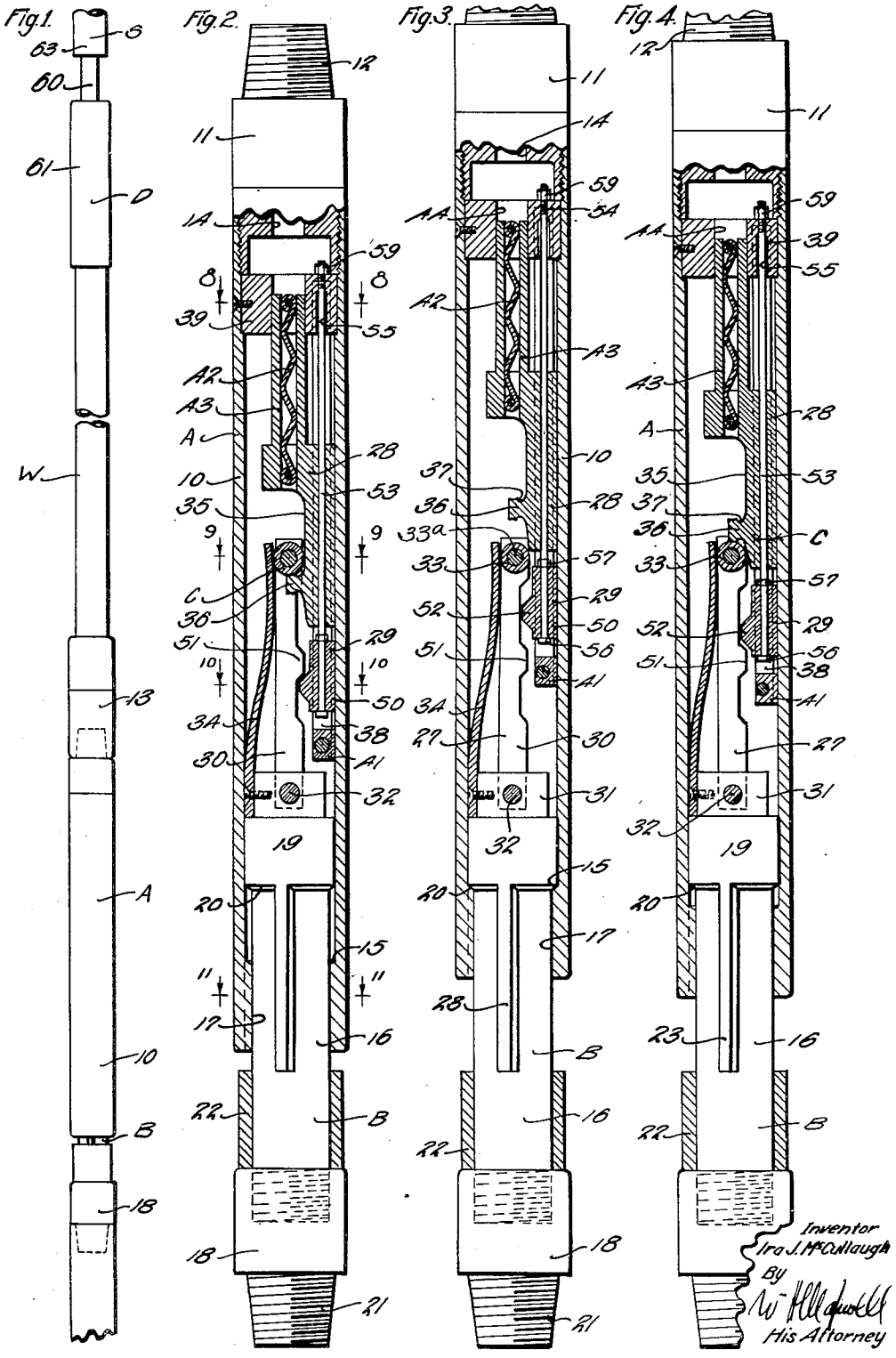
March 8, 1932. I. J. McCULLOUGH 1,848,535

JARRING TOOL

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JARRING TOOL

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Fig. 5.

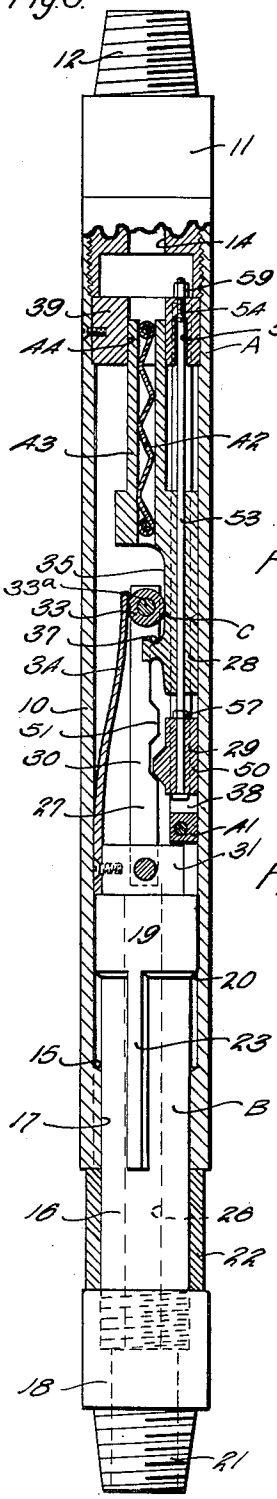


Fig. 6.

