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D. U. SHAFFER ET AL

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HYDRAULIC TRIP TOOL JAR

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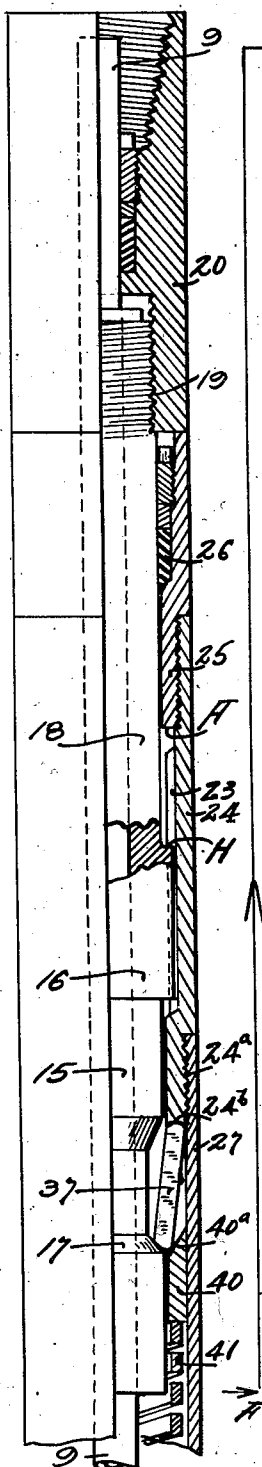


Fig. 1.

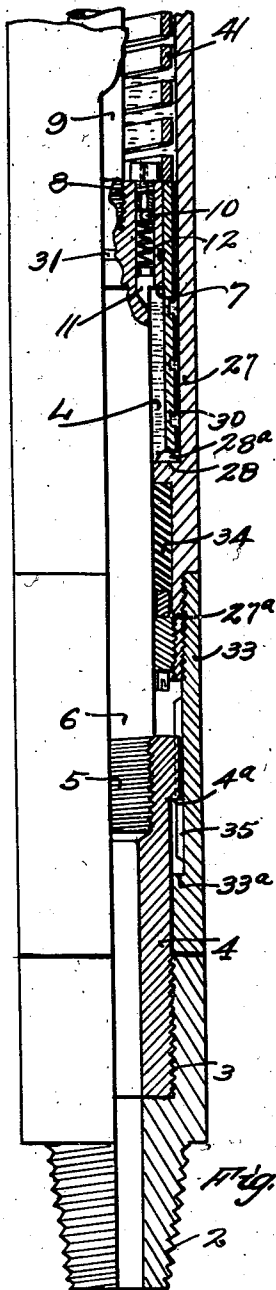


Fig. 2.

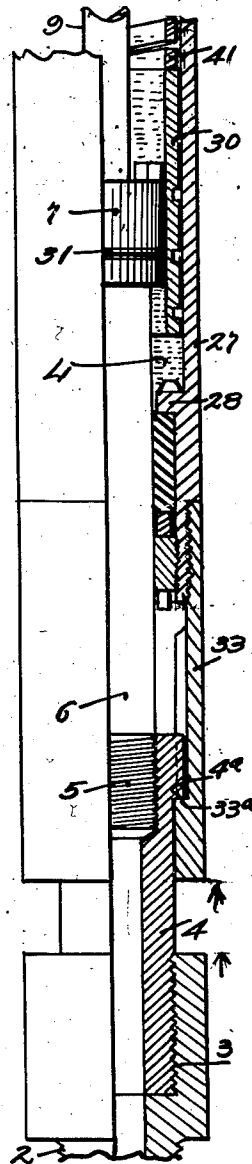


Fig. 3.

INVENTORS,  
D. U. Shaffer and  
E. C. Hamm;  
By their attorney,  
Frederick E. Maynard.

## UNITED STATES PATENT OFFICE

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## HYDRAULIC TRIP TOOL JAR

Donald U. Shaffer, Brea, and Edward C. Hamm,  
Norwalk, Calif., assignors to Shaffer Tool  
Works, Brea, Calif., a corporation of California

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10 Claims. (Cl. 255—27)

This invention relates to the deep well industry and is a jar tool for use with various specific implements employed in the industry.

Tools of this class are proposed for the purpose of imparting up-shocks or jolts to such objects as may be caught onto a fishing tool of one kind or another in a well or well hole and which objects are to be extracted, if possible.

It is desired that the degree of up-jolt may be varied during the fishing process according to the fastness with which the object or "fish" may be held by the earth formation or other causative factor; it being an advantage to gradually work the tension in the tool string up to that effort which will do the work and thus avoid placing over-strain on the apparatus in the string make-up.

