Dec. 12, 1944. F. N. OSMUN 2,364,869

JAR

Filed Feb. 13, 1942 2 Sheets-Sheet 1

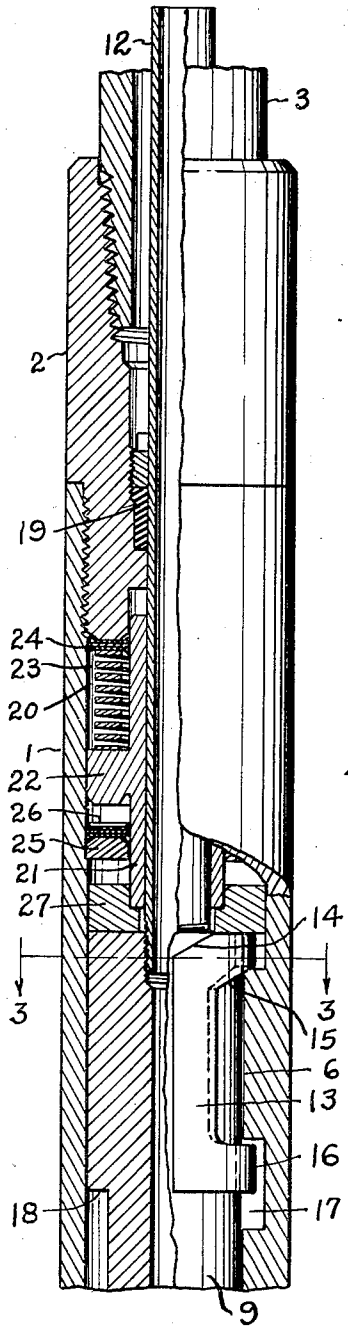


Fig. 1.

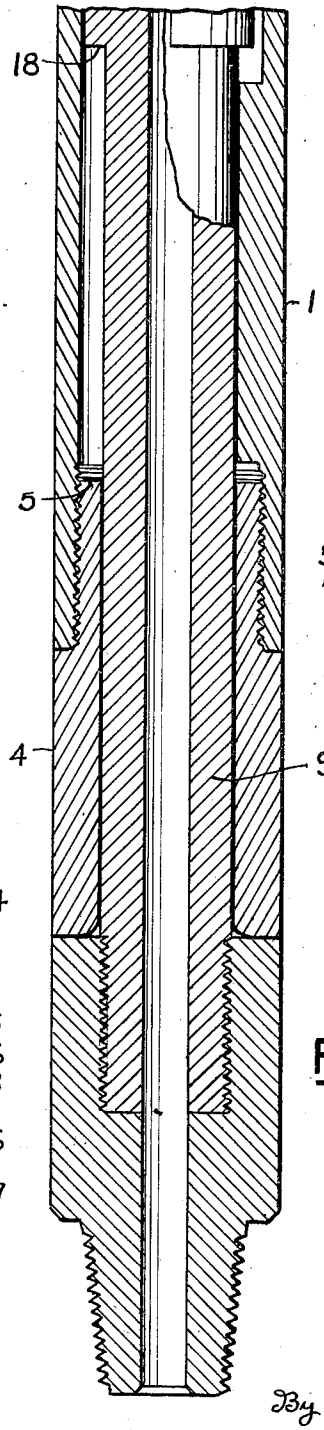


Fig. 2.

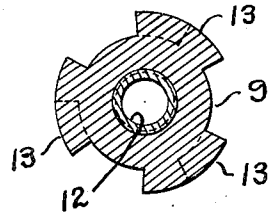


Fig. 3.

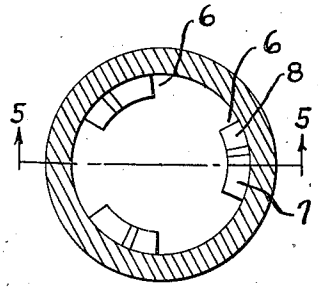


Fig. 4.

