

Oct. 12, 1965

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3,211,222

PRESSURE ACTUATED FISHING APPARATUS

Filed Jan. 9, 1963

3 Sheets-Sheet 1

FIG. 1.

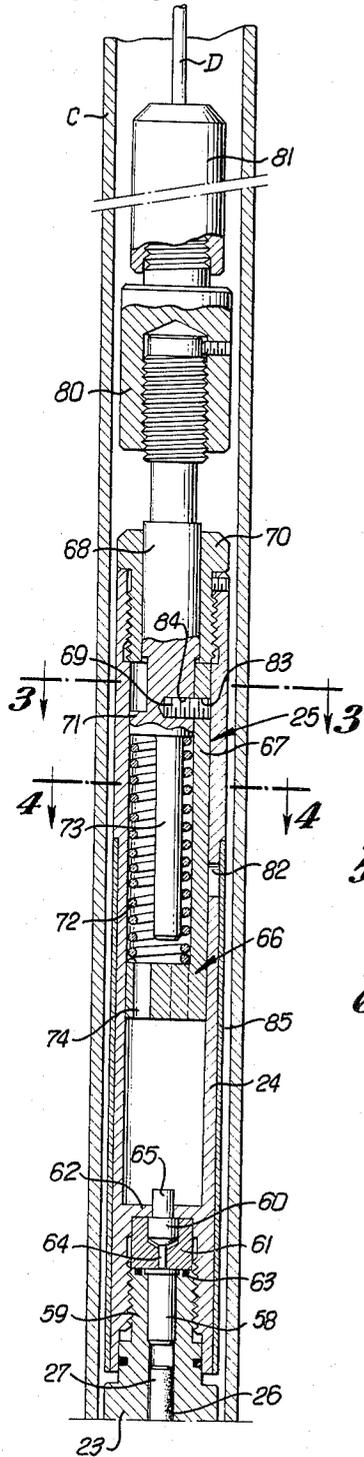


FIG. 1a.

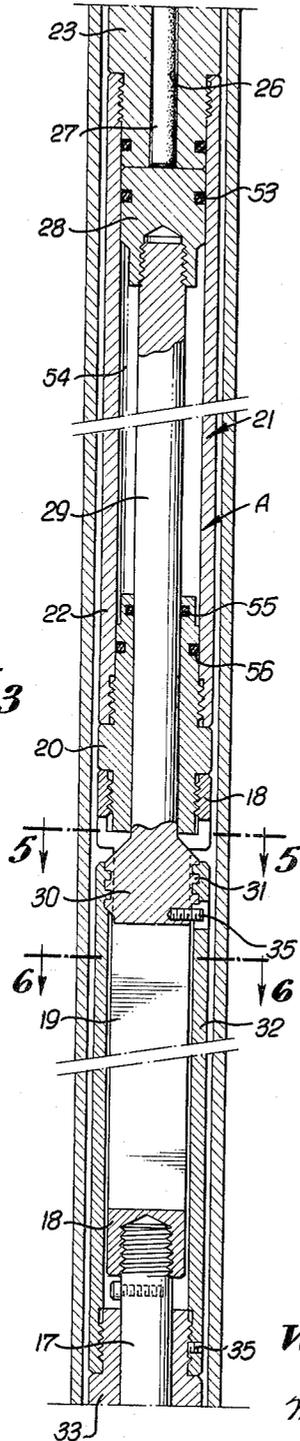
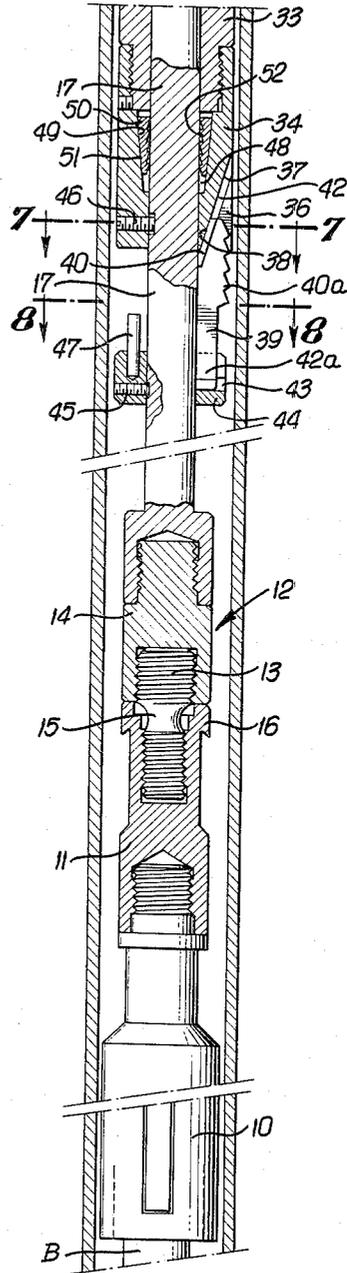


FIG. 1b.



