March 19, 1968 W. E. CUBBERLY, JR., ET AL 3,373,817

APPARATUS FOR SELECTIVELY RELEASING CABLE-SUSPENDED WELL TOOLS

Filed March 23, 1966 2 Sheets-Sheet 1

Fig. 1B

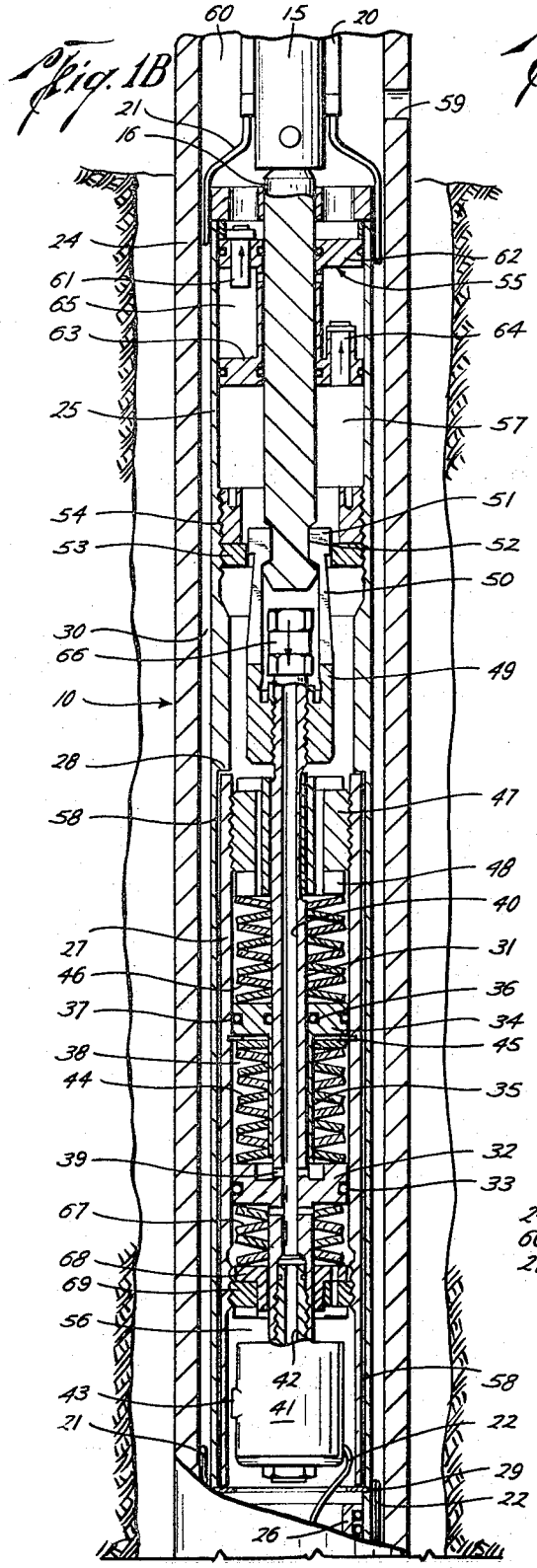
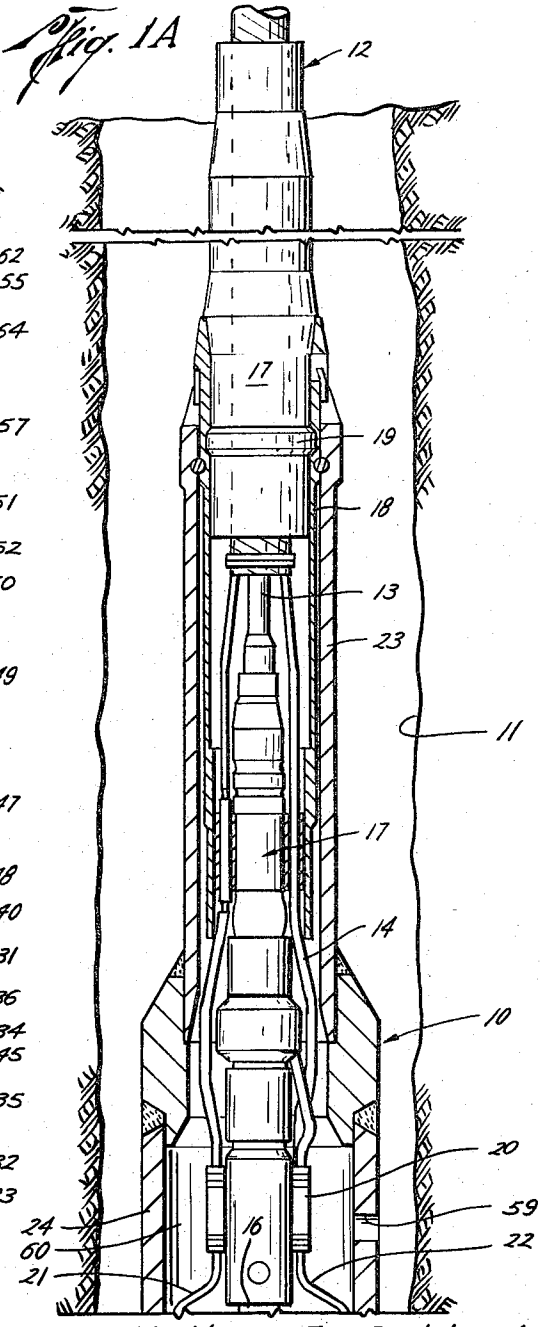