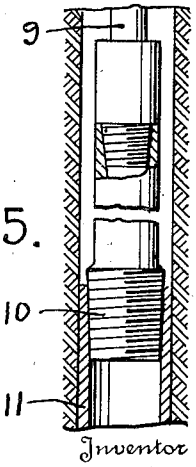


Fig. 5.

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Dec. 12, 1944. F. N. OSMUN 2,364,869

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Filed Feb. 13, 1942 2 Sheets-Sheet 2

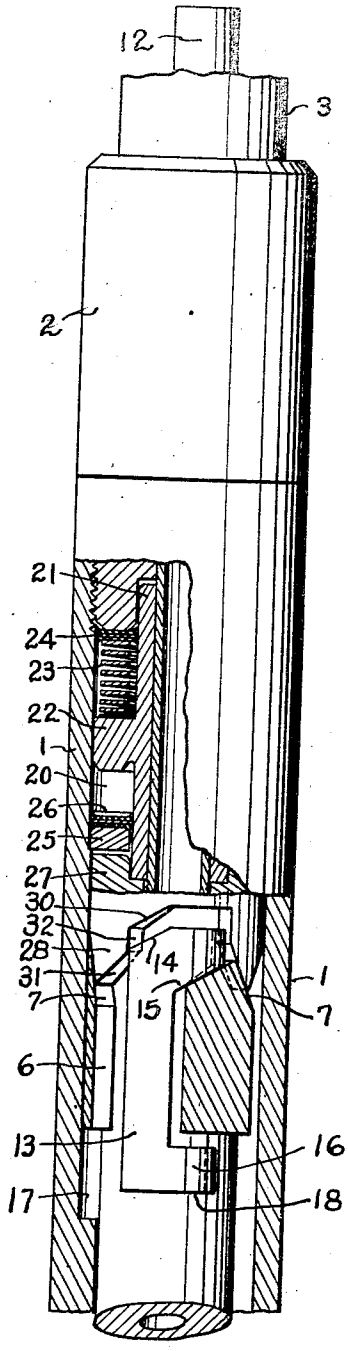
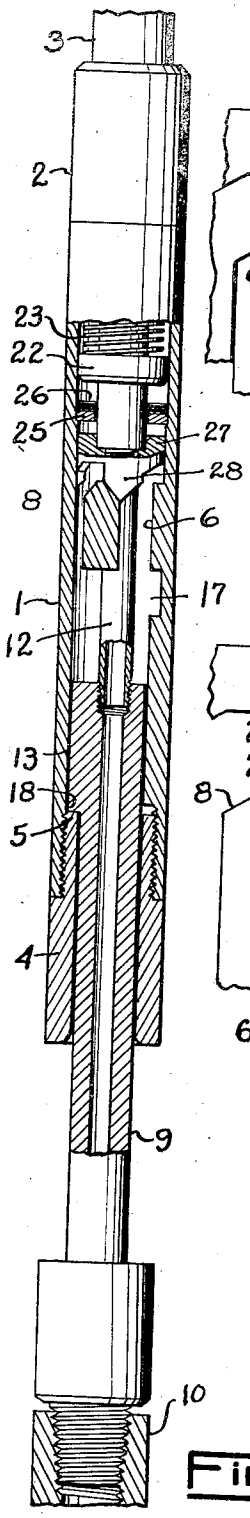


Fig. 6.



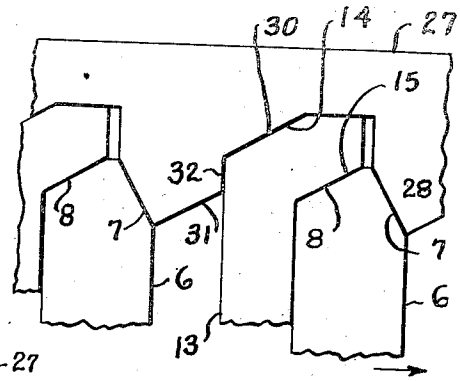


Fig. 7.

