April 1, 1958 C. B. GREER 2,828,822

WELL JAR

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Fig. 1A

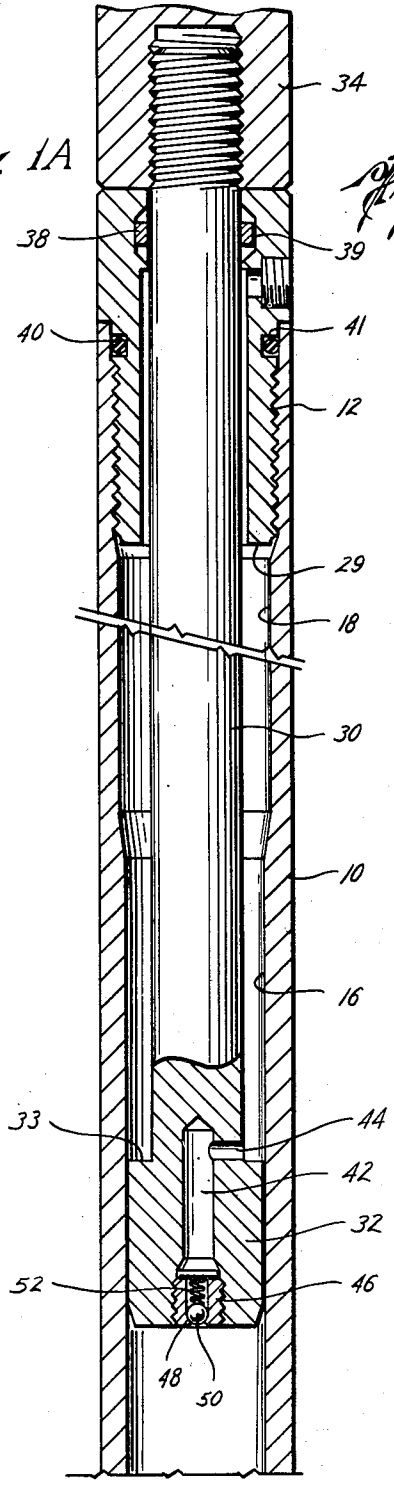
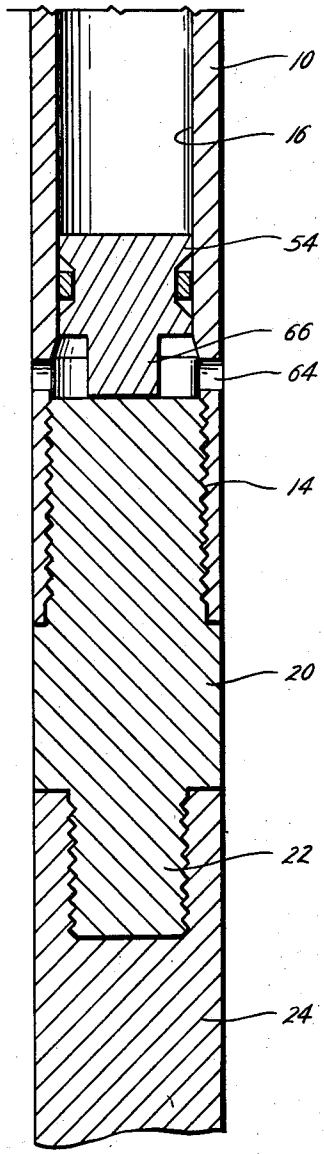



Fig. 1B




Cecil B. Greer
INVENTOR.