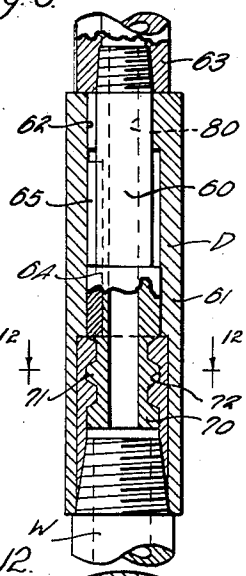


Fig. 12.

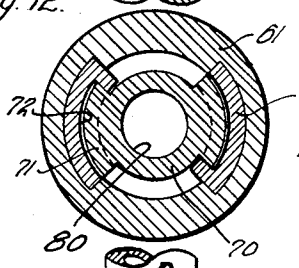


Fig. 7.

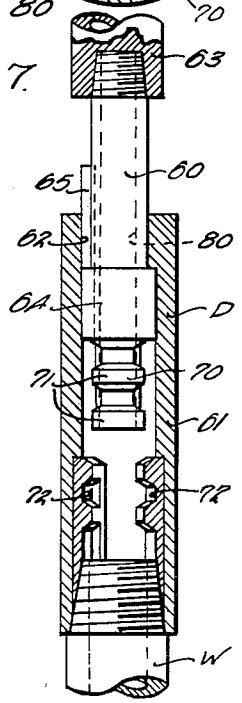


Fig. 8.

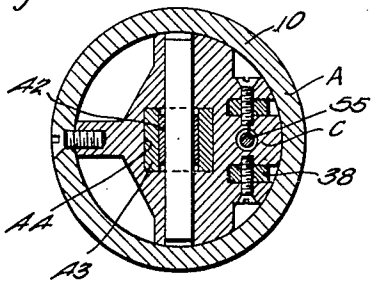


Fig. 9.

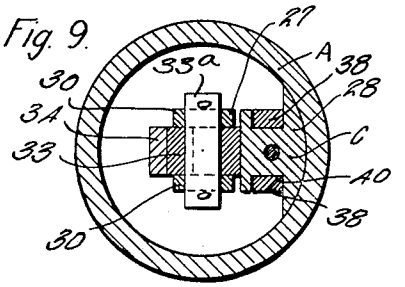


Fig. 10.

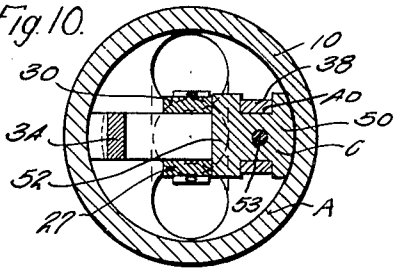
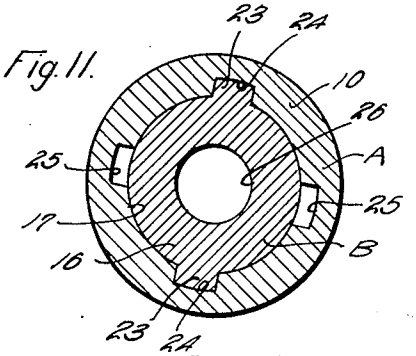


Fig. 11.



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UNITED STATES PATENT OFFICE

IRA J. McCULLOUGH, OF HUNTINGTON PARK, CALIFORNIA

JARRING TOOL

Application filed May 7, 1930. Serial No. 450,392.

This invention relates to a device for use in well drilling operations and relates more particularly to a tool for effecting a jarring action within a well. It is a general object of the invention to provide a simple, practical, and effective jarring tool for use in a well.

During the course of well drilling operations it is sometimes necessary to effect a jarring action within the well. For example, during drilling the bit sometimes becomes stuck making it desirable to jar the drilling string to free the bit and during fishing operations it is often necessary to jar the fish or lost object before it can be withdrawn from the well. When an object is stuck in a well it is usually packed or embedded in the formation so that it cannot be moved or shifted without first being jarred to free it from the formation or material in which it is packed. Various types of jarring tools have been proposed and used. The common types of jarring tools are only operable to produce an upward jarring action and are operated either by rotation of the operating string to disengage cooperating shoulders while an upward strain is maintained, or are operable by varying the pressure on the circulation fluid.

