March 21, 1967 J. H. WIGGINS 3,310,291

TENSION RESPONSIVE POWER DRIVEN WINCH

Original Filed Nov. 10, 1964 3 Sheets-Sheet 1

FIG. 1

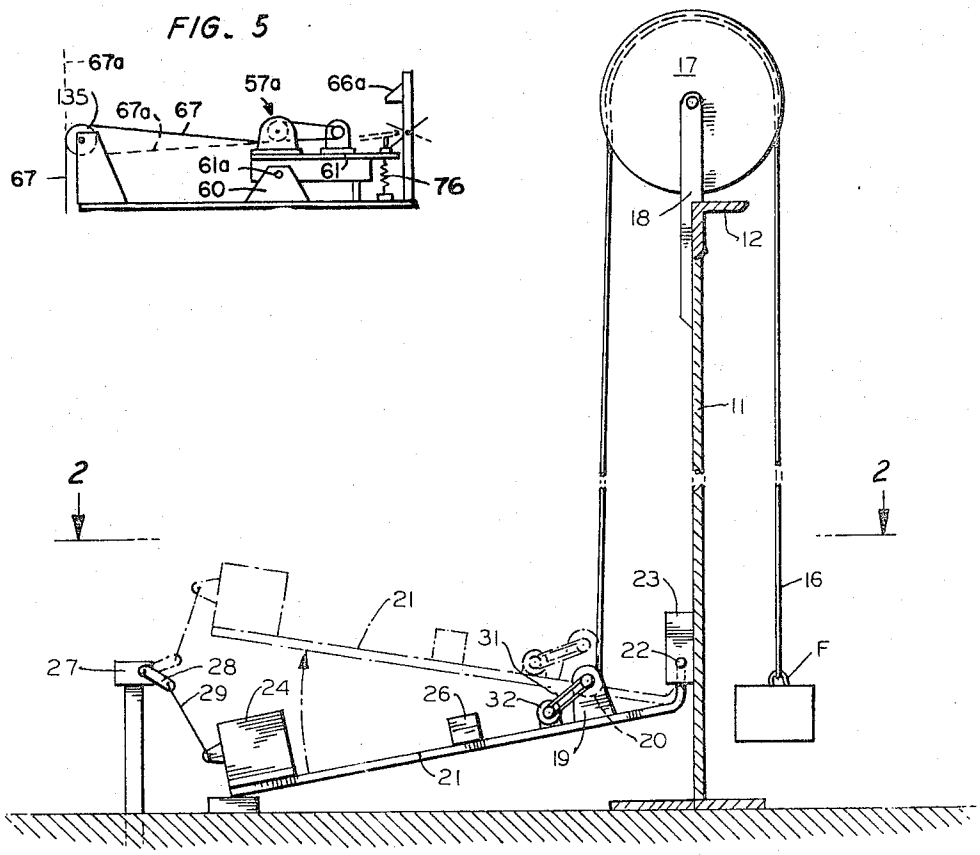


FIG. 5

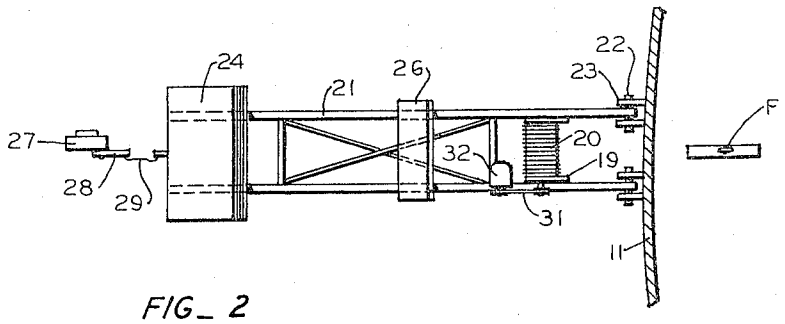


FIG. 2

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Original Filed Nov. 10, 1964 3 Sheets-Sheet 2

