April 10, 1934. J. S. BECK 1,954,513

ADJUSTABLE TRIP JAR

Filed Oct. 28, 1933 2 Sheets-Sheet 1

Fig. 1

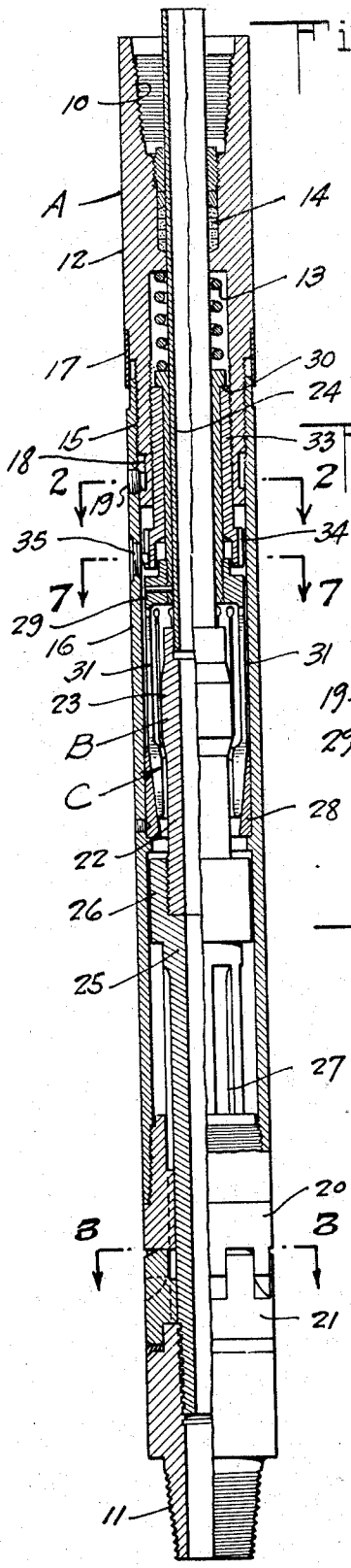

Fig. 2

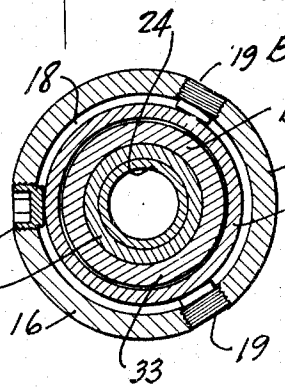

Fig. 3

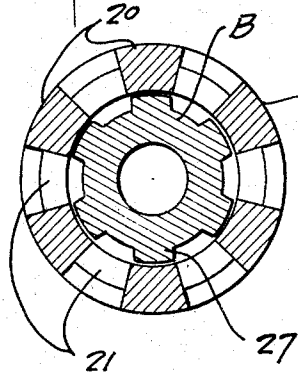