It is an object of the present invention to provide a jarring tool for use in a well that is operable to provide or effect both an upward jarring action and a downward jarring action.

It is another object of the invention to provide a jarring tool that is operable to effect an upward jarring action upon a predetermined upward strain or pressure being applied to the tool and is operable to produce a downward jarring action upon a predetermined downward pressure being exerted on the tool.

Another object of the invention is to provide a jarring tool that is operable without rotating the operating string and without varying the pressure on the circulating fluid. The tool provided by this invention is fully operable by simple reciprocation or longitudinal movement of the operating string.

It is another object of the invention to provide a jarring tool that embodies two sections related for limited relative longitudinal movement and a single latch or control means operable to releasably hold the sections against relative movement and operable to release the sections for relative movement upon either an upward or a downward pressure of a predetermined degree being applied to the tool.

It is another object of the invention to provide a jarring tool of the character mentioned in which the control means for releasably holding the sections against relative movement is such that when it is tripped or operated to release the sections for relative movement in one direction it is automatically set or positioned to releasably hold the sections against relative movement in the opposite direction so that the tool is capable of effecting alternate upward and downward jarring actions.

It is a further object of the invention to provide a means in combination with the relatively movable sections and the control means whereby a weight in the form of a portion of the operating string is connected to one of the sections and is slackly connected with the remainder of the operating string to provide the weight or force for imparting the jarring blow when the control means is released.

A further object of the invention is to provide a jarring tool of the character mentioned that may be controlled when within a well to be operable to effect only an upward jarring action.

It is another object of the invention to provide a jarring tool of the character mentioned that is adjustable so as to be operable upon any desired pressure being put on the tool.

It is a further object of the invention to provide a tool of the character mentioned that is simple in construction and is dependable and effective in operation.

Other objects and features of my 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 drawings, in which:

Fig. 1 is a side elevation of the tool illustrating the parts in position to be operated for effecting an upward jarring action. Fig. 2 is an enlarged longitudinal detailed sectional view of the principal parts of the tool illustrating the parts in position to be operated for effecting an upward jarring action. Fig. 3 is a view similar to Fig. 2 illustrating the tool in the position where it has been operated to cause an upward jarring action. Fig. 4 is a view similar to Fig. 2 illustrating the tool in the set position for operation to provide a downward jarring action. Fig. 5 is a view similar to Fig. 2 illustrating the tool after it has been tripped from the position illustrated in Fig. 4 where it operates to provide a downward jarring action. Fig. 6 is an enlarged vertical detailed sectional view of the means for connecting the portions of the operating string for relative movement illustrating it in the contracted position. Fig. 7 is a view similar to Fig. 6 illustrating the connecting means in the extended position. Figs. 8, 9, 10 and 11 are enlarged transverse detailed sectional views taken as indicated by lines 8—8, 9—9, 10—10, and 11—11, respectively, on Fig. 2, and Fig. 12 is an enlarged transverse detailed sectional view taken as indicated by line 12—12 on Fig. 6.

The jarring tool provided by this invention includes, generally, two sections A and B related for limited relative longitudinal movement, one section being adapted for connection with the object to be jarred, the other section for connection with an operating string, control means C for releasably holding the sections A and B against relative longitudinal movement, and means D for connecting a weight W in the form of the lower portion of the operating string with the remainder of the operating string for limited relative longitudinal movement.

The sections A and B constitute an assembly adapted to be connected between the object to be jarred and the weight or lower portion W of the operating string S. The sections A and B are slackly connected or related for relative longitudinal movement and are provided with parts in the form of shoulders which limit their relative longitudinal movement and which cooperate to provide the jarring actions. The sections A and B are preferably telescoped or arranged one within the other. The section A is a tubular member, and the section B is in the form of a mandrel or stem and extends into the section A. The tool as illustrated in the drawings is positioned so that the section A is the uppermost section and is adapted to be connected with the weight W or the operating string, and the section B extends into the lower end of the section A and is adapted to be connected with the object to be jarred. It is to be understood that the tool may be disposed and operated with the section B uppermost in which position the section B is adapted to be connected with the operating string, while the section A is at the lower end of the section B and is adapted to be connected with the object to be jarred. In view of the above, where the terms "upper" and "lower" are used in the following description they are not to be taken as limiting or restricting the invention to the particular disposition of the tool illustrated in the drawings or to the relative locations of parts that might be inferred or construed from the use of such terms.

