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R. R. DILLON
SAFETY LOAD LIMITING MEANS FOR
HOISTS AND THE LIKE
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2,512,055

Fig. 1

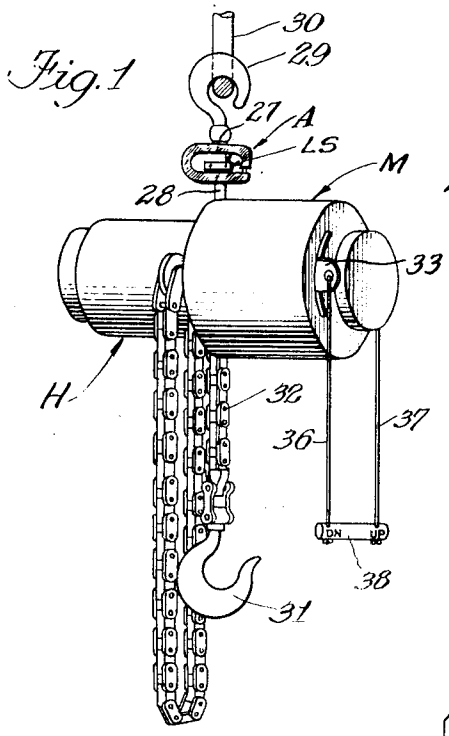


Fig. 4

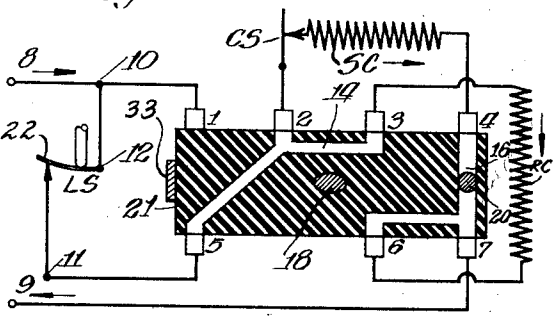


Fig. 5

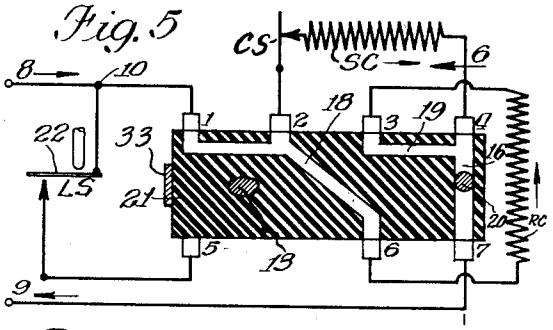


Fig. 2

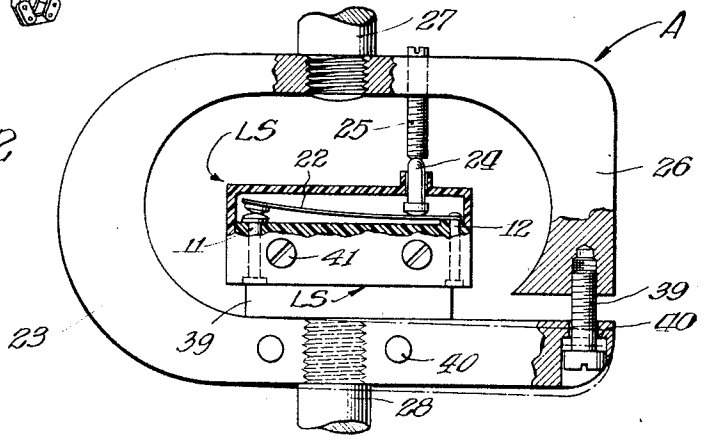


Fig. 3

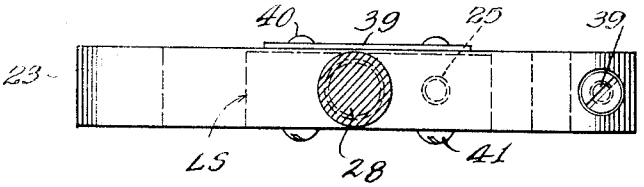
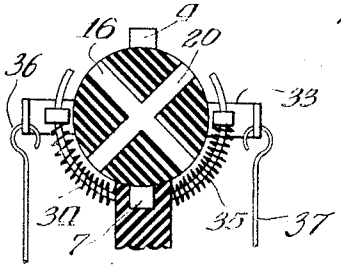


Fig. 6



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SAFETY LOAD LIMITING MEANS FOR HOISTS AND THE LIKE

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6 Claims. (Cl. 318—488)

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This invention relates to a means to make safe the operation of hoists and the like by positively preventing any overloading of the hoist.

One object of the invention is to provide a load limiting means in the form of a device that weighs the load, and if the load exceeds a predetermined safe weight the means for operating the hoist is rendered inoperative thereby notifying the operator of the hoist of such fact and at the same time preventing any possibility of unsafe operation due to an overload on the hoist.

Another object is to provide means which is simple and inexpensive in construction and readily adaptable for connecting in the electric circuit of the hoist operating motor for serving to limit the load, thus preventing any possibility of either accidental or intentional overloading of the hoist.