BY Charles E. Lightfoot
ATTORNEY

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Fig. 2

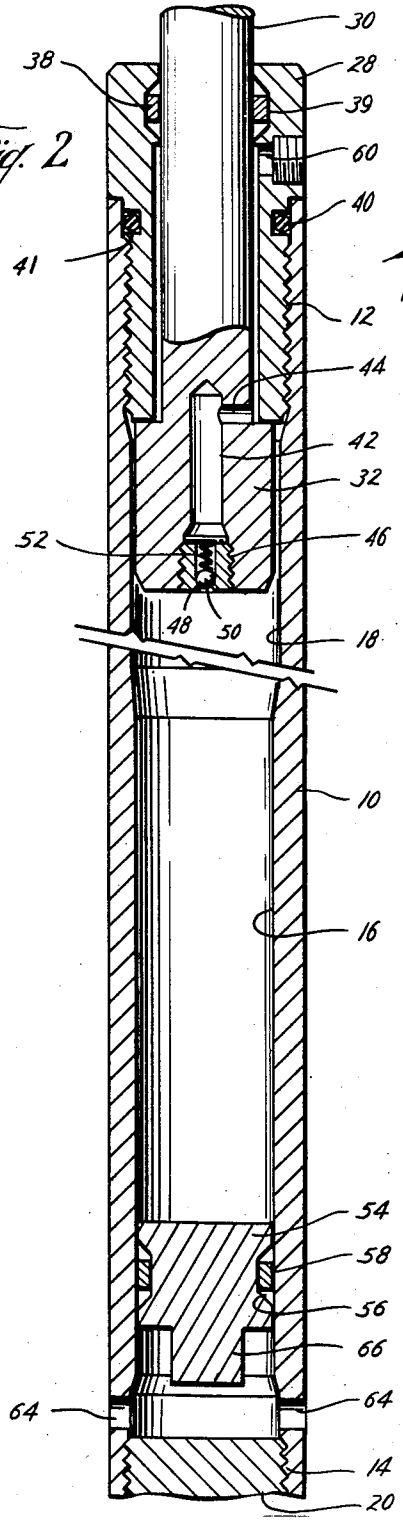
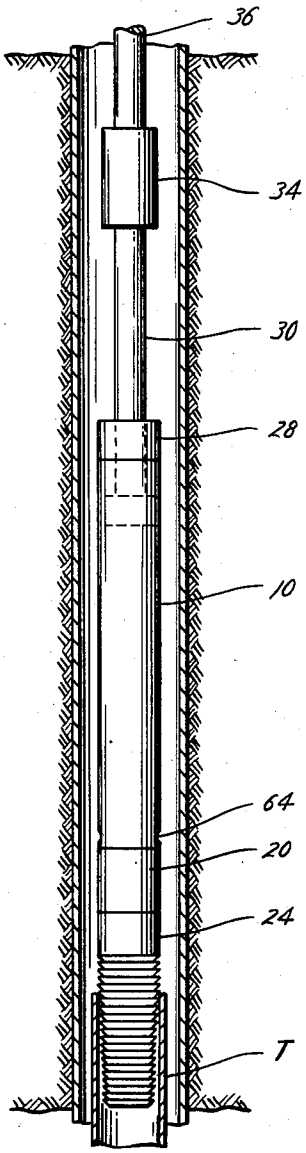



Fig. 3

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INVENTOR.

BY Charles E. Lightfoot
ATTORNEY

United States Patent Office 2,828,822 Patented Apr. 1, 1958



2,828,822

# WELL JAR

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

Application January 31, 1955, Serial No. 484,961

6 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 a portion of reduced internal diameter 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 portion of reduced internal diameter, thus resisting such movement of the parts.

When the piston moves beyond the portion of reduced internal diameter 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 wherein means is embodied for counteracting the external pressure exerted on the seal forming means between the parts by well fluid surrounding the jar.

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 1A and 1B are fragmentary, elevational, vertical, central, cross-sectional views illustrating a preferred form of the invention, showing the relative positions of the parts in the fully retracted condition of the tool, Figure 1B being a downward continuation of Figure 1A;

Figure 2 is a view similar to those of Figures 1A and 1B showing the relative positions of the parts in the extended condition of the tool; and

Figure 3 is an assembly view, on a somewhat reduced scale, illustrating the manner in which the invention is used and showing the same in use in a well with the parts in extended positions at the completion of a jarring movement.

Referring now to the drawings in greater detail, the numeral **10** designates an outer tubular part, or barrel, whose upper and lower end portions are internally threaded, as indicated at **12** and **14**, respectively, and which is formed with a portion **16** of reduced internal diameter, above which is a portion **18** of greater internal diameter than that of the portion **16**.

