June 28, 1949. J. S. BECK 2,474,459

JAR

Filed Feb. 19, 1945 2 Sheets-Sheet 1

Fig. 1

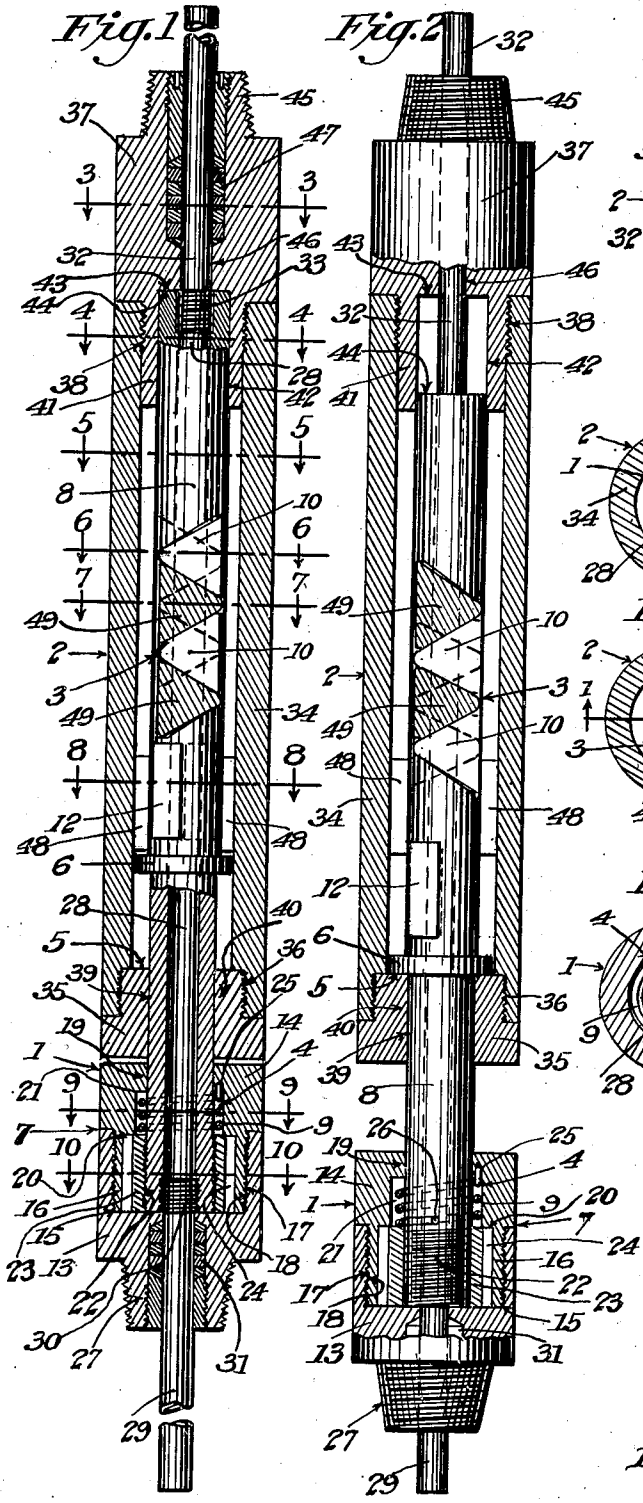


Fig. 2

Fig. 3

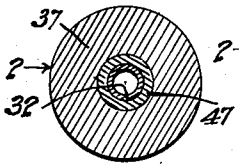


Fig. 4

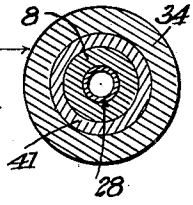


Fig. 5

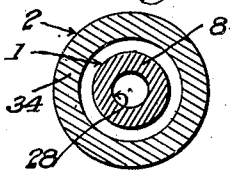


Fig. 6

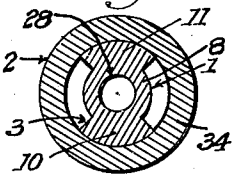


Fig. 7

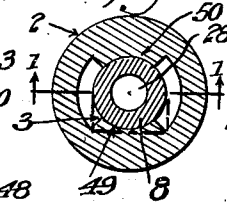


Fig. 8

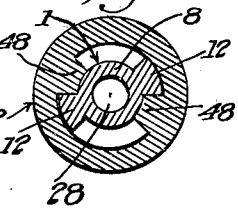


Fig. 9

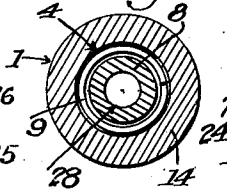
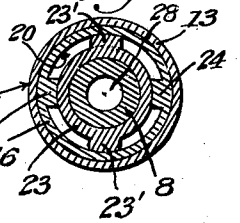


Fig. 10



Inventor:
Julius S. Beck,
By Alan Franklin
Attorney.