Fig. 4

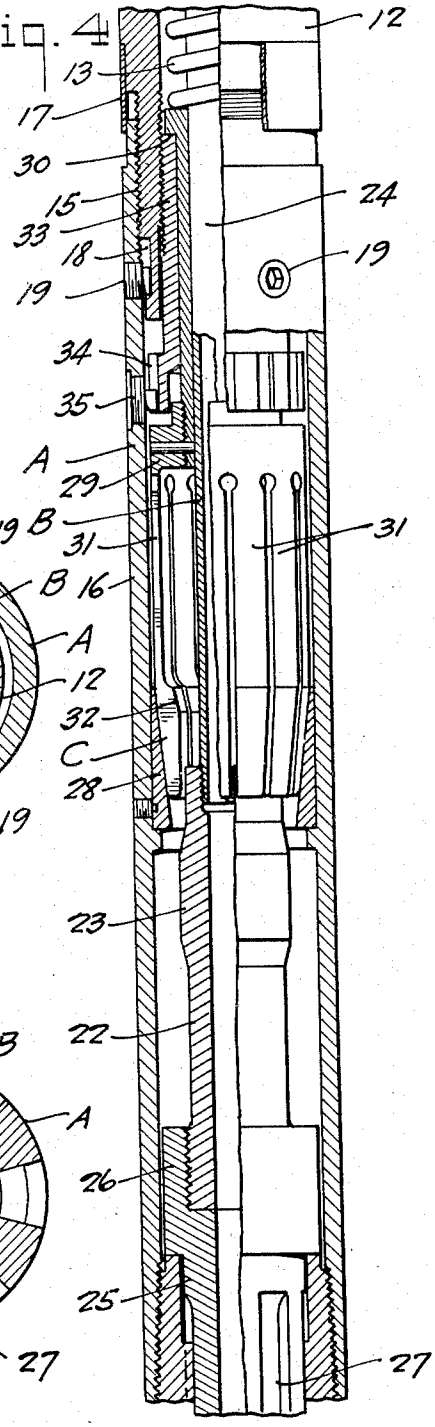

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Fig. 5

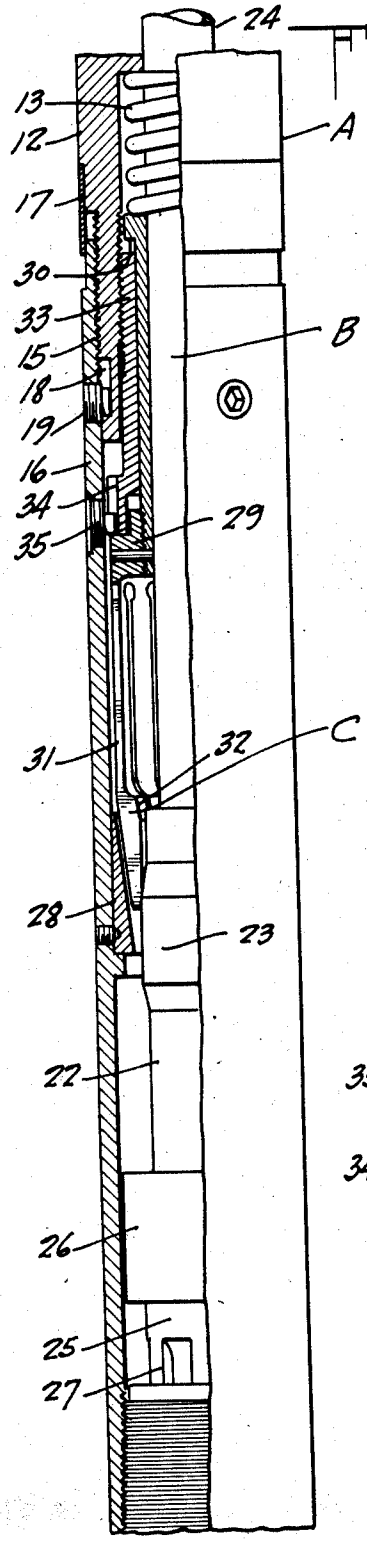


Fig. 6

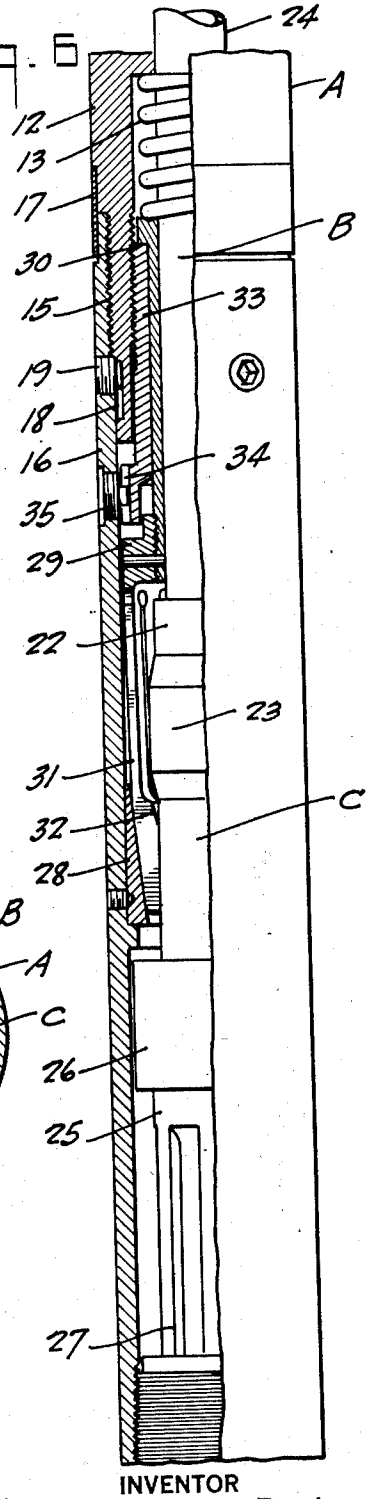
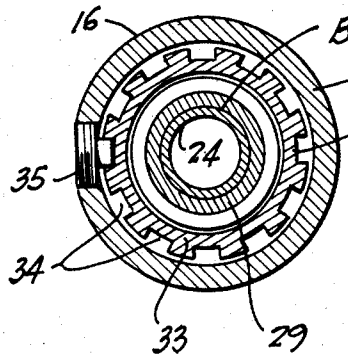


