Sept. 16, 1969 W. L. CURTIS ET AL 3,467,224

CABLE SAFETY CLAMPING DEVICE FOR OIL WELLS AND THE LIKE

Filed May 5, 1968 2 Sheets-Sheet 1

FIG. 1.

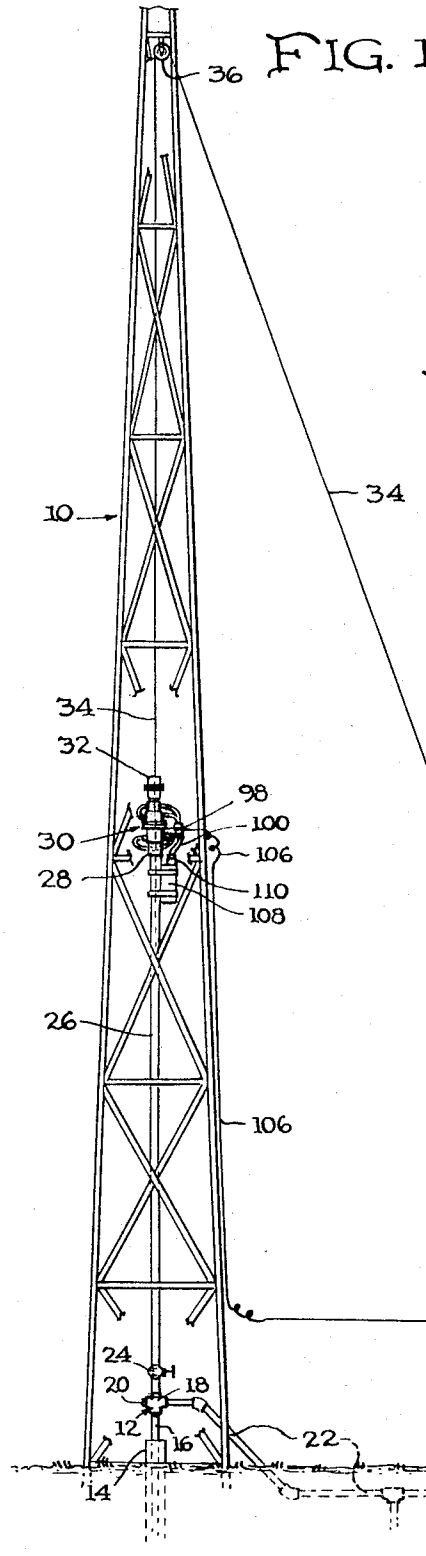
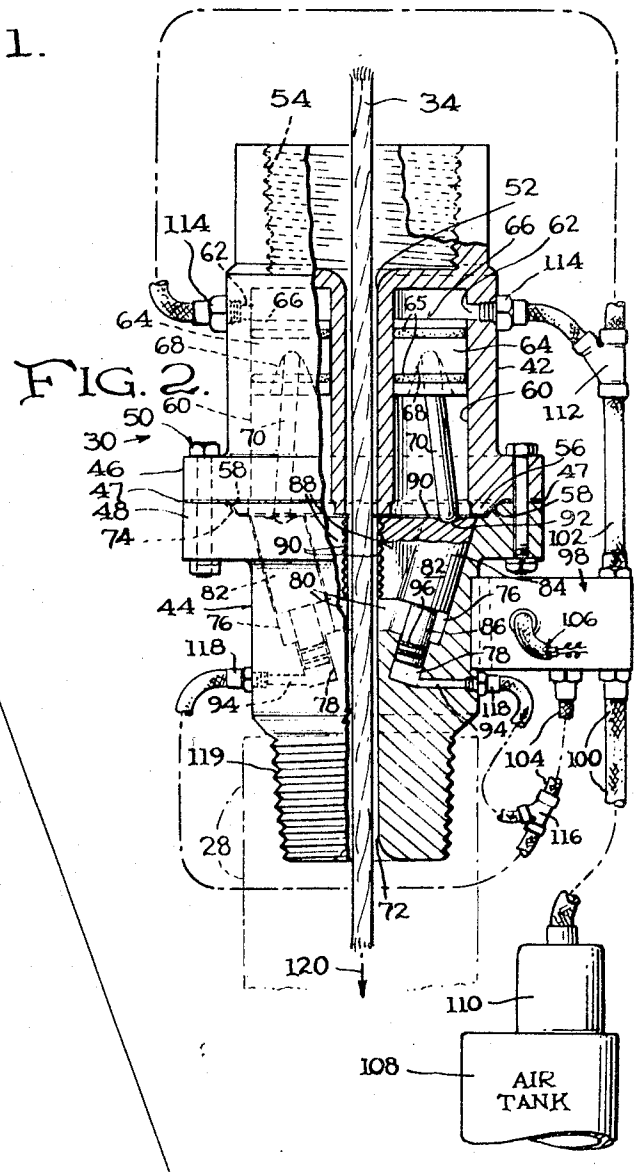


FIG. 2.