June 28, 1949. J. S. BECK 2,474,459

JAR

Filed Feb. 19, 1945 2 Sheets-Sheet 2

Fig. 17

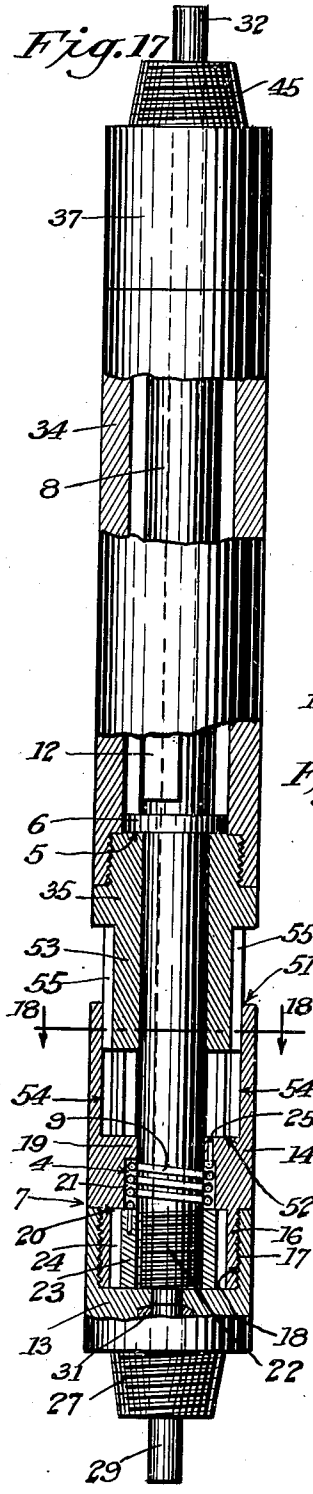


Fig. 11

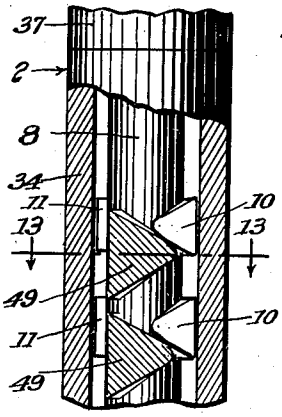


Fig. 12

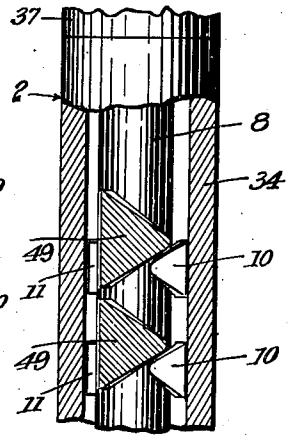


Fig. 13

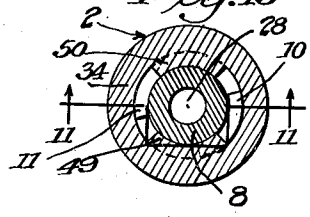


Fig. 14

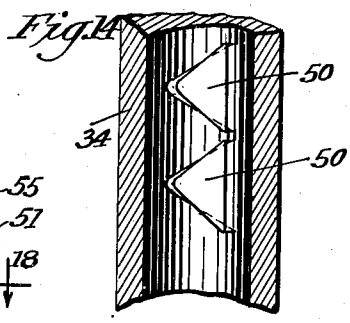


Fig. 15

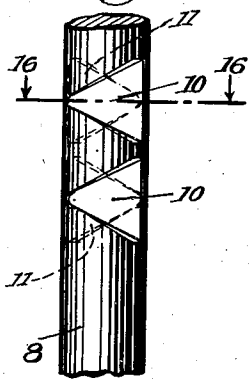


Fig. 16

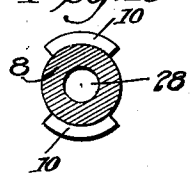
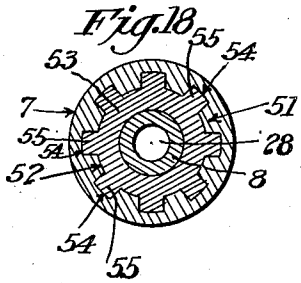


Fig. 18



INVENTOR:
Julius S. Beck,
BY
By Alan Franklin,
ATTORNEY.

Patented June 28, 1949 2,474,459

UNITED STATES PATENT OFFICE

2,474,459

JAR

Julius S. Beck, Los Angeles, Calif.

Application February 19, 1945, Serial No. 578,661

7 Claims. (Cl. 255—27)

1

This invention relates to oil-well tools, and more particularly to jars used in drilling oil wells and in other oil-well operations.

In the operation of present types of jars the application of torque to the drill pipe is necessary to release the jar to enable it to perform its jarring operation. Such torque is difficult to calculate and especially in deep well drilling and when incorrectly calculated may cause certain hazards, such as pulling in the derrick above the well, twisting off the drill pipe, galling the drill pipe threads, and distortion of the fibre, of the metal of the drill pipe and consequent crystallization and fatigue of said metal.

One of the objects of my invention is to provide a novel and improved jar which may be operated entirely under tension applied thereto through a drill pipe, whereby the hazards caused by the application of torque to other jars now in use are eliminated.

Present types of oil-well drilling jars require an expert operator to install and operate the same. If said jars are installed upside down they will not function, and a right hand jar will not function in a left hand string of drill pipe, nor will a left hand jar function in a right hand string of drill pipe.

