Dec. 5, 1939. G. W. BOWEN 2,182,245

MECHANICAL RAM

Filed March 31, 1939 2 Sheets-Sheet 1

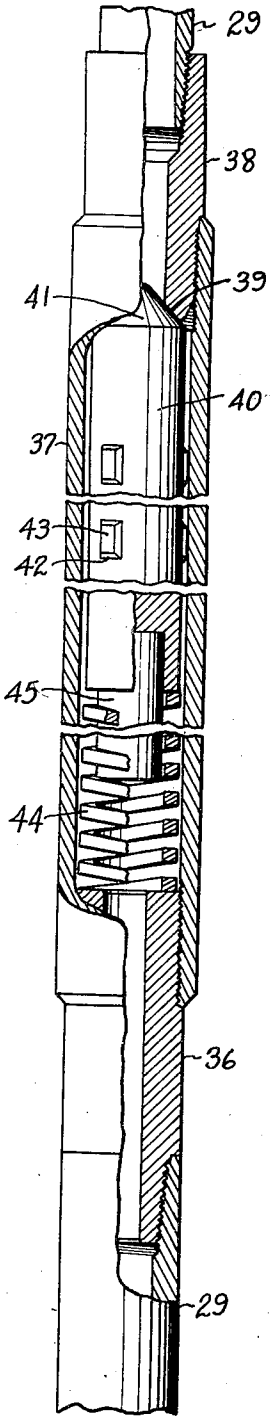

Fig. 1.

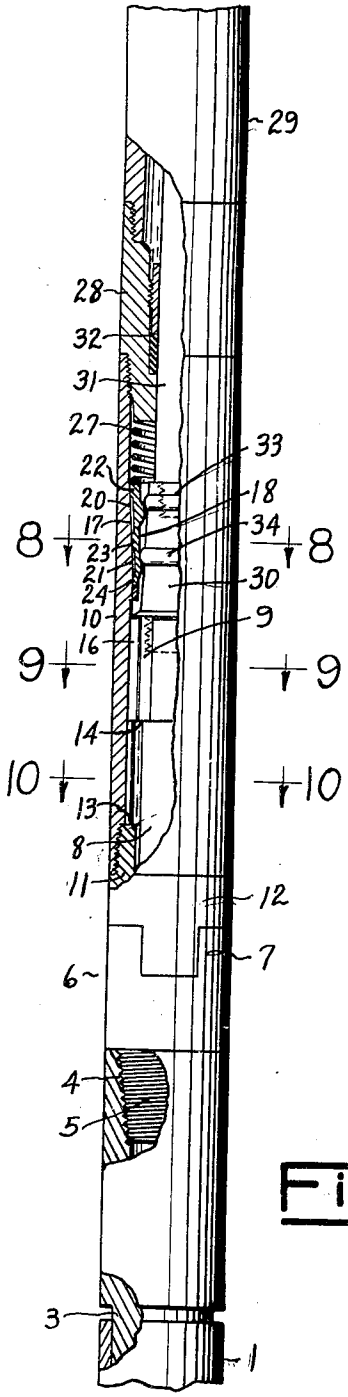

Fig. 2.

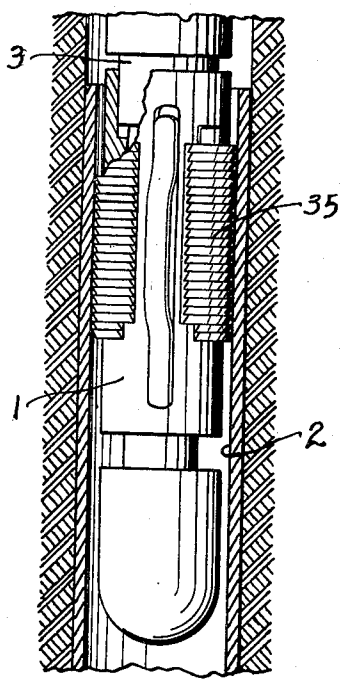

Fig. 3.

