April 4, 1961 R. W. WALKER 2,978,048

BUMPER SAFETY JOINT

Filed Oct. 1, 1958 3 Sheets-Sheet 1

FIG. 1.

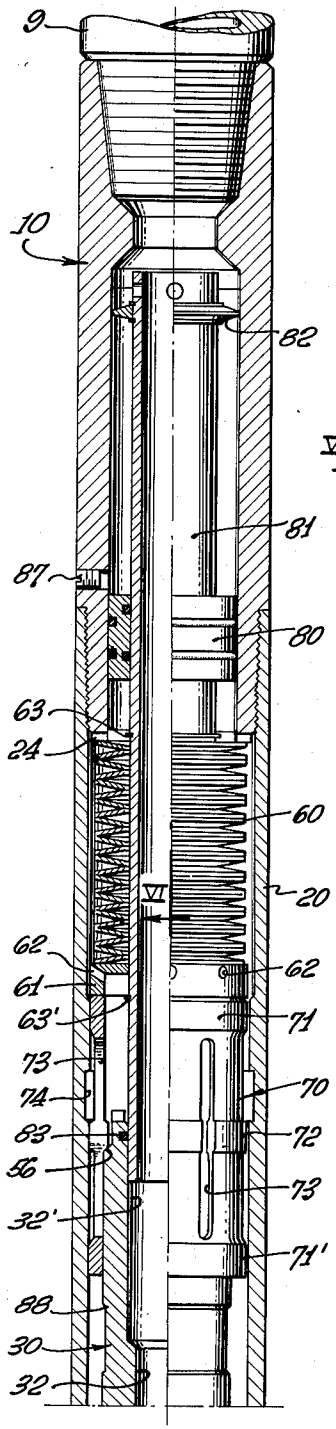


FIG. 1a.

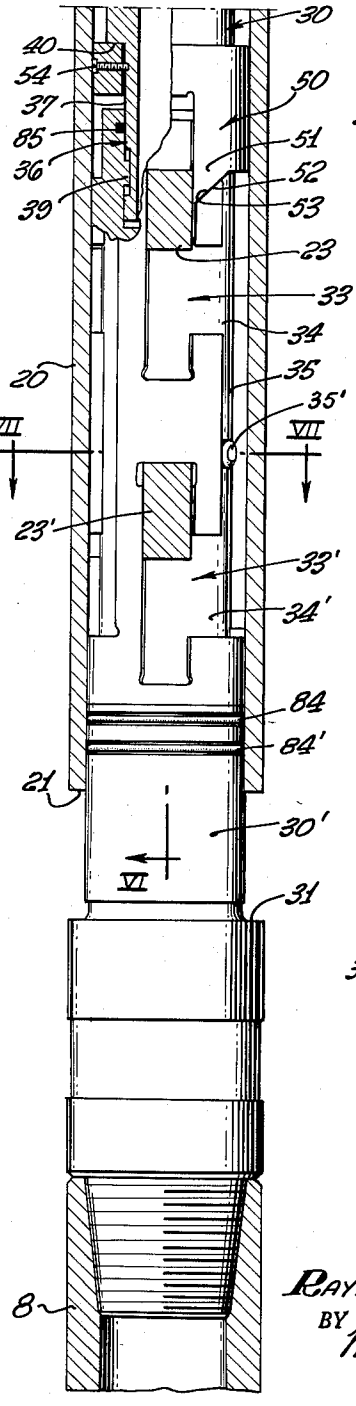


FIG. 7.

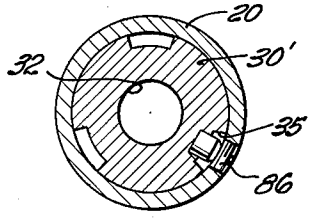


FIG. 8.

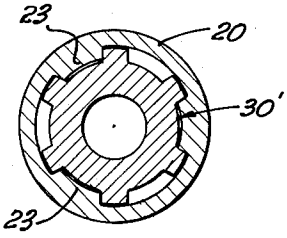
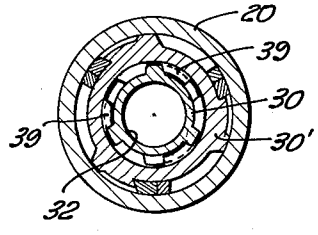


FIG. 9.



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Filed Oct. 1, 1958 3 Sheets-Sheet 2

FIG. 2.

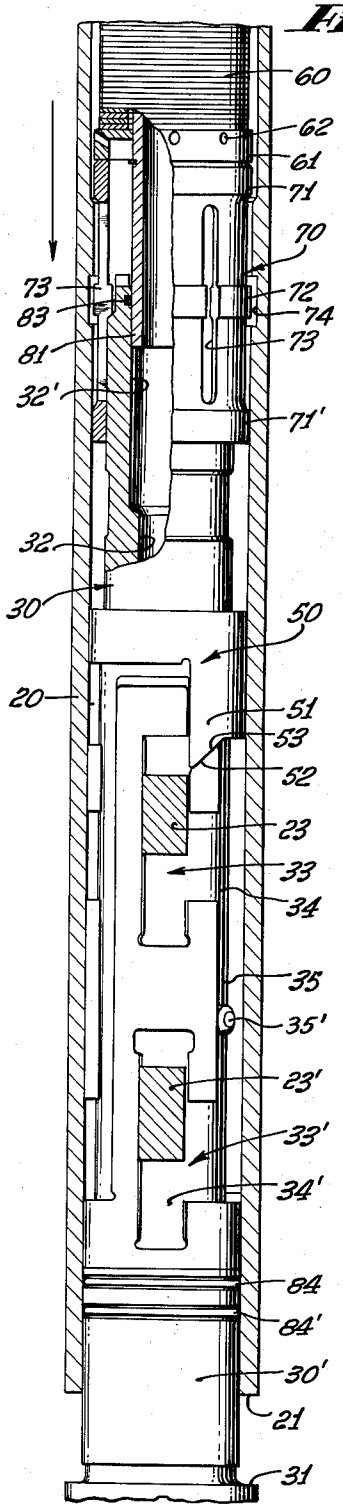


FIG. 3.