Another object of my invention is to provide a novel and practical jar, which does not require an expert operator to install and operate the same, but may be installed and operated by the ordinary oil-well operator and may be installed and operated either in its normal upright position or in an inverted position, and which may be used in either a right hand or a left hand string of drill pipe.

Another object is to provide a novel and practical jar that will operate successfully in oil wells of any known drilling depth.

In the use of present types of jars mud, oil and/or water either clogs, locks or otherwise adversely affects the working mechanism thereof, causing costly delays and expensive wear and tear on the drilling equipment.

Another object of my invention is to provide a jar of such construction and arrangement that its working parts are not affected by even the most adverse mud, oil or water conditions in a well hole.

A further object of my invention is to provide a jar containing a floating mandrel and uniform automatic releasing mechanism to enable the jar to operate successfully in drilling wells of any known depth.

2

Other objects and advantages will appear hereinafter as this specification progresses.

The invention is illustrated in the annexed drawings, which form a part of this specification and in which:

Fig. 1 is a longitudinal vertical section on my jar taken on line 1—1 of Fig. 7, shown in its normal upright position, with its jar members in their interlocked position and set for being released, under a predetermined longitudinal tension, so that its hammer will strike its anvil to produce its upward jarring action.

Fig. 2 is a view of my jar like Fig. 1, except that the jar members are shown as having been released and the anvil struck by the hammer in producing its upward jarring action, and the jar members are shown interlocked and set for enabling the jar to produce a downward jarring action.