Fig. 7



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1,954,513

ADJUSTABLE TRIP JAR

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12 Claims. (Cl. 255—27)

This invention relates to a trip mechanism applicable to an oil well jar and to slip members which are arranged to be yieldingly held in contracted or extended position, and, upon a determined longitudinal strain being exerted thereon, will release to permit movement to a correspondingly opposite position. The invention may be applied to up-pull jars, down drive jars, safety joints and the like. The present invention has for its primary object the provision of means for adjusting the longitudinal strain necessary to effect release. The important feature of the adjusting means is the structure whereby adjustment may be effected without pulling the tool from the hole. Another more specific object of the invention is to provide adjustment means which may be controlled by turning at the ground surface the drill pipe string in which the tool is disposed.

These objects are obtained by means of the embodiment of my invention illustrated in the accompanying drawings, in which:—

Fig. 1 is an axial sectional view of a jar in set or contracted position; Figs. 2 and 3 are sections as seen on the planes correspondingly designated in Fig. 1; Fig. 4 is a fragmental view on an enlarged scale, partly in elevation and partly in section showing the trip mechanism. Fig. 5 is a fragmental view partly in section and partly in elevation showing the trip mechanism in extended or tripped position and being returned to contracted or set position; Fig. 6 is a view similar to Fig. 4 showing the trip mechanism in another adjusted position; Fig. 7 is a section as seen on the plane designated 7—7 in Fig. 1.

Referring more particularly to the drawings, the invention is disclosed embodied in a straight pull type of jar wherein the jarring effect is produced by a pull. However, it will be understood that the invention is not limited to use with a pull type of jar. The jar illustrated comprises a shell or bowl A in which a mandrel B is telescopically nested. The trip mechanism is denoted generally by C. The bowl A has a tapered box 10 adapted to receive the pin of a drill string. The mandrel B has a pin 11 at its lower end adapted to be connected directly or by intermediate drill pipe means to the drill stem of a bit, fishing tool or other device to be used in transmitting a jarring blow to an instrumentality to be jarred.

Referring with more particularity to the details of the jar, the bowl A comprises an actuating section 12 provided with a bore having the top box section 10, an intermediate section for a conventional packing 14 and a lower section to house a compression spring 13. The actuating section is externally reduced in diameter at its lower end and threaded as indicated by 15. Threadedly mounted on the actuating section is the seat section 16 of the bowl whereby relative rotation of sections 12 and 16 will cause longitudinal lengthening or shortening of the bowl. The external space between confronting ends of the sections is covered by an annular shield 17 to prevet lodgment of sand, mud or detritus therein. The actuating section is provided with an annular groove 18, and pins 19 threadedly mounted in the seat section extend into the groove to limit the lengthening or shortening of bowl A. The lower end of the seat section is internally threaded and receives a combined anvil and clutch jaw 20 which is adapted to be engaged with a clutch jaw 21 on mandrel B.