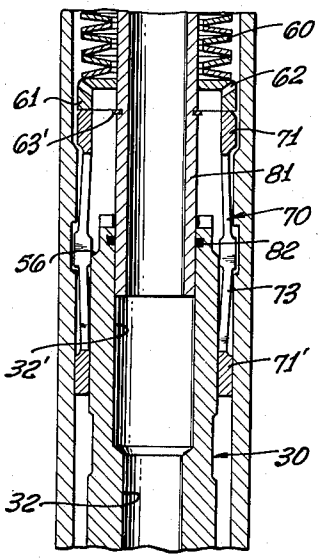


FIG. 10.

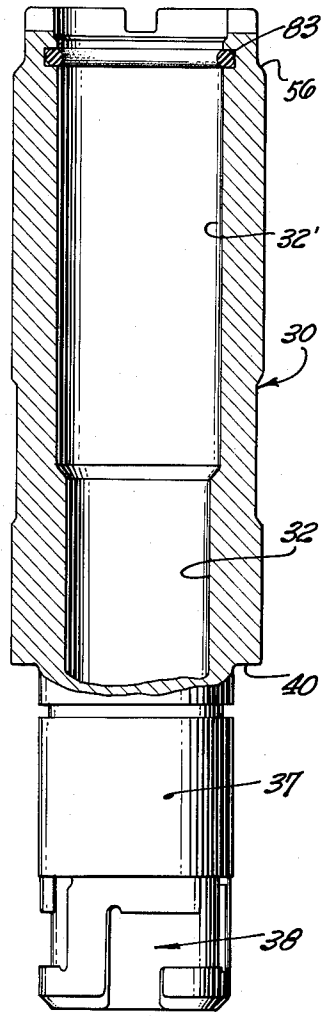
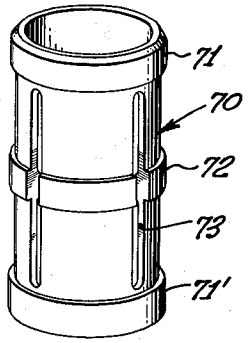


FIG. 11.



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Filed Oct. 1, 1958 3 Sheets-Sheet 3

FIG. 4.

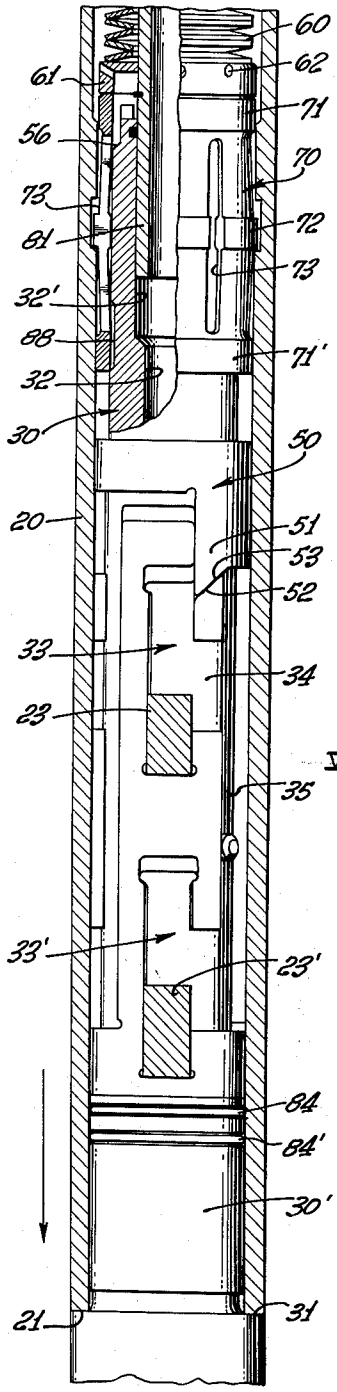


FIG. 6.

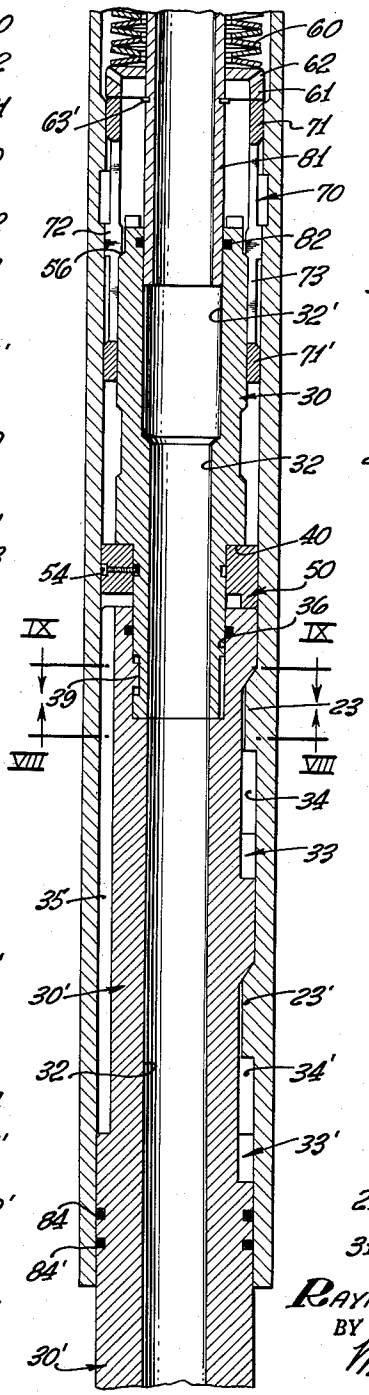
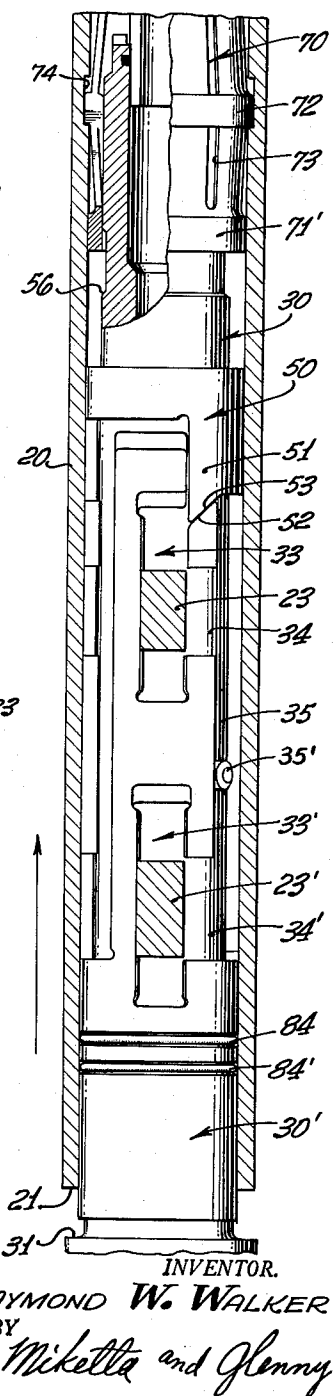


