Sept. 9, 1958 C. B. GREER 2,851,110

WELL JARS

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Fig. 1

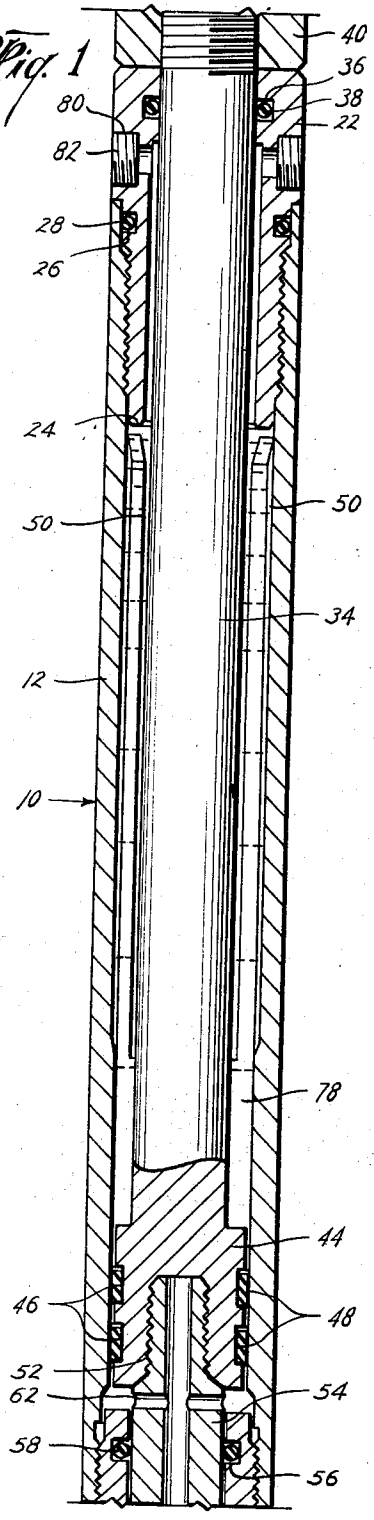
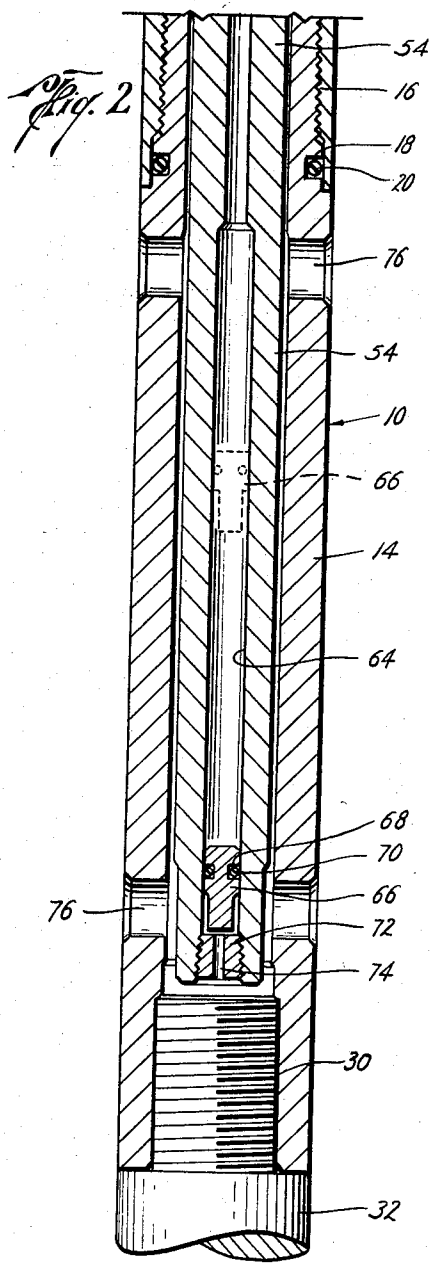


Fig. 2



Cecil B. Greer
INVENTOR.