The section A is an elongated tubular structure adapted to receive or carry the section B. The section A includes a main tubular part 10, and a head 11. With the tool positioned as illustrated in the drawings the head 11 is mounted at the upper end of the tubular portion 10 and is provided to facilitate connection with the operating string or the weight W. The head 11 is in the form of a sub and is screw-threaded into the upper end of the tubular part 10. The head 11 is provided with an upwardly projecting screw-threaded pin 12. The pin 12 may be screw-threaded into the box section of a tool joint 13 at the lower end of the operating string portion W. The head 11 is provided with a central longitudinal fluid passage 14 communicating with the interior of the tubular part 10. The main tubular part 10 of the section A is comparatively long and is provided at its lower end with a portion of reduced internal diameter providing an upwardly-facing internal shoulder 15.

The section B of the tool is in the nature of a mandrel or stem and extends into the open or lower end of the section A. With the tool positioned as illustrated in the drawings, the section B is adapted to be connected with the object to be jarred. For example, the section B may be connected with a fishing tool engaging the fish or object to be jarred or to a drilling bit or the like. The section B includes a stem 16 slidable in the opening 17 of the reduced end of the section A, and a connecting member 18 on the projecting or lower end of the stem. The stem 16 projects inwardly into the interior of the tubular part 10 of the section A and an enlargement or head 19 is provided on the inner end of the stem. The enlargement 19 provides a downwardly-facing annular shoulder 20 and it is slidable in the tubular part 10. The sections A and B are related so that the shoulders 15 and 20 are spaced apart when the tool is in position to be operated to effect an upward jarring action. The connecting member 18 may be screw-threaded onto the lower end of the stem 16 and is provided with a downwardly projecting screw-threaded pin 21 to facilitate connection with an operating string or a fishing tool. A collar or sleeve 22 may

be arranged on the stem 16 between the upper end of the connecting member 18 and the lower end of the section A. The shoulders 15 and 20 are adapted to cooperate in providing a jarring action between the sections A and B in one direction while the lower end of the tubular part 10 is adapted to cooperate with upper end of the sleeve 22 to provide a jarring action between the sections A and B in the other direction.

In accordance with the preferred form of the invention means is provided for holding the sections A and B against relative rotation. In the particular form of the invention illustrated keys or splines 23 are provided on the stem 16 to slidably operate in longitudinal grooves or keyways 24 in the wall of the opening 17. Longitudinal grooves 25 may be provided in the walls of the opening 17 to permit the escape of fluid trapped between the shoulders 15 and 20. A central longitudinal fluid passage 26 is provided in the section B. The passage 26 extends longitudinally through the section B from one end to the other, its upper end communicating with the interior of the tubular part and its lower end discharging at the lower end of the pin 21.

The control means C is provided to releasably hold the sections A and B against relative longitudinal movement in a position where the shoulders 15 and 20 are spaced apart and to release the sections under a predetermined tensile strain allowing the shoulders 15 and 20 to come together causing a jar, the control means C being also operable to releasably hold the sections A and B against relative longitudinal movement in a position where the end of the tubular part 10 is spaced from the end of the sleeve 22 and to release the sections from this position under a predetermined compression strain allowing the sleeve 22 and the lower end of the part 10 to come together causing a jar. In the particular case illustrated the control means C is operable to releasably hold the sections A and B against relative longitudinal movement in a position where the shoulders 15 and 20 are spaced apart and is operable to release the sections for relative movement upon a predetermined upward or tensile strain being put on the tool to cause the shoulders 15 and 20 to be brought into jarring engagement to cause an upward jarring action from the section A to the section B and is operable to releasably hold the sections A and B against relative longitudinal movement in a position, such as illustrated in Fig. 4 of the drawings, where the end of the tubular part 10 is spaced from the end of the sleeve 22 and is operable to release the sections for relative longitudinal movement upon a predetermind downward or compression strain being put on the tool to cause the lower end of the section A to be brought into engagement with the sleeve 22. The control means C is such that when it is released allowing operation of the sections A and B in one direction, it is automatically set or positioned to hold the sections A and B against relative longitudinal movement in the opposite direction so that the tool is operable to alternately effect upward and downward jarring.

The control means C includes, generally, a latch 27 carried by one section of the tool adapted to engage a block 28 connected with the other section, and means 29 for causing the release of the latch 27 from the block 28 upon predetermined strains being put on the tool. The latch means C is preferably located within the tubular part 10 between the upper end of the section B and the head 11 of the section A. In the embodiment of the invention illustrated in the drawings, the latch 27 is carried by the section B to cooperate with the block 28 carried by the section A. The latch 27 is in the nature of a pivoted latch and is preferably mounted on the head or inner end of the section B. The latch 27 includes two spaced parallel links 30 pivotally mounted on the upper end of the head 19 to project upwardly in the interior of the tubular part 10. A lug 31 may be provided on the upper end of the head 19 and the links 30 may have their lower ends pivotally supported at opposite sides of the lug 31 on a pivot pin 32. A roller 33 is rotatably mounted between the upper ends of the links 30 to cooperate with the block 28. The roller 33 is rotatably carried on a pin 33^a extending between the links 30 adjacent their upper ends.

