

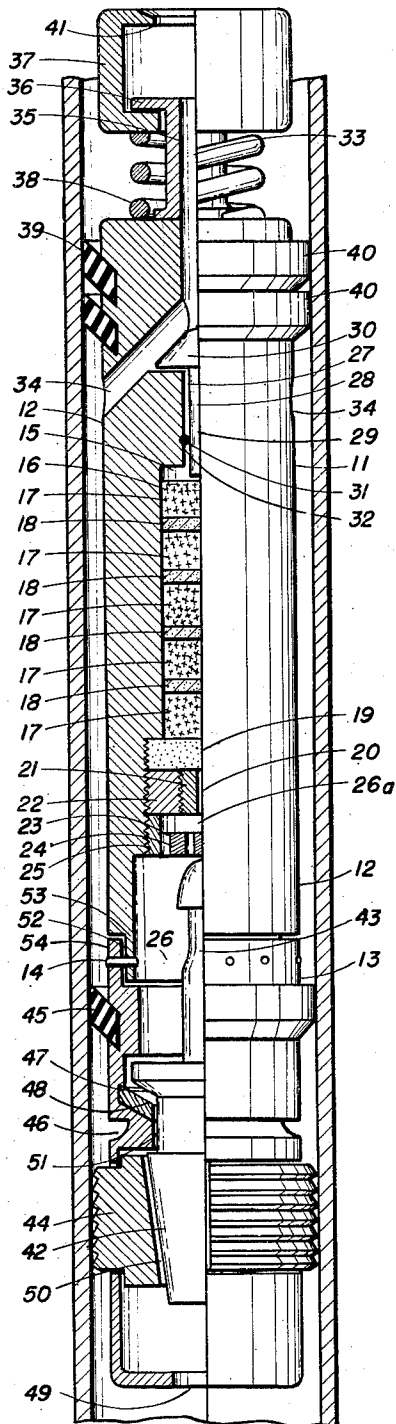
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TOOL FOR REMOVAL OF FLUID FROM WELL BORES

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TOOL FOR REMOVAL OF FLUID FROM WELL BORES

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The present invention is directed to a tool for removing fluid from well bores. More particularly, the invention is directed to apparatus for a swab-like tool for removal of liquid heads from well bores having insufficient formation pressure for initially flowing the well. In its more specific aspects, the invention is directed to a wire line tool which is self-energizing.

The present invention may be briefly described as a tool for removal of liquid from a well bore which comprises an elongated member provided with a first section having an integral source of energy arranged therein. The first section is provided with means for sealing with the wall of the well bore. The elongated member comprises a second section which is releasably or detachably connected with the first section. The second section is provided with pipe gripping means normally carried on the second section in inoperative position and are adapted to be urged into operative position on release of the energy. Means are carried by the second section for sealing with the wall of the well bore. The first section is adapted to be propelled upwardly in the well bore on release of the energy thus carrying with and ahead of it a column of liquid.

The integral source of energy may suitably be a body or plurality of bodies of explosive, such as illustrated by spark ignition of any of gunpowder type material, preferably slow burning. The source of energy may suitably be a chemical or gas under pressure which may be released to propel the first section upwardly in the well bore. Examples of propellants other than the explosive may be illustrated by chemicals which will react with each other to generate a gas under pressure, such as calcium carbide and water, perchloric acid and hydrocarbon or other organic material, aluminum and caustic soda and hydrochloric acid with any of various reagents such as zinc, sodium bicarbonate or ferrous sulphide. Carbon dioxide, solidified, liquified or in a highly compressed state, may be liberated also to provide the required energy.

The sealing means on the first section may suitably be a deformable packing member or a series of rings of packing material. The sealing means on the second section may be of similar construction.

The pipe gripping means carried on the second section in inoperative position may be pipe slips, dogs, and the like which are designed to bite into and engage with the wall of the well bore such as one that has been lined with a casing cemented into place.

The invention will be further illustrated by reference to the drawing in which the single figure is a sectional view of a preferred embodiment.

