

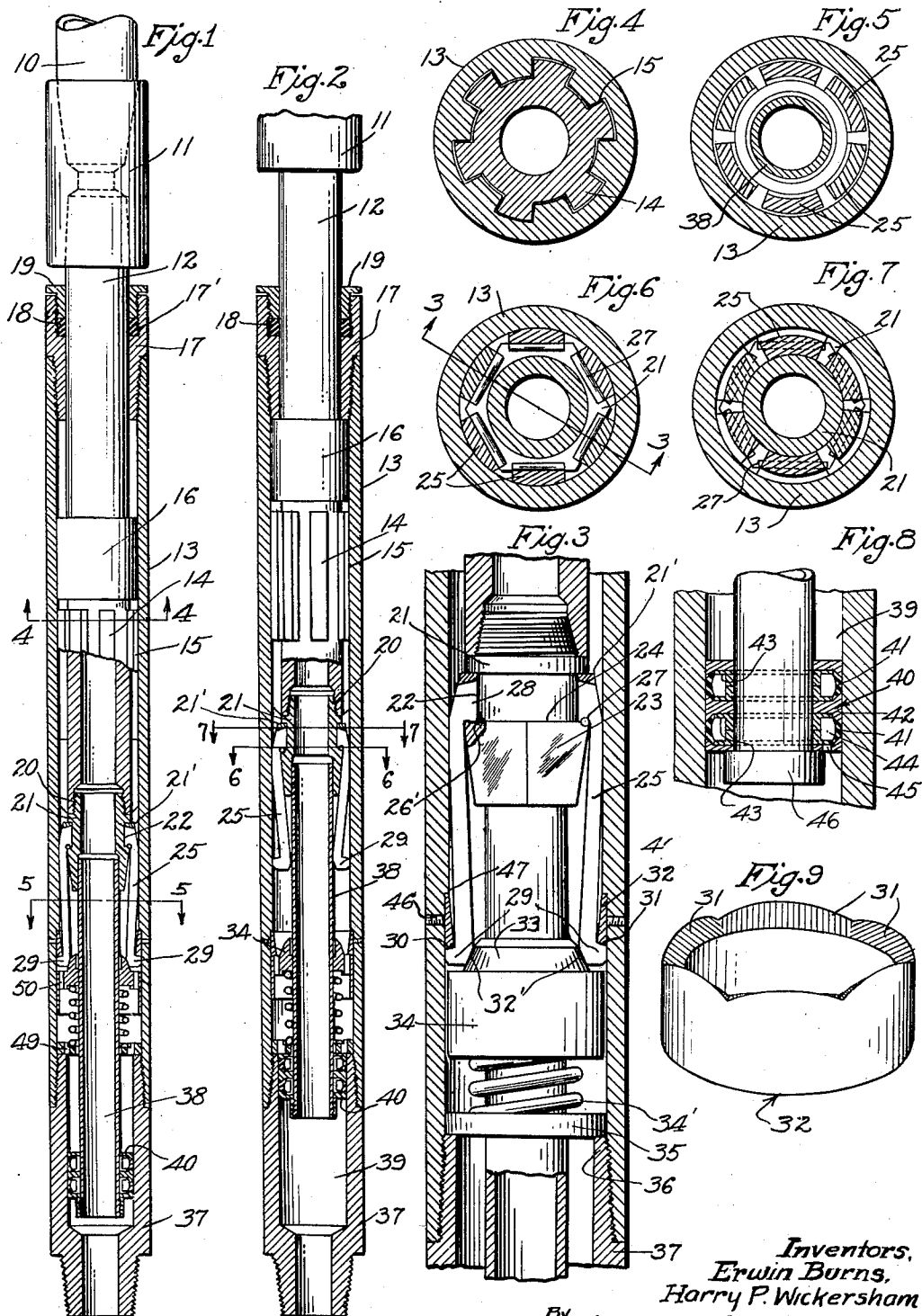
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WELL JAR

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WELL JAR

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This invention relates to well drilling apparatus and particularly pertains to a jar for rotary drill equipment.

In the operation of rotary well drilling equipment it often becomes necessary to exert violent jarring action upon the drill string and it is the principal object of the present invention to provide a jar structure adapted to be interposed at a point in a drill string, and which will normally function to cause unitary rotation of the drill string without strain upon parts of the jar, and which may be actuated under a predetermined tension to release itself, thereby permitting limited relative movement between the portion of the length of the drill string above the jar and the length of drill string below the jar, and it is a further object of the present invention to provide a structure capable of this operation, the parts of which are securely housed, and are of sufficient strength to withstand all of the strain to which they may become subject without becoming inoperative, and while making it possible for them to be actuated to lock the jar in its normal position after a jarring action has taken place, all of which structure is compactly enclosed within a fluid seal compartment within which a lubricant may be contained.

