

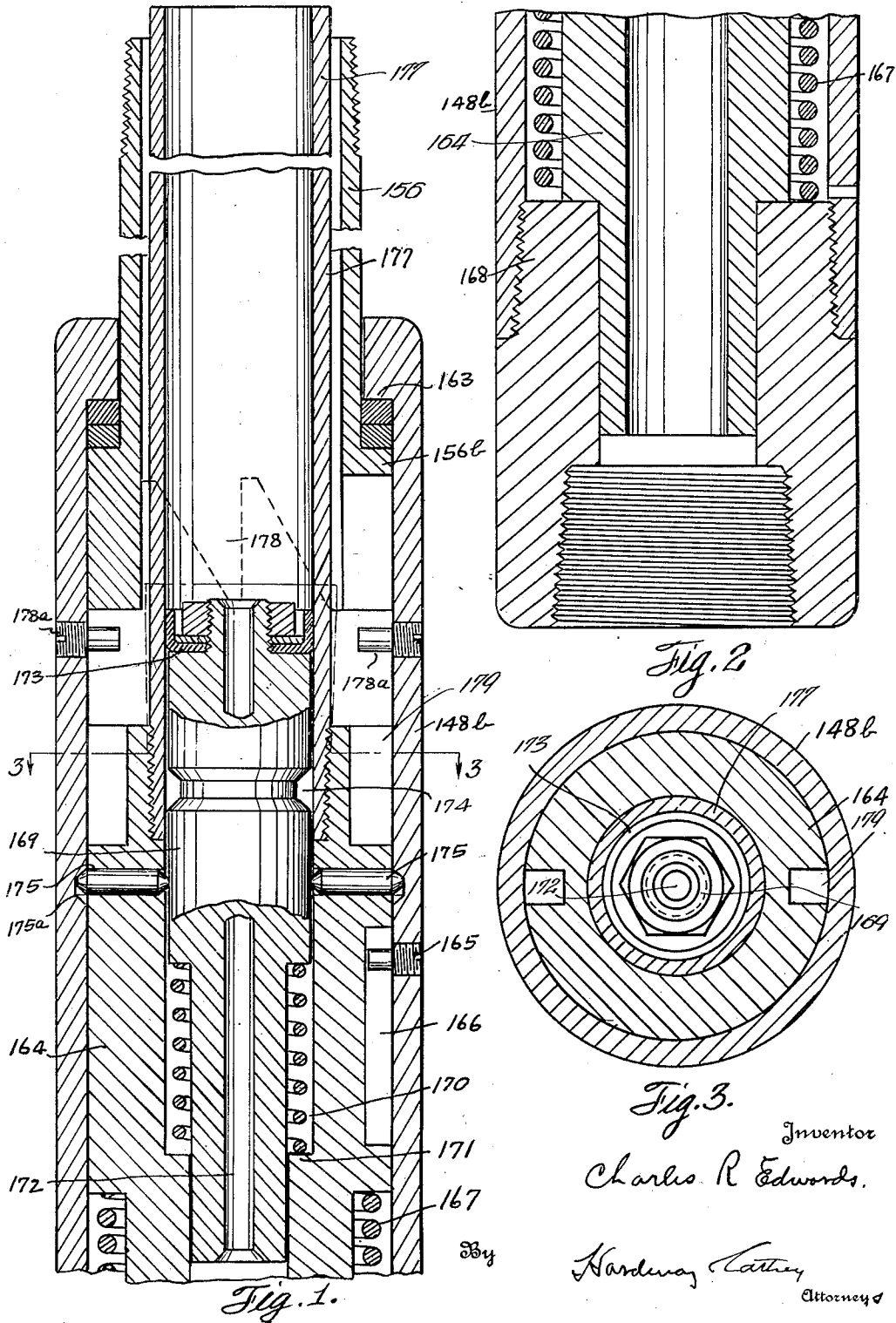
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ROTARY JAR

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2,055,683

ROTARY JAR

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13 Claims. (Cl. 255—27)

This invention relates to rotary jar and more particularly to a rotary drill hydro-mechanical jar.