Fig. 3 is a cross section of my jar taken on line 3—3 of Fig. 1.

Fig. 4 is a cross section of my jar taken on line 4—4 of Fig. 1.

Fig. 5 is a cross section of my jar taken on line 5—5 of Fig. 1.

Fig. 6 is a cross section of my jar taken on line 6—6 of Fig. 1.

Fig. 7 is a cross section of my jar taken on line 7—7 of Fig. 1.

Fig. 8 is a cross section of my jar taken on line 8—8 of Fig. 1.

Fig. 9 is a cross section of my jar taken on line 9—9 of Fig. 1.

Fig. 10 is a cross section of my jar taken on line 10—10 of Fig. 1.

Fig. 11 is a fragmentary longitudinal section of my jar taken on line 11—11 of Fig. 13 showing the mandrel partly turned and the wedges of the jar members partly disengaged in the act of releasing the jar members.

Fig. 12 is a fragmentary longitudinal section of my jar taken on line 11—11 of Fig. 13, but showing the mandrel and its wedges partly turned backward under the influence of the mandrel spring, and the mandrel wedges partly in engagement with the wedges of the female jar member, with the jar members in their position when drawn apart by a jarring action.

Fig. 13 is a cross section of my jar taken on line 13—13 of Fig. 11.

Fig. 14 is a fragmentary longitudinal section of the female jar member, showing the wedges at the side of said member opposite the wedges at the opposite side of said member as shown in Figs. 1, 2, 11 and 12.

Fig. 15 is an elevation of a fragment of the mandrel.

Fig. 16 is a cross section of the mandrel taken on line 16—16 of Fig. 15.

Fig. 17 is a longitudinal section partly in elevation of a modification of my invention.

Fig. 18 is a cross section of said modification of my invention taken on line 18—18 of Fig. 17.

Referring more particularly to the drawings in which the same parts are designated by the same reference numerals in all of the figures my jar includes generally a male jar member 1; a female jar member 2; releasable interlocking means 3 on said jar members for releasably holding said jar members set for jarring operation under a predetermined axial tension applied thereto, yielding means 4 for normally holding said interlocking means in interlocking engagement and for returning said interlocking means to interlocking engagement, when released as aforesaid, after each jarring operation; an anvil 5 on said female jar member 2; and a hammer 6 on said male jar member 1 for striking said anvil and producing a jarring action, when said interlocking means 3 are released as aforesaid.

The male jar member 1 comprises a coupling 7; a mandrel 8 turnably coupled at its lower end to said coupling; and a coil spring 9 for yieldably holding said mandrel against turning to the right or counterclockwise as shown in Figs. 1, 2 and 9, there being a pair of triangular wedges 10 on one side of said mandrel and a pair of triangular wedges 11 on the opposite side of said mandrel, and there being a pair of stops 12 on said mandrel for the purposes hereinafter more fully described. The coupling 7 comprises two coupling members 13 and 14, the lower member 13 being formed in its upper end with a circular recess 15 and the upper member 14 being formed with a reduced lower end portion 16, which is threaded in said recess of said lower member by interengaging internal and external threads 17 and 18, respectively, in the cylindrical wall of said recess 15 and on said reduced end portion 16. The upper coupling member 14 is formed in its upper end with a mandrel bearing 19 and in its lower reduced end portion 16 with a circular recess 20, and a circular recess 21 is formed between said bearing 19 and said recess 20 in said coupling member. The lower end portion of the mandrel 8 extends through the bearing 19 and recess 21 and into the recess 20 in the upper coupling member 14 and said mandrel is turnably fitted in said bearing. The mandrel 8 is formed on its lower end with a thread 22 on which is threaded a nut 23 within the recess 20 in the lower reduced end portion 16 of the coupling member 14, which nut is of smaller diameter than said recess 20 but larger than the upper recess 21, and is formed with a pair of external axial ribs 23' turnably fitted to the surface of the cylindrical wall of said recess for engaging a pair of internal lugs 24 formed on the reduced lower end portion 16 of the coupling member 14 of coupling 7 for limiting the turning of the mandrel 8 in said coupling under the influence of the spring 9. The spring 9 is coiled around the lower end portion of the mandrel 8 within the recess 21 in the coupling member 14, and one end of said spring is secured to said coupling member at 25, while the other end of said spring is secured to the mandrel 8 at 26. On the lower end of the lower coupling member 14 is formed a "pin" 27 for threaded engagement with a "box" in the upper end of a string of drill pipe (not shown). The mandrel 8 is formed with a duct 28 extending axially therethrough, and a pipe 29 is threaded at its upper end at 30 in the lower end of said duct and extends downwardly from the lower end of said mandrel through the lower coupling member 13 and through a packing box 31 in said coupling member. In the upper end of the mandrel duct 28 a pipe 32 is threaded at its lower end at 33.

