Dec. 30, 1969 G. R. SANTOS 3,487,280

HOIST PUSH BUTTON CONTROL

Filed March 17, 1967 2 Sheets-Sheet 1

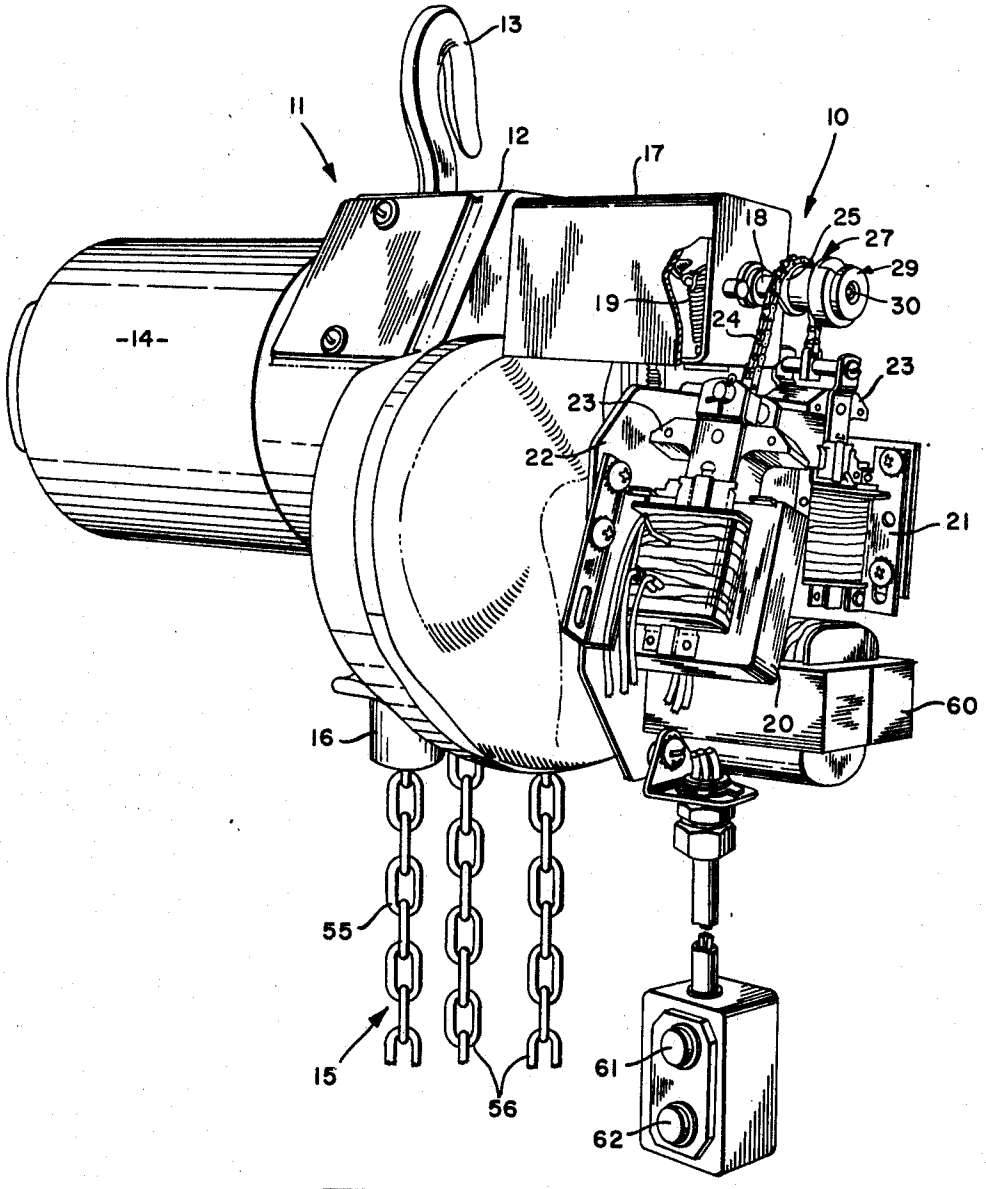

Fig. 1

