Feb. 24, 1953 E. C. GILBERT, JR 2,629,851

AUTOMATIC SAFETY DEVICE FOR POWER LIFTS

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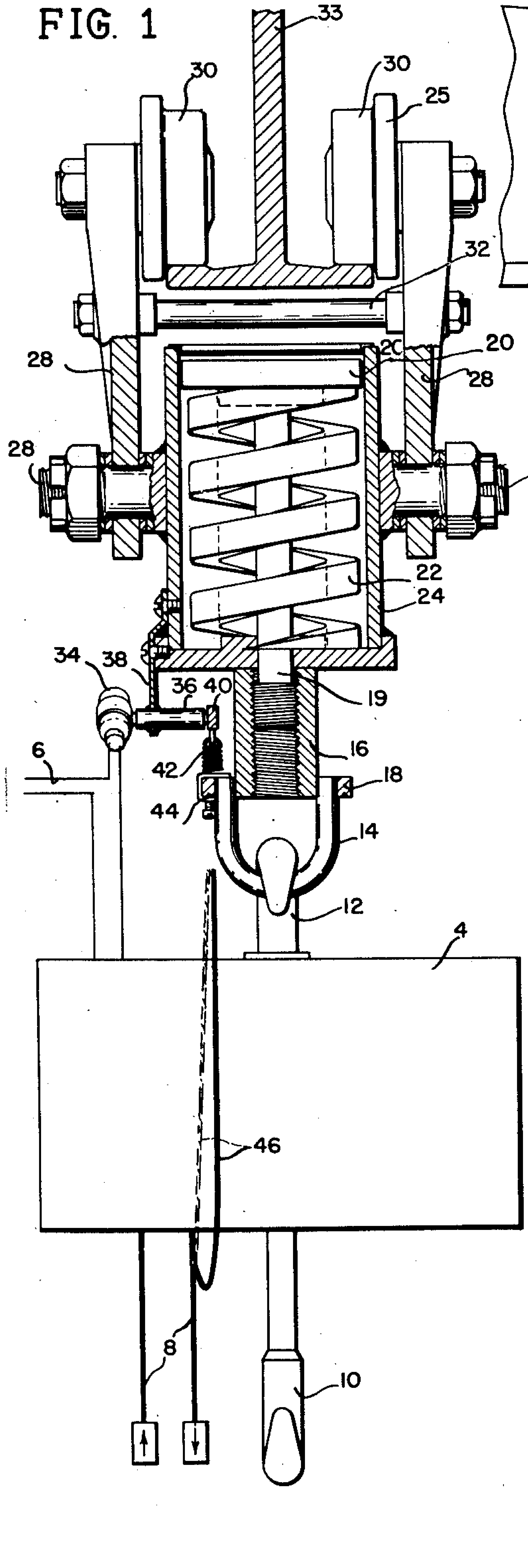
FIG. 1



