Sept. 11, 1962 S. T. BUCK 3,053,344

AUTOMATIC CONTROL SYSTEM FOR HOISTING MACHINE

Filed Sept. 15, 1958 5 Sheets-Sheet 1

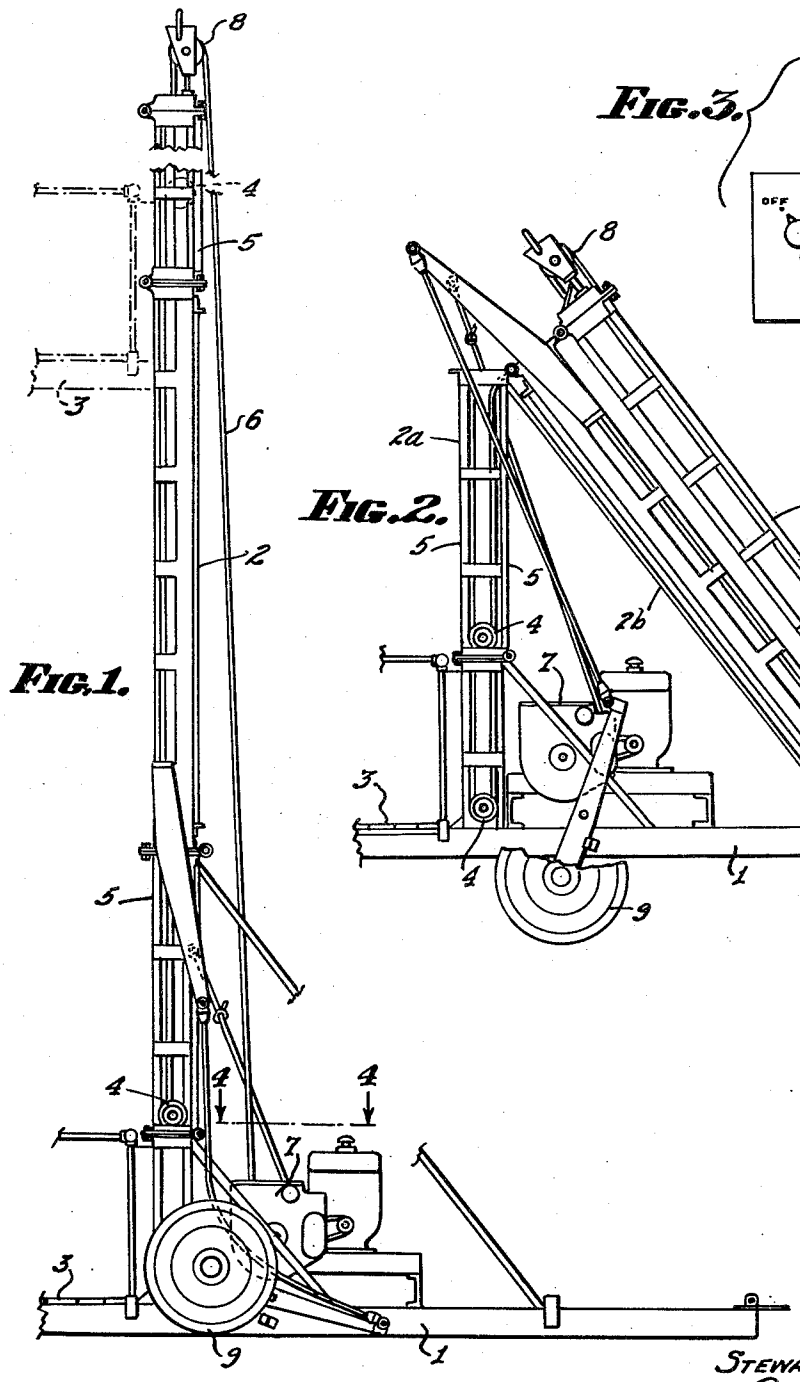


FIG. 1.

FIG. 2.

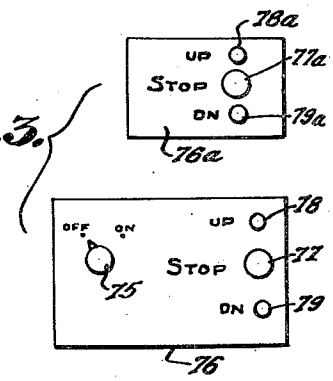


FIG. 3.

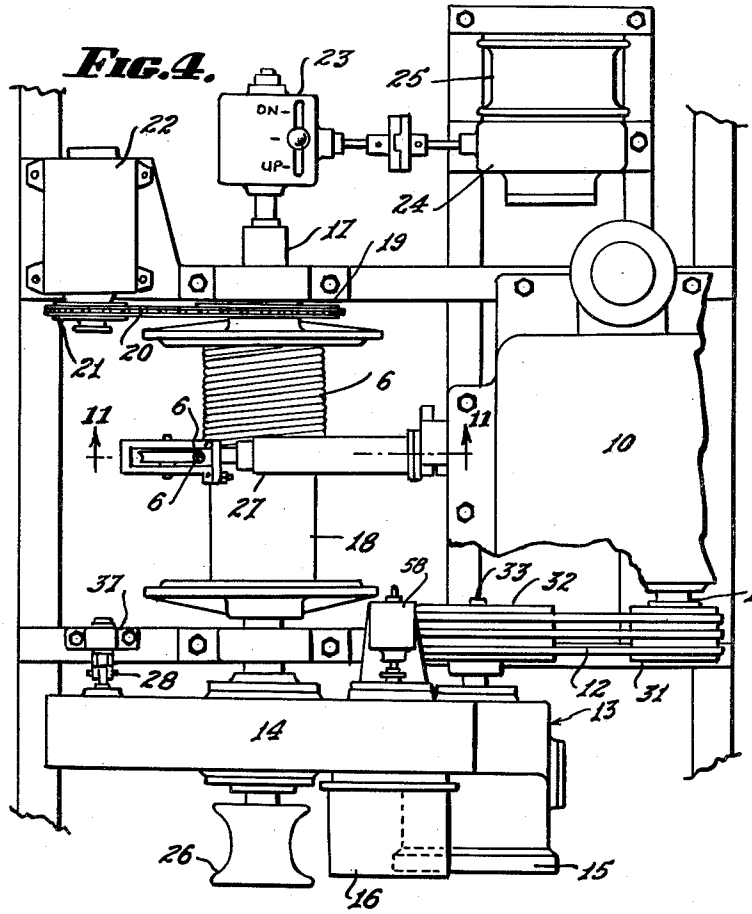
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AUTOMATIC CONTROL SYSTEM FOR HOISTING MACHINE

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FIG. 4.