Fig. 1A



Walter E. Cubberly
Dean F. Saurenman
INVENTORS

BY

E. L. Archambeau Jr.
ATTORNEY

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Fig. 2A

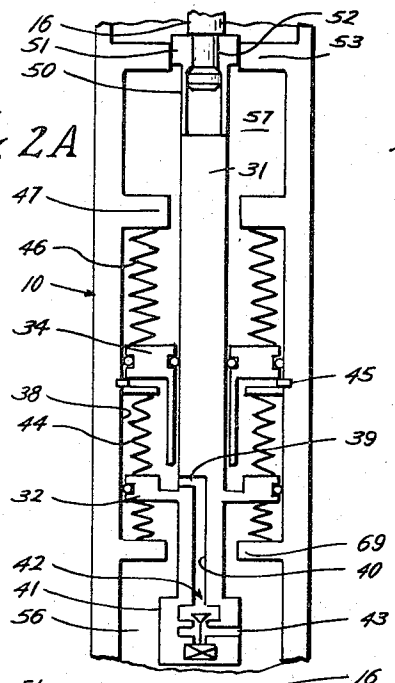


Fig. 2B

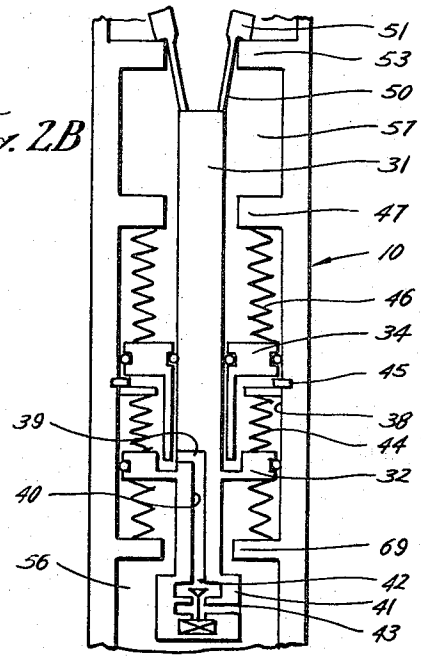


Fig. 3A

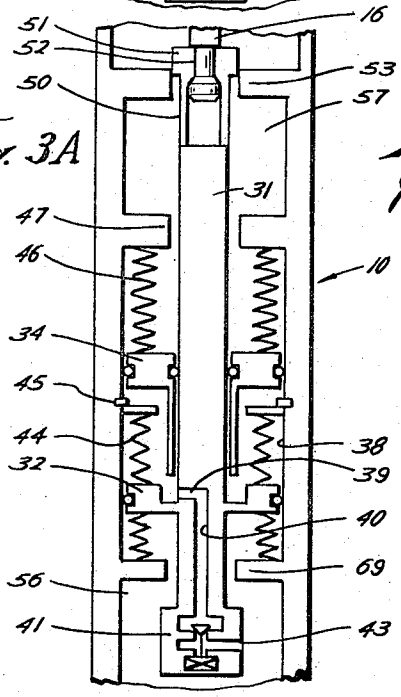
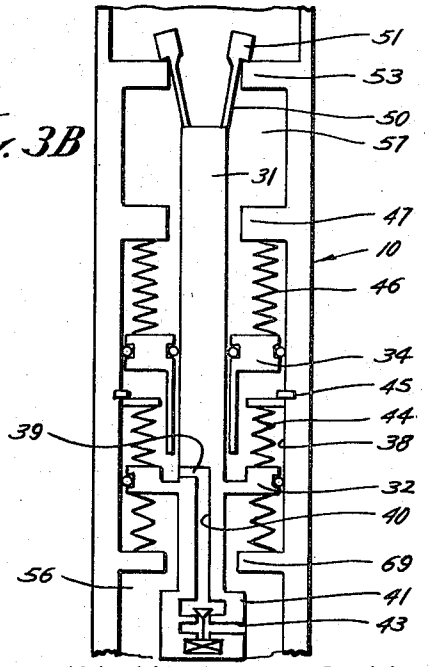


