Sept. 12, 1939. F. N. OSMUN 2,172,480

JAR

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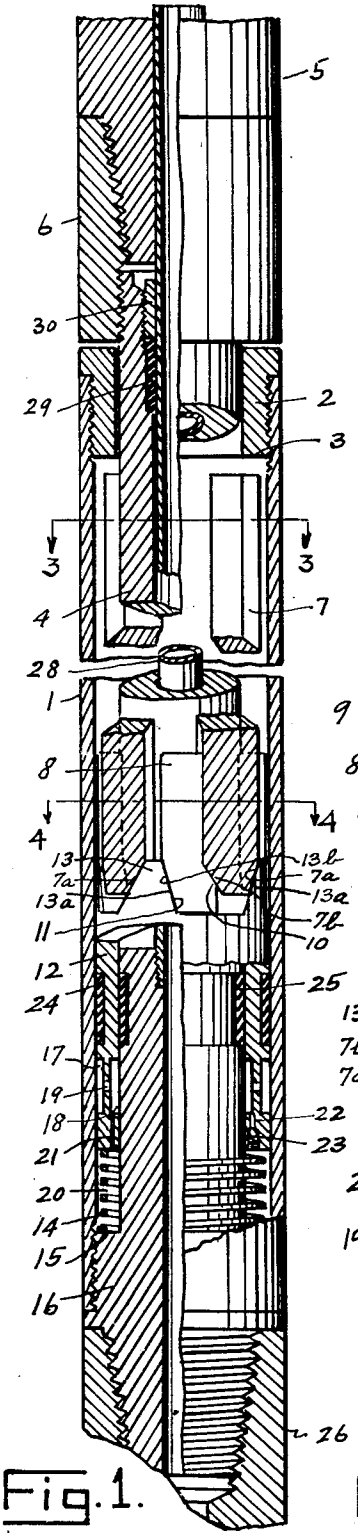


Fig. 1.

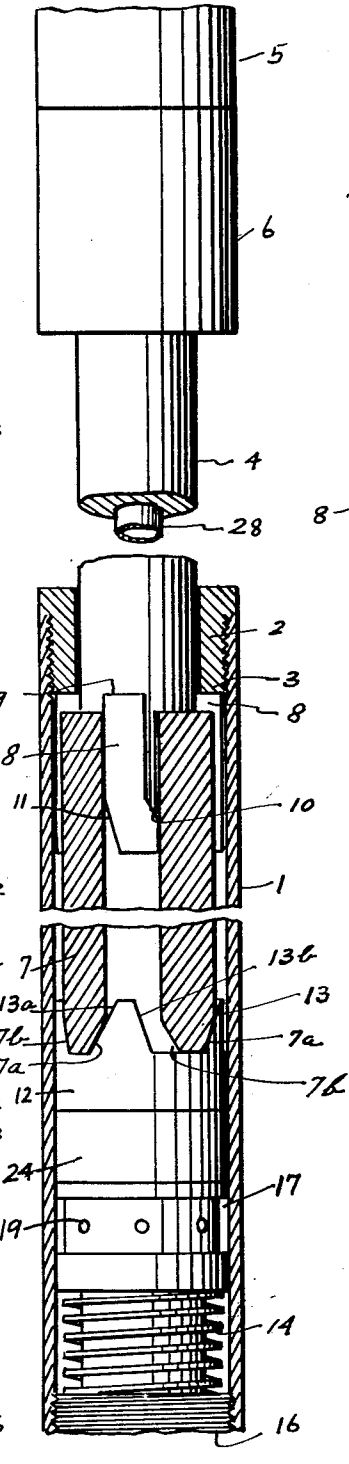


Fig. 2.

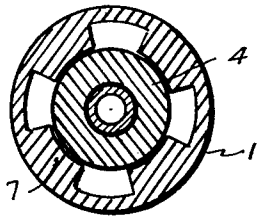


Fig. 3.