FIG. 5.



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United States Patent Office 2,978,048 Patented Apr. 4, 1961

2,978,048

BUMPER SAFETY JOINT

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Filed Oct. 1, 1958, Ser. No. 764,595

14 Claims. (Cl. 175—294)

The present invention relates to an improved bumper safety joint which can be installed at any desired point in a string of drill pipe, will transmit drilling torque without chattering or undesired vibration, can be readily manipulated from the surface to deliver any desired number of sharp downwardly directed blows to the string, tools or fish below the safety joint in the event such tool has been stuck or has encountered an obstruction which requires downward blows, in which all of the working parts are maintained clean in a bath of oil and free of drilling mud and debris from both the internally supplied drilling mud and debris in the well hole, which can readily and effectively transmit upward pull at normal or extremely rapid rates which produce upward, dislodging jars, and which, in the event the lower tool or fish is immovably held, can be caused to disconnect the lower portion and tool from the major portion of the safety joint and upper drilling string to permit recovery of the string; the drilling tool can be the subject of a subsequent fishing operation.

Devices for imparting upwardly and/or downwardly directed blows to drilling string and tools located below such device in a well hole have been known in the art heretofore (see 2,158,406, 1,954,513 and 2,309,866 for examples), but these prior devices did not have the advantages of the bumper safety joint of this invention and depended greatly upon the skill of the operator. Many prior devices have used J-slots in one member and keys carried by another member and cooperating with such slots to provide a driving, rotative connection and some longitudinal movement, but in prior devices excessive and damaging chatter, jumping and vibration was imparted to the joint, drill stem and tool by reason of the looseness of fit deemed necessary. Prior attempts to minimize such vibration (as in Patent 2,572,895) have not been satisfactory, and the present invention provides novel and effective means for overcoming prior difficulties. Where latching means have been previously employed, as in the last mentioned patent, such latching means were not dependable and subject to excessive wear and modification due to the presence of mud fluid and the inherent weakness of slender latching fingers having free ends. The present invention discloses a construction including fluid seals which compensate for variations of ambient fluid or mud and constantly maintain the moving parts in a bath of clean oil, insuring direct, smoothly sliding metal-to-metal contact without excesive wear and precluding jamming due to accumulation of sand, clay or other foreign matter.

Also, a relatively simple means in the form of an elongated, cylindrical cage having upper and lower circumferential bearing rings and an intermediate circumferential releasing ring is utilized in the bumper safety joint of the present device for holding the hammer and anvil portions apart until a predetermined load is applied to cause the cage to move into a released position and the hammer portion to strike the anvil portion with a predetermined force. The anvil portion and stuck fish

can be struck any number of successive blows by resetting the hammer portion above the anvil portion and repeating the operation. Due to the efficient operation of the cylindrical cage, each blow delivered to the anvil portion will be of the same predetermined force. The cylindrical cage performs its function without the aid of any latching rings or sleeves either movable or fixed as are generally used in combination with pivoted trip fingers in devices provided heretofore.

An object of the present invention is the provision of a bumper safety joint having means for eliminating vibration and chatter between driving shoulders and J-slot means of cooperating mandrel and bowl or barrel portions.

Another object is to provide a sealed bumper safety joint which allows all of the moving members therein to operate in a bath of lubricating oil.

A further object of the invention is the provision of means for balancing the pressure within the joint to relieve excessive pressure differentials on the oil seals.

Still another object is to provide a bumper safety joint which can deliver successive blows of the same predetermined force to a lower element, tool or fish or can be disconnected from the lower element in order to salvage the drill pipe extending up to the surface.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better underestood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figs. 1 and 1*a* show a side elevational view, partly in section, with parts broken away, of a preferred embodiment of the invention in its normal drilling position. Fig. 1 illustrates the upper half of the device and Fig. 1*a* shows the lower half of the device, the two figures being broken along a transverse plane.

Fig. 2 is a side elevational view similar to Figs. 1 and 1*a*, but in which the outer bowl member has started its downward movement to position the circumferential releasing groove in the bowl member opposite the releasing ring on the cylindrical cage member.

Fig. 3 is a fragmentary side elevational view of the device, in section, showing the releasing ring on the cylindrical cage member in the expanded position within the circumferential releasing groove in the bowl member whereby the bowl and mandrel members are free to longitudinally move relative to each other.