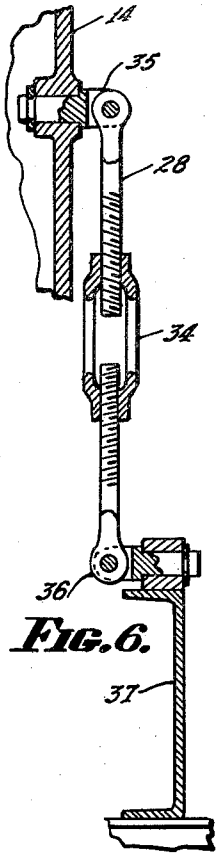
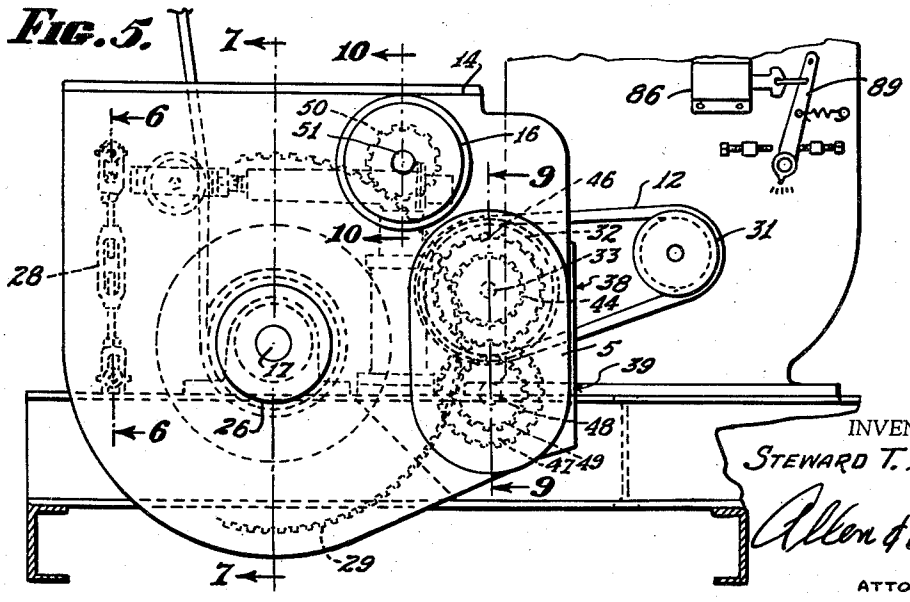


FIG. 6.

FIG. 5.



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FIG. 7.

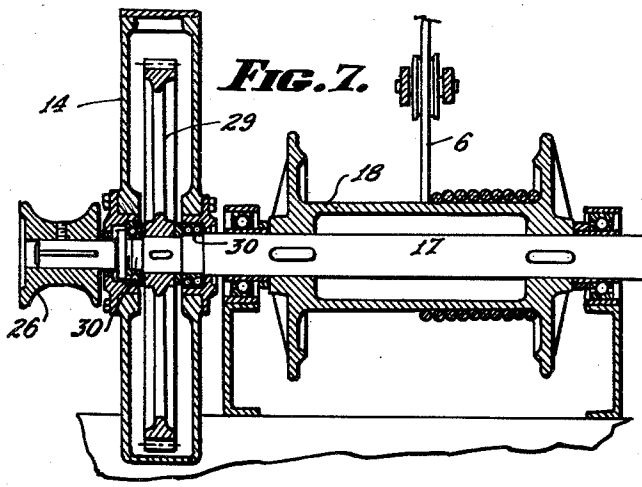
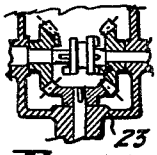


FIG. 8.



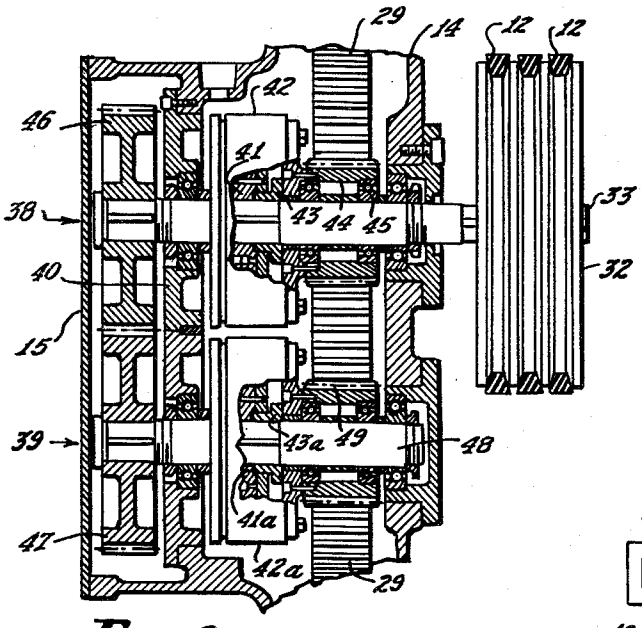


FIG. 9.

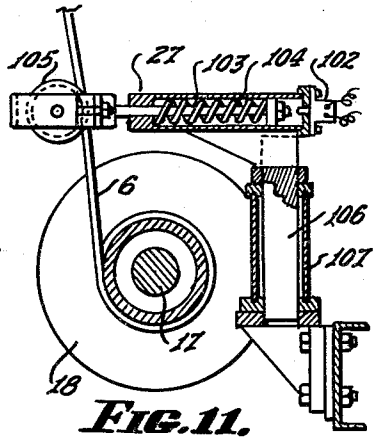


FIG. 11.

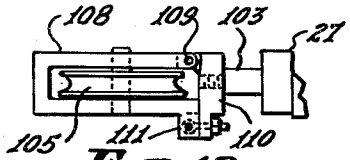


FIG. 12.