Mandrel B comprises a barrel 22 having an externally enlarged section 23 with tapering sides. Secured to the upper end of the barrel 22 is a wash pipe 24 disposed to slide in packing 14. Secured to the lower end of barrel 22 is a hammer or striking abutment section 25. This striking abutment member 25 has an enlarged striking abutment 26 for impact against the upper surface of anvil 20. Threaded onto the lower end of section 25 is the jaw 21. The mandrel B and bowl A are splined as indicated by 27 to enable extension of the bowl and mandrel and to insure their rotation as a unit. Jars are inserted in rotary drill strings wherein rotational motion of the string is imparted to the devices appended to the jar. For illustration, they are commonly inserted in the drill string above a rotary bit. When the jar is extended, the clutch jaws 20 and 21 are disengaged. This occurs during the jarring operation. When contracted, the jaws clutch and the rotary strain is taken off the splines.

To releasably hold the bowl A and mandrel in contracted position, the trip C is provided. Mounted on the seat section 16 of the bowl A is a seat ring 28 forming one element of the trip. This ring rests on an internal shoulder in the seat section of the bowl and is secured in place by a suitable set screw. The bore of the ring provides a tapered seat converging downwardly. Mounted over the mandrel to be slidable thereon is a wedge sleeve 29 shown as formed of an upper tubular section with an external shoulder 30 and a wedge finger section threaded and pinned thereto. The wedge finger section is longitudinally slit to provide spring fingers 31 having outer inclined tips to seat on ring 28. The tips are radially thick-

ened to provide inclined surfaces 32 for engaging the inclined shoulders on the enlarged section 23 of barrel 22. To limit downward movement of the wedge sleeve 29, a limiting sleeve 33 is provided having an upper face to engage the shoulder 30 on the wedge sleeve. This limiting sleeve is externally threaded to engage corresponding threads on the actuating section 12 of bowl A. The threads are preferably of a less pitch than the external threads on the actuating section. The limiting sleeve is externally enlarged at its lower end and key ways 34 are cut longitudinally therein. Into one of these key ways a key pin 35 is disposed. The key pin is threaded in the seat section 16 and prevents rotation of the limiting sleeve 33 therein but enables longitudinal movement.

The parts are assembled as shown in the drawings. With the jar in contracted position, the tips of spring fingers 31 are disposed between barrel 22 below the enlargement 23 and seat ring 28 so as to keep the jar in contracted position against the exertion of a longitudinal pull, until a critical pull has been obtained whereupon the wedging action due to the elasticity of the shell section 16 causes the latter to give laterally or "breathe" and thereby allow the fingers to pass the enlargement 23 on the barrel. The spring 13 urges the wedge sleeve 29 onto the limiting sleeve 33. When the jar is returned to set position from the tripped position shown in Fig. 5, the wedge sleeve may ride upwardly on the seat ring 28 to enable free passage of the trip parts by one another to set position. The spring 13 then urges the wedge sleeve downwardly against the seat ring 28. It will be apparent that the lower the position of the wedge sleeve on ring 28, the greater the wedging action, and the greater is the pull required to release the trip. An initial adjustment may be obtained by removing key pin 35, engaging the limiting sleeve 33 at splines 34 through the key pin opening in the barrel and turning the limiting sleeve 33 to raise or lower the latter as desired.

Assume that the initial adjustment has been made, the drill string with jar is in the hole and has a hold on an instrument to be jarred, such as a fish. Jarring is then effected by repeatedly pulling sufficiently to effect release and lowering to set the jar. If the jarring impact is not of sufficient magnitude, and it is wished to change it, the drill string is turned from the surface, the actuating section 12 being turned while the seat section 16 and mandrel B are held stationary by the fish. Turning of the actuating section to shorten the bowl lowers the limiting sleeve 33, but the threaded engagement between the limiting sleeve and actuating sleeve causes the latter to rise thereon. Due to the difference in pitches of threads, the proportionate rise of the limiting sleeve is less than the lowering so that the resultant effect is a lowering of the limiting sleeve. There is a differential action and a movement of the limiting sleeve less than the shortening of the bowl is obtained permitting fineness of adjustment. Lowering the limiting sleeve allows the wedge sleeve 29 to seat lower on ring 28 and to be moved further inwardly to produce a greater wedging action. Obviously, turning the drill string in the opposite direction causes the limiting sleeve to be raised with opposite action on the wedging sleeve. The pins 19 limit the amount of adjustment by engaging one or the other side of groove 18 yet do not interfere with the turning of the actuating section 12 for adjustment.