The female jar member 2 comprises a cylindrical tubular body 34, a head 35 threaded at 30 in the lower end of said body and a coupling 37 threaded at 38 in the upper end of said body. Said head 35 is provided with an axial bore 39 and forms a bearing 40 for the lower portion of the mandrel 8 which extends through said bore and is slidably and turnably fitted therein. The upper inner end of the head 35 forms the anvil 5 which is struck by the hammer 6 for producing a jarring action, in the manner hereinafter more fully described. The coupling 37 is formed at its lower end with a bearing 41, which is of smaller diameter than the coupling to fit within the upper end of the tubular body 34, and is provided with an axial cylindrical bore 42 in which the upper end portion of the mandrel 8 is slidably and turnably fitted. The upper and inner end of the bore 42 forms an anvil 43 which is struck by a hammer 44 formed by the upper and inner end of the mandrel 8, to produce a downward jarring action of the jar, in the manner hereinafter more fully described.

On the upper end of the coupling 37 is formed a "pin" 45 for threaded engagement with a "box" on the lower end of a string of drill pipe above the jar. The coupling 37 is provided with an axial bore 46 leading upwardly from the upper end of the bearing bore 42 into a packing box 47 which extends upwardly through the upper end of said coupling, through which bores and packing box the pipe 32 slidably and turnably extends from the upper end of the mandrel 8. The tubular body 34 of the female jar member 2 is formed with a pair of diametrically opposite elongated internal lugs 48 which are engaged by the mandrel stops 12 for limiting the turning movement of the mandrel 8 in either direction with relation to the jar members 1 and 2, in the manner and for the purpose hereinafter more fully described. The female jar member 2 is formed with two pairs of diametrically opposite internal triangular wedges 49 and 50 which are constructed and arranged to be interlocked with the mandrel wedges 10 and 11, respectively, in the manner and for the purpose hereinafter more fully described.

The interlocking means 3 comprises the mandrel wedges 10 and 11 of the jar member 1 and the wedges 49 and 50 of the jar member 2.

The operation of my invention as above described is as follows:

The jar members 1 and 2 being coupled at their lower and upper ends by their couplings 7 and 37, respectively, in a string of drill pipe, and the drill string being lowered in a well hole with the gripping tool on the lower end of the drill string, gripping a broken part held fast in the well hole, and the parts of the jar being in the position shown in Fig. 1 of the drawings, an upward force of sufficient power is applied to the drill string above the jar to cause the engaging inclined surface of the interlocking wedges 10 and 49, and the engaging inclined surface of the interlocking wedges 11 and 50 to turn the mandrel 8 and its wedges 10 and 11 ninety degrees to the right against the tension of the spring 9 until the mandrel wedges 10 and 11 of the jar mem-