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FIG. 4.

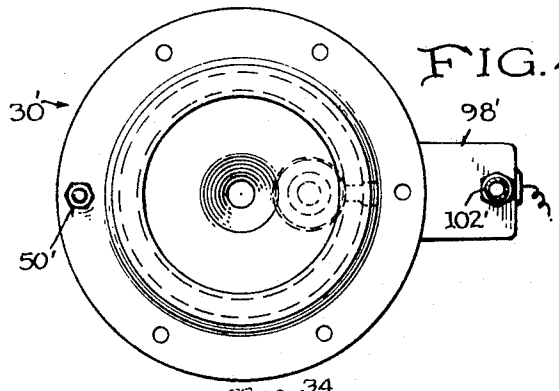


FIG. 6.

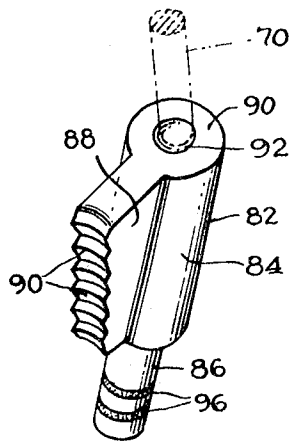


FIG. 3.

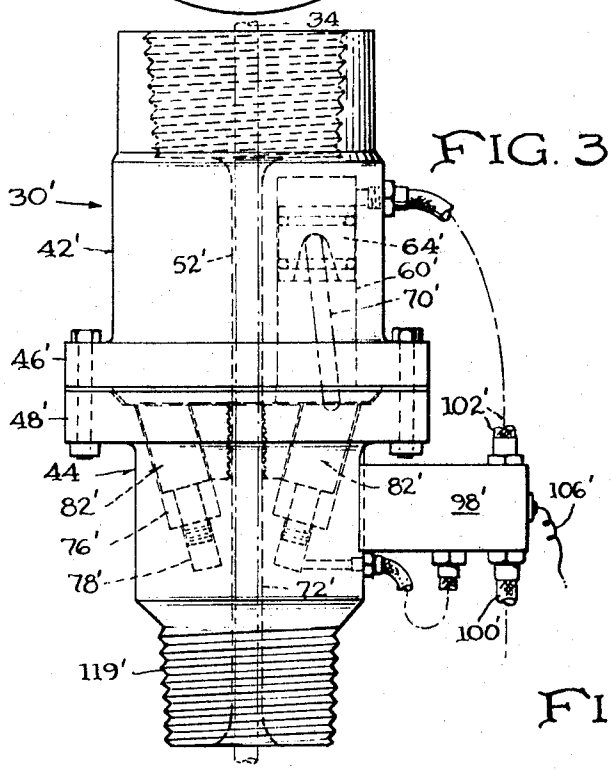


FIG. 7.

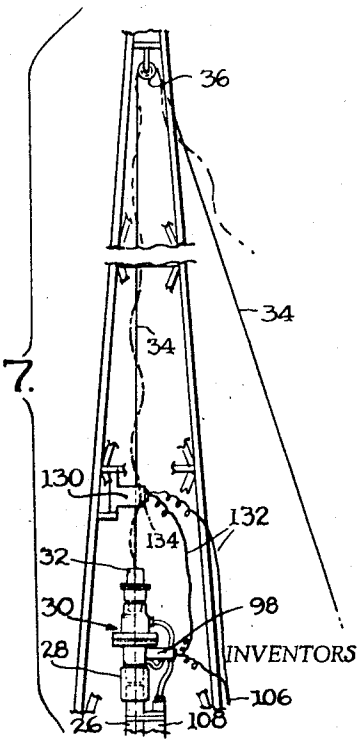
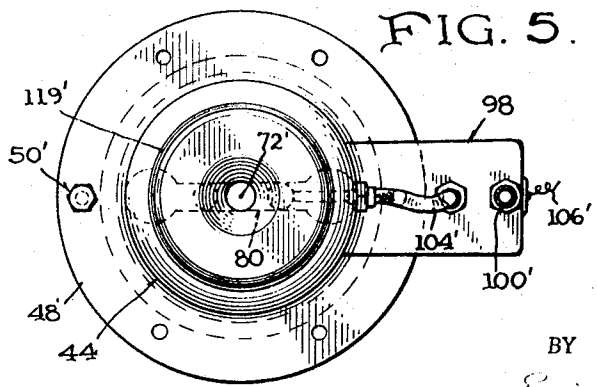


