June 11, 1940. H. P. WICKERSHAM 2,204,458

JARRING TOOL

Filed March 20, 1931

Fig. 1.

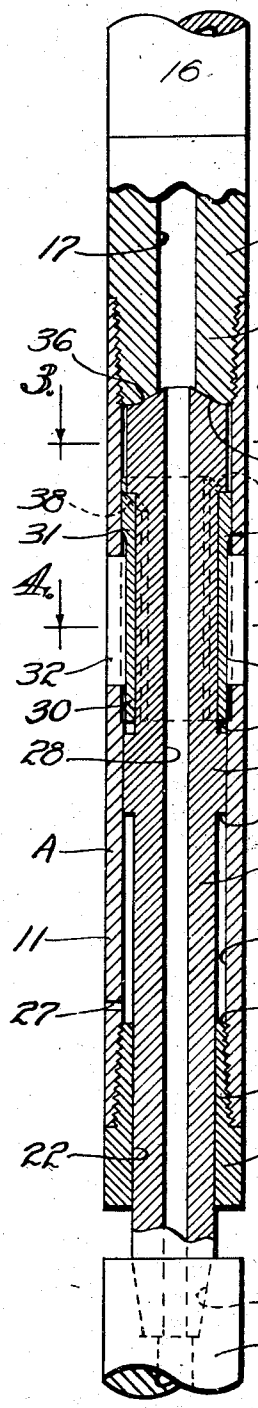


Fig. 2.

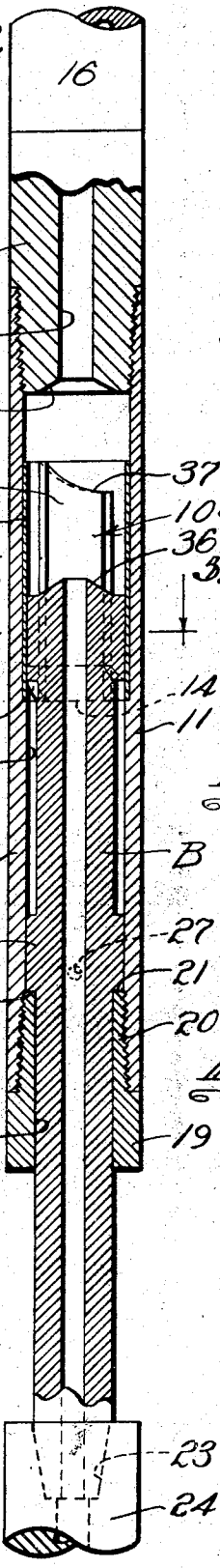


Fig. 3.

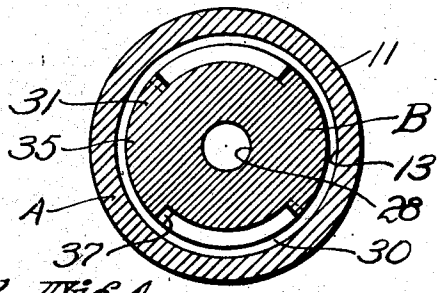


Fig. 4.

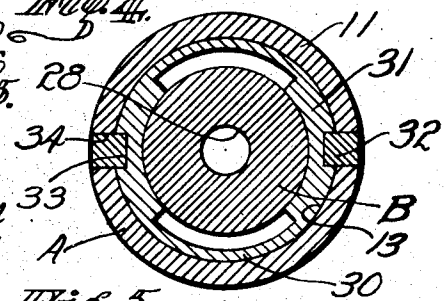


Fig. 5.

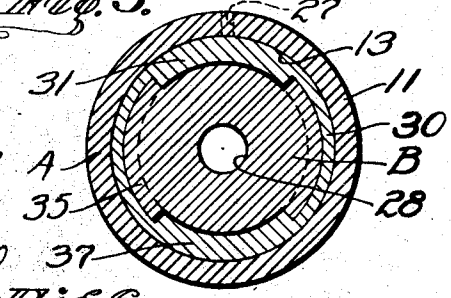
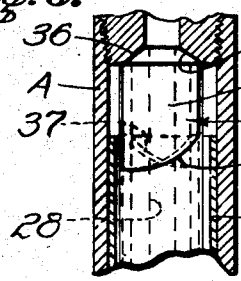


Fig. 6.