Inventor
GEORGE W. BOWEN

E. V. Hardway,
Attorney

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MECHANICAL RAM

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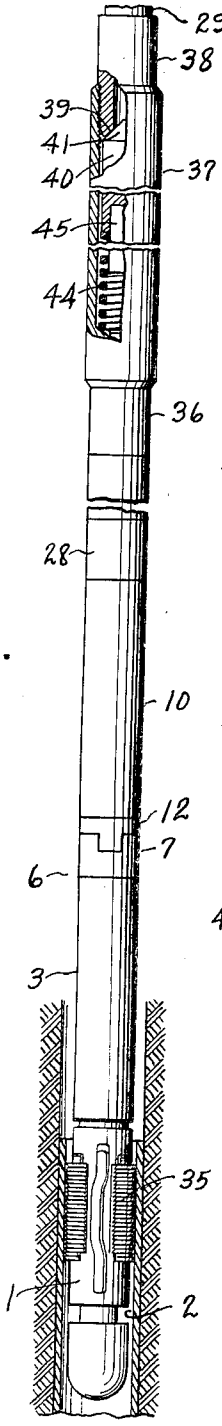

Fig. 6.

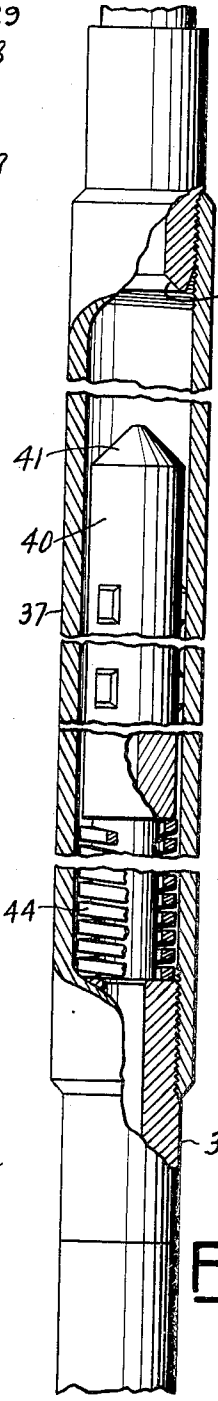

Fig. 4.

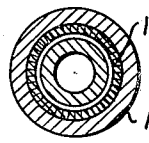

Fig. 8.

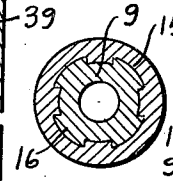

Fig. 9.

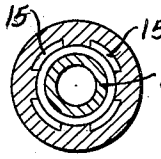

Fig. 10.

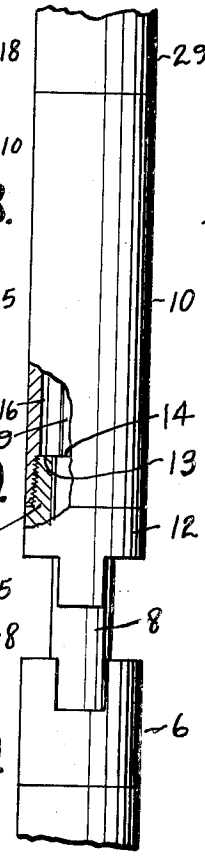

Fig. 5.

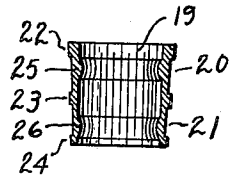

Fig. 11.