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FIG. 2.

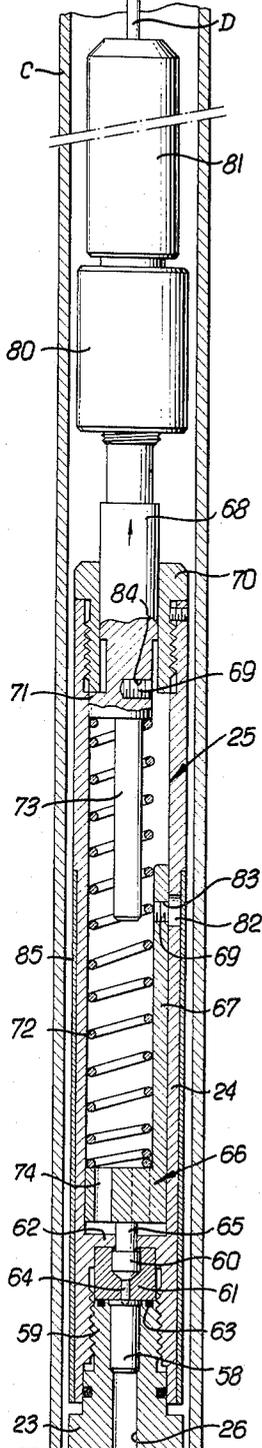


FIG. 2a.

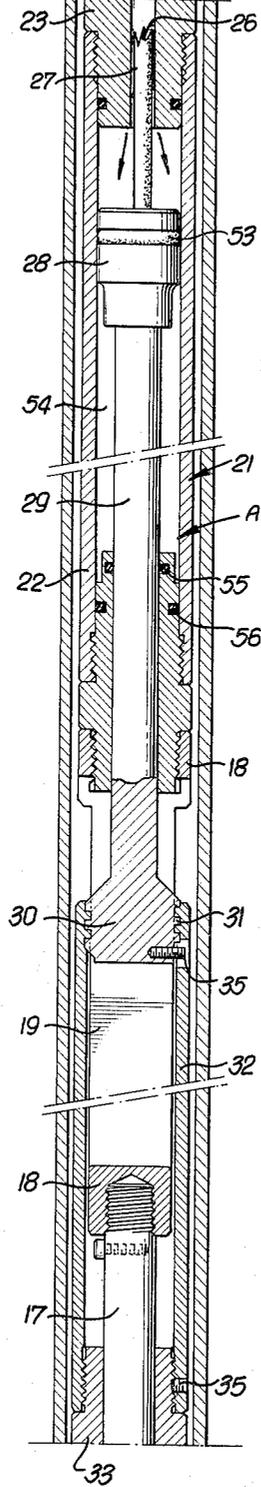
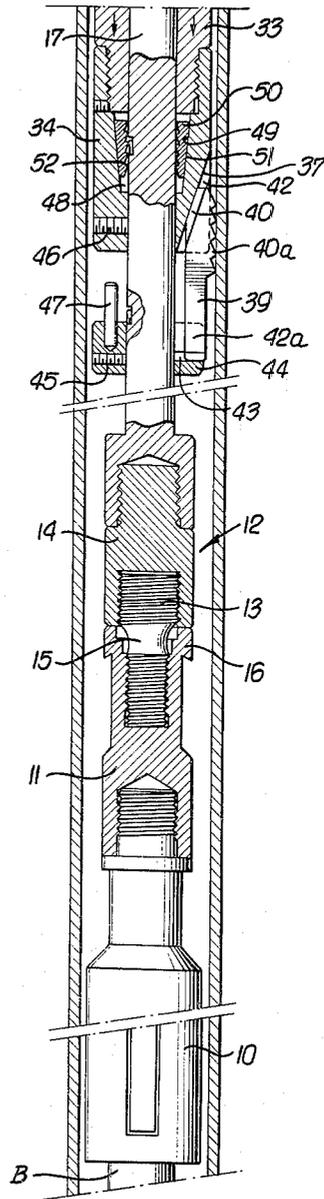


FIG. 2b.