INVENTOR.
G. R. SANTOS

BY Teagno & Toddy

ATTORNEYS

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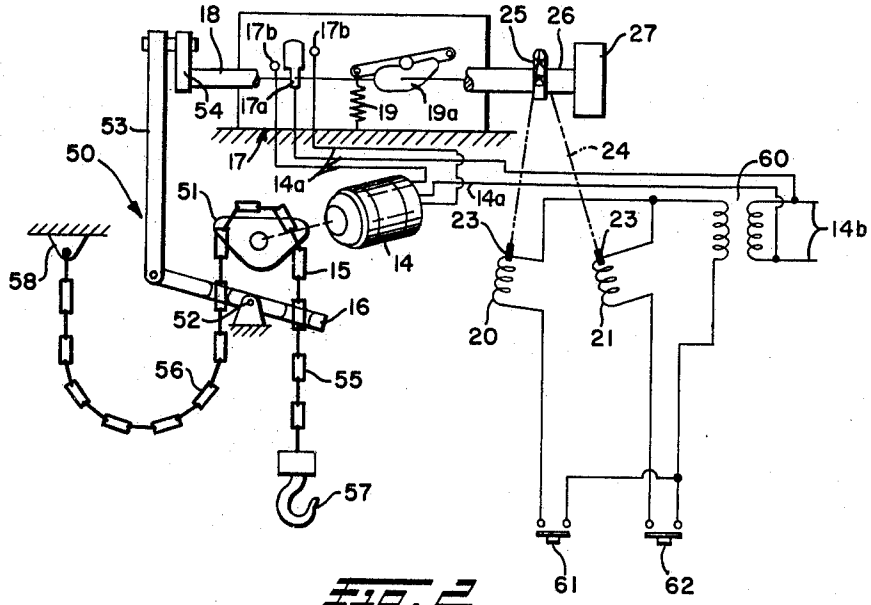