FIG. 5.



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CABLE SAFETY CLAMPING DEVICE FOR OIL WELLS AND THE LIKE

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U.S. Cl. 188—65.1 15 Claims

ABSTRACT OF THE DISCLOSURE

A cable or line safety clamping mechanism for use in snubbing and retaining particularly broken cables which often result from use in oil well operations. The safety clamp mechanism herein comprises a clamp housing embodying therewithin a pair of gripping wedges or slips at least one of which may be of the servo actuated type, disposed oppositely about a cable, said slips being fluid pressure operated responsive to usually an overhead break in a cable which is threaded over one or more sheaves supported in the well's superstructure, and said slips being instantly activated to snub and grip the cable to preclude it being lost down inside of the well. One preferred form embodies electrical switch means to automatically activate the safety clamping slips by fluid pressure means responsive to the whipping action of a slack cable after it breaks, while another embodiment provides for manual energization of the switch means by one of the attendant workers, responsive to observing a broken cable.

Statement of invention

The present invention relates to an improved safety retention clamping means usable in connection with a heavy load lifting cable, rope and similar lines. More specifically it may relate to a safety device for clamping and holding in a given position a so-called catline or other cables as often used in association with portable rigs now commonly utilized in oil field work.

As a matter of background, it is common practice in oil field operations to utilize all steel portable drilling rigs and to employ various makeshift holding devices and means to attempt to snub the catline with the so-called cathead or to otherwise grip and retain a cable for a given reason. It is a hazardous task to the workmen because the cables become frictionally burnt, chafed and sometimes break causing injury to those workmen within the vicinity of the falling load or whipping broken cable ends.

While we are aware of various prior art devices intended for use in holding and clamping such lines, there seems to be the need for an improved device having increased effectiveness and one which is more automatically responsive to a cable break for instantaneous operation.

Objects

Accordingly, it is a principal object of the present invention to provide for a novelly improved cable clamping device having a two part housing embodying a pair of wedge shaped gripping slip members having serrated gripping teeth disposed oppositely about a cable passing through a central cable aperture. The slip members are fluid-pressure operated responsive to electrical solenoid-operated switch means activated automatically by the whipping action of a broken or slakened cable, with the slips tapering to their wedge shapes in the direction of travel which the broken cable would normally follow.

Another primary object is to provide for an improved cable clamping device of the character described of which one of the dual slip members is positively activated by

fluid pressure means to effect engagement of said one slip with the running cable, whereupon continued application of the fluid pressure forces a slight and nearly instantaneous lateral displacement of said cable whereby it frictionally engages the other of said slip members with the result that the second slip wedge becomes servo-actuated and is drawn, together with the first slip, into continuously tightening engagement with the cable and the clamp housing to effectively brake the cable.

A further object of the present invention is to provide an improved cable clamp of the aforedescribed character embodying double acting switch means in combination with fluid pressure means to reset the device once a cable has been repaired, and which may be manually or automatically operated.

These and other objects including the provision of an improved most-effective clamping device which may be produced at relatively competitive costs, will become more readily apparent from the following detailed description taken in conjunction with the illustrative drawings wherein:

Figure description

FIG. 1 is representative of an elevational view of a field rig structure embodying the improved invention therewith;

FIG. 2 is an enlarged detail view, partially in elevation and partially in cross-section, depicting one embodiment of our improved cable clamping device;

FIG. 3 is an enlarged elevational view, similar to FIG. 2, depicting a second embodiment of our improved device, with the operating members shown in dotted outline;

FIG. 4 is a top plan view generally representative of our improved devices but particularly of that embodiment depicted in FIG. 3;

FIG. 5 is a bottom plan view of the cable clamping devices shown in FIGS. 2 and 3;

FIG. 6 is an enlarged perspective detail view of one of the slip members adapted to frictionally engage and clamp the cable with which the present invention is associated; and

FIG. 7 is a fragmentary elevational view similar to the structure depicted in FIG. 1 but showing a modification operative automatically responsive to a broken cable.