Fig. 3B



Walter E. Cubberly
Dean F. Saurenman
INVENTORS

BY

E. R. Archambeau Jr.
ATTORNEY

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APPARATUS FOR SELECTIVELY RELEASING CABLE-SUSPENDED WELL TOOLS

Walter E. Cubberly, Jr., and Dean F. Saurenman, Houston, Tex., assignors, by mesne assignments, to Schlumberger Technology Corporation, Houston, Tex., a corporation of Texas

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This invention relates to well tools suspended from a cable; and, more particularly, to apparatus for selectively releasing a suspension cable from such tools.

It is not at all uncommon for a cable-suspended well tool, such as a perforator or logging instrument, to become stuck in a well bore as it is being used. When it has been determined that the tool cannot otherwise be dislodged, it is then necessary to disconnect the cable from the tool in one of several manners. Once the cable is disconnected from the tool, one or more of the many typical fishing tools can then be secured to the stuck tool to pull it free. It will be recognized, of course, that the cable should be disconnected as close as possible to the tool to avoid leaving a loose skein of cable piled on top of the tool which will unduly hamper these fishing operations.

Heretofore, in one manner of disconnecting a cable from a well tool, it has been customary to connect the free end of the cable to the tool by a so-called "weak point" having a reduced portion of less tensile strength than the cable. Then, should the tool become stuck, the cable can often be disconnected by pulling on the cable to break the weak point connection.

Such weak point connections are not always too reliable, however. It will be appreciated that a weak point must have sufficient tensile strength to support the static weight of the tool as well as any loads induced either in raising the tool or in reasonable efforts to dislodge the tool should it become stuck. On the other hand, this weak point may in some instances be too strong and the suspension cable itself may part near the surface as it is being tensioned to break the weak point connection. For example, assume that a tool is suspended from a cable having a tensile strength of 12,000-pounds and the weak point is designed to fail at 6,200-pounds. If the combined weight of the cable already in the well bore and the tool is 6,200-pounds, it is quite likely that the suspension cable will part near the surface before sufficient tension can be applied to break the weak point. Moreover, this problem becomes more pronounced as the operating depth increases and a greater weight of cable is in the well bore.

There are other instances where a conventional weak point may not even be usable as, for example, where the cable itself has become stuck, as by keyseating or differential sticking, at an intermediate point in the borehole. Should this happen, sufficient tension can not be applied to the cable to break the weak point without first parting the cable above the point where it is stuck.

Accordingly, it is an object of the present invention to provide apparatus for connecting a well tool to a suspension cable which apparatus is selectively releasable in response either to application of tension of a predetermined magnitude through the cable or to an electrical signal from the surface through the cable.

This and other objects of the present invention are attained by providing a cable-suspended well tool with a movable member that is normally retained in one position to connect the tool to its suspension cable and that, upon being moved to another position, will disconnect the cable from the tool. Selectively operable restraining means are provided between the movable member and tool that, in response either to cable tension or to an electrical signal from the surface through the cable, will free

the movable member for movement to its cable-releasing position.

The novel features of the present invention are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation together with further objects and advantages thereof, may best be understood by way of illustration and example of certain embodiments when taken in conjunction with the accompanying drawings, in which:

FIGS. 1A and 1B are successive cross-sectional views showing one embodiment of apparatus arranged in accordance with the principles of the present invention;

FIGS. 2A and 2B are somewhat simplified schematic views sequentially illustrating one mode of operation of the apparatus depicted in FIG. 1; and

FIGS. 3A and 3B are similar to FIGS. 2A and 2B but illustrate an alternate mode of operation of the apparatus shown in FIG. 1.

Turning now to FIG. 1, an exemplary embodiment is shown of releasing apparatus **10** arranged in accordance with the present invention as it will appear within a well bore **11**. To facilitate explanation of the invention, a few minor constructional details have been omitted in FIGS. 1A and 1B to better illustrate the significant features of the releasing apparatus **10**.