Fig. 2

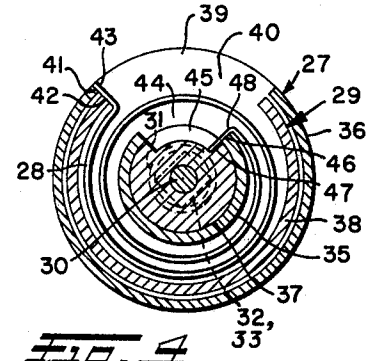

Fig. 4

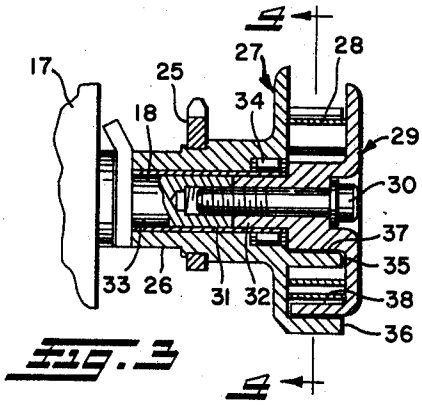

Fig. 3

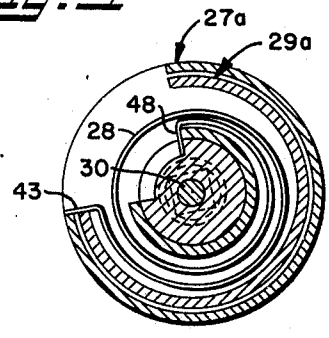

Fig. 5

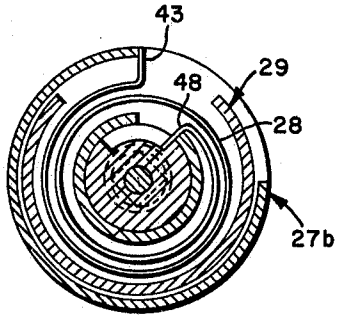

Fig. 7

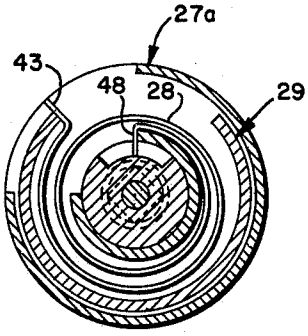

Fig. 6

INVENTOR.
G. R. SANTOS

BY

Teagno & Toddy
ATTORNEYS

United States Patent Office 3,487,280
Patented Dec. 30, 1969

3,487,280

HOIST PUSH BUTTON CONTROL

Gerard R. Santos, Levittown, Pa., assignor to Eaton Yale & Towne Inc., Cleveland, Ohio, a corporation of Ohio

Filed Mar. 17, 1967, Ser. No. 623,915
Int. Cl. H02p *1/40, 1/00, 3/00*
U.S. Cl. 318—267 10 Claims

ABSTRACT OF THE DISCLOSURE

A motor operated hoist is equipped with a pair of push button operated solenoids that normally control a switch for the hoist motor. A spring is interposed between the switch and the solenoids so as to yield and to prevent overstressing of a solenoid when hoist limit means move the switch independently of the normal control.

My invention relates to motor operated hoists.

As may be appreciated, there is a considerable demand for motor operated hoists that an operator can control through the actuation of push buttons. There are in use many hoists that are controlled in that way, but due to the particular requirements of hoist operation, the push buttons often have made it necessary to equip the hoist with control mechanism that is quite complex and costly. In some cases, the controls do not offer the best performance. Through the novel concept of my invention, it will be possible to achieve extremely satisfactory operation of a hoist while utilizing push button control. Moreover, that can be done through means that are relatively low in cost and that actually are quite simple.

In my invention, I equip a hoist with a motor switch that may be of a usual type, together with a yielding connection through which control means will act to move the motor switch. The operator of the hoist will actuate the control means, as by push buttons, for controlling the lifting and lowering movements of the hoist. There are further means for moving the switch, and those means will be effective through yielding of the yielding connection to move the switch independently of the control means. More particularly, the further means will be limit means that move the switch to neutral position incidental to a limit operation of the hoist.

As a feature of my invention, I equip a hoist with a pair of solenoids that will move a switch from a neutral position to opposed positions for effecting lifting and lowering movements of the hoist. The solenoids are very well adapted to be controlled through push buttons and enable me to construct an effective hoist control requiring no complex circuits. As a more particular feature, I utilize a spring through which a solenoid normally will act to control the switch. The spring may yield when the switch is moved by hoist limit means, so that the limit means cannot overstress the solenoid when overriding the control that may be applied by the solenoid.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the concept upon which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in

order to prevent the appropriation of my invention by those skilled in the art.

In the drawings:

FIG. 1 shows a perspective view of a hoist that utilizes my invention.

FIG. 2 shows a diagrammatic view of my invention.

FIG. 3 shows a longitudinal section of the switch shaft and spring assembly.

FIG. 4 shows a cross-section on the line **4—4** in FIG. 3, the assembly being in neutral position.

FIG. 5 is a section like FIG. 4 but shows the assembly in normal lifting control position.

FIG. 6 is similar to FIG. 5 but illustrates the yielding of the spring when the limit control overrides normal lifting control.

FIG. 7 illustrates the yielding when the normal control is in lowering position.

Referring now more particularly to FIG. 1 of the drawings, I show my novel control **10** utilized on an electric hoist **11** having a frame **12** that is equipped with a support hook **13**, and a motor **14** for operating a load chain **15**. Those skilled in the art will understand that the motor **14** may operate in opposed directions to effect lifting and lowering movements of the load chain **15**, there being suitable gearing (not shown) through which the motor acts. A limit member **16**, a part of which can be seen in FIG. 1, will limit the operations of the hoist, and I shall refer in more detail to the limit member **16** as my description proceeds.