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UNITED STATES PATENT OFFICE

2,204,458

JARRING TOOL

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Application March 20, 1931, Serial No. 524,017

25 Claims. (Cl. 255—27)

This invention relates to a well tool, and relates more particularly to a jarring tool for effecting a jarring action in a well bore. It is a general object of the invention to provide a simple, practical, and effective jarring tool for use in fishing operations in a well for imparting a jarring action to parts or tools in the well.

An object of the invention is to provide a jarring tool that is operable to impart a very heavy or powerful jarring action.

Another object of the invention is to provide a jarring tool that is operable by an up-pull or tensile strain on the operating string.

It is another object of the invention to provide a jarring tool that is operable upon an upward pressure or tensile strain being put on the tool while a torsional strain is maintained on the tool. The tool is put under tension after the sections of the tool have been connected together against relative longitudinal movement with their hammer or striking parts spaced apart by the co-operation of helicoidal or suitably pitched faces on the sections. The tool may be adjusted or set to release and operate to provide the jarring action upon tensile strains of various intensities being transmitted through the tool. It is an important feature of the present invention that the tripping load or force of the jarring action obtained is dependent upon or governed by the torsional strain put on the operating string and tool. A heavy torsional strain put on or maintained on the operating string causes a very heavy or severe jarring action, and vice versa.

It is another object of the invention to provide a jarring tool of the character mentioned that may be easily and quickly re-set for operation without being withdrawn from the well. The tool may be operated to provide any number of heavy jarring blows in rapid succession by simple reciprocation of the operating string while a given or constant torsional strain is maintained on the string.

Another object of the invention is to provide a jarring tool of the character mentioned that does not interfere with the free flow of circulation fluid through the operating string and which does not depend upon fluid pressure for its actuation.

Another object of the invention is to provide a jarring tool in which an effective fluid-tight seal is automatically made between the sections of the tool around their fluid passages without employing packing rings or packing glands.

A further object of the invention is to provide a jarring tool of the character mentioned that is of simple, sturdy construction and which embodies a minimum member of parts.

Other objects and features of the invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawing, in which:

Fig. 1 is a longitudinal detailed sectional view of the tool, illustrating the parts in the normal or unactuated position. Fig. 2 is a view similar to Fig. 1, illustrating the parts in the jarring or actuated position. Figs. 3 and 4 are enlarged transverse detailed sectional views taken as indicated by lines 3—3 and 4—4 on Fig. 1. Fig. 5 is an enlarged transverse detailed sectional view taken as indicated by line 5—5 on Fig. 2, and Fig. 6 is a fragmentary sectional view showing the upper end of the mandrel in elevation.

It is believed that the method provided by the invention will be more readily understood after the device or tool has been described and therefore I will proceed with a detailed description of the construction and operation of the tool.

The tool provided by the present invention includes, generally, two sections A and B connected or related for limited relative longitudinal movement, and means 10 for releasably holding the sections A and B against relative longitudinal movement and operable to release the sections for relative movement while under a tensile strain to cause a jarring action to be obtained between the sections.

The sections A and B are the main or body sections of the tool and constitute an assembly adapted to be connected in an operating string above the object or part to be jarred. An operating string employed in well drilling during actual drilling and during the usual fishing and jarring operations, is a string of pipe formed by lengths of drill pipe assembled into sections or stands by couplings, the stands being joined by tool joints. The usual drilling is done by rotating the drill in a clockwise direction and therefore the threaded joints entering into an operating string are made to tighten by clockwise rotation. The sections A and B are telescoped, that is, one section is arranged in or extends into the other. The body section A is tubular and receives the section B which is in the form of a stem or mandrel. In the form of the invention illustrated in the drawing, the tubular section A is the upper body part of the tool and is adapted to be con-

nected with the upper or main portion of an operating string, while the section B is the lower section and is adapted to be connected with the object to be jarred. It will be obvious that the relative positions of the sections A and B may be reversed without departing from the spirit of the invention, and the invention is not to be taken as restricted to the particular positions of the sections A and B illustrated in the drawing.