Fig. 4 is a side elevational view of the device, partly in section, in a succeeding and completed down-bump position with the hammer portion in direct contact with the anvil portion.

Fig. 5 is a side elevational view, partly in section, of the device in an intermediate position and that assumed as the first step during disconnecting.

Fig. 6 is a longitudinal section through a portion of the device shown in Figs. 1 and 1*a*, and taken along plane VI—VI.

Fig. 7 is a transverse section taken along plane VII—VII in Fig. 1*a*.

Fig. 8 shows a transverse section taken along plane VIII—VIII in Fig. 6.

Fig. 9 is a transverse section taken along plane IX—IX in Fig. 6.

Fig. 10 shows an enlarged side elevational view, partly in section, of an elongated friction mandrel forming the upper end of the inner mandrel member.

Fig. 11 is a perspective view of the elongated cylindrical cage for holding the hammer and anvil portions in spaced relation when the device is in its normal drilling position as shown in Figs. 1 and 1*a*.

Generally stated, the bumper safety joint of the pres-

ent invention illustrated in the drawings comprises an upper sub 10 which is connected to and may be said to be integral with the outer tubular, hollow bowl member 20. The bowl member terminates in a hammer face 21 at its lower open end. Extending into the lower open end of the hollow bowl member 20 is a two-part mandrel having the upper mandrel section 30 and the lower mandrel section 30', the two sections being suitably interlocked (details of which are described hereinafter) for selectively operable longitudinal movement and rotation within the bowl and for selective separation to permit recovery of the upper mandrel section in the event the entire device is disconnected from the lower tool, drill stem, or the like. The lower mandrel section may be integral with a threaded pin for attachment to a drill pipe, to a drilling tool, to a fishing tool, or other device, and includes an anvil face 31 upon which the hammer face 21 will controllably deliver its blow. The torque stabilizer and antivibration device of the present invention is carried by the upper mandrel portion and is indicated at 50. The torque stabilizer 50 receives downward pressure from the loaded spring 60 transmitted through the releasing cage 70, is applied to the torque stabilizer which translates such pressure into a lateral force which maintains a tight driving connection between the lower mandrel section and the outer bowl member. The system for permitting drilling mud to be circulated through the device, while at the same time the working parts of the entire safety joint are maintained in a bath of clean oil, includes a floating hydraulic seal 80 surrounding the wash pipe 81 and other related elements, as will be described in greater detail hereinafter.

As previously indicated, the upper sub 10 may be provided with a box adapted to threadedly receive and hold the pin of a drill collar or drill pipe 9 extending to the surface of the well hole. The lower end of the lower mandrel section 30' may be similarly provided with a pin adapted to be connected to a drill pipe or to a drilling tool, fishing tool or the like, indicated at 8. Both the upper and lower mandrel sections are provided with an axial bore 32 (Fig. 6) for drilling mud fluid. The outer circumference of the lower mandrel section 30' is provided, preferably at 120° intervals, with J-slot type means whereby such mandrel portion may be connected to and driven by the outer bowl member 20. Each of said J-slot-type means is composed of a longitudinally extending operating groove or slot 33 terminating at upper and lower stop shoulders, and includes a transversely extending slot portion 34 in communication with a longitudinally extending escape slot 35 which extends to the upper end of the lower mandrel portion 30'. Another slot 33' is in longitudinal alignment with the slot 33 and is also provided with a transversely extending slot 34' in communication with the same escape slot 35. The inner surface of the outer bowl member 20 is provided with three sets of inwardly extending driving shoulders 23 and 23' adapted to slidably fit into the slots 33 and 33'. These driving shoulders are adapted to transmit the rotation of the drill stem and outer bowl member into rotation of the mandrel; since normal driving rotation is to the right (looking down from the top of a drill stem), the transversely extending slots 34 and 34' extend in a left-hand direction from the slots 33 and 33' into the escape slot 35. It may be noted that the longitudinal slots 33 and 33' are appreciably longer than the length of each of the driving shoulders 23 and 23' and the width of each of the transverse slots 34 and 34' is simply adequate to permit the passage of the driving key therethrough.

The bore 32 extending through the lower mandrel section 30' is enlarged at the upper end so as to form a recess 36 adapted to receive the lower end 37 of the upper mandrel section 30. This lower end 37 of the upper mandrel section 30 is also provided with J-type slots or a loose bayonet-type joint indicated at 38 (see

Fig. 10), each of said J-type slots being adapted to slidably receive an inwardly extending driving shoulder 39 (see Fig. 1a) carried by the enlarged bore 36 of the lower mandrel section 30'. The upper mandrel section 30 is generally made of a very hard, wear resisting and durable steel or alloy for reasons which will be apparent from later description.

The lower end 37 of the upper mandrel section 30 also carries the torque stabilizer 50. This torque stabilizer 50 may be in the form of a ring slidably fitting into the smooth bore of the outer bowl member 20, the upper part of the ring slidably resting against a downwardly facing shoulder 40 formed in the upper mandrel section 30, the ring also including downwardly extending teeth 51 provided with an inclined face 52 adapted to rest against an inclined face 53 formed in the outer surface of the lower mandrel section 30', and a longitudinal face adapted to contact a driving shoulder of the bowl. A full dog set screw or a pin carried by the ring portion of the torque stabilizer, and indicated at 54 (Fig. 1a) may extend into a circumferential groove formed in the outer surface of the lower reduced diameter end 37 of the upper mandrel portion 30 so as to maintain the torque stabilizer against the shoulder 40. It may be noted that when assembled, the vertical face of the downwardly extending tooth of the torque stabilizer bears against the side of the driving shoulder 23 and is urged in that direction by the cooperating action of the two inclined surfaces 52 and 53, thereby maintaining a positive driving connection.