Referring again to FIG. 1, I mount on the hoist **11** a motor switch **17** having an operating shaft **18** that can rotate from a neutral position in either direction to energize the motor **14** in a corresponding direction. Preferably, the switch **17** is equipped with a centering spring **19**, shown diagrammatically in FIGURE 2, applying pressure to a cam **19*a*** on switch shaft **18** so as to press the switch shaft **18** toward neutral position. For purposes of disclosure FIGURE 2 also shows switch **17** equipped with a contact arm **17*a*** that the shaft **18** will rotate from neutral position to engage either of two contacts **17*b***, so as to complete a corresponding directional circuit that will connect motor **14** through lines **14*a*** to a source of power **14*b***. I believe that it will be unnecessary to describe motor switch **17** in further detail because that switch may be of a standard type. It is merely necessary here to know that the switch operating shaft **18** can be rotated to opposed positions effecting lifting and lowering movements of the load chain **15**, the shaft **18** in neutral position stopping the operation of the chain. Merely to facilitate my description, I shall assume that switch shaft **18** is placed in lifting position when rotated counterclockwise, as viewed in FIG. 1.

In my novel control **10**, I utilize a pair of solenoids **20**, **21** mounted on the hoist frame **12**, as through a bracket **22**, that normally will control the rotation of the switch shaft **18**. Power for the solenoids **20**, **21** may be supplied through a transformer **60** that is connected to source **14*b***, FIGS. 1 and 2, and the operator of the hoist may energize the solenoids by depressing corresponding push buttons **61**, **62**. The armature **23** of each solenoid **20**, **21** is connected to one end of a chain **24** that engages a sprocket **25**, so that one solenoid when energized will rotate the sprocket in each direction. Solenoid **20** will effect counterclockwise rotation and therefore I may term it a lifting solenoid, and solenoid **21** a lowering solenoid.

The sprocket **25** is integrally secured to a sleeve portion **26** of a control part **27**, best shown in FIG. 3, that is mounted to rotate relatively to the switch operating shaft **18**. The control part **27** forms a portion of an assembly including a coil spring **28**, and a mounting part **29** that is integrally secured to the end of switch shaft **18**, as by a screw **30**. I prefer to utilize a bushing **31** that keys a

stem portion **32** of mounting part **29** to a portion **33** of switch shaft **18**, those portions **32** and **33** being squared, as indicated in dotted lines in FIG. 4, to coact with a corresponding square opening in bushing **31**. Control part **27** and its sprocket **25** then may rotate on the outer surface of bushing **31**, with the friction preferably reduced through roller bearings **34**.

Coacting with the coil spring **28**, the control part **27** has inner and outer cylindrical walls **35** and **36**, FIGS. 3 and 4, while mounting part **29** has cylindrical walls **37**, **38** each arranged just inwardly of the corresponding wall **35** or **36** on part **27**. Between inner wall **35** on part **27** and outer wall **38** on part **29** is a circular space in which coil spring **28** is assembled.

As well shown in FIG. 4, the outer walls **36**, **38** on control part **27** and mounting part **29** are formed with clearance openings **39**, **40**, one end of those openings forming stop surfaces **41**, **42** for an angular end portion **43** on coil spring **28**. Similarly, inner walls **35**, **37** have clearance openings **44**, **45** forming stop surfaces **46**, **47** in opposed relation to surfaces **41**, **42** and coacting with the inner spring end **48**. Coil spring **28** is so tensioned that its end portions **43**, **48** will act between the opposed stop surfaces **41**, **42** and **46**, **47**, tending to prevent any relative rotation between the control part **27** and mounting part **29**. At those times when the spring **28** yields, there naturally will be rotation in one direction or the other between the parts **27** and **29**, while the spring ends **43**, **48** move away from certain stop surfaces in the clearance openings, as may be seen in FIGS. 6 and 7. Actually, the coil spring **28** that I utilize in my invention will have strength sufficient to hold parts **27**, **29** in a predetermined relation to one another during normal operation of the hoist. Normally, therefore, parts **27** and **29** will rotate in unison, as from the FIG. 4 position to the FIG. 5 position, so that the solenoids **20**, **21** will fully control the rotation of the switch shaft **18**.