ber 1 disengages the wedges 49 and 50 respectively, of the jar member 2 and release the interlocking means 3, while the mandrel stops 12 engage the stop lugs 48 and limit said turning movement of the mandrel in position with said interlocking means disengaged, whereupon the upward force applied to the drill string above the jar draws the upper jar member 2 upwardly with a quick movement with relation to the jar member 1, until the hammer 6 strikes the anvil 5 and applies an upward jarring action, through the jar member 1 and the drill string and gripping tool below said jar member, to the broken part lodged in the well hole, as illustrated in Fig. 2 of the drawings. The upward force applied to the upper section of the drill string is then relieved, whereupon the floating mandrel 8 and its wedges 10 and 11 are rotated to the left by the contracted spring 26 until said mandrel wedges 10 and 11 again interlock with the wedges 49 and 50, respectively, but in the raised position of said wedges 49 and 50, as determined by the upward jarring movement of the jar member 2 and as shown in Fig. 12. The drill pipe above the jar is then lowered so that the weight of said drill pipe and the upper jar member 2 causes the lower edges of the wedges 49 and 50 of said jar member to engage the upper edges of the mandrel wedges 10 and 11, respectively, and rotate the mandrel 8 to the right ninety degrees until the mandrel wedges 10 and 11 disengage the wedges 49 and 50, whereupon the upper jar member 2 drops by gravity until the upper hammer 44 strikes the upper anvil 43 and applies a downward jarring action through the jar member 1 and the drill string and gripping tool below said jar member, to the broken part held in the well hole. The above described up and down jarring actions are applied by applying a straight upward force to the drill pipe above the jar and lowering said drill pipe straight downward without turning said drill pipe to turn the upper jar member 2 and without applying torque to the drill pipe.

After producing an upward jarring action, as illustrated in Figs. 2 and 12, the jar may be operated to produce a succeeding upward jarring action by applying a turning force to the drill pipe above the jar and turning said upper drill pipe and the upper jar member 2 to the left, until the wedges 49 and 50 of said jar member disengage the mandrel wedges 10 and 11, respectively; then lowering the upper drill pipe and the jar member 2 until the upper hammer 44 on the upper end of the mandrel 8 engages the anvil 43 at the upper end of the bore 42 of the bearing 41 of said jar member 2; then turning said upper drill pipe and jar member 2 to the right until the wedges 49 and 50 of said jar member interengage the mandrel wedges 10 and 11, respectively, as shown in Fig. 11 of the drawings; and then applying a direct upward pulling force to the upper end of the drill string and the jar member 2 until the upper inclined edges of the wedges 49 and 50 of the jar member 2, engaging the lower inclined edges of the mandrel wedges 10 and 11, respectively, rotate the mandrel 8 to the right, until the mandrel wedges 10 and 11 disengage the wedges 49 and 50 of the jar member 2, respectively, whereupon the upper jar member 2 will be drawn upwardly with a quick movement until the hammer 6 strikes the anvil 5 and causes the jar to produce said succeeding upward jarring action as illustrated in Fig. 2. A series of upward jarring actions may be applied as above described.

After producing a downward jarring action, as illustrated in Figs. 1 and 11 of the drawings, the jar may be operated to produce a succeeding downward jarring action by applying a turning force to the drill pipe above the jar and turning said upper drill pipe and the jar member 2 to the left until the wedges 49 and 50 of said jar member disengage the mandrel wedges 10 and 11, respectively; then raising the upper drill pipe and the jar member 2 until the anvil 5 engages the hammer 6 on the mandrel 8 of jar member 1, and limits the upward movement of jar member 2, then turning said upper drill pipe and jar member 2 to the right until the wedges 49 and 50 of said jar member interengage the mandrel wedges 10 and 11, respectively, as illustrated in Fig. 12; and then directly lowering the upper drill pipe and jar member 2 so that the lower inclined edges of the wedges 49 and 50 of said jar member, engaging the upper inclined edges of the mandrel wedges 10 and 11, respectively, rotate the mandrel 8 to the right, until said mandrel wedges 10 and 11 disengage said wedges 49 and 50, respectively, of the jar member 2, whereupon the upper jar member 2 will drop directly under the weight of the upper drill pipe and said jar member 2, with a quick movement until the hammer 44 on the upper end of the mandrel 8 strikes the anvil 43, at the upper end of the bore 42 of bearing 41 of jar member 2, and cause the jar to produce said succeeding downward delayed jarring action, as illustrated in Fig. 1. A series of downward jarring blows may be produced as above described.