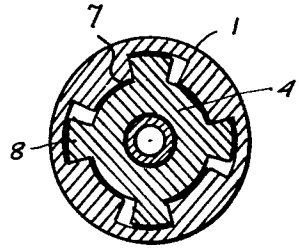


Fig. 4.

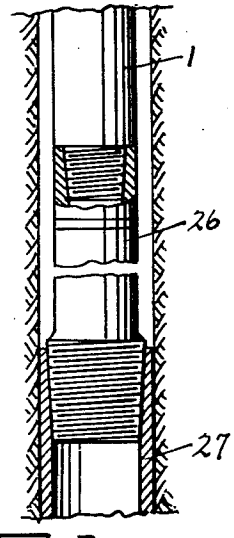


Fig. 5.

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JAR

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7 Claims. (Cl. 255—27)

This invention relates to a jar of the straight pull type.

The invention has particular relation to a well tool for effecting a jarring action in the well incidental to the removal of a stuck object, such as a stuck pipe in a well.

An object of the invention is to provide a tool of this character adapted to be operated by the elasticity of the operating string when subjected to a tensile strain, and which may be readily reset for successive operations without withdrawal from the well.

A further object of the invention resides in the provision of a jarring tool of the character described wherein there are only two relatively movable parts to come into contact to cause the jarring action with means for locking said parts in set position, said locking means forming also a timing device and being releasable under the influence of the tensile strain on the operating string and including a release member controlled by a confined body of liquid and which governs the release of the locking means.

A still further feature resides in the provision of a well tool of the character described which may be set for operation, and operated, and the intensity of the blow controlled without the necessity of making adjustments of the tool or the placing of the operating string under torsional strain.

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 drawing, wherein:—

Figure 1 shows a side elevation of the tool, in set position, shown partly in section and partly broken away.

Figure 2 shows a fragmentary, side elevation thereof showing the parts in released, or active position, and shown partly in section.

Figure 3 shows a cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 shows a cross-sectional view taken on the line 4—4 of Figure 1, and

Figure 5 shows a fragmentary, side elevation showing the fishing tool in engagement with the pipe to be pulled.

Referring now more particularly to the drawing, wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates an outer housing or shell threaded into the upper end of which there is a tubular gland 2 whose lower end presents an annular impact face 3. Extended through the gland 2 there is a tubular mandrel 4. The upper end of this mandrel is connected to an operating string 5 by means of a suitable coupling 6. The lower end of this coupling abuts the upper end of the gland 2 when the tool is set, as hereinafter referred to, so as to limit the downward movement of the mandrel in the shell.

On the inside of the shell there are a plurality of vertical ribs 7, four of said ribs being shown spaced apart around the shell as more clearly shown in Figure 3. The upper ends of these ribs 7 terminate the required distance beneath the impact face 3 and their lower ends are beveled on each side to provide the downwardly converging faces 7*a*, 7*b* on the lower end of each rib 7.

At the lower end of the mandrel 4 there are the vertical ribs 8 which extend out radially from the mandrel and which work between the ribs 7 of the shell as illustrated in Figure 4. The overall circumferential width of each rib 8 is substantially the same as the corresponding width of the space between the corresponding ribs 7. The upper end of each rib 8 presents an upwardly facing flat face 9 adapted to strike against the impact face 3 of the gland 2. Each rib 8 is formed with a tapering face 10 which conforms, in pitch, to the pitch of the corresponding face 7*b* against which it is adapted to closely fit when the tool is set for actuation. At the lower end of each rib 8 and on the side opposite the face 10 said rib is formed with a tapering face 11 which diverges downwardly with respect to the opposing face 7*a* as more clearly illustrated in Figure 1.

