Sept. 28, 1954 R. C. BAKER 2,690,228

WELL TOOL OPERATING AND JARRING APPARATUS

Original Filed Jan. 12, 1948 2 Sheets-Sheet 1

Fig. 1.

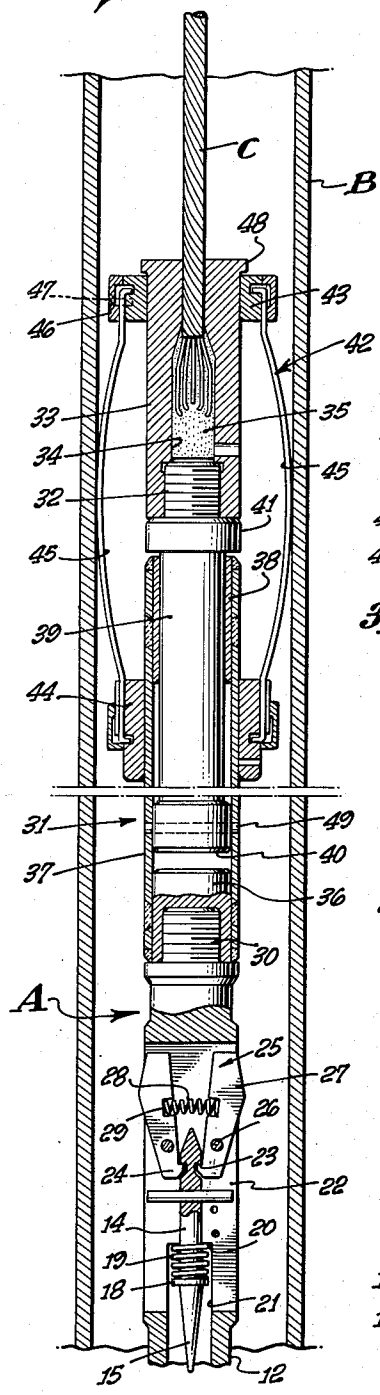


Fig. 2.

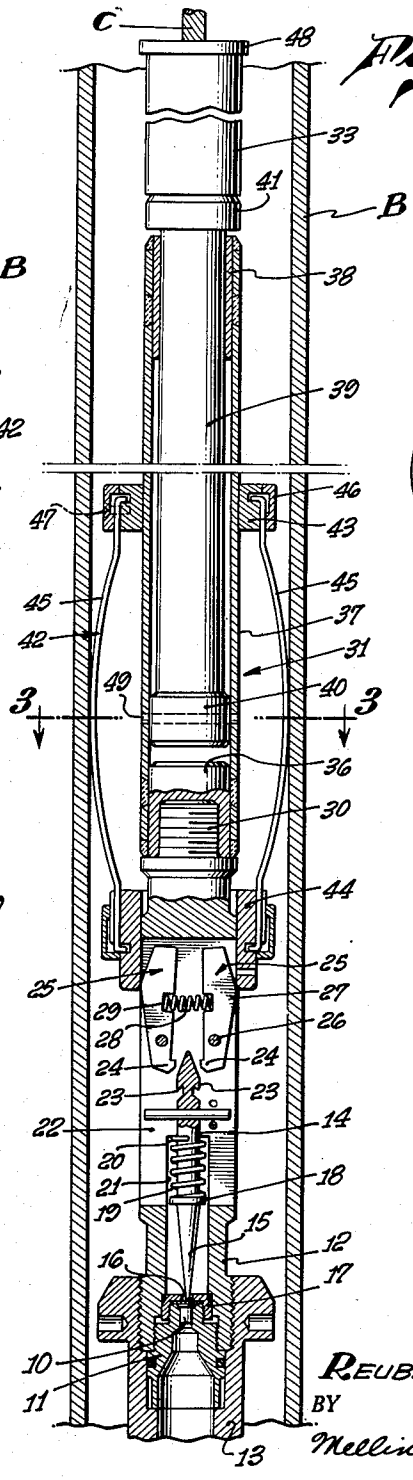
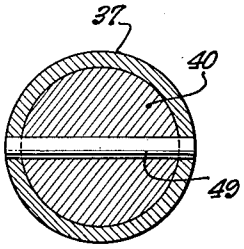


Fig. 3.



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Fig. 4.

