April 5, 1932. I. J. McCULLOUGH 1,852,250

JARRING TOOL

Filed Jan. 13, 1930

Fig. 1.

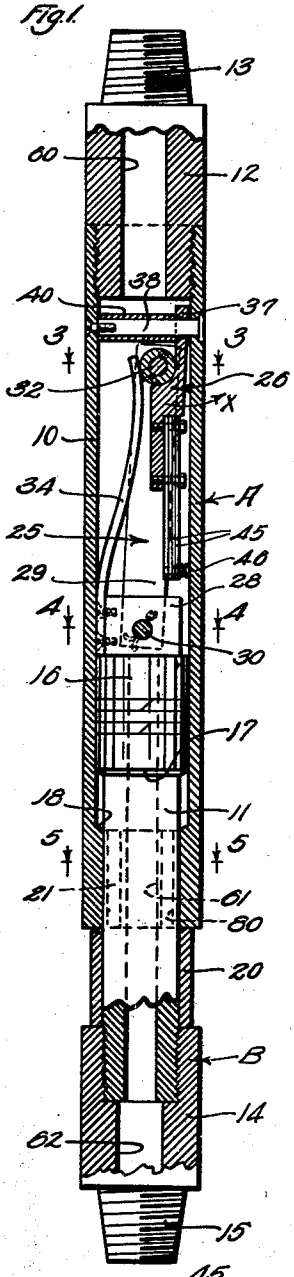


Fig. 2.

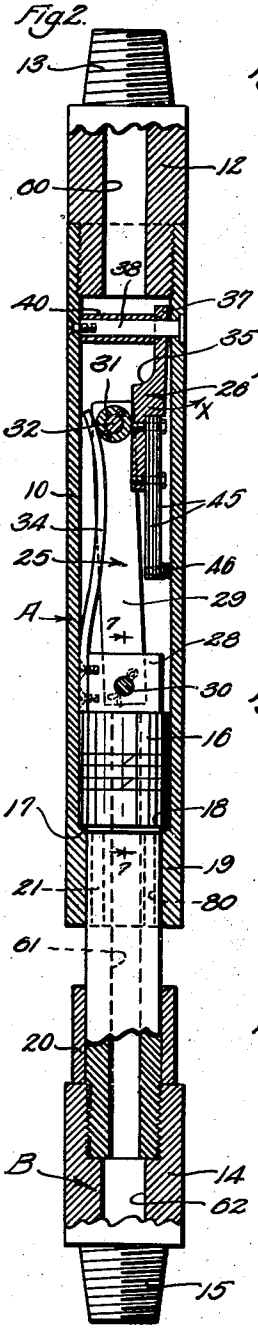


Fig. 3.

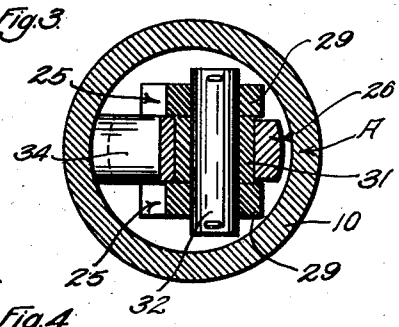


Fig. 4.

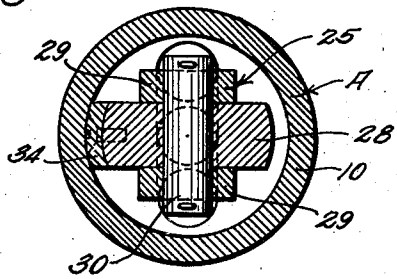


Fig. 5.

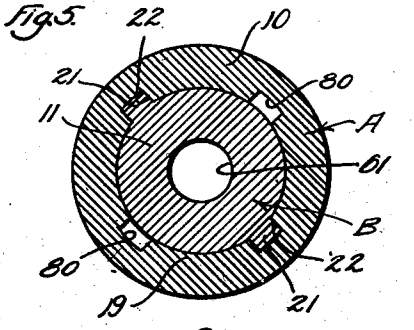


Fig. 7.