FIG_3

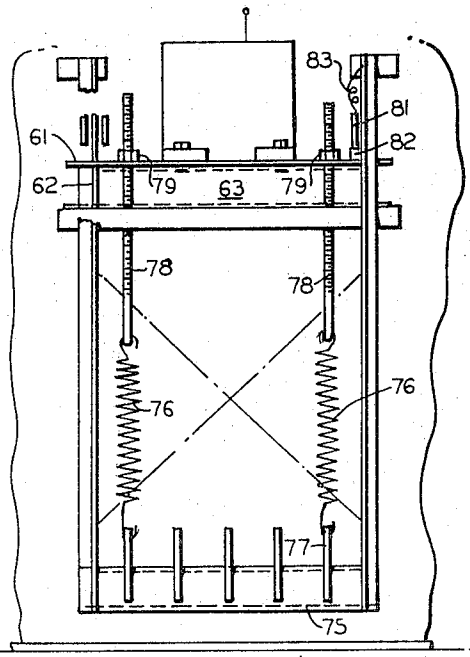
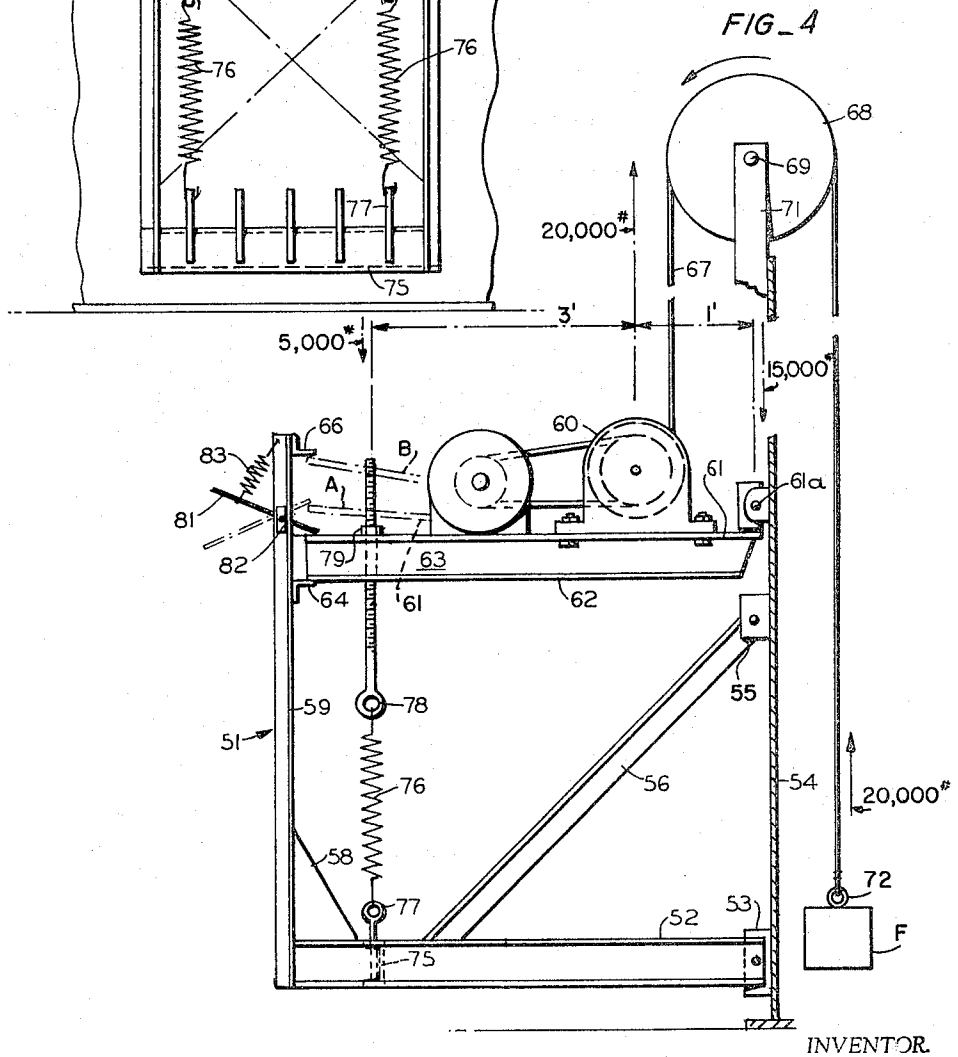