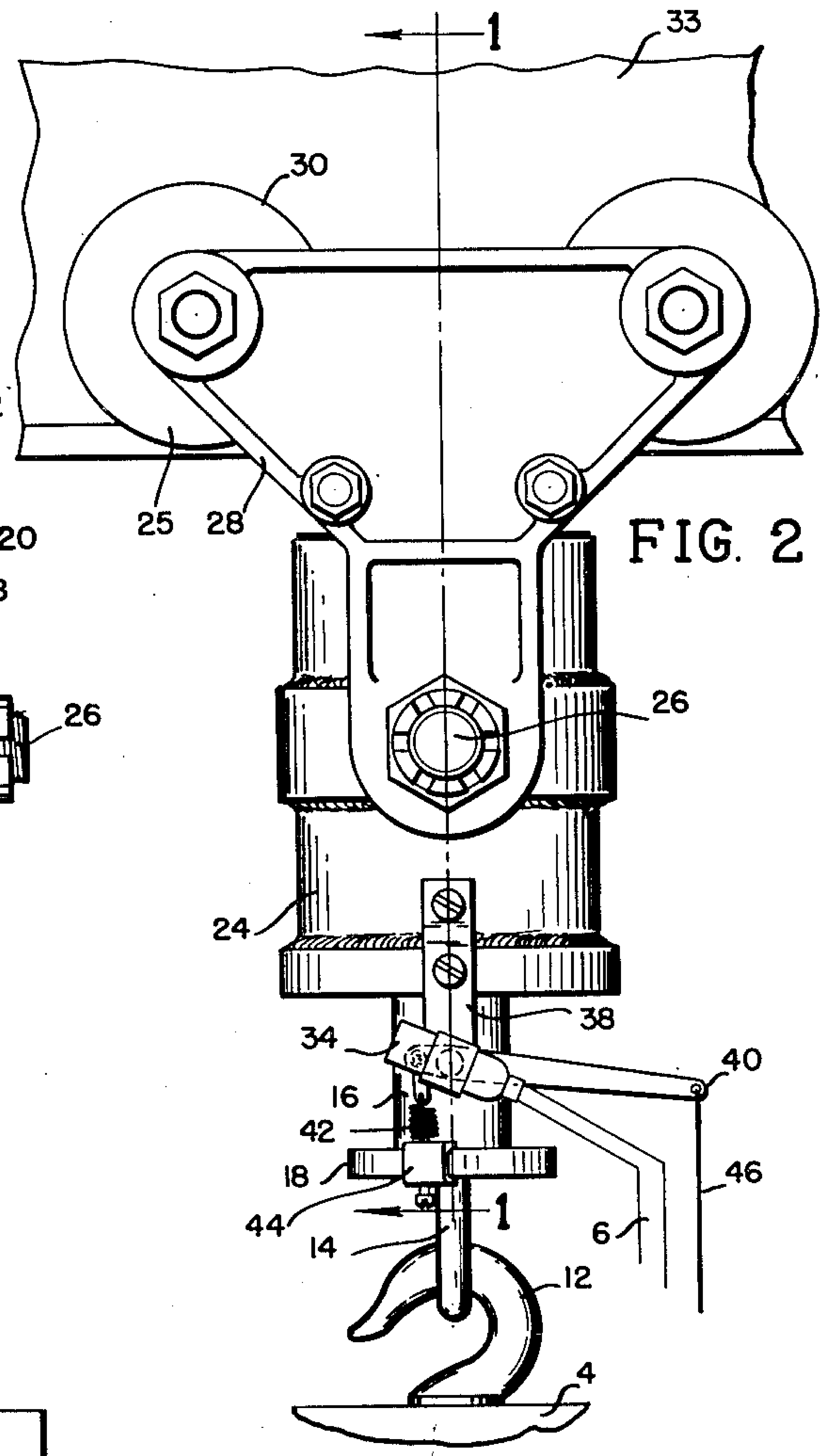


FIG. 2

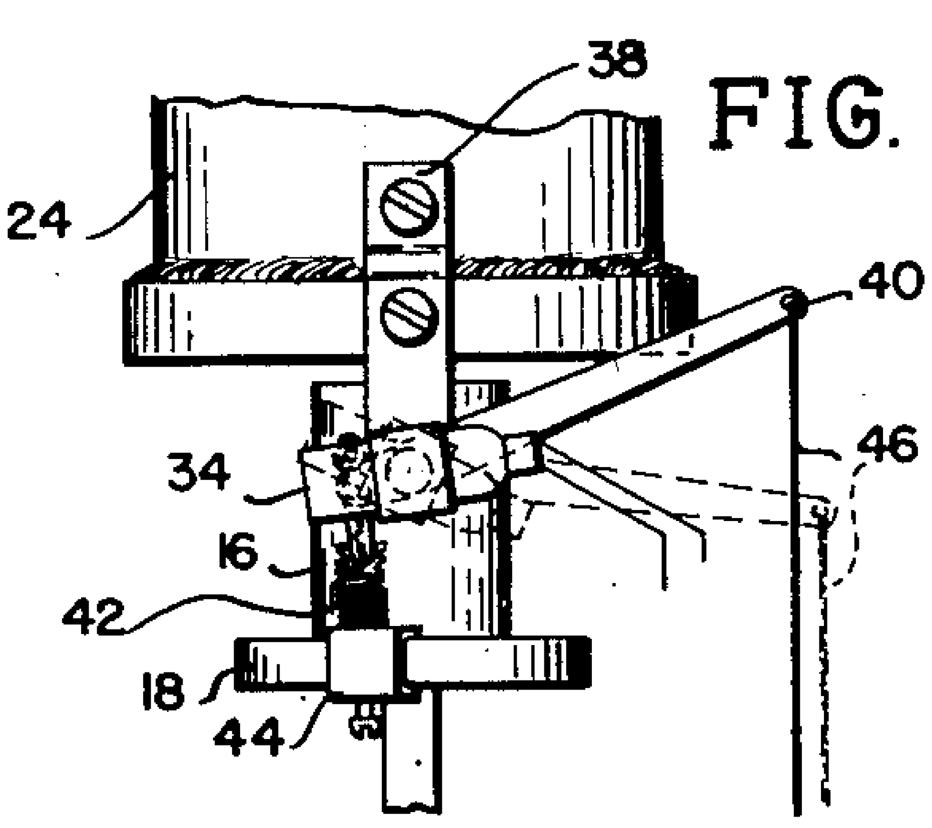


FIG. 3

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AUTOMATIC SAFETY DEVICE FOR POWER LIFTS

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10 Claims. (Cl. 318—475)

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The invention relates to improvements in safety devices for power lifts.

In the operation of power lifts a load is frequently encountered which is greater than the capacity of the hoist. If the hoist were allowed to raise this excessive load, damage to the mechanism would result.

The usual overload safety device provided uses an overload spring arranged between the point of anchorage of the hoist and the point of attachment to the load. Overloads with this type device will cause an excess deflection in the spring which is operably arranged so this excess deflection is sufficient to actuate a switch effecting a stoppage of the electric hoist motor. However, with use of this type spring, working loads will, when suspended, have dynamic instability moving up and down as the spring compresses and expands.

Automatic power hoists are equipped for safety by compulsion of law with automatic brakes which operate to instantly lock the mechanism when the power is turned off. Therefore when the automatic overload device turns off the hoist the automatic lock freezes the hoist with the overload straining on the hook. The system thus locked, remains under stress and it is impossible to remove the overload without reversing the hoist to loosen the cables and hooks. With the overload safety switch positioned in the power supply circuit as it usually is, the power supply is cut off and reversal cannot be made. The overcoming of these difficulties present in the prior art are among the objects of the present invention.