The tubular body section A includes a main elongated tubular part 11 and a head or upper part 12. The tubular part 11 is of uniform external diameter throughout its length, and the upper end portion of its longitudinal opening 13 is of enlarged diameter to provide an upwardly facing annular shoulder 14. The head or upper part 12 of the section A is provided with a pin 15 screw-threaded into the upper end of the part 11. The head 12 is of the same external diameter as the tubular part 11 and is in the nature of a coupling member to be connected with a tool joint section 16, or the like. It is to be understood that the tool joint connection is the usual or standard type of connection in which the threads are such as to tighten upon rotation of the assembly in a clockwise direction. A central longitudinal fluid passage 17 is provided in the head or upper part 12. The lower end of the pin 15 is in the form of a sealing and bearing surface 18. The bearing surface 18 has a central portion which is inclined upwardly and inwardly.

A nut 19 is provided on the lower end of the tubular part 11 of the section A. The nut 19 is preferably of the same external diameter as the tubular part 11 and has a pin 20 screw-threaded into the lower end of the tubular part 11. The upper end 21 of the nut 19 forms an upwardly facing annular shoulder in the opening 13 which is adapted to co-operate with a shoulder on the mandrel section B to provide the jarring action upon the release of the means 10. A central longitudinal opening 22 is provided in the nut 19 to slidably pass the mandrel section B.

The mandrel section B is adapted to be connected with the object to be jarred, for example, it is adapted to be connected with a fishing tool engaging the fish or part to be jarred. The mandrel section B is preferably a simple, integral stem or mandrel extending upwardly into the lower end of the tubular section A. The lower end of the section B may be screw-threaded into a socket 23 in a coupling or joint section 24. The connection with the fishing tool being through a usual coupling or joint the threads thereof are pitched the same as the threads of the operating string. The mandrel B is of round cross sectional configuration and slidably and rotatably fits the opening 22 in the lower end of the section A. In accordance with the invention, the mandrel section B extends a considerable distance through the section A to normally have its upper end at or adjacent to the lower end of the pin 15.

An annular enlargement 25 is provided on the mandrel B to slidably fit the opening 13. The enlargement 25 occurs at a point between the shoulders 14 and 21 of the section A, and its lower end forms an annular shoulder 26 that is adapted to be engaged by the shoulder 21 to provide the upward jarring action on the section B and the parts connected therewith. A port 27 is provided in the walls of the tubular part 11 to permit the escape of fluid from the opening 13 upon upward movement of the section A relative to the section B. The sections A and B are normally related or positioned as illustrated in Fig. 1 of the drawing and, upon releasing of the means 10, the section A is pulled or operated upwardly to bring the shoulder 21 into hammering or jarring engagement with the shoulder 26. A central longitudinal fluid passage 28 extends completely through the mandrel section B to pass circulation fluid from the section A into the fishing tool or lower portion of the operating string.

The means 10 includes parts on the body sections A and B that are adapted to cooperate to releasably hold the sections in the contracted position and that operate to release or disengage, upon a heavy tensile strain being put on the sections, to permit relative longitudinal movement between the sections A and B to cause the shoulders 21 and 26 to come into jarring engagement. In the preferred form of the invention illustrated in the drawing, the means 10 includes a collar or ring 30 removably mounted in the opening 13 and seating on the shoulder 14. The ring 30 is proportioned to have its upper end spaced some distance below the end 18 of the pin 15 and fits closely in the opening 13.

The ring 30 is provided with diametrically opposite internal projections or splines 31. The splines 31 are elongated and may extend the entire length of the ring. The inner sides or walls of the splines 31 are concentrically curved about the longitudinal axis of the tool and are adapted to slidably pass the mandrel section B. The portions of the ring 30 between the spaced splines 31 are of the same thickness as the shoulder 14 so that their inner sides are flush with the walls of the opening 13. Means is provided for holding the ring 30 against rotational movement in the section A. Keys 32 are provided on the body section 11 to fit into or co-operate with longitudinal keyways 33 in the ring 30. The keyways 33 are provided in the ring 30 at the spaced splines 31. In the particular form of the invention illustrated in the drawing, the keys 32 are welded in openings or slots in the tubular body part 11. The ring 30 being arranged and mounted as just described is in effect a part of body part 11 or section A of the tool.