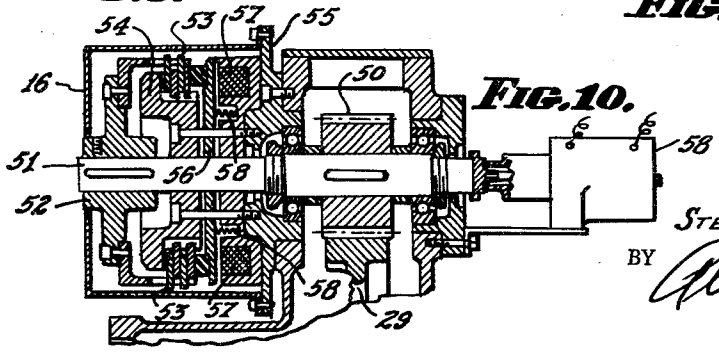


FIG. 10.

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AUTOMATIC CONTROL SYSTEM FOR HOISTING MACHINE

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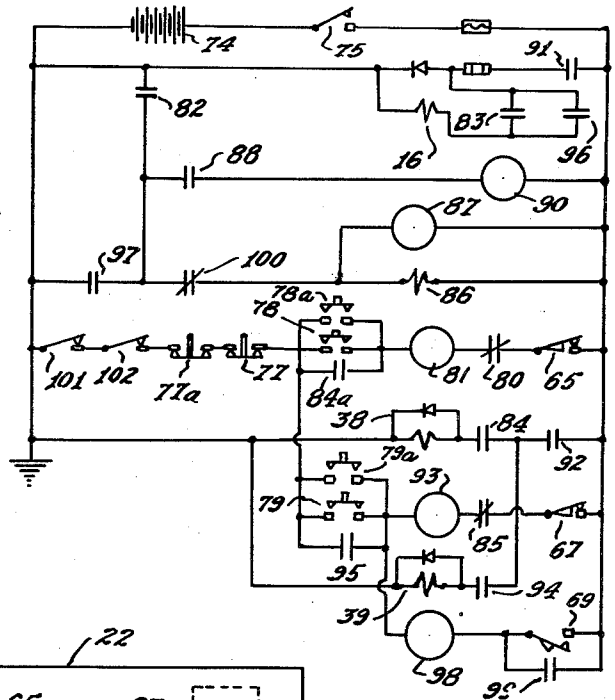


FIG. 17.

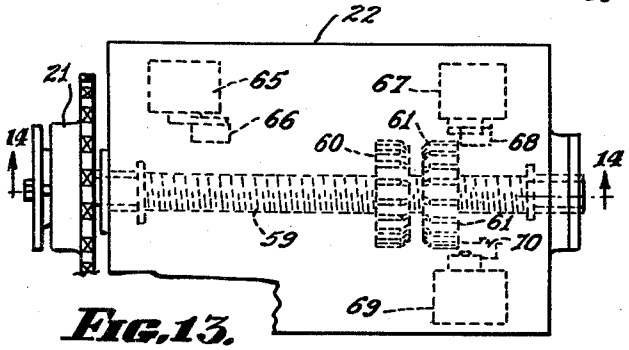


FIG. 13.

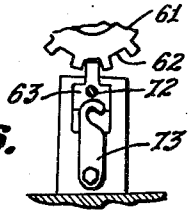


FIG. 16.

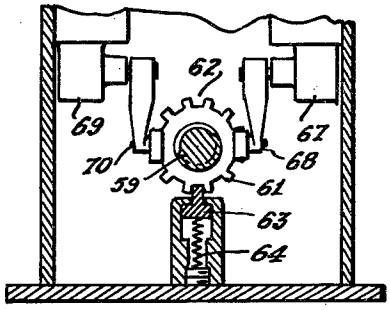


FIG. 15.

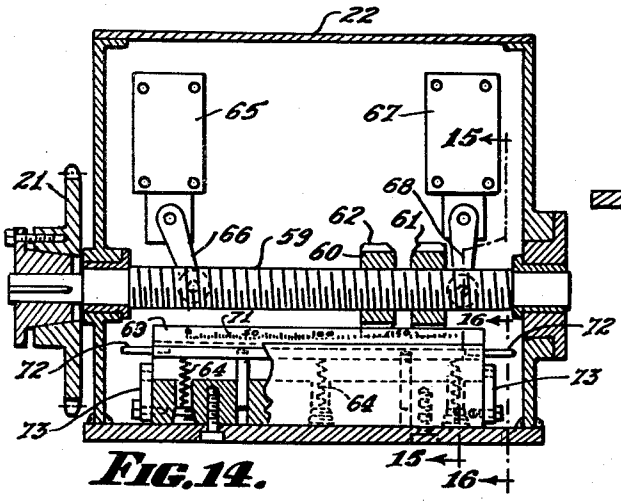


FIG. 14.

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AUTOMATIC CONTROL SYSTEM FOR HOISTING MACHINE

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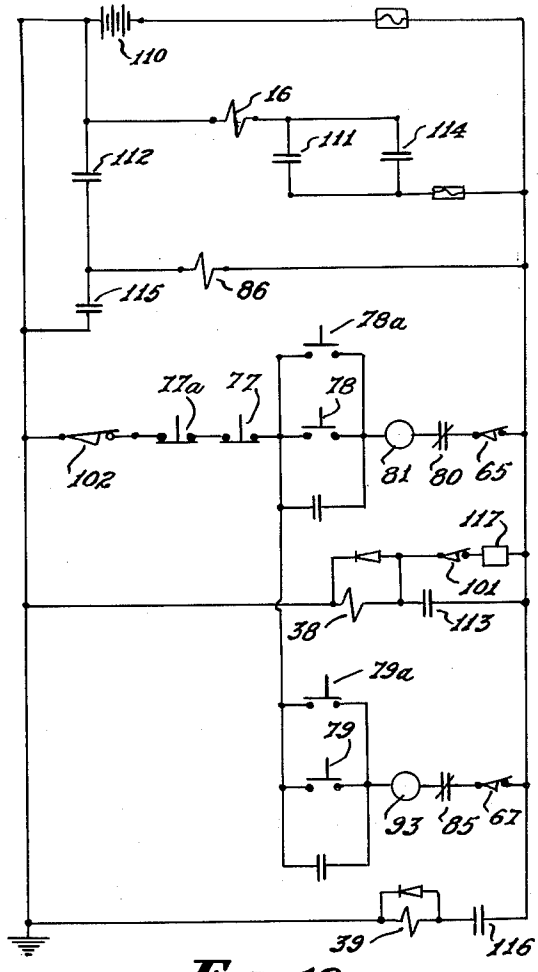


FIG. 18.