One object of the invention is to provide an apparatus of the character described whereby well drilling and oil producing equipments, such as pipe, drill stems, casing, tubing, screens, packers and the like, when stuck in a well bore, may be dislodged and removed from the bore expeditiously and inexpensively, without injury, or with a minimum of injury to the removed equipment.

A jar that is caused to release to jar by rotation is not suitable for operation with ordinary fishing taps unless designed with a rotation interlock, and fishing taps are unsatisfactory for use with jars because they often cannot be released from stuck objects and in other cases they tend to split the casing and the like, or fail to grab and very often cause serious losses and failures. Therefore, to be successful in such jarring it is necessary to use releasable grapples.

Certain types of releasable grapples are not suitable for use with jars, particularly any type that is not adapted to take torsional strain or that has any threaded release that may be overstretched when such a release comes under the severe jarring blows such as are encountered particularly when a number of very heavy "Kelly" joints are used immediately above the jars. Also all threaded connections in the fishing string must be maintained very tight, for any working or movement in a threaded joint will almost always cause the joint to break and further complicate the work. For these and other reasons it is very essential to success that special grapples that are designed to transmit torque be combined with jars for as explained many grapples cannot be used at all or if used the jars will not successfully work.

The grapples shown in the parent application are very well suited to operate with jars of this present type.

An object of this invention is to provide a jar that does not require the use of the drill rotary to latch or unlatch jar members. In jarring on stuck objects it, in many cases, requires constant jarring for several hours to loosen the stuck object and if the rotary is used to unlatch or latch the jars then the driller's work becomes almost unbearable with the result that the jarring operations are greatly slowed up and consequently the loose material that is jarred out and falling out of the walls of the well during the jarring operations often settle down as fast or faster than the stuck object can be jarred and pulled up past

this falling material that is settling or falling down through the drilling fluid.

With this invention since the driller does not need to stop and change the clutches several times for each stroke of the jars, great saving in time is made and the falling material is far less in quantity and the stuck object can be much more quickly removed before there is an extra accumulation of the fallen material to hinder operations.

The principal subject matter of this application constitutes matter taken out from my copending application on Well cleaning apparatus filed in the United States Patent Office on October 25, 1927, under Serial No. 228,681, and is therefore a continuation in part of said indicated parent application.

With the above and other objects in view this invention has particular relation to certain novel features of construction, operation and arrangement of parts as will become more apparent from an examination of the examples here given in this specification and illustrated in the accompanying drawing, wherein:—

Figures 1 and 2 show vertical sectional views of a type of jar employed.

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

Referring now more particularly to the drawing wherein like numerals of reference designate similar parts in each of the figures and referring particularly to Figures 1, 2 and 3 wherein there is illustrated one form of a mechanical jar, especially adapted for and of use with pipe pulling tools, cutters and the like, often when a section of pipe will not move under a straight pull.

In the jar shown in Figures 1 to 3 inclusive the body 148b has an annular inwardly extending flange 163, at its upper end and the operating drill stem is adapted to be connected to the flanged nipple 156b, said flange nipple having a swiveling connection with said body. There is a cylinder 164 which is fitted within said body and which is held against rotation therein by means of the key 165 which is threaded through the body wall and whose inner end projects into a vertical keyway 166 in the periphery of the cylinder.

A use for the key 165 is to prevent relative rotation between the cylinder 164 and the body (148b—168) which carries a grappelling tool that is screwed into the threads in the lower end of Figure 2.

The grappelling tool may at times be an ordinary taper tap to be screwed into or over the stuck pipe. In the event the grapple is a taper

tap it is necessary to screw it onto the stuck pipe tight and therefore, a rotatable driving connection as at 165—166 is necessary to transmit rotation when using pipe 177, the upper section of which

may be drill stem, as the operating member.