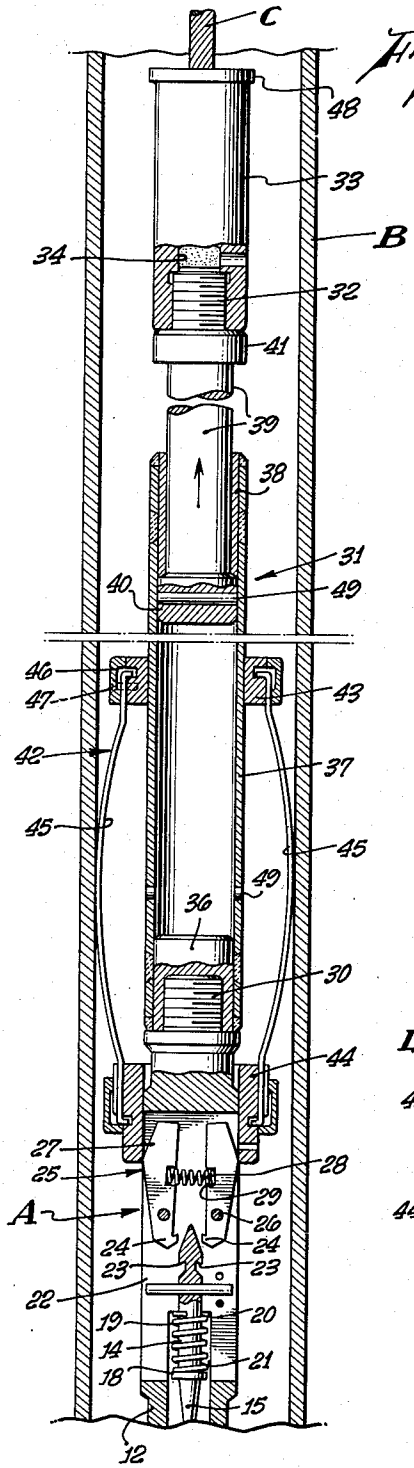


Fig. 5.

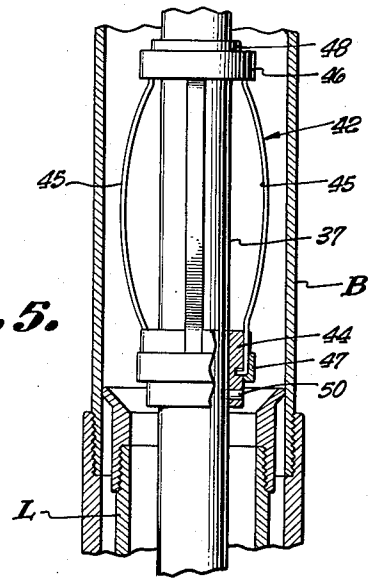
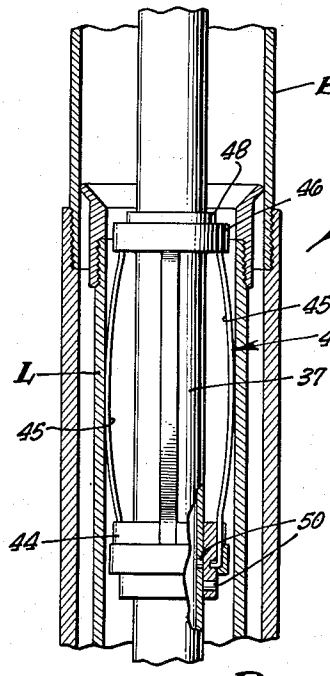


Fig. 6.



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WELL TOOL OPERATING AND JARRING APPARATUS

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Original application January 12, 1948, Serial No. 1,845. Divided and this application April 12, 1951, Serial No. 220,699

10 Claims. (Cl. 166—178)

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The present invention relates to well devices, and more particularly to subsurface devices or apparatus useful in bore holes, such as oil, gas and similar wells.

This application is a division of the application of Reuben C. Baker, Thomas M. Ragan, John R. Baker and Martin B. Conrad, Serial No. 1,845, filed January 12, 1948, now Patent No. 2,640,547, for "Gas Operated Well Apparatus."

An object of the present invention is to provide an improved jarring mechanism capable of use in a well bore.

Another object of the invention is to provide a telescopic well jarring mechanism, and a device slidable thereon, in which the device is prevented from catching or hanging up on the jarring mechanism.