Present invention

Referring now to the general arrangement depicted in FIG. 1, wherein like reference characters designate corresponding parts in this and the other drawing figures, **10** designates generally the portable steel rig with which the improved clamping means of this invention is associated. The conventional so-called Christmas tree extending approximately 2½ feet up out of the well is designated generally at **12** and may comprise an 8" diameter pipe **14** terminating about one foot above the ground, and a smaller 3" diameter well pipe **16** projecting coaxially up within the pipe **14** and terminating approximately two to two and one-half feet above the ground in a T or X fitting **18**, as shown. One side of the horizontal arm of the fitting **18** is plugged off as at **20**, while the opposite side is provided with a pipe line **22** which leads to one or more underground storage facilities, not shown. Out of the top of the fitting **18**, there projects a short length of pipe to which is attached a conventional gate valve **24**, and thereabove is an extended 20 foot to 30 foot length of pipe **26** having a threaded collar **28** affixed on the end thereof. Said upright piping **26** is steadied by and secured in the usual manner (not shown) to the rigging **10**.

Our improved cable clamping assembly is designated generally **30** and is preferably threadedly mounted atop the length of pipe **26** by means of said collar **28**. Also

threadedly mounted atop the cable clamping assembly **30** is a conventional stuffing box **32** to effect cleaning of the cable, with the cable **34** extending from the workpiece within the well up through the pipes **16** and **26**, passing centrally up through the clamping device **30** and stuffing box **32** and then threaded around a sheave **36** which is suspended perhaps another thirty feet or so overhead in the rigging. Said cable **34** is then directed downwardly and is connected in the usual manner with the usual rotary winding and lifting winch mechanism generally designated **38** disposed on a suitable tractor generator **40** at ground level approximately twenty feet or so away from the base of the rigging.

Referring now more specifically to the constructional and operational details of our improved clamping devices, as depicted in FIGURES 2, 5 and 6, it will be noted that the assembly **30** comprises basically a two-part generally cylindrical housing including an upper housing member **42** and a lower housing member **44**, both having complementally formed and apertured annular joining flanges **46** and **48** respectively, preferably an interposed sealing gasket **47**, and being fastened together by a plurality of bolt assemblies **50**.

Upper housing **42** is of a slightly elongated cylindrical form and is provided with a central bore **52** of a diameter slightly in excess of and adapted to receive passage therethrough of the cable **34**. Flange **46** is preferably integrally formed with the housing body **42** at one end, as shown, and is provided at the opposite end with an enlarged female threaded recess **54**, within which the aforementioned conventional stuffing box **32** is threadedly mounted. An annular boss **56** having a tapered shoulder **58** projects slightly beyond the face of the mounting flange **46**, and is of a diameter generally corresponding to that of the cylindrical body **42**. A pair of axially extended piston cylinders **60** are suitably provided within said housing on diametrically opposite sides of the central cable bore **52**, having their open ends communicating with the flanged end of the housing and their closed ends terminating inwardly adjacent the aforementioned threaded recess **54** thereof. This half housing is further provided with fluid inlet-outlet ports **62, 62** communicating with the respective cylinders **60, 60**. Each of the cylinders is fitted with an operating piston **64** having the usual sealing rings **65**. The pistons are provided with flat upper surface **66** against which fluid pressure is exerted during operation, and are each further provided with a substantial conical recess **68** having a rounded seat adapted to receive the rounded end of a piston-operated toggle-arm **70** for a purpose to become apparent shortly hereafter.

The lower housing member **44** is also provided with a central bore **72** corresponding in diameter and in coaxial alignment with bore **52**. The flanged end **48** is provided with a recess **74** of complementary configuration to that of boss **56**. Also extending generally axially into the lower body member from this flanged end are a pair of preferably generally cylindrical shaped bores **76, 76** disposed on diametrically opposite sides of the central cable-receiving bore **72**. Bores **76, 76** are disposed so that their upper open ends are in alignment with the respective cylinder bores **60, 60** of the upper housing half member when they are in assembled condition. Bores **76, 76** are further provided with coaxial counter bores **78, 78**, with the common axis thereof being substantially inclined toward the axis of said central cable bore **72**, perhaps having an included angle with a vertical axis of approximately 20°. The bores **76, 78** per se do not intersect with the central cable bore **72**, although there is provided a milled or otherwise suitably formed slotway **80** interconnecting the bores **76, 76** and the bore **72**. FIGS. 2 and 5 better show the slotway **80** which is of less thickness than the diameter of the bores **76**, and generally corresponds in thickness to the diameter of the cable bore **72**.

