Aug. 1, 1944. D. U. SHAFFER 2,354,709

PRESSURE REGULATED, STRAIGHT PULL JAR MECHANISM

Filed April 1, 1942

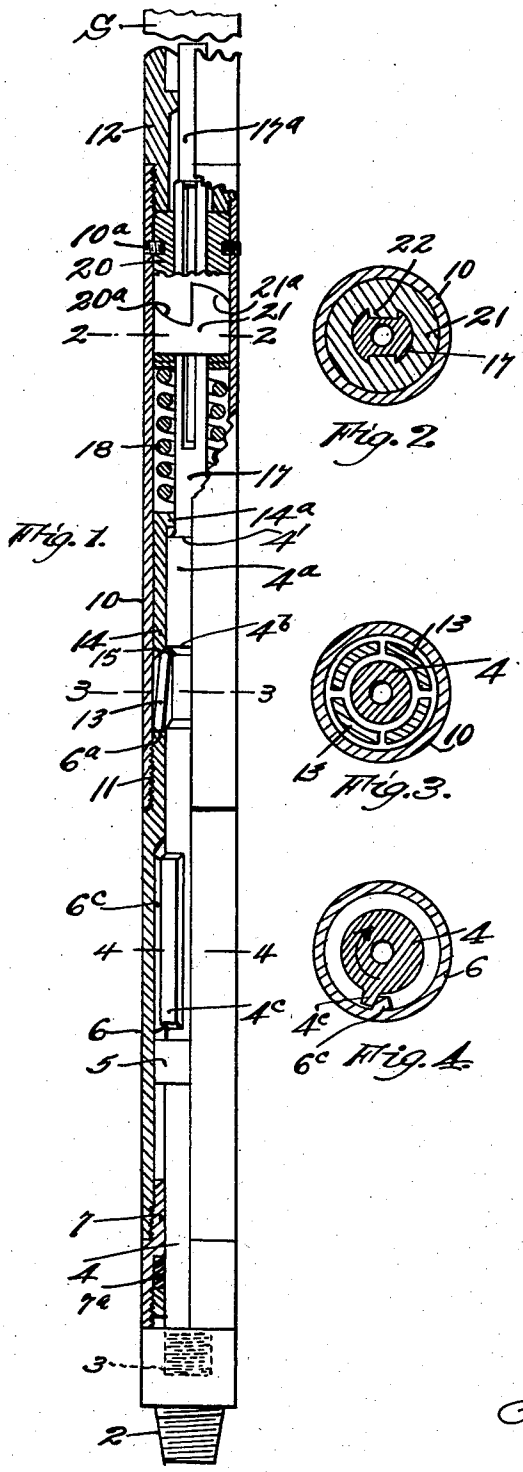


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

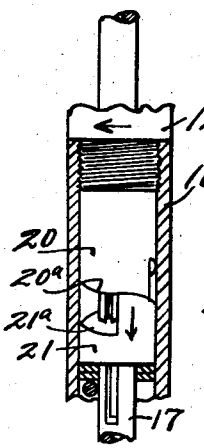
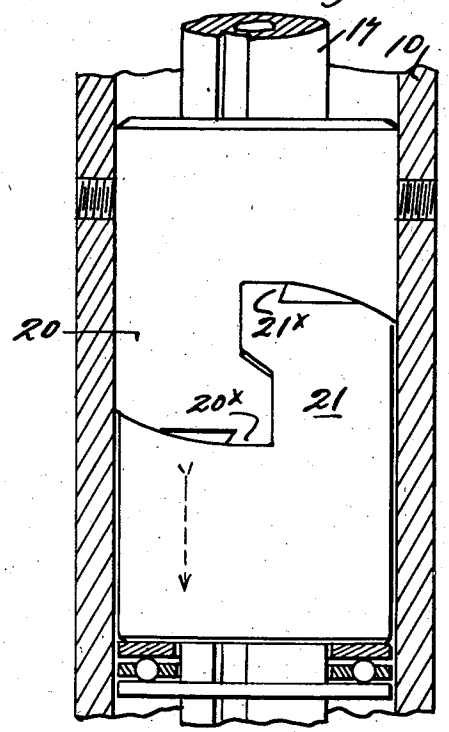


Fig. 5.

Fig. 6.



Inventor;
Donald U. Shaffer;
By his Attorney
Frederick E. Maynard.

Patented Aug. 1, 1944

2,354,709

UNITED STATES PATENT OFFICE

2,354,709

PRESSURE REGULATED, STRAIGHT PULL JAR MECHANISM

Donald U. Shaffer, Brea, Calif.

