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INITIATING DEVICE FOR OIL WELL TOOLS

Filed April 21, 1959

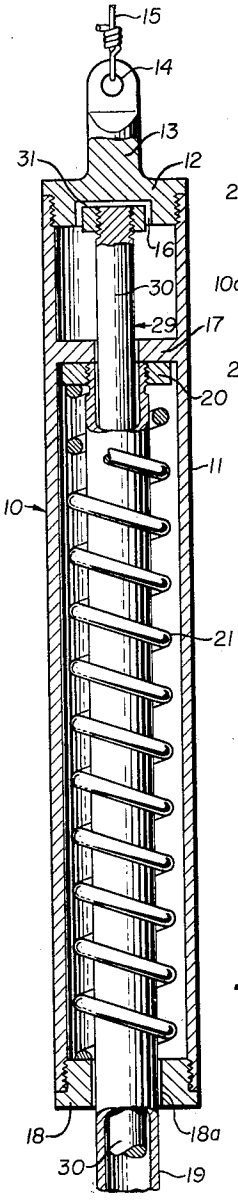


Fig-1

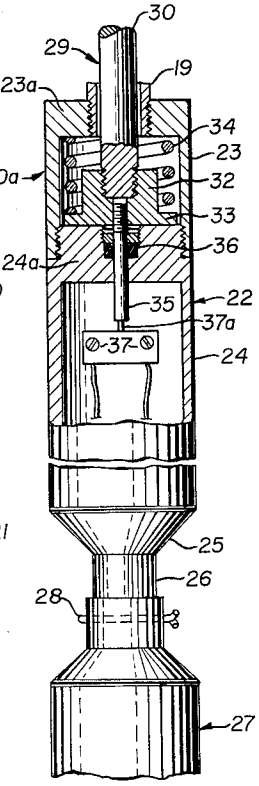


Fig-1a

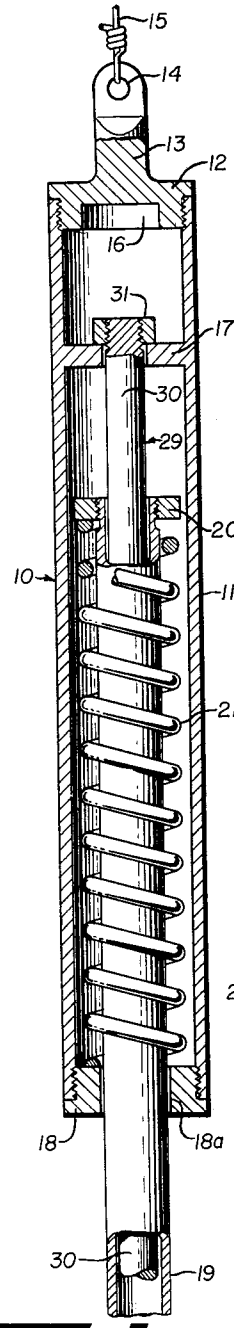


Fig-2

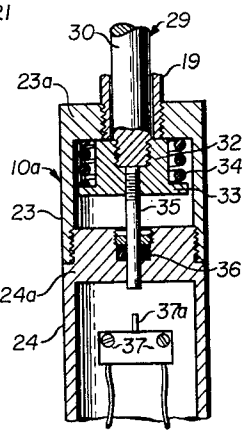


Fig-2a

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INITIATING DEVICE FOR OIL WELL TOOLS

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5 Claims. (Cl. 166—65)

The present invention relates generally to devices for initiating operation of well tools suspended by non-electric lines and particularly to the arrangement by which the initiating device is operated.

A device of the kind to which this invention relates has been disclosed in my copending patent application Serial No. 807,928, filed April 21, 1959, and assigned to the same assignee as is the present invention.

This invention is particularly directed to the arrangement by which the initiating mechanism is operated but is not concerned with the initiating mechanism itself, for details of which reference may be made to the copending patent application above referred to.

An object of the present invention is to provide a novel method of, and improved means for, operating initiating mechanism of a well tool suspended by a non-electric line.

