May 8, 1951 K. BRADY 2,551,868

HYDRAULIC JAR

Filed Feb. 2, 1948 3 Sheets-Sheet 1

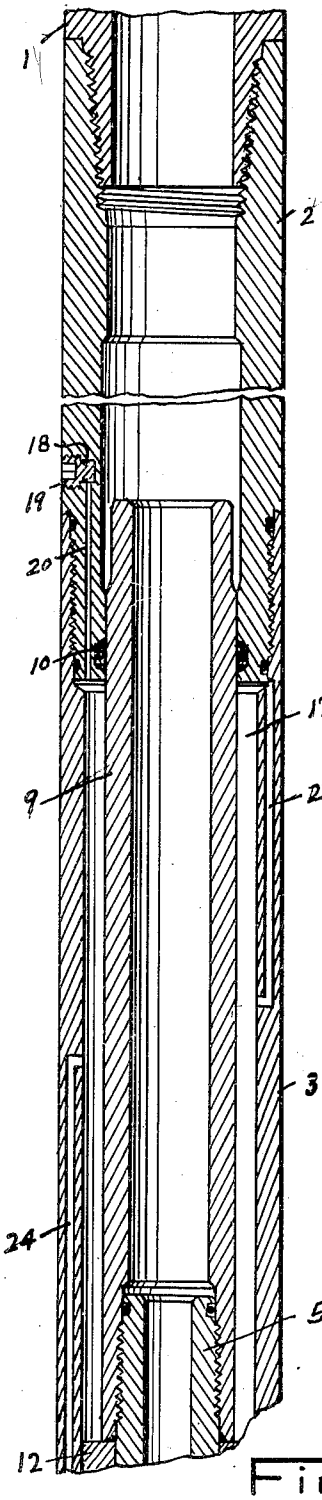


Fig. 1.

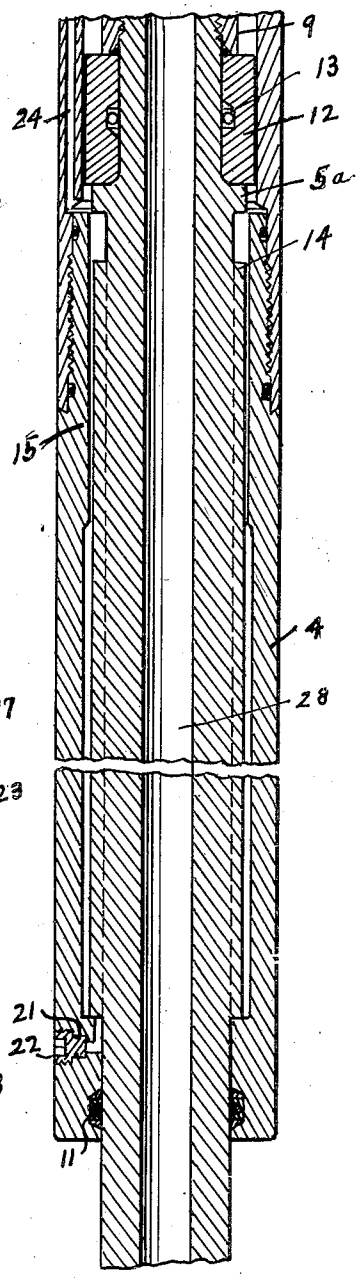


Fig. 2.

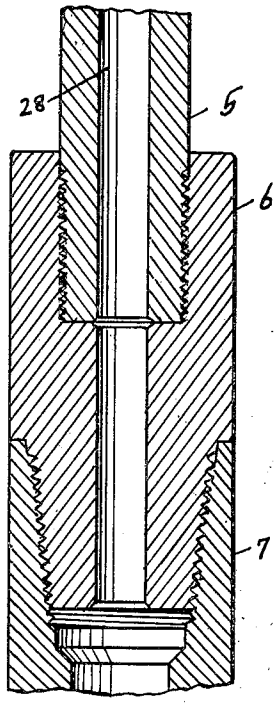


Fig. 3.