A pair of generally wedge-shaped cable-gripping members hereinafter designated slip members **82, 82** are adapted to be slidably disposed within slipways constituted by a combination of the respective bores **76, 78** and slotway **80**, and said slips will now be described in more detail. Each slip member **82** (see FIGS. 2 and 6) comprises a generally cylindrical first body portion **84** having a diameter complemental to that of bore **76** and preferably an integrally formed depending second body portion **86** of reduced diameter complemental to that of counter bore **78**. A web or key **88** of a thickness to complementally slide within the slotway **80** is preefrably integrally formed with and extends the length of slip portion **84** and terminates in a serrated edge **90**, said edge **90** being adapted to engage the cable **34** responsive to actuation of the fluid-pressure-operated piston **64** and toggle arm **70**. The upper end or face **90** of the slip is provided with a rounded recess **92** to complementally receive the other rounded end of toggle arm **70** described hereinabove.

At the lowermost end of each counterbore **78** there is another fluid inlet-outlet port **94** of smaller diameter than port **62** in the upper half housing, the purpose of which will become more apparent in the following operational description. The lowermost end of depending slip portion **86** is provided with one or more suitable annular fluid sealing rings **96**.

An electrically operated solenoid valve assembly designated generally at **98** is mounted to the lower clamp housing portion **44** in any suitable manner, not shown. The valve assembly **98** is of a conventional construction which embodies a double acting piston or valve, which when in one given position opens the passageway which connects fluid conduits **100, 102** and closes off the internal communication between conduit **100** and **104**. When said valve is in the other given position it blocks communication between conduits **100** and **102** while establishing communication between conduits **100** and **104**, the purpose of which will be further clarified hereinafter. The solenoid valve is connected to a suitable source of electrical power as at the tractor-generator **40** by means of electrical conduit designated **106**. A manually operable switch **105** may be disposed on the winch brake lever **107** of the tractor **40**.

A source of fluid operating pressure, such as a tank of compressed air designated **108**, is mounted near the upper end of pipe **26** and beneath the cable clamping device **30**, as better seen in FIG. 1. Because the tank **108** may contain air under as much pressure as 1,000 lbs., a suitable pressure regulator **110** is mounted atop the tank to effect a reduction of the pressure to a more suitable predetermined operating pressure, such as approximately 150 lbs. per sq. inch. Conduit **100** is interconnected by suitable fittings between the pressure regulator valve **110** on tank **108** and the solenoid valve **98**. Conduit **102**, leading upward from the solenoid valve **98**, divides via a Y fitting **112** and the respective divided branches thereof are attached to the respective inlet-outlet ports **62, 62** of the upper housing by means of suitable threaded fittings **114** or the like. Conduit **104** leading away from the valve **98** also divides, in the preferred form depicted in FIG. 2, via a Y fitting **116**, with the respective divided branches being similarly attached to the inlet-outlet ports **94, 94** of the lower housing by means of suitable threaded fittings **118**. Lowermost housing **44** is provided preferably with a male threaded lowermost portion **119** to be accomplementally received for mounting the assembly **30** in said collar **28**.

Operation

Although the operation is now generally apparent from the foregoing detailed description, a review of the full operation of our improved cable clamping devices will be undertaken. Should an emergency or any other condition arise, during the well operations, whereby it is desirable or becomes mandatory that the cable **34** be effectively clamped or locked in a predetermined condition, our improved clamping device becomes operational by the mere closing of switch **105** at the tractor by one of

the attendant workmen. The closing of switch **105** instantly activates the solenoid switch **98**, opens the passageway through the valve between fluid pressure conduits **100** and **102** whereby the fluid pressure enters the upper housing via ports **62, 62** to exert a downwardly driving force on the pistons **64, 64**, and in turn via the toggle arms **70, 70** activates the wedge-shaped slip members **82, 82**. It is apparent that such action forces the slips downwardly and angularly toward the cable, with the serrated gripping edges **90, 90** effectively interengaging the cable **34** to lock same in an immovable condition.