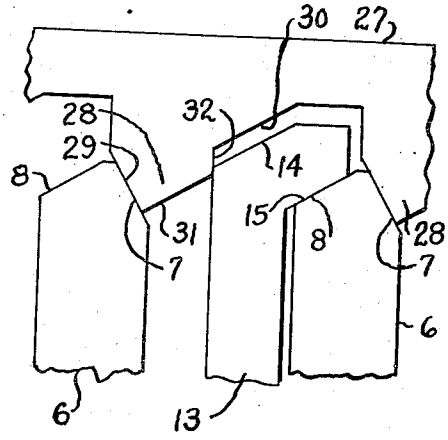


Fig. 8.

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Patented Dec. 12, 1944 2,364,869

UNITED STATES PATENT OFFICE

2,364,869

JAR

Fred N. Osmun, Houston, Tex.

Application February 13, 1942, Serial No. 430,747

2 Claims. (Cl. 255—27)

This invention relates to a jar and has particular relation to a well tool for effecting a jarring action on a stuck object in the well incidental to the removal of such object.

The invention embodies certain improvements over that type of jar disclosed in the United States Patent No. 2,172,480.

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 and embodies an improved type of interlocking means on the relatively movable parts which are readily releasable upon appropriate relative movement between said parts and which are of such construction as to withstand the frictional wear incident to the release of said locking means.

A further object of the invention resides in the provision of a jarring tool of the character described which, in its simplest form, may embody 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 being of special construction to withstand the wear to which the same may be subjected and said locking means forming also a timing device and being releasable under the influence of the tensile strain on the operating string and including release means controlled by a confined body of liquid which governs the release of the locking means.

The tool may be successively reset and successively operated while in the well as is the case with the type of jar described in the patent above referred to.

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:

Figure 1 shows a side elevation of the upper end of the tool partly in section and in set position.

Figure 2 shows a vertical, sectional view of the lower end thereof.

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

Figure 4 shows a cross-sectional view of the housing also taken on the line 3—3 of Figure 1.

Figure 5 shows a side view of the grapple engaged with the stuck object.

Figure 6 shows a side elevation, partly in section of the upper end of the tool showing the locking means partly in released position.

Figure 7 shows a diagrammatic view of the locking means in set position.

Figure 8 shows a diagrammatic view of the locking means approaching released position for the subsequent hammer blow, and

Figure 9 shows a side view of the complete tool partly in section showing the hammer and anvil in co-action to effect the jar.

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 an outer housing or shell threaded into the upper end of which there is a coupling 2 to the upper end of which the operation string 3 is connected. Attached to the lower end of the housing there is a tubular gland 4 whose upper end forms an annular hammer 5 within the housing.

Within the housing, and preferably formed integrally with the walls thereof are the ribs 6, three being shown in the present illustration. The upper ends of these ribs are formed with the upwardly converging faces 7, 8 as clearly shown in Figures 7 and 8. As illustrated the faces 7 have a greater pitch, relative to the vertical, than the faces 8.

Within and extending beneath, the housing 1 there is a tubular mandrel 9 which works through the gland 4. Its lower end carries any suitable type of grappling tool such as 10 adapted to engage a struck object such as 11 in the well. The grappling tool is shown as a tap although any type of grappling tool may be employed. A wash pipe 12 has its lower end attached to the upper end of the mandrel 9 as shown in Figures 1 and 2 and which extends on axially up through the housing.