With the above and other objects which will appear from the following specification and accompanying illustrative drawings, the invention comprises an operating means having a two-part casing with an upper tubular member connected to the suspending line and a lower tubular member containing the initiating mechanism and resiliently connected to the upper member. A trip member co-axially mounted in said upper and lower members is resiliently connected to the lower member and is positively engaged by the upper member after a certain amount of lost motion, the positive engagement of the trip member by the upper member effecting operation of the initiating mechanism in the lower tubular member.

In the drawings:

FIG. 1 is a fragmentary central vertical section through the upper portion of the device of the invention showing the idle position of the parts;

FIG. 1*a* is a fragmentary central vertical section through the lower portion of the device shown in FIG. 1;

FIG. 2 is a fragmentary section similar to FIG. 1 but showing the position of the parts while being jerked upwardly by a short pull on the suspending line; and

FIG. 2*a* is a fragmentary central section through a portion of the device shown in FIG. 2, in operative position.

In the drawings, the numeral **10** generally indicates the upper member and the numeral **10***a* indicates the lower member of the device.

The upper member of the device comprises a tubular casing **11**, the upper end of which is closed by a plug **12** threaded to the casing and furnished with an upwardly extending short shank **13** furnished with an eye **14** to which the lower end of a measuring line **15** is secured. The lower surface of plug **12** may be recessed as shown at **16**.

The inner surface of casing **11** toward the upper end thereof is provided with an inwardly extending centrally apertured partition or flange **17**. The lower end of the casing **11** is closed by a centrally bored plug **18** screwed into its lower end.

The lower member **10***a* of the device comprises an upwardly extending tubular part **19** of reduced diameter telescoping within upper member **10**, and guided for axial movement therein by sliding in the central hole **18***a* in plug **18** and by the sliding engagement of a head **20** screwed on the outer surface of the upper end of the tubular part **19** within the wall of the tubular casing **11**.

A coil compression spring **21** is arranged around the outer surface of the tubular part **19** and is under compression between the upper surface of plug **18** and the under surface of the head **20**. Spring **21** is stiff enough to carry the weight of the lower portion of the device and of the well tool suspended therefrom while holding head **20** against partition **17**.

The lower end of tubular part **19** is screwed into a built-up casing **22** of greater diameter than the tubular portion **19**. The built-up casing **22** comprises an upper end cap **23** having a thick upper end **23***a* into which tubular part **19** is screwed, and is itself screwed onto the thick upper end **24***a* of a pressure case **24**.

The lower end of the pressure case **24** is closed by a plug **25** screwed therein to and having a downwardly extending tubular portion **26** of reduced diameter to which a well tool **27** is connected, as for instance by a shear pin **28**.

A trip member **29** comprises a rod **30** mounted within the tubular part **19** and extending upwardly through the central opening in the partition or flange **17**. At its lower end rod **30** extends into the cap member **23**. The upper end of the rod **30** is fitted with a nut **31** which limits the downward movement of the rod **29** relative to the upper member **10** of the device by engagement with the upper surface of partition **17**. The lower end of the rod **29** is screwed into a lower head **32** in cap member **23**, which limits the upward and downward movement of the rod with respect to the lower tubular member **10***a*.

Lower head **32** is formed with a radially extending flange **33** around its lower end and a coil spring **34** is arranged around the lower head **32** under compression between the flange **33** and lower surface of the upper end **23***a* of cap **23**. Spring **34** therefore holds rod **19** resiliently in retracted relation to the lower member **10***a* of the casing.

An operating plunger **35** is screwed into the lower head **32** to project downwardly through an axial bore in the thick upper end **24***a* of the pressure case **24** and to project into the latter. Sealing means **36**, preferably an O ring, are positioned in a peripheral groove in the upper end **24***a* of the pressure case around the axial bore therethrough to provide a liquid tight seal against the surface of operating plunger **35**.

The vertical movement of the operating plunger **35** is utilized to operate initiating mechanism mounted in the pressure case **24**, and while such mechanism may be of any suitable type either mechanical, or electrical as described in copending patent application Serial No. 807,928, filed April 21, 1959, a normally closed switch **37**, that is one which closes a circuit while the plunger **37***a* is free of pressure, is shown as the element operated by the movement of the operating plunger. Spring **34** in the normal or idle position of the parts holds lower head **32** against the top **24***a* of the pressure case, and presses the operating plunger **35** against the switch plunger **37***a* thus holding open the circuit controlled by the switch.