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HYDRAULIC JAR

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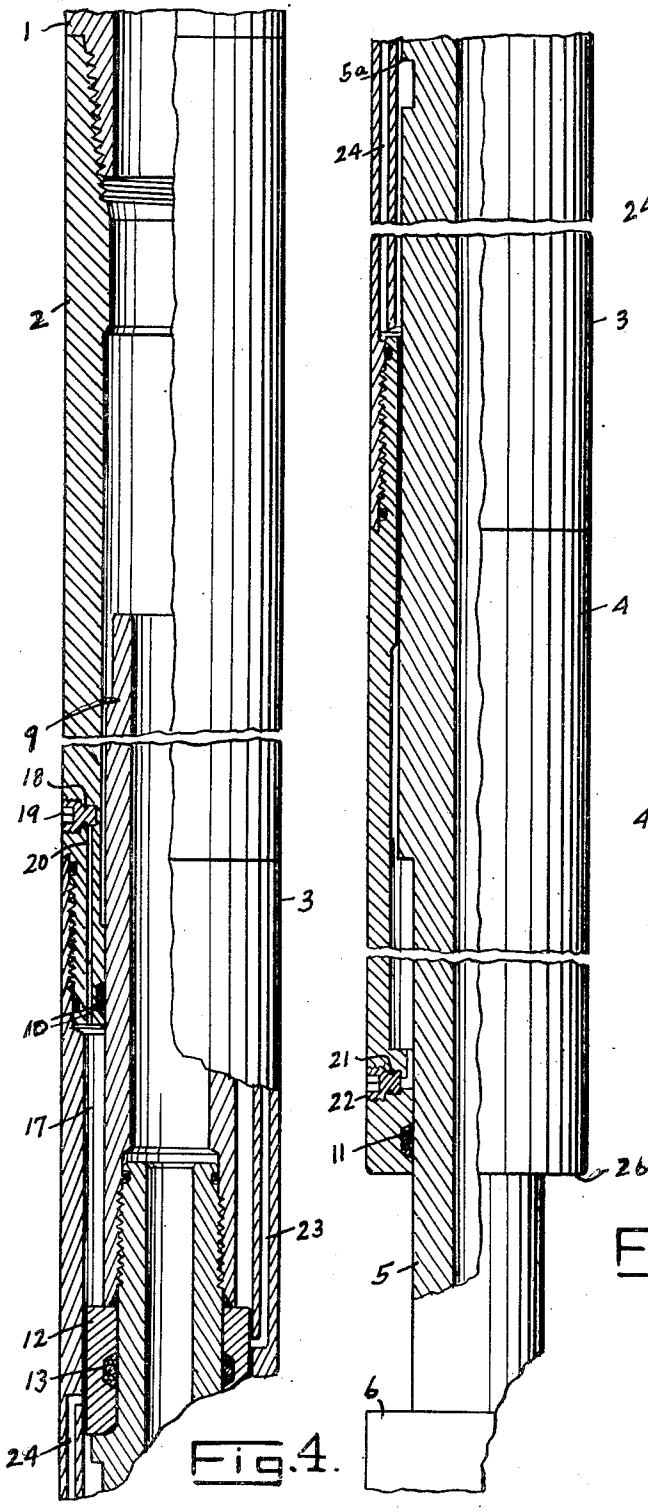


Fig. 4.

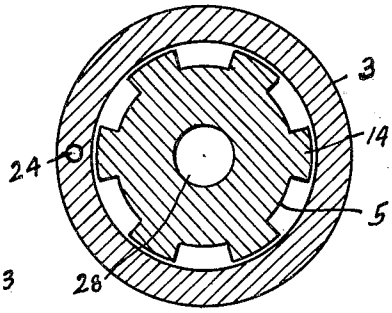


Fig. 6.