Application April 1, 1942, Serial No. 437,217

1 Claim. (Cl. 255—27)

Attention is directed to U. S. Patents No. 1,801,673 to Knox, and No. 2,199,969 to Hamm, the latter closely following the simple Knox tool jar and providing means to directly regulate the degree of reaction of the master spring 22, of Knox, which reacts on an assembly locking, trippable means.

The instant invention is a straight pull, tool jar of the Knox and the Hamm type and is an improved reaction regulator.

It is an object of this invention to simplify the means whereby the degree of resistance to the tripping feature is controlled and regulated, particularly so while the jar assembly is in a well or hole and is caught onto and by a "fish" or other part or object which may be jammed or frozen in the hole or well.

A further object is to provide a jar mechanism of remarkably low cost, of great ease of operation by but a partial turn of the upper string unit as to a lower tool unit to be jarred upwardly by function of the upper unit.

An additional object is to provide a jar of reliable and effective operation and of very ready, easy and rapid manipulation as to reaction load changes.

The invention consists in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose constructions, combinations and subcombinations, and details of means, and the functions, and the manner of operation will be made manifest in the following description of the herewith illustrative embodiments; it being understood that modifications, variations and adaptations may be resorted to within the scope, spirit and principle of the invention as it is more particularly claimed presently.

Figure 1 is an elevational, longitudinal section of the jar mechanism showing the parts at minimum trip resistance.

Figure 2 is a cross-section on line 2—2 of Fig. 1, to show intersplined mandrel and pressure regulator features.

Figure 3 is a cross-section on line 3—3 of Fig. 1 to show the group of tripping and locking tumblers in situ.

Figure 4 is a cross-section on line 4—4 of Fig. 1 to show rotation stops between the hammer and the anvil units of the assembly.

Figure 5 is a detail view showing the regulating presser foot in an increased reaction position along the mandrel of the tool unit.

Figure 6 is a longitudinal section, partly in side elevation showing a stopping means directly incorporated with the spring regulator to limit the degree of rotation of the cooperative regulator parts.

In one of its adaptations the tool jar here depicts a bottom pin or other means 2 for attachment of any desired combination of elements or implements as may be desired subjacently, as, for instance a fishing implement of which several kinds are well known in the deep well industry.

The pin 2 has bore threads 3 to receive the companion end of a mandrel shank 4 having an enlarged, medial piston slidably disposed in a barrel or shell element 6 the lower end of which has a bushing 7 in which is a bore packing 7a to seal on the mandrel 4. The upper end of the bushing 7 constitutes a substantial, annular hammer to impinge the lower shoulder face of the piston 5 when the barrel 6 is permitted to snap upward by tension of or on an upper shell part or jacket 10 threaded at 11 onto the barrel 6 and having at its top a suitable joint section 12 attachable to a tool or other string S.

Means are provided whereby to releasably lock the hammer bushing in down-spaced position from the anvil piston 5 until such a tension has been generated in the string S as may be desired. The barrel 6 has its upper end concaved at 6a to form a seat for an annular group of upright tumblers 13 whose upper ends are in direct end engagement with and constant end in-thrust action of a ram in the form of an annular presser foot 14 presenting a bottom end cam edge 15 to constantly, centripetally press the upper ends of the tumblers 13. This is a particularly efficacious mechanism or mechanical movement in tools of the jar-function type and is fully shown in the cited art.

The presser foot 14 slidably fits a head 4a, of the mandrel 4, having an out-bevelled annular shoulder 4b engaged by the rounded upper ends of the tumblers 13. Thus the top ends of the tumblers rest in the re-entrant angle between the annular cam edge 15 and the peripheral, conical, down-facing shoulder 4b of the mandrel. The mandrel and its affixed portions may be considered as the anvil unit of the disclosed tool jar.

The presser foot 14 has an inturned flange 14a adjacent a rim shoulder 4' of the head 4a and telescopes on the upwardly extending tubular stem (or wash pipe) 17 of the mandrel head 4a. The presser foot 14 is constantly pressed down onto the tumblers 13 by a suitable control spring device 18 whereby to keep the tumblers inward

under the lock shoulder 4b until such a tension is placed on the shell or jacket 10, while the mandrel tool is anchored, that the tumblers 13 will be wedged outward by the shoulder 4b and will overcome the pressure of the presser foot 14 and will force it upward on the head 4a.