The invention provides means for normally urging the roller 33 toward the block 28. A leaf spring 34 may be attached to the lug 31 and may engage the roller 33 to urge it toward the block 28.

The block 28 is mounted on the section A so as to be shiftable upon a pressure being put on the tool when the block is in cooperative engagement with the latch 27. The block 28 is mounted to shift longitudinally of the section A and is slidably arranged against the interior of the tubular part 10. The block 28 presents a substantially axial inner side 35. An inwardly extending projection 36 is provided on the inner side 35 of the block 28 to cooperate with the roller 33 of the latch. The projection 36 provides an upper side or upwardly-facing shoulder for cooperation with the roller 33 when the sections A and B are in the contracted position prior to being released for effecting the upward jarring action and a downwardly-facing lower side or shoulder for cooperation with the roller 33 when the sections A and B are in the extended position prior to being released for providing the downward jarring action. The upper and lower sides of the projection 36 are pref-

erably parallel and substantially horizontal. The projection 36 is comparatively short and terminates at a point in substantially longitudinal alignment with the axis of rotation of the roller 33. Recesses or grooves 37 are provided in the upper and lower sides of the sections 36 adjacent the side 35 of the block to prevent deposits of solid matter from accumulating on the roller-receiving faces of the projection.

The block 28 is guided for longitudinal movement in the tubular part 10 by spaced parallel guides 38. The guides 38 are carried by a mounting ring 39 arranged in the upper end of the tubular part 10 and project longitudinally downward from the ring. Guideways 40 are provided in the opposite sides of the block 28 for slidably passing the guides 38. The guides 38 project downwardly below the lower end of the block 28 and the lower ends of the guides may be spaced by a spacer block 41.

The invention provides means for yieldingly resisting shifting of the block 28 when a pressure on the tool is transmitted through the latch 27 and block 28. The means for yieldingly resisting shifting of the block 28 is such that the block is permitted to shift a definite amount upon a predetermined pressure being put on the tool. The means for yieldingly resisting movement of the block 28 relative to the section A is in the nature of a spring means and is operable to resist shifting of the block 28 both upwardly and downwardly relative to the section A. An elongated leaf spring 42 connects the block 28 with the section A to yieldingly resist shifting of the block relative to the section. The spring 42 may connect the block 28 with the mounting ring 39. The spring 42 is arranged vertically or longitudinally in the tool and has its lower end secured to the block 28 and its upper end attached to the mounting ring 39. The spring 42 is transversely bent or offset, for instance it may be corrugated or crimped so that it is capable of being compressed and elongated without danger of failing. The spring 42 is preferably comparatively heavy and formed so that it is capable of resisting heavy strains before yielding sufficiently to cause disengagement of the roller 33 from the projection 36. In the preferred form of the invention the block 28 is provided with spaced upwardly projecting extensions 43 for guiding the spring 42. The extensions 43 are disposed at opposite sides of the spring 42 and project upwardly into an opening 44 in the ring 39. The extensions 43 are slidable in the opening 44. The extensions 43 hold the spring 42 against excessive flexing or buckling.

When the roller 33 is in engagement with the upper side of the projection 36, as shown in Fig. 2 of the drawings, and a tensile strain is put on the sections A and B, the strain is directly communicated between the sections through the latch 27 and the block 28. The spring 42 connects the block 28 with the section A and is elongated upon a tensile strain being transmitted through the control means C. Upon a predetermined tensile strain being applied to the tool the spring 42 yields a given amount to allow relative shifting of the sections A and B. It will be obvious that when the roller 33 is in engagement with the lower side of the projection 36 and a compression strain is put on the sections that the spring 42 is put under a compression strain.

The means 29 is provided to cause disengagement of the roller 33 from the projection 36 upon the spring 42 yielding to permit a given relative longitudinal movement between the sections A and B. The means 29 is in the nature of a cam means and includes a cam block 50 connected with the section A and cams 51 on the links 30. The cam block 50 is located below the block 28 between the guides 38. The cam block 50 is provided with an inwardly projecting cam 52 having beveled upper and lower sides to cooperate with the beveled sides of the cams 51. The cams 51 and 52 are related so that when the sections A and B shift longitudinally relative to one another a given amount from the contracted portion in a direction tending to bring the shoulders 15 and 20 together the latch 27 is shifted transversely or laterally so that the roller 33 is disengaged from the projection 36 and are related so that when the sections A and B are permitted to shift a given distance from the extended position in a direction to bring the lower end of the tubular part 10 toward the collar 22 they cause the latch 27 to be shifted so that the roller 33 is disengaged from the lower side of the projection 36.