The upper end of the mandrel 9 has the vertical ribs 13 thereon, three being shown and which work between the ribs 6 in the housing. The upper ends of the ribs 13 are overturned, as shown in Figure 8, and formed with the parallel upper and lower faces 14, 15 of the same pitch as the corresponding faces 8. When the tool is set for operation the housing is in its lower position, relative to the mandrel, as shown in Figure 2 with the faces 15, of the ribs 13 overlying the faces 8 of the ribs 6 as shown in Figure 7. The lower ends of the ribs 13 have the widened extensions 16 extending circumferentially around the mandrel, the ribs 6 having corresponding cut away portions 17 for the reception of said extensions 16. The lower ends of the ribs 13, accord-

ingly, will present large areas thus forming, in effect, an anvil 18 against which the hammer 5 may strike. The impact of the hammer striking the anvil will be transmitted to the mandrel and to the grappling tool and stuck object engaged thereby.

The coupling 2 is inwardly thickened and fitted about the wash pipe 12 and located within the said coupling there is the stuffing box 19 which causes the drilling fluid to pass on down through the wash pipe. There is a cylinder 20 contained within the upper end of the housing around the wash pipe. Within this cylinder and closely surrounding the wash pipe there is a cylindrical piston 21 whose mid portion is extended outwardly forming an annular flange 22 which extends out nearly to the inside wall of the housing, a small clearance being left to permit leakage of liquid to pass the flange 22 from the chamber above it to the chamber beneath it and vice versa.

Surrounding the upper end of the piston 21 there is a coil spring 23. Mounted on this spring there is an annular seal ring 24 which closely surrounds the reduced upper end of the portion 21 and which fits closely against the inside wall of the cylinder 20. This seal ring abuts the lower end of the coupling 2 and may be of any selected design to prevent leakage of liquid, such as oil with which the cylinder is filled, from the cylinder. The lower end of the cylinder is closed by a ring 25 which is fitted therein and on which is mounted an annular seal ring 26 which forms a close fitting seal with the reduced lower end of the piston and with the wall of the cylinder.

The tool will usually be used in a well filled with fluid which is under relatively high pressure. The parts are not of such close fit as to prevent this well fluid from entering and acting against the lower side of the ring 25 so that it is under constant pressure. In order for the release member, hereinafter described, to function accurately the cylinder 20 should be kept completely filled with fluid and the loss of liquid from the cylinder by reason of leakage will be readily taken up, or compensated for by the pressure of the well liquid against the lower side of the ring 25.

The lower end of the plunger 21 carries a release ring 27 provided with the depending wedge shaped locking lugs 28 each formed on one side with the tapering face 29 to seat against the face 7 of the corresponding ribs 6 and is formed on its other side with a tapering face 30 to seat against the face 14 of the corresponding ribs 13 when the tool is locked in set position as shown in Figure 7. Each lug 28 also has a tapering face 31 parallel with, but offset from, the face 30 to provide a vertical locking face 32 which abuts the opposing sides of the corresponding ribs 13 when the tool is set as shown in Figure 7.

Normally the plunger 21, including the release ring 27, is in its lower position, being held in said position by the spring 23 with the faces 29 in abutting relation with the faces 7 and when the tool is set for operation the overturned upper ends of the keys 13 will be engaged over the upper end faces 8 of the keys 6 and will be locked in that position by the faces 32 with the tapering faces 14 resting against the faces 30. The main body of the liquid in the cylinder 20 will be above the plunger flange 22 so that the tool will be locked in set position. In this position the hammer 5 will be spaced beneath the anvil 18 as shown in Figure 2.

It will be noted that the contacting faces 8, 15 have a relatively large wear area.