Parts or elements are provided on the upper end of the mandrel B to co-operate with parts in body section A, for instance, with the upper ends of the splines 31. The upper end portion of the mandrel B is substantially T-shaped, having diametrically opposite enlargements or splines 35. The splines 35 are proportioned to slidably pass through the ring 30 between the splines 31. The upper end of the mandrel section B and the upper ends of the splines 35 are shaped to have effective sealing and frictional engagement with the end of the pin 15. An upwardly and inwardly inclined conical face 36 is provided on the upper end of the mandrel section B to co-operate with the central portion of the bearing surface 18.

The lower ends of the mandrel splines 35 and the upper ends of the ring splines 31 are adapted to co-operate to cause the upper end of the mandrel to have pressural and frictional engagement with the lower end of the pin 15 upon relative turning between the sections A and B in one direction, so that the splines 35 may be wedged between the upper ends of the splines 31 and the bearing face on the lower end of the pin 15 to yieldingly hold the sections A and B against relative longitudinal movement. The co-operating ends of the splines 31 and 35 are shaped to cause relative rotative or turning movement between the sections A and B upon a tensile strain being

put on the tool to bring the splines 31 in alignment with the spaces between the splines 35 so that the section A may move upwardly relative to the section B and bring the shoulder 21 into jarring engagement with the shoulder 26.

A helicoidal face 37 is provided on the upper end of each spline 31 to co-operate with correspondingly shaped faces 38 on the lower ends of the splines 35. The faces 37 and 38 are pitched or inclined in the same direction and have the same helix pitch or angle. In practice, it has been found desirable to form the faces 37 and 38 at approximately a 20° helix angle. The faces 37 and 38 may be pitched in a right hand direction to cause binding or wedging of the mandrel splines 31 and the pin 15 and binding of the upper end of the mandrel against the pin 15 upon turning of the section A in a forward or clockwise direction relative to the section B. It will be apparent that the helicoidal faces 37 and 38 may be pitched in the opposite or left hand direction if desired without departing from the broad principles of the invention, however, in practice this would make it desirable to employ an operating string having threaded connections opposite to those of the ordinary operating string. In one manner of carrying out the invention the mandrel splines 35 are preferably proportioned so that the head or upper end of the mandrel B is in tight binding, frictional, and sealing engagement with the end of the pin 15, and the faces 38 are in tight co-operative engagement with the faces 37 before the section A has been turned sufficiently to bring the longitudinal edges of the splines 35 into alignment with the longitudinal edges of the splines 31. When the sections A and B have been connected against relative longitudinal movement by turning the section A relative to the section B to wedge the end of the pin 15 against the upper end of the mandrel section B, the sections A and B may be released for limited relative longitudinal movement to provide the jaring action by putting a tensile strain on the tool to cause the helicoidal faces 37 and 38 to co-operate to turn the section A relative to the section B in a counter-clockwise direction to bring the splines 31 between the splines 35 so that the section A may suddenly move upwardly relative to the section B and bring the shoulder 21 into hammering or jarring engagement with the shoulder 26. In accordance with the invention the pitch or inclination of the cooperating faces 37 and 38 is sufficient to cause slippage between the faces to release the tool for operation upon a tensile strain being applied to the tool. It is to be noted that, when the faces 37 and 38 are in co-operation, the fluid passages 17 and 28 are in direct register and that the bearing faces 18 and 36 are in co-operation to form a fluid-tight seal between the sections A and B around the fluid passages.

It is believed that the operation of the jar provided by the present invention will be readily apparent from the foregoing detailed description. When it is desired to set the tool for actuation, the upper section A is brought to a position where the splines 31 are in engagement with the lower ends of the splines 35. The section A may then be turned in a clockwise direction to bring the helicoidal faces 37 and 38 into co-operative engagement to cause the lower end of the pin 15 to be tightly engaged against the upper end of the mandrel B. To actuate the jar release the sections A and B for relative longitudinal movement, an upward or tensile strain is put on the operating string and the jar. The tensile strain on the tool causes the helicoidal faces 37 and 38 to co-operate to turn the section A in a counter-clockwise direction relative to the section B so that the faces are shifted out of engagement and the splines may pass between the splines 35 and allow the section A to move upwardly and bring the shoulder 21 into hammering engagement with the shoulder 26. The tool may be set to trip or actuate under tensile strains of various intensities by putting various torsional strains on the tool tending to hold the cooperating faces 37 and 38 against disengagement. Such torsional strains may cause wedging of the lower end of the pin 15 against the upper end of the mandrel section B with different pressures so that a greater or lesser tensile strain is required to cause the co-operation between the faces 37 and 38 to turn the section A. In practice, the tensile strain required to actuate the jar elongates or stretches the operating string so that the faces 37 suddenly move out of engagement with the faces 38 so that the splines 31 pass upwardly between the splines 35 upon the tensile strain overcoming the frictional co-operation between the mandrel and the pin 15 and the friction between the faces 37 and 38 so that a very heavy or powerful upward jarring action is obtained when the shoulder 21 comes into engagement with the shoulder 26.