It will be understood, of course, that, as shown in FIG. 1A, the typical suspension cable **12** connected to the upper end of the releasing apparatus **10** is comprised of a plurality of load-carrying members **13** and electrical conductors, such as at **14**, that are enclosed within a protective armored sheath and covered by an outer waterproof jacket. The cable **12** is spooled from a winch (not shown) at the surface of the ground in the usual manner. As is customary, means (not shown) are provided at the surface for indicating the tension on the cable **12** at any time. It will be further understood that the releasing apparatus **10** is also secured in a suitable manner to the upper end of a well tool (not shown) which, for example, may be a typical logging instrument.

The lower end of the suspension cable **12** is suitably arranged for reception in the uppermost portion of the releasing apparatus **10**, with its load-carrying members **13** being connected by a swage fitting **15** to a depending central rod member **16**. As best seen in FIG. 1A, to fit the lower end of the cable **12** into the upper end of the releasing apparatus **10**, the cable end is covered by an elastomeric sleeve **17** that is snugly received in an elongated sleeve **18** secured to the apparatus and releasably held therein by a peripheral bead **19** received in a complementary annular recess in the sleeve **18**.

As best seen in FIG. 1B, the electrical conductors **14** in the cable **12** are connected through break-away connectors, as at **20**, to extension conductors, as at **21** and **22**, in the releasing apparatus **10** that, as may be required by the particular circumstances, are passed on through the apparatus into the well tool (not shown) therebelow. It will also be seen from FIG. 1 that once the depending rod is disengaged from the releasing apparatus **10**, the cable **12**, swage **15** and rod **16** will be freed and, upon failure of the break-away connectors **20**, can be pulled out of the sleeves **18** and **23** and away from the releasing apparatus **10** and the well tool therebelow.

The releasing apparatus **10** shown in FIG. 1 is comprised of an outer tubular housing **24** in which is secured an inner housing or tubular member **25** closed at its lower end by a closure member **26** and receiving a cylindrical insert sleeve **27** in its lower portion that is secured between spaced housing shoulders **28** and **29**. By leaving sufficient clearance between the outer and inner housing **24** and **25**, a suitable passage, as at **30**, is provided for the conductor extensions **20** and **21**. A movable central member **31** is coaxially disposed within the inner housing **25**

and has an enlarged-diameter portion 32 near its lower end that is slidably received in the insert sleeve 27 and fluidly sealed thereto by an O-ring 33. An annular piston 34 is also slidably disposed within the insert sleeve 27 and is guided around the intermediate portion of the central member 31 above its enlarged piston portion 32 by a depending skirt 35. O-rings 36 and 37 fluidly sealing the annular piston 34 around the central member 31 and within the insert 27 provide an enclosed chamber 38 therein that is filled with a suitable hydraulic fluid such as oil or the like.

Fluid communication with the enclosed chamber 38 is provided by a lateral port 39 in the central member 31 above the enlarged piston portion 32 that opens to an axial passage 40 in the central member that is open at its lower end. For controlling fluid communication to and from the enclosed chamber 38, selectively-operated flow control means are provided, such as a normally-closed, solenoid-actuated valve 41 having one port 42 connected to the lower end of the central member 31 and another port 43 opening into the lower portion of the inner housing 25 below the enlarged piston portion 32.

Biasing means, such as a spring or a stack of corrugated or Belleville washers 44, are received in the enclosed chamber 38 and engaged between the upper face of the enlarged piston portion 32 and a fixed stop, such as the lower face of an inwardly directed shoulder 45 in the insert sleeve 27 and on which the floating annular piston 34 normally rests. Other biasing means, such as another stack of Belleville washers 46, are disposed in the insert sleeve 27 above the enclosed chamber 38 and engaged between the upper face of the floating piston 34 and an adjustable stop, such as a collar 47 threadedly secured within the upper end of the sleeve 27 and which receives a loose spring-retainer sleeve 48 through which the central member 31 extends.

Means, such as a typical collet 49 having a plurality of upright, outwardly biased, flexible fingers 50 and secured to the upper end of the central member 31, are adapted for releasably connecting the central member to the lower end of the depending rod member 16. To accomplish this, the free ends 51 of the flexible collet fingers 50 are enlarged and their inwardly directed surfaces adapted for cooperative reception within a groove 52 formed by a reduced-diameter or necked portion immediately above the lower end of the depending rod member 16. Adjustable stop means, such as an annular ring 53 movably secured within the inner housing 25 by threads 54, normally confine the enlarged finger ends 51 within the groove 52 and prevent the fingers 50 from moving radially outwardly therefrom so long as the central member 31 is in its relative position shown in FIG. 1B. It will be appreciated, however, that should the central member 31, collet 49 and depending rod 16 be shifted upwardly a sufficient distance for the enlarged finger ends 51 to move above the annular ring 53, the collet fingers 50 will be free to spring outwardly and thereby free the depending rod.