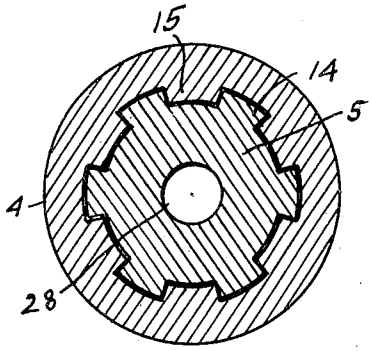


Fig. 7.

Fig. 5.

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HYDRAULIC JAR

Filed Feb. 2, 1948 3 Sheets-Sheet 3

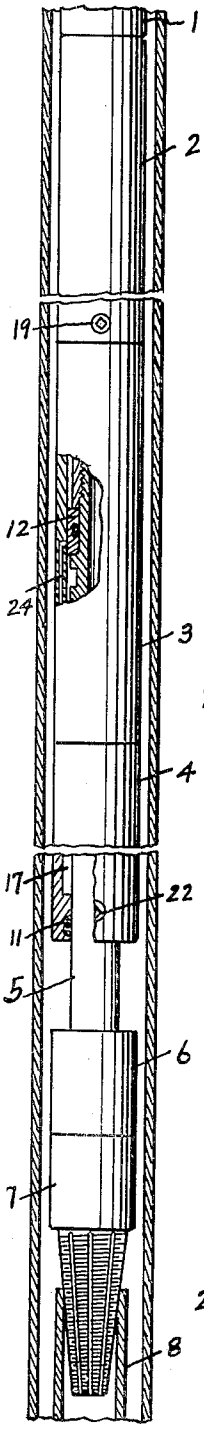


Fig. 10.

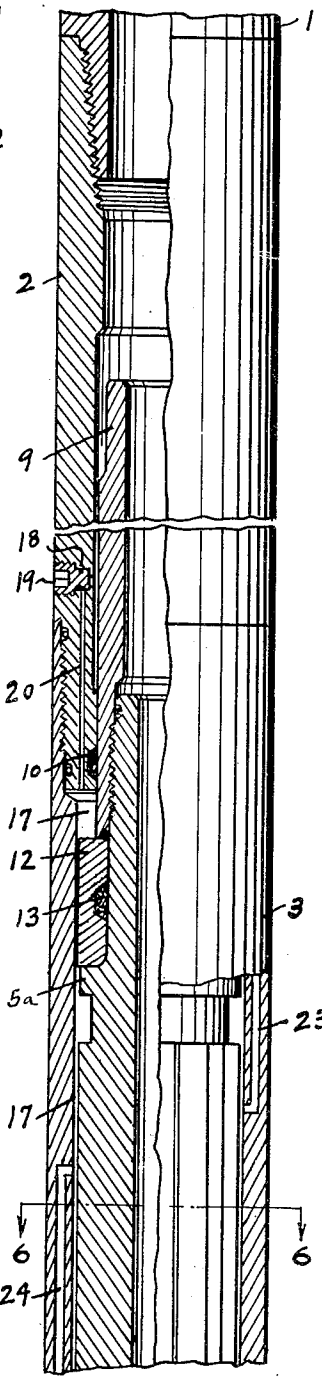


Fig. 8.

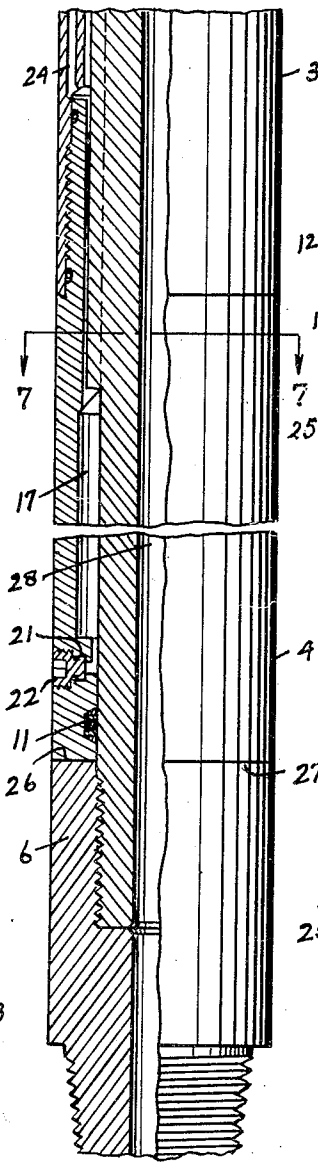


Fig. 9.