Whereas the outer surface of the lower mandrel section 30' slidably contacts the inner surface of the outer bowl member 20, the outer surface of the upper mandrel section 30 is spaced from the inner surface of the bowl member 20. Within this space there is located the releasing cage 70, usually made of a very hard, wear resisting but resilient alloy such as nitralloy. Adjacent the upper end of the upper mandrel section 30 there is provided a circumferentially extending, inclined shoulder or face indicated at 56. The inner bore extending through this upper mandrel section 30 is also enlarged, as indicated at 32' (Fig. 1), so as to slidably receive the lower end of the wash pipe 81.

In its assembled and operative position, the bumper jar is so arranged that the downward pressure of the drilling string is transmitted by the outer bowl member 20 through the spring 60 onto the cage 70. This cage rests against the friction face 56 to which reference has been made. As illustrated in the embodiment shown in the drawings, the spring 60 may be made of a series of spring discs and surrounds the wash pipe 81. One end of the spring may rest against a shoulder 24 presented by the sub 10. The other end of the spring 60 may bear against a follower 61 which may be provided with a plurality of ports 62 for purpose which will be described later. Snap rings 63 and 63' may be carried by the wash pipe for the purpose of loosely retaining the spring and follower assembly on the pipe during assembly of the entire device. The spring follower 61 bears against the upper circumferential bearing ring 71 of the cage 70.

The cage 70 is cylindrical, and normally made from a hard resilient wear-resistant metal or alloy such as nitralloy (a steel containing about 0.4% C, 1.4–1.8% Cr and 0.3–0.4% Mo). This cylindrical cage is provided with circumferential upper and lower bearing rings 71 and 71' and an intermediate releasing ring 72, the outer surfaces of these three rings being in slidable contact with the smooth inner bore of the bowl member 20. The cylindrical web interconnecting said rings is preferably somewhat thinner than the rings themselves. The cage 70 also has a plurality of longitudinally extending, circumferentially spaced slots such as 73 between the upper and lower rings and traversing the intermediate releasing ring. The intermediate releasing ring 72 presents a shoulder which extends beyond the inner surface

of the cage and rests upon the friction face 56 at the upper end of the upper mandrel section 30. It will be therefore apparent that downward pressure delivered to the outer bowl member and its associated sub will be transmitted by the spring 60 to the upper bearing ring of the cage 70 and by the intermediate releasing ring 72 of such cage to the mandrel, causing the upper mandrel section 30 (and its associated torque stabilizer 50) to bear down upon the lower mandrel section 30'. This downward pressure causes the driving shoulders 23 and 23' to bear against the upper ends of the slots 33 and 33'. Simultaneously, the torque stabilizer 50 translates the downward pressure (by reason of the inclined co-operating faces 52 and 53) into a lateral force whereby the vertical side of the tooth 51 bears against the driving shoulder 23, causing intimate contact between the side of such shoulder and the side of the slot 33. During actual drilling operations or rotation of the entire string and safety joint, looseness and vibration or chattering is virtually eliminated by such translated forces.

The substantially smooth, internal surface of the bowl member 20 is provided with a circumferential releasing and retaining groove 74 having upper and lower shoulders, said groove and its shoulders normally lying in a plane above the intermediate release ring 72 of the cage 70, as illustrated in Fig. 1. It will be noted that in this normal position, the lower bearing ring 71' extends into the space between the outer surface of the upper mandrel section 30 and the inner surface of the bowl 20 and the outer surface of the release ring 72 is in sliding contact with such inner surface of the bowl. When it is desired to deliver a sharp blow downwardly upon the anvil face 31 of the mandrel, the weight of the entire drilling string is slowly imposed upon the bowl member causing the spring 60 to be compressed. This permits downward movement of the bowl 20 with respect to the mandrel, the parts then assuming the position indicated in Fig. 2 wherein the release groove 74 is shown to have assumed a position in substantially horizontal alignment with the release ring 72. As greater downward pressure is imposed upon the bowl 20, the release ring slips upon the outwardly and downwardly inclined surface 56 of the mandrel and snaps into the release groove 74 as indicated in Fig. 3, permitting the bowl to move rapidly downward so as to impart a sharp blow upon the anvil face 31 by the hammer face 21 of the bowl. Attention is called to the fact that the longitudinally extending slots 73 of the cage divided the cage into a plurality of strips, each strip being connected at its ends to the upper and lower bearing rings which act as bearing members during flexure of the medially positioned release ring 72. While this releasing action is taking place and after the release ring of the cage has entered the release groove 74, the spring 60 continues to apply force to the upper end of the cage maintaining the lower edge of the release ring 72 in contact with the lower shoulder or wall of the release groove 74. The overall thickness of the release ring 72 is substantially equal to the space between the outer surface of the upper mandrel section 30 and the bottom of the release groove 74 so that although the mandrel section 30 may slide upon the release ring 72 (in this position), the cage, through its release ring, frictionally grasps the mandrel.

This frictional engagement between the cage and the upper mandrel section 30 is utilized whenever it is deemed necessary to abandon the tool or lower element 8 in the well hole, separate or break the safety bumper jar and withdraw it, and superimposed sections of drill stem etc., from the hole. Such recovery is attained immediately after delivering the downwardly directed blow. The entire string is raised until the driving keys 23 and 23' are in horizontal alignment with the transverse slot portions 34 and 34' and the spring is then rotated to the left to move the driving keys into the escape slot 35. It may be noted that the escape slot 35 is normally provided with one or more shearable plugs 35' in order to prevent accidental separation of the bowl from the mandrel. When, however, it is desired to actually cause such separation or disassembly of the device, after the driving shoulders 23 and 23' have been placed in the escape slot 35, the string and the bowl member 20 are raised causing the shear pin 35' to be broken and permitting the entire bowl 20 to be withdrawn from the lower mandrel section 30'. It will be noted that during this operation, the upper mandrel section 30 is frictionally retained within the bowl 20 by the cage 70 since the release ring 72 is in engagement with the release slot or groove 74 formed in the inner surface of the bowl and such cage exerts a frictional hold upon the upper mandrel section 30 together with its torque stabilizer 50. The relatively loose driving connection between the upper and lower mandrel sections (including the J or bayonet slots 38) is disengaged during the left-hand rotation of the bowl with respect to the lower mandrel section 30'.