An object of the invention is to provide an overload safety switch which can easily and quickly be manually reset to further operate the hoist to release the overload after the overload has operated the overload safety mechanism and caused the switch to automatically stop the hoist motor.

Another object of the present invention is to provide an automatic safety device using few and simple parts and taking up a minimum of head room, and wherein the load will remain dynamically stable during normal operation.

A further object is to provide a safety device in which the maximum load setting at which the automatic switch will stop the motor may easily be changed without altering the switch setting or the distance from point of anchorage to power winch.

Further objects and advantages will become

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apparent in the following description and drawings in which:

Figure 1 is a front elevation of the safety device in partial cross-section taken along 1—1 of Fig. 2;

Fig. 2 is a side elevation of the safety device; and

Fig. 3 is a front elevation of the switch reset mechanism of the safety device showing the relative position of the parts loaded by an overload.

The mechanism embodying the present invention is shown in the drawings as consisting of the following components: the electric power hoist, the overload safety device comprising the overload mechanism and the reset switch, and a trolley supporting the safety device and power hoist.

The electric power hoist mechanism indicated by the numeral 4, is not shown in detail, and is of the conventional type comprising a reversible electric motor, a reduction gearing, and an automatic brake. Electric power is furnished from a power source through leads 6. Pull chains 8 control line switches which start, stop and reverse the hoist motor to raise and lower loads.

A hook 10 beneath the power hoist serves to attach the loads to be lifted. The power hoist has a second hook 12 above it normally provided to suspend it from the overhead trolley. In the present invention the safety device is interposed between the electrical hoist and the trolley. The hook 12 is hooked to a U ring 14 which is secured to an internally threaded cylindrical spool 16. An annular flange 18 extends around the lower edge of the spool for purposes which will later appear. The spool is threaded to a vertical load shaft 19 of a load carrying member 20 which is umbrella-shaped.

The upper spreading portion of the load carrying member rests on top of a coil compression spring 22. The spring is compressibly supported within a hollow spring housing cylinder 24. This housing cylinder has a hole in the bottom through which the vertical shaft of the load carrying member freely extends the hole not being large enough to admit the spool. Thus as the spool is threaded onto the shaft pulling the load carrying member downwardly, the coil spring is compressed. The reaction of the compressed coil spring pulls the spool into abutment with the bottom of the hollow cylinder. This completes the overload mechanism which is suspended from the trolley above and carries the electric power hoist below it. It will be noticed that it comprises only a few simple parts and is positioned to take very little head room between the power hoist below and the trolley above.

To attach the overload device to the trolley 25, a pair of pins 26 extend laterally from the hollow cylinder and plates 28 are held on the pins by a nut threaded on each pin. The plates extend upwardly to be attached to the trolley wheels 30. A pair of spacer bolts 32 having shoulders adjacent their ends lie between the plates inserted into holes in the plates. Nuts on the spacer bolt ends hold the plates against shoulders on the spacer bolts to insure rigid positive spacing of the plates. The rollers attached to the upper end of the plates roll on the flanges of the I beam 33, thus forming the trolley mechanism which acts as the overhead anchorage for the hoist.

Returning now to the overload device, its operation will be described. To adjust the maximum load capacity, the spool 16 is screwed to the load carrying shaft 19 to draw it down until the coil spring 22 is under the desired compression. The spring is compressed to a point where it reacts with a force equal to the maximum load which is to be carried. At this compression only a greater load will further compress the spring. This adjustment can easily be made without disconnecting or removing any of the parts of the overload device and the head room from the trolley to the winch does not change when the capacity adjustment is made. As the power lift raises a load, the pull is transmitted through the load support member to the coil spring and only a load greater than the maximum allowable load will further compress the spring to cause the support shaft to move downwardly to move the spool downwardly away from the cylinder bottom, as is shown in Fig. 3.

It will be noticed that in normal operation the spool remains in abutting relation with the cylinder being held there by the spring. There is no flexing of the spring and the load remains dynamically stable. Only an overload greater than the compression of the spring will further compress the spring to move the load support member and spool downward. This characteristic of spool movement with overload is utilized in the reset switch mechanism which will now be described.

The switch 34 shown in the preferred embodiment of the safety reset switch mechanism is a mercury switch which makes and breaks contact by tilting at an angle with the horizontal to allow the mercury to run toward one end to close the contacts or toward the other to break the circuit. The switch is mounted on a horizontal shaft 36 to switch to "on" or "off" as the shaft turns. The shaft is carried by a mounting bracket 38 which is suitably secured by screws to the spring housing cylinder above. The end of the switch supporting shaft is secured to the midpoint of a reset lever 40. A manually operated reset pull rope 46 is attached to one end of the lever and an extension spring 42 is secured to the other end of the lever to balance the weight of the rope. This extension spring is attached to the flange 18 on the spool by a U clamp 44 secured by a set screw. The spring is strong enough not to expand with the normal weight of the rope but will extend if an operator pulls on the rope to pivot the shaft. The U clamp 44 is easily removable by loosening the set screw for turning the spool 16 to change the adjustment of the winch overload capacity.

The operation of the switch reset mechanism as the hoist encounters an overload will now be described. As the winch begins to raise the overload, the compression spring 22 compresses allowing the supporting shaft 19 to move downwardly and hence allowing the spool 16 to move downwardly away from the bottom of the hollow cylinder 24. The extension reset spring 42 pulls down the end of the reset lever 40 and rotates the horizontal shaft 36 causing the mercury switch 34 to tilt through horizontal to the "off" position. This breaks the main line circuit to the electric motor and stops the hoist 4. The relative position of the parts at this point is shown by the unbroken lines of Fig. 3. At this moment when the current is shut off the automatic brake locks, leaving the hoist straining at the overload so it cannot be unhooked. To relieve this stress and unhook the overload the operator desires to reverse the electric hoist and lower the overload. To do this the circuit from the main power line to the electric hoist motor must be closed.