Referring now to the drawing, numeral 11 designates an elongated body member comprised of a first section indicated generally by the numeral 12 and a second section indicated generally by the numeral 13. The first section is releasably or detachably connected to the second section by frangible means such as a plurality of shear pins 14.

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The first section has a cavity 15 which contains a source of energy 16 made up of a plurality of bodies 17, of an explosive or propellant, such as of the type mentioned before, separated by time fuse material 18 which causes the ignition of the next body of the explosive 16 as the succeeding body is ignited and consumed.

Arranged adjacent the lower body of explosive 17 in the cavity 15 is a hydrostatically operated primer chamber 19 which causes the first of the bodies 17 to be ignited or detonated or otherwise to initiate reaction, when the elongated member 17 has reached a predetermined depth in the well bore. As the propellant is energized or released the gases which are released will be directed and removed through a sized orifice 20 in the annular member 21 which is threadably engaged in the annular member 22 holding the primer 19 in place. The gases released through the orifice 20 are directed through the spaced openings 23 in the plate 24 arranged in an annular member 25.

The lower portion of the section 12 encloses a space 26 which is separated by the plate 24 into a smaller space 26a.

Arranged above the uppermost of the explosive 17 in a passageway 27 is a closure member 28 provided with a shank 29 and a head 30. The closure member 28 is sealed in the passageway 27 by means of an O-ring 31 in a recess 32.

The upper end of the section 12 has a passageway 33 which divides into lateral passageways 34. The upper end of the passageway 33 proceeds through an upthrusting member 35 having an annular collar 36 to which is movably attached a bumper head 37. Embracing or surrounding the member 35 and held apart from the section 12 by a spring or shock absorber means 38. The section 12 is provided with a packing member 39 which may be a plurality of packing rings 40 constructed of suitable deformable material which will seal with the walls of the casing and the like.

The bumper head 37 is provided with an inwardly projecting lip or shoulder 41 for engagement with a suitable dog mechanism in the lubricator of a wellhead, not shown.

The second section 13 has arranged internally a plug member 42 which is provided with a fishing head and stem 43. The plug member 42 is arranged in operative relationship with pipe gripping means or pipe slips 44 for urging the latter into operative position as will be described. Carried on the section 13 is a packing means 45 which may be similar to packing rings 40 of the packing member 39. The second section 13 defines a circular indent 46 on its outer surface for engagement of a second dog mechanism, not shown, in the wellhead.

The plug member 42 is provided with a sealing surface 47 which is adapted to cooperate in seating engagement with the seating surface 48 of the section 13.

It is to be noted that the section 13 is provided with an opening 49 to allow entry of fluids into the section 13 and which may pass upwardly through the section 13 by clearance between the pipe gripping means 44 and the plug 42 defining a passageway 50 and between the seating member 48 and the seating surface 47 which defines a passageway 51 into the space 26 which communicates with the exterior of the elongated member 11 by means of a passageway 52 defined by the sections 12 and 13 providing a clearance between the downwardly thrusting collar 53 of the section 12 and the upwardly thrusting collar 54 of the section 13.

The present invention is adaptable for removal of superimposed or accumulated excessive liquid heads from well bores having formation pressure insufficient for this purpose.

In the present invention the device may be lowered

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into the well bore by free fall or by wire line engagement with the bumper head 37 or by other means as may be desired. When liquid removal is to be initiated, the device of the present invention will be lowered into the well bore to a predetermined depth to allow initiation of the release of energy by the hydrostatically operated primer 19. By release of the propellant or by firing of the explosive 17, the expanding gases resulting therefrom would be directed through the orifice 20 into the space 26a and thence through the orifices 23 against the plug 42 causing surfaces 47 and 48 to close the passageway 51 and rupture the shear pin 14, releasing the section 12 from the section 13 and also forcing the slips 44 into engagement with the wall of the casing, not shown. The section 12, like the section 13 would be in sealing engagement with the wall of the casing by virtue of the packers 39 and 43 and a column of liquid trapped above the section 12 would then be propelled to the earth's surface. As the series of explosives 17 are fired on upward travel of the section 12, the section 12 would be propelled upwardly through the well until it reaches the wellhead including a lubricator not shown. The lip or shoulder 41 would engage with a suitable dog mechanism provided for that purpose and to catch the section 12. The shock absorber or spring 38 would absorb or dissipate the force of impact resulting from the section 12 reaching the well head.