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FIG. 3.

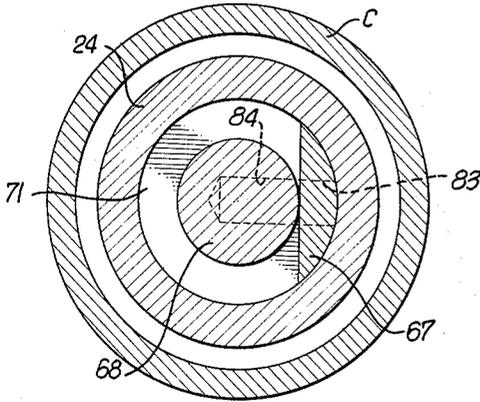


FIG. 4.

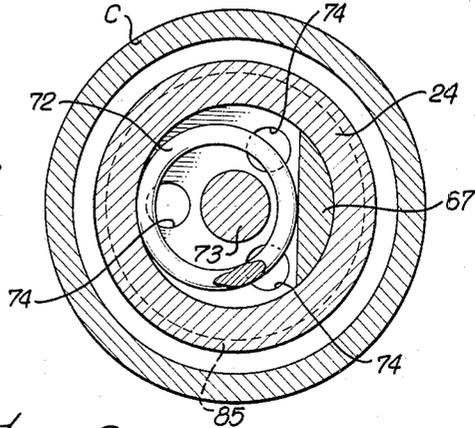


FIG. 5.

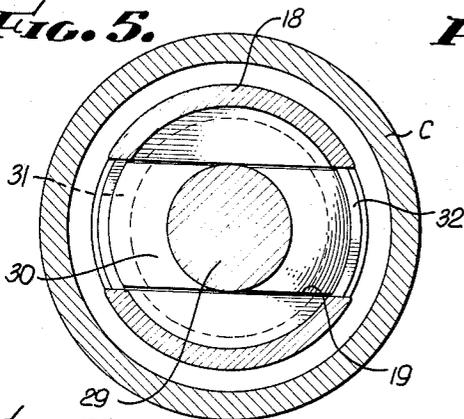


FIG. 6.

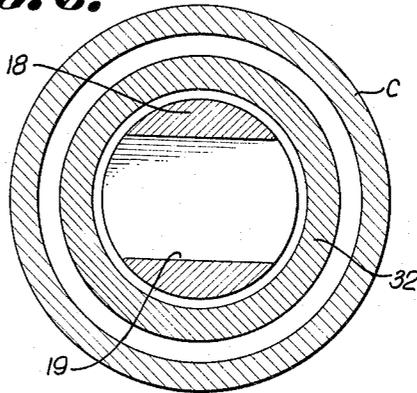


FIG. 7.

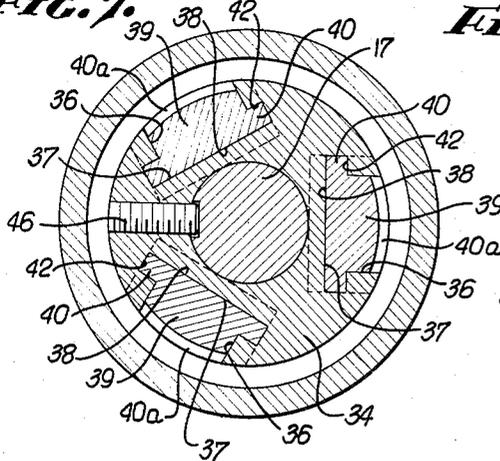
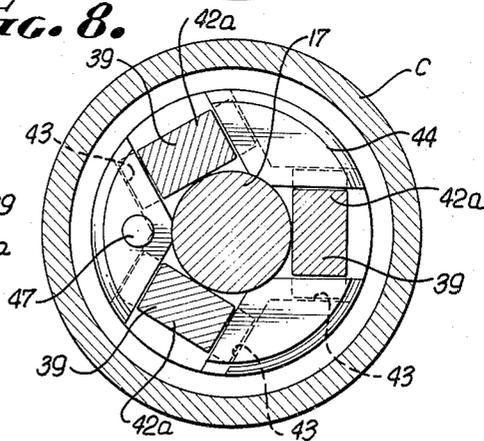


FIG. 8.



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PRESSURE ACTUATED FISHING APPARATUS
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Filed Jan. 9, 1963, Ser. No. 250,289

9 Claims. (Cl. 166-63)

The present invention relates to subsurface well apparatus, and more particularly to apparatus for releasing and retrieving devices from well bores.