When a torsional strain necessary to operate the tool in the desired manner has been determined, the tool may be repeatedly actuated by maintaining such torsional strain on the operating string and raising and lowering the string, i. e., by raising and lowering the upper section A while the tool is under the constant given torsional strain. In this manner, upward blows or jarring shocks may be imparted to the fish, or object in the well, in rapid succession. The splines 31 and 35 come into sliding engagement immediately after the faces 37 and 38 move out of engagement so that the sections A and B are connected against relative rotation during operation and the torsional strain may be maintained on the tool. It will be apparent that severe or heavy jarring blows may be obtained by maintaining a heavy torsional strain on the tool. When the tool is operated in this manner while under a constant torsional strain, the upward or tensile strain for tripping the jar must be sufficient to cause the co-operation between the helix faces 37 and 38 to overcome the friction between the sections A and B and to overcome the torsional strain acting in the opposite direction on the tool. When the sections A and B are in the contracted position, the bearing and sealing faces 18 and 26 provide an effective fluid-tight seal between the sections, eliminating the necessity of packing glands, etc. It will be obvious that through the torsional strain blows of various intensities may be obtained and that the torsional strain may be varied at will to give any desired blow to an object being jarred.

From the foregoing it will be recognized that two forces are set up in the fishing string preceding the jarring operation, and that the inclined faces 37 and 38 are acted upon by these forces so that the tensile stress through its action on the faces 37 and 38 must overcome the resistance to slippage plus the resisting torque stress, and since the angle of slippage is constant, variation in the torque stress set up and maintained in the fishing string will determine the amount of tensile stress necessary to release the

faces 37 and 38, and thereby create a jarring blow of a desired magnitude. This action is possible because the fishing string has characteristics of elasticity, allowing the metal of the string to yield under tensile stress exerted around the longitudinal axis of the tool. In the course of operating the tool the torsional stress is first exerted and then set at a desired magnitude. The tensile strain is then exerted gradually, causing the drill string to be stretched. The inclined faces 37 and 38 then must move relative to each other under the action of the tensile strain not only against the friction between their surfaces resisting slippage, but also against the torsional strain and before release occurs the fishing string must flex torsionally in a direction counter to the torsional stress on it. By maintaining the torsional stress in the tool constant, reciprocation of the drill string from its upper end will cause the inclined faces 37 and 38 to be alternately locked and released, and will have the effect of creating a jarring blow and setting the tool for a subsequent jarring blow, which blow is gained by the sudden release of stretch in the string and is governed in magnitude by the amount of twist or torsional force maintained in the string.

From the above description of the tool provided by the invention it will be apparent that the method of the invention may be carried out in several different manners. One simple manner of carrying out the invention includes, providing an operating string or fishing string having two slackly linked or connected sections A and B with inclined or spiralled faces 37 and 38 adapted to cooperate to hold the sections A and B against relative longitudinal movement, connecting the string to the object caught in the well, putting a torsional strain on the string to bring the faces 37 and 38 into holding cooperation, and then putting a longitudinal strain, preferably a tensile strain, on the strain so that the faces 37 and 38 cooperate to cause relative turning between the sections to disengage the faces and allow the sections A and B to jar together. Another manner of carrying out the method is to maintain a torsional strain on the string while alternately subjecting the string to a tensile strain and allowing it to lower or settle to successively engage and disengage the faces 37 and 38 and provide for the repeated jarring of the object in the well. The tension necessary to release the faces 37 and 38 and the intensity of the resultant jarring action depends upon the amount of torsion on the string.

Having described only a typical preferred form of and manners of carrying out my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the following claims.