What I claim is:—

1. A jar for use in rotary drilling comprising two members telescopically assembled one within the other for relatively longitudinal movement between contracted and extended positions, one of said members being adapted to be connected to a drill pipe for actuating said jar and the other member being adapted to be secured to an instrument to be jarred, striking abutments on said members into-engageable at one of said positions, trip means to releasably hold said members in the other of said positions but releasable by the exertion of a longitudinal strain exerted between said members, said trip means including mechanism operable by rotary movement of said drill pipe relative to said instrument to adjust said trip means and vary the force required to release said members.

2. A jar for use in rotary drilling comprising two members telescopically assembled one within the other for relative longitudinal movement between contracted and extended positions, one of said members being adapted to be connected to a drill pipe for actuating said jar and the other member being adapted to be secured to an instrument to be jarred, striking abutments on said members inter-engageable at one of said positions, wedge trip means interposed between said members to releasably hold the latter in the other of said positions but releasable by the exertion of a longitudinal strain exerted between said members, said trip means including mechanism operable by rotary movement of said drill pipe relative to said instrument to adjust its wedging action and vary the force required to release said members.

3. A jar for use in rotary drilling comprising two members telescopically assembled one within the other for relative longitudinal movement between contracted and extended positions, one of said members being adapted to be connected to a drill pipe for actuating said jar and the other member being adapted to be secured to an instrument to be jarred, striking abutments on said members inter-engageable at one of said positions, a trip to releasably hold said members in the other of said positions but releasable by the exertion of a longitudinal strain exerted between said members, said trip including inter-engageable wedge elements, one element being carried by one of said members and another element being carried by the other member, one of said elements being longitudinally movable on its carrying member, and mechanism operable by rotary movement of said drill pipe to fix the wedging position of the movable element whereby to adjust the force required to release said members.

4. A jar for use in rotary drilling comprising two members telescopically assembled one within the other for relative longitudinal movement between contracted and extended positions, one of said members being adapted to be connected to a drill pipe for actuating said jar and the other member being adapted to be secured to an instrument to be jarred, striking abutments on said members inter-engageable at one of said positions, a trip to releasably hold said members in the other of said positions but releasable by the exertion of a longitudinal strain exerted between said members; said trip including inter-engageable wedge elements, one element being carried by one of said members, another element being interposed between said members and carried by the other of said members to be longitudinally

movable thereon and mechanism operable by rotary movement of said drill pipe to fix the longitudinal wedging position of the movable element whereby to adjust the force required to release said members.

5. A jar for use in rotary drilling comprising two members telescopically assembled one within the other for relative longitudinal movement between contracted and extended positions, one of said members being adapted to be connected to a drill pipe for actuating said jar and the other member being adapted to be secured to an instrument to be jarred, striking abutments on said members inter-engageable at one of said positions, a trip to releasably hold said members in the other of said positions but releasable by the exertion of a longitudinal strain exerted between said members; said trip including inter-engageable wedge elements, one element being carried by one of said members, another member having a tapered seat, said first recited element being adjustable and having an inclined face engageable with said seat and being interposed between said members, said elements being carried by one of said members, and mechanism operable by rotary movement of said drill pipe to fix the coacting seating position of said elements whereby to adjust the force required to release said members.

6. A jar for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, striking abutments on said members inter-engageable when said members are in one of said positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement, said seat section having a longitudinally tapered seat facing said mandrel member, an inclined surface sleeve interposed between said seat section and said mandrel member to provide a wedge trip element, said sleeve being longitudinally movable with respect to said seat section to vary the wedging action, limiting means threadedly connected to said seat section and engageable by said sleeve to limit the longitudinal movement of the latter toward wedging position, and coupling means between said actuating section and said limiting means to prevent rotation of the latter and permit longitudinal movement with respect to said seat, said wedge trip acting to hold said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