Beneath the lower ends of the ribs 7 and located within the shell 1 there is a tubular plunger 12 whose upper end has the upwardly extended wedge-shaped locking lugs 13. These lugs have the upwardly converging faces 13*a* and 13*b*, respectively, adapted to wedge between the opposing faces 7*a* and 11 of the respective ribs 7 and 8, when the tool is in set position as more accurately illustrated in Figure 1 so as to lock the relatively movable parts in set position until released under the influence of the tensile strain on the operating string as hereinafter explained. The plunger 12 is seated on a relatively strong coil spring 14 which in turn rests on the external shoulder 15 of the inside tubular coupling member 16. This coupling member is screwed into the lower end of the shell 1, as shown in Figure 1 and its upper end is reduced, forming the external shoulder 15, and extended up into the tubular plunger 12. This plunger has the outside and inside, relatively wide, annular channels 17, 18 which are con-

nected by the ports 19. The inside channel 18 is connected into the space 20 beneath the plunger by means of the duct 21 and is also connected into said space 20 by a larger duct 22 which is controlled by the downwardly opening back pressure valve 23. The channels 17, 18 and the space 20 are filled with a liquid, such as a lubricating oil. An annular packing 24 surrounds and is countersunk into the plunger 12 above the channel 17 and an annular packing 25 surrounds and is countersunk into the extended upper end of the inside coupling 16 above the channel 18 thus forming leak-proof joints between said plunger and the outside shell and inside coupling 17. The coupling 17 is connected to any conventional type of grappling tool 26 which in turn may be connected to the pipe 27 stuck in well and which it is desired to jar loose.

A suitable wash pipe is fitted downwardly through the mandrel and its lower end is screwed into the upper end of the coupling 16 whereby washing fluid may be forced downwardly through the tool to clean out the bore or to wash out obstructing material from the upper end of the stuck pipe. A suitable annular packing 29 surrounds the wash pipe and is countersunk into the upper end of the mandrel and is maintained suitably compressed by the gland 30 which is screwed into the upper end of the mandrel and which abuts the upper end of said packing.

Normally the plunger 12 is in its upper position, being held in said position by the spring 14. As said plunger is moved upwardly by the spring the liquid in the channels 17, 18 will quickly drain through the duct 22 back into the space 20 beneath. In order to set the tool the mandrel 4 may be moved downwardly relative to the shell 1, the ribs 8 passing between the ribs 7 and when the lower ends of the ribs 8 contact the lugs 13 the plunger will be forced slightly downwardly, and the faces 10 of the ribs 8 will move into contact with the faces 7b of the ribs 7 and the spring 14 will force the plunger upwardly so as to wedge the lugs 13 closely between the downwardly flared faces 7a and 11. When the plunger 12 is in this last named position a major portion, or all of the liquid in the channels 17, 18, will have drained into the space 20 beneath said plunger. The tool is then set. With the grappling tool 26 in engagement with the pipe 27 to be pulled, an upward pull may be exerted through the operating string 5 by the conventional appliances at the ground surface for that purpose. This tensile strain on the operating string will tend to release the faces 10 from the corresponding faces 7b, but in order to permit such release the mandrel 4 must turn partially to the right to permit said faces to clear and upon such partial turning movement the faces 11 will ride against the abutting faces 13b thus gradually forcing the plunger 12 downwardly. As the plunger 12 moves downwardly the liquid in the chamber 20 will gradually leak through the duct 21 up into the channels 18, 17 to permit such downward movement and when the faces 10 clear the faces 7b the elasticity of the operating string under tension will cause a sudden upward movement of the mandrel causing the upper ends of the ribs 8 to strike suddenly, and with a powerful blow, against the impact face 3 thus imparting a jar, in an upward direction to the stuck pipe 27. If the stuck pipe is not thus released the operation may be repeated by moving the mandrel 4 downwardly, as before, to again set the tool and then again subjecting the operating string to a tensile strain.

From the foregoing it is obvious that the means, including the plunger 12 for locking the parts in set position, form, in effect, a timing device. When the tool is set for operation and engaged with the stuck object in the well and the operating string is placed under tension, the plunger will be forced downwardly in the manner hereinabove explained, the liquid in the chamber 20 beneath the plunger, gradually leaking through the duct 21 and passing into the channels 18, 17 until the faces 10 clear the faces 7b whereupon a jar will be imparted as above explained. The intensity of the jar will be controlled solely by the amount of tension under which the operating string is placed without the necessity of making adjustments of the tool or placing the operating string under torsional strain for the purpose of controlling the intensity of the desired stroke.