The present invention contemplates the provision of a jar structure within which a mandrel and body may have limited reciprocal movement with relation to the mandrel, said members being normally locked together and automatically released upon exertion of predetermined tension force, and thereafter relocked if desired.

The invention is illustrated by way of example in the accompanying drawing in which:

Figure 1 is a view in vertical section and elevation showing the well jar with which the present invention is concerned and with the mandrel and body locked against longitudinal movement.

Fig. 2 is a view in central vertical section with parts broken away showing the mandrel and the jar as released with relation to each other, whereby limited reciprocating movement may take place.

Fig. 3 is an enlarged fragmentary view in section and elevation showing the locking mechanism.

Fig. 4 is an enlarged view in transverse section through the structure as seen on the line 4—4 of Fig. 1.

Fig. 5 is an enlarged view in transverse sec-

tion through the lock portion of the well jar as seen on the line 5—5 of Fig. 1.

Fig. 6 is a view in transverse section through the well jar as seen on the line 6—6 of Fig. 2, showing the manner in which the slips are pivotally mounted.

Fig. 7 is an enlarged view in transverse section through the well jar as seen on the line 7—7 of Fig. 2 and showing further details of the arrangement of the slips.

Fig. 8 is an enlarged fragmentary view in vertical section showing the packing piston within the body and the manner in which it is mounted upon the wash pipe.

Fig. 9 is an enlarged view in perspective showing the peculiar formation of the latch collar.

Referring more particularly to the drawing, 10 indicates a drill stem to the lower end of which a bottom substitute coupling 11 is attached. This coupling has a threaded aperture in its lower end to receive a threaded upper end of a mandrel 12. This mandrel is tubular and extends for a considerable distance downwardly into the tubular body 13 of the well jar. For a distance along the length of the mandrel and near its lower end is formed a series of flutes 14 which engage keyways 15 formed along and extending longitudinal of the inner face of the body 13, and which permit relative longitudinal movement between the body and the mandrel while insuring that the mandrel and the body will rotate in unison, irrespective of their longitudinal positions with relation to each other. Formed upon the mandrel directly above the fluted portion is a jar collar 16 which is cylindrical and substantially agrees in diameter with the inner diameter of the body within which it may reciprocate. This jar collar may be brought to bear against the end face of a knocker substitute coupling 17 which is threaded into the upper end of the body and through which the mandrel extends. This coupling is formed with a packing bore 17' within which the packing of rubber or other suitable material 18 is positioned, and which packing is held in position by a gland 19 threaded into the bore. The lower end of the mandrel 12 is formed with an internal threaded bore 20 to receive the threaded end of a tubular adaptor 21. This member extends longitudinally from the end of the mandrel and at a point midway its length is formed with a reduced portion 22, the lower end of which is formed with an enlarged frusto-conical portion 23 providing a shoulder 24 over the edge of which the slips 25 extend. This shoulder is here shown as being hexagonal, having recessed faces 26' to receive bearing pins 27. The

overhanging shoulders 28 of the upper ends of the slips 25 are also recessed to receive a portion of the bearing pins so that the slips will be pivoted upon roller bearings and may readily swing with relation to the shoulder without wear. The slips 25 are substantially arcuate in section and conform to the inner surface of the body 13 in a plane substantially agreeing with that of the shoulder 24. The lower ends of the slips are formed with out-turned hooks 29 having upper faces 30 registering with faces 31 of a latch collar 32. This latch collar is particularly shown in Fig. 9 of the drawing, where it will be seen that the various faces 31 are disposed at an angle to the transverse plane of the collar, and that each face is in a continuous flat plane which insures that under a predetermined tension upon the slips agreeing with the angle of the face the hooked end of the slips will slide off of these faces and permit the device to release the back faces of the ends 29. The slips are beveled as indicated at 32' and are in contact with a cone shaped end 33 of a control piston 34. This control piston reciprocates within the tubular body 13 and its projecting cone end 33 is forcibly wedged between the depending ends 29 of the set of slips by an expansion spring 34' which rests upon a washer 35. The washer 35 is held in position by the upward projecting end 36 of a piston substitute coupling 37 which is threaded into the lower end of the body 13.