As soon as the tumblers 13 clear the side of the head 4a the tension of the string S upward of the barrel 6 causes the barrel to jerk the hammer sharply against the anvil face of the piston 5. After string tension is thus released the hammer is again lowered, by the string, from the anvil piston 5 and the control spring 18 expands and the presser foot 14 again tips the tumblers into locking position under the lock shoulder 4b.

The novel concept of the present invention is the provision of a means greatly simplifying the Hamm adjuster to regulate or adjust the spring device 18 (here a simple helical spring) by less than one turn of the tool string S as to the shell enclosed mandrel while this is held against rotation by a fish or other agent. In this disclosure the mandrel 4 has, above the anvil piston 5, an elongate, spline or feather 4c which is designed to be engaged by a like feather 6c projecting inward from and along the bore face of the barrel 6 and above the piston 5. The shell barrel may, therefore, be rotated to nearly a full turn as determined by the peripheral width of the two feathers 4c and 6c.

The purpose of this range of turn of the shell structure as to the (stuck) mandrel is that a device to adjust the spring pressure may be brought into full range of function by only less than a turn of the tool string S by whatsoever agent may be utilized at the head of the well or hole—say the rig turntable or an equivalent wrench whereby the string can be and is locked against reversing action due to resistance of the powerful and sole spring device 18. The adjusting device here includes a preferably detachable and renewable or refaceable plug 20 rigidly and solidly affixed in the upper bore end of the jacket 10 in any suitable manner and means, the latter here shown as set screws 10a in the jacket. The lower end of this plug has an end, fast pitch or lead helical cam face 20a which is in constant engagement with a mating screw cam face 21a on the upper end of a floating cylinder 21 splined at 22 on the mandrel stem 17 which extends up through the plug 20 and has a reduced guide spindle 17a working in suitable packing in the joint section 12.

The operation is as follows: The assembly, including the lower unit comprising all parts joined to the mandrel, with the splined regulator cylinder 21, and the upper unit including all parts joined or fixed to the shell structure which joins the string S, is lowered into the well or hole while the cam 21a of the regulator is in fully screwed-up or closed position on its actuator screw-cam 20a so that the spring 18 is at least resistance on the presser foot 14. Assuming that the fishing implement, on joint 2, has caught a stuck fish or that some other holding situation exists as to the mandrel 4 the string S is now pulled until the locking tumblers can automatically repulse or wedge back the spring driven presser foot 14 and allow the hammer part 7 to be jerked up by and with the lower end of the stretched string S and the upper or hammer unit. If the obstruction held mandrel is not thereby loosened and started up the string is lowered to reset the tumblers under the locking shoulder 4b. The string may now be given a slight (say one sixth) turn with the result that the screw cam 20a presses the slidable, but anchored, regulator 21 down an amount of movement determined by the pitch of the facial helix of the controlling device and the spring 18 is somewhat more compressed and thereby holds the presser foot 14 on the ends of the tumblers 13 with an increased tilting load. Tension is now again applied to the tool string S until the tumblers are wedged out and release the hammer unit for strike against the anvil. When the fish is jarred loose by these actions the string S and its assembled jar units are drawn from the hole. By reason of a long lead or pitch of the helical face feature in the adjuster a great range of compression resistances is had in the master spring 18, even by less than one turn of the string S and the actuator part 20.

The table or wrench device T is in any suitable manner rotative one way to turn the string S and then locked against reverse moment under torque of the fast pitch helical feature of the adjuster.

A form of the rotation stop means is shown in Fig. 6 which eliminates the feathers in the lower members of the assembly and consists of a substantial nog or side shoulder 20x on the actuator 20 to abut a companion shoulder 21x on the cylinder 21 when these parts have made nearly a full relative rotation.

What is claimed is:

A well tool jar having in combination, relatively rotative hammer and anvil parts and means splining the parts and limiting relative rotation, the anvil part having a friction shoulder, a set of tumblers having engagement with the shoulder, and with the hammer part, a trip control spring constantly acting on the tumblers to press them under said shoulder and said shoulder reacting on the tumblers to trip them out of locking engagement when predetermined tension is placed on the hammer and the anvil parts, and means for varying the reaction of the spring by a relative rotation of said parts, the last named means including mutual cam members one of which is slidable as to both the hammer and the anvil and is splined to one of them against turning thereon and the other cam member is fixed to the other of them to rotate therewith for the purpose of axially shifting its companion cam member and thereby increase the compression of the said spring.

DONALD U. SHAFFER.