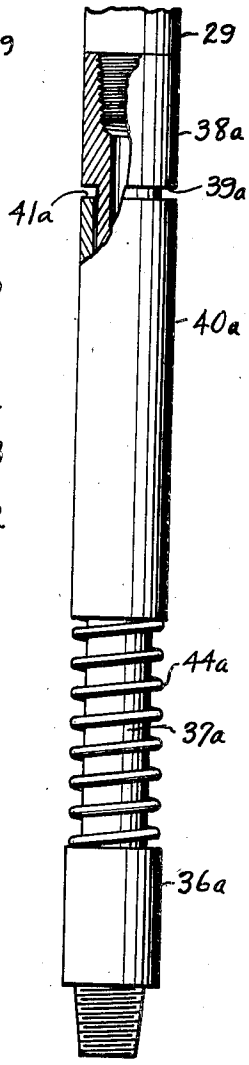

Fig. 7.

Inventor
GEORGE W. BOWEN

By E. V. Hardway
Attorney

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MECHANICAL RAM

George W. Bowen, Houston, Tex.

Application March 31, 1939, Serial No. 265,213

7 Claims. (Cl. 255—27)

This invention relates to a mechanical ram.

The invention is designed to be used in combination with a conventional type of jar commonly used for jarring pipe stuck in a well bore in the process of removing the stuck pipe from the bore.

It is another object of the invention to provide a mechanical ram which, acting together with the jar, will be effective in imparting blows in succession thereby transmitting to the stuck pipe successive jars or vibrations in the required concert to obtain the best results.

It is another object of the invention to provide, in a jar, a mechanical ram so constructed and mounted as to deliver its blow after the jarring action and while the operating string is under tension.

Other objects and advantages will be apparent from the following description illustrated by the accompanying drawings, wherein:

Figure 1 shows a side view of the ram, partly in section, with the spring extended as after the blow has been struck.

Figure 2 shows a side view of the jar, partly in section.

Figure 3 shows a side view of a pipe grapple employed, partly in section.

Figure 4 shows a side elevation, partly in section, of the ram in active position, that is, showing the rebound spring under compression.

Figure 5 shows a side elevation, partly in section, of the lower end of the jar.

Figure 6 shows an elevational view, partly in section, of the combined grapple, jar and ram.

Figure 7 shows another embodiment of the ram.

Figure 8 shows a cross-sectional view taken on the line 8—8 of Figure 2.

Figure 9 shows a cross-sectional view taken on the line 9—9 of Figure 2.

Figure 10 shows a cross-sectional view taken on the line 10—10 of Figure 2, and

Figure 11 shows a sectional view of the slip employed in the jar.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a grapple of any conventional type engageable with a pipe, such as 2, stuck in a well. The grapple embodies an upwardly extended shank 3 terminating at its upper end in the box 4 into which the pin 5 is threaded. This pin is formed on the lower end of the lower jar member, designated generally by the numeral 6, said lower jar member embodying a clutch member 7, a mandrel 8, upstanding therefrom and an enlarged head 9 on the upper end of said mandrel. There is an upper jar member embodying a tubular shell or housing 10 screwed into the lower end of which there is an inside collar 11 whose lower end is formed with a clutch member 12 adapted to be clutched for rotation with the lower clutch member 7 as shown in Figure 5. The upper end of the inside collar 11 forms the hammer 13 and the lower end of the head 9 forms the anvil 14. The housing 10 has the inside vertical dove-tailed grooves 15 extending from the hammer upwardly and the head 9 has the external vertical dove-tailed ribs 16 which are fitted into said grooves. Above the grooves the housing is formed with an upwardly flared seat 17 on which the slip 18 is seated. This slip is of a general tubular shape with its outside tapering downwardly to conform to the contour of and to seat on the seat 17 and has the staggered lengthwise slits 19 extending from opposite ends thereof, each slit extending from one end of the slip and terminating near the other end thereof, so that the slip will be expansible as shown in Figure 11. The slip has the upper and lower external annular grooves 20, 21 therearound and the spaced upper, intermediate and lower external ribs 22, 23 and 24 therearound to bear against the seat. The slip also has the upper, inside annular rib 25 opposite the groove 20 and the lower inside annular rib 26 opposite the groove 21. These inside ribs are oval as shown in Figure 11.