Secured within the lower open end of the adaptor 21 is a wash pipe 38 which extends downward through a central fitting of the control piston 34, and then into a cylindrical bore 39 of the lower connection 37. Mounted upon the lower end of the wash pipe and reciprocating within the cylindrical bore 39 of the coupling 37 is a packing piston 40. This piston is a composite structure comprising a plurality of self-aligning piston rings 41 supplemented by piston discs 42 and annular supporting angles 43.

Referring particularly to Fig. 8, it will be seen that the sectional formation of the pistons is substantially crescent shaped with a relatively narrow flat portion on the outer face of each piston and intended to contact with the wall of the bore 39. Due to this arrangement fluid may enter the annular space 44 in the rear of the piston through opening 45, and exert an outward pressure against the piston rings sufficient to cause the rings to hold tight against the side wall, and since the rear face of the ring with which the fluid contacts is of greater surface area than the flat face in contact with the wall of the cylindrical bore 39, the rings will be held in alignment with the face and will create a seal therewith. A nut 46 is provided to hold the packing piston upon the end of the wash pipe.

Attention is directed to the fact that latch collar 32 is held in position longitudinally and circumferentially by screws 46 and that the collar rests against a shoulder 47 formed by a counter bore in the body member 13, thus insuring that the weight of the drill stem will be imposed upon the shoulder when under strain.

Attention is directed to the fact that the slips 25 are held in their assembled condition by a ring 21' having an undercut face beneath which the inclined ends of the slips 25 extend.

In operation of the present invention the structure is assembled as particularly shown in Fig. 1, with the body member 13 and the mandrel telescoped with relation to each other and locked in their telescoped position. This is accomplished by forcing the mandrel 12 into the body member

13 until the inclined faces 30 of the ends 29 of the slips 25 have passed through the collar 32 and have come to rest against the inclined faces 31 thereof, at which time the conical portion 32' of the control piston 34 will force its way in between the ends 29 of the slips and will cause them to be wedged outwardly and held in register with their seats, so that under normal tension the mandrel cannot be withdrawn. The slips and contacting inclined faces, as well as the springs, are designed so that the predetermined pull required to effect the release of the parts is usually the safe amount required to stretch the pipe two times the length of the jar stroke, thus the pipe is used as a spring to give a quick blow or jar.

When it is desired to create a jarring action tension is exerted upon the mandrel tending to withdraw it from the body member 13. This action is resisted by the wedging action of the control piston against the ends 29 of the slips 25. When, however, the mandrel exerts a pull against the slips 25 sufficient to cause the faces 30 of their ends 29 to slip upon the inclined faces 31 of the latch collar and to cause the inclined back faces 32' of the slips to wedge against the inclined face of the projection 33 of the control piston with sufficient force to move the piston longitudinally and away from the slips, the slips will swing inwardly at their outer ends while pivoting upon the bearing rollers 27. This will cause the slips to become disengaged from the collar and permit the mandrel to be lifted a distance as represented by the space between the upper end of the jar collar 16 and the lower face of the knocker coupling 17. When this lifting action is violently accomplished considerable force will be exerted against the coupling by the collar and will tend to jar the drill tool loose. After a desired jarring action has taken place the mandrel and the body may again be locked in relation with each other by forcing the mandrel downwardly as the control piston is also forced downwardly and out of the path of the ends of the slips 25 so that these ends may be moved automatically outwardly into hooked relation to the latch collar 32.

Attention is directed to the fact that the structure provides unrestricted flow of fluid directly through the jar mechanism and the wash pipe, and that in addition the packing 18 at the upper end of the body member 13 and the packing piston 40 at the lower end of the wash pipe 38, and within the cylindrical bore 39 of the coupling 37, will make it possible for a desired amount of lubricant to be confined within the body and around the mandrel and the various parts carried thereby. This lubricant may have free flow within the confined compartment and through ducts 49 of the washer 35, and ducts 50 through the end wall of the control piston.

As indicated at 26' in Fig. 3, it will be seen that the roller bearing 26 may be eliminated and that the member 25 may hook directly over the edge of the member 23.

It will thus be seen that the structure here disclosed is compact and sturdy in its construction, is composed of parts not liable to get out of order, and all of said parts are confined in such a manner as to maintain them in desirable working condition.