Still another object is to provide an element interposed at any point between a stationary support and the load being hoisted for the purpose of controlling an electric circuit that renders the hoist operating motor inoperative to further lift the load whenever the load causes the safety load limiting means to assume its operative position.

A further object is to provide a special link interposed between a support and the load, which link is extensible in proportion to load, which carries an electric switch and which so operates the switch as to move it to hoist motor de-energizing position at a predetermined loading of the hoist.

Still a further object is to provide the switch carried by the special link connected in the lifting circuit of the hoist motor but so connected with an electric switch for the motor that the switch can be operated to the reverse position for lowering the load independent of the load limiting switch, thereby making it possible to lower the load sufficiently to release all or part of it upon the lifting circuit of the hoist motor being rendered inoperative by the load limiting switch.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in the accompanying drawings, wherein:

Figure 1 shows a motor driven chain hoist

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merely by way of example to which my safety load limiting means has been applied.

Figure 2 is an enlarged side elevation of a safety load limiting switch forming part of my load limiting means.

Figure 3 is a bottom plan view thereof,

Figure 4 is an electrodiagrammatic view showing the circuit arrangement between a control switch for the hoist motor and my load limiting switch, the switch being adjusted to lift a load,

Figure 5 is a similar view showing the control switch adjusted for lowering the load, and

Figure 6 is a sectional view on the line 6—6 of Figure 5 showing the switch in neutral position.

On the accompanying drawing I have used the reference character LS to indicate a limit switch of a safety load limiting means indicated in general at A. The switch LS comprises terminals 11 and 12 and a switch blade 22 adapted to normally establish a circuit across the terminals. The blade 22 is normally held in the downwardly bowed position of Figures 2 and 4 by an actuating pin 24 against which an adjusting screw 25 rests.

The screw 25 is carried by a U-shaped frame 23 having an arm 26 extended from the upper leg toward the lower leg of the U. This frame is preferably made of tool steel cut to the shape shown and then hardened so that it will carry a substantial load without breaking when interposed in a hoist line. It may be connected in the line by means of studs 27 and 28 which by way of example are shown connected with a supporting hook 29 and a hoist H respectively in Figure 1. A support 30 is shown for the hook 29 and the hoist H has extended therefrom a lifting chain 32 terminating in a load engaging hook 30.

The safety load limiting means A may be placed instead just above the hook 31 and can be connected with the hoisting cable of a crane or elevator as it is applicable to any type of hoisting mechanism. The type of hoist shown in Figure 1 is merely for the purpose of illustration.

The limit switch LS may be supported on the lower leg of the U frame by means of a plate 39 riveted at 40 to the arm, screws 41 being provided to mount the switch housing on the plate. The switch terminals 11 and 12 are connected in a circuit with the motor M and a control switch therefor which is shown diagrammatically in Figures 4 and 5. The control switch consists of a rotor 21 rotatable about one-fourth turn be-

tween upper brushes 1, 2, 3 and 4 and lower brushes 5, 6 and 7.

The motor M has a starting coil SC connected with the brushes 2 and 4, a centrifugal switch CS being in the circuit or any suitable switch may be used for cutting out the starting coil after the motor gets up to speed. The motor also includes a running coil RC connected to the brushes 3 and 6. The brush 1 is connected with terminals 8 and 12 with the circuit branching at a terminal 10, and the brush 5 is connected with the terminal 11 of the limit switch. The terminal 8 is a current supply terminal and a second one is provided indicated at 9. The terminal 9 is connected with the brush 7.

The rotor 21 of the control switch has therein current conducting bars 13, 14, 15, 16, 17, 18, 19 and 20 for connecting the various brushes 1 to 7 with each other in a desired circuit path.

Normally the conductors 13 to 20 are out of contact with all the brushes 1 to 7 and the rotor is in the position of Figure 6. The rotor has a cross bar 33 normally retained in the position shown in Figure 6 by opposing springs 34 and 35. It can be rotated an eighth of a turn in either direction however by pull wires 36 and 37 extending to a control bar 38. This bar may be manipulated for causing rotation of the motor M in either direction for either raising or lowering the load as desired, and when the control bar is released the rotor 21 returns to the neutral position.

When the control bar 38 is lowered at its right hand end in Figure 1 the rotor 21 assumes the position shown in Figure 4. The circuit may now be traced from the current supply terminal 8 through the elements 10, 12, 22 of LS, 11, 5, 13, 2, CS, SC, 4, 16 and 7 to current supply terminal 9. The current divides at brush 2, part of it going through 14, 3, RC, 6 and 15 to 7, whereby current flows to the right in the starting coil SC and downwardly in the running coil RC of Figure 4. This causes rotation of the motor M in the proper direction for raising the load hook 31 and any load thereon.

If such load exceeds the predetermined safe load for the particular hoist in question, as soon as the load is almost sufficiently supported by the hook 31 the link 23 will open enough to permit the switch blade 22 to move away from the contact connected with the terminal 11 in the limit switch thus breaking the circuit to the running coil RC, the circuit usually having been broken to the starting coil SC by the motor coming up to speed and due to the centrifugal switch CS having opened. If the load is imposed on the hoist before the starting coil has been de-energized by opening of the centrifugal switch the opