

Nov. 25, 1969

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3,480,255

PLURAL WINCH LIFTING UNIT

Filed May 13, 1968

4 Sheets-Sheet 1

FIG. 1

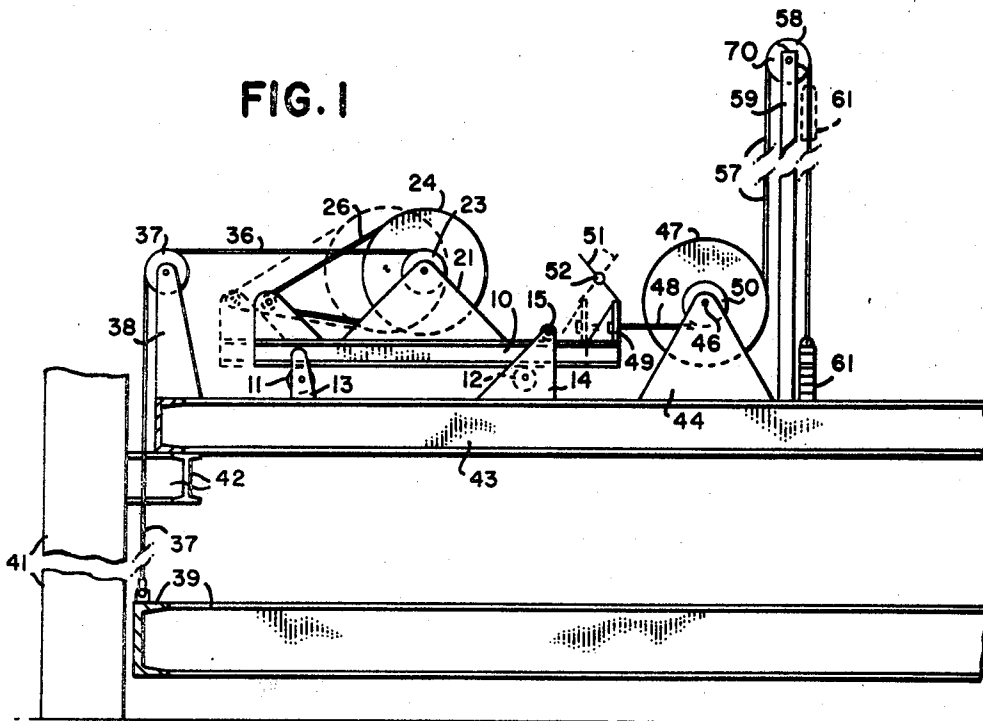
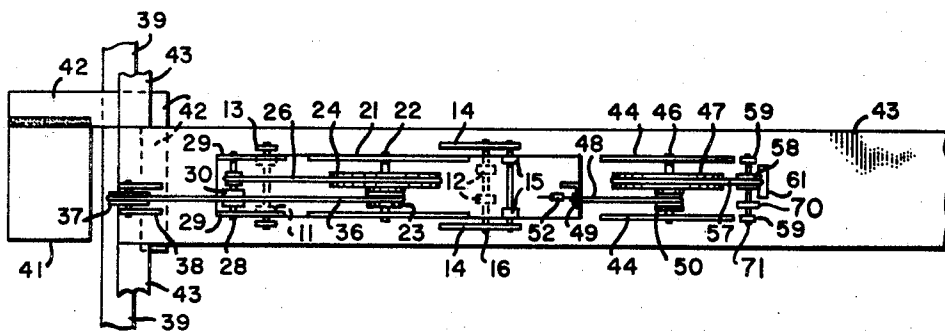


FIG. 2



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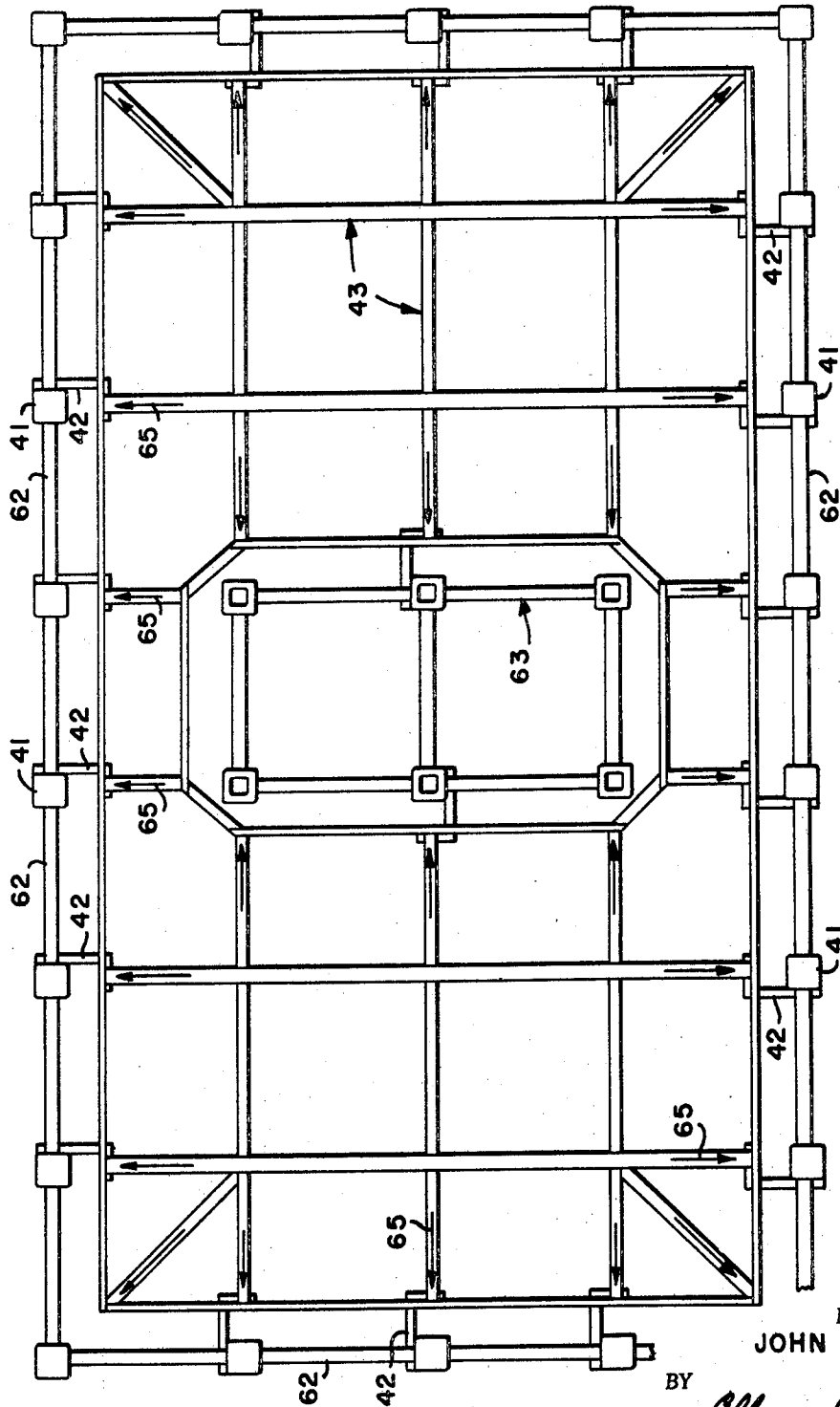


FIG. 3

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4 Sheets-Sheet 3

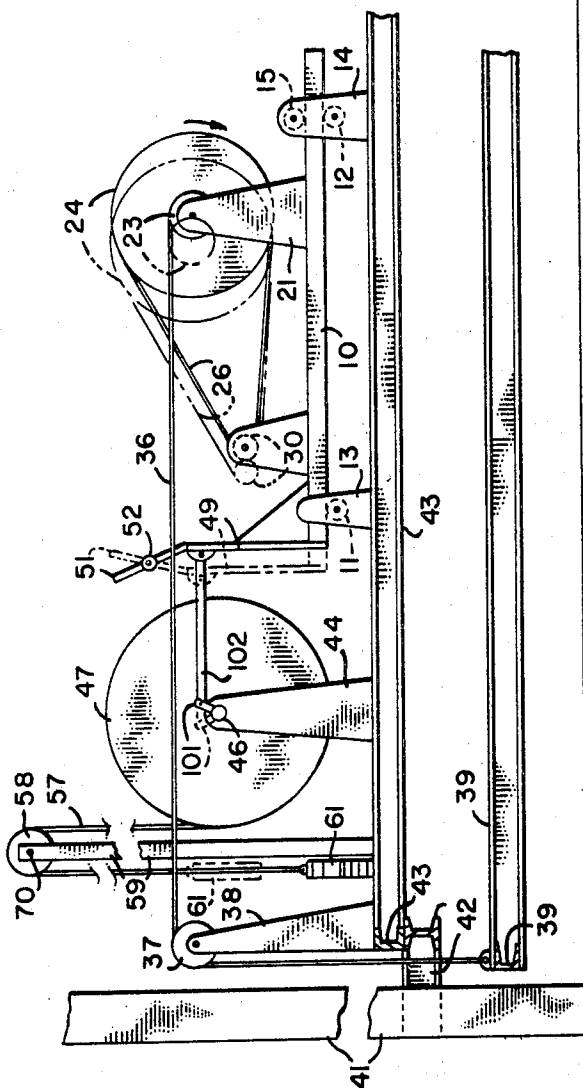


FIG. 4

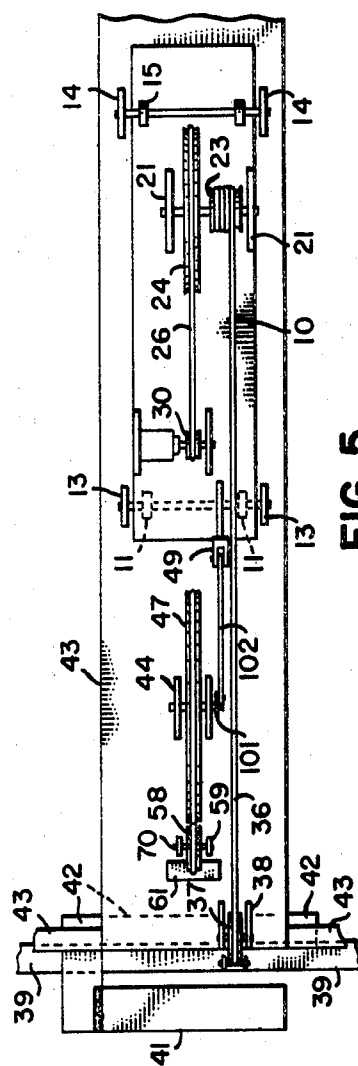


FIG. 5

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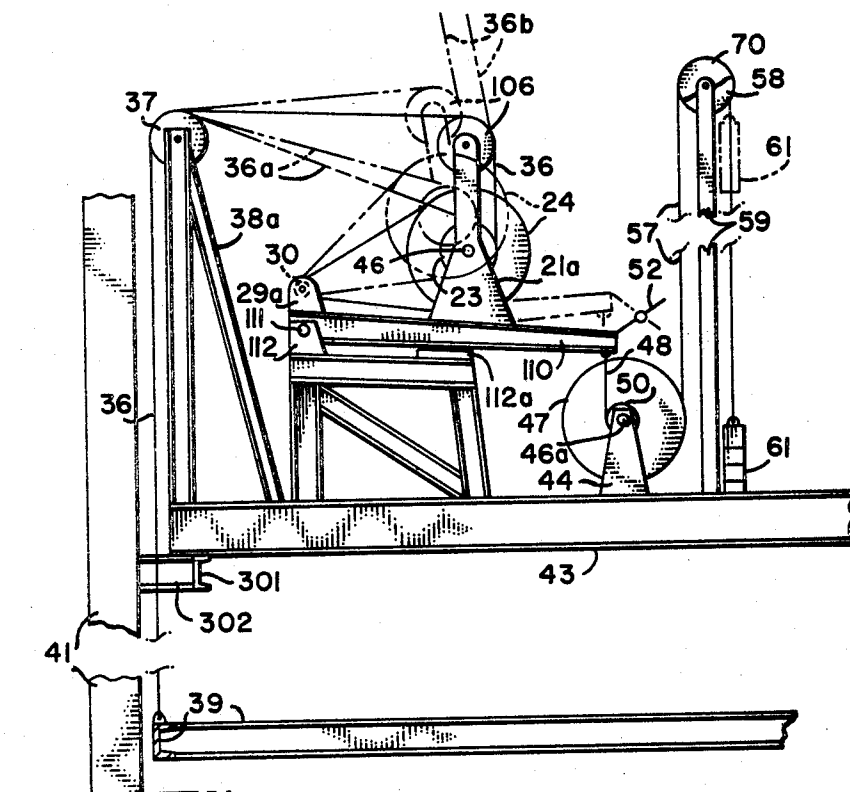


FIG. 6

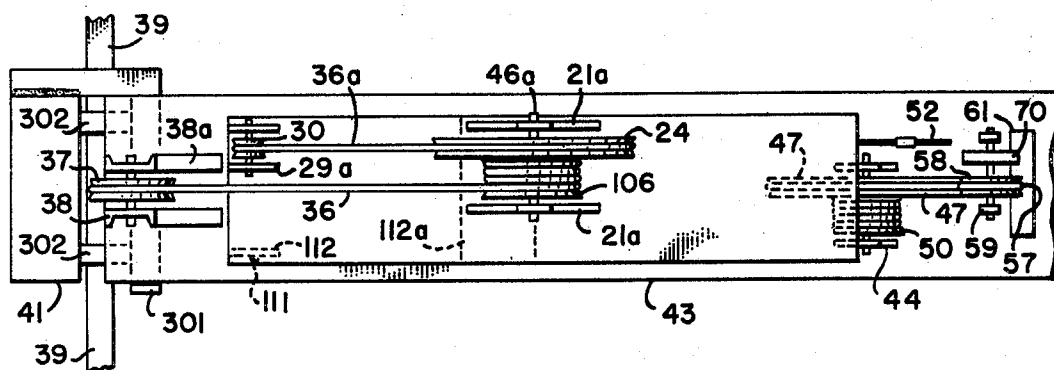


FIG. 7

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PLURAL WINCH LIFTING UNIT

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Continuation-in-part of application Ser. No. 710,168,
Mar. 4, 1968. This application May 13, 1968, Ser.
No. 728,858

Int. Cl. B66d 1/50

U.S. Cl. 254—173

9 Claims

ABSTRACT OF THE DISCLOSURE

A power driven winch and cable system and counterweight control system adapted to apply continuous tension to a cable for pulling a body wherein a power driven winch is mounted on a movable frame and a first tension cable extends therefrom parallel to the frame for a portion of its stretch to lift the body. Attached to the movable frame for the power driven winch is a motion transmitting connection extending to a power storing tension-responsive mechanism comprising a second winch unit wherein the winch is adapted to be driven by a counterweight through a sheave of considerably greater diameter and a third cable from this sheave extends to a counterweight which is lifted from its rest position in response to overload of the first cable for lifting the body at the same time that the frame for the winch moves in response to this overload or excessive tension. After a given movement of the movable winch frame a switch for the motor of the power driven winch is turned from "on" to "off" so that the gravity pull of the weight through the speed reducing mechanism to the second winch assumes the burden of lifting the load until the movable frame is restored to its original position and the motor switch is turned from "off" to "on."

DESCRIPTION OF INVENTION

This application is a continuation-in-part of my copending application Ser. No. 710,168, filed Mar. 4, 1968 for Plural Winch Lifting Unit.

In order to obtain an accurate yet sensitive control of the lifting of a body by a power driven winch and cable system and counterweight control system of compact structure which alternately employs the motor and the counterweight to supply the lift, it is desirable to have a large gear ratio between the motor and the power driven winch. When the counterweight is used to assume the lifting load, it is desirable to have a similarly large ratio between this weight and the body to be lifted. It is desirable, also, that these objects be attained while occupying a minimum of space insofar as the power driven winch and cable system and counterweight control system is concerned so that it can be used advantageously as a movable lift unit in the erection of building structures, for example.

Accordingly, it is a general object of the invention to provide a power driven winch and cable system and counterweight control system employing two winch constructions, a power driven winch to assume the normal lifting load, and a gravity operated winch to assume the load when the tension becomes excessive on the cable during the lifting operation.

It is another object of the invention to provide such systems wherein the power driven winch is movable in the direction of the portion of the cable extending therefrom during the lifting operation and such movement is resisted by a second winch construction using a gravity weight as its source of power which normally resists movement of the first winch unit against the normal tension of the load, but if the tension becomes excessive, the

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first winch unit moves so that its motor is cut off and the sole source of power is the gravity operated winch.

A further object of the invention is to provide systems of the above character which are compact in size and in which the power driven winch is mounted to provide a leverage advantage for the gravity winch in operating the system when the tension becomes excessive, thereby providing for a smaller weight to be employed in the gravity system.

The above and other objects of the invention are attained as described in connection with a preferred embodiment of the invention as shown in the attached drawings, in which:

FIG. 1 is a side elevational view of a power driven winch and cable system and counterweight control system;

FIG. 2 is a plan view of the apparatus shown in FIG. 1;

FIG. 3 is a schematic plan view of a building erection system employing a plurality of the above described power driven winch and cable systems and counterweight control systems on an erection frame shown supported inside the walls of the building and surrounding the well frame for such building;

FIG. 4 is a side elevational view of a modified form of the power driven winch and cable system and counterweight control system;

FIG. 5 is a plan view of the apparatus shown in FIG. 4;

FIG. 6 is a side elevational view of another modified form of the power driven winch and cable system and counterweight control system;

FIG. 7 is a plan view of the apparatus shown in FIG. 6 on a larger scale.

Referring to FIGS. 1 and 2 the power driven winch and cable system includes an auxiliary frame 10 which is supported by respective pairs of rollers 11 and 12 whose shafts are journaled in respective supporting brackets 13 and 14 having portions extending upwardly to either side of the auxiliary frame 10 to maintain its position on the rollers. Tilting of the frame 10 on the rollers 11 and 12 is prevented by a pair of upper rollers 15 having a shaft 16 journaled in respective side brackets 14. The auxiliary frame 10 carries a pair of journal brackets 21 for a shaft 22 which carries a winch drum 23 and a large sheave 24. The sheave 24 is connected by a belt 26 to a sheave 27 mounted on motor shaft 28 which is supported in respective side brackets 29 at either side of the motor 30. The gear ratio between the motor sheave 27 and the winch drum 23 is preferably about 100 to 1. A lifting or tension cable 36 is connected to the drum 23 and extends outwardly therefrom in generally parallel relation to the auxiliary frame 10 and is guided by a sheave 37 carried by brackets 38 so that the cable 36 then extends downwardly and is connected to a load 39 to be lifted. While the tension cable 36 is not always exactly parallel to the auxiliary frame 10 because of variations in the position of the cable on the drum, the tension cable always provides a horizontal component of force which is applied generally parallel to the auxiliary frame 10.

In the embodiment illustrated, this load is a rigid horizontal member and a part of the framework of a building, which building also includes an upright post 41 and I-beam supports 42 for the erection frame 43 which carries the brackets 13 and 14. The erection frame 43 is disclosed in my copending application Ser. No. 681,329 filed Nov. 8, 1967.

This erection frame 43 (FIGS. 1 and 2) also mounts the counterweight control system which includes a second winch unit and for this purposes carries a pair of journal brackets 44 in which the shaft 46 of the winch drum 50 is journaled. A cable 48 is attached to the winch drum 50 at one end and to an upright bracket 49 at the other,

and this bracket 49 is carried by the auxiliary frame 10 and is pivotally connected to an arm 51 for a conventional type of "on" and "off" switch 52 which is adapted to remain set in either position of its adjustment. The switch 52 is mounted on a suitable bracket supported on the frame 43 in any convenient manner, the exact showing having been omitted to simplify the illustration.

To provide a speed reducing mechanism for the counterweight control system, the shaft 46 (FIGS. 1 and 2) for the winch drum 50 carries a large sheave 47 which has a cable 57 connected thereto and extending upwardly over a sheave 58 journaled in a mounting structure 59 and has its end connected to a counterweight 61, normally the counterweight 61 is in the position shown resting on the erection platform 43. The gear ratio between the travel of weight 61 and the travel of the auxiliary frame 10 is preferably about 100 to 1. In order to regulate the speed at which the counterweight 61 operates as a reserve source of power a governed flywheel 70 is mounted on the shaft 71 for the sheave 58 to act as a speed control means and prevent too rapid a movement of the weight 61 as it starts to move from its upper position (equivalent to the stop point of the movable winch 23) and to continue to regulate the speed as it continues moving the movable part back to its start point. The start and stop points are equivalent respectively to the "on" and "off" positions of the switch 52.

Normally, the parts are as shown in full lines in FIG. 1 and the counterweight 61 forming a power driven tension mechanism of the second winch unit or stationary part is resting on the platform 43 or is raised only slightly off this platform so that the speed reducing mechanism provided by the large sheave 47 in reference to the diameter of the winch drum 50 is sufficient to hold the auxiliary frame 10 in its full line position or start point, i.e., to the right in FIG. 1 when the power driven winch of the movable part is in operation. In other words, for a certain maximum tension on the cable 36 when driven by the power driven winch 23, the counterweight operated winch 50 does not move but simply restrains movement of the frame 10 against the tension on the cable 36. However, when the cable 36 moves faster in its lifting operation than adjacent similar cables, the tension on the cable 36 will increase due to the excess load and the movable frame 10 will be drawn to the left as seen in FIG. 1 to its dotted line position, and the counterweight 61 is lifted. Ultimately, the motor for the winch 23 will be turned off, and the counterweight 61 will reverse the direction of movement of the frame 10 and the winch 23 and assume the lifting of its portion of the load or body 39 at a reduced governed speed under the control of the flywheel 70 until the said portion of the body 39 falls back to its normal position of lift with respect to the remainder of the body.

When the weight 61 (FIG. 1) moves downwardly to its full line position, the motor switch 52 is turned to its "on" position before the reserve power of the counterweight 61 is used up, and the power driven winch unit 23 reassumes the lifting operation.

The diagrammatic view in FIG. 3 illustrates use of a plurality of the power driven winch and cable and counterweight systems, location of these systems on the frame 43 being indicated by the arrows 65. This erection frame 43 is shown within an outer wall composed of the vertical posts 41 and the horizontal frame members 62, and disposed about a center frame 63 for the well structure of the building.

Referring to FIGS. 4 and 5 there is illustrated a modified form of the power driven winch and cable system and counterweight control system where the relative positioning of the winch and cable system with respect to the counterweight control system is reversed so as to require a rigid motion transmitting connection between the movable frame of the winch and cable system and the driven element of the counterweight control system. Similar and

identical parts are numbered in FIGS. 4 and 5 corresponding to the numbering thereof in FIGS. 1 and 2.

As shown in FIGS. 4 and 5, the power driven winch and cable system comprises again the winch 23 driven by the large pulley 24 from the motor 30, and in this case, the tension cable 36 extends from the winch 23 past the counterweight control system and over the sheave 37 to the load or body 39. The frame 10 is movable from its right hand position shown in full lines to the dotted line position at the left in moving from its start to its stop position in controlling the switch 52. The upright bracket 49 on the frame 10 is connected pivotally to a rigid member or link 102 as a motion transmitting connection. At its other end, the link 102 is pivoted to a lever 101 secured to the shaft 46 of the sheave 47 so that movement of the frame 10 to the left will operate through the motion transmitting connection or member 102 to rotate the sheave 47 and lift the counterweight 61 from its rest position to its dotted line position as shown so that the power for the motor 30 is cut off and the counterweight and control system assumes the burden of continuing the lift of the portion of the load 39 which is normally lifted by the winch 23. As in the modification of FIGS. 1 and 2, the descent of the weight 61 controlled by the governed flywheel 70 continues this lift until the weight 61 reaches its full line position, and toward the latter part of this movement the frame 10, being restored to its full line position, will operate the switch 52 to again turn the power for the motor 30 "on" and the winch 23 again assumes the lifting load.

Referring to FIGS. 6 and 7, there is illustrated another modified form of the power driven winch and cable system and counterweight control system wherein the movable member mounting the power driven winch unit 23 is carried by a lever at a position on the lever where a mechanical advantage is obtained, multiplying the effective force of the gravity winch unit. Similar and identical parts are numbered in FIGS. 6 and 7 corresponding to the numbering thereof in FIGS. 1 and 2.

As shown in FIGS. 6 and 7, the power driven winch and cable system comprises an erection frame 43 supported by I-beams 301, 302 on the post 41. The winch 23 is driven by the large pulley 24 from the motor 30, and in this case the tension cable 36 extends upwardly from the winch over an idler sheave or pulley 106 and then over the sheave 37 to the load or body 39. The frame 110 carrying the winch unit 23 comprises a lever pivoted at 111 on a support 112, the support including a platform portion 112a upon which the lever 110 rests normally during the operation of the power driven winch 23. It is seen that the winch unit 23 is mounted at a point intermediate the ends of the lever 110 so that the cable 48 of the gravity winch 50, being connected to the outer end of the lever 110, has a mechanical advantage in applying its force during the time it assumes the lifting load after disabling of the motor 30 for the winch unit 23 by the switch 52, as previously described.

If desired, the sheave 106 may be omitted and the cable 36 may take the optional path 36a directly to the sheave 37, as indicated in dotted lines in FIG. 6. Also, if the cable should extend to higher location of the sheave 37, it may be extended upwardly as indicated at 36b for the lifting of taller parts, for example, for lifting the wall posts of the frame 41.

The operation of the winch unit 23 and the gravity winch unit 50 are the same as previously described except in the functioning of the lever 110 to multiply the force of the gravity-operated winch 50 when it is brought into play to assume the lift from the power driven winch while the motor 30 for the power driven winch is disabled.

In use, each assembly or system, coacting with many alike adjacent assemblies, effectively drags or lifts a body at a certain speed in a level or prescribed attitude and constantly delivers a share of the total resisting force of

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the body being moved at a certain speed of movement which is the desired result.

The electric winch provides the movement. If too fast, this winch builds a "reserve power" into the gravity winch and then makes a stop but the assembly through the gravity winch continues to deliver its share of the load and continues the movement without interruption, the sum of these movements being the certain speed.

At each stop, the share of the load is provided by the "reserve power" of the gravity powered winch with no interruption of movement and is placed or controlled by the adjacent assemblies. When the "reserve power" is almost used up, the electric winch again takes over the share of the load and again with no interruption of movement.

While I have shown and described certain preferred forms of the invention, it will be apparent that the invention is capable of variation and modification from the forms shown.

I claim:

1. A power driven winch and cable system and cable tension control system therefor adapted to supply continuous tension to a cable for moving a body comprising a movable part, a stationary stress control part, and a stress and motion transmitting connection therebetween; said movable part having a tension cable for connection to said body and a power driven winch for winding said cable on the winch drum, said cable extending away from said winch in a direction providing a component of the force of the cable parallel to the movement of said movable part and attached to and pulling said body at a certain speed and having a certain desired maximum tension, means mounting said movable part for movement relative to said stationary part for a prescribed distance from a start point to a stop point, and said movable part being moved by said tension cable whenever the winding speed of said tension cable exceeds said certain speed or the tension in said tension cable equals said certain desired maximum tension, said stationary part having a power-storing tension-responsive control mechanism for resisting movement of said movable part and limiting the tension in said tension cable and said stress control mechanism being operated by means of said motion transmitting connection simultaneously with the beginning of said movement of said movable part and thereby build up an additional prescribed usable reserve body pulling power until said movable part reaches said stop point, and control means for first cutting off the power for said winch as said movable part is reaching said stop point, and for thereby bringing said reverse power into action to continue the pulling of said body and to reverse said movement and return said movable part to said start point, and

said control means thereafter turning on the power for said winch as said movable part is reaching said start point.

2. A power driven winch and cable system and cable tension control system, as recited in claim 1, in which the power-storing tension-responsive control mechanism comprises a second winch and a counterweight.

3. A power driven winch and cable system and cable tension control system therefor, as recited in claim 1, in which the motion transmitting connection includes a cable.

4. A power driven winch and cable system and cable tension control system therefor, as recited in claim 1, in which the motion transmitting connection includes a rigid member.

5. A power driven winch and cable system and cable tension control system therefor, as recited in claim 1, in which said stationary part has speed control means to regulate the speed at which said power-storing tension-responsive mechanism operates.

6. A power driven winch and cable system and cable tension control system therefor, as recited in claim 1, in which said movable part has an electric motor for driving said winch, said control means is an electric switch, and in which the power-storing tension-responsive mechanism includes a weight.

7. A power driven winch and cable system and cable tension control system therefor, as recited in claim 1, in which said movable part is mounted for movement in a straight line.

8. A power driven winch and cable system and cable tension control system therefor as recited in claim 1, in which said movable part includes means for multiplying the effective force of said power-storing tension-responsive control mechanism.

9. A power driven winch and cable system and cable tension control system therefor as recited in claim 1, in which said movable part comprises a pivotally mounted lever carrying said power driven winch and said lever is connected to said motion transmitting connection at a location to provide a leverage advantage for the additional prescribed usable reserve body lifting power as supplied by said power-storing tension-responsive mechanism.

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U.S. Cl. X.R.

254—178