Tools have been proposed whereby the tripping point of the tension in the string might be varied but they involved objectionable operation of the apparatus, that is its rotation, and which operation, by a purpose of the instant invention, is eliminated. That rotation was for the mere purpose of varying the effect of a control spring device. Such a type of machine requires costly machine parts and labor and involves risk of tool loss, as by twist-offs or unscrewing at joints, and an object of this invention is to eliminate such parts and to greatly simplify the means for controlling the tripping function of the jar mechanism or tool.

A purpose of this invention is to provide means operated by a straight pull of the string to set the control for automatic release action.

Another object is to provide a hydro-mechanical control means for a hammer tripping mechanism, and provide for indefinite number of repeat operations at any desired string tension: all without other than a straight lift or lowering due to function of the mechanism and of the string.

An additional object of the invention is to provide a tool of this class which is of simple construction and easy and effective operation, and is substantial and reliable, and particularly whose several control parts are quite easily repaired or bodily substituted by parts which may be machined in field or supply shops with ordinary equipment.

The invention consists of certain advancements in this art as set forth in the ensuing disclosure and having, with the above, other objects and advantages as hereinafter developed, and whose constructions, combinations, and details of means, and the manner of operation will be

made manifest in the following description of the herewith illustrative apparatus; it being understood that modifications, variations and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more particularly claimed presently.

Figure 1 and Figure 2 are axial, partly elevational sections of related upper and lower fragments making up a whole jar mechanism of the instant invention; in the (fish attached) normal position for string tensioning.

Figure 3 is an axial section of a fragment of the mechanism showing parts when the string is under tension and in ready position for an automatic trip of its locking means or latch dogs.

This invention involves a string section consisting of a series of coordinated, cooperative devices making up a lacking means and a lock control device which latter is characterized as a hydro-mechanical governor; all of these features being organized into a unitary control tool whose head is connected to an appropriate tool string operated by a derrick works, and whose lower end is attachable to any appropriate fishing or other implement; neither the fishing tool nor the string being here shown.

The instant invention will be considered as made up of certain assemblies as follows:

*The wash pipe assembly*

A pin 2, for attaching a fishing implement, is screwed at 3 onto a nipple 4 which is screwed at 5 onto a tubular stem 6 having a packed head 7 into which is screwed at 8 an upstanding core or wash pipe 9 which ends at about the top of the control unit.

The piston head 7 has a vacuum breaking, check valve 10 seating upwardly in a port 11 by action of a spring 12 and fluid may flow down past the valve 10 under suction influence but not upwardly under pressure.

*The jar hammer*

Slidably mounted on the wash pipe 9 is a tubular hammer 15 having a ring head 16 and therebelow a reduced waist providing an upwardly facing, annular shoulder 17 on which rests a device or means functioning to yieldably lock the hammer 15 in a normally retracted position (away from an anvil) downward on the pipe 9. The hammer 15 is rigid with a tubular, upper mandrel 18 which screws at 19 into a top pin box 20 by which this control unit, in toto, attaches to the desired, upper string to the derrick floor. Thus a pull on the string pulls on

the hammer 15 and if this hammer is suddenly released it will snap sharply upwardly along the wash pipe; this being anchored to the engaged fish in the hole. Means are here provided to impart blows by the hammer 15 to the caught fish to loosen it in the hole.

#### *The anvil assembly*

Fitted about, and splined at 23 on the hammer head 16 there is a shell 24 having a bushing 25 packed at 26 onto the mandrel 18 and the lower end of the bushing presents an anvil face A to the upper shoulder H of the hammer head 16. The shell 24 is reduced and screws at 24a into the upper end of a barrel 27 and presents an annular, bottom end face 24b to the locking means above referred to. The barrel 27 is of considerable length and at its lower end has an internal shoulder 28 above which there is slidably mounted in the barrel chamber a sleeve piston 30 so fitted in the barrel as to expressly provide for a leakage of fluid between its periphery and the bore face of the barrel.

The sleeve piston 30 slidably fits on the piston head 7 and in normal, lower position is held slightly spaced, as by spurs 28a, from the shoulder 28 to insure that fluid L sealed in the barrel under the head, will be readily effective on the lower end face of the sleeve piston 30; which will hereinafter be called the floating piston, though it does not float: it has a free sliding action both as to the piston head 7 and as to the barrel 27 and as to a collar 40, and is an entirely unattached, fluid motivated prime motor. Packing 31 is provided about the piston head to prevent escape of motivating liquid L when it is subjected to pressure by up-stroke of the bottom 28 of the pocket below the head 7; the pocket above the head 7 being an unfilled reservoir.