It will be appreciated that it is preferable to equalize insofar as possible pressure differentials due to hydrostatic pressures normally encountered in a well bore that would otherwise be acting across the releasing apparatus 10 so as to minimize any unbalanced forces acting on the moving parts. Accordingly, in addition to the bottom closure member 26, the inner housing 25 is also fluidly sealed at its upper end above the central member 31 by a floating annular piston 55 that is fluidly sealed relative to the housing and around the depending rod member 16. In addition to the enclosed chamber 38 already described, the space 56 below the enlarged piston portion 32 in which the solenoid valve 41 is disposed is filled with oil as is also the space 57 between the floating pistons 34 and 55. By providing a slight clearance, as at 58, between the inner housing 25 and insert sleeve 27, fluid communication is provided between the lower enclosed space 56 and the upper space 57. It will be recalled, of course, that the solenoid valve 41 controls fluid communication between the enclosed chamber 38 and lowermost oil-filled space 56. A port 59 is provided in the upper end of the outer housing 24 above the upper floating piston 55 to admit fluids from the well bore 11 into the uppermost space 60 in the outer housing 24.

Accordingly, it will be appreciated that the pressure of fluids in the well bore 11 will be transmitted to the various oil-filled spaces 56, 57 and 58 by virtue of the upper floating piston 55. Thus, any unbalanced forces that would otherwise be applied downwardly on the depending rod member 16 will be counterbalanced by the pressure developed in the oil in the upper space 57 acting upwardly on the rod member.

It will be understood, of course, that means should also be provided for accommodating variations in the volume of the oil in the inner housing 25 due to changes in temperature and pressure. Accordingly, by mounting a conventional normally-closed check valve 61 in the upper floating piston 55 that is arranged to discharge oil from the uppermost oil-filled space 57 into the open space 60 thereabove, oil will be released from the oil system as it expands.

It will be recognized, of course, that the check valve 61 will not open in the opposite direction to permit entry of well bore fluids into the oil system.

It is preferred to arrange the upper floating piston 55 as shown in FIG. 1B with spaced piston portions 62 and 63 and mount another check valve 64 (such as the check valve 61 already described) in this lower portion 63. Thus, as oil is slowly discharged from the oil system through the check valves 64 and 61 to accommodate changes in oil volume during the prolonged use of the releasing apparatus 10, the floating piston 55 will be moved downwardly into the upper oil space 57 by the hydrostatic pressure. Then, after the apparatus 10 and well tool are retrieved and the oil supply replenished in routine maintenance operations through a filling port (not shown) in the bottom closure member 26, the upper floating piston 55 will again be moved upwardly. As the floating piston 55 moves upwardly, the cylinder walls adjacent thereto will most likely be coated with mud and the like from well bore fluids and small residual amounts thereof will most likely remain on the walls of the inner housing 25 as the piston 55 moves upwardly thereby. It is expected, therefore, that any contaminating fluids that might pass below the upper piston portion 62 will remain in the space 65 above the lower piston portion 63. Thus, as fresh oil is added to the system, the contaminated oil will be displaced through the upper check valve 61 as fresh oil flows upwardly through the lower check valve 64 into the space 65.

To accommodate such changes in the oil volume as well as to provide a ready means for equalizing pressures and for filling the enclosed chamber 38, means, such as a normally-closed check valve 66 mounted on the upper end of the central member 31 and in communication with the axial passage 40 therethrough, are provided. The check valve 66 naturally must be arranged to open to allow oil to enter the axial passage 40 but cannot open to permit flow in the opposite direction. Since oil cannot be permitted to escape freely from the enclosed oil-filled chamber 38, increases in the volume of oil in that enclosed space are accommodated by yieldable means, such as a short spring or a third stack of Belleville washers 67, mounted between the lower face of the enlarged piston portion 32 and a spring retainer 68 loosely received in an annular stop member 69 threadedly secured to the lower portion of the insert sleeve 27. Thus, since the Belleville washers 44 restrain free upward movement of the central member 31, an increase of oil volume in the enclosed space 38 will be accommodated by a slight downward movement of the enlarged piston portion 32 and central member against the slight restraint of the Belleville washers 67.