I shall refer to FIG. 2 of the drawings while describing further means that will rotate switch shaft **18**. Thus, I show diagrammatically at **50** in FIG. 2 a usual type of limit control including the limit member **16**, to which I already have referred in connection with FIG. 1. The limit member **16** is arranged below a usual load wheel **51** through which the hoist motor operates the load chain **15**, and is mounted at a medial point for tilting about a pivot **52** on the hoist frame. I show limit member **16** connected through link means **53** and a crank **54** to the switch operating shaft **18** so that limit member **16** by tilting may move the motor switch **17**. The load portion **55** and slack portion **56** of the load chain **15** extend from the load wheel **51** downwardly and when operating will move freely in openings in opposed portions of limit member **16**. Load portion **55** of chain **15** is equipped with a load hook **57**, while slack portion **56** is anchored at **58** to the hoist frame.

The limit arrangement that I have just described is not new, and those persons skilled in the art will understand that load chain **15** when moving to an upper limit position will cause the load hook **57** to engage the limit member **16** and to tilt it counterclockwise, as viewed in FIG. 2. When chain **15** moves to a lower limit position, its slack portion **56** will engage a portion of limit member **16** so as to tilt it clockwise. That tilting of limit member **16** in either direction will move shaft **18** to neutral so as to stop the operation of motor **17** and chain **15**. Should there be some overtravel of chain **15**, that is, past a limit position, the tilting of member **16** will move switch shaft **18** past neutral so as to reverse the hoist motor, causing chain **15** to move back to limit position. That naturally will enable member **16** and shaft **18** to move again to neutral position.

I now call attention to the fact that the limit control **50** may operate through yielding of the coil spring **28**, so as to rotate switch shaft **18** independently of the normal control that is applied through the solenoids **20**, **21**. Let us assume as an example that limit control **50** acts while solenoid **20** holds switch shaft **18** in lifting. position. In that position of shaft **18**, control part **27** and mounting part **29** will be in the positions **27***a*, **29***a*, shown in FIG. 5, having been rotated from the neutral FIG. 4 position. Now, upon lifting limit operation of the limit control **50**, the mounting part **29** will rotate with switch shaft **18** back to neutral position as shown in FIG. 6, while coil spring **28** yields so that control part **27** may remain in its position **27***a*. The lowering limit control operation will be substantially the same, though naturally being in directions opposed to those I have described, and with spring **28** yielding while control part **27** is held in position **27***b* as shown in FIG. 7.

I have already mentioned the fact that overtravel of the load chain **15** will cause switch shaft **18** to rotate past neutral, thereby reversing the hoist motor. When shaft **18** rotates in that way, the coil spring **28** can yield farther as I shall explain. Referring to FIGS. 5 and 6, it will be seen that the clearance openings **39**, **40** and **44**, **45** are considerably wider than is necessary to allow the spring ends **43**, **48** to move when the limit control merely rotates mounting part **29** to neutral position. In the particular example shown, there merely need be a movement of approximately 45° between each spring end **43**, **48** and its corresponding opening **39**, **45**. However, as also shown, each clearance opening actually allows approximately 90° clearance. Thus, the spring ends **43**, **48**, can move farther, enabling coil spring **28** to yield while the limit control rotates mounting part **29** beyond its neutral position to a motor reversing position.

It will now be understood that my invention will enable the operator of a hoist to utilize push buttons so as to apply normal control to the movements of a hoist, while also enabling a limit control to act effectively while overriding the push button control.

However, to fully appreciate my invention, it is necessary to realize that the limit control cannot overstress the normal control. That is important because the operator of a hoist frequently will attempt to hold the normal control in actuated position after the limit control operates. In my invention, when that happens, the normal control may remain in actuated position and the limit control cannot force it toward neutral position. Thus, when the normal control comprises a solenoid, the operator cannot injure or destroy the solenoid through a continued application of power when the limit control operates.

Further, by utilizing solenoids I am able to control the movements of a hoist through means that are quite simple, while well adapted to be actuated through push buttons. Also, I achieve control that is extremely effective and that will very well meet the requirements of hoist operation. I believe, therefore, that the considerable value of my invention will be understood, and that its merits will be appreciated by those persons skilled in the art.