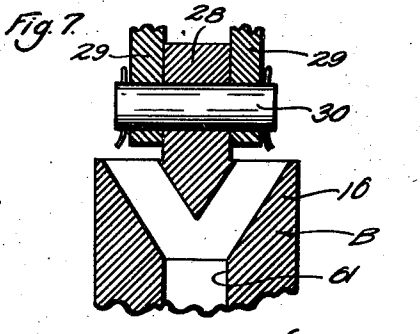
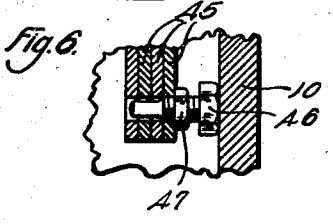


Fig. 6.



INVENTOR

Ira J. McCullough

Patented Apr. 5, 1932 1,852,250

UNITED STATES PATENT OFFICE

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JARRING TOOL

Application filed January 13, 1930. Serial No. 420,338.

This invention has to do with a jarring tool for use in wells, and it is an object of the invention to provide a simple, practical, and effective tool of this character.

In the course of drilling wells it is sometimes necessary to effect a jarring action in the well. For instance, in fishing objects from a well bore it is sometimes necessary to jar them before they can be withdrawn. Jarring tools of various constructions have been proposed and used with varying degrees of success. Most tools of this character involve slackly-linked sections adapted to be held in a contracted position by cooperating shoulders released through rotation between the sections or through the medium of the circulating fluid to allow the sections to move apart so that a hammering action is obtained. Difficulty is experienced in providing cooperating shoulders which will effectively withstand the strains to which they are necessarily subjected, and in practice it is not altogether convenient to rotate such a tool while an up strain is maintained on the string in which the tool is connected.

It is an object of this invention to provide a jarring tool in which the slackly-linked sections are held in the contracted position by a means which is automatically released upon a predetermined strain being put upon the tool. The present invention provides a tool which is entirely automatic in its operation in that it is not necessary to rotate the string in which the tool is connected nor to control the pressure on circulating fluid in order to effect actuation of the tool.

Another object of the invention is to provide a control means for the slackly-linked sections of a jarring tool which will operate effectively and dependably and which is not subject to rapid deterioration or wear as are the cooperating shoulders in the ordinary tool of this character.

It is a further object of the present invention to provide a tool of the character mentioned that can be adjusted or regulated to trip or operate upon any desired strain being put upon it.

It is another object of the invention to provide a tool of the character mentioned which is fully operable by simple reciprocation of the string to which the tool is connected, the tool being such that it will operate effectively and dependably as fast as it is practical to raise and lower the operating string putting the desired strain on the string to effect the upward movement.

It is a further object of this invention to provide a tool of the character mentioned in which the wearing parts are of simple, inexpensive construction and are such that they can be very easily repaired or replaced.

The various 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 longitudinal detailed sectional view of the tool provided by this invention showing it positioned ready for operation, the means which controls the movement of the body sections being positioned to hold the body sections contracted with the jarring shoulders spaced apart. Fig. 2 is a view similar to Fig. 1 showing the tool released or operated so that the body sections are extended and the jarring shoulders are in engagement. Figs. 3, 4, and 5 are detailed transverse sectional views taken on line 3—3, 4—4, and 5—5, respectively, on Fig. 1. Fig. 6 is an enlarged detailed sectional view illustrating a portion of the tool. Fig. 7 is an enlarged detailed view taken on line 7—7 on Fig. 2.

The tool provided by this invention includes, generally, two main or body sections A and B loosely linked or connected together for limited relative longitudinal movement, and latch or control means in connection with the body sections for releasably holding them in a contracted position.