An object of the invention is to provide apparatus capable of exerting a high force on a device to be released from a well bore without the necessity for transmitting the force from the top of the hole down the well bore to the device.

Another object of the invention is to provide an apparatus adapted to be lowered in a well bore on a wire line to the location of a device to be released from the well bore, the apparatus being adapted to be coupled to the device and capable of exerting a high releasing force thereon without such force being transmitted through the wire line. In a more limited sense, the apparatus can exert a high pulling force on the device or fish disposed in and to be released from the well bore.

A further object of the invention is to provide apparatus to be lowered in a well bore on a running-in string for exerting a high force, such as a pulling force, on a device to be released from the well bore without the necessity for transmitting the force through the running-in string, substantially all of the apparatus being releasable and recoverable from the well bore in the event of its inability to release the device, or in the event of its malfunctioning.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of 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:

FIGURES 1, 1a and 1b together constitute a longitudinal section, with parts shown in side elevation, of a fishing apparatus disposed in a tubular string preparatory to its actuation, FIGS. 1a and 1b constituting lower continuations of FIGS. 1 and 1a, respectively;

FIGS. 2, 2a and 2b are views similar to FIGS. 1, 1a and 1b disclosing the apparatus conditioned for exerting a force on a device to be released from the tubular string, FIGS. 2a and 2b constituting lower continuations of FIGS. 2 and 2a, respectively;

FIG. 3 is an enlarged cross-section taken along the line 3-3 on FIG. 1;

FIG. 4 is an enlarged cross-section taken along the line 4-4 on FIG. 1;

FIG. 5 is an enlarged cross-section taken along the line 5-5 on FIG. 1a;

FIG. 6 is an enlarged cross-section taken along the line 6-6 on FIG. 1a;

FIG. 7 is an enlarged cross-section taken along the line 7-7 on FIG. 1b; and

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FIG. 8 is an enlarged cross-section taken along the line 8-8 on FIG. 1b.

An apparatus A has been specifically provided for releasing a device B, such as a choke, which is stuck in a string of production tubing C, or other tubular string, or other fish that is to be removed from the tubular string disposed in a well bore. The apparatus is lowered in the tubular string C from the top of the hole on a running-in string D, such as a wire line, which can be piano wire. Actually, the apparatus is capable of performing its function of freeing the fish in the tubular string without the necessity for transmitting any force from the top of the hole down through the wire line D to the apparatus. The motivating force to be exerted on the fish B is supplied within the apparatus itself.

The apparatus A includes a suitable fishing device, such as an overshot 10 of any desired type, which is adapted to fit over the fish B, such as the choke, stuck in the tubular string C. Details of the overshot are unnecessary to an understanding of the present invention and, for that reason, are not illustrated. It is sufficient to note that it is capable of fitting over the fish B and to be coupled thereto upon being subjected to an upward movement or force. The upper end of the overshot is threadedly connected to a lower connector or coupling 11 forming the lower portion of a safety joint 12. The safety joint includes a tension release stud 13 threadedly secured to the lower coupling 11 and also threadedly secured to an upper connector 14, the release stud having a central weakened section 15 at which it will part when subjected to a predetermined tensile force. The lower coupling or connector has an outwardly directed flange or fishing head 16. In the event the release stud 13 is parted and it is then necessary to lower another fishing tool (not shown) into the tubular string to release the fish B, such other fishing tool will move over the head 16 of the lower connector 11 and be coupled thereto, in a known manner.

The upper connector 14 of the safety joint is threadedly attached to the lower portion of a tension rod or mandrel 17 on which an upwardly directed force is to be imposed, as described hereinbelow. The upper end of this rod is threadedly secured to the lower end of a tension mandrel 18 having an elongate transverse slot 19 therethrough, the upper portion of this tension mandrel being threadedly secured to the lower head 20 of a cylinder 21 in which fluid pressure is to be generated for the purpose of exerting an upward force on the cylinder 21 and on the tension mandrel 18 and rod 17. The lower cylinder head 20 is threadedly secured to a cylinder sleeve 22 that extends upwardly therefrom, the upper portion of this cylinder sleeve being threadedly secured to an upper cylinder head 23, which, in turn, is threadedly attached to the housing 24 of a firing device 25.