Operation

The initiating device, with whatever tool or instrument is to be positioned attached to the device, is lowered into the well to the predetermined depth, for example, by a measuring wheel over which the suspending line is run. Such measuring lines are standard accessories in the oil well art.

In the idle position of the device the movement of the lower member **10***a* of the device (containing the initiating mechanism and supporting the well tool) into the upper member **10** (suspended from the line) is limited by the engagement of head **20** with partition **17**. The plunger **37***a* of switch **37** is pressed inward by the operat-

ing plunger 35 because of the action of spring 34. Spring 34 is provided to ensure that the plunger 37*a* of switch 37 is depressed and the initiating electrical circuit broken until head 20 is engaged by partition 17.

It will be noted that fluid tight fits are reduced to a minimum, being restricted to the lower member 10*a* containing the actual initiating mechanism. The presence of well fluid in the upper portion 10 is of no consequence.

It should be noted that while electrical initiating means are indicated in the drawings, particulars of which are given in copending patent application Serial No. 807,928, filed April 21, 1959, the initiating mechanism may equally well be of a mechanical type since the plunger 35 could operate such mechanism. Also, although operating plunger 35 is shown as directly working against the switch plunger 37*a* for simplicity, the plunger 35 could act directly on the switch mechanism since the movement of the plunger is limited by engagement of lower head 32 against the top 24*a* of pressure case 24. Alternatively the plunger 35 could work against some mechanical arrangement transmitting movement to the switch plunger 37*a* and protecting it against direct impingement by the operating plunger 35.

Adjustment of the effective length of the operative plunger 35 may be readily made in assembling the device by screwing the plunger 35 a greater or lesser distance into the head 32.

At the predetermined depth, the device is lowered a short further distance and the suspending line given a sharp upward jerk. Since the line is directly secured to the upper member 10, that member will also move upward sharply, but the lower member 10*a* of the device, because of the lagging of the lower member due to the inertia of its weight and that of the tool or instrument suspended therefrom, will cause compression of spring 21.

The head 20 of lower member 10*a* of the casing will thereupon be left behind by partition 17 in the upper member of the casing. Nut 31 on the upper end of trip rod 30, which is resiliently held for movement with the lower portion 10*a* of the casing, will be engaged by the partition 17, and rod 30 will thereafter move upward with the upper member 10 of the casing. The lower head 32 secured to member 30 will therefore be moved upward against the resistance of spring 34 which is compressed between flanges 33 and head 23*a* due to the lagging of the lower member 10*a* to which head 23*a* is secured as shown in FIG. 2*a*, withdrawing operating plunger 35 from the switch plunger 37*a*. Switch 37 will then close, completing a circuit from a source of electrical energy contained in the pressure case 24 and transmitting electrical current to set into action the operating means contained in the well tool 27.

After the spring 21 has overcome the inertia of the lower member 10*a* at termination of the rapid upward movement of upper member 10, the parts of the device will be re-established in their original positions as shown in FIGS. 1 and 1*a*.

It will be noted that a relatively sharp jerk has to be given the line to ensure that nut 31 is engaged by the partition 17 since unless this engagement is effected the rod will not be displaced upwardly in the lower member 10*a* of the casing and therefore will continue to depress the plunger 37*a* of the normally closed switch and keep open the operating circuit of the initiating mechanism. This arrangement ensures that the initiating mechanism will not be operated when steadily raising the device or should it not be desired for any reason to operate the tool.

In operating the device, care should be taken that lowering into the well is effected at a rate such that a sudden stoppage of the downward movement, for instance by jamming of the lowering cable, cannot result in operation of the tool due to the momentum of the resiliently supported lower member of the casing and well tool suspended therefrom causing head 31 to strike against partition 17 with consequent release of switch plunger 37*a*.