Having described my invention, I claim:

1. A jarring tool of the character described including, a tubular section having an internal abutment, a mandrel section extending into the tubular section, a spline on the mandrel section having a helicoidal face, a ring removably mounted in the tubular section, and a spline in the ring having a helicoidal face adapted to cooperate with the first mentioned face to clamp the abutment against the mandrel section to releasably hold the sections against relative longitudinal movement and operable to disengage the abutment from the mandrel section upon a predetermined tensile strain being put on the sections.

2. A jarring tool of the character described including, a tubular section, a mandrel section extending into the tubular section, a spline on the mandrel section having an inclined face, a ring in the tubular section, means for holding the ring against rotation in the tubular section, and a spline on the ring having an inclined face to cooperate with the first mentioned face to releasably hold the sections against relative longitudinal movement, the faces of the splines being inclined at an angle suffiicent to cause slippage between them upon a tensile strain being put on the sections.

3. A jarring tool of the character described including, two sections related for limited relative longitudinal movement, means releasably holding the sections in a contracted position operable to release the sections for relative longitudinal movement upon a tensile strain being put on the sections, said means including an abutment on each of the sections, and parts on the sections having helicoidal faces adapted to co-operate to clamp the abutments into frictional co-operation to releasably hold the sections in a contracted position and operable to cause relative turning between the sections to disengage the abutments upon a tensile strain being put on the sections, and means for arresting relative longitudinal movement between the sections to provide an impact, there being a fluid passage through each section, the said abutments forming a seal between the sections around the passages when in frictional co-operation.

4. A jarring tool of the character described including, two sections related for limited relative longitudinal movement, means releasably holding the sections in a contracted position operable to release the sections for relative longitudinal movement upon a tensile strain being put on the sections, said means including an abutment on each of the sections, and parts on the sections having helicoidal faces adapted to co-operate to clamp the abutments into frictional co-operation to releasably hold the sections in a contracted position and operable to cause relative turning between the sections to disengage the abutments upon a tensile strain being put on the sections, and means for arresting relative longitudinal movement between the sections to provide an impact, there being fluid passages through the sections terminating at said abutments to be in register when the sections are in the contracted position, the said abutments forming a seal between the sections around the passages when in engagement.

5. A well tool of the character described including, two sections connected for limited relative longitudinal movement, one section having one abutment adapted to receive an end of the other section, and parts on the sections having inclined faces adapted to cooperate to clamp the said abutment against the said end to releasably hold the sections against relative longitudinal movement, the said faces being pitched at an angle sufficient to cause slippage between them upon a tensile strain being put on the sections.

6. A jarring tool including a tubular section having an internal abutment and a helicoidal face spaced from the abutment, a mandrel section extending into the tubular section, the sections being connected for limited relative longitudinal movement, and a part on the mandrel section having a helicoidal face adapted to co-

operate with the face on the tubular section to bring the aboutment and the mandrel section into frictional engagement to releasably hold the sections against relative longitudinal movement upon relative turning between the sections in one direction, the faces being pitched at an angle sufficient to cause slippage between them and relative turning between the sections in the other direction to release the abutment from the mandrel section upon a tensile strain being put on the sections.

7. A jarring tool of the character described including, two sections related for limited relative longitudinal movement, means releasably holding the sections in a contracted position operable to release the sections for relative longitudinal movement upon a tensile strain being put on the sections, said means including longitudinal splines on the sections establishing, rotational driving engagement between the sections and having helicoidal faces adapted to cooperate to hold the sections in contracted position, the said faces being pitched at an angle sufficient to cause slippage between them and relative turning between the sections to disengage the splines upon the sections being subjected to a tensile strain, and means for arresting relative longitudinal movement between the sections to provide an impact.

8. A jarring tool of the character described including, two sections related for limited relative longitudinal movement, means releasably holding the sections in a contracted position operable to release the sections for relative longitudinal movement upon a tensile strain being put on the sections, said means including an abutment on each of the sections, and longitudinally disposed projecting parts on the sections having helicoidal end faces adapted to cooperate to clamp the abutments into frictional cooperation to releasably hold the sections in a contracted position, the said faces being pitched at an angle sufficient to cause slippage between them and relative turning between the sections to disengage the abutments and disengage said parts to release the sections for relative longitudinal movement, and means for arresting relative longitudinal movement between the sections to provide an impact.