FIG_4



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Original Filed Nov. 10, 1964 3 Sheets-Sheet 3

FIG_ 6

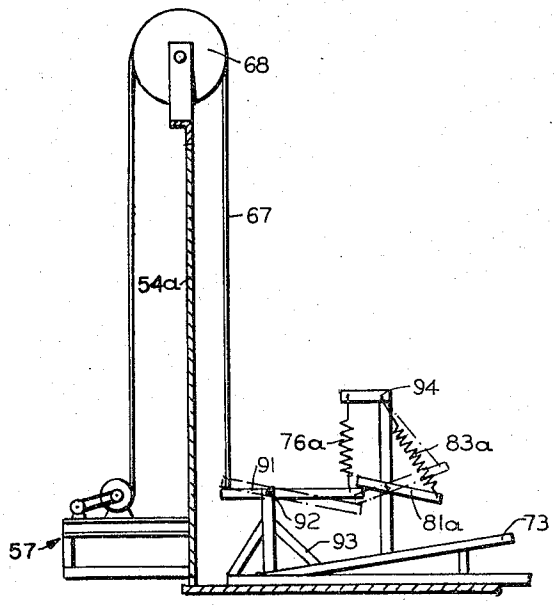


FIG_ 7

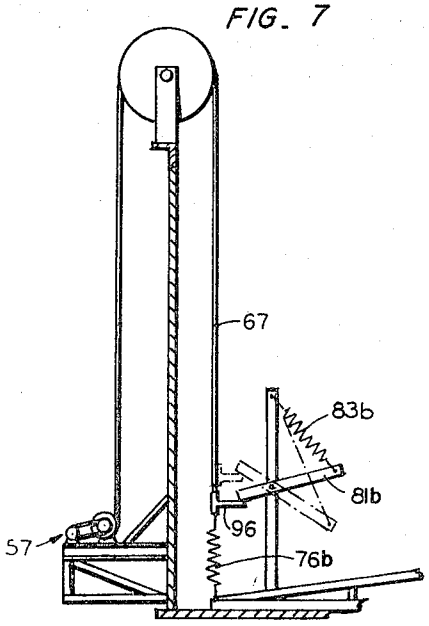
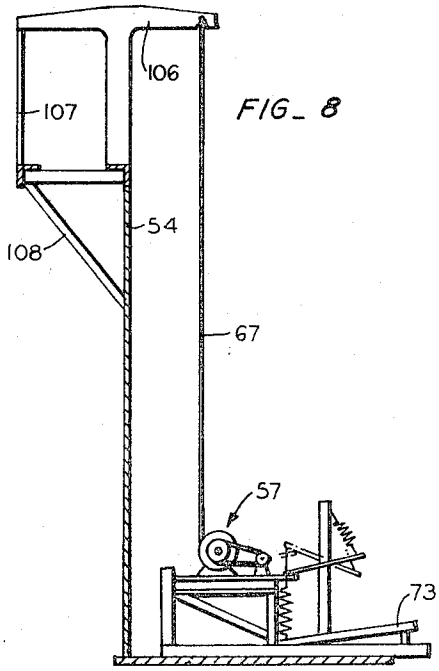


FIG_ 8



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3,310,291

TENSION RESPONSIVE POWER DRIVEN WINCH

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Original application Nov. 10, 1964, Ser. No. 411,675, now Patent No. 3,252,688, dated May 24, 1966. Divided and this application Dec. 20, 1965, Ser. No. 514,909
2 Claims. (Cl. 254—173)

This application is a division of my copending application Ser. No. 411,675, filed Nov. 10, 1964, now Patent No. 3,252,688, for Apparatus for Raising a Stiff Horizontal Frame.

The present invention relates to tension responsive power driven winches and control means therefor and is concerned, more particularly, with improved apparatus associated with the winch and the cable driven thereby for measuring and controlling the tension in the cable in response to operation of said winch.