It is further apparent that in the case of a broken cable having occurred at a point above the clamping device, then the weight of the tool or work member suspended by said cable would cause the cable to be drawn downwardly, in the direction of the arrow **120**, into the well. Thusly, with the cable traveling in said direction and the slips having been activated as aforedescribed, it is further apparent that the slips are further characterized by a positive servo action, due to the cam-like action imparted to the slips responsive to their respective downward travel in the inclined slipways **76, 78**, effected by the pull of the cable. Accordingly, a more positive and improved cable locking device has been evolved which is instantly and easily activated, and once the emergency or other condition which triggered the operation of our device has been remedied, our cable clamp is readily deactivated as will be described in the following.

De-activation of clamping device

With the embodiment of a double acting solenoid valve, when the aforementioned condition has been remedied and reverse direction tension is applied to the cable, it is only necessary to open switch **105** which by means of the double-acting solenoid valve in turn closes off communication between fluid pressure conduits **100** and **102**, and simultaneously establishes communication of the fluid pressure in conduit **100** with that in conduit **104**. This, in turn, directs fluid pressure into the lower housing ports **94, 94** against the respective ends of the lower portions **86** of the slip members **82, 82**, thereby raising the slips and disengaging them from their locked condition with the cable. It is further apparent that this action forces both the slips **82, 82** and their respective operating pistons **64, 64** back up into their cocked position where they are ready again to meet any emergency condition.

Modified embodiments

Referring to the modified embodiments depicted in FIGS. 3 and 4, it will be observed that the same basic construction is utilized, with similar but primed reference characters designating corresponding parts of both embodiments. The only difference structurewise is that only one operating piston and piston cylinder are utilized instead of two of them. The operation is generally the same except that only one of the slip **82'** initially is activated by the fluid pressure operation of the corresponding piston **64'**. Upon continuing application of the fluid pressure exerting its downward force on slip **82'**, the gripping serrations of the slip engage the cable, and its continuing downwardly and angularly directed motion forces the cable laterally until the normally small clearance tolerance between it and the slips is overcome. It is then apparent that the serrated portion of the other slip **82''** as frictionally engaged by the downward motion of the cable, serves to draw said other slip **82''** downwardly whereby its camming action with slipway **76', 78'** serves to drive it into an ever tightening, servo-actuated locking condition, together with the first slip **82'** to effectively lock the cable in the desired condition. Release and resetting of this embodiment of our improved cable clamp is achieved in the same manner as that of the first-described embodiment.

Proceeding now to FIG. 7, there is fragmentarily shown the upper portion of the same rigging **10**, with our improved cable clamp assembly **30** being mounted in conjunction with means to enable it to become automatically operable responsive to an overhead break in the cable, thereby precluding the necessity of relying upon the human reaction to activate same, which human reaction may be more susceptible to error and a belated application of the clamping device.

Therefore, a second switch means **130** is disposed above the clamping device **30**, with the cable **34** passing up through an aperture provided in said switch means **130**. With cable under its normal operating tension, there is sufficient clearance whereby the switch thereof is maintained in its open condition. Suitable electrical control wiring is schematically shown as at **132** connecting the switch means **130** with the previously described solenoid switch means **98**, which together with either of the aforementioned clamping assemblies **30** or **30'** remain the same.

Automatic operation is achieved when an emergency condition comes into existence as by the breaking of said cable at a position above the clamping assembly. Due to the whipping action of a slackened or broken cable, as depicted by broken line **134** in FIG. 7, switch of switch means **130** will be closed thereby nearly instantaneously energizing solenoid switch **98** which results in the identical application of the cable clamping action as already described hereinabove.

From the foregoing detailed description and operation, it is apparent that we have evolved a greatly improved cable clamping device which achieves the objects and advantages as set forth in the preamble and foregoing specification of this application.

While specific embodiments and details related thereto have been shown and described, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the inventive scope.

We claim:

1. A cable clamping device of the class described comprising:

(a) an elongated housing body including lower and upper portions and having an axially aligned cable-receiving aperture extending therethrough;

(b) said housing body having at least one slipway inclined with respect to the axis of the body, said slipway disposed in the lower portion and including an inclined wall facing the cable-receiving aperture;

(c) said slipway further including a vertically disposed slotway interconnecting the inclined wall and the cable aperture;

(d) slip means including at least one generally wedge-shaped slip member mounted for slidable movement within said slipway and upon the inclined wall;

(e) said slip means further including cable-engaging means projectible into and out of said cable aperture for selective engagement of the cable with which the device is to be associated; and

(f) actuating means including fluid pressure means operatively connected with said slip means to urge the latter into and out of engagement with said cable.