I now claim:

1. In a hoist having a load member and a motor for operating the load member, a switch for said motor, movable control means connected to the switch for moving said switch whereby to control the operation of the hoist load member by said motor, yielding means forming a connecting part between the control means and the motor switch and through which said control means normally act to control the movements of said switch to motor actuating and to neutral positions, limit means acting independently of said control means for moving the switch to a neutral position incidental to an operation of the load member, and said yielding means yielding so that said limit means cannot overstress the control means while moving the switch independently of said control means.

2. A construction as set forth in claim **1**, including opposed stop surfaces against which said yielding means press on said switch and on said control means, and said

yielding means having strength sufficient that its pressure against said surfaces normally will move the switch in unison with the control means.

3. A construction as set forth in claim 1, in which said control means include a solenoid that acts through said yielding means, and means to energize said solenoid for moving said switch, and said yielding means having strength sufficient normally to move the switch in unison with the solenoid.

4. In a hoist having a load member and a motor for operating the load member, a switch movable to opposed positions actuating the motor to effect lifting and lowering movements of the load member, a pair of solenoids, means connecting each solenoid to said switch so as to be effective when energized to move the switch to one of said opposed positions, means for selectively energizing one solenoid or the other solenoid whereby to control the operation of the load member, further means positively connected to said switch and effective by moving the switch for positively overriding the control applied through the solenoids, and said means that connect each solenoid to the switch comprising a yielding portion that will yield so that said further means cannot overstress the solenoids when overriding the solenoid control.

5. A construction as set forth in claim 4, in which a spring forms said yielding portion of the connecting means, and including stop surfaces between which said spring acts relatively to the switch and solenoids whereby to press the switch toward a predetermined relation to the solenoids.

6. In a hoist having a load member and a motor for operating the load member, a switch having an operating member movable from a neutral position to opposed positions actuating the motor to effect lifting and lowering movements of the load member, a control part mounted for movement relatively to the switch operating member, means for moving said control part, a spring connecting the control part and the switch operating member and through which said part may move said operating member to control the lifting and lowering movements of the hoist load member, limit means connected to the switch operating member and actuated by the load member positively to move said operating member to neutral position incidental to an operation of the load member, and said spring effective by yielding to enable the limit means to act independently of the movements of the control part.

7. A construction as set forth in claim 6, in which said spring has strength sufficient normally to hold the switch operating member in predetermined relation to said control part.

8. A construction as set forth in claim 6, in which said means for moving the control part comprise a pair of solenoids, and means for energizing said solenoids selectively to move the control part in opposed directions.

9. In a hoist having a load member operated through the actuation of a motor, and a switch equipped with a shaft that is rotatable from a neutral position in opposed directions to positions actuating the motor to effect lifting and lowering movements of the load member, a control part mounted for rotation on said switch shaft, a spring having opposed ends engaging the switch shaft and a control part and connecting said shaft and part for rotation normally with one another, a pair of solenoids connected to the control part for rotating said part in opposed directions, push buttons for energizing selectively one solenoid or the other solenoid whereby to control the rotation of the switch shaft, limit means connected to the switch shaft and effective to rotate said shaft independently of the control part to neutral position whereby to override the solenoid control incidental to a movement of the hoist load member to a limit position, and said spring yielding so that the limit means when overriding the solenoid control cannot overstress the solenoids.

10. A construction as set forth in claim 9, in which said spring is a coil spring mounted in the axis of the switch shaft, said shaft and said control part having stop surfaces between which the spring ends act to press said shaft toward a normal relation to said part, and said stop surfaces moving through yielding of said spring to enable said limit means to rotate the switch shaft in either direction from its normal relation to the control part.

References Cited

UNITED STATES PATENTS

2,253,557	8/1941	Collins	318—466
2,537,288	1/1951	Townsley et al.	318—466

ORIS L. RADER, Primary Examiner

K. L. CROSSON, Assistant Examiner

U.S. Cl. X.R.

318—446, 468