A further object of the invention is to provide a subsurface well tool embodying a friction drag device that cannot move downwardly of the tool while disposed within, and out of contact with, the wall of an enlarged diameter well bore, but which, nevertheless, is capable of moving relatively downward of the tool when disposed in contact with the wall of a smaller diameter well bore.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

Figure 1 is a longitudinal section through a well jarring and tool operating apparatus, with the parts disposed in their relative position for lowering through a well casing, or similar well conduit;

Fig. 2 is a view similar to Fig. 1, disclosing parts of the tool in another position;

Fig. 3 is a cross-section taken along the line 3—3 on Fig. 2;

Fig. 4 is a view similar to Figs. 1 and 2, illustrating the jarring portion of the apparatus in extended position;

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Fig. 5 is a longitudinal section through a well casing and liner disposed therein, with a friction drag device being lowered through the casing to the liner;

Fig. 6 is a view similar to Fig. 5 of the friction drag device disposed in the liner.

The apparatus A disclosed in the drawings can control and operate subsurface well apparatus disclosed in the above-identified parent application, in which the setting of a well packer (not shown) may be initiated by firing a cartridge 10 disposed in a gun barrel 11 threaded into a gun body 12, which is, in turn, threadedly secured to the upper head of a setting tool cylinder 13. The apparatus is lowered through a well casing B by means of a wire line C.

The cartridge 10 is fired by a pin 14, whose tapered end 15 can enter a tapered hole 16 in a breechblock 17 threaded on the gun barrel 11, to strike and fire the cartridge. The flame from the cartridge ignites the upper end of a fusee or power charge (not shown) disposed within the cylinder head 13 and initiates its combustion.

The tapered lower end 15 of the firing pin extends downwardly from a flange or spring seat 18 integral with the firing pin shaft, all of these elements being disposed within the gun body 12. A compressed helical spring 19 is disposed between the seat 18 and the upper end 20 of the central bore 21 through the body, this spring exerting sufficient force to shift the pin 14 downwardly and strike its end 15 against the cartridge 10, in order to fire the latter.

The shaft of the pin 14 extends upwardly through an elongate transverse slot 22 within the body 12, its upper end being formed with a pair of wings or hooks 23 adapted to be engaged by inwardly directed latch fingers 24 on the lower ends of the latch levers 25 disposed in the body slot and pivotally mounted on pins 26 supported in the body. The upper arms 27 of the levers are urged in an outward direction to maintain the latch fingers 24 engaged under the firing pin hooks 23 by an expansible spring 28 whose opposite ends are received within recesses 29 in the arms. So long as the spring 28 holds the upper lever arms 27 outwardly and the latch fingers 24 under the firing pin hooks 23, the firing pin 14 is maintained in elevated position above the cartridge 10, holding the firing spring 19 in a highly compressed condition. The latch lever

arms 27 are movable inwardly toward each other, to swing the fingers 24 outwardly from engagement with the firing pin 14, allowing the firing spring 19 to move the point 15 of the pin downwardly and strike a firing force against the cartridge 10.

The upper end 30 of the gun body 12 is threaded into a jarring device 31, to provide sufficient weight for forcing the entire apparatus through the well fluid during its descent in the casing B, and to impose a hammering or jarring force on the equipment whenever necessary. The upper end 32 of the jarring device is secured to a wire line socket 33 having an enlarged bore 34 for the reception of the unravelled lower end of the wire line C. As is well known, the wire line may be firmly secured in the socket by filling the bore of the latter with Babbitt metal 35, or any other suitable material.

The jarring device includes a lower head 36 threaded on the upper end 30 of the gun body 12. An outer barrel 37 is welded, or otherwise suitably secured, to the lower head 36 and has an upper head 38 welded, or otherwise suitably secured, to it. An inner mandrel 39 is disposed within the barrel 37, having a lower head 40 adapted to engage the lower barrel head 36, when in its lowermost position, and also with the upper head 38 within its uppermost position. This mandrel 39 is threaded into the lower end of the wire line socket 33 and has a flange 41 to substantially bridge the space between the socket 33 and the barrel 37 when the mandrel is fully telescoped within the barrel.

Reciprocation of the mandrel 39 by the wire line C will cause the mandrel head 40 to strike one or more hammer blows against either the lower or upper barrel heads 36, 38, to provide the desired jarring action on the mechanism.

For the purpose of moving the latch lever arms 27 inwardly, a friction drag device 42 is employed. This device includes upper and lower collars 43, 44 slidable along the wire line socket 33, jarring mechanism 31 and gun body 12. The upper and lower ends of outwardly bowed springs 45 are suitably secured to these collars 43, 44 as by the use of encompassing rings 46 and screws 47. The springs 45 frictionally engage the wall of the well casing B, which tends to resist its movement therewithin. Nevertheless, the drag device 42 is forced through the well casing B during lowering movement of the apparatus therewithin by engagement of the upper collar 43 with a shoulder 48 on the wire line socket 33. Upward movement of the wire line C, after the desired location has been reached in the well bore in which the equipment is to be operated, moves the entire apparatus, with the exception of the drag device 42, upwardly within the casing B, pulling the latch levers 25 within the lower drag collar 44 (Fig. 2) and causing the latter to shift the latch lever arms 27 inwardly and release the fingers 23 from the firing pin 14, whereupon the spring 19 is free to strike the pin end 15 against the cartridge 10 to fire the latter.