A preferred embodiment of the invention has been described and shown by way of example but not as limitative of the invention, since various changes and modifications may be made by those skilled in the art in the described embodiment without departing from the scope of the invention as defined by the appended claims.

I claim:

1. Operating means for an initiating device for well tools adapted to be suspended by a suspending line within an oil well and provided with self-contained operating means requiring to be put into action by means external to the tool, comprising: an upper tubular member attached to the suspending line; a partition extending across the interior of said upper tubular member toward the upper end thereof and provided with a central opening; a centrally apertured plug closing the lower end of said upper tubular member; a lower tubular member connected to the well tool and having a portion of reduced diameter extending upwardly through the central opening in the plug at the lower end of the upper tubular member; an outwardly projecting flange mounted on the upper end of the reduced diameter portion of said lower tubular member; a coil spring surrounding said reduced diameter portion of the lower tubular member under compression between said plug and projecting flange and normally holding said flange against said partition; a trip member mounted within said portion of reduced diameter of the lower tubular member and projecting upwardly through said partition and having a head on its uppermost portion; switch means having a contact member in engagement with said trip member; said switch means positioned within said lower tubular member, and a resilient means mounted between said lower tubular member and said trip member tending to hold said trip member against said switch contact member.

2. Operating means for an initiating device for well tools adapted to be suspended by a suspending line within an oil well and provided with self-contained operating means requiring to be put into action by means external to the tool, comprising: an upper tubular member attached to the suspending line; a lower tubular member connected to the well tool and having a portion of reduced diameter telescopically mounted within the upper tubular member; means maintaining the said lower tubular member resiliently within the upper tubular member; a trip member mounted within said portion of reduced diameter of the lower tubular member and extending into the lower tubular member; a partition extending across said upper tubular member and provided with a central opening therein, the movement of the lower tubular member into the upper tubular member being limited by the abutment of the portion of reduced diameter of the lower tubular member with the lower surface of said partition, the upper end of said trip member projecting through the opening in said partition; a head on the upper end of said trip member; a lower head on said trip member positioned within said lower tubular member; switch means having a contact member in engagement with said trip member; said switch member positioned within said lower tubular member, and a resilient means mounted between said lower tubular member and said trip member tending to hold said trip member against said switch contact member.

3. Operating means as set forth in claim 2 in which the said trip member has an adjustable length in contact with the said switch contact member.

4. Operating means for an initiating device for oil well tools adapted to be suspended by a suspending line within an oil well comprising: an upper member attached to said suspending line, a lower member containing a switch, a telescoping means positioned within said upper member and fixedly attached to said lower member, means for limiting the movement of the said telescoping means with-

in said upper member, said limiting means being integrally formed within said upper member, a plunger trip member contained within said lower member and telescoping means and contacting the said switch therein, a spring positioned within the upper member between the telescoping means and upper member tending to urge said telescoping means against the limiting means, resilient means positioned within the lower member between the trip member and the lower member tending to keep said plunger trip member in contact with said switch, head means contained within the upper member fixedly attached to said plunger trip member and positioned above the limiting means for causing the upper member to be pulled upwardly causing the said resilient means to compress and break the contact between the said plunger trip member and switch.

5. A device for actuating a switch comprising: an upper tubular member having a normal and a second position, said upper tubular member containing a partition with a central passageway therethrough dividing the member into upper and lower portions, a lower tubular member having a hollow upper chamber and a hollow lower chamber separated by a partition, a tubular telescoping element positioned within the lower portion of the upper tubular member and attached to the lower tubular member, a spring encompassing the telescoping element and positioned between the upper tubular member and the telescoping element urging the telescoping element against the upper tubular member partition, a trip member received by said tubular telescoping element and extending into the hollow upper chamber and means resiliently retaining the trip member against the partition of the said lower tubular element, an enlarged head portion on the upper portion of said trip member retained within said upper portion of the said upper tubular member in spaced relationship with said upper tubular member partition, a switch fixedly attached within the hollow lower chamber of the said lower tubular member and having a movable contact thereon, a plunger fixedly attached to the lower end of the said rod that extends through the partition in the lower tubular element engaging the movable contact of said switch, and a line fixedly attached to the said upper tubular member.

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