The movement of the various parts from normal position to the completion of a downward blow is therefore indicated by Figs. 1 and 1*a*, 2, 3 and 4. Fig. 5 illustrates the position of the parts just prior to left turn of the bowl for the purpose of withdrawing the bowl and leaving the lower mandrel section within the hole and it also represents the upward movement of the entire bowl and drill stem in order to reposition the bumper joint for another downward blow. In the event the upward movement of the outer bowl 20 (Fig. 5) is continued until the driving shoulders 23 and 23' reach the ends of vertical slots 33 and 33', the cage 70 would be carried upwardly (by engagement of the bottom of the release groove with the bottom shoulder of the release ring) so as to permit the cage to again assume its normal cylindrical form with the lower and inner shoulder of the release ring resting against the friction face 56 of the upper mandrel section 30. By such sequence of steps, any given number of predetermined forceful blows may be applied by the hammer 21 upon the anvil 31.

Since all these operations take place in a well hole containing mud fluid and debris, and it is often desirable to circulate drilling mud through the device during such operations, means have been provided for isolating the moving parts in a body of lubricating oil to prevent undue wear, impairment of function due to the presence of gritty debris, packing with clay, etc. In order to permit such isolation, the wash pipe 81 is surrounded by a floating hydraulic seal 80 provided with suitable sealing rings on its inner and outer cylindrical surfaces which cause said ring 80 to seal both against the inner surface of sub 10 and against the outer surface of wash pipe 81 while permitting vertical movement of the ring. The upper end of the wash pipe 81 may also be provided with a wiper disc or annulus 82 attached by suitable snap rings to the pipe. The enlarged bore portion 32' of the upper mandrel section 30 may also carry an oil seal 83 in sliding contact with the wash pipe, such oil seal preventing free movement of fluid from within the bore to the space occupied by the cage. Lower mandrel section 30' is preferably provided with a plurality of oil seals such as 84 and 84' in sliding engagement with the smooth inner surface of bowl 20, these seals preventing escape of lubricating oil from the working chamber. In addition, an oil seal may be carried by the enlarged axial bore 36 at the upper end of the lower mandrel section 30' as indicated at 85 in order to prevent loss of oil or entry of mud fluid at the connection between the upper and lower mandrel sections. The entire chamber between the bowl and the inner mandrel sections and wash pipe 81 below the hydraulic floating seal 80 and the lower sealing means 84 is preferably filled with a lubricating oil. This lubricating oil may be added or inserted into the working cavity through a plugged opening such as is indicated at 86 in Fig. 7, such opening being in alignment with the escape slot 35 and/or through a suitable plugged port such as 87 in the vicinity of the floating oil seal 80 in the sub 10. The ports or passageways 62

in the spring follower 61 permit ready movement of oil when the spring 60 expands and contracts under load conditions. It should also be noted that the lower shoulder 24 on the top sub is provided with transverse channels permitting oil to flow from the top sub to the bowl member 20.

A circumferential relief groove 88 may be provided in the outer surface of upper mandrel section 30 to permit oil to move from below lower bearing ring 71' of the cage to above said cage through such relief groove and slots 73 of the cage when the parts move from the position shown in Fig. 3 to that shown in Fig. 4. It will be noted that no oil sealing rings are subjected to excessive pressure differentials during operation of the device, since the pressure compensating seal 80 can move with changes in volume, due to temperature variations, displacement or wear.

It is to be remembered that fluid pressures in deep bore holes may vary and reach high proportions. The floating seal 80 is capable of movement in accordance with variation in pressure differentials existing on opposite sides of such seal. Moreover, during compression and expansion of the spring 60, such floating seal 80 permits enlargement and contraction of the lubricating oil chamber without development of excessive pressures or undesirable vacuum. All of the moving parts such as the cage and mandrel sections are maintained in a clean bath of lubricating oil insuring dependable and uniform working characteristics.

The construction and operation of the safety bumper joint and its advantages will be readily appreciated and understood from the above description. The device constitutes a rigid unit during drilling; the stabilizer 50 maintains positive driving connection at all times. Since the upper mandrel section is connected to the lower mandrel section by a relatively loose driving connection (note that key 39 is spaced from top and bottom walls of slot 38, Fig. 1*a*) and torque stabilizer 50 can turn on the upper mandrel section, the tooth of the stabilizer can at all times compensate for wear of the parts in contact therewith. The bumping blow is preloaded by the spring 60; the force of the blow and that necessary to release the outer bowl from the inner mandrel is in part influenced by the length and strength of the spring used, but primarily determined by the resiliency and flexibility of the metal of the cage 70 and the inclination of the mating surfaces 56 of the mandrel and the lower inner surface of ring 72 of the cage. The blow struck is very powerful; one form of the invention delivers an effective downward blow of 20 tons. In such device it was determined that it required 9 tons to compress spring 60 until it acted as a rigid body and to move the outer bowl 20 to place releasing groove 74 in position, and an additional 11 tons to cause flexure of intermediate ring 72 and release of the mandrel. It will be noted that the blow is supplemented by forceful contact of driving shoulders with the bottom of slots 33 and 33' at the end of travel and at the instant hammer 21 contacts anvil 31.

The construction is relatively simple and economical; all elements made of expensive alloys can be recovered; a minimum number of parts and threaded connections are employed. It is to be understood that changes and modifications coming within the scope of the claims are embraced thereby and that the example illustrated in the drawings is not limiting.