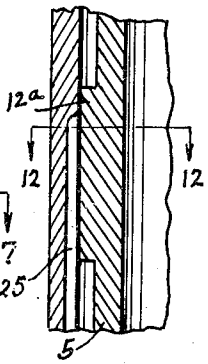


Fig. 11.

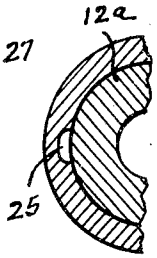


Fig. 12.

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HYDRAULIC JAR

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Application February 2, 1948, Serial No. 5,889

7 Claims. (Cl. 255—27)

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This invention relates to a hydraulic jar.

An object of the invention is to provide a tool of the character described shaped to be lowered into a well and engaged with an object stuck in the well bore and which is operable to deliver blows or strokes which will transmit vibration to the stuck object thus eventually jarring the same loose.

It is another object of the invention to provide a jar of the character described which is of the straight pull type and which can jar either up or down and can also be readily controlled in operation to deliver blows of varying intensity.

The invention embodies certain improvements over that type of jar disclosed in a co-pending application filed in the United States Patent Office on March 18, 1947 under Serial No. 735,398 now Patent No. 2,499,695.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:

Figures 1, 2 and 3 show longitudinal, sectional views of the upper, intermediate and lower sections of the tool with the parts in the position they will occupy upon completion of the upstroke.

Figure 4 is a side elevation of the upper end of the tool, shown partly in section, with the parts in intermediate position.

Figure 5 is a side view thereof, partly in section, showing the lower end of the jar.

Figure 6 is a cross-sectional view taken on the line 6—6 of Figure 8.

Figure 7 is a cross-sectional view taken on the line 7—7 of Figure 9.

Figures 8 and 9 are side elevations, partly in section, of the upper and lower ends of the tool, respectively, showing the parts in the position they will occupy upon completion of a down stroke.

Figure 10 is a side view, partly in section, of the complete tool shown in the well and in engagement with the stuck object.

Figure 11 is a fragmentary, vertical, sectional view of another embodiment of the tool, and

Figure 12 is a fragmentary, cross-sectional view taken on the line 12—12 of Figure 11.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a string of drill pipe having a pin at its lower end which may be threaded into the upper end of the tubular barrel 2.

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Connected to the lower end of the barrel there is a tubular body preferably formed of upper and lower sections 3 and 4, and forming a cylinder.

Working axially through the body there is a tubular piston stem 5 and its lower end is threaded into a coupling 6.

Attached to the lower end of the coupling 6 there is a grapple 7 of any selected type and which is adapted to engage with the stuck object 8 to be pulled.

The piston stem 5 extends up through the body and threaded onto its upper end there is a wash pipe 9 which extends up into the lower end of the barrel 2.

This piston stem 5 and wash pipe 9 move as a unit which is sealed with the lower end of the barrel by means of an annular seal ring 10 between them and said stem is also sealed with the lower end of the body by means of the seal ring 11 between them.

Secured to the upper end of the piston stem there is a piston 12 which fits loosely in the body and which is clamped between the external annular rib 5a, on the stem and the lower end of the wash pipe 9.

This piston 12 is formed of any suitable material and is preferably provided with an inside O-ring type of packing 13 to prevent leakage between it and the stem 5.

Spaced beneath the rib 5a the piston stem 5 is provided with external longitudinal ribs, or splines, 14 spaced apart therearound which intermesh with similar internal longitudinal ribs, or splines, 15 in the upper end of the lower body section 4. These splines allow relative longitudinal movement between the piston stem and body but prevent their relative rotation.