The ribs 7 and 8 form, in effect, a clutch whereby the relatively movable sections of the tool may be rotated as a unit.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. A jarring tool comprising two relatively movable parts, mechanical means for connecting one of said parts to a stuck object in a well, means for releasably locking said parts against relative longitudinal movement, said locking means having sloping contacting faces effective to cause release of said locking means under the influence of tension on the parts, hydraulically controlled means within the tool, resisting the release of the locking means for an interval of time and means for arresting such relative longitudinal movement to effect a jarring action of the tool on the stuck object.

2. A jarring tool comprising two relatively movable parts, means for connecting one of said parts to a stuck object in a well, a cylinder in one of said parts, a piston in the cylinder, liquid in the cylinder to resist movement of the piston, said parts and said piston having mechanical interlocking means for releasably locking said parts against longitudinal movement, said locking means being releasable under the influence of tension on the parts applied for a predetermined time to allow such longitudinal movement and means for arresting such relative longitudinal movement to effect a jarring action on the tool and on the stuck object.

3. A jarring tool comprising two relatively movable parts, means for connecting one of said parts to a stuck object in a well, one of said parts having a cylinder, a piston in the cylinder, liquid in the cylinder resisting movement of the piston in one direction, said piston having a restricted passageway to relieve said liquid to permit such movement of the piston, said piston having a valve controlled passageway to permit the free movement of the piston in the other direction, a yieldable member for causing the movement of said piston in said other direction, interlocking means on said parts and on the piston for releasably locking said parts against relative longitudinal movement, said locking means being releasable under the influence of tension on the tool to permit such relative longitudinal movement and means for suddenly arresting such

movement to effect a jarring action of the tool and of the stuck object.

4. A jarring tool comprising two relatively movable sections, means for connecting one of said sections to a stuck object in a well, one of said sections having a cylinder, a piston in the cylinder, liquid in the cylinder resisting movement of the piston in one direction, said piston having a restricted passageway to permit such movement of the piston, said piston having a valve controlled passageway of greater capacity than said restricted passageway to permit relative free movement of the piston in the other direction, interlocking means on said sections and on the piston for releasably locking said sections against relative longitudinal movement, a yieldable member for causing the movement of said piston in said other direction to move said means on the piston into such interlocking relation, said locking means being releasable under the influence of tension on the tool to permit such relative longitudinal movement of said sections and means on the sections for suddenly arresting such longitudinal movement to effect a jarring action of the tool and of the stuck object.

5. A jarring tool comprising two relatively movable parts, means for connecting one of said parts to a stuck object in a well, one of said parts having a cylinder, a piston in the cylinder, liquid in the cylinder resisting the movement of the piston in one direction, interlocking means on said parts and on the piston for releasably locking said parts against relative longitudinal movement, said locking means being releasable under the influence of tension on the tool to permit such relative longitudinal movement and means for suddenly arresting such movement to effect a jarring action of the tool and of the stuck object.

6. A jarring tool comprising two relatively movable parts, one of said parts having a cylinder, a piston in the cylinder, a fluid in the cylinder resisting movement of the piston in one direction, a member for causing the movement of the piston in the other direction, interlocking means on said parts and on the piston for releasably locking said parts against relative longitudinal movement, said locking means being releasable under the influence of tension on the tool to permit such longitudinal movement and means for suddenly arresting such movement to effect a jarring action of the tool.

7. A jarring tool comprising two relatively movable parts, means for connecting one of said parts to a stuck object in a well, one of said parts having a cylinder, a piston in the cylinder, liquid in the cylinder resisting the movement of the piston in one direction, interlocking means on said parts and on the piston for releasably locking said parts against relative, longitudinal movement, said locking means being releasable upon appropriate relative movement between said parts to permit an acceleration of such movement upon such release and means for suddenly arresting such movement to effect a jarring action of the tool and of the stuck object.

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