After the section 12 has reached the surface and carried the liquid upwardly therewith, the section 13 is designed to be recovered in the following manner: The reduction of hydrostatic head caused by removal of fluid from the well bore will effect a pressure differential acting from below the plug 42 to urge it upwardly and thereby permit release of the pipe gripping means 44, normally effective only in one direction. The velocity of flow acting from beneath the relatively restricted passageways of the section 13 will move the entire unit from the well bore into the wellhead and/or lubricator, not shown, where the circular indent 46 engages with a second dog mechanism to hold same in place at the surface. If this means of recovery is not effective, the section 13 may be retrieved by lowering a wire line to which a fishing tool is attached to engage with the fishing head and stem 43 for recovery in conventional wire line manner.

In the practice of the present invention the section 13 acts as a base for sealing off the lower portion of the well to allow maximum benefits to be derived from the propellants or explosives releasing energy and to prevent excessive and possibly detrimental pressures being applied to the lower formation in the well bore.

The section 12 and the section 13 are provided with fluid passageways 33 and 34 and 50, 51 and 52, respectively, to allow fluid to be bypassed through and around the tool as the tool is being lowered into the well.

The pipe gripping means 44 are so constructed to prevent downward movement of the plug 42 while the plug 42 will allow release of the slips on formation pressure from below, moving the plug 42 upwardly after the release of the section 12. Thus the section 12 when formation pressure is sufficient may be retrieved by flow of the well fluids or liquids causing it to travel up the well bore. Otherwise it may be retrieved by engagement with the wire line fishing tool and pulling up in the well.

In the event of any difficulties, either the section 12

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or section 13 or both of them may be retrieved by engagement with suitable wire line fishing tool.

Thus the present invention is quite useful and has great utility in removal of well liquids and fluids where initially the formation pressure is insufficient to move the column of liquid or it is desired to swab the well to initiate production.

The nature and objects of the present invention having been completely described and illustrated, what we wish to claim as new and useful and to secure by Letters Patent is:

1. A tool for removal of liquid from a well bore which comprises an elongated member provided with an upper section being formed to provide a first chamber, a body of propellant explosive and a primer means for firing said propellant arranged in said first chamber, first closure means arranged in said upper section adapted to sealingly close the upper end of said first chamber, a lower section detachably connected to said upper section and being formed to provide a second chamber, the upper end of which before detachment fluidly communicates with the lower end of said first chamber, movable pipe gripping means carried by said lower section adapted to secure said lower section in the well bore, movable second closure means arranged in said second chamber having first and second positions adapted to close off the lower end of said second chamber when in said second position and to fluidly communicate said second chamber and said well bore when in said first position, said second closure means operatively engaging with said pipe gripping means to move said pipe gripping means into pipe gripping position upon movement of said second closure means from said first to said second position, first sealing means carried by said upper section adapted to close off downwardly directed fluid flow in the annulus between said upper section and said well bore and second sealing means carried by said lower section adapted to close off downwardly directed fluid flow in the annulus between said lower section and said well bore.

2. An apparatus as recited in claim 1 wherein said upper section is formed to provide lateral passageways adapted to fluidly communicate said first chamber and the annulus between said upper section and said well bore below said first sealing means, said first closure means being movable and having a first and second position whereby fluid communication through said passageways is closed off when said first closure means is in said first position and fluid flow through said passageways is permitted when said first closure means is in said second position.

3. An apparatus as recited in claim 2 wherein said body of explosive comprises a plurality of propellant explosives separated by time fuse materials whereby each body of propellant explodes successively at timed intervals following detonation of the body of propellant exploded by the hydrostatically operated primer.

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