

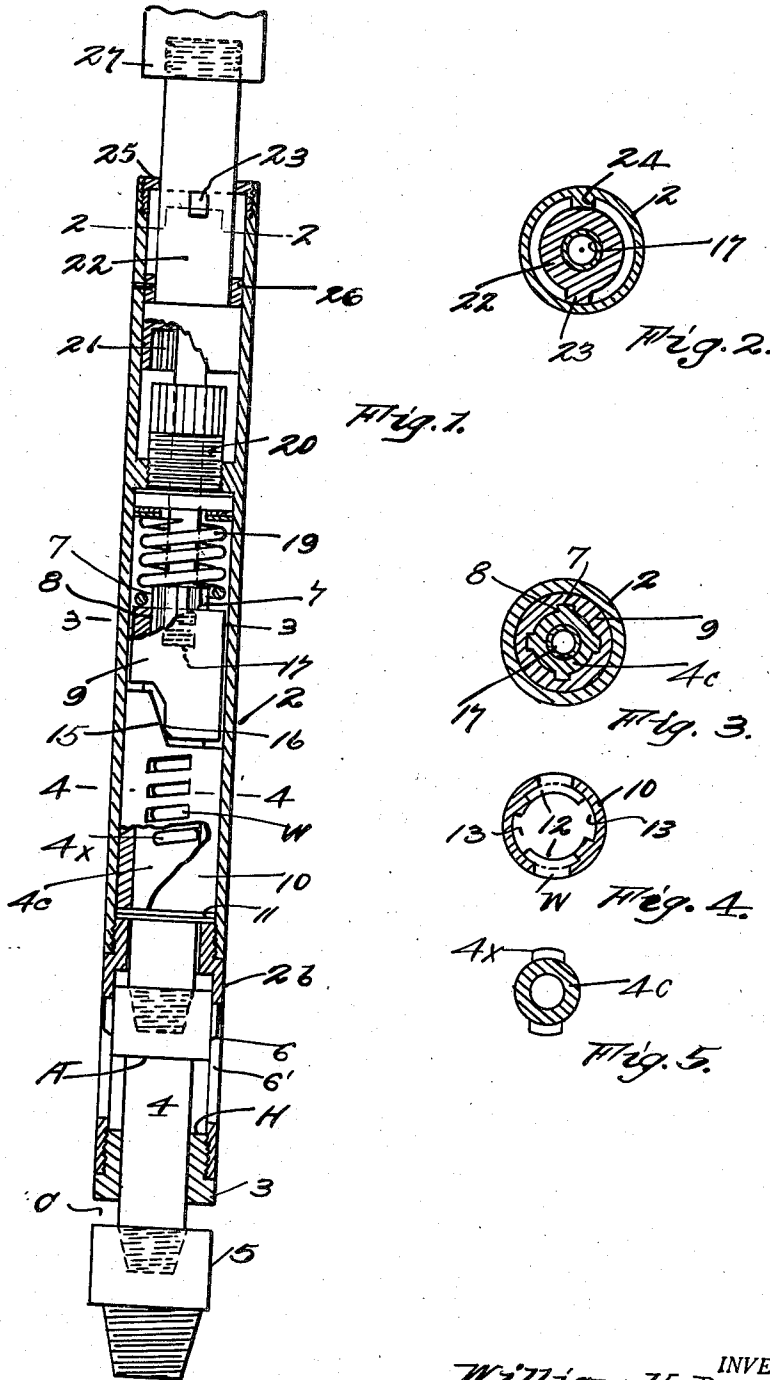
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ROTARY JAR

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ROTARY JAR

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This invention is an assembly of the type known in the oil field industry as a jar.

Such jars are incorporated in a tool string for the purpose of imparting a blow of considerable intensity suddenly to the tool end of the string if and when the tool should be so firmly frozen in a well hole that it cannot be pulled without danger of damage to or loss of the tool and a part, at least of the made-up string of pipe sections and drill collar, which latter is at the lower end of the working string.

Many kinds of torque controlled jars assemblies have been proposed and several are quite successful, but there is always some chance of jar failure for various reasons well known in the art; especially so when the essential tripping elements have at least one trip member rigid with the conventional jar housing.