Turning now to the operation of the releasing apparatus **10**, the apparatus has been schematically depicted in FIGS. 2 and 3 to illustrate its two modes of operation. It will be recognized that with the releasing apparatus **10** in the position depicted in FIG. 2A (which position is the same as that shown in FIG. 1), the well tool (not shown) connected therebelow is effectively suspended from the co-engaged rod and central members **16** and **31**. Thus, so long as the central member **31** is not moved upwardly relative to the annular stop **53** a distance sufficient to move the enlarged ends **51** of the collet fingers **50** clear of the annular stop member, the well tool will remain connected to the cable **12**.

Assuming for the moment that the lower floating piston **34** is restrained by the washers **46** from moving upwardly away from the sleeve shoulder **45**, it will be appreciated that the relative non-compressibility of the oil in the enclosed chamber **38** will prevent the enlarged piston portion **32** (and, of course, the central member **31**) from moving upwardly so long as the solenoid valve **41** remains closed. Thus, with the solenoid valve **41** closed, the weight of the releasing apparatus **10** and well tool will be supported by the Belleville washers **44** and as well, in effect, by the oil in the enclosed chamber **38**.

Turning now to FIG. 2B, the releasing apparatus **10** is shown as it will generally appear after the solenoid valve **41** has been opened. It should be kept in mind that in this mode of operation, it is assumed that the Belleville washers **46** maintain the floating piston **34** against the stop shoulder **45**. Once the solenoid valve **41** is opened, the oil in the enclosed chamber **38** will be free to move through the axial passage **40** and solenoid valve into the lower space **56**.

Thus, assuming that the outer portions of the releasing apparatus **10** are stationary (as by the well tool being stuck), by applying an upward force on the cable **12**, the depending rod **16** will shift the central member **31** upwardly so long as the collet fingers **50** are co-engaged therewith. Then, once a sufficient volume of oil has been displaced out of the enclosed chamber **38** by movement of the enlarged piston portion **32** for the enlarged ends **51** of the collet fingers **50** to have cleared the annular housing stop **53**, the fingers will be free to move radially outwardly and disengage the depending rod **16**. As previously mentioned, once the depending rod **16** is released, it, the swage **15** and all parts of the cable **12** will be free to move out of the outer housing **24** once the connectors **20** are broken. Accordingly, by merely opening the solenoid valve **41** and applying tension to the cable **12**, the cable can be quickly disconnected from the releasing apparatus **10** and the well tool depending therefrom.

It will be recognized that the combined spring rate of the stacked Belleville washers **44** will regulate the tension force required to release the cable **12** once the solenoid valve **41** is opened. Thus, by selecting appropriate Belleville washers for the lower stack **44** that will deflect a distance equal to the amount required for the enlarged finger ends **51** to clear the annular stop shoulder **53** in response to a particular force, the cable **12** can be released from the well tool upon application of a force equal to that load. It will also be recognized, of course, that the stack of Belleville washers **44** can in effect be "pre-loaded" by placing them in compression in the releasing apparatus **10**. Should this be done, the force applied to the cable **12** must first overcome the pre-loading force and then compress the Belleville washers **44** sufficiently for the enlarged finger ends **51** to clear the annular stop **53**.

It has been found that an appropriate releasing force for this mode of operation is about twice the static weight of the well tool suspended from the cable **12**. By selecting the Belleville washers **44** in accordance with this criteria, they will support the static weight of the well tool as well as sustain reasonable drag forces such as might be experienced while withdrawing a well tool through a slight obstruction in a well bore without inadvertently releasing the cable **12** from the tool. On the other hand, when it is desired to release the cable **12** from the well tool, it is necessary only to energize the solenoid valve **41** from the surface and apply a sufficient predetermined tension force to the cable to shift the enlarged finger ends **51** clear of the annular stop shoulder **53**. It should be pointed out that should the solenoid valve **41** be inadvertently actuated, the cable **12** will not be released until this predetermined tension force is applied. Thus, the solenoid valve **41** can be re-closed without releasing the cable. If desired, a flow restriction (not shown) could be added in the outlet passages **39** and **40** or solenoid valve **41** to increase the time required to displace oil from the chamber **38**.