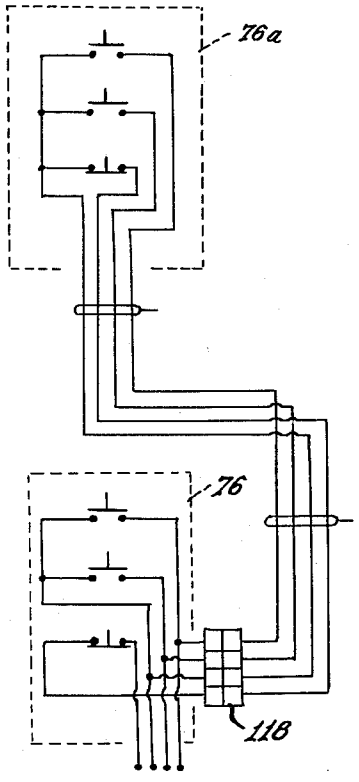


FIG. 19.

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United States Patent Office 3,053,344
Patented Sept. 11, 1962

3,053,344

AUTOMATIC CONTROL SYSTEM FOR HOISTING MACHINE

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720 Anderson Ferry Road, Cincinnati 38, Ohio

Filed Sept. 15, 1958, Ser. No. 761,186
7 Claims. (Cl. 187—2)

My invention relates to hoisting machines and more specifically to an automatic control system for the lift platform or elevator of a hoisting machine.

In recent years hoisting machines have come into wide spread use in construction jobs and the like wherein supplies are elevated to different floor levels. Such hoisting devices fall generally into two categories, the first comprising towers which are erected on the building site by a crew of workmen, the tower and its component parts being assembled more or less piece by piece. The second type comprises portable hoisting towers which are mounted either on a truck or trailer and formed in hinged together sections which may be quickly raised and lowered. Essentially, the instant invention has been expressly designed for use with hoisting devices of the latter class, although its utility is not so limited and it may be readily used with the first type of tower or in any other hoisting device wherein substantially automatic operation is desired.

All prior art hoisting devices of which I am aware, irrespective of their type, have been manually controlled in that it is necessary for the operator to start and stop the lifting mechanism each time the lift platform or other lifting means is raised or lowered. With the operator at ground level, it is particularly difficult for him to accurately judge when the lifting platform is properly aligned with the level of a floor a number of stories above him. This results in considerable jockeying back and forth of the lift platform which is both time consuming and hard on the operating parts of the machine. Similarly, even if the platform is being lowered, the operator must stand by to disengage the operating mechanism when the platform reaches its lowermost position or some intermediate position of use, as where materials are being unloaded directly from a truck or the like onto the lift platform. Since in most instances the hoist operator has other duties, such as loading materials onto the lift platform, or bringing materials to the loading area, he can perform such other duties only when the hoisting machine is not in operation.

A principal object of the instant invention is to provide an automatic control system for hoisting machines which require a minimum of operator attention, thereby freeing the operator for other duties.

A further object of the invention is the provision of a control system which will automatically stop the lifting means at predetermined upper and lower positions, the operator having only to start the lifting means on its upward or downward journey, whereupon the control mechanism takes over to stop the lifting means at a preset position.

Still a further object of the invention is the provision of a control system incorporating improved hoisting mechanism and safety features which greatly enhance the versatility of the hoisting machine and at the same time assure positive accident free operation.

The foregoing, together with other objects of the invention which will appear hereinafter or which will be apparent to the skilled worker in the art upon reading these specifications, I accomplish by that construction and arrangement of parts of which I shall now describe an exemplary embodiment.

Reference is now made to the accompanying drawings wherein:

FIGURE 1 is a side elevational view of a hoisting machine incorporating the invention.

FIGURE 2 is a side elevational view illustrating the machine in collapsed position.

FIGURE 3 is a schematic view illustrating the control panels for the system.

FIGURE 4 is a horizontal sectional view taken along the line **4—4** of FIGURE 1.

FIGURE 5 is a side elevational view of the mechanism illustrated in FIGURE 4.

FIGURE 6 is a vertical sectional view taken along the line **6—6** of FIGURE 5.

FIGURE 7 is a vertical sectional view taken along the line **7—7** of FIGURE 5.

FIGURE 8 is a horizontal sectional view taken along the line **8—8** of FIGURE 7.

FIGURE 9 is a vertical sectional view taken along the line **9—9** of FIGURE 5.

FIGURE 10 is a vertical sectional view taken along the line **10—10** of FIGURE 5.

FIGURE 11 is a vertical sectional view taken along the line **11—11** of FIGURE 4.

FIGURE 12 is an enlarged fragmentary plan view of the cable engaging pulley shown in FIGURE 11.

FIGURE 13 is a plan view with interior parts shown in dotted lines of the automatic stop mechanism for the lift platform.

FIGURE 14 is a vertical sectional view taken along the line **14—14** of FIGURE 13.

FIGURE 15 is a vertical sectional view taken along the line **15—15** of FIGURE 14.

FIGURE 16 is a fragmentary vertical sectional view taken along the line **16—16** of FIGURE 14.

FIGURE 17 is a wiring diagram of the control system.

FIGURE 18 is a wiring diagram of a simplified control system.

FIGURE 19 is a wiring diagram illustrating how the control panels of FIGURE 3 may be wired to the system.

Referring first to FIGURES 1 and 2 of the drawings, I have therein illustrated an exemplary portable hoisting machine with which the control system of the present invention may be employed. The device comprises a base or frame **1** mounting a vertically extending tower **2** along which a platform or other lifting means **3** is adapted to travel, the lift platform having grooved rollers **4** which move along the trackways **5** formed as integral parts of the tower structure. The life platform **3** is raised and lowered, as from the position shown in solid line to the position shown in dotted lines, by means of a cable **6** which extends upwardly from the drive unit **7** around a pulley mechanism **8** at the top of the tower and then downwardly for engagement with the lift platform. Preferably a two part cable will be employed.