7. A device of the character described for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement; a trip including a longitudinally tapered seat element facing said mandrel member, an inclined surface wedging sleeve element interposed between said seat section and said mandrel member, one of said elements being longitudinally movable with respect to said seat section to vary the wedging action, a limiting annulus threadedly connected to said actuating section and engageable by the movable element to limit the longitudinal movement of the latter, and coupling means between said seat section and said limiting annulus to prevent rotation of the latter and permit longitudinal movement of said limiting annulus with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

8. A device of the character described for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement; a trip including a longitudinally tapered seat element facing said mandrel member, an inclined surface wedging sleeve interposed between said seat element and said mandrel member, said wedging sleeve being longitudinally movable with respect to said seat section to vary the wedging action, a limiting sleeve threadedly connected externally to said actuating section by a thread of different pitch than the thread between said actuating and seat sections, and engageable by said wedging sleeve to limit the longitudinal movement of the latter, and coupling means between said seat section and said limiting sleeve to prevent rotation of the latter and permit longitudinal movement with respect to said seat section whereby rotation of said actuating section with respect to said seat section will cause a differential longitudinal movement of said limiting sleeve with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

9. A jar for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, striking abutments on said members inter-engageable when said members are in one of said positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement; a trip including a longitudinally tapered seat element on said seat section facing said mandrel member, an inclined surface wedging sleeve element interposed between said seat element and said mandrel member, one of said elements being longitudinally movable with respect to said seat section to vary the wedging action, a limiting annulus threadedly connected to said actuating section and engageable by the movable element longitudinal movement of the latter, and coupling means between said seat section and said limiting annulus to prevent rotation of the latter and permit longitudinal movement with respect to said seat section whereby rotation of said actuating section with respect to said seat section will cause a longitudinal movement of said limiting annulus with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

10. A jar for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, striking abutments on said members inter-engageable when said members are in one of said positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary move-

ment; a trip including a longitudinally tapered seat element on said seat section facing said mandrel member, an inclined surface wedging sleeve interposed between said seat element and said mandrel member, said wedging sleeve being longitudinally movable with respect to said seat section to vary the wedging action, a limiting sleeve threadedly connected to said actuating section and engageable by said wedging sleeve to limit the longitudinal movement of the latter, and coupling means between said seat section and said limiting sleeve to prevent rotation of the latter and permit longitudinal movement with respect to said seat section whereby rotation of said actuating section with respect to said seat section will cause a longitudinal movement of said limiting sleeve with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

11. A jar for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, striking abutments on said members inter-engageable when said members are in one of said positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement; a trip including a longitudinally tapered seat element on said seat section facing said mandrel member, an inclined surface wedging sleeve interposed between said seat element and said mandrel member, said wedging sleeve being longitudinally movable with respect to said seat section to vary the wedging action, a limiting sleeve threadedly connected externally to said actuating section by a thread and engageable by said wedging sleeve to limit the longitudinal movement of the latter, and coupling means between said seat section and said limiting sleeve to prevent rotation of the latter and permit longitudinal movement with respect to said seat section whereby rotation of said actuating section with respect to said seat section will cause a longitudinal movement of said limiting sleeve with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

12. A jar for use in rotary drilling comprising a shell member, a mandrel member, said members being telescopically assembled for relative longitudinal movement between contracted and extended positions, striking abutments on said members inter-engageable when said members are in one of said positions, said shell member including a seat section and an actuating section threadedly assembled for relative rotary movement; a trip including a longitudinally tapered seat element on said seat section facing said mandrel member, an inclined surface wedging sleeve interposed between said seat element and said mandrel member, said wedging sleeve being longitudinally movable with respect to said seat section to vary the wedging action, a limiting sleeve threadedly connected externally to said actuating section by a thread of different pitch than the thread between said actuating and seat sections and engageable by said wedging sleeve to limit the longitudinal movement of the latter, and coupling means between said seat section and said limiting sleeve to prevent rotation of the latter and permit longitudinal movement with respect to said seat section whereby rotation of said actuating section with respect to said seat section will cause a differential longitudinal movement of said limiting sleeve with relation to said seat element, said trip holding said members in the other position but releasing said members on exertion of a longitudinal strain determined by position of said limiting means.

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