Turning now to FIG. 3, the releasing apparatus **10** of the present invention is schematically represented as it will appear where it is desired to release the cable **12** from the well tool (not shown) solely by application of a predetermined cable tension. In FIG. 3A, the apparatus **10** is shown as it will appear before sufficient tension has been applied to release the cable **12**. In this mode of operation, the solenoid valve **41** is not actuated, hence the oil in the enclosed chamber **38** will remain trapped therein. It will, of course, be recognized that with the solenoid valve **41** closed, the oil in the enclosed chamber **38** will move the lower floating piston **34** upwardly from its shoulder **45** as the central member **31** and its enlarged piston portion **32** are pulled upwardly in response to an applied tension on the cable **12**. Thus, it will be appreciated that to shift the central member **31** upwardly, both stacks of Belleville washers **44** and **46** must be compressed as these members are moved upwardly.

Accordingly, by selecting appropriate Belleville washers **46** for the upper stack, a still greater total combined tension force than required for the first mode of operation must be applied to the cable **12** for releasing it from the well tool. In practice, it has been found suitable to select the Belleville washers **46** for the upper stack to have a combined spring rate in the order of the three to four times greater than that for the lower stack **44**. Thus, since the effective spring rates of the upper and lower stacks of Belleville washers **44** and **46** are combined in this second mode of operation, it will be appreciated that a considerable tension force will be required on the cable **12** before it can be released from the well tool.

It will be understood that any spring rate can be selected for the stacks of Belleville washers **44** and **46** and that these spring rates may be unequal or substantially equal as the particular circumstances may require. The combined spring rate of the upper stack of Belleville washers **46** must, of course, be at least slightly greater than that of the lower stack **44** so that, when the releasing apparatus **10** is operated in its first mode (FIG. 2), the lower floating piston **34** will be maintained against the stop member **45** as the central member **31** moves upwardly.

From the foregoing description, it will be seen that in either of these two modes of operation, it is necessary only that the central member **31** move upwardly only as far as is required to bring the ends **51** of the collet fingers **50** above the annular stop **53**. Accordingly, in the first mode of operation (FIG. 2) it is only the spring rate of the lower stack of Belleville washers **44** that determines the tension force required to disconnect the suspension cable **12**. Thus, since the necessary deflection may well be very slight, it is quite simple to regulate the tension force required to obtain this deflection by adjusting the position of the lower stop **69**. Once the lower stack of washers **44** are regulated, it may, of course, be necessary to readjust the position of the stop shoulder **53** to complete the adjustment. In this manner, if desired, the lower stack of Belleville washers **44** can

be partially compressed. Then, before the cable **12** can be released, it will be necessary to first overcome this "pre-loading" force before an additional force will deflect the washers **44** the requisite distance as established by the position of the stop shoulder **53**.

Similarly, the upper stack of Belleville washers **46** can be "pre-loaded" if required by adjusting the upper stop **47**. Since, in the second mode of operation (FIG. 3), both stacks of washers **44** and **46** must be deflected the same amount to release the cable **12**, it will be recognized that whatever additional releasing force is desired may be obtained by adjusting the upper stop **47**. By adjusting this stop **47** so the upper stack **46** will deflect the required distance under a load that when added to the load applied to the lower stack **44** will equal the total desired predetermined release force, the cable **12** will be released as desired in the second mode of operation.

It should be noted that the present invention also permits the operability of the solenoid valve **41** to be checked before the releasing apparatus **10** is lowered into a well. Merely opening and closing the solenoid valve **41** will naturally not impair the integrity of the oil-filled system and it can be used to verify the completeness of the wiring circuitry to the valve. Of similar import is the fact that aside from the break-away connectors **20**, there is no part of the apparatus **10** that needs replacement once the apparatus is used. It is necessary only to clean the apparatus **10** and refill it with fresh oil.

Accordingly, it will be appreciated that the present invention has provided new and improved cable-releasing apparatus that is suitably arranged to permit a suspension cable to be selectively disconnected from a well tool suspended therefrom in two alternate manners. In one of these modes of operation, by transmitting a signal, such as electrical voltage, through the suspension cable to the releasing apparatus, a tension force of one magnitude on the cable thereafter will release the cable from the apparatus and well tool. On the other hand, without having to transmit an electrical signal, application of a greater tension force will suffice to release the cable from the releasing apparatus and well tool.

While a particular embodiment of the present invention has been shown and described, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects; and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

We claim:

1. In sub-surface apparatus adapted for suspension from a cable extending to the surface, means for releasably connecting said apparatus to the cable, comprising: connecting means including a movable member on said apparatus releasably connected to the cable in a first position of said member relative to said apparatus and movable in response to cable tension to a second position relative to said apparatus for disconnection from said cable; and hydraulic means between said movable member and apparatus releasably retaining said movable member in said first position and selectively operable from the surface to release said movable member for movement to said second position.