This cylinder 164 is mounted on a yieldable seat such as a stiff strong coil spring 167, which in turn rests on the coupling 168 which is threaded onto the lower end of the body and to which the grappling or fishing tool is adapted to be connected.

Within the cylinder there is a piston 169 which is supported on a yieldable seat such as a coil spring 170, which in turn rests on an inside annular shoulder 171 in said cylinder. The piston has an axial channel 172 therethrough and secured on the upper end thereof, there is the usual cup ring 173 and beneath the ring, the plunger has an annular groove 174.

The cylinder 164 is normally locked against lengthwise movement in the body 148b by radial dogs 175 whose inner ends rest against the piston 169 and whose outer ends are seated in recesses 175a in the inside of the body 148b. Screwed into the upper end of the cylinder 164 there is a section of pipe 177 which forms a weight and also constitutes in effect, an extension of the cylinder 164.

Obviously the upper sections of the pipe 177 may be taken as extending to above the top of the well and may be at times used as the operating stem or member in which event no pipe need be added to the top of 156b; this manner of using the present jarring device of Figures 1 to 3 does not contemplate or make any change whatsoever in the structure of the device in Figures 1 to 3.

However, the now preferred form is the form shown here in Fig. 1. The reasons for preferring the form shown here in Fig. 1, are that it has an independently movably jarring element, such as the member 164 and thus requires a far lighter jarring blow to move the stuck pipe when the stuck pipe is under a constant strain upward at all times while jarring. Also with this type of jar when using lighter jarring blows there is much less damage done to the tools and other equipment. With this type of jar it is unnecessary to use heavy jarring that causes a well to cave.

With this type of jar that uses light blows and avoids using heavy jarring in a mud filled well having porous walls which, heavy jarring, often causes a large part of the water in the mud to be driven out of the mud and into the porous walls of the well bore thus this light jarring causing the mud that is below the jar and below the circulating mud to become so nearly dry, hard and compact as to tend to stick the stuck pipe more and more.

When water under pressure is forced down through the drill stem the piston is forced downwardly until the groove 174 comes opposite the keys 175 and said keys are released to move forwardly into the groove 174 thus releasing said cylinder 164 from the body 148b and the cylinder moves upwardly due to the force of the compressed pressure spring 167 striking said flanged coupling 156b a sudden blow, and said spring 167 is again compressed by lowering the weight of the drill stem and flanged coupling 156b and is again locked down when locking pins 175 are brought opposite the depressions 175a by the action of the spring 170 on piston 169. An-

other pull and another pump pressure causes another jar.

An alternate method of locking the cylinder 164 in its down position is to apply sufficient fluid pressure on the top of the piston 169 so as to carry the groove 164 to below the inner ends of the radial dogs 175. In this last event the cylinder remains locked down until the fluid pressure above the piston 169 is released and the compressed spring 170 then raises the piston 169 until the groove 174 comes to a point opposite to the radial dogs 175 and permits them to enter groove 174 and thus unlock the cylinder and its attached parts to jar up on the stuck pipe. It is obvious that when the inner end of the dogs are bottomed in the groove 174 a vertical movement of the piston 169, either up or down, will force the dogs 175 out into recesses 175a whenever cylinder 164 is in its down position so as to lock the cylinder 164 in its down position preparatory to jarring.

The lower end of the flanged coupling 156b is formed with depending ratchet teeth 178, adapted to be engaged with the inwardly extending studs 178a carried by said body so that they may be interlocked and the entire apparatus rotated as a whole when the flanged coupling is lowered.

The upper end of the element 164 is formed with keyways 179, as shown in Figs. 1 and 3 suitably placed to receive the screw studs 178a when the element 164 is in its upper positions.

The upper end of the element 164 is annular in form (see Fig. 3) except for the keyways 179 and in its uppermost position abuts upwardly against the lower end of the flanged coupling in such a manner as to deliver an upwardly jarring blow when the interlocks 175 are released.