The upper cylinder head 23 has a central propellant chamber 26 therein, in which a propellant or power charge 27 can be disposed. When ignited, the propellant will burn away and generate a gas at an increasing pressure, this gas acting downwardly upon a piston 28 slidable in the cylinder 21, the piston being attached to a piston rod 29 extending within the cylinder sleeve 22 and slidable in the lower head 20 and the mandrel 18. Below the head 20, the piston rod is integral with a cross-over link or head 30 extending in the mandrel slot 19, this cross-over link having its outer portion 31 threaded for attachment to the upper end of a thrust sleeve 32 extend-

ing around the mandrel 18 with its lower end threadedly attached to a coupling or connector 33, which, in turn, is threadedly secured to the upper end of an expander 34. Inadvertent unscrewing of the thrust sleeve 32 from the cross-over member 30 and from the connector 33 is prevented by set screws 35.

The expander 34 has circumferentially spaced slots 36 therein, the bases 37 of which taper in a downward and inward direction to provide expander surfaces engageable with companion tapered surfaces 38 on slips 39 mounted within the slots 36. The slips have external wickers or teeth 40a facing in a downward direction and engageable with the wall of the tubular string C to anchor the expander 34 and the parts thereabove connected thereto against movement in a downward direction in the tubular string. Each slip has tapered side tongues 40 adapted to fit within companion grooves 42 in the expander, forming a positive interconnection between the expander and each slip, whereby downward movement of the expander 34 within the slips 39 will shift the latter outwardly into engagement with the wall of the production tubing C, and relative upward movement of the expander will effect a retraction of the slips 39 from the wall of the production tubing C.

The slips 39 are movable longitudinally jointly, while their radial movement is permitted, by forming their lower ends as T-shaped heads 42a adapted to fit within companion radial T-shaped slots 43 in a slip ring 44 disposed around the mandrel 17. Initially, the slips 39 are in a retracted position, as disclosed in FIG. 1b, being releasably retained in such position by releasably securing the slip ring 44 to the mandrel 17 by one or more shear screws 45 and by releasably securing the expander 34 to the mandrel 17 by one or more shear screws 46. Downward movement of the expander 34 along the mandrel will disrupt its shear screw 46 and shift it downwardly along the slips 39 and expand the latter outwardly against the production tubing C. The extent of movement of the expander along the mandrel 17 and toward the slips 39 is limited by a longitudinally extending limit pin 47 secured to the slip ring 44 and projecting upwardly therefrom a partial distance toward the expander 34.

The expander 34 and the members thereabove connected thereto can move relatively downwardly along the tension rod or mandrel 17, but relative upward movement is prevented by a one-way lock device. As shown, the expander 34 has an internal groove 48 formed therein in cooperation with the connector 33, the side wall 49 of which tapers in a downward and inward direction. This groove contains a split lock ring 50 having an external tapered surface 51 companion to the internal surface 49 in the expander, the lock ring also having internal wickers or teeth 52 facing in an upward direction so as to grip the periphery of the tension rod 17 and prevent relative upward movement of the expander 34 along the tension rod 17. The one-way lock device will also prevent relative downward movement of the tension rod or mandrel within the expander.

The piston 28 has a suitable seal ring 53 thereon slidably and sealingly engageable with the wall of the cylinder sleeve 22. The low pressure side 54 of the cylinder below the piston 28 initially contains air at atmospheric pressure, any fluid in the tubular string C being prevented from passing into the cylinder below the piston 28 by a suitable seal ring 55 mounted on the lower head 20 and sealingly engaging the piston rod 29. Another seal ring 56 mounted on the head engages the cylinder sleeve 22 to prevent leakage through the threaded connection between the lower head 20 and cylinder sleeve.

The propellant or power charge 27 contains its own source of oxygen and, when ignited, will progressively burn away to generate gas at an increasing pressure within the cylinder 21, urging the piston 28 downwardly and the cylinder 21 relatively in an upward direction. The downward movement of the piston 28 is transmitted through

the piston rod 29 and the cross-over head 30 to the thrust sleeve 32, from where the downward movement or force is transmitted through the connector 33 to the expander 34. The upward movement or force of the cylinder 21 is transmitted from its lower cylinder head 20 to the tension mandrel 18, and from the latter upwardly through the tension rod 17, which is connected through the safety joint 12 and its release stud 15 to the overshot 10, the upward force or movement then being exerted upwardly on the choke B, or other fish, disposed in the tubing string C, through the fact that the overshot is coupled thereto.