2. The apparatus of claim **1** further including means normally maintaining said movable member in said first position and responsive only to a predetermined tension force on the cable after said hydraulic means has been operated to permit said movable member to move to said second position.

3. The apparatus of claim **1** wherein said hydraulic means is movable relative to said apparatus between an ineffective position and another position effective to retain said movable member in its said first position, and further including means normally maintaining said hydraulic means in its said effective position and responsive only to a predetermined tension force on the cable to permit said hydraulic means to move to its said ineffective position whereby said movable member can be moved to its said second position without operating said hydraulic means.

4. The apparatus of claim **3** further including means normally maintaining said first member in its said first position and responsive only to a predetermined tension force on the cable after said hydraulic means has been operated to permit said movable member to move to its said second position.

5. The sub-surface apparatus of claim **1** further including biasing means between said movable member and apparatus normally urging said movable member toward said first position and yieldable only in response to a predetermined tension force on the cable after said hydraulic means has been operated to permit said movable member to move to said second position.

6. The sub-surface apparatus of claim **1** wherein said hydraulic means is movable relative to said apparatus between an ineffective position and a position effective to retain said movable member in its said first position and further including biasing means between said hydraulic means and apparatus normally retaining said hydraulic means in its said effective position and yieldable only in response to a predetermined tension force on the cable to permit said hydraulic means to move to its said ineffective position whereby said movable member can be moved to its said second position without operating said hydraulic means.

7. The sub-surface apparatus of claim **6** further including second biasing means between said movable member and apparatus normally urging said movable member toward its said first position and yieldable only in response to a second predetermined tension force on the cable after said hydraulic means has been operated to permit said movable member to move to its said second position.

8. The sub-surface apparatus of claim **7** wherein said second predetermined tension force is less than the other of said predetermined tension forces.

9. In sub-surface apparatus adapter for suspension from a cable extending to the surface, means operable from the surface for releasing said apparatus from the cable, comprising: a tubular body; a first companion member adapted for connection to the cable; a second companion member telescopically received in said body and movable therein between first and second longitudinally-spaced positions; means for releasably connecting said companion members in tandem to one another including a gripping member on one of said companion members adapted to co-engage the other of said companion members; means on said body for maintaning said gripping member co-engaged with said other companion member so long as said second companion member is in said first position; hydraulic means for releasably restraining said second companion member in its said first position including piston means on said second companion member, sealing means between said body and second companion member defining an enclosed piston chamber within said body above said piston means, and hydraulic fluid in said enclosed chamber; and normally-closed electrically-responsive valve means selectively operable from the surface through the cable for releasing said hydraulic fluid from said piston chamber to free said second companion member for movement through said piston chamber to its said second position.

10. The sub-surface apparatus of claim **9** further including biasing means between said second companion member and said body normally urging said second companion member toward its said first position and yieldable only in response to a predetermined tension force on the cable after said valve means has been opened to permit said first companion member to move said second companion member to its said second position.

11. The sub-surface apparatus of claim **9** wherein said sealing means includes an annular member movably

mounted within said body and around said second companion member and further including biasing means between said annular member and body normally urging said annular member toward said piston means and yieldable only in response to a predetermined tension force on the cable to permit said annular member and second companion member to move together toward said second position without opening said valve means.

12. The sub-surface apparatus of claim **11** further including second biasing means between said second companion member and said body normally urging said second companion member toward its said first position and yieldable only in response to a second predetermined tension force on the cable less than the other predetermined tension force after said valve means has been opened to permit said first companion member to move said second companion member to its said second position.

13. The sub-surface apparatus of claim **12** further including pressure-balancing means for applying environmental pressure on both ends of said second companion member.

14. The sub-surface apparatus of claim **12** further including first and second closure means fluidly sealed within said body, at least said first closure means being movable

relative to said body, one of said closure means being below said second companion member defining a first enclosed space below said piston means and the other of said closure means being above said sealing means and fluidly sealed around one of said companion members and defining a second enclosed space above said annular member, passage means between said enclosed spaces, a hydraulic fluid filling said enclosed spaces and passage means, and means for admitting environmental fluids to the exterior of said first movable closure means.

15. The sub-surface apparatus of claim **14** further including check valve means for releasing hydraulic fluid from said enclosed spaces to accommodate volumetric increases of said fluid.

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JAMES A. LEPPINK, *Primary Examiner.*