Mounted on the upper end of the slip there is a coil spring 27 maintained under suitable compression by means of the coupling 28 whose lower end is threaded into the upper end of the housing 10 and abuts against the upper end of the spring 27. The operating string 29 is connected to the upper end of the coupling 28 and extends to the ground surface.

Screwed into the upper end of the head 9 there is a mandrel 30 and screwed into the upper end of the mandrel there is a wash pipe 31. Between the wash pipe 31 and the coupling 28 there is a stuffing box 32 forming a seal between them. The wash pipe, mandrel and lower jar member as well as the grapple are formed tubular so that a washing fluid may be forced down through the operating string, or drill stem, and the jar and grapple into the well beneath as the necessities of the case may require.

In lowering the tool into the well it is at times necessary to rotate the same and while being lowered the clutch jaws 7, 12 will be engaged for

that purpose and also the splines, or ribs 16, being at all times in the grooves 15 of the shell or housing 10 will enable the entire tool to be rotated as a unit irrespective of whether the clutch jaws 7, 12 are engaged as shown in Figure 2 or released as shown in Figure 5.

The mandrel 30 is provided with the external, annular, oval, upper and lower ribs 33, 34 which cooperate with the corresponding inside ribs 25, 26 of the slip.

The tools may be assembled as shown in Figures 1, 2 and 3 and as so assembled may be lowered into the well until the grapple 1 enters the upper end of the stuck pipe 2 and an upward pull may then be exerted through the drill stem or operating string 29 causing the grappling jaws 35 of the grapple to engage the stuck pipe 2 in any conventional manner. A further upward pull is then taken on the operating string. The ribs 25, 26 are now interlocked with the ribs 33, 34 preventing, temporarily, further upward movement of the upper jar member. The operating string will thus be placed under tension and the amount of stretch imparted to it will depend on the length of the operating string and on the intensity of the tension. As hereinbefore stated the external grooves 20, 21 are opposite the internal ribs 25, 26 so that said last mentioned ribs are permitted to expand or increase in inside diameter so that they will eventually pass by the ribs 33, 34 thus releasing the tension of the operating string to a sudden upward movement and the hammer 13 will thereupon be suddenly projected upwardly and will strike the anvil 14 with an intense blow which will be transmitted to the grappling tool and to the stuck pipe and which may jar the latter loose so that it can be withdrawn. If, however, the stuck pipe is not released by the blow and moved upwardly the operating string will remain under considerable tension after the blow is struck.

Above the jarring tool there is incorporated into the operating string a coupling 36 which is thickened inwardly and to the upper end of which an enlarged section 37 of the operating string is connected and the upper end of this section 37 is connected to the string above by means of the coupling 38 whose lower end is threaded into the section 37 and is provided with the downwardly flared, annular, anvil face 39.

Within the section 37 there is an approximately cylindrical ram 40 whose upper end is preferably tapered forming a hammer face 41 arranged to impact against the anvil face 39 as hereinafter stated. The ram has a plurality of radial projections 42 thereon having friction faces 43 of relatively small area. These projections are provided to hold the ram centered in the section 37 and to reduce the frictional contact of the ram with said section. The ram 40 is mounted on a strong coil spring 44 which in turn is supported on the upper end of the inwardly thickened coupling 36. Suitably attached to the lower end of the ram and extended down within the spring 44 there is a mandrel pin 45.

Upon sudden upward movement of the upper jar member as hereinabove explained the ram 40 will be temporarily held substantially stationary, by its own inertia, placing the spring 44 gradually under compression as shown in Figure 4. In construction the strength of the spring 44 and the weight of the ram 40 will be such that at the time the hammer face 13 strikes the anvil face 14 the spring 44 will be fully compressed and the ram will be moving upwardly at the same rate of speed as the upper jar member. Upon sudden stoppage of the upper jar member the ram 40 will be projected on upwardly by its own momentum assisted by the expansion of the spring 44 and the hammer face 41 will strike the anvil face 39 with an intense blow thus imparting an additional jar, or vibration, while the operating string is under the additional tension of its own upward momentum, which jar or vibration will be transmitted to the stuck pipe 2.