The propellant 27 may be of a known type. It may be provided in stick form, pellet form, or powder form, one specific type of propellant or power charge being described in United States Patent 2,640,547. It is ignited by firing a blank cartridge 58 mounted within the upper gun barrel portion 59 of the upper cylinder head 23. When fired, the flame issuing in a downward direction from the cartridge ignites the propellant 27. The blank cartridge is fired by a firing pin 60 slidably mounted in a breechblock or cap 61 disposed across the upper end of the gun barrel 59, being clamped thereagainst by an inwardly directed flange 62 of the housing 24. Fluid leakage into the gun barrel 59 is prevented by a suitable gasket seal 63 between the breechblock and the upper end of the barrel.

The firing pin 60 has a lower projection 64 extending through the breechblock 61, which is adapted to engage the upper end of the cartridge 58. It also has an upwardly extending stem 65 projecting through the flange 62 into the interior of the housing 24. This stem is adapted to be hit by a striker 66 mounted within the housing 24 and disposed initially a substantial distance above the firing pin stem. The striker is slidable in the housing and has an upwardly extending arm 67 at one side secured to a mandrel 68 by a shear screw 69. Movement of the striker 66 and mandrel 68 in an upward direction within the housing 24 is limited by engagement of the upper end of the arm 67 with a head 70 extending into the housing and threadedly secured thereto. The mandrel 68 also has a stop flange 71 disposed within the housing and adapted to engage the lower end of the head 70, after the shear screw 69 has been disrupted. This stop flange 71 also functions as an upper seat for a helical compression spring 72 disposed within the housing and along the striker arm 67, the lower end of the spring engaging the striker 66. This spring is retained in appropriate operative position when in its compressed condition by an aligning pin 73 integral with and depending from the mandrel 68. The striker 66 also has a plurality of longitudinal by-pass ports 74 therein to prevent air, or other fluids, in the housing 24 from retarding downward movement of the striker 66 when the compression spring 72 is released as a result of shearing of the screw 69, as described hereinbelow.

The mandrel 68 is movable downwardly within the housing 24 to an extent limited by engagement of the lower end of an upper sub 80, threaded on the upper end of the mandrel, with the upper end of the head 70. The upper end of this sub 80 is threadedly attached to sinker bars or a set of jars 81, which are, in turn, suitably secured to the wire line D extending to the top of the well bore.

To facilitate compressing the spring 72 and attaching of the striker arm 67 to the mandrel 68, the housing 24 has a suitable lateral access hole 82 therethrough, which is, at first, open to the exterior of the housing. Prior to assembly of the housing 24 to the upper cylinder head 23, the striker 66 is disposed in the housing and the spring 72 also placed therein. The mandrel 68 is then lowered into the housing, the striker resting upon the flange 62, at which time the hole 83 of the striker arm 67 is aligned with the access hole 82. The mandrel 68 is then shifted downwardly to compress the spring 72, until its threaded hole 84 for the shear screw 69 is aligned with

the arm hole 83, whereupon the shear screw 69 can be inserted through the access hole 82 and threaded into the arm hole 83 and the mandrel hole 84, which will serve to secure the striker mechanism 66 to the mandrel 68 with the spring 72 in its highly compressed condition. The head 70 can then be slipped over the mandrel 68 and threaded into the housing 24. A cover sleeve 85 is slipped over the housing 24 to cover the opening 82, the housing 24 then being assembled on the upper cylinder head 23 with the firing pin 60, breechblock 61, blank cartridge 58, and the propellant 27 in their proper positions. The attachment of the upper sub 80 to the mandrel 68 will prevent the mandrel from moving downwardly sufficiently for the striker 66 to engage the firing pin stem 65.

Assuming that it is desired to release a stuck choke B, or other fish, from the production tubing C, the apparatus A is connected to the running-in string D, such as the wire line, and is run into the production tubing until the overshot 10 moves over the fish B and latches onto this stuck tool. If desired, downward jarring action can be imparted on the apparatus A, since the upper sub 80 will engage the head 70 and the downward jarring force transmitted through the housing 24, cylinder 21, tension mandrel 18, tension rod 17, and safety joint 12 to the overshot 10, without effecting firing of the mechanism or relative shifting of any other parts.