A connector member **20** is threadably attached to the lower end of the barrel and is provided with an externally threaded, reduced end portion **22** to which a fishing tool, such as a spear, indicated at **24** may be connected, whereby the equipment may be connected to an object, such as the tubing T, which is to be removed from a well.

At its upper end the barrel is threadably connected to a tubular plug **28**, through which the inner part or mandrel **30** of the tool is slidably extended.

The inner part or mandrel **30** may take the form of a solid shaft having an external enlargement **32** at its lower end, forming a piston movably disposed in the barrel, and which is of a size to fit into the reduced portion **16** thereof, but which is substantially smaller in external diameter than the internal diameter of the enlarged portion **18**, so that the piston may move freely in the latter. The external periphery of the piston is spaced slightly radially inwardly of the interior wall of the cylindrical portion **16** to permit the flow of fluid around the piston from one side to the other thereof as the piston moves in the portion **16**. The mandrel is threadably connected at its upper end to a connector member **34**, which may in turn be connected to the lower end of an operating string of tubing, or to a rod or wire line, as indicated at **36**, whereby the tool may be suspended in a well bore.

Suitable packing, such as that indicated at **38**, which is positioned in a groove **39** provided therefor in the plug **28**, forms a fluid tight seal between the plug and inner part. Packing means, such as the O-ring **40**, is positioned in an external groove **41** in the plug **28** to form a fluid tight seal between the plug and the barrel.

The piston **32** has a central longitudinal passageway **42** therein which opens outwardly at its lower end, and with which a lateral passageway **44** in the inner part **30** communicates, passageway **44** also opens outwardly of the inner part above the upper end of the piston. A tubular plug **46** is threaded into the lower end of the passageway **42**, which plug has an internal valve seat **48** therein, and a valve, such as the ball **50** is movably disposed in the plug in position to be urged into closing relation to the seat by a coil spring **52** within the plug. The valve **50** thus operates as an inwardly opening check valve in the piston **32** to close the passageway **42** against the flow of fluid downwardly therethrough. The piston has an impact face **33**, and the lower end of the plug **28** has an impact face **29** positioned for engagement with the face **33**, when

the barrel and mandrel reach the limit of their relative longitudinal movement in a direction to increase the length of the tool.

Within the reduced portion 16 of the barrel, beneath the piston 32 of the inner part, a movable piston member 54 is positioned, which has an external annular groove 56 within which suitable packing, such as that indicated at 58 is located, to form a fluid tight seal between the member and the interior wall of the barrel. It will be apparent that the internal space within the barrel between the packing 58 of the member 54 and the packing 38 of the plug 28 forms a fluid containing chamber, whose volume may be varied by movement of the piston member 54 longitudinally in the barrel.

The plug 28 is also provided with an opening 60, which may be closed by a screw plug 62, and through which the internal chamber of the barrel may be completely filled with liquid.

Near its lower end the barrel also has one or more openings 64, through which well fluid may enter the barrel beneath the piston member 54, and the member 54 may be formed with a downwardly projecting portion 66 positioned to engage the upper end of the connector member 20 to limit downward movement of the piston member 54 to prevent this member from closing the openings 64.

In making use of the invention, constructed as described above, the chamber between the upper packing 38 and the lower packing 58 is filled with a suitable liquid, such as oil, and the jar is connected to the lower end of an operating string and lowered into the bore B of a well W to engage the spear 24 with the tubing T therein. When the spear has been connected to the tubing, should it be desired to perform an upward jarring operation, the string may be further lowered to move the mandrel 30 downwardly in the barrel to position the piston 32 in the reduced portion 16. During such downward movement of the piston 32, the liquid in the barrel beneath the piston will be compressed and will act upon the valve 50 to open the valve to permit liquid to flow upwardly through the passageways 42 and 44 from beneath the piston to above the same. An upward pull may then be exerted on the string, whereupon the liquid in the barrel will leak slowly past the piston 32 in the reduced portion 16 until the piston moves out of the reduced portion into the enlarged portion 18, whereupon the liquid may flow freely past the piston and the piston will move upwardly suddenly under the influence of the tension on the string to engage the lower end of the plug 28, thus exerting a jarring action on the spear.