In the embodiment illustrated, the base or frame **1** is provided with retractable wheels **9** by means of which the device may be readily transported from place to place; and to this end the tower is formed in a plurality of hinged sections **2***a*, **2***b* and **2***c*, as seen in FIGURE 2, so that it may be readily collapsed for movement from one site to another. Since the mechanism for erecting the tower does not constitute a part of the present invention, it will not be described in detail. Reference is, however, made to the recently isued Patent No. 2,653,685 dated September 29, 1953 and entitled, Portable Hoisting Tower, wherein the construction and mode of erecting and collapsing the tower structure are described in detail. As already indicated, the instant invention is concerned with the driving unit and its associated control for raising and

lowering the lift platform, which unit will find utility in all types of hoisting machine.

Referring now to FIGURE 4 of the drawings, the drive unit comprises a prime mover **10** which may be either an electric motor or an internal combustion engine, the drive shaft of which is shown at **11**. A series of drive belts **12** connects the drive shaft of the motor to a transmission **13** enclosed in a housing **14** which also mounts clutch mechanism **15** and brake mechanism **16**. The transmission **13** serves to drive the main shaft **17** which mounts a winch **18** for winding and unwinding the cable **6** which raises and lowers the lift platform. The shaft **17** also mounts a sprocket **19** connected by an endless chain **20** to the sprocket **21** forming a part of control mechanism **22** which automaticallly regulates the extent of upward and downward movement of the lift platform.

While not, strictly speaking, a part of the instant invention, the shaft **17** may also be provided at one end with a power take-off **23** operatively connected through suitable gear mechanism **24** to a winch **25** utilized to raise and lower the tower sections. Similarly, at its opposite end the shaft **17** may be provided with a work head **26**.

Other operating components of the drive unit are a slack cable device **27** which acts to deenergize the control system should the cable become slack for any reason, and a torque bar arrangement **28** to adjust the tension of the drive belts **12** connecting the prime mover to the transmission.

Referring now to FIGURE 7, it will be seen that the main shaft **17** is driven by means of a bull gear **29** located within the housing **14**. The entire housing **14** is supported by the main shaft **17**, being mounted thereon by means of ball bearings **30**, the arrangement being such that the housing may pivot about the shaft **17**. Such pivoting movement permits tightening or loosening of the drive belts **12** by varying the distance between the sheaves **31** on drive shaft **11** and sheaves **32** on clutch shaft **33** forming a part of the clutch mechanism **15**. Pivotal movement of the housing **14** is controlled by means of the torque bar **28** which, as best seen in FIGURE 6, comprises a turn buckle **34** one end of which is connected through a swivel joint **35** to the transmission housing **14**, and the opposite end of which is connected through a swivel joint **36** to the machine frame **37**. By tightening or loosening the turn buckle **34**, the entire transmission housing may be rocked about the shaft **17**, thereby altering the distance between the sheaves **31** and **32** and hence altering the tension on the drive belts **12**.

Referring now to FIGURES 5 and 9, the bull gear **29** is reversibly driven from clutch mechanism **15** which incorporates a "down" clutch **38** and an "up" clutch **39**, both of which are electrically controlled and adapted to rotate the bull gear in opposite directions, depending upon the direction in which the shaft **17** is to be rotated. As seen in FIGURE 9, the clutch shaft **33**, which is driven by drive belts **12**, is journaled in housing **14** and an inner frame member **40**. A first element **41** of electric clutch **42** is keyed to the shaft **33** and engageable, upon actuation, with a second element **43** secured to a gear **44** which is freely mounted on shaft **33** by means of ball bearings **45**. The teeth of gear **44** mesh with the teeth of bull gear **29**, as will be evident from FIGURE 5, so that upon actuation of the clutch **42**, the elements **41** and **43** will coact to drive gear **44**. When clutch **42** is deenergized, the driven shaft **33** will simply turn relative to gear **44**, which remains stationary.

At its outermost end the shaft **33** mounts a gear **46** the teeth of which mesh with a mating gear **47** keyed to a shaft **48** which parallels shaft **33** and is journaled in the housing **14** and inner frame member **40**. The shaft **48** mounts an electric clutch **42***a* which is identical to clutch **42** and has a first operating part **41***a* keyed to shaft **48** and a second element **43***a* secured to gear **49** which is freely rotatable on shaft **58**. On energization of the clutch **42***a*, the shaft **48** will drive gear **49** which meshes with the bull gear **29**.

With the arrangement just described, both the shafts **33** and **48** are driven at all times the machine is in operation, but the bull gear **29** will be driven only at such time as one or the other of the clutches **42**, **42***a* is energized. This clutch arrangement has proven to be highly advantageous in that it operates smoothly and is instantaneously reversible.

The brake control for the winch is independent of the drive mechanism and, as seen in FIGURE 10, comprises an electro magnetic multiple disc spring brake which is normally set. That is, it is only upon energization of the brake mechanism that the winch is free to rotate. The winch is normally held against rotation by means of a gear **50** which is keyed to shaft **51**, the gear **50** meshing with bull gear **29**. A generally cup-shaped element **52** is also keyed to the shaft. This element contacts alternate discs of a set of discs **53** carried by stationary element **54** fixedly secured to the housing **55**. A spring pressed plate **56**, also fixed relative to the housing, normally bears against the discs **53**, thereby holding them against rotation and, through the cup-shaped element **52**, preventing rotation of the shafts **51**. When the brake mechanism is energized, electro magnets **57** act to retract plate **56** against the compression of its springs **58**, thereby releasing the discs **53** for rotation about the stationary element **54** and hence freeing the cup-shaped element and shaft for rotation.

As an additional safety feature when the lift platform is being lowered, the shaft **51** of the brake mechanism is connected to an over speed governor **58** which is a centrifugal device acting to automatically energize the "up" electric clutch **39** in the event a predetermined excessive speed is attained, thereby effecting an additional braking action on the bull gear.