The invention is useful in connection with the lifting of bodies or the application of a pulling tension on a body where it is desired to control the tension in the cable operated by a winch and provide an indication of that tension, and to control the power for the winch in accordance with the described usefulness. In lifting of very heavy loads, it is desirable to know ahead of time when an overload of a given winch is being approached or about to be reached, and just as importantly to know when the load is located at a certain elevation so that appropriate measures can be taken to prevent snapping of the cable and possible injury to the co-operating apparatus and to the workers.

In other winch operations where the winch is used to apply tension to the cable, it is one purpose of this invention to always maintain the tension above a given amount and below another given amount and, consequently, it is desirable to provide an automatic means to turn on and cut off the power for the winch when a given amount of tension is reached in the cable driven by the winch.

It is accordingly a general object of the invention to provide a power driven winch for applying tension to a cable, said winch being responsive to tension in the cable driven thereby.

Another object of the invention is to provide a power driven winch of the above character in which means is provided for cutting off the power to the winch when the tension reaches a given amount as, for example, when an object being moved encounters an unexpected obstruction.

A further object of the invention is to provide a power driven winch aparatus in which the cable has associated therewith energy storing means which provides an indication of the tension in the cable and which can be utilized to give a signal when the tension arrives at, exceeds, or is less than a given amount.

Still another object of the invention is to provide an apparatus for lifting a body including a power driven winch in which the winch includes means for indicating when the tension applied by the body arrives at, exceeds, or is less than a given amount.

Other objects an advantages of the invention will be apparent to those skilled in the art to which it relates from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, in which:

FIGS. 1 and 2 are respectively a sectional side elevation and a plan view of one form of the invention;

FIGS. 3 and 4 illustrate another form of the invention, FIG. 3 being an end elevation of the apparatus and FIG. 4 being a side elevational view of the apparatus

with certain operative positions shown in phantom lines;

FIG. 5 is a schematic side elevational view of another form of the invention;

FIG. 6 is a sectional elevation of a fourth form of the apparatus;

FIG. 7 is a sectional elevation of a fifth form of the apparatus; and

FIG. 8 is a sectional elevation of a sixth form of the apparatus.

Referring to FIGS. 1 and 2, the tension responsive winch apparatus of the present invention is adapted for use, for example, with a support **11** having a stop rim **12** at its upper edge. The winch apparatus includes a cable **16** which is attached at one end to a load F and extends oved an upright sheave **17** carried by a frame **18** on the wall **11**, and downwardly to a winch **19** having a drum **20** which is mounted on a lever frame **21** pivoted at **22** to a bracket **23** on the support **11**. At the outer end of the lever means **21** there is provided a weight or load member **24** and intermediate the ends of this lever means there is provided a movable weight **26** which can be adjusted by hand along the lever means **21** so as to obtain fine adjustment to compensate for the total weight being lifted. Associated with each lever means **21** is an "on" and "off" switch **27** for a motor **32** and having a movable control arm **28** connected to the weight **24** by a flexible cable **29**. The winch **19** is driven through a chain and sprocket driven connection **31** from the constant speed electric motor **32**. Thus, if a weight **24** (FIG. 1) is rising and the automatic cut off operates to stop the motor, the tension in the cable does not change when the weight **24** changes from an upward to a downward direction because the kinetic energy of motion of the weight **24** is substantially at zero and that change of direction is substantially instantaneous. The result is that at said cut off the tension in the cable does not change and the sheave **17** does not stop moving and, hence, stationary friction is not reassumed at the sheave. In this case, there is no retrograde movement of the winch drum because of its one-way holding ratchet (not shown) and the weight **24** will continue to furnish this power for lift of the load so that the lift is continued by lowering of the weight **24** until the motor is again switched on and maintains the cable tension to repeat the process.

When the load has been raised practically to the full height, the highest point lifted will reach the automatic stop rim **12** and the motor continues to run until it has lifted its load **24** to shut off the motor. Then that load **24** remains stationary holding the load gently at that point against the stop rim **12**. It will be noted that the lever means employed to apply the load in this modification provides for increased accuracy and control of the lifting movement for ease in the loading of the cable and increases the accuracy of control of the rise of the winch since the movement of the lever weight is several times the movement of the winch.