The lower end of the reset rope 46 is attached to the "down" pull chain 8 which lowers the hoist. Normally the rope hangs slack as shown by the unbroken lines of Fig. 1 so that pulling the "down" pull chain merely takes the slack out of the reset rope. When the hoist encounters an overload and the reset lever 40 tilts up, as is shown in the unbroken lines of Fig. 3, the slack is taken out of the reset rope which is shown by the broken line of Fig. 1. In this condition the operator pulling the "down" pull chain will also pull the reset rope and move the reset lever down to the position shown by the broken lines of Fig. 3.

To close the powerline circuit so the motor will run in reverse, the operator pulls the "down" pull chain which pulls down the reset rope 46, pulling down the line end of the reset lever 40 to expand the reset spring 42 at the opposite end of the lever. This rotates the mercury switch 34 through horizontal back to "on" position. The relative position of the parts at this point is indicated by the dotted lines of Fig. 3. When in this position the circuit to the main line is again closed and the hoist motor operates lowering the hoist to unhook the overload. Should the operator inadvertently pull the "up" pull chain the mercury switch 34 remains open and the hoist will not operate. As only the "down" pull chain is operative, the operator cannot negligently raise the overload and damage the mechanism. The reset rope need not be attached to the "down" pull chain but can hang down to be pulled directly by the operator. In the present embodiment, however, this arrangement would sacrifice safety as the operator could operate the hoist up or down after pulling the reset rope.

As the operator lowers the hoist, relieving the stress, the main overload spring 22 expands, returning the spool 16 to normal position abutting the cylinder 24. This shortens the distance between the spool flange 18 and cylinder, allowing the reset spring 42 to contract. In this position the mercury switch 34 will remain tilted to "on" position for further normal operation of the hoist.

The safety reset switch mechanism is constructed of a few simple parts allowing use of a standard mercury switch which is capable of carrying high voltage and current and so can be placed in the direct power supply circuit. No extra switch wires or by-pass circuits or complicated reset devices are needed. Further, no excess time is consumed to reset the safety switch which is important where overloads are frequently encountered. It is to be understood that the reset switch unit is not restricted to use with the compression spring overload device shown but could be adapted to use with any suitable overload unit which reacts to overloads by relative movement of parts. The safety switch reset mechanism is not to be limited to use with a mercury switch although this type switch is preferred. Adaptation with another switch could easily be accomplished employing the principle of a spring which is strong enough to operate the switch on relative movement of parts but which will yield to allow the switch to be manually reset when the reset cord is pulled.

Thus it will be seen I have provide a simple and reliable automatic overload device and safety switch reset mechanism. The overload mechanism requires little head room and is compact and foolproof. The safety reset switch device can be easily adapted to any existing overload device and is cheap and easy to construct. It offers a device which expedites the handling of jobs where overloads are frequently encountered by permitting speedy unhooking and moving on to a new load.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and have described in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

I claim as my invention:

1. An overload safety device for a power lift comprising in combination an anchored support means, a spring supported by the support means, a load carrying member supported by the spring, an element attached to the load carrying member and urged into abutment with the support means by action of the spring on the load carrying member, the point of attachment determining the force with which the spring urges said abutting element into abutment, the abutting element moving away from the support means as an overload is encountered, lift means connected to said atttached member and adapted to carry a weight to be lifted, and a switch member connected to the support means and to the abutting element to be operated to turn off the power lift when said abutting element moves away from the support means as the overload is encountered.