Referring now to FIGURES 13–16, I have therein illustrated the control mechanism for automatically stopping the lift platform at predetermined upper and lower levels. As seen therein the sprocket **21** which, it will be remembered, is driven through chain **20** and sprocket **19** affixed to main shaft **17**, drives a threaded shaft **59** which is journaled at its ends in the casing of the device. In place of the sprocket arrangement shown, the shaft **59** may be gear driven from the main shaft **17**. The threaded shaft mounts a pair of internally threaded members **60** and **61** each having a plurality of radially disposed teeth **62** arranged to be selectively engaged by a longitudinal guide bar **63** normally biased into engagement with the teeth by means of springs **64**. When in its normally "up" or tooth engaging position, the bar **63** will hold the members **60** and **61** against rotation so that, as the shaft **59** rotates, the members **60** and **61** will move axially along the threaded shaft depending upon the direction of its rotation.

The control device preferably contains a set of three limit switches arranged to coact with the members **60** and **61**, the switch **65** being a normally closed "up" switch and having an arm **66** adapted to be contacted and opened by member **60** as the member travels along the threaded shaft. Similarly, the switch **67** is a normally closed switch having an arm **68** arranged to be contacted and opened by the member **61**. The switch **69** having arm **70** is a normally open switch and is also adapted to be contacted by the member **61**. The switch **67** is the "down" switch, whereas the switch **69**, which is arranged to be contacted slightly in advance of the switch **67**, is a "slow down" switch.

The bar **63** carries a scale **71** on its front face by means of which the operator may set the members **60** and **61** in accordance with the desired stop levels of the lift platform. For example, if the maximum travel of the lift platform is from 0′ to 150′, the scale **71** will be calibrated, left to right, from 0 to 150 for the member **60**; and the rightmost end of the scale will also have a "0"

position to indicate the point at which the member **61** will contact and close switch **67**. It will be understood, of course, that the shaft **59** rotates in synchronism with the main shaft **17**, and consequently for each revolution of the winch **18**—which either reels in or pays out a given length of cable—the threaded members **60** and **61** will move along the shaft a proportional distance. In an exemplary embodiment wherein a two part cable is employed, the ratio of rotation between the winch **18** and the threaded shaft **59** is 1:2, with the pitch of the threads on the shaft **59** such that the members **60** and **61** will travel axially ¼" for each 10' of platform movement or 20' of cable, the members **60** and **61** moving to the left, as seen in FIGURES 13 and 14, as the cable is wound onto the drum and moving to the right as it is played out.

In the exemplary setting down in FIGURE 14, the member **60** is set to contact and open "up" switch **65** when 150' of cable has been wound on the winch. As the threaded shaft **59** rotates to move the member **60** to the left for contact with the switch **65**, the member **61** will move a like distance to the left so that the member **61** will subsequently travel to the right for contact with "down" switch **67** as the threaded shaft is rotated in the opposite direction upon unwinding movement of the winch to return the lift platform to the lowermost position.

If, for example, the lift platform is to be raised only 50' then the guide bar **63** would be depressed, thereby freeing the member **60** for rotation, and the member would be advanced along the shaft **59** until its leading edge coincided with the 50' mark on the scale. When in this position, the member **60** will contact the arm of switch **65** when 100' of cable has been wound on the winch (assuming a two part cable). As seen in FIGURES 14 and 16, the guide bar **63** may be conveniently provided with pins **72** at its opposite ends engageable by hooks **73** effective to lock the guide bar in depressed position, thereby permitting the threaded members **60** and **61** to be readily rotated relative to the shaft. Critical or close adjustment of the threaded members can be obtained by rotating them through only one or two of the notches **62**. For example, in the exemplary embodiment illustrated, the notches **62** are on 30° centers and their relation to the pitch of the screws is such that each notch represents 2" of platform movement. In other words, each adjusting revolution of the members **60**, **61**, results in a 2' variation in platform height.

Adjustment of the "down" or lower position of the platform is made by bringing the lift platform to the desired "down" position—which may be anywhere between 0–150'—and with the platform so positioned rotating the member **61** until it coincides with the "0" at the right end of the scale **71**.

The switch **69**, which is a "slow down" switch, is adapted to be contacted and closed by the members **61** in advance of the time it contacts the stop swicth **67**. This switch will be contacted when the lift platform is from 5 to 10 feet from its lower limit and will serve to reduce the speed of the motor driving the winch, thereby slowing down the lift platform as it approaches its lowermost position. The function of the slow down mechanism will be best understood from the following discussion of the overall operation of the device. This switch is optional and may be eliminated if desired. Of course, if desired a fourth switch could be installed to act as a "slow down" as the lift reaches its upper limit.

Reference is now made to FIGURE 17 of the drawings wherein an exemplary control circuit for the various operating components of the device is illustrated. The circuit includes a source of power **74** which may be either a storage battery or a current rectifier, if A.C. current is available. In either event, the control system will comprise an "On-Off" switch **75** which, as seen in FIGURE 3, may be conveniently made a part of an operator control panel **76** mounted at any convenient place adjacent the drive unit, the panel including a "stop" button **77**, and "up" and "down" buttons **78** and **79**, respectively. I also prefer to provide a second control panel **76***a* which may be secured to the tower **2** at any desired position. This panel has a "stop" button **77***a* and "up" and "down" buttons **78***a*, **79***a* arranged in series with their counterparts on panel **76**. The panel **76***a* may be conveniently positioned adjacent an upper floor level so that a workman removing material from the lift platform may control the device in the event the operator on the ground is busy with other duties.

Referring again to the exemplary wiring diagram of FIGURE 17, when either of the "up" buttons is pushed to initiate upward movement of the lift platform, a circuit is formed through the normally closed "up" switch **65** of control mechanism **22** and normally closed relay **80**, thereby energizing relay coil **81**. The coil **81** serves to close relays **82**, **83**, **84**, and "up" switch by-pass relay **84***a*, and it opens normally closed realy **85**. The relay **82** form a circuit to throttle solenoid **86** and the coil **87** of timed delay relay **88**. As seen in FIGURE 5, the solenoid **86** is connected to the throttle **89** which controls the speed of prime mover **10** and serves to advance the prime mover from idling speed to full operating speed. The time delay relay **88** does not close for a matter of seconds after the initial energization of coil **87**, thereby permitting the motor to attain full operating speed; but when it does close, it energizes coil **90** which closes relays **91** and **92**, the former acting through previously closed relay **83** to energize normally set brake **16**, thereby releasing the drive mechanism, and at the same time relay **92** completes the circuit to "up" clutch **38** to drive the main shaft **17** and winch **18**.