It is an object of this invention to provide a jar in which the tripping device is more dependable.

A further object is to provide a jar in which a trip sleeve releasably interlocks with cooperative thread lugs rigid on a mandrel and which sleeve is relatively movable in and is positively actuated by the jar housing to put lifting pressure on the mandrel lugs and effect ultimate trip of the sleeve and its housing from the frozen mandrel.

Also, an object of the invention is to provide a spring controlled tripping jar in which there is wrench and nut means for varying the reaction of the spring at will, and which wrench has the further function of rotatively driving the housing structure of the jar.

The invention resides in certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as will hereinafter develop, and whose constructions, combinations and details of means and the manner of operation will be made manifest in the following description of the here-with illustrative embodiment; it being understood that modifications, variations and adaptations may be resorted to within the scope, spirit and principles of the invention as it is claimed in conclusion hereof.

Figure 1 is an axial, sectional elevation of the jar with its hammer and anvil members locked in normal spaced position ready for a jar stroke of the hammer. Figure 2 is a cross section of the housing on line 2-2 of Fig. 1. Figure 3 is a cross-section on line 3-3, Fig. 1. Figure 4 is a cross-section of the trip sleeve, on line 4-4 of Fig. 1. Figure 5 is a cross-section of the upper part of the mandrel; its locking lugs being in plan.

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The housing of this jar includes an elongate, tubular shell 2 to the lower end of which is threaded a barrel 2b in the lower end of which is threaded a bushing 3 whose top end constitutes a hammer H. Slidably fitted in the bore of the barrel is a mandrel 4 on which is screwed a coupling 5 for attachment of any desired subjacent tool or other tool string device (not shown). The mandrel has longitudinal splines 6 fitting spline-ways 6' in the barrel so that torque on the barrel, by way of the housing shell 2, will rotate the mandrel. Torque herein means rotational effort.

The mandrel has an anvil forming shoulder A to be impinged by the hammer H when this is given a sudden upward stroke, as will be explained.

To the mandrel 4 is coaxially screwed a mandrel upper core 4c which has a suitable number of longitudinal rows of spaced, rigid camming or trip lugs 4x which are uniformly helically pitched in screw-like manner on the core 4c. Upwardly of these rows of lugs the mandrel core is provided with longitudinal splines 7 which engage in spline-ways 8 formed in the upper end of a tubular dog 9 which slidably fits on the core 4c and freely slides in the housing shell.

A feature of this invention is the provision of a reliable means for normally, but releasably locking that is, axially hooking the housing structure to the mandrel by way of the lugs 4x to hold the hammer spaced from the anvil. This feature here includes a tensioning sleeve 10 which turnably and slidably fits in the bore of the shell 2 and is supported normally and turnably on bearing washers 11 resting on the top, sleeve supporting end of the barrel 2b.

To facilitate the washing out of small solid grains of sand or other pieces the sleeve has wash windows W to its bore. For the purpose of locking the sleeve to the mandrel lugs 4x so that a tension can be put on the mandrel and hold the hammer spaced below the anvil A opposite rows of internal, interrupted threads or helical cam teeth 12 are provided between the window edges on the sleeve and which are complementary to the short camming lugs 4x of the mandrel core. The longitudinal spaces 13 at the ends of the teeth 12 provide escape ways for the mandrel lugs when the sleeve 10 relatively rotates on the lugs 4x of the mandrel to such a degree that the lugs can ride off, or trip off of the pulling sleeve teeth 12. Such a tripping action by the inclined, cam lugs 4x allows the sleeve and the housing to snap upwardly along the frozen tool mandrel to bring the hammer H against the standing anvil by reason of tension that has been set up in the

tool string—when this jar is made up in such a string.

Means are provided to restrain the tripping action of the trip sleeve until a desired tool string tension has been set up in the jar by way of the mandrel lugs 4x locking in the sleeve teeth 12. To that purpose the upper end of the sleeve 10 has an oblique torque face 15 constantly engaged by an opposed face 16 on the lower end of the controlling, tubular dog 9 which is slidably splined at 8 on the upper end of the mandrel core 4c.