The barrel 27 has a nipple 27a screwing into a thimble 33 and is packed at 34 about the headed stem 6 which forms a lower mandrel. The thimble 33 has an internal, annular shoulder 33a which is splined at 35 onto the nipple 4 of the stem 6 and this nipple 4 has a top shoulder 4a in normal, spaced opposition to the thimble shoulder 33a. It will be seen that if the thimble 33 moves upwardly as to the nipple 4 a pull is placed on the nipple and parts attached thereto and hanging therefrom. In other words, tension is applied to the caught fish. At the same time, if the barrel 27 is pulled upwardly, by means now to be described, the hammer head 16 will still be locked in down spaced position, as to its anvil A of the shell bushing 25, by a locking device and its control means.

#### *The hammer lock*

The locking means in the present illustrative embodiment includes a ring of separate, stiff, nearly vertical, truss bars or dogs 37 (13 in Hamm Patent No. 2,199,969, and over which this invention is a direct improvement in the same manner that Hamm advanced the jar of Knox Patent No. 1,801,673). The ring of dogs 37 is shaped to fit about the waist of the hammer 15 and partly stand on the shoulder 17 thereof and which shoulder slants downwardly and outwardly to be of cam function on the standing dogs while their upper ends are thrusting up against the end face 24b of the shell 24; the said face forming a fulcrum for oscillation of the dogs.

The dogs 37 are normally, yieldably, thrust

radially at their lower ends onto the cam face 17 by a contractor or controller collar 40 fitting slidably between the barrel 27 and the hammer head 16; the collar having an inverged face 40a engaging the near ends of the dogs. The collar 40 is seated on an appropriate (here helical) spring 41 housed in the barrel 27 and whose lower end stands on the floating sleeve piston 30; the spring 41 being normally somewhat compressed between the piston 30 and the collar 40 to insure that the dogs 37 are normally functioning to lock the hammer head 16 in down spaced position from the anvil A of the housing assembly 24, 25, 27 and 33.

It is understood that the incompressible liquid L fills the space between the packing on the piston head 7 and the packing 34 on its stem 6 and this liquid can at times flow down from the reservoir through the relief valve 10.

#### *The operation*

The fishing tool fixed on the assembly pin 2, having been caught onto a fish in a hole, the tool string is tensioned from the draw-works to pull on the top mandrel box 20 and thereby pull on the hammer element 15, which, being locked by the dogs 37 to the housing assembly, acts to pull this assembly upwardly along the stationary, wash pipe assembly holding onto the fish. The housing can move up until the thimble shoulder 33a engages the nipple shoulder 4a and is thereby stopped. The purpose of this upward movement of the housing assembly on the stem 6 and on the wash pipe 9; the housing being pulled up by the hammer element 15, is to effect a material increase of compression of the spring 41 against the collar 40 and this pressure is exerted harder on the toe ends of the dogs 37 until the spring pressure forces the floating piston down, (after the string pull of the hammer assembly including the locked barrel 27 has been stopped but holds greatly increased tension) as fast as an intentional leakage of fluid L around the piston sleeve 30 allows, and the reaction of the cam shoulder 17 of the hammer thrusts the dogs 37 outwardly and represses the cam collar 30 and thereby releases the tensioned hammer element 15 from the barrel 27 and the hammer then snaps up and strikes the anvil A of the barrel bushing 25. Since the thimble shoulder 33a is at this time pulling up on the nipple shoulder 4a it will be seen that a jar shock is struck on the tool coupling 2 on nipple 4. Thus the piston sleeve 30 by its differential upward stroke, under fluid pressure above the pocket bottom 28, has two functions, one to compress the spring 41 independently of any motion of the collar 40, and two, to hold it compressed to maintain the collar 40 against the dogs 37 until enough liquid has leaked past the elevated piston to allow the cam 17 to toe out the dogs and depress the collar 40. When this occurs the dogs take a vertical position between the barrel and the lower body part of the hammer 15 which has now been snapped upwardly so that the shoulder H impacts the anvil A of the barrel 27; the shoulder 33a all this time being in engagement with the joint shoulder 4a and therefore the blow of the hammer is transmitted to the fish tool on pin 2.

The string can be repeatedly lowered, after each jar function, to re-set the dogs and in this action the check valve 10 opens downwardly for free flow of the liquid L to break vacuum under the stem piston head 7.