When the lift platform reaches its predetermined upper level, the normally closed "up" switch **65** is opened, thereby breaking the circuit to coil **81** and opening relay **84** which acts to deenergize clutch relay **84** and brake relay **83**.

When either of "down" switches **79**, **79***a* is closed, a circuit is formed to coil **93** which acts to close relays **94** and **95**. At the same time relay **96** is closed to energize and release brake **16**, as is relay **97** which energizes throttle solenoid **86** and time delay coil **87**. The coil **87** functions as before to close relays **91** and **92**, thereby completing the circuit to the "down" clutch through relay **94**. The normally closed relay **80** in the "up" clutch circuit is also opened, thereby locking out the "up" clutch **38**.

As the lift platform approaches its lowermost position, "slow down" switch **69** in the control device is closed to energize coil **98** which closes relay **99** and opens normally closed relay **100**, the latter relay serving to break the circuit to throttle solenoid **86** and thereby release throttle **89** for movement to the idle position. This effectively reduces the speed of the lift platform as it approaches its lowermost position. As the lift platform reaches the lowermost position, the switch **67** will be opened, thereby breaking the circuit to coil **93** which opens relays **94** and **95** to deenergize "down" clutch **39** and also opens relay **96** to deenergize and hence set brake **16**.

It will be apparent that either the "up" or "down" circuit can be broken by pressing either of the stop buttons **77**, **77***a* or upon opening of overspeed switch **101** or slack cable switch **102**. The overspeed switch will be opened by the overspeed governor **58** (FIGURE 10) in the event the mechanism runs at a predetermined excessive speed.

The mechanism controlling the slack cable switch **102** is shown in FIGURES 4, 11 and 12, wherein it will be seen that the switch **102** is adapted to be opened by a plunger **103** spring press toward the switch by spring **104** but normally maintained out of contact therewith by pulley wheel **105** engaged by the lift platform cable **6**. When the cable is taut, it presses against the pulley and compresses spring **104**, thereby maintaining the plunger **103** away from switch **102**. However, should the cable break or become slack for any other reason, the force of

the taut cable against the pulley **105** will be released, and the spring will move the plunger into contact with switch **102** thereby opening it and breaking the drive circuit.

As best seen in FIGURE 11, the slack cable device is mounted on a column **106** pivotally received in sleeve **107** mounted to the machine frame, the arrangement being such that the slack cable device may pivot in a horizontal plane to follow the cable **6** as it travels across the winch. As shown in FIGURE 12, I prefer to mount the pulley **105** in a closed yoke **108** pivoted at **109** to a base block **110**, the yoke having a latch **111** by means of which it may be opened to readily reengage the cable.

From the foregoing description, it should be apparent that the proposed device provides an essentially automatically acting lifting device requiring operator control only to start the lift platform on its upward or downward movement, as the case may be. The device is extremely versatile and is adjustable over a wide range of operating levels.

While I have disclosed my invention in a preferred embodiment, various modifications may be made without departing from the spirit and purpose of it, and consequently I do not intend to be limited excepting in the manner set forth in the claims which follow. As a specific example of a modification, the "up" switch **65**, "down" switch **67** and "slow down" switch **69** could be adjustably mounted on the tower structure for actuation by the lift platform itself, as it travels along the tower, rather than by employing the control mechanism **22**. Such an arrangement would, however, require that the position of the switches be changed with each change in operating conditions—which would be more time consuming than simply adjusting the members **60** and **61** in the control device **22**.

In FIGURE 18, I have illustrated a simplified control system particularly suited for use with an internal combustion engine. In this embodiment the control system is wired through the motor generator **110** so that current is supplied to the system only when the engine is running. Should the engine stop for any reason—as by running out of fuel—the generator will no longer supply current to the control system. This will have the effect of setting the brake **16** which, it will be remembered, is a normally set brake.

As before, the control system contemplates up switches **78**, **78***a* and down switches **79**, **79***a*, together with stop switches **77**, **77***a* which may be arranged on the control panels **76** and **76***a*. When either of the up switches is closed, a circuit is formed through normally closed "up" switch **65**, normally closed relay **80**, thereby energizing relay coil **81**. In this instance, however, the coil serves to directly close relay **111** to energize and hence release brake **16**. At the same time relay **112** is closed to actuate throttle **86** and relay **113** serves to energize the up clutch **38** to drive the winch **18**. At the same time, the normally closed relay **85** locks out the "down" clutch mechanism. When the lift platform reaches the upper limit, the limit switch **65** will be opened thereby breaking the circuit controlling the up clutch and brake and throttle.

In similar fashion, when either of the "down" switches **79**, **79***a* are closed, the limit switch **67** and relay **85** form a circuit to coil **93** which closes relays **114**, **115** and **116**, thereby releasing the brake, actuating the throttle solenoid and energizing the down clutch **39**.

In this embodiment the overspeed limit switch **101** is a normally open switch and arranged to form a circuit to "up" clutch **38** in the event the lift platform attains an excessive speed during its downward travel. The circuit also includes a resistor **117** which provides a partial voltage drop so that full power is not applied to the "up" clutch component. With this arrangement the partial power applied to the "up" clutch causes it to exert a braking action on the bull gear and hence serves to slow down its speed of rotation and hence the rate of descent of the platform.

In FIGURE 19, I have illustrated a simplified circuit by means of which the control panel **76***a* may be connected to the main control panel **76**, the connection being effected by means of a plug-in jack **118**. It will be obvious that more than one remote control panel may be conveniently provided if desired.

The foregoing modifications are exemplary of those which can be made without departing from the spirit and purpose of the invention. Similarly, it will be understood that the bull gear employed to drive the winch could be replaced by a worm gear adapted to be driven from a second shaft to which the clutch component are operatively connected. In such event, one of the clutch components could be geared to the second shaft with the remaining component connected to the shaft by a sprocket and chain, thereby providing a simple reversing drive for the second shaft.