BY Charles E. Lightfoot
ATTORNEY

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Fig. 3

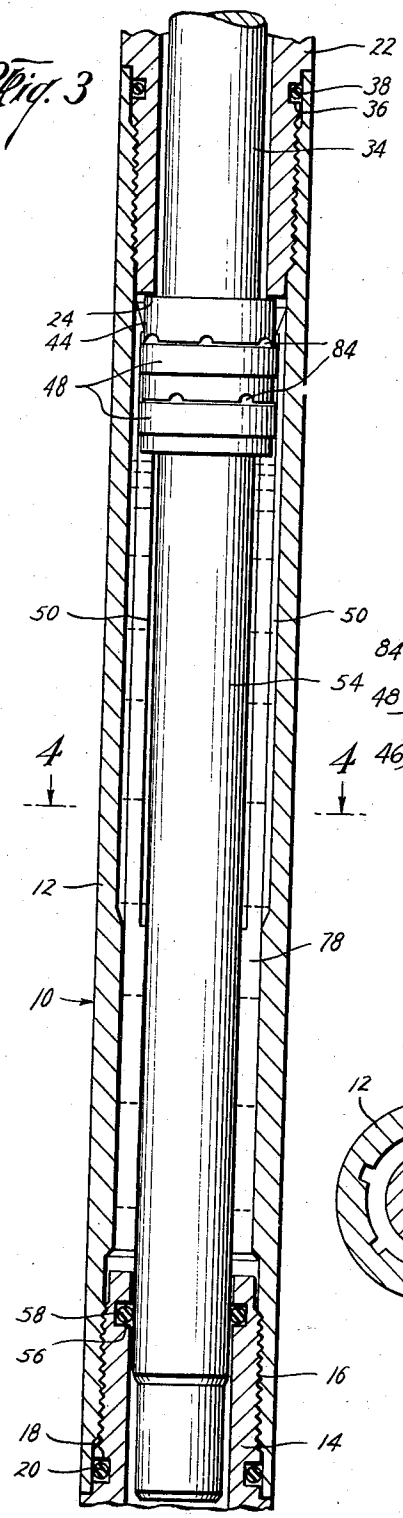


Fig. 5

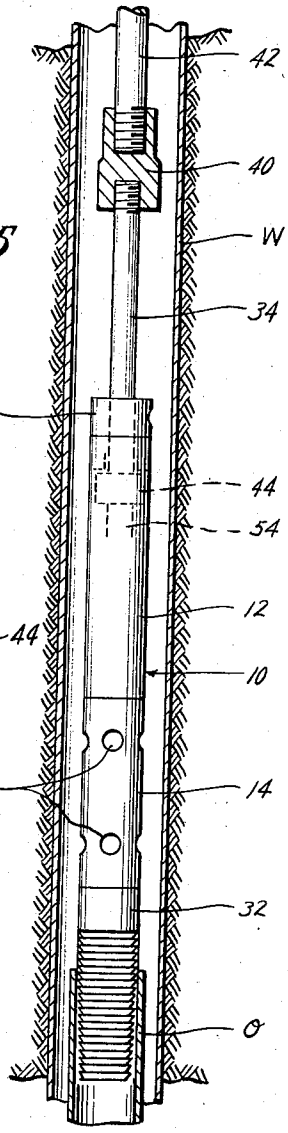


Fig. 6

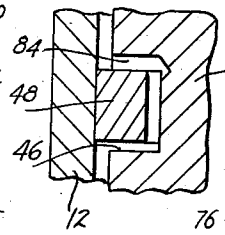
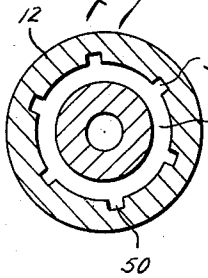


Fig. 4



Cecil B. Greer
INVENTOR.