Refering to FIGS. 3 and 4, another preferred embodiment of a winch apparatus is shown, the unit **57** including a frame **51** which includes a pair of spaced-apart base channels **52**. Each channel **52** is secured at one end to a plate **53** attached to a shell or wall **54** and having a diagonal bracing angle **56** extending from each of the channels **52** to a lug **55** on the wall. Also, a gusset plate **58** is provided at the outer end of each channel **52** to connect it to an upright angle **59** of the frame.

The motor and winch unit **60** (FIGS. 3 and 4) is mounted on a tilting plate **61** which is pivotally mounted at **61***a* on a support **54** and at its outer end rests on respective lugs **64** carried by the angles **59**. The plate **61** is braced by respective side angles **62** welded at either side thereof and by a cross channel **63** extending between the

angles 62. Spaced above each lug 64 is a second lug 66 which forms a safety or emergency stop for the tilting control plate 61 in case of an accidental overload at F. The cable 67 from the motor and winch unit 60 extends over an idler sheave 68 journalled at 69 in a temporary bracket 71 on the support 54 and the cable 67 extends down the support and is attached at 72 to the load F to be lifted.

The hinged control plate 61 (FIGS. 3 and 4) is constantly urged downwardly by a plurality of springs 76 which are attached by eye-bolts 77 to a bottom cross-channel 75 of the frame and at their upper ends are attached to respective adjustable eye-bolts 78, each extending through the plate 61 and having a stop-nut 79 threaded thereon. As seen in FIG. 3, a series of the springs 76 are employed and the stop-nuts 79 may be adjusted so that the tension of the springs can be varied and thereby the force urging the plate 61 downwardly to place a desired tension or force on the cable 67. The tension on the cable 67 can also be varied by varying the number of springs 76. It will be understood that the tension placed on the cable by the springs 76 of a unit 57 is sufficient to lift the load at the moment or just as the plate 61 starts to rise. This extra tension is to overcome stationary friction of the moving parts and to assure continuous movement of the load.

An "on" and "off" control lever 81 (FIGS. 3 and 4) is pivotally mounted on a switch box 82 for the motor on one of the upright angles 59 and is urged to its upper or "on" position by a tension spring 83. The control bar or lever 81 is shown in its upper or "on" position in full lines and appears as seen in FIG. 4. The inner end of control lever 81 rests on the control plate 61 at all times. As the plate 61 is lifted or tilted as shown in dotted lines, the lever 81 will be rotated counterclockwise to its dotted line "off" position A. The switch box 82 has a switch therein which is operated by the lever 81 in a conventional manner in order to control the operation of the motor of the winch unit 60.

The operation of the unit shown in FIGS. 3 and 4 is as follows. The minimum and maximum desired tensions for the group of springs 76 are, say, 5,000 lbs. and 6,000 lbs., respectively. When the starting switch for the motor is turned on, the group of springs 76 is stretched 5 inches and is pulling 5,000 lbs. on plate 61 at 79. The motor runs until the group of springs 76 is stretched an additional one inch, until the group is pulling 6,000 lbs., at which point the automatic switch goes off. In the full line position of the winch unit in FIG. 4, for example, with the stop-nut 79 in the position shown, there is a 5,000 lb. downward pull against the plate 61. Assuming as an example the dimensions given in FIG. 4, i.e., from the point of application of the force spring 76 to the center of the winch 60 is 3 ft., and from the center of the winch 60 to the pivotal axis 61*a* is 1 ft., then a 20,000 lb. lift for the unit would involve a 5,000 lb. pull against the springs 76 and a 15,000 lb. pull against the pivot 61*a*. In other words, the springs 76 pull down on the plate 61 through the nuts 79, and the pivot 61*a* in the example given pulls down on the plate 3 times as much as the springs. The cable 67 pulls up on the plate through the winch an amount which is the sum of the pull-down forces at 79 and 61*a*. When the pivoted control plate 61 lifts to position A, this additional movement moves the switch control lever 81 to cause the switch to go off. The position B shown for the lifting plate 61 is an emergency stop position and would not be used in the normal operation.