The pipe 177, shown in broken sections, is screwed into the upper end of the cylinder element 164 and extends upwardly to any suitable distance. This pipe 177 may form a part of the cylinder 164.

There are enough dependent ratchet teeth 178 formed in the lower end of the rotatable section 156b to receive the screw studs 178 when the section 156b is in its lowered positions. These are of use in rotating the body 148b through 156b when 156b is in its lower positions.

The upper end of the piston 169 is formed with an upstanding threaded reduced in diameter stud suitably formed to receive the packing member 173 and a washer and a nut to retain the washer and packing in place.

The screw studs 165, only one is shown, extend through the wall of the outer body 148b into slots or keyways 166, only one is shown, formed in the cylinder element 164 and are of use to prevent the body 148b from turning with reference to the cylinder element 164 and at the same time permit limited vertical movement of the cylinder 164 in reference to the body 148b.

What I claim is:—

1. A jarring tool for use in connection with a hollow operating member including two sections connected for limited relative longitudinal movement, jarring shoulders in connection with the sections, means for releasably holding the sections against relative movement, and means for releasing the holding means including a member directly engaging the holding means and a piston for operating the member to release the holding means operable by fluid pressure applied through the operating member.

2. In a rotary hydraulic jar, a barrel, a mandrel arranged for sliding movement within said barrel, a plurality of slips arranged between said barrel and mandrel, means for holding said slips in position to effect locking engagement between the barrel and mandrel and means for producing and maintaining hydraulic pressure on said rotating means.
3. In a rotary jar, a barrel, a mandrel arranged for sliding movement within said barrel, a plurality of slips arranged between said barrel and mandrel and pressure actuated means for holding said slips in position to effect locking engagement between the barrel and mandrel.
4. A well tool of the character described including, a barrel, a body movable longitudinally in the barrel, means adapted to be set to releasably hold the barrel and body against relative movement, and fluid pressure actuated means for setting the first mentioned means.
5. A device of the character described including, a barrel, a body movable longitudinally of the barrel, a key operable to a position where it prevents longitudinal movement between the barrel and body, and fluid pressure means for operating the key to said position.
6. A device of the character described including, a barrel, a body movable longitudinally of the barrel, a key operable to a position where it prevents longitudinal movement between the barrel and the body, and fluid pressure actuated means for operating the key to said position, said means including a piston.
7. A jar including two members slackly linked together and having spaced, opposing impact abutments, means rendered operative by fluid pressure to interlock said members against relative longitudinal movement in one direction.
8. A jarring tool of the character described including two sections connected for relative longitudinal movement, jarring shoulders limiting movement between the sections, means for releasably holding the sections against movement

including a latch carried by one section having a part to extend into a recess in the other section and a projection on the latch, a member at the latch to hold the latch with said part in the recess and having a recess to receive the projection to allow the latch to move so that said part leaves the first mentioned recess, and a spring normally holding the member in position where the latch is held with said part in the first mentioned recess.

9. In a drilling jar, a barrel, opposed hammer faces within said barrel and a hydraulically releasable clutch for holding the hammer faces apart.

10. In a rotary drilling jar, a barrel, means for supporting a barrel from the well string, a bit or tool below the barrel, a wash pipe and plunger within the barrel, an expansible clutch carried by the barrel and plunger, and hammer faces also on or between said barrel and plunger.

11. A jar including, two members slackly linked together and having spaced opposing impact faces, means for interlocking said members against relative lengthwise movement with their faces spaced apart, and means to releasably hold the first mentioned means in inter-locking relation controllable by pressure.

12. A well jar of the character described including, a barrel, a body movable longitudinally in the barrel, means adapted to be set to releasably hold the barrel and body against relative movement, and means for setting the first mentioned means releasable by fluid pressure.

13. A jarring tool for use on a string of drill pipe including, two sections connected for limited relative longitudinal movement, the sections having fluid passages, mechanical means for releasably holding the sections against relative longitudinal movement releasable by a tensile strain on the sections, and fluid pressure means for controlling the operation of the said mechanical means.

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