I claim:

1. In a bumper safety joint, including an inner, hollow mandrel slidably and turnably received in one end of an elongated, hollow, outer bowl member having a smooth inner surface, said bowl and mandrel having opposing hammer and anvil faces, respectively, adapted to be brought into forceable engagement with each other, the provision of: a two-section mandrel, comprising a lower section having J-slot-type means formed therein including a longitudinally extending operating slot having upper and lower stop shoulders and a transverse slot portion communicating said operating slot with a longitudinally extending escape slot, an inwardly extending driving shoulder on the bowl cooperating with said J-slot means to drive said mandrel, said J-slot means limiting relative longitudinal movement of the bowl and mandrel when said driving shoulder is in said operating slot and permitting assembly and separation of bowl and lower mandrel section when the driving shoulder is selectively placed in said escape slot; an upper mandrel section of hard, wear-resisting metal carried within the bowl member, means for loosely and releasably connecting said upper mandrel section with the upper end of the lower mandrel section and for allowing said upper and lower mandrel sections to be separated when said lower mandrel section is separated from said bowl, said upper mandrel section having an outer surface including an inclined, circumferential, friction face spaced from the inner surface of the outer member; spring means for transmitting downward pressure from the outer bowl member to the upper mandrel section acting upon a cylindrical cage having upper and lower circumferential bearing rings and an intermediate circumferential releasing ring slidable along the inner surface of the bowl member, and longitudinally extending, circumferentially spaced slots in said cage between said upper and lower bearing rings and traversing said releasing ring, said intermediate releasing ring resting upon said inclined friction face of the upper mandrel section and normally incapable of extending into the space between said upper mandrel section and the inner surface of the bowl member; an outwardly directed, circumferential, releasing groove formed on the inner surface of the bowl, said releasing groove being normally in a transverse plane between said spring and releasing ring of said cage, whereby forceful compression of said spring and movement of the outer bowl with respect to said mandrel and cage will cause intermediate portions of said cage and releasing ring to be flexed outwardly into said releasing groove on the bowl and release said mandrel sections to bring the hammer and anvil faces into forceful contact with each other.

2. A device as stated in claim 1, wherein said loose releasable connection between said upper and lower mandrel sections includes second J-slot-type means on said upper mandrel section having a longitudinal slot communicating with an escape slot by a transverse slot portion and an inwardly extending shoulder carried by said lower mandrel section and cooperating with said second J-slot means, so that the releasing ring of the cylindrical cage is held in the releasing groove of the outer bowl after said forceful contact of said hammer and anvil faces and the upper mandrel section is held non-rotatable with respect to the outer bowl member by the said cylindrical cage, whereby said outer bowl member and upper mandrel section may be jointly rotated to release the connection in said second J-slot means between said upper and lower mandrel sections and place the driving shoulder of the bowl in the escape slot of the first J-type slot means of the lower mandrel to permit removal of the bowl and upper mandrel section from the lower mandrel section by upward longitudinal movement of the bowl and upper mandrel section.

3. A device as stated in claim 1, including a torque stabilizer carried by and movable longitudinally with the upper mandrel section and partly rotatable thereon, said torque stabilizer including means cooperating with the lower mandrel section to translate downward pressure of the bowl transmitted to said upper mandrel section into a lateral force directed to maintain a tight driving connection between the outer bowl member and said lower mandrel section.

4. A device as stated in claim 1, wherein said upper and lower mandrel sections include an interconnected axial bore, a wash pipe slidably extending into the axial

bore of said upper mandrel section; a fluid seal between said wash pipe and upper mandrel section; a movable hydraulic seal between said wash pipe and outer bowl above said spring means; and a fluid seal between said lower mandrel section and said bowl to isolate a body of lubricating oil around said spring means and between said mandrel sections and outer bowl.

5. In a bumper safety joint, including an inner, hollow mandrel slidably and turnably received in one end of an elongated, hollow, outer bowl member having a smooth inner surface, said bowl and mandrel having opposing hammer and anvil faces, respectively, adapted to be brought into forceable engagement with each other, the provision of: J-slot-type means formed in the mandrel including a longitudinally extending operating slot having upper and lower stop shoulders and a transverse slot portion communicating said operating slot with a longitudinally extending escape slot and an inwardly extending driving shoulder on the bowl cooperating with said J-slot-type means to limit relative longitudinal movement of the mandrel and bowl and to drive the mandrel in said operating slot and to assemble and separate the bowl and mandrel when said driving shoulder is selectively placed in said escape slot; an elongated, cylindrical cage of hard metal having upper and lower circumferential bearing rings and an intermediate circumferential releasing ring, slidably positioned within said bowl with said upper and lower bearing rings in sliding contact with the inner surface of the bowl and the inner portion of the intermediate releasing ring in engagement with the upper end of said mandrel; a spring carried within the bowl and exerting force upon said cage; an outwardly directed, circumferential releasing groove formed on the inner surface of the bowl, said releasing groove being normally in a transverse plane between said spring and releasing ring of said cage; and longitudinally extending, circumferentially spaced slots in said cage between said upper and lower bearing rings and traversing said releasing ring, whereby forceful compression of said spring by movement of the bowl with respect to said mandrel will cause intermediate portions of said cage and said releasing ring to be flexed outwardly into said circumferential releasing groove on the bowl and release said mandrel to bring the hammer and anvil portions into forceful engagement with each other.