9. A jarring tool including, two sections related for limited relative longitudinal movement, annular abutments on the sections adapted to come into engagement when the sections are in a contracted position and parts on the sections cooperating to establish a rotary driving connection between the sections and having helicoidal faces adapted to cooperate to move the sections together and force the said abutments into frictional cooperation upon a torsional strain being put on the sections, the said faces being pitched at an angle sufficient to cause slippage between them and to overcome the frictional cooperation between the abutments and the torsional strain and cause relative turning of the sections in a direction opposite to that of the torsional strain and release the sections for relative longitudinal movement upon a tensile strain being put on the sections.

10. A well tool of the character described including, two sections related for limited relative longitudinal movement, means for releasably holding the sections against relative longitudinal movement including, cooperating parts on the sections having engaging shoulders pitched at an angle sufficient to cause slippage between the shoulders to disengage them upon the sections being subjected to a tensile strain, and shoulders on the sections to come into jarring engagement upon the release of said means.

11. In combination, a string of pipe to be operated in a well bore, two sections connected together in the string of pipe for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement including cooperating parts on the sections having inclined faces adapted to engage one another and pitched at an angle sufficient to cause slippage between them to disengage them upon a tensile strain being put on the sections.

12. A jarring tool of the character described including, two elongate sections connected for limited relative longitudinal movement, one a tubular section the other a mandrel section operating in the tubular section, and means for releasably holding the sections against relative longitudinal movement including longitudinally disposed splines on the sections having inclined faces to engage one another, the faces being pitched at an angle sufficient to cause slippage between them upon a tensile strain being applied to the sections, the splines being located on the sections and being of sufficient length to remain in engagement with each other to establish rotary driving engagement between the sections when the faces are disengaged.

13. A rotary jar including, two sections connected for limited relative longitudinal movement, and parts on the sections having faces inclined at approximately 20° to a plane normal to the longitudinal axis of the jar adapted to cooperate to releasably hold the sections against relative longitudinal movement and operable to cause relative turning between the sections to disengage the said parts and release the sections for relative longitudinal movement upon a tensile strain being put on the sections.

14. A jarring tool of the character described including, two sections connected for limited relative longitudinal movement, one a tubular section and the other a mandrel section operating in the tubular section, means for releasably holding the sections against relative longitudinal movement including parts on the sections having engageable inclined faces inclined at an angle sufficient to cause slippage between them upon a tensile strain being put on the sections, and shoulders on the sections within the tubular section to come into jarring engagement upon the release of said means, the tubular section having an opening through its wall to allow escape of fluid from within the tubular section between the shoulders.

15. A rotary jar including, two sections connected for limited relative longitudinal movement, parts on the sections having inclined faces adapted to cooperate upon turning of one section relative to the other in one direction, and abutments on the sections engageable upon such cooperation of the inclined faces to hold the faces in engagement, the said faces being pitched at an angle sufficient to cause slippage between them and between the abutments upon a tensile strain being put on the sections.

16. A jarring tool of the character described for use in a well string, including: a pair of cooperating parts in longitudinal sliding engagement so as to move between collapsed and extended positions, there being means for securing said parts between adjacent portions of said well string; cooperating stop means on said parts en-

gaging when said parts are in relatively extended position and limiting the outward movement thereof; and movement delay means operative between said parts to releasably hold said parts in relatively collapsed position, said movement delay means comprising interengaging elements on said cooperating parts so formed as to be releasable by tension forces applied to said coopon said cooperating parts so formed as to be rerating parts and being so formed and connected to said cooperating parts that they will resist release in proportion to the torsion stress transmitted through one of said cooperating parts to the other.

17. A jarring tool of the character described, for use in a well string, including: a pair of cooperating parts in longitudinal sliding engagement so as to move between collapsed and extended positions, there being means for transmitting torsion through one of said cooperating parts to the other and means for securing said parts between adjacent portions of said well string; cooperating stop means on said parts engaging when said parts are in extended position to limit the outward movement thereof; and movement delay means operative between said parts to releasably hold said parts in relatively collapsed position, said movement delay means being so formed as to be automatically releasable in response to tension exerted on said jarring tool by said well string, and having parts operative in response to torsion applied through said well string for varying the resistance of said movement delay means to release by said tension.