BY Charles E. Lightfoot
ATTORNEY

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WELL JARS

Cecil B. Greer, Houston, Tex., assignor to Independent Tool Company, Houston, Tex., a partnership

Application August 31, 1954, Serial No. 453,243

5 Claims. (Cl. 166—178)

This invention relates to well jars, and more particularly to jars of the hydraulic type having inner and outer telescopingly arranged parts, movable longitudinally relative to each other and forming a closed fluid chamber, one of said parts having a piston thereon which is movable in the chamber and the other of the parts having means thereon forming a restriction in the chamber into and out of which the piston is movable.

In jars of this type the chamber is filled with a suitable liquid, such as oil, whereby upon the exertion of a force on the parts tending to move the parts longitudinally relative to each other, the flow of liquid from one end of the chamber to the other is restricted while the piston is in the restriction, thus resisting such movement of the parts.

When the piston moves beyond the restriction the liquid may then flow freely past the piston, thus releasing the force exerted on the parts and permitting the parts to move suddenly longitudinally relative to each other to the limit of such movement to perform a jarring action.

One difficulty encountered in the use of jars of this type, as heretofore constructed, is that it is often very difficult to maintain the chamber entirely filled with liquid due to the development of bubbles of air or vapor in the chamber, which results in faulty operation of the jar. Moreover, fluid tight seals must be maintained between the parts at the ends of the chamber resulting in slight variations in chamber volume due to leakage of the liquid or the entrance of air or the like past the sealing means, or from other causes, which likewise interferes with the efficient operation of the jars.

The present invention has for an important object the provision of a jar structure whereby the above difficulties are overcome and wherein means is provided for maintaining the fluid chamber of the jar at all times completely filled with liquid.

A further object of the invention is to provide a hydraulic jar having means for compensating for changes in the volume of the liquid contained in the fluid chamber formed between the inner and outer parts.

Another object of the invention is the provision of a jar of the type referred to embodying means for substantially equalizing the pressure within the fluid chamber of the jar and the pressure of the external well fluid surrounding the jar, whereby the pressure exerted on the seal forming means between the parts will be substantially balanced.

A further object of the invention is to provide hydraulic jarring mechanism of the type mentioned embodying means for preventing the hydrostatic head of fluid in the well from affecting the operation of the equipment when carrying out a jarring operation.

A still further object of the invention is to provide hydraulic jarring mechanism of simple design and rugged construction, having few parts and capable of long withstanding the extreme conditions of hard usage and exposure to which equipment of this character is customarily subjected.

The above and other important objects and advantages

of the invention may best be understood from the following detailed description, constituting a specification of the same, when considered in conjunction with the annexed drawings, wherein—

Figures 1 and 2 are fragmentary elevational views, partly in vertical, central, cross-section and partly broken away, illustrating a preferred form of the invention and showing the parts in the retracted condition of the tool preparatory to the performing of a jarring action, Figure 2 being a downward continuation of Figure 1;

Figure 3 is a view similar to that of Figure 1, showing the relative positions of the parts at the completion of a jarring action of the tool;

Figure 4 is a cross-sectional view, taken along the line 4—4 of Figure 3, looking in the direction indicated by the arrows;

Figure 5 is a vertical, central, cross-sectional view of a well showing the invention in assembled condition therein and indicating the manner in which the tool is operated; and

Figure 6 is a fragmentary, cross-sectional view, on an enlarged scale, showing details of construction of the one-way seal employed in the invention.

Referring now to the drawings in greater detail, the numeral **10** designates an outer tubular part, or barrel, which may conveniently be made up of upper and lower tubular sections **12** and **14**, threadably connected together as indicated at **16**, the lower section being provided with an external annular groove **18**, for the reception of suitable packing means such as the O-ring indicated at **20**, to form a fluid tight seal between the sections. The upper tubular section **12** is internally threaded at its upper end, for the connection thereto of an externally threaded tubular head element **22**, whose lower end extends within the upper section, to provide an impact face **24**, for a purpose later to be made apparent. The head element **22** is provided with an external annular groove **26**, for the reception of suitable packing means, such as the O-ring **28**, forming a fluid tight seal between the head element and the upper tubular section.