In order to prevent the drag collars 43, 44 from catching or hanging up on the jarring device 31, the latter is purposely maintained in its fully contracted position, with the mandrel head 40 adjacent the lower barrel head 36; so that a substantial gap does not exist between the upper end of the barrel 37 and the flange 41, in which the drag collars might catch. Maintenance of the mandrel 39 in the barrel 37 in this desired position is assured by a shear pin 49 extending through the mandrel head 40 into the outer barrel 37. If the jarring mechanism is to be operated, a pull taken on the wire line C of sufficient force will shear the pin 49, but at that time the drag device 42 has already performed its function of releasing the latch levers 25, and it is immaterial whether it subsequently catches or hangs up on the jarring mechanism.

The engagement of the shoulder 48 on the wire line socket with the upper collar 43 insures the forcing of the drag device 42 through the well casing B against the friction provided by the dragging of the drag springs 45 against the wall of the well casing B. The shear pin 49 holds the mandrel 39 telescoped fully within the barrel 37, and provides only a relatively small space between the flange 41 on the mandrel and the upper end of the barrel 37 that is substantially shorter than the length of the upper collar 43; so that the latter can easily slide from the socket 33 over the flange 41 and onto the outer barrel 37, without danger of hanging up or catching on any of the parts, which action would preclude sufficient relative downward movement of the lower drag collar 44 on the barrel 37 and gun body 12 to force it into engagement with the lever arms 27, to release their fingers 24 from the firing pin 14.

In the event it is necessary to employ the jarring device, due to the equipment therebelow being firmly held in the well bore, such holding force will prevent the barrel 37 from moving, which allows an upward pull to be taken on the wire line C and socket 33, to exert a corresponding upward pull on the mandrel 39 of sufficient force to shear the pin 49 and thereby free the mandrel 39 from connection to the barrel 37. The wire line can then be pulled upwardly (Fig. 4), to strike the mandrel head 40 against the upper barrel head 38 until the barrel 37 and the mechanism depending therefrom is jarred free; or the wire line C can be dropped, to drop the socket 33 and mandrel 39, in order to cause the flange 41 to strike the upper head 38 or the upper end of the barrel 37, and exert a downward jarring action on the mechanism.

In some well bores, the apparatus is to be operated within a liner L having a substantially smaller diameter than the casing B in which the liner is disposed (see Figs. 5 and 6).

In lowering the above-described apparatus through the casing, the springs 45 of the drag device, which have a maximum unrestrained diameter to frictionally engage the inner wall of the line L may not frictionally engage the wall of the casing B; so as to maintain the drag device 42 in its uppermost position on the socket 33 and jarring mechanism 31. Accordingly, this device 42 may drop downwardly into engagement with the latch levers 25 and inadvertently and prematurely effect their release while the apparatus is disposed in the casing B above the liner L. This contingency is guarded against, as disclosed in Figs. 5 and 6, by securing the drag device 42 to the barrel 37. As disclosed, a shear pin 50 may be disposed in the lower collar 44 and threaded into the outer barrel 37. When so attached, the drag springs 45 assume their unrestrained outwardly bowed condition. However, upon entering the liner L of less diameter than the unrestrained diameter of the bowed springs 45, the latter are pressed inwardly, which exerts a downward force on the lower collar 44 of sufficient value to shear the screw 50, and thus free the drag device 42 for the performance of its function of releasing the latch levers 25. The

lower collar **44** will move downwardly, since the upper collar **43** is prevented from moving upwardly by its engagement with the flange **48** on the wire line socket **33**. During lowering of the device through the liner L, following shearing of the screw **50**, the friction of the springs **45** against the wall of the liner L insures the disposition of the drag device **42** in its upper location, such as disclosed in Fig. 1, with the upper collar **43** engaging the flange **48** of the socket **33**. When the latch levers **25** are to be released from the firing pin **14**, the wire line C need merely be pulled upwardly, the wall of the liner L frictionally engaging the drag springs **45** and preventing corresponding upward movement of the drag device **42**. This allows the latch arms **27** to be pulled within the lower drag collar **44**, as disclosed in Fig. 2, to release the latch levers **25** from the firing pin **14**.