In the preferred form of the invention the cam block 50 is mounted on the section A so that it may be adjusted longitudinally of the section to provide a means for adjusting the control means C to be releasable upon any desired pressure being applied to the tool. The cam block 50 may be connected with the section A by an adjusting rod 53. The rod 53 has its upper end screw-threaded through an opening 54 in the mounting ring 39 and projects downwardly from the ring 39 through an opening 55 in the block 28. The opening 55 slidably passes the rod 53. The lower end of the rod 53 extends through an opening in the cam block 50 and a head 56 is provided on the lower end of the rod 53 to engage the lower side of the cam block. A nut 57, may be threaded on the rod 53 to engage the upper side of the cam block. By threading the rod 53 through the opening 54 the cam block 50 may be adjusted longitudinally of the tool. A nut 59 may be threaded on the upper end of the rod 53 to set the rod in position.

The weight W used in connection with the tool for providing the weight or force for effecting the jarring action is preferably a portion of the operating string carrying the tool. The weight W or portion of the operating string may be as long and as heavy as desired. The portion W of the operating string is connected with the remaining upper portion of the string for limited relative longitudinal movement by the means D. The portion W of the operating string is connected between the section A and the upper or remaining portions of the operating string. The portion W of the operating string may be connected with the section A by the tool joint 13.

The means D connects the portion W of the string with the main upper portion S of the operating string so that it is shiftable a limited extent longitudinally relative to the string S. The means D may be varied considerably in construction. In the particular case illustrated the means D includes a stem 60 projecting downwardly from the lower end of the operating string S into a tubular member 61 on the upper end of the weight portion W. The stem 60 is slidable through the opening 62 of a reduced portion at the upper end of the tubular member 61. The stem 60 is provided with a fluid passage 80 and may be connected with the operating string S by a suitable sub 63. The stem 60 may be provided with an enlargement 64 at its inner or lower end to slidably operate within the tubular member 61. The stem 60 and tubular member 61 are connected against relative rotation. Splines 65 are provided on the stem to slidably operate in keyways in the opening 62 of the member 61. The relative movement between the stem 60 and the member 61 is limited in one direction by the sub 63 engaging the upper end of the member 61 and is limited in the opposite direction by the upper end of the enlargement 64 engaging the reduced upper portion of the member 61. In accordance with the invention the stroke or extent of relative movement between the stem 60 and the tubular member 61 is greater than the relative longitudinal movement between the sections A and B.

When the sections A and B are in the contracted position and an upward strain is put on the operating string S to release the control means C, the stem 60 is in the up position illustrated in Figs. 1 and 7 of the drawings, and, upon release of the control means C, the section A and the weight W are free to be operated upwardly relative to the stem 60 and the operating string S. When the sections A and B are in the extended position shown in Fig. 4 of the drawings the sub 63 is spaced a short distance above the upper end of the tubular member 61. The weight of the portion W of the string compresses the spring 42 to some extent and the control means C may be released by allowing the operating string S to settle in the well sufficiently to bring the lower end of the sub 63 into engagement with the tubular member 61 so that a portion of the weight of the operating string may be put upon the tool. When the control means C is released to provide the downward jarring action, the lower portion W of the operating string is free to drop downwardly relative to the remaining portion S of the string to provide the weight for effecting the downward jarring action.

The invention provides means whereby the connecting means D may be set so that the section W of the string is held against longitudinal movement relative to the remaining upper portion S of the string. By connecting the portions W and S of the operating string against relative longitudinal movement, the tool may be made operable to provide only an upward jarring action. A downward projecting extension 70 is provided on the lower end of the enlargement 64 of the stem 60. The enlargement 70 carries spaced circumferential splines or lugs 71. The splines 71 are adapted to fit into recesses 72 in the inner walls of the tubular member 61 when the stem 60 is in the down position illustrated in Fig. 6 of the drawings. The lug 71 may be shifted into the recesses 72 by partial rotation of the stem 60 relative to the tubular member 61. The splines 71 terminate at points spaced some distance below the sub 63 so that when the stem 60 is in the down position they are free of the keyways in the opening 62 and the stem may be rotated relative to the tubular member 71. The lugs 71 fit the recesses 72 so that the stem 60 and member 61 are held against relative longitudinal movement.

In employing the tool it may be connected with an operating string S as illustrated in Fig. 1 of the drawings and a fishing tool for engaging a fish or object to be jarred may be connected with the lower end of the section B. Assuming that the fishing tool connected with the section B is in engagement with an object immovably held or stuck in the well and the parts are in the position shown in Figs. 1 and 2 of the drawings, an upward strain is put on the tool through the operating string S. The upward strain on the operating string stretches or lengthens the spring and is transmitted through the latch 27 and block 28 so that the spring 42 is put under tension. Upon a predetermined upward strain being applied to the tool, the spring 42 yields a given amount so that the section A shifts upwardly relative to the section B, bringing the cam 52 into engagement with the lower sides of the cams 51 to shift the latch 27 outwardly disengaging the roller 33 from the projection 36. Upon release of the roller 33 from the projection