While we have shown the preferred form of our invention as now known to us it will be understood that various changes may be made in the combination, construction and arrangement of parts by

those skilled in the art, without departing from the spirit of the invention as claimed.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A well jar comprising a tubular body member, means connecting said body member with a section of said drill string at its lower end, a mandrel telescoping into the tubular body, means connecting the mandrel with a section of drill string at its upper end, a plurality of longitudinally extending non-resilient fingers within the tubular body member and articulately associated with the mandrel, interlocking means carried by the tubular body member and engaged by said fingers to normally hold the mandrel and body member against longitudinal motion with relation to each other, and control means set to actuate at a predetermined tension and normally acting to hold the fingers in their locked positions.

2. A well jar comprising a tubular body member, means connecting said body member with a section of said drill string at its lower end, a mandrel telescoping into the tubular body, means connecting the mandrel with a section of drill string at its upper end, a plurality of longitudinally extending non-resilient fingers within the tubular body member and articulately associated with the mandrel, interlocking means carried by the tubular body member and engaged by said fingers to normally hold the mandrel and body member against longitudinal motion with relation to each other, control means set to actuate at a predetermined tension and normally acting to hold the fingers in their locked positions, and packing means carried by the mandrel and body member whereby to confine a lubricant around the mandrel and said locking fingers irrespective of the relative longitudinal movement of the mandrel and the body member.

3. A well jar comprising a tubular body member, means connecting said body member with a section of said drill string at its lower end, a mandrel telescoping into the tubular body, means connecting the mandrel with a section of drill string at its upper end, a plurality of longitudinally extending non-resilient fingers within the tubular body member and articulately associated with the mandrel, interlocking means carried by the tubular body member and engaged by said fingers to normally hold the mandrel and body member against longitudinal motion with relation to each other, control means set to actuate at a predetermined tension and normally acting to hold the fingers in their locked positions, packing means carried by the mandrel and body member whereby to confine a lubricant around the mandrel and said locking fingers irrespective of the relative longitudinal movement of the mandrel and body member, and means causing the mandrel and the body member to rotate in unison.

4. A well jar comprising a tubular body, a mandrel telescoping into said tubular body, a knocker fitting disposed at the upper end of the tubular body into which the mandrel extends, a packing carried thereby, a wash pipe secured to the lower end of the mandrel, a packing sealing the wash pipe with relation to the tubular body, hinged lock fingers carried upon the mandrel at

a point between the packing, a lock ring carried by the body member to be engaged by the free ends of said lock fingers, said ring and fingers having complementary inclined presser faces at a predetermined obtuse angle to the longitudinal center of the structure sufficient to cause the fingers and the ring to remain in engagement under normal tension force, a latch collar yieldably held between the free ends of said hinged fingers, said collar and fingers having contacting faces on an angle to the longitudinal center of the mandrel whereby a longitudinal pull in excess of predetermined force will cause the free ends of the hinged fingers to swing inwardly as they force the latch collar longitudinally from its locking position.

5. In a drill jar having a tubular body portion within which a mandrel telescopes, locking means therefor, including a plurality of longitudinally extending fingers articulately associated with the mandrel and capable of swinging radially within the tubular body, an annular shoulder within the tubular body having a face on an obtuse angle to the longitudinal center of the body, the engaging portions of the lock fingers being on an angle complementary thereto whereby the fingers and the shoulder will be held in locked relation to each other under normal conditions of tension, a tapered wedge member yieldably held against the back faces of said fingers, the face of the wedge and back faces of the fingers being complementary enclosed and at an acute angle to the longitudinal center of the device whereby composition of forces acting against the obtuse faces of the fingers and the shoulder, and the acute faces of the fingers and the lock ring will cause the lock member to move from its obstructing position in the rear of the fingers and permit the fingers to move outwardly to points of disengagement from the shoulder of the body member.

6. In a drill jar, a tubular body portion, a mandrel telescoping therewith, lock means therefor including a plurality of longitudinally extending slips, a lock shoulder within the tubular body engaged by the slips, a shoulder upon the mandrel engaged by the slips, and rollers interposed between the shoulder on the mandrel and the engaging portion of the slips for articulately associating the mandrel and the slips.

7. A well jar comprising a tubular body secured to a lower drill section, a tubular mandrel secured to an upper drill section and telescoping into the tubular body, a wash pipe within said tubular body and formed as a continuation of the mandrel whereby communication will be constantly established between the tubular mandrel and the tubular body through the wash pipe, a plurality of non-resilient fingers extending longitudinally within the tubular body and articulately connected with the mandrel, a lock collar carried by the tubular body and with which the lower ends of said fingers frictionally engage, and means through which the wash pipe extends and by which said fingers are held in frictional engagement with said collar to release under predetermined pull exerted upon the mandrel and against the tubular body.

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