18. A jarring tool of the character described for use in a well string, including: a pair of cooperating parts in longitudinal sliding engagement so as to move between collapsed and extended positions, there being means for securing said parts between adjacent portions of said well string; cooperating stop means on said parts engaging when said parts are in relatively extended position and limiting the outward movement thereof; and cooperating shoulders formed on said parts so as to meet on a helical plane of engagement when said parts are in relatively collapsed position and resist relative outward movement of said parts, said plane of engagement being so sloped relative to the longitudinal axis of said tool that the component of rotary thrust of said shoulders in response to longitudinally applied force will be greater than the resisting forces of friction effective between said shoulders.

19. A jarring tool of the character described for use in a well string, including: a pair of cooperating parts in longitudinal sliding engagement so as to move between collapsed and extended positions, there being means for securing said parts between adjacent portions of said well string; cooperating stop means on said parts engaging when said parts are in relatively extended position and limiting the outward movement thereof; and cooperating shoulders formed on said parts in positions to be engaged by relative rotation of said parts when said parts are in relatively collapsed position to resist relative outward movement of said parts when in engagement, said shoulders having the co-engaging faces thereof inclined at such angle relative to the longitudinal axis of the tool as to cause reverse relative rotation of said parts and consequent disengagement of said shoulders in response to tension being applied to said jarring tool through said well string.

20. An automatic jar of the character described, comprising: two jarring members telescopically mounted for limited relative longitudinal movement; means on said members engageable upon a torsional stress being put upon said members for relaying the relative longitudinal movement of said members, said means being slopingly arranged to automatically release and permit longitudinal movement between said members upon a tensile strain being put upon said members of sufficient magnitude to overcome the torsional stress being applied thereto; and means for arresting longitudinal movement between said members to effect a jarring action.

21. An automatic jar of the character described, comprising: two members telescopically mounted for limited relative longitudinal movement; means for delaying the relative longitudinal movement between said members including cooperating surfaces on said members engageable upon a torsional stress being put upon said members to hold the same in their collapsed position, said surfaces being slopingly arranged to disengage and permit longitudinal movement upon a tensile strain being put upon said members of sufficient magnitude to overcome the torsional stress being applied thereto; and means for arresting the longitudinal movement between said members to effect the jarring action.

22. An automatic jar of the character described, comprising: two cylindrical members telescopically mounted for limited relative longitudinal movement; means for delaying such movement between the members including an inclined surface on each of said members engageable upon the application of a torsional stress therebetween to hold said members in collapsed position, said surfaces having such inclination that they automatically disengage and permit longitudinal movement between the said members when one of said members is subject to a tensional force of sufficient magnitude to overcome the torsional force applied between the said members; and means for arresting the longitudinal movement between the said members to effect a jarring action.

23. An automatic jar of the character described, comprising: two elements telescopically mounted for limited relative longitudinal movement; means for delaying the longitudinal movement between said elements including a member on one of said elements projecting into a recess on the other element, said member and said recess having cooperating surfaces engageable on application of a torsional force to one of said elements for frictionally holding said elements in retracted position and disengageable on application of a tensile strain between said elements of sufficient magnitude to overcome the friction between said surfaces; and means for arresting the relative longitudinal movement of said elements to effect a jarring action.

24. An automatic jar of the character described, comprising: two elements telescopically mounted for limited relative longitudinal movement; a member on one of said elements projecting into a recess in the other element, said recess having a widened portion for receiving said member on relative rotative movement of said elements for holding the elements in retracted position, said member being arranged to automatically slide out of the widened portion of

said recess and release said elements on application of a tensile strain to one of the elements; and means for arresting the relative longitudinal movement of said elements to effect a jarring action.

25. An automatic jar of the character described, comprising: jarring elements telescopically mounted for limited relative longitudinal movement; means for delaying the longitudinal movement between said elements including a multi-width female spline on one of said elements and a male spline on the other element, said splines having cooperating inclined surfaces engageable upon application of a torsional force to one of said elements and automatically disengageable upon application of a tensile strain to said element of sufficient magnitude to overcome the torsional force being applied thereto; and means for arresting the relative longitudinal movement of said elements to effect a jarring action.

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