My jar, if inverted, may be operated to produce the jarring actions as above described by pulling upwardly on the upper drill pipe and the jar member 1 coupled by coupling 7 to said drill pipe, and lowering said drill pipe and jar member, and by turning said drill pipe and said jar member 1 in the opposite direction to the turning movement of said drill pipe and the jar member 2 as above described.

In the modification of my invention shown in Figs. 17 and 18 the construction is the same as my jar shown in Figs. 1 to 16 inclusive except that spline means 51 are provided for preventing relative turning movement of the jar members 1 and 2 while allowing relative axial movement of said jar members, which spline means comprises a socket 52 in the upper end of the coupling 7 of the jar member 1 and a stud 53 depending from the head 35 on the lower end of the jar member 2 into said socket, in the inner periphery of which socket are formed a plurality of axial grooves 54 in which are slidably fitted a plurality of axially-extending tongues or splines 55, respectively, on the periphery of said stud 53.

The operation of this form of my invention is the same as the operation of the form of my invention shown in Figs. 1 to 16 inclusive, except that with the spline means 51 the lower jar member 1 may be turned directly by the upper jar member 2 instead of indirectly through the mandrel 8.

This modification of my invention permits tightening of the screw joints of the drill string without placing a strain on the mandrel 8 and the parts connected to or associated with the mandrel.

My invention may be used in connection with casing perforators, liner hangers, formation test-

ers, surveying tools, packers, casing cutters, fishing tools and other devices.

In the use of any of the above mentioned oil well tools it is considered good practice to use various types of jars namely:

1. A common bumper or telescopic slip joint.
2. A straight upward pull jar with a delayed action.
3. A down jar with a delayed action.
4. A jar that jars on the up and down stroke with delayed action.
5. A torque jar.

My jar may be actuated to accomplish the results accomplished by any of the above-mentioned conventional jars without the application of torque thereto and at the moment required by other jars and without the necessity of lifting the drill string and withdrawing my jar from the hole for the purpose of changing jars and including in the drill string a jar of the type necessary to do the particular work required.

Those skilled in the art of oil well engineering will readily appreciate the novel and useful performances and the time saved by my invention.

I claim:

1. A jar including a lower jar member and an upper jar member, a hammer on one of said jar members and an anvil on said other jar member, means for connecting said upper jar member to an upper section of a drill pipe, said lower jar member including a coupling member for coupling said lower jar member to the upper end of a lower section of said drill pipe, a mandrel turnably connected at one end to said coupling member, a spring coiled around said mandrel and connected at one end to said coupling member and at its other end to said mandrel for normally holding said mandrel in its initial position against turning in one direction, said mandrel extending into and slidable axially and turnable in said upper jar member, and interengaging wedges on said mandrel and on said upper jar member, respectively, to cause said mandrel to rotate against the tension of said spring and disengage said interengaging wedges to enable said upper jar member to move upwardly with relation to said lower jar member, under upward tension applied to said upper jar member, to cause said hammer to strike said anvil and produce a jarring action.

2. A jar as claimed in claim 1 including stop means for limiting the rotating movement of the mandrel against the tension of its spring in a position wherein the wedges are disengaged and are free of each other, to permit one jar member to move axially with relation to the other jar member, under axial tension applied to one of said jar members, to cause the hammer to strike the anvil and produce a jarring action.