With the overshot 10 engaged with the fish B, an upward jarring action can take place, the wire line D, sinker bars or jars 81, and upper sub 80 moving upwardly, to move the mandrel 68 and striker device 66 upwardly, the striker arm 67 engaging the head 70, whereupon the upward jarring action shears the screw 69 securing the arm to the mandrel 68 to release the spring 72. The spring propels the released striker 66 downwardly into contact with the firing pin 60 with sufficient force to fire the blank cartridge 58, the flame emanating therefrom igniting the power charge 27 in the propellant chamber 26. The pressure generated by the burning of the power charge acts downwardly on the piston 28 and upwardly on the upper cylinder head 23, the cylinder 21 and parts connected thereto being incapable of upward movement since the overshot 10 is attached to the stuck choke B, or other fish. When the pressure exceeds the shear strength of the screw 46 securing the expander 34 to the mandrel 17, the screw is disrupted and the expander shifted downwardly within the slips 39, expanding the latter outwardly into anchoring engagement with the wall of the tubing C. When this occurs, the piston 28 cannot move downwardly to any further extent. As a result, the pressure in the cylinder 21 is exerted in an upward direction thereon, being transmitted through the tension mandrel 18, tension rod 17, upper connector 14, release stud 13, and lower connector 11 to the overshot 10, the latter being coupled to the fish B and exerting an upward pull thereon.

The fluid pressure in the cylinder 21 increases as the propellant 27 burns away, until the fish B is released from the tubing string C. Upward movement of the tension mandrel 17 is permitted relative to the slips 39 and the expander 34 since the shear screw 45 securing the slip ring 44 to the mandrel will disrupt. When the fish B is released, the cylinder 21 can shift upwardly to the maximum extent determined by engagement of the piston 28 with the lower cylinder head 20, after which the wire line D can be elevated, the elevating movement being transmitted through the mandrel stop flange 71 and the head 70 to the housing 24 and cylinder 21, which will pull upwardly on the tension mandrel 18, tension rod 17, safety joint 12, overshot 10, and fish B. Such upward movement is also transmitted to the piston 28 and the piston rod 29, which will then pull upwardly on the thrust sleeve 32 to shift the expander 34 upwardly, allowing the slips 39 to drop downwardly relatively along the expander. In view of the tongue and groove interconnection 40, 41 between the expander and slips, the slips 39 will shift back to their

retracted position. The apparatus A can now be withdrawn from the production tubing C with the fish B in the overshot 10.

In the event that the stuck tool B cannot be released as a result of the pressure generated in the cylinder 21, the pressure capable of being generated is more than sufficient to overcome the strength of the release stud 13 at its weakened section 15. Accordingly, with the tool remaining stuck in the production tubing C, the release stud disrupts at its section 15, allowing the apparatus thereabove to be withdrawn from the production tubing. Thereafter, other tools (not shown) can be lowered through the production tubing and coupled onto the lower connector coupling 11, these other tools being capable of exerting a much greater force on the stuck choke B to effect its release.

In the event that the release stud 13 does not part as a result of inadequate pressure in the cylinder 21, the wire line D can be manipulated to impose an upward jarring action on the apparatus. The stop flange 71 will jar upwardly against the head 70, the upward jarring force being transmitted through the housing 24 and cylinder 21 to the tension mandrel 18 and the tension rod 17. If there is any elasticity in the train of mechanism resulting from such upward jarring action, the tension rod 17 will be prevented from moving downwardly, once it has shifted upwardly, by virtue of the one-way gripping action of the latch ring 50 thereon. Whatever upward movement on the tension rod or mandrel 17 is obtained is retained, since its downward movement cannot occur, in view of its being locked through the ring 50, expander 34 and slips 39 to the production tubing C against downward movement with respect thereto. The jarring action eventually disrupts the tension stud 13, allowing the apparatus to be withdrawn from the tubular string.

It is evident that a fishing apparatus has been provided which is capable of exerting a very large force on the fish B and release it from the production tubing. None of the force need be transmitted through the wire line D, since the force is generated within the apparatus itself. The pressures generated can be quite substantial, being of the order of 10,000 to 50,000 p.s.i. within the tool. If there is any liquid present in the production tubing, it is not necessary to overcome the entire hydrostatic head of such liquid since the low pressure side 54 of a cylinder 21 initially contains air at atmospheric pressure, the well fluid being prevented from entering the cylinder. Only the hydrostatic head of fluid acting over the cross-sectional area of the piston rod 29 need be overcome. The apparatus A is fired after the overshot 10 has been coupled to the fish itself, the spring 72 employed in the firing mechanism 25 being relatively large in diameter and capable of exerting a large downward propelling force on the striker 66 to insure firing of the cartridge 58. In the event of malfunctioning of the apparatus A, or its inability to release the fish B, assurance is had that substantially all of the apparatus can, nevertheless, be retrieved from the production tubing, either as a result of the pressure generated in the cylinder releasing the safety joint 12, or as a result of the jarring action imposed on the apparatus disrupting the safety joint. Whatever tension is placed on the release stud 13 is retained since the tension rod or mandrel 17 is prevented from shifting down to any extent by the action of the one-way lock device 48-52.