2. A cable clamping device as defined in claim **1** wherein the fluid pressure actuating means includes piston means disposed in the upper portion of the body housing, and operably connected with the slip means aforesaid.

3. A cable clamping device as defined in claim **1** wherein the housing body comprises generally cylindrically formed upper and lower body portions having complemental joining flange means, and including mounting means at the opposite ends of said body.

4. A cable clamping device as defined in claim **1** wherein the housing body comprises generally cylindrically formed upper and lower body portions having complemental joining flange means, said upper body portion

including reciprocable piston means operatively connected with the slip means to effect movement of the latter into engagement with said cable.

5. A cable clamping device as defined in claim 1 wherein the housing body is provided in the upper portion with piston means in operative communication with the slip means to effect movement of the latter into engagement with said cable.

6. A cable clamping device as defined in claim 1 wherein the upper housing portion is provided with dual piston means disposed on opposite sides of the cable aperture, and the lower portion is provided with dual slipways each inclined to the axis of the body, slip means including dual slip members slidable in the dual slipways and the latter being disposed oppositely of the cable aperture and in corresponding alignment with the piston means.

7. A cable clamping device as defined in claim 1 wherein the fluid pressure means includes:

(a) piston means disposed in the upper portion of the housing body,

(b) a supply of pressurized operating fluid connected with the housing at a point above and in communication with said piston means and also therewith below and in communication with said slip means, and

(c) valve means interposed between said piston means and said slip means for selectively directing a pressurized fluid to the piston means for effecting clamping engagement of the slip means with the cable and subsequently beneath the slip means to effect disengagement thereof.

8. A cable clamping device as defined in claim 1, wherein the actuating means includes electrically energized valve means to effect operation of the fluid pressure actuating means.

9. The device as defined in claim 7 wherein the valve means includes an electrically solenoid-operated valve.

10. The cable clamping device as defined in claim 7 wherein the actuating means is automatically operative responsive to a break in the cable; and said actuating means includes a first electrical switch means connected with a suitable source of electrical energy; said first switch means being fixedly mountable above the clamping device and including means having a passageway through which the cable passes in a manner as not to engage or close the contacts of said first switch when the cable is under normal operating tension, but which will close responsive to contact by a slackened or broken cable; a second electrical switch means with which the first switch means is operatively connected, and said second switch means being operatively connected with said valve means as interposed between the piston means and slip means aforesaid.

11. A cable clamping device comprising an elongated housing body including upper and lower portions and

having an axially extended cable-receiving aperture extending therethrough, means for securing the body on the framework of an oil well rig with which it is adapted to be associated and in a manner to receive an operating cable through said aperture, a plurality of cable-clamping slips slidably mounted in the lower body portion to be selectively moved into and out of engagement with said cable, said slips being generally wedge-shaped and having complementally formed slip ways formed in the body including inclined walls facing and in open communication with the cable aperture, fluid pressure operated piston means including at least one piston reciprocably mounted within a piston cylinder provided in the upper body portion, said piston being operatively connected with said slip means, a source of pressurized fluid operatively connectable with said clamping device, and actuating means including selective valve means interposed between the source of pressurized fluid to effect operation of the slip means to selectively project the same into and out of clamping engagement with said cable.

12. The cable clamping device as defined in claim 11 wherein the actuating means is automatically set into operation responsive to whipping action of a broken cable and includes electrical switch means which are actuated by engagement therewith of a slackened or broken cable, said switch means being operatively connected to the valve means aforesaid.

13. The cable clamping device as defined in claim 11 and including manually and automatically operable electrical switch means for actuating said clamp.

14. The cable clamping device as defined in claim 11 wherein the actuating means includes an electrical circuit, a source of electrical power and an electrical solenoid mechanism connected with said valve means to effect selective operation of the valve, and also includes a manual switch means in the electrical circuit adapted to be operated by an attendant workman.

15. The cable clamping device as defined in claim 11 wherein the valve means is an electrically operated solenoid valve mechanism mounted on the clamp body.

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U.S. Cl. X.R.

24—126; 182—191