Having thus described the invention in certain exemplary embodiments, what I desire to secure and protect by Letters Patent is:

1. In drive mechanism for a hoisting machine having a vertically movable lifting means which is raised and lowered by a winch and cable, a main shaft mounting the said winch, clutch means operatively connecting said shaft to a motor having an idle speed and an operating speed, said clutch means comprising an "up" and "down" element for rotating the said shaft and winch in opposite directions so as to raise and lower the lifting means, means for selectively engaging said "up" and "down" clutch elements, and control means for automatically stopping said lifting means at a predetermined "up" position, said control means including means operative, when the lifting means reaches the predetermined "up" position, to disengage said "up" clutch element and to reset said brake means, said control means also including means operative, when said "down" clutch element is engaged, to engage said "up" clutch to effect a braking action on said winch should said winch attain a predetermined excessive speed.

2. In drive mechanism for a hoisting machine having a vertically movable lifting means raised and lowered by a winch and cable, a main shaft mounting said winch, clutch means operatively connecting said shaft to a motor having an idle speed and an operating speed, said clutch means comprising an "up" component and a "down" component, brake means normally holding said shaft against rotation, the improvements which comprises control means for selectively raising and lowering said lifting means, said control means including manually actuated means for selectively initiating engagement of said "up" and "down" clutch components, time delay means operative upon the actuation of the said manually actuated means to effect engagement of the selected clutch component after a predetermined time delay, said time delay means also acting to release said brake means concurrently with the engagement of the selected clutch component, means responsive to the actuation of the said manually actuated means for advancing said motor from idle speed to operating speed prior to the engagement of the selected clutch component, and means for automatically disengaging said clutch components in accordance with predetermined vertical positions of said lifting means, said last named means including means operative, when the lifting means has reached its predetermined position, to set said brake means and return said motor to idle speed.

3. In drive mechanism for a hoisting machine having a vertically movable lifting means raised and lowered by a winch and cable, a main shaft mounting said winch, clutch means operatively connecting said shaft to a motor having an idle speed and an operating speed, said clutch means comprising an "up" component and a "down" component, brake means normally holding said shaft against rotation, the improvement which comprises control means for selectively raising and lowering said lifting means, said control means including manually actuated means for ini-

tiating engagement of said clutch components, time delay means operative upon the actuation of said manually actuated means for effecting engagement of the selected clutch component after a predetermined time delay, said time delay means also acting to release said brake means concurrently with the engagement of the selected clutch component, means responsive to the actuation of said manually actuated means for advancing said motor from idle speed to operating speed prior to the engagement of the selected clutch component, means for automatically disengaging said clutch components in accordance with predetermined vertical positions of said lifting means, said last named means including means operative, when the lifting means reaches predetermined "up" or "down" positions, to set said brake means, means effective when said limting means reaches the predetermined "up" position to return the motor to idle speed, and means operative upon "down" movement of the lifting means to return the motor to idle speed in advance of the lifting means reaching the "down" position, whereby to retard the speed of the lifting means in advance of its reaching "down" position.

4. The device claimed in claim 3 wherein said clutch components include electro magnetic clutch members, wherein said brake means comprises an electro magnetic brake, wherein said control means includes a control circuit for energizing said electro magnetic clutch and brake members, and wherein the manually actuated means for initiating engagement of said clutch components comprises switch means forming a part of said control circuit.

5. The device claimed in claim 4 wherein the means for automatically disengaging said clutch components comprises limit switches forming a part of said control circuit, said limit switches being incorporated in a control device having a threaded shaft rotated in timed relation to the movement of said main shaft, wherein the said threaded shaft mounts a pair of threaded member movable axially along said threaded shaft upon rotation thereof, and wherein said threaded members are adapted to contact and actuate said limit switches as said threaded shaft is rotated.

6. The device claimed in claim 5 wherein the means acting upon "down" movement of the lifting means to return the motor to idle speed in advance of the lifting means reaching the "down" position comprises a third limit switch mounted for contact by one of said threaded members as it moves along said threaded shaft.

7. In drive mechanism for a hoisting machine having a vertically movable lifting means raised and lowered by a winch and cable, a main shaft mounting said winch, a bull gear fixed to said shaft, clutch means operatively connecting said bull gear to a motor having an idle speed and an operating speed, said clutch means comprising an "up" component and a "down" component, an electro magnetic brake means normally holding said bull gear against rotation, the improvement which comprises a clutch housing pivotally mounted on said shaft and surrounding said bull gear, said clutch housing mounting said "up" and "down" clutch components, each of said components comprising a clutch shaft having a gear thereon in engagement with said bull gear, said last named gears being rotatable relative to their shafts, an electro magnetic clutch member mounted on each of said clutch shafts, said electro magnetic clutch members each having a first element fixed to one of said last named gears and a second element fixed to the shaft on which it is mounted, said electro magnetic clutch members, upon energization, acting to connect each clutch shaft to the gear thereon, means connecting one of said shafts to said motor, a drive gear fixed to said last named shaft in meshing engagement with a drive gear connected to the other of said shafts, whereby said second shaft is powered from the first, control means for selectively raising and lowering said lifting means, said control means including manually actuated means for initiating engagement of the selected clutch component, time relay means operative upon the actuation of said manually actuated means to energize said electro magnetic clutch member controlling the selected clutch component after a predetermined time delay, said time delay means acting to energize said electro magnetic brake means concurrently with the energization of the selected clutch component, means responsive to the actuation of said manually actuated means for advancing said motor from idle speed to operating speed prior to the energization of said electro magnetic clutch member, and means for automatically de-energizing said electro magnetic clutch members in accordance with predetermined vertical positions of said lifting means, said last named means including means operative, when the lifting means reaches its predetermined position, to reset said brake means and simultaneously return said motor to idle speed.

References Cited in the file of this patent

UNITED STATES PATENTS

1,586,768	Allen	Jan. 1, 1926
1,601,346	Callahan	Sept. 28, 1926
1,651,569	Wilson	Dec. 6, 1927
2,001,674	Erickson	May 14, 1935
2,068,948	Freeman	Jan. 26, 1937
2,085,504	McDill	June 29, 1937
2,165,993	Young	July 11, 1939
2,386,392	Fike	Oct. 9, 1945
2,566,824	Carlson	Sept. 4, 1951
2,581,887	Saxton	Jan. 8, 1952
2,646,965	Addicks	July 28, 1953