2. An overload safety device for a power lift comprising in combination an anchored support means, a compression spring supported thereby, a load carrying member supported by the spring to compress same, an adjustment member adjustably attached to the load carrying member to change the compression of the spring and urged to abutment with the anchored support means by the action of the spring on the load carrying member, a lift means connected to the adjustment member and adapted to carry a weight to be lifted the adjustment member moving away from the support means as an overload is applied to said lift means, a switch operatively attached between the adjustment member and anchored support and operated by relative movement of the adjustment member with respect to the anchored support to turn off the power lift to prevent damage to parts.

3. An overload safety device for a power lift comprising in combination, a hollow supporting cylinder, a coil compression spring mounted therein, a load carrying member carried by the spring, an overload adjusting spool threaded to the load carrying member and urged into abutment with the cylinder by the action of the spring on the load carrying member, said spool changing the compression of the spring by threading on or off of the load carrying member, and a switch attached between the spool and cylinder to switch off the power lift as the spool and cylinder move away from each other as an overload is encountered.

4. A safety overload device for a power lift of the type having a load responsive device including an overload spring interposed between an anchorage means and a power hoist means to permit relative movement of said means when an excessive load is lifted comprising in combination a switch mounted on one of said means, a spring connected to the switch and to the other of said means, the spring having strength to operate the switch from normal to operative position as said means have relative movement, and a manually operable reset member operatively associated with the switch to return it to normal position against the action of the spring.

5. A safety overload device for a power lift of the type having an overload spring interposed between an anchorage means and a power hoist means to permit relative movement of said means when an excessive load is lifted, comprising a switch mounted on one of said means, a coil extension spring secured to the other of said means operating the switch from normal to operative position without appreciable extension as said means move apart, and a manually operable reset means operably associated with the switch and spring expanding the spring and returning the switch to normal.

6. A safety overload device for a power lift of the type having an overload spring interposed between an anchorage point and a power hoist, to permit relative movement between said anchorage point and said hoist when an excessive load is lifted, comprising in combination a mercury switch pivoted about its midpoint and mounted on one of said means, a coil spring connected to the other of said means and operatively connected to pivot the mercury switch to "off" position with relative movement of said means, and a manually operable reset means to counteract said spring and pivot said switch back to "on" position.

7. A safety overload device for a power lift of the type having an overload spring interposed between an anchorage means and a power hoist means to permit relative movement of said means when an excessive load is lifted, comprising in combination a mercury switch pivotally supported by the anchorage means, an extension spring connected at one end to the switch and at the other to the power hoist means to be moved with the relative movement of said means and tilt the mercury switch to turn off the hoist motor, and a manual reset line connected to the other end of the mercury switch, said extension spring having strength to balance the weight of said reset line but extendable by a pull of the reset line to tilt the mercury switch to turn on the switch to operate the power hoist means.

8. A safety overload device for a power lift comprising an overload spring, an anchored spring support means, a load support means con-

nected between the spring and the power lift, an adjustment member adjustably attached to the load support means and being drawn into abutment with the spring support means by the spring, a switch mounted on one of said support means, a switch operating reset spring connected to the switch and to the other of said support means to move the switch to one position to open the circuit to the power hoist when said support means have relative movement with respect to each other and a manual reset line to move the reset switch to the other position against the reset spring action to close the circuit to the power lift.

9. A safety overload device for a power lift having a load responsive device to permit relative movement between an anchorage means and a hoist when an overload is encountered and having manually operated control means to operate the hoist to lower the load, the overload device comprising in combination a spring operated switch mounted between the anchorage means and hoist to turn off the hoist with overload, the spring operating the switch from normal to operative position when said relative movement occurs, and a member connected between the spring and control means to return the switch to normal position against the spring when the control means is operated.

10. A safety overload device for a power lift having a load responsive device to permit relative movement between an anchorage means and a hoist means including a hoist motor when an overload is encountered and having pull chains to operate the hoist motor to raise or lower the load, the overload device comprising in combination a switch mounted on one of said means, a spring connected between the switch and the other of said means operating the switch on said relative movement, and a reset line connected between the down pull chain and switch and normally slack but becoming taut as said relative movement occurs, the line returning the switch to normal position against the action of the spring when the pull chain is pulled against the taut line.

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