6. In a bumper safety joint, including an outer tubular bowl member adapted to be rotated about its longitudinal axis and receive the weight of a drilling string and an axially bored mandrel slidably and turnably extending into the lower end of said outer bowl member, the provision of: J-slot-type means on the mandrel including a longitudinally extending operating slot having upper and lower stop shoulders and a transverse slot portion communicating said operating slot with a longitudinally extending escape slot and driving shoulders extending inwardly from an inner, cylindrical surface of the bowl member into cooperative relation with said slot means whereby said mandrel may be rotated by said bowl member and said bowl member may be moved longitudinally upon and selectively removed from the mandrel; said mandrel including an upper section having an outer surface including a circumferential, outwardly and downwardly inclined friction face spaced from the inner surface of the bowl member; a cylindrical cage of hard, resilient metal having upper and lower circumferential bearing rings and an intermediate circumferential releasing ring slidably positioned within said bowl with the upper and lower bearing rings in sliding contact with the inner surface of the bowl and said intermediate releasing ring resting upon said friction face; a wash pipe slidably carried by the upper end of the axial bore of the mandrel and extending thereabove; a spring surrounding said wash pipe, said spring being adapted to transmit downward pressure of said outer bowl into the upper bearing ring of said cage and into the friction face of said mandrel; an outwardly directed, circumferential releasing groove formed on the inner surface of the bowl, said releasing groove being normally in a transverse plane between said spring and releasing ring of said cage; and longitudinally extending, circumferentially spaced slots in said cage between said upper and lower bearing rings and traversing said releasing ring, whereby forceful compression of said spring by movement of the bowl with respect to said mandrel will cause intermediate portions of said cage and said releasing ring to be flexed outwardly into said circumferential releasing groove on the bowl and release said mandrel.

7. In a bumper safety joint as stated in claim 6, the provision of a slidable hydraulic seal between said wash pipe and bowl member above said spring, and a hydraulic sealing means between said mandrel and lower section of the bowl member to retain and isolate a body of lubricant around said spring and cage and between said mandrel and bowl member.

8. In a bumper safety joint as stated in claim 6, wherein said mandrel comprises a lower mandrel section having said J-slot type means, and an upper mandrel section of reduced outer diameter carrying said inclined friction face, means for loosely and releasably connecting said upper mandrel section with the upper end of the lower mandrel section and for allowing said upper and lower mandrel sections to be separated when said lower mandrel section is removed from said bowl.

9. In a bumper safety joint as stated in claim 6, wherein said mandrel comprises a lower mandrel section having said J-slot type means, and an upper mandrel section of reduced outer diameter carrying said inclined friction face, means for loosely and releasably connecting said upper mandrel section with the upper end of the lower mandrel section and for allowing said upper and lower mandrel sections to be separated when said lower mandrel section is removed from said bowl; and a torque stabilizer carried by and movable longitudinally with the upper mandrel section, said torque stabilizer including a downwardly extending tooth having an inclined face cooperating with an inclined face on said lower mandrel section to convert downwardly directed force received by the upper mandrel section into a lateral force to maintain a tight driving connection between the outer bowl member and lower mandrel section.

10. In a bumper safety joint, including an inner, hollow mandrel slidably and turnably received in one end of an elongated, hollow, outer bowl member having a smooth inner surface, said bowl and mandrel having opposing hammer and anvil faces, respectively, adapted to be brought into forceable engagement with each other, the provision of: an elongated, cylindrical cage of hard metal having upper and lower circumferential bearing rings and an intermediate circumferential releasing ring, slidably positioned within said bowl with said upper and lower bearing rings in sliding contact with the inner surface of the bowl and the inner portion of the intermediate releasing ring in engagement with the upper end of said mandrel; longitudinally extending, circumferentially spaced slots in said cage between said upper and lower bearing rings and traversing said intermediate ring; and a spring within the bowl transmitting pressure from the bowl to the upper bearing ring of the cage, whereby said intermediate ring delivers said force to the upper end of said mandrel.

11. A device as stated in claim 10, wherein said mandrel comprises a lower mandrel section having means for releasably and drivingly connecting it to said outer bowl member and an upper mandrel section of reduced outer diameter provided with a friction face near its upper end for frictional engagement with said intermediate ring of said cage, means for loosely and releasably connecting said upper mandrel section with the upper end of the lower mandrel section and for allowing said upper and

lower mandrel sections to be separated when said lower mandrel section is released from said bowl.

12. A device as stated in claim 10, wherein said mandrel comprises a lower mandrel section having means for releasably and drivingly connecting it to said outer bowl member and an upper mandrel section of reduced outer diameter provided with a friction face near its upper end for frictional engagement with said intermediate ring of said cage, means for loosely and releasably connecting said upper mandrel section with the upper end of the lower mandrel section and for allowing said upper and lower mandrel sections to be separated when said lower mandrel section is released from said bowl; and a torque stabilizer carried by the upper mandrel section, said torque stabilizer including downwardly extending teeth cooperating with said lower mandrel section to convert downwardly directed force received by the upper mandrel section into a lateral force to maintain a tight driving connection between the outer bowl member and lower mandrel section.

13. In a bumper safety joint, including an inner, hollow mandrel slidably and turnably received in one end of an elongated, hollow, outer bowl member having a smooth inner surface, said bowl and mandrel having opposing hammer and anvil faces, respectively, adapted to be brought into forceable engagement with each other, the provision of: J-slot-type means formed in the mandrel including a longitudinally extending operating slot having upper and lower stop shoulders and an inwardly extending driving shoulder on the bowl cooperating with said slot to drive the mandrel; a longitudinally movable, torque stabilizer carried by said mandrel and partly rotatable thereon; and spring means for transmitting downward pressure from the outer bowl to said torque stabilizer, said torque stabilizer including means cooperating with the driving connection between the outer bowl and the inner mandrel to translate downward pressure of the bowl into a lateral force directed to maintain a tight driving connection between the outer bowl member and the inner mandrel section.

14. A device as stated in claim 13, wherein said means on said torque stabilizer includes downwardly extending teeth having inclined surfaces cooperating with an inclined surface on said inwardly extending driving shoulder and J-slot means to maintain a tight driving connection therebetween.

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