The body sections A and B form a unit to be connected between the object to be jarred and an operating string. In practice the tool may be arranged immediately adjacent the fishing tool employed to engage the object in the well or it may be arranged at a suitable point in the operating string. The body sections are related or connected for limited rela-

tive longitudinal movement and are provided with cooperating parts or shoulders adapted to effect jarring of one section from the other. In the preferred construction the body sections are telescoped one into the other. In the form of the invention illustrated the body section A has a tubular portion 10 while the section B has a stem portion 11 extending into the tubular portion 10 from one end. The stem portion 11 is shown extending upwardly into the lower end of the tubular portion 10. The body section A has a detachable upper end 12 screw threaded to the upper end of the tubular portion 10 and provided with a tapered screw threaded pin projection 13 to facilitate connection with an operating string, fishing tool, or other such part. The section B is provided with a lower end part 14 screw threaded to the lower end of the stem 11 and provided with a downwardly extending tapered screw threaded pin projection 15 corresponding to the pin 13 above mentioned. It will be obvious from the following description that the tool can be operated in the position shown in the drawings or can be turned end for end, in which case the part 12 of the body section A would be at the lower end of the tool and the end part of the body section B at the upper end of the tool. An enlargement or head 16 is formed on the stem 11, preferably at the upper end of the stem, to slidably fit the bore of the body portion 10. Suitable packing means is provided between the head and the body portion 10. The head 16 forms or presents a downwardly-facing shoulder 17 adapted to cooperate with an upwardly-facing shoulder 18 formed by a part 19 of reduced diameter at the lower end of the body section 10. It is preferred ordinarily to connect the sections A and B so that they have a limited longitudinal movement relative to each other but are held against relative rotation. The shoulder 17 cooperates with the shoulder 18 to limit relative longitudinal movement of the sections in one direction while a spacer sleeve 20 on the stem 11 below the body section A cooperates with the lower end of the tubular body portion 10 to limit movement in the other direction. The spacer 20 rests on the upper end of the lower end part 14 of the body section B. In practice the parts may be designed and proportioned so that the upper end of the end part 14 directly engages the lower end of the tubular body part 10 to limit relative movement between the body sections.

The body sections may be suitably keyed or otherwise connected together to prevent them from rotating relative to each other. In the case illustrated I have shown keys 21 provided on the stem 11 to cooperate with suitable keyways 22 in the part 19 of the body portion 10.

The latch means provided by the present invention for releasably holding the body sections contracted or in position where the jarring shoulders 17 and 18 are spaced apart, is such as to be automatically released upon a predetermined longitudinal strain or pull being put upon the tool. The latch means is preferably located within the tubular body portion 10 above the head 16 of the body section B. The latch means provided by this invention includes, generally two cooperating members, one a latch 25, and the other a shouldered block 26. One of the members of the latch means is carried by one of the body sections while the other member of the latch means is carried by the other body section. In the particular arrangement of the invention illustrated the latch 25 is carried by the body section B while the shouldered block is carried by the body section A.

In the preferred form of the invention the latch 25 is directly connected to the stem portion 11 of the body section B. For instance, it may be connected to the head 16 of the stem portion so that it extends or projects upwardly into the tubular body portion 10 in the manner clearly illustrated in Figs. 1 and 2 of the drawings. The head 16 is shown provided at its upper end with a lug 28 to carry the latch. The particular latch illustrated in the drawings includes two spaced parallel side links 29 carried by a pivot pin 30 which extends through the lug 28 on the head 16. A roller 31 is arranged between the outer or upper ends of the links 29 and is rotatably carried on a pin 32 which extends between the links.

The invention provides means for normally yieldingly urging the latch 25 in the direction of the shouldered block, that is, in a direction to cooperate with the shouldered block. In the form of the invention shown a leaf spring 34 is carried by the lug 28 and engages the roller 31 to normally yieldingly urge the roller in the direction of the shouldered block 26.

The shouldered block 26 is formed with a seat or shoulder 35 adapted to receive and hold the roller 31 of the latch and is shiftable to allow the roller to be disengaged from the shoulder. In practice the block may be mounted in various manners to tilt or shift to effect the disengagement of the roller from the shoulder. In the construction illustrated the block has a part 37 projecting above the shoulder 35 and a pin 38 is carried by the tubular portion 10 to extend through an opening in the part 37. The pin 38 extends diametrically across or through the tubular body portion 10 and fits the opening in the projection 37 so that the block 26 is free to have the desired tilting movement. A spacer sleeve 40 is provided on the pin to confine the projection 37 to the desired position on the pin.