At its lower end the lower tubular section **14** is internally threaded, as indicated at **30**, for the attachment thereto of any desired well equipment, such as a spear or other fishing tool indicated at **32**.

An inner part or mandrel **34** extends downwardly through the head element **22** into the upper section **12**, for longitudinal sliding movement relative thereto, the head element being provided with an internal annular groove **36**, for the reception of suitable packing means such as the O-ring **38**, forming a fluid tight seal between the head and mandrel. The mandrel or stem **34** extends upwardly beyond the head element **22** and is externally threaded at its upper end for the attachment thereto of a connector member **40**, whereby the mandrel may be connected to the lower end of an operating string **42**, extending to the surface of the ground. The lower end of the connector member **40** may be positioned for engagement with the upper end of the head element **22**, to limit downward movement of the mandrel in the outer part.

The section **12** and the mandrel **34** form between them a fluid containing chamber, and within the section **12**, the mandrel **34** is provided with an enlargement **44**, forming a piston, which may have external annular grooves **46**, for the reception of suitable packing means, such as the packing rings **48**. The upper section **12** is provided with internal longitudinal grooves **50**, forming passageways therein whose lower ends terminate in spaced relation to the lower end of the upper section, and through which fluid within the outer part may flow past the piston when the piston is opposite the grooves. It will be apparent that when the piston **44** is in a position below the lower ends of the grooves **50**, the packing rings **48** will be

in sealing engagement with the interior of the upper section 12, so that downward flow of fluid past the piston will be restricted.

The piston 44 has an internally threaded counterbore 52, for the attachment thereto of a tubular extension 54, which extends downwardly from the piston within the lower tubular section 14, the lower tubular section being provided with an internal annular groove 56, for the reception of suitable packing means, such as that indicated at 58, forming a fluid tight seal between the extension and the lower section. The extension 54 is provided with one or more openings 62, leading from the exterior to the interior thereof, above the upper end of the lower tubular section 14.

The tubular extension 54 has an enlarged counterbore 64 opening outwardly at its lower end, within which a plug 66 is movably positioned. This plug element having an external annular groove 68 for the reception of suitable packing means, such as the O-ring 70, which forms a fluid tight seal between the plug element and the interior of the counterbore. It will be apparent that a fluid chamber 78 is formed by the parts within the jar mechanism, between the upper packing 38 at the upper end of the tubular section 12, and the packing 70 of the plug 66 in the counterbore 64, which chamber may be filled with a suitable liquid, such as oil. The lower end of the counterbore 64 may be closed by a screw plug 72, having a passageway 74 therethrough, whereby well fluid may enter the counterbore beneath the plug 66.

The lower tubular section 14 is provided with suitable openings 76, through which well fluid may enter the lower section in surrounding relation to the extension 54, therein, such fluid also entering the counterbore 64 beneath the plug 66 therein through the passageway 74 of the plug 72.

The head element 22 may conveniently be provided with openings 80, closed by suitable screw plug 82, whereby the fluid chamber 78 previously described may be filled with liquid.