When the tension of the operating string is released and said string suddenly moves upwardly the upward momentum of the mass of the string will place the string under increased tension when the hammer face 13 comes into contact with, and is stopped by, the anvil face 14 and the blow of the ram 40 while the string is under said additional tension will likely be more effective in dislodging the stuck pipe than the jar itself.

Another embodiment is illustrated in Figure 7 wherein the section 37*a* of the operating string is shown reduced and the ram 40*a* is slidably mounted thereon and supported on the coil spring 44*a* which in turn is supported on the upper end of the coupling 36*a*. The upper end of the ram 40*a*, in this embodiment, forms an annular, hammer face 41*a* which opposes the anvil face 39*a* above formed on the lower end of the coupling 38*a* to the upper end of which the string or stem 29 is connected. In use the operation and effect of the form shown in Figure 7 is the same as that shown in Figure 4.

What I claim is:

1. A jarring tool comprising two parts slackly linked together and capable of limited, relative longitudinal movement, under tension, means to arrest such movement to cause a jar, means for connecting one part to a stuck object, an anvil on the other part, a ram arranged to be projected by its momentum against the anvil upon the arrest of such movement, a yieldable support for the ram arranged to be compressed by the inertia of the ram, upon such relative longitudinal movement, to supplement the momentum of the ram.

2. A jarring tool comprising two relatively movable parts, means holding said parts against relative longitudinal movement while the tool is under tension, said means being releasable to permit such longitudinal movement, means for arresting such longitudinal movement to cause a jar, means for connecting one part to a stuck object, an impact abutment on the other part and a yieldably mounted ram arranged to be projected against said abutment upon the arrest of such relative longitudinal movement of said parts.

3. A jarring tool comprising two relatively movable parts, means for releasably locking said parts against relative longitudinal movement, said locking means being releasable while the tool is under tension to permit such relative longitudinal movement, means for arresting such relative longitudinal movement to cause a jar, means for connecting one part to a stuck object, an anvil on the other part, a yieldable support on said other part, a ram on said support arranged to exert a compressive force on the support, by its inertia, upon such relative longitudinal movement and to be projected by its momentum, supplemented by the expansion of said

support, against the anvil upon the arrest of such relative, longitudinal movement.

4. In combination an operating string, a jarring tool incorporated into the string, means for connecting the jarring tool to a stuck object, an anvil carried by the string, a yieldable support carried by the string, a ram on the support effective, by its inertia, to compress the support and to be projected, by its momentum supplemented by the expansion of the support, against the anvil upon operation of the jarring tool.

5. In a jarring tool a movable part having an anvil, a yieldable support on said movable part, a ram on said support, effective, by its inertia, to place said support under compression upon movement of said part, said ram being arranged to be projected, by its momentum, supplemented by the expansion of said support, against the anvil upon arrest of the movement of said part.

6. In a jarring tool comprising two relative movable parts slackly linked together and having impact means to limit the relative movement of said parts, means for connecting one part to a stuck object, an anvil on the other part, a coil spring on said other part forming a support, a ram on said support effective to place the support under compression, by its inertia, upon such relative movement and arranged to be thereafter projected by its momentum, assisted by the expansion of said support, against said anvil.

7. In combination an operating string, a jarring tool incorporated into the string, means for connecting the jarring tool to a stuck object, an impact abutment on the string, a coil spring on the string, a ram supported by said spring and effective to place the spring under compression, by its inertia, and arranged to be projected by its momentum, assisted by the expansion of the spring, against said abutment upon operation of the jarring tool.

GEORGE W. BOWEN.