There is a differential, upward movement of the floating piston 30 due to liquid pressure, greater than the spring reaction, on its lower end at each upward pull of the tool string. When the tension on the string is able to act through the hammer shoulder 17 to push the dogs 37 back out of the way of the shoulder 17 the dogs take a vertical position on the control collar 40 and the whole hammer element slides upward on the wash pipe 9 and in the stationary housing assembly (held by the nipple shoulder 4a) and the hammer bangs onto the anvil A and a jarring vibration is sent to the pin 2 and the subjacent fishing tool and its fish.

By watching the weight indicator the operator can regulate the jolt blow at will—the intensity of the blow is entirely independent of the degree of compression of the spring 41 whose function is, first to push up on the control collar, and second, to force the hydraulically controlled piston sleeve 30 down as fast as leakage of liquid past this piston will allow. When the pull on the shoulder 17 equalizes the thrust of the collar 40 on the dogs 37 the latter are about ready to trip off the hammer, and then at a little less pressure by the collar, due to liquid leak past the piston 30, the hammer is let go to hit the anvil.

What is claimed is:

1. In a mechanism for jarring well tools; a hammer element, a part having an anvil to be struck by the hammer, means connective to a tool string to put the hammer under tension, trippable, yieldable means to lock the hammer and said part (to be struck) as one, a hydraulic chamber, a floating device in said chamber and means yieldingly repressing said device, and a means for generating fluid pressure in said chamber to move said device against said yieldable means.

2. In mechanism for jarring well tools; a tensionable hammer means, an anvil means to be struck by the tensioned hammer, yieldable means for locking the said hammer and anvil in spaced, co-pullable relation, one of said hammer or anvil means being attachable to a tool string, a hydraulic chamber and a spring therein for said locking means, a piston working in said chamber and a seat for the said spring operative by change of fluid pressure by action of the piston to compress the spring.

3. A tool jar including a housing assembly including a hammer receiving anvil, a wash pipe assembly connective to a fishing tool and along which the said housing is slidable, a hammer slidably mounted on the wash pipe assembly and as to the housing, trippable locking means to connect the hammer to said housing for a pull as one, a spring for normally setting the locking means in effective position, a fluid chamber, a piston connected to the anvil and working in said chamber, and a seat working free in the chamber

and supporting the spring and being operative by fluid pressure under compression stroke of the piston.

4. The jar of claim 3, and said seat having a loose fit in the chamber to provide a slow leak and having a snug fit on the piston.

5. A tool jar including a housing assembly having an anvil, a wash pipe assembly connective to a fishing tool and along which pipe the housing is slidable, a hammer attachable to a pulling string, trippable means to interconnect the hammer to the housing for pull on the latter, an initial stop to limit motion of the housing on the wash pipe under such pull, a hydraulic chamber, a spring reacting on the locking means, freely movable spring supporting means in the chamber and a piston for generating changes in pressure of fluid in the chamber to accomplish a spring compressing action of said supporting means.

6. The jar of claim 5; said interconnecting means including a cam collar engaging the spring and a set of dogs repressible by the tensioned hammer to overcome the collar and repress it on the spring to disconnect the hammer from the housing for striking function.

7. In a jar having a set of latching dogs and a cam collar for setting the dogs in holding position on a jar element, a spring acting on the collar, a hydraulic chamber, a member in the said chamber for compressing the spring, and a piston in the chamber for generating pressure in a fluid in the chamber whereby to motivate said member in spring compressing function.

8. The jar of claim 7, said member being repressive by the spring as to the said piston whilst the collar is in a normal dog setting position.

9. In a jar of the class described, a hammer assembly and a jar anvil to be struck by the hammer, a hydraulic chamber, a piston in the chamber and connected to the anvil, a floating sleeve fitting the piston to shift thereon, a spring setting on the sleeve, and assembly and jar anvil interlocking means controlled by the spring; said piston operative to generate fluid pressure in the chamber to shift the sleeve in spring compressing direction and the spring reacting subsequently to repress the sleeve and to permit the locking means to trip.

10. A well tool jar having, in combination, a jar control and assembly lock including a latch dog cam collar, a hydraulic chamber in which the collar is slidable, a spring urging the collar in latch closing position, and a trip timing means including a floating seat for the spring, and a piston working in said chamber and operative to generate fluid pressure against said sleeve whereby to move the sleeve in spring compressing function; the sleeve having a leaky fit in the chamber so as to be repressed by the spring to time the moment of latch trip.

DONALD U. SHAFFER.  
EDWARD C. HAMM.