With the grappling tool 10 engaged with the stuck object 11 and with the tool set for operation as above described the operating string 3 is placed under the desired tension, the amount of tension depending upon the intensity of the blow desired to be delivered. The string is held under said tension. This will cause a gradual leakage of the liquid from the chamber above the plunger flange 22 into the chamber beneath. This leakage will be caused by the pressure applied by the ribs 6 acting against the ring 27. As the housing 1, and rib 6, move upwardly under the influence of the tension of the string 3 the ring 27 and the plunger will also move upwardly. The timing of this movement will depend on the rapidity of the leakage of the liquid from the cylinder chamber above to the cylinder chamber beneath. As the ribs 6 move upwardly, relative to the ribs 13, the co-action of the sloping faces 8 with the sloping faces 15 will cause a turning movement of the housing relative to the mandrel in the direction of the arrow indicated in Figure 7. The relative upward movement of the ring 27 is caused by the upward movement of the ribs 6 relative to the ribs 13 and the face 8 riding on the face 15 generates a force tending to force the rib 6 and housing 1 to the right as indicated by the arrow in Figure 7 and this tends to force the ring 27 in the opposite direction, causing the sloping faces 29 of the lugs 28 to ride upon the corresponding sloping surfaces 7 of the ribs 6 until the vertical faces 32 clear the corresponding upper ends of the ribs 13. During this movement the major portions of the area of the faces 8 and 15 are still in contact and the frictional wear is thus distributed over a relatively large area so that these parts will not soon become worn away. As soon as the vertical faces 32 clear the upper ends of the ribs 13 the elasticity of the operating string 3 under tension will cause a sudden upward movement of the housing 1 causing the hammer 5 to strike suddenly and with a powerful blow against the widened lower ends of the ribs 13, herein designated as the anvil, thus imparting a jar in an upward direction to the stuck pipe 11. If the stuck pipe is not released the operation may be repeated after resetting the tool. This may be done by lowering the operating string and the housing relative to the mandrel until the overturned upper ends of the ribs 13 are again in engaged position over the sloping faces 8 at the upper ends of the ribs 6 and the tension on the operating string being relieved the spring 23 will force the plunger 21 and release ring 25 down until the lugs 28 of said ring are in interlocking relation between the upper ends of the ribs 6 and 13 as shown in Figure 7, whereupon, upon again placing the string under tension another blow may be struck as before.

From the foregoing it is obvious that the means including the plunger 21 and the release ring 25 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 and release ring will be forced upwardly, in the manner hereinabove explained, the liquid in the cylinder 20 above the plunger flange gradually leaking past said flange and passing into the chamber beneath until the

faces 32 clear the lower ends of the faces 14 whereupon a jar will be imparted as above explained. The intensity of the blow 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 blow. It is to be observed, however, that there will be a comparatively small relative movement between the faces 8 and 15 while the string is under tension until the locking means are released and accordingly these interlocking faces 8, 15 will not be subjected to severe frictional wear until the instant of their release.

The ribs 6, 13 form, in effect, a clutch whereby the relatively movable sections of the tool may be rotated as a unit.

The drawings and description are illustrative merely and are not intended to limit the scope of the invention excepting as defined by the appended claims.

What I claim is:

1. A releasable jarring tool comprising a mandrel, a housing around the mandrel, a release member within the housing, ribs on the mandrel and housing, locking lugs on the release member, the ribs and lugs having inclined faces, the mandrel ribs and locking lugs having contacting axial faces, said faces being arranged to allow the ribs to interlock with each other and with the lugs, the inclined faces being effective to cause relative movement of the parts toward released position, when the tool is under tension, and the axial faces simultaneously acting to temporarily resist said relative movement, said axial faces being arranged to finally disengage to unlock the ribs, and a hydraulic timing device for resisting movement of the release member to temporarily resist unlocking of the ribs and lugs.

2. A jarring tool comprising a mandrel, a housing around the mandrel, a release member within the housing, interlocking means on the mandrel and housing respectively, locking lugs on the release member, said interlocking means and lugs having inclined faces, the interlocking means on the mandrel and the locking lugs having contacting axial faces, said faces being arranged to allow the interlocking means to interlock with each other and with the lugs, the inclined faces being effective to cause relative movement of the parts toward released position, when the tool is under tension, and the axial faces simultaneously acting to temporarily resist such relative movement said axial faces being arranged to finally disengage to unlock the interlocking means on the mandrel and housing, and a hydraulic timing device for resisting movement of the release member to temporarily resist unlocking of said interlocking means on the mandrel and housing.

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