The inventor claims:

1. In well apparatus: an outer member; an inner member telescoped within said outer member; said inner member having an enlarged portion of greater outside dimension than the bore of said outer member and disposed externally of said outer member adjacent an end of said outer member when said inner and outer members are in contracted relation; releasable means holding said members together in such contracted relation; and a drag device engageable with a surrounding medium and slidable along said outer member and enlarged portion, said drag device having a portion movable along and off said enlarged portion onto said outer member when said members are in such contracted relation.

2. In well apparatus: a cylindrical outer barrel; upper and lower heads secured to said barrel; an inner mandrel telescoped within said barrel, said mandrel having a head disposed between and engageable with said barrel heads; said mandrel having an enlarged portion externally of said barrel and disposed adjacent an end of said barrel when said mandrel and barrel are in contracted relation; releasable means securing said mandrel and barrel together in such contracted relation; and a drag device slidable along said barrel and enlarged portion.

3. In well apparatus: a cylindrical outer barrel; upper and lower heads secured to said barrel; an inner mandrel telescoped within said barrel, said mandrel having a head disposed between and engageable wtih said barrel heads; said mandrel having an enlarged portion externally of said barrel and disposed adjacent an end of said barrel when said mandrel and barrel are in contracted relation; releasable means securing said mandrel and barrel together in such contracted relation; a drag device slidable along said barrel and enlarged portion; and frangible means securing said drag device to said barrel.

4. In well apparatus: a cylindrical outer member; an inner member telescoped within said outer member; said inner member having an enlarged portion of greater outside dimension than the bore of said outer member and disposed externally of said outer member adjacent an end of said outer member when said inner and outer members are in contracted relation; releasable means securing said members together in such contracted relation; a running-in string connected to one of said members; a drag device engageable with a surrounding medium and slidable along said outer member and enlarged portion, said drag device having a portion movable along and off said enlarged portion onto said outer member when said members are in such contracted relation; and releasable means securing said drag device to one of said members.

5. In well apparatus: a cylindrical outer member; an inner member telescoped within said outer member; said inner member having an enlarged portion of greater outside dimension than the bore of said outer member and disposed externally of said outer member and disposed adjacent an end of said outer member when said inner and outer members are in contracted relation; releasable means securing said members together in such contracted relation; a running-in string connected to one of said members; and a drag device slidable along said outer member and enlarged portion, said drag device comprising upper and lower collars, and outwardly bowed springs secured to said collars; at least one of said collars being slidable along said enlarged portion and outer member when said members are in such contracted relation, the length of said one of said collars being greater than the space between said enlarged portion and adjacent end of said outer member when said inner and outer members are in contracted relation.

6. In well apparatus: a cylindrical outer member; an inner member telescoped within said outer member; said inner member having an enlarged portion of greater outside dimension than the bore of said outer member and disposed externally of said outer member and disposed adjacent an end of said outer member when said inner and outer members are in contracted relation; releasable means securing said members together in such contracted relation; a running-in string connected to one of said members; a drag device slidable along said outer member and enlarged portion, said drag device comprising upper and lower collars, and outwardly bowed springs secured to said collars; at least one of said collars being slidable along said enlarged portion and outer member when said members are in such contracted relation, the length of said one of said collars being greater than the space between said enlarged portion and adjacent end of said outer member when said inner and outer members are in contracted relation; and releasable means securing one of said collars to one of said members.

7. In well apparatus: a cylindrical outer member; an inner member telescoped within said outer member; a drag device engageable with a surrounding medium and slidable along said inner member and outer member; stop means on said inner member engaging said drag device for limiting upward movement of said drag device with respect to said members; and means detachably securing said drag device to one of said members while said drag device engages said stop means.

8. In well apparatus: a cylindrical outer member; an inner member telescoped within said outer member; a drag device engageable with a surrounding medium and slidable along said inner member and outer member; stop means for limiting upward movement of said drag device with respect to said members; and means detachably securing said drag device to one of said members while said drag device engages said stop means.

9. In well apparatus: a member adapted to be disposed in a well bore; a drag device slidable along said member, said drag device comprising upper and lower collars, and intervening outwardly bowed springs secured to said collars; stop means engaging one of said collars to prevent

upward movement of said drag device along said member; and frangible means securing the other of said collars to said member.

10. In well apparatus: a member adapted to be disposed in a well bore; a drag device slidable along said member, said drag device comprising upper and lower collars, and intervening outwardly bowed springs secured to said collars; stop means engaging said upper collar to prevent upward movement of said drag device along said member; and frangible means securing said lower collar to said member.

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