In accordance with the present invention I provide means in connection with the shoul-

dered block 26 to normally yieldingly hold the block in position where the shoulder 35 will hold or retain the roller 31 of the latch. This means is an important feature of the invention and operates to retain the block in position to hold the latch until a predetermined strain is put upon the tool tending to move the sections in a manner to bring the shoulders 17 and 18 together. In the preferred form of the invention illustrated in the drawings, this means includes a spring construction normally holding the latch in the desired roller-holding position. In practice it is usually desired to subject a tool of this kind to a heavy strain before the sections are released to jar, and therefore the means for holding the shouldered block in position to retain the roller of the latch must be such as to withstand a heavy strain tending to disengage the roller and such as to allow the roller to remain on the shoulder while the tool is under heavy strain. The form of the invention which I have found to operate satisfactorily includes a laminated structure in the form of a plurality of leaf springs 45 attached to the shouldered block 26 to project downwardly therefrom and provided at their lower ends with a stop member 46 which engages the wall of the tubular body portion 10. The stop 46 may be in the nature of a screw having threaded engagement with one or more of the springs 46 and having its head positioned to engage the inner wall of the body portion 10. A set or lock nut 47 may be provided on the screw to fix it in the desired adjusted position. With the construction just described the shouldered block is tiltable about the connection made through the engagement of the projection 37 by the pin 38. The stop member or screw 46 is set to hold the lower end portion of the shouldered block out or away from the wall of the tubular body portion 10 so that the shoulder 35 is in position to hold and retain the roller 31.

When a strain is put upon the tool tending to move them to bring the shoulders 17 and 18 together, the latch, being engaged with the latch block, causes such strain to be communicated through the latch and latch block. The strain is communicated through the roller 31 of the latch and the shoulder 35 of the latch block. The shoulder 35 of the latch block is offset from the point of engagement of the projection 35 with the pin 38 so that the strain coming on the shouldered block tends to turn the latch block in the direction indicated by the arrow X in Fig. 1. The assembly of leaf springs 45 resists turning of the shouldered block and has such mechanical advantage over the turning movement as to effectively hold the block against turning until the strain is very heavy. It will be obvious that the leaf spring assembly may be made very stiff or strong by providing a suitable number of stiff or heavy springs. Further, it will be obvious that the point or strain under which the shouldered block will operate to release the latch roller, allowing the body sections to move so that the jarring shoulders 17 and 18 may come together, may be varied by varying the position of the stop screw 46. By adjusting the stop screw so that the lower end of the spring assembly is held far away from the wall of the tubular body portion, the strain necessary to disengage the latch roller from the shoulder will be great, whereas if the screw is positioned so that the lower end of the spring assembly is close to the wall of the body portion 10, the strain necessary to release the latch roller from the shoulder will be comparatively little.

The present invention preferably provides the tool with means for circulating fluid through it, for instance, with openings to allow circulating fluid to be circulated from a drilling string that may be connected to one end of the tool to a fishing tool, or the like, and that may be connected to the other end of the tool or between two portions of a drilling string between which the tool may be connected. In the case illustrated, a circulation opening 60 is shown provided through the upper end part 12 of the body section A to discharge downwardly into the tubular body portion 10, and an opening 61 is formed through the stem portion of the body section B, to communicate with an opening 62 in the lower end portion of the body section B. The opening 61 in the stem portion may be branched at the upper end of the head to open at opposite sides of the lug 28, as clearly shown in Fig. 7 of the drawings. Fluid escape openings 80 are provided in part 19 to allow free circulation of fluid into and out of the space between the shoulders 17 and 18 so that the action of the tool is not checked.

It is to be noted that the circulating fluid passed through this tool passes through this tubular part in which the head operates. The fluid freely fills and discharges from the space above the head 16 so that the action of the tool is in no way checked or retarded.