Upon again moving the inner part downwardly relative to the barrel to reset the jar to perform another jarring action, the check valve 50 will be moved to open position by the pressure of the liquid beneath the piston 32 when the piston enters the reduced portion 16, so that the liquid may flow freely from beneath the piston to above the same, thus permitting the inner part to be moved quickly to its lowermost or set position.

In the event that there should be a slight leakage of liquid from the liquid chamber past the upper or lower packing means, the piston member 54 will move upwardly to maintain the chamber at all times entirely filled with liquid. It will also be apparent that fluid in the well bore may enter the barrel beneath the member 54 through the openings 64, so that the difference between the pressure inside and outside of the liquid chamber will not result in distortion or disruption of the packing, or cause the packing to develop friction sufficient to interfere with the resetting of the jar by downward movement of the mandrel relative to the barrel.

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, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber, below the element, sealing means between said element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel positioned to be engaged by said element when said element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, said upper chamber having upper and lower portions of dissimilar internal diameter, the internal diameter of said upper portion being greater than the internal diameter of said lower portion, the external diameter of said piston being slightly smaller than the internal diameter of said lower portion to permit of fluid flow around the piston as the piston moves in said lower portion, and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.

2. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber, below the element, sealing means between said element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel positioned to be engaged by said element when said element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, said upper chamber having upper and lower portions of dissimilar internal diameter, the internal diameter of said upper portion being greater than the internal diameter of said lower portion, the external periphery of the piston being spaced slightly radially inwardly from the internal wall of said lower portion to permit of fluid flow around the piston as the piston moves in said lower portion and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.

3. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber, below the element, sealing means between said element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel

positioned to be engaged by said element when said element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, said upper chamber having a lower portion of smaller internal diameter than the upper portion thereof into and out of which said piston is movable, the external periphery of the piston being smaller than the internal periphery of said lower portion to permit of fluid flow around the piston as the piston moves in said lower portion and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.

4. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber, below the element, sealing means between said element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel positioned to be engaged by said element when the said element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, said upper chamber having upper and lower portions of dissimilar internal diameter, the internal diameter of said upper portion being greater than the internal diameter of said lower portion, the external diameter of said piston being slightly smaller than the internal diameter of said lower portion to permit of fluid flow around the piston as the piston moves in said lower portion, said piston having a passageway therethrough from one end to the other end of the piston, means on the piston operable under the influence of the pressure of liquid in the upper chamber upon upward movement of the piston in said lower portion to close said passageway and upon downward movement of the piston in said lower portion to open said passageway, and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.

5. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber below the element, sealing means between the element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel positioned to be engaged by said element when the element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, said upper chamber having a lower portion of smaller internal diameter than the upper portion thereof into and out of which said piston is adapted to move upon relative longitudinal movement of the mandrel and barrel, the external diameter of said piston being slightly smaller than the internal diameter of said lower portion to permit of fluid flow around the piston as the piston moves in said lower portion and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.



6. A well tool comprising an outer tubular barrel and an inner mandrel arranged in telescoping relation and movable longitudinally relative to each other, a longitudinally movable element in the barrel to provide an upper liquid filled chamber above the element and a lower expansible chamber below the element, sealing means between said element and barrel at the lower end of said upper chamber, sealing means between the barrel and mandrel at the upper end of said upper chamber, said barrel having an opening located below said element in communication with the interior of said lower chamber and with the exterior of the barrel, means on the barrel positioned to be engaged by said element when said element is in its lowermost position in the barrel to hold the element out of closing relation to said opening, a piston on the mandrel in said upper chamber, and having a passageway therethrough leading from one end to the other end of the piston, means for closing said passageway against the flow of liquid downwardly therethrough and for opening the passage to the flow of liquid upwardly therethrough, said upper chamber having upper and lower portions of dissimilar internal diameters, the internal diameter of said lower portion being smaller than the internal diameter of said upper portion, the external diameter of said piston being slightly smaller than the internal diameter of said lower portion to permit of fluid flow downwardly around the piston as the piston moves upwardly in said lower portion, and impact faces on the barrel and piston arranged to contact when the mandrel reaches the limit of its upward movement relative to the barrel.

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