in accordance with the disclosure in U.S. letters Pat. No. 3,505,913, for example.

The tong assembly, as is typical of tongs of the type here involved, includes a head section generally denoted at **40** and a supporting and power transmission section generally denoted at **42.** The power transmission section in the illustrative embodiment has a hydraulic motor **44** adapted to be connected to a suitable source of motive fluid under pressure (not shown) so as to drive the transmission mechanism of the tong assembly, which may be of any desired type, but which may be constructed in accordance with the disclosure in the U.S. letters Pat. No. 3,516,308, for example. The head section **40** of the tong assembly **12** may be of any desired type of tong head mechanism adapted to grip and effect rotation of the pin end **18** of the pipe while the box end **20** of the pipe **16** is held against rotation either in the usual rotary table slips or by the back-up tong assembly generally denoted at **10,** made in accordance with the invention and hereinafter to be more fully described. The tong head **40** may be made in accordance with the disclosure in U.S. letters Pat. No. 3,540,326, for example.

The back-up tong assembly **10,** as best illustrated in FIGS. **1** and **2,** includes a support structure **46** comprising an elongated hollow case **48** supported at its rear end **50** by a post **52** depending from the power tong assembly **12.** If desired, as will be appreciated by those skilled in the art, the post **52** may be connected to a torque indicating mechanism (not shown) including a gauge which will show the angular force applied to the back-up tong **10** tending to cause angular movement of the support structure **46,** as an indication of the connecting torque applied to pipe joints held by the back-up tong, by rotation of the power tong assembly **12.**

At the forward end of the support structure **46** is a back-up tong head assembly generally denoted at **54,** the support structure **46** including brackets **56** connected to ears **58** formed as part of the head assembly **54** by bolts **60.** This head end of the back-up tong assembly is also, in the illustrative embodiment, supported beneath the power tong assembly **12** by means

of ears **62** projecting from the sides of the tong assembly **12** and supporting bolts **64** which extend through outwardly extended gussets **66** carried by the suport structure. Coiled springs **68** are provided between the gussets **66** and the ears **62,** and the gussets **66** and the bolts **64,** to cushion relative vertical movement between the head **40** of the power tong assembly **12** and the head **54** of the back-up tong assembly **10.**

Referring more particularly to FIGS. **2** and **3,** back-up tong head assembly **54** is seen to include hydraulic pipe gripping units **70,** each having a jaw unit **72** disposed to converge toward a common point which ordinarily would be the center of the pipe **16** when box end **20** is moved into head assembly **54.** Each jaw unit carries one or more mortise and tenon mounted pipe dies **73,** as shown, for ready removal and replacement. In the illustrated embodiment, three of such gripping units are preferably provided. It will be understood, however, that as few as two jaw units **72** may be employed with one of such jaws being movable through a gripping unit **70** and the other of such jaws being fixed within head **54.** The provision of two to several movable jaw units **70** are preferred, however, so that all the jaws may be retracted to give optimum clearance for movement of the well pipe through head **54.**

Each gripping unit **70** includes a cylinder guide **74** with the three provided cylinder guides being joined as by welding through gusset members **76** to form the main body or frame of head **54** as shown. The head assembly ears **58** are mounted from two of the gusset members **76** as shown to mount head **54** with support structure **46** as previously mentioned. It is to be noted that head unit **54** may be of welded construction as shown or integrally formed as a casting or forging, depending on production and service factors.

As shown in FIG. **3,** the cylinder guide **74** may be of generally rectangular shape in section. Reciprocably mounted within cylinder guides **74** is a movable jaw carrying cylinder **78** which mounts the jaw unit **72** through a mortise and tenon structure **80** including a lock screw **82** as shown. Each jaw unit **72** includes one or more pipe gripping dies **73** also mounted through a mortise and tenon arrangement as shown. The exterior of cylinder **78** is of rectangular configuration to register within guide **74** in a manner preventing rotation of the cylinder within the guide.

A cylindrical piston **84** is mounted and retained on the distal end of a piston rod **86** by means of a snap ring **88** as shown and mounted within a cylindrical blind bore **90** defined within cylinder **78.** The blind end of bore **90,** the piston **84** and the piston rod **86** define a pressure chamber **92** which is rendered fluid tight by a seal ring **94** mounted between the piston rod and the piston and seal rings **96** mounted between the piston and the cylindrical wall of bore **90** as shown.