3. A jar including a lower jar member and an upper jar member, means for connecting said upper jar member to an upper section of a drill pipe, said lower jar member including a coupling member for coupling said lower jar member to the upper end of a lower section of said drill pipe, a mandrel turnably connected at one end to said coupling member, and a spring coiled around said mandrel and connected at its ends to said mandrel and to said coupling member, respectively, for normally holding said mandrel in its initial position against turning in one direction, said mandrel extending into said upper jar member, the inner end of said mandrel forming a hammer, an anvil in said upper jar member, and interengaging wedges on said mandrel and said upper jar member to cause said mandrel to rotate and disengage said interengaging wedges to enable said upper jar member to slide axially with relation to said lower jar member until said hammer strikes said anvil and produces a jarring action, under axial tension applied to said upper jar member.

4. A jar including a lower jar member and an upper jar member turnable with relation to said lower jar member, a hammer on one of said jar members and an anvil on said other jar member, means for coupling said upper jar member to the lower end of an upper section of a drill string, said lower jar member including a coupling member for coupling the lower jar member to the upper end of a lower section of said drill string, a mandrel turnably connected at its lower end to said coupling member, and a spring coiled around said mandrel and connected at its ends to said mandrel and to said coupling member, respectively, for normally holding said mandrel in its initial position against turning in one direction, said mandrel extending upwardly into and slidable axially and turnable in said upper jar member, and interengaging wedges on said mandrel and said upper jar member to cause said mandrel to rotate against the tension of said spring and disengage said interengaging wedges to enable said upper jar member to slide axially with relation to said lower jar member and cause said hammer to strike said anvil to produce a jarring action, under axial tension applied to said upper jar member through the upper section of said drill string connected to said upper jar member.

5. A jar as characterized by claim 1 including stop means for limiting the turning movement of the mandrel in its initial position against turning in one direction, with its wedges interengaged with wedges on said jar member, and stop means for limiting the turning movement of the mandrel in the other direction in a position wherein the wedges are disengaged and are free of each other, to permit the upper jar member to move upwardly with relation to the lower jar member, under axial tension applied to the upper jar member, to cause the hammer to strike the anvil and produce a jarring action.

6. A jar including a lower jar member, and an upper jar member, turnable with relation to said lower jar member, two hammers on said lower jar member, and two anvils in said upper jar member, means for connecting said upper jar member to the lower end of an upper section of a drill pipe, said lower jar member including a coupling member for coupling said lower jar member to the upper end of a lower section of said drill pipe, a mandrel turnably connected at its lower end to said coupling member, a spring coiled around said mandrel and connected at one end to said coupling member and at its other end to said mandrel for normally holding said mandrel in its initial position against turning in one direction, said mandrel extending into and slidable axially and trunable in said upper jar member, and interengaging wedges on said mandrel and in said upper jar member, respectively, to cause said mandrel to rotate against the tension of said spring and disengage said interengaging wedges, when upward tension is applied to said upper jar member, or when said upper jar member is lowered with relation to said lower jar member, to cause one of said hammers to strike one of said anvils to produce an upward jar, or to cause

said other hammer to strike said other anvil to produce a downward jar.

7. A jar including a lower jar member and an upper jar member, a hammer on one of said jar members and an anvil on said other jar member, means for connecting said upper jar member to an upper section of a drill string of pipe, said lower jar member including a coupling member for coupling said lower jar member to the upper end of a lower section of said drill string of pipe, a mandrel turnably connected at its lower end to said coupling member, a spring coiled around said mandrel and connected at one end to said coupling member and at its other end to said mandrel for normally holding said mandrel in its initial position against turning in one direction, said mandrel extending into and slidable axially and turnable in said upper jar member, and interengaging wedges on said

mandrel and in said upper jar member, respectively, to cause said mandrel to rotate against the tension of said spring and disengage said wedges, to enable said upper jar member to move downwardly upon releasing said upper jar member, to cause said hammer to strike said anvil and produce a downward jar.

JULIUS S. BECK.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,672,321	Kammerdiner	June 5, 1928
2,101,968	Wickersham	Dec. 14, 1937
2,029,579	McCullough	Feb. 4, 1936