The dog is constantly pressed down onto the sleeve by a strong spring 19 reacting upwardly against a nut 20 threaded in the bore of the shell 2.

Another feature of this invention is a means whereby to adjust the nut 20 at will for regulation of pressure of the spring 19. The adjusting means includes a wrench socket 21 to non-turnably fit on the upper end of the nut 20. A stem 22 extends up from the socket and has a drive key 23 turnable in the shell, to engage a stop 24 fixed therein, and having longitudinal movement limited by top and bottom stops 25 and 26 in the shell. To the upper end of the stem is attached a coupling 27 to join to a superjacent tool string in making up a tool assembly using this jar.

By lowering the tripped housing unit (shell and barrel) the tripping sleeve is again shifted down the stuck mandrel to again interlock the core lugs 4x into the sleeve threads in readiness for a repeat tripping and jar function.

Enough clearance is left at C between the foot of the barrel 2b and the bottom coupling 5 to allow the sleeve 10 to open from its bearing washers 11 so that liquid can flush out small solid particles which may collect in the tripping sleeve.

A wash pipe 17 screws into the upper end of the mandrel.

Figure 1 shows the mandrel lugs 4x in a position interlocked between the teeth 12, between the windows, of the sleeve 10 and therefore locking the shell and its hammer H in a position to make an up stroke toward the anvil A; the splines 6 being for turning torque only from the sleeve to the mandrel. When pulling tension is put on the shell and the barrel 2b by the tool string (in which the jar may be connected) the sleeve 10 is forced upward by the barrel and because of the inclination of the now engaged teeth 12 and the lugs 4x the sleeve exerts a strong turning torque on the frozen or stuck mandrel or its attached implement. This is a desired action as the sustained torque will aid in the jarring effect.

When the engaged cam lugs and cooperative teeth 12 can no longer resist the turning torque and the torque overcomes the spring pressure on the dog 9, the cam facet 15 of the sleeve forces the dog upward and the released sleeve 10 moves its teeth 12 into register with the escapeways 13. The freed sleeve and the hammer barrel are now snapped upward along the mandrel and the hammer strikes the anvil. During the jar stroke the splines 6 shift upward along the stationary splines 6. The right-hand pitch of the cam teeth

12 causes the sleeve to rotate to the left-hand (viewed looking down, Fig. 1).

What is claimed is:

1. A rotary jar, for well tools strings, having, in combination, an anvil-faced mandrel structure provided with peripheral camming lugs, a sleeve having internal, camming teeth in a row along the sleeve bore and which are complementary to the said lugs and an escape-way longitudinally in the sleeve for longitudinal shift of the sleeve when its teeth are freed from the said lugs, and a mandrel hammer housing in which the sleeve is rotative and axially movable; the housing, when under tension, operative to pull the sleeve teeth against the mandrel lugs whereby to effect a sliding trip-off of the sleeve from the lugs a tubular, sleeve-locking dog slidably splined on the mandrel, said dog and sleeve having cooperative, lateral, locking faces whereby the dog is repressed by the sleeve to permit free ascent of the housing as to the mandrel for hammer blow when the said lugs and teeth relatively turn out of engagement, an expansion spring seated on the upper end of the dog, a nut threaded in the housing and compressing the upper end of the spring onto the sleeve, and a socket wrench enclosed in the housing and shiftable to and from operative engagement with the said nut whereby to adjust the spring compression.

2. The jar of claim 1; and means in the housing for connecting the wrench to the said spring nut at any time desired when the jar is organized in a tool string.

3. The jar of claim 2; a wrench stem slidable and having a limited degree of rotation in the upper end of the housing and adapted to lock the socket onto said upper end of the nut and turn it in the housing to change compression of said spring; the wrench normally being disengaged from the nut.

4. In a tool string jar; a torque trip-off device, a housing for said device, a spring for controlling trip action of the device, and means for varying the spring compression at will and including a nut threaded in the housing and engaging one end of the spring, and a wrench freely shiftable and having less than one rotation in the housing to interlock with and turn the said nut by rotation of the housing; the wrench having a stem provided with a shoulder on and by which the housing is suspendable and is rotative, said housing having a hammer part and telescoping on an anvil part of the mandrel to be jarred by the hammer.

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