The supporting end of piston rod **86** is joined by threaded connection through a support member or plate **98** and retained by a threaded nut **100.** Support member **98** is connected to cylinder guide **74** and head assembly **54** by means of fasteners such as cap screws **102.** As can be seen, the piston **84** and piston rod **86** are fixed and immovable with respect to the head assembly **54.**

A flanged bushing **104** is mounted within the bore **90** of cylinder **78** and about piston rod **86** to align the piston and piston rod within the cylinder and also to retain the piston within the bore. The bushing **104** is retained in position by means of fasteners such as cap screws **106** extending through an outer flange of the bushing and into threaded connction within the wall of cylinder **78.** A cylinder return spring **108** is disposed around piston rod **86** and confined in compression between a flange formed within bushing **104** and the rear of piston **84** to urge the bushing **104** and attached cylinder **78** into retracted position against support member **98.**

A passage **110** is longitudinally defined through piston rod **86** to provide fluid communication through the piston rod into chamber **92.**

When fluid under pressure, oil for example, is introduced through passage **110** into chamber **92,** cylinder **78** and jaw unit **72** for each of the pipe gripping units **70** is displaced inwardly to concurrently converge into gripping contact with pipe box end **20.** The gripping force corresponds to the fluid pressure introduced into chamber **92.** In the embodiment of FIGS. **2** and **3,** the operating pressures may be in the range of 500–2,500 p.s.i. (35–175 kilograms/sq. centimeter), for example.

When the pressure is released from chamber **92,** the resilience of spring **108** imposed against the bushing **104** displaces the fluid out of chamber **92** through passage **110** and returns cylinder **78** into retracted position with bushing **104** abutting support member **98.** Thus, each cylinder **78** and jaw unit **72** is moved from retracted position to gripping posiiton and return by periodic admission of fluid under pressure into chamber **90.**

A source of fluid under pressure **112** is connected through a manual or remotely operated switching valve **114** through conduits **116** and fluid fittings **118** into respective communication with each of passages **110.** Valve **114** is also connected to a return sump as shown. With valve **114** in a first position, fluid under pressure is admitted into each of the chambers **92,** causing each of the cylinders **78** and jaw units **72** to extend and converge into gripping relation with pipe box end **20.** When valve **114** is switched to a second position the pressurized fluid is blocked off and the fluid in chambers **92** is free to flow into the return sump. Thus periodic switching of valve **114** causes periodic gripping and release of pipe gripping units **70** as desired.

In operation of the back-up tong assembly **10** in combination with a power tong assembly **12,** the assembly **12** will be operated to grip and rotate a joint of pipe in either a righthand or lefthand direction respectively, when a pipe joint is to be connected or disconnected. During the initial or final stages of rotation, as applicable, the back-up tong unit may remain idle. However, when the tool joints **18** and **20** shoulder together, as when connecting, or need to be broken apart as when disconnecting, the back-up tong unit **10** is employed to apply high torque resistant forces to the tool joint box end **20** in either direction, as necessary, while torque is applied to pipe pin end **18** by power tong **12.**

Following the above described jaw engaging operations, the back-up jaw units **72** will remain retracted in response to the springs **108.**

The foregoing description and drawing will suggest other embodiments and variations to those skilled in the art, all of which are intended to be included in the spirit of the invention as herein set forth.

That being claimed is:

1. Pipe tong apparatus comprising a horizontal support frame providing a central opening adapted to receive a vertically disposed length of pipe; pipe gripping

means carried by said support frame, said pipe gripping means including a plurality of horizontally and radially disposed pipe gripping units arcuately arranged about said central opening, each of said pipe gripping units having a cylinder guide carried by said support frame and providing a radially extending guideway therein, said guideway being rectangular in cross-section normal to its radial dimension, a blind cylinder disposed in said guideway and having a rectangular cross-section complemental to the cross-section of said guideway for preventing rotation of said cylinder within said guideway, the blind end of said cylinder facing said central opening, pipe engaging jaw means mounted on said blind end, said cylinder being slidable in said guideway to move said jaw means into and out of engagement with a length of pipe in said opening, a piston fitted within said cylinder, a piston rod having one end fixed to said piston and the other end fixed to said frame, said piston and said cylinder defining a fluid pressure chamber at said blind end of said cylinder, fluid pressure manifold means for simultaneously introducing fluid under pressure into the fluid pressure chambers of all of said pipe gripping units to slide their respective cylinders towards a pipe disposed in said central opening, thereby to move their respective jaw means into gripping engagement with the pipe, and retraction means associated with each of said units for sliding their respective cylinders away from the pipe, thereby to move their respective jaw means out of engagement with the pipe.

2. The apparatus of claim **1** wherein said retraction means comprises a coil spring mounted in compression between the rear of said piston and the rear of said cylinder.

3. The apparatus of claim **1,** wherein said manifold means includes a fluid passage defined through said piston rod to the exterior of said frame.

4. The apparatus of claim **3** including a fluid switching valve connected through conduit means and said passage into communication with said chamber and adapted for connection with a fluid pressure source to switch fluid under pressure into and out of said chamber.

5. The apparatus of claim **1** wherein said support frame includes gusset means connecting said pipe gripping units together.

6. The apparatus of claim **1** wherein said jaw means is removable from said cylinder and at least one pipe die is removably mounted in said jaw means.

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