Within the body sections 3 and 4 there is a cylindrical chamber 17 in which the piston 12 moves and this chamber is completely filled with a suitable liquid such as an oil of the proper weight. The tubular barrel 2 is provided with a lateral opening 18 which is normally closed by a removable plug 19. The cylindrical chamber 17 may be filled with oil by removing the plug 19. For filling purposes a channel 20 is provided in the wall of the barrel 2 which leads from the opening 18 into the upper end of said chamber, as shown in Figures 1, 4 and 8.

The lower end of the chamber 17 has a drain opening 21 normally closed by a plug 22 so that the liquid may be drained from the cylindrical chamber, when desired, by the removal of said plug 22.

Within the walls of the upper body section 3 there are the enclosed upper and lower channels 23 and 24. The upper end of the channel 23 is inwardly turned and enters the upper end of the cylindrical chamber 17 and its lower end is also inwardly turned and enters said chamber, as shown in Figure 1.

The upper end of the channel 24 is spaced slightly below the lower end of the channel 23 and is inwardly turned into the cylindrical chamber 17 while the lower end of the channel 24 is inwardly turned into the chamber 17 just above the upper end of the lower body section 4.

In the form illustrated in Figures 11 and 12 there are wall grooves such as 25 instead of the channels 23 and 24 but similarly arranged and at the upper end of the stem 5 there is a piston 12a instead of the piston 12 shown in the other figures. This piston 12a is formed integrally with the stem 5. In both forms the piston 12, or 12a, as the case may be, fit within the cylindrical chamber 17 rather snugly but allow a slight leakage of liquid past them.

With the piston in the position shown in Figures 4 and 11 and simultaneously closing adjacent ends of the channels 23, 24 or the grooves 25 any attempt to force the piston in either direction will be opposed by the liquid which is substantially non-compressible. Therefore, to allow movement of the piston, when in this position, a slight clearance has been provided around the piston.

In operation the tool may be assembled as shown in Figure 10 and lowered into the well bore until the grapple is in position to engage the stuck pipe 8 to be pulled.

In the present illustration the grapple is shown as a tapered tap which may be screwed into the stuck object by rotation of the tool. As illustrated in Figure 10 the tool is in position for jarring upwardly and the drill pipe 1 is shown as being raised with the body sections passing upwardly relative to the piston but with both channels 23 and 24 closed. As the body moves upwardly over said piston the liquid in the cylindrical chamber 17 beneath will be subject to pressure and since this liquid is substantially non-compressible no relative travel results between the body and piston except that provided by the transfer of liquid from the lower to the upper side of the piston through the clearance left around said piston. A certain period of time, depending on the pressure created, will be required, therefore, for the body to move over the piston and this length of time is known to the operator. During this time interval the operator places a pre-determined pressure on the string of pipe 1 thus imparting a stretch to the pipe and holds the pipe under this tension until the necessary liquid exchange due to pressure differential takes place.

At the instant the body moves upwardly a sufficient distance to clear the adjacent ends of the channels 23, 24, or grooves 25, as the case may be, the compressive, or restraining, force is lost and the liquid is quickly transferred from beneath the piston into the cylindrical chamber above it and the stretched pipe rebounds thus causing the upper ends of the ribs 15 to strike the annular rib, or anvil, 5a of the stem thus imparting a violent blow which is transmitted through the piston stem 5 to the stuck pipe 8. This sudden upward movement is caused by the piston clearing the adjacent ends of the channels 23, 24 or the corresponding grooves 25.

The tool is then in a position to strike downwardly if it be desired to do so. Since the piston is now in the lower end of the cylindrical chamber the operator may simply slack off as much weight as he desires and the process of compression and bleed-off above described is repeated, only the compression and travel of the liquid is reversed in relation to the piston and cylindrical chamber; in other words the cylinder moves downwardly over the piston and the liquid in the cylindrical chamber 17 above the piston is placed under compression until the piston clears the adjacent ends of the channels 23, 24, or the grooves 25, as the case may be and upon downward movement of the body of the tool, relative to the anchored portion of the tool the lower end 26 of the body of the tool strikes a blow against the upper end 27 of the coupling 6 which is transferred directly through the grappling tool 7 to the stuck pipe 8.