Another preferred embodiment of the winch apparatus is shown in FIG. 5 in which the winch unit 57 is carried by a support structure 61 which is pivotally mounted at 61*a* in suitable supporting brackets carried by a base plate. Tension indicating means in the form of springs 76 are connected between this base plate and the support structure 61 and pull down on the support structure 61 in the same fashion as described in connection with FIGS. 3 and 4, the switch operating lever being indicated schematically and the safety stop 66*a* also being provided. In this embodiment the base plate for the winch unit carries also a sheave 135 spaced to the left of the winch unit 57*a* and the cable 67 can either be carried over the top of the sheave 135 and extended downwardly to a load, or be carried underneath this sheave and extend upwardly to the load, as indicated in dotted lines. In this modification the leverage advantage is obtained in bellcrank fashion with the arms of the bellcrank lever corresponding respectively to the distance from the pivot 61*a* to the lower surface of the winch drum and to the point of attachment of the springs 76. Thus, the springs 76 resist tilting of the unit about its pivotal mounting by the pull of the cable, and any excessive pull on the cable will result in moving the switch operating lever to its "off" position as an indication of the excessive pull or tension.

Referring to FIG. 6, a winch unit 57, as described in connection with FIGS. 3 and 4, is stationarily mounted on the outside of a wall 54*a*, and the cable 67 extends over a sheave 68 and is attached to the end of a lever 91 pivoted at 92 on a control frame 93 disposed inside of the wall on the frame structure 73 to be lifted. The springs 76*a* are secured between the ends of a lever 91 and a fixed bracket 94. The control spring 83*a* for the switch control lever 81*a* is also provided so that the switch box 82*a* will be operated in accordance with the changes in tension in the cable 67.

Referring to FIG. 7 there is illustrated a modified form wherein the cable 67 is connected to a control member 96 which, in turn, is connected to the springs 76*b*, the switch control lever 81*b* and its spring 83*b* being connected as shown in FIG. 6.

Referring to FIG. 8 there is illustrated a construction where the winch unit 57, as described in connection with FIGS. 3 and 4, is mounted on the load 73 so as to be lifted therewith and the cable 67 extends directly upwardly from the winch to a T-frame 106 which is mounted on the wall 54 by means including a rod 107 and its supporting framework 108.

The operation of the embodiments shown in FIGS. 5, 6, 7 and 8 is believed to be obvious in view of the explanations of the operation of FIGS. 1 and 2 and of FIGS. 3 and 4, respectively.

While I have shown and described certain preferred forms of the invention, it is apparent that the invention is capable of variation and modification from the forms shown so that the scope thereof would be limited only to the proper scope of the claims appended hereto.

What I claim is:

1. A power driven winch and cable and counterweight system whereby a continuous lifting cable tension is applied at a body, said system including a support and a lever pivoted thereon, a winch mounted on said lever at a spaced location from the pivotal axis thereof, said lever and said winch comprising a part of the counterweight of said system, operation of said winch in response to an increase in load serving to move said counterweight upwardly and raise said body, a switch positioned to be opearted by said counterweight and to cut off said power at a predetermined cable tension, and whereby subsequently said counterweight moves downwardly actuated by its own effective weight upon removal of said increased tension, and operates to raise said body a predetermined distance and turn on said power by operating said switch.

2. A tension responsive power driven winch and cable and counterweight system for constantly applying a lifting cable tension at a tension inducing body, said system including a support, a lever pivotally mounted on said support, a counterweight mounted on said lever at a location spaced from the pivotal mounting thereof, and a winch mounted on said lever at a location spaced from said pivotal mounting, said winch having a drum with

a cable wound thereon for attachment to said tension inducing body whereby said cable is in operative tension producing relation in response to operation of said winch, whereby movement of said lever in one direction in response to an increase in cable tension also moves said winch to provide effectively more cable to wind on said drum between said winch and said tension inducing body, means for interrupting the power for said drum upon said movement of said lever and said winch, removal of the force causing the increase in cable tension thereby allowing said lever and said winch to move in the opposite direction and thereby lift said body, and means for reactivating the power for said winch upon

return of said lever and said winch to their initial position.

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