In use the tool provided by this invention is inserted in the drilling string at a suitable point or is located between the fishing tool and the lower end of the operating string. To make the tool ready for operation the body sections A and B are moved together until the latch roller 31 is moved into engagement with the shoulder 35 through the action of the spring 34. A strain or pull is then put upon the tool by pulling upwardly on the operating string. When the strain thus put upon the tool becomes sufficient to deflect the springs 45 so that the shoulder 35 will no longer hold the roller 31, the roller leaves the shoulder, allowing the body sections to move relative to each other so that the shoulders 17 and 18 come together, thus effecting the desired jar-

ring action. To repeat the operation it is merely necessary to lower the operating string to allow the sections to move together until the latch roller 31 again engages the shoulder 35, whereupon the tool is in position ready for another operation. As above stated, the latch construction can be adjusted or regulated to hold the tool against operation until the desired strain is put upon it. It is to be particularly noted that the tool is operated solely by vertical movement or reciprocation of the operating string, and does not require any rotation of the operating string or any variation of the circulating fluid that may be delivered through the operating string. To operate the present tool it is merely necessary to raise and lower the operating string, putting enough up strain on the operating string to effect disengagement of the latch roller from the shoulder. It is also to be pointed out that the operating or wearing parts of the control latch are such as to effectively withstand long hard usage without failure and without showing appreciable wear. The latch, being equipped with a roller for cooperation with the shouldered block, eliminates injury to the cooperating parts of the control and assures uniform, dependable 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, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined pressure being applied to the sections tending to cause relative longitudinal movement between them, said means including two cooperating parts, one part being a block tiltably carried by one section and having a shoulder, and the other part being a pivoted latch carried by the other section and cooperating with the shoulder.

2. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined pressure being applied to the sections tending to cause relative longitudinal movement between them, said means including two cooperating moveable parts, one part being a block tiltably carried by one section and having a shoulder, and the other being a pivoted latch carried by the other section and cooperating with the shoulder, and a spring attached to the block and bearing against the first-mentioned section to resist tilting of the block.

3. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined pressure being applied to the sections tending to cause relative longitudinal movement between them, said means including two cooperating parts carried by the sections, one a pivoted latch and the other a latch holder mounted to tilt under strain tending to move the sections longitudinally relative to each other to release the latch.

4. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined pressure being applied to the sections tending to cause relative longitudinal movement between them, said means including two cooperating parts, one part being mounted to tilt under a strain tending to move the sections longitudinally relative to each other, a leaf spring resisting movement of said part, the spring having one end attached to the tiltable part, and an adjusting screw at the other end of the spring engaging a relatively stationary abutment.

5. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined pressure being applied to the sections tending to cause relative longitudinal movement between them, said means including two cooperating parts, one a pivoted latch, the other a latch holder mounted to tilt under strain tending to move the sections longitudinally relative to each other, a spring resisting movement of said latch holder, and means for regulating the action of the spring.

6. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechanical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined strain being applied to the sections tending to cause relative longitudinal movement between them, said means including a shouldered block carried by one section, and a latch carried by the other section, the latch having a roller cooperatively engaging the shoulder of said block.

7. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and mechan-

ical means for releasably holding the sections against relative movement, said means being operable to release the sections upon a predetermined strain being applied to the sections tending to cause relative longitudinal movement between them, said means including a shouldered block tiltably carried by one section, a pivoted latch carried by the other section to cooperate with the shouldered block, a spring normally urging the latch in a direction to engage the shoulder, and spring means resisting tilting of the block.

8. A well tool of the character described including, two sections connected for limited relative longitudinal movement, and a latch for releasably holding the sections against relative movement, said latch being operable to release the sections upon a predetermined strain being applied to the sections tending to cause relative longitudinal movement between them, the latch including a pair of pivotally mounted arms and a roller mounted between the arms.

In witness that I claim the foregoing I have hereunto subscribed my name this 2nd day of January, 1930.

IRA J. McCULLOUGH.