I claim:

1. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; cylinder means; piston means in said cylinder means and movable relatively downwardly therein; force transmitting means connecting said cylinder means to said fishing tool; slip means carried by said force transmitting means; expander means connected to said piston means and engageable with said slip means and responsive to downward movement of said piston means to expand said slip means; and means providing a fluid under pressure in said cylinder

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means for shifting said piston means downwardly thereof to cause said expander means to expand said slip means and to cause said cylinder means and force transmitting means to move upwardly and exert an upward force on said fishing tool tending to release the device.

2. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; cylinder means; piston means in said cylinder means and movable relatively downwardly therein; force transmitting means connecting said cylinder means to said fishing tool; slip means carried by said force transmitting means; expander means connected to said piston means and engageable with said slip means and responsive to downward movement of said piston means to expand said slip means; and means for generating a gas under pressure in said cylinder means for shifting said piston means downwardly thereof to cause said expander means to expand said slip means and to cause said cylinder means and force transmitting means to move upwardly and to exert an upward force on said fishing tool tending to release the device.

3. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said slip means; means connecting said piston means to said expander; and means providing a fluid under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against said slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device.

4. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said slip means; means connecting said piston means to said expander; means for generating a gas under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against said slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device; and means responsive to manipulation of the running-in string for initiating operation of said gas generating means.

5. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said slip means; means connecting said piston means to said expander; means providing a fluid under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against said slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device; and one-way lock means operatively connecting said expander and force transmitting means and permitting upward movement only of said force transmitting means relative to said expander.

6. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said

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slip means; means connecting said piston means to said expander; a propellant in said cylinder for generating a gas under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device; a cartridge for initiating combustion of said propellant; and means responsive to upward movement of said running-in string for firing said cartridge.

7. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said slip means; means connecting said piston means to said expander; a propellant in said cylinder for generating a gas under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against said slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device; a cartridge for initiating combustion of said propellant; a firing pin for said cartridge; a striker for striking said pin, releasable means retaining said striker in ineffective position; and means operable by the running-in string for releasing said releasable means and allowing said striker to strike said pin.

8. In apparatus for releasing a device in a well bore: a fishing tool adapted to be coupled to the device; a cylinder; piston means in said cylinder; force transmitting means connecting said cylinder to said fishing tool; slip means on said force transmitting means; an expander on said force transmitting means and engageable with said slip means; means connecting said piston means to said expander; a propellant in said cylinder for generating a gas under pressure in said cylinder for moving said piston means downwardly and said cylinder upwardly to shift said expander downwardly against said slip means and expand said slip means outwardly against the wall of the well bore and to then urge said cylinder upwardly to exert an upward force on said force transmitting means and fishing tool to release the device; a cartridge for initiating combustion of said propellant; a firing pin for said cartridge; a housing connected to said cylinder; a striker in said housing for striking said pin; spring means for propelling said striker against said pin; a mandrel in said housing and adapted to be connected to the running-in string; shear means connecting said mandrel to said striker to prevent said spring means from propelling said striker against said firing pin, said shear means being disruptable upon coupling of said fishing tool to the device and the taking of an upward pull on said mandrel by the running-in string.

9. In apparatus for releasing a device in a well bore: fluid actuated means adapted to be lowered in the well bore on a running-in string and having relatively movable members; means connected to one of said members and adapted to engage the device; expandible and retractable gripping means engageable with the wall of the well bore for anchoring the other of said members in the well bore against longitudinal movement; a propellant in said fluid actuated means for generating a gas under pressure in said fluid actuated means for expanding said gripping means against the wall of the well bore and for exerting a force on said one member and the device tending to release the device; a cartridge for initiating combustion of said propellant; a firing pin for said cartridge; a housing connected to said fluid actuated means; a striker in said housing for striking said pin; spring means for propelling said striker against said pin; a mandrel in said housing and adapted to be operatively connected to the running-in string; shear

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means connecting said mandrel to said striker to prevent
 said spring means from propelling said striker against
 said firing pin, said shear means being disruptable upon
 taking of an upward pull on said mandrel by the running-
 in string.

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CHARLES E. O'CONNELL, *Primary Examiner.*