In making use of the jar, constructed as described above, the mandrel or stem 34 may be connected to the operating string 42, by the coupling member 40, in the manner indicated in Figure 5, whereupon the equipment may be lowered in a well to engage the fishing tool 32 with an object, indicated at O, to be removed from the well. By downward movement of the operating string 42, the mandrel 34 may be moved downwardly to move the piston 44 downwardly in the tubular section 12, the fluid in the chamber 78 flowing upwardly through the grooves 50, past the piston, until the piston moves below the lower ends of the grooves. The piston 44, and packing elements 48, preferably form a seal of a conventional one-way type, constructed to permit a relatively rapid flow of liquid from beneath the piston to above the same, upon downward movement of the piston in the inner part below the grooves 50, and to form a relatively tight seal between the piston and the interior of the section 12, below the grooves therein, when the piston moves upwardly relative to the outer part, whereby the piston may be moved downwardly, rapidly, to its lowermost position, but upward movement of the piston will be resisted until the piston moves to a position to permit the free flow of liquid past the piston through the grooves 50.

A conventional type of one-way seal which may be employed with the invention is illustrated in Figure 6, wherein the piston 44 has one or more radially extending passageways 84 which open into each of the grooves 46 at one side wall of the groove and which open at their outer ends to the exterior of the piston. By this arrangement when the mandrel moves downwardly relative to the barrel the piston rings 48 will be in their uppermost position in the grooves to permit fluid in the chamber to flow through the grooves past the rings and out of the passageways 84, and when the mandrel moves upwardly relative to the barrel the rings 48 will be in contact with the lower side walls of the grooves to shut off such flow of fluid through the grooves.

By exerting an upward pull on the operating string 42, with the piston in its lowermost position in the upper section 12, as seen in Figure 1, the operating string may be placed under tension, the mandrel moving upwardly in the upper section 12 against the resistance of the liquid in the chamber 78 above the piston, as this liquid leaks past the packing elements 48, until the piston moves past the lower ends of the grooves 50. As soon as the piston reaches a point at which liquid may flow past the piston through the grooves 50, the resistance to upward movement of the mandrel will be suddenly removed, whereupon the piston will be moved upwardly suddenly into engagement with the lower end of the head element 22 to perform a jarring action.

It will readily be seen that any change in volume of the liquid in the chamber 78, due to slight leakage of the liquid past the packing elements at the ends of the chamber, or from other causes will result in upward movement of the plug 66 in the counterbore 64 of the extension 54, due to the pressure of well fluid on the lower side of the piston element, thus maintaining the chamber at all times completely filled with liquid. Moreover, the pressure exerted by the well fluid surrounding the jar on the plug 66 will be balanced by the pressure of the liquid in the chamber, thus tending to reduce the force exerted on the packing at the ends of the chamber, so that there is less likelihood of leakage of liquid into or out of the chamber.

It will thus be seen that the invention provides hydraulic jarring mechanism of improved design and operating characteristics, which is of economical manufacture, and wherein the parts are easily replaceable for purposes of maintenance and repair.

While the invention has been disclosed herein in connection with a certain specific embodiment of the same, it will be understood that this is intended by way of illustration only, and that numerous changes can be made in the construction and arrangement of the various parts, without departing from the spirit of the invention or the scope of the appended claims.

Having thus clearly shown and described the invention what is claimed as new and desired to secure by Letters Patent is—

1. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, said mandrel being spaced radially inwardly from the barrel to form between the barrel and mandrel a fluid containing chamber, a fluid filling said chamber, a piston on the mandrel in said chamber, sealing means between the barrel and the mandrel at the ends of the chamber, said barrel having an internal longitudinal groove in the chamber terminating at one end in spaced relation to one end of the chamber, said piston being movable upon relative longitudinal movement of the barrel and mandrel to one position opposite said groove to permit the free flow of fluid through the groove past the piston and to another position beyond said one end of the groove to restrict such flow the annulus of said piston being spaced from the inner wall of the barrel to permit restricted flow of fluid around said piston as the piston moves in said chamber beyond said one end of said groove, said mandrel having a passageway in communication with the interior of the chamber and opening exteriorly thereof, movable means in said passageway closing the passageway and means in the passageway positioned for engagement with said movable means to limit movement of said movable means toward the exterior end of said passageway.

2. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, said mandrel being spaced radially inwardly from the barrel to form between the barrel and mandrel a fluid containing

chamber, a fluid filling said chamber, a piston on the mandrel in said chamber, sealing means between the barrel and mandrel at the ends of the chamber, said barrel having an internal longitudinal groove in the chamber terminating at one end in spaced relation to one end of the chamber, said piston being movable upon relative longitudinal movement of the barrel and mandrel to one position opposite said groove to permit the free flow of fluid through the groove past the piston and to another position beyond said one end of the groove to restrict such flow the annulus of said piston being spaced from the inner wall of the barrel to permit restricted flow of fluid around said piston as the piston moves in said chamber beyond said one end of said groove, said mandrel having a passageway in communication with the interior of the chamber at one side of the piston and opening exteriorly of the chamber, movable means in said passageway closing the passageway and means in the passageway positioned for engagement with said movable means to limit movement of said movable means toward the exterior end of said passageway.

3. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, said mandrel being spaced radially inwardly from the barrel to form between the barrel and mandrel a fluid containing chamber, a fluid filling said chamber, a piston on the mandrel in said chamber, sealing means between the barrel and mandrel at the ends of the chamber, said barrel having an internal longitudinal groove in the chamber terminating at one end in spaced relation to one end of the chamber, said piston being movable upon relative longitudinal movement of the barrel and mandrel to one position opposite said groove to permit the free flow of fluid through the groove past the piston and to another position beyond said one end of the groove to restrict such flow the annulus of said piston being spaced from the inner wall of the barrel to permit restricted flow of fluid around said piston as the piston moves in said chamber beyond said one end of said groove, said mandrel including a tubular extension whose interior is in communication with the interior of the chamber and opening exteriorly thereof, movable means in the extension closing the extension and means in said extension positioned for engagement with said movable means to limit movement of said movable means away from said chamber.

4. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, said mandrel being spaced radially inwardly from the barrel to form between the barrel and mandrel a fluid containing chamber, a fluid filling said chamber, a piston on the mandrel in said chamber, sealing means between the barrel and mandrel at the ends of the chamber, said barrel having an internal longitudinal groove in the chamber terminating at one end in spaced relation to one end of the chamber, said piston being movable upon relative longitudinal movement of the barrel and mandrel to one position opposite said groove to permit the free flow of fluid through the groove past the piston and to another position beyond said one end of the groove to restrict such flow the annulus of said piston being spaced from the inner wall of the barrel to permit restricted flow of fluid around said piston as the piston moves in said chamber beyond said one end of the groove, said mandrel including a tubular extension in the barrel whose interior is in communication with the interior of the chamber and opening exteriorly thereof, movable means in the extension closing the extension, said barrel having an opening externally of the chamber in communication with the exterior of the barrel and with the interior of the extension outwardly of said movable means and means on said extension positioned for engagement with said movable means to limit movement of said movable means away from said chamber.

5. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, said mandrel being spaced radially inwardly from the barrel to form between the barrel and mandrel a fluid containing chamber, a fluid filling said chamber, a piston on the mandrel in said chamber, sealing means between the barrel and mandrel at the ends of the chamber, said barrel having an internal longitudinal groove in the chamber terminating at its lower end in spaced relation to the lower end of the chamber, said piston being movable upon relative longitudinal movement of the barrel and mandrel to one position opposite said groove to permit the free flow of fluid through the groove past the piston and to another position below the lower end of the groove to restrict such flow the annulus of said piston being spaced from the inner wall of the barrel to permit restricted flow of fluid around said piston as the piston moves in said chamber beyond the lower end of said groove, a tubular extension on the mandrel extending below the piston in the barrel and whose interior is in communication with the interior of the chamber and with the interior of the barrel beyond the chamber, movable means in the extension closing the extension, said barrel having an opening in communication with the interior of the barrel beyond the chamber and with the exterior of the barrel and means in said extension positioned for engagement with said movable means to limit movement of said movable means away from said chamber.

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