36, the section A is operated upwardly with considerable force to bring the shoulder 15 into jarring engagement with the shoulder 20 to provide an upward jarring action on the section B and the object connected therewith. In practice the operating string is stretched considerably when the tensile strain is put on the tool and upon release of the control means C suddenly returns to its normal length to cause the section A and the lower portion W of the operating string to be operated upwardly, rapidly and with great force so that a substantial jarring action is provided when the shoulder 15 engages the shoulder 20. The portion W of the operating string being free of the remainder of the string, acts as a weight which is suddenly thrown upward to provide a heavy force when the shoulders 15 and 20 are brought into engagement. Upon disengagement of the roller 33 from the upper side of the projection 36 it passes over the projection and seats against the inner side 35 of the block below the projection 36 as illustrated in Fig. 3 of the drawings.

When it is desired to provide the downward jarring action, the lower portion W of the operating string is permitted to move downwardly so that the projection 36 of the block engages the upper side of the roller 33. The combined weights of the lower portion W of the operating string and the section A are not sufficient to compress the spring 42 the required amount to cause disengagement of the latch and the operating string S may be permitted to settle in the well so that the lower end of the sub 63 engages the upper end of the tubular member 61. When a predetermined downward pressure is applied to the sections A and B by the weight of the string portion W and the portion of the weight of the operating strip S, the spring 42 yields a given amount so that the lower side of the cam 42 engages the upper sides of the cams 51 to shift the latch 27 outwardly to cause disengagement of the roller 33 from the projection 36. When the control means C is released upon the predetermined downward pressure being exerted on the tool, the weight W and the section A are permitted to suddenly drop downwardly so that the lower end of the section A strikes the upper end of the sleeve 22 to impart a downward jarring action to the object connected with the section B. After the tool has been actuated to provide the downward jarring action, it is automatically set in a position to be operated for providing an upward jarring action. If it is desired to operate the tool to effect an upward jarring action only, the operating string S is partially rotated to shift the lugs 41 into the recesses 42 so that the portions W and S of the operating string are held against relative longitudinal movement. When the parts are in this position the tool may be operated to impart an upward jarring action in the manner described above and may be reset for further upward jarring by lowering the string after actuation of the tool to cause the projection 36 to be positioned below the roller 33.

The spring 42 is such that it effectively resists the strains to which it is subjected and so that it automatically returns to its normal size and configuration after actuation of the tool so that the tool may be operated as many times as desired without being withdrawn from a well. It will be obvious how the control means C may be adjusted by adjusting the cam 50 longitudinally of the tool to cause disengagement of the roller 33 from the projection 36 upon any desired strain being put on the tool. The tool provides a free passage for the circulation of fluid so that the pressure of the fluid is not varied during operation of the tool.

Having described only a typical preferred form of 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 scope of the following claims:

Having described my invention, I claim:

1. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another, a weight connected to one section, and means for connecting the weight with an operating string for longitudinal movement relative thereto.

2. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another, a portion of an operating string connected to one section, and means for connecting said portion with the remainder of the operating string for longitudinal movement relative thereto.

3. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another, there being a fluid passage through the sections, a portion of an operating string of drill pipe connected

with one section, and a connection between the said portion and the remainder of the string whereby the said portion is longitudinally movable relative to the remainder of the operating string.

4. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another in either direction, a weight connected to one section, and means for connecting the weight with an operating string for longitudinal movement relative to the string.

5. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another in either direction, a length of tubing connected to one section, and means for connecting the said tubing with an operating string for limited longitudinal movement relative to the operating string, the extent of relative longitudinal movement between the tubing and the operating string being greater than the extent of relative longitudinal movement between the sections.

6. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement from said position upon a predetermined tensile strain being put on the sections, and operable to release the sections for relative longitudinal movement from another position upon a predetermined compression strain being exerted on the sections.

7. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections.

8. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one direction and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including two cooperating parts, one a latch carried by one section, the other a block carried by the other section.

9. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, a latch carried by the other section, and means yieldingly resisting shifting of the block.

10. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the section for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including, a part carried by one section for movement relative to the section in one direction, and a part carried by the other section to cooperate with the first mentioned part and mounted for movement in a direction substantially opposite to the direction of movement of the first mentioned part.

11. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for

relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including, a part carried by one section for movement relative to the section in one direction, a part carried by the other section to cooperate with the first mentioned part and mounted for movement in a direction substantially opposite to the direction of movement of the first mentioned part, means for yieldingly resisting movement of the first mentioned part, and means for causing disengagement of the parts upon a predetermined shifting of the first mentioned part.