The force of either the up or down stroke may be either increased or decreased at will by merely regulating the tension in the pipe at a given time interval for upstroke and by regulating the weight of the pipe imposed in preparation for the down stroke.

It is also to be noted that the operator may jar only upwardly or only downwardly if he so desires.

It is to be here noted that the displacement of the wash pipe 9 and the stem 5 are so proportioned that the liquid system is balanced above and beneath the piston. Thus the liquid is merely transferred from one side of the piston to the other in the complete cycle.

If it be desired not to make an up stroke only sufficient tension may be taken on the pipe to cause the liquid to leak through from below to above the piston without a reserve supply of tension on the pipe to cause sufficient stretch to effect a stroke and similarly in slacking off a sufficient weight may be provided to cause a transfer of liquid from above the piston to the chamber beneath thus avoiding the creation of excessive pressures to the liquid which would cause an accumulation of stretch, or load, on the pipe.

It is further to be noted that circulation may be maintained through the tool at all times through the tubular washpipe and through the bore 28 which leads through the piston stem, the coupling 6 and the grapple 7.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A well tool comprising, two telescopically arranged parts, means for connecting one of said parts to an operating string, means for connecting the other part to an object stuck in a well bore, the outer part forming a tubular body and the inner part being spaced from the outer part to form a chamber between them to contain liquid, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said sec-

ond mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact upon such accelerated movement to transmit a jarring force to said stuck object.

2. A well tool comprising, two telescopically arranged parts the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them to contain liquid, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said second passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable in a selected direction along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement in the same direction to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact upon such accelerated movement in said selected direction to transmit a jarring force to said stuck object.

3. A well tool comprising, two telescopically arranged parts the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them to contain liquid, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said second mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement in the same direction to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact when said parts reach the limit of their relative movement in a direction to increase the length of the tool to transmit an upward jarring force to said stuck object.

4. A well tool comprising, two telescopically arranged parts, the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them to contain liquid, said chamber being closed at each end, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said second mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact upon such accelerated movement in either direction, to transmit a jarring force to said stuck object.

5. A well tool comprising, two telescopically arranged parts splined against relative rotation the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them to contain liquid, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said second mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side

to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact upon such accelerated movement when the parts reach the limits of their relative movement to transmit a jarring force to said stuck object.

6. A well tool comprising, two telescopically arranged parts the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them, a substantially non-compressible liquid filling said chamber, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said first mentioned passageway communicating with the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said second mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated movement of said inner and outer parts, and impact faces formed on the respective parts arranged to contact upon such accelerated movement when the parts reach the limit of their relative movement in a direction to decrease the length of the tool to transmit a downward jarring force to said stuck object.

7. A well tool comprising, two telescopically arranged parts the outer part forming a tubular body and the inner part being spaced from the outer part to form a cylindrical chamber between them to contain liquid, said outer part having upper and lower liquid passageways extending longitudinally of said chamber, the upper end of said chamber and the lower end of said first mentioned passageway communicating with said chamber intermediate the ends thereof, the upper end of said second mentioned passageway being longitudinally spaced and oppositely disposed in said chamber below the lower end of said upper passageway, and the lower end of said second mentioned passageway communicating with the lower end of said chamber, a piston mounted on said inner part movable along said chamber to temporarily and simultaneously restrict the lower end and the upper end respectively of said first and second mentioned passageways, to restrict the transfer of liquid from one side to the other side of the piston, and upon further movement to uncover the lower end and the upper end respectively of said first and second mentioned passageways to allow free transfer of liquid from one side to the other side of the piston through said passageways to allow an accelerated relative movement of said inner and outer parts, and impact delivering means on the respective parts arranged to contact upon such accelerated movement in either direction to transmit a jarring force to said stuck object.

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