12. A well tool including two sections related for limited relative longitudinal movement, a block mounted on one section to shift longitudinally relative to the section, a projection on the block, a latch mounted on the other section for movement transversely of the section and adapted to cooperate with either of two opposite sides of the projection when the sections are in either of two relative positions, means for yieldingly holding the block against shifting operable to yieldingly resist relative longitudinal movement of the sections in either direction when the latch is in engagement with the projection, and means for shifting the latch transversely out of engagement with the projection upon a predetermined strain being put on the sections tending to move them relative to one another.

13. A well tool including two sections related for limited relative longitudinal movement, a block mounted on one section to shift longitudinally relative to the section, a projection on the block, a latch mounted on the other section for movement transversely of the section and adapted to cooperate with either of two opposite sides of the projection when the sections are in either of two relative positions, means for yieldingly holding the block against longitudinal shifting operable to yieldingly resist relative longitudinal movement of the section in either direction when the latch is in engagement with the projection, and cam means for shifting the latch transversely out of engagement with the projection upon a predetermined strain being put on the sections tending to move them relative to one another.

14. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, a latch carried by the other section to cooperate with the block, means yieldingly resisting shifting of the block, and means for disengaging the block and latch upon the block shifting a predetermined amount.

15. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, a latch carried by the other section to cooperate with the block, spring means yieldingly resisting shifting of the block, and means for disengaging the block and latch upon the block shifting a predetermined amount, last mentioned means including a cam connected with the section carrying the block and operable to engage the latch.

16. A well tool including, two sections relative for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the section, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, a latch carried by the other section to cooperate with the block, spring means yieldingly resisting shifting of the block, and means for disengaging the block and latch upon the block shifting a predetermined amount, the last mentioned means including, a cam on the latch, a cam connected with the section carrying the block, and means for adjusting the cam relative to the section

17. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the

sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, a latch carried by the other section to cooperate with the block, spring means yieldingly resisting shifting of the block, and means for disengaging the block and latch upon the block shifting a predetermined amount, said spring means including a spring connected to the block and connected to the first mentioned section.

18. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another, a weight connected to one section, and means for connecting the weight with an operating string for longitudinal movement, relative to the string, said last mentioned means being operable to hold the weight against movement relative to the operating string.

19. A well tool of the character described including, two sections connected for limited relative longitudinal movement, control means releasably holding the sections against relative longitudinal movement operable to release the sections for relative longitudinal movement upon a predetermined strain being put on the sections tending to move them relative to one another, a weight connected to one section, and means for connecting the weight with an operating string for longitudinal movement relative to the string, said last mentioned means being operable by rotation to hold the weight against longitudinal movement relative to the operating string.

20. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one direction and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including two cooperating parts, one carried by each section, one of said parts being movable relative to the section by which it is carried.

21. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one direction and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including two cooperating parts, one carried by each section, one of said parts being pivotally connected to the section by which it is carried.

22. A well tool including, two sections related for limited relative longitudinal movement, and means for releasably holding the sections against relative longitudinal movement operable to releasably hold the sections against relative longitudinal movement in one position and to release the sections for relative longitudinal movement in one direction from said position upon a predetermined tensile strain being exerted on the sections, and operable to release the sections for relative longitudinal movement in the opposite direction from another relative position upon a predetermined compression strain being exerted on the sections, said means including a block shiftably carried by one section, and a member carried by the other section cooperating with the block.

23. A well tool including two sections related for limited relative longitudinal movement, a block mounted on one section to shift longitudinally relative thereto, a projection on the block, a latch mounted on the other section for movement transversely of the section and adapted to cooperate with either of two opposite sides of the projection when the sections are in either of two relative positions, means for yieldingly holding the block against shifting operable to yieldingly resist relative longitudinal movement of the sections in either direction when the latch is in engagement with the projection, and means for positively shifting the latch transversely out of engagement with the projection upon a predetermined strain being put on the sections tending to move them relative to one another.

24. A well tool including two sections related for limited relative longitudinal movement, a block mounted on one section to shift relative thereto, a projection on the block, a latch mounted on the other section for movement transversely of the section and adapted

to cooperate with either of two opposite sides of the projection when the sections are in either of two relative positions, means for yieldingly holding the block against shifting operable to yieldingly resist relative longitudinal movement of the sections in either direction when the latch is in engagement with the projection, and means for shifting the latch transversely out of engagement with the projection upon a predetermined strain being put on the sections tending to move them relative to one another.

25. A jarring tool including, two sections related for relative longitudinal movement, means for limiting relative longitudinal movement of the sections in both directions to provide jarring action between the sections, and means for releasably holding the sections against relative longitudinal movement operable to release the sections for relative movement in one direction upon a predetermined compression strain being exerted on the sections and operable to release the sections for movement in the opposite direction upon a predetermined tensile strain being exerted on the sections.

In witness that I claim the foregoing I have hereunto subscribed my name this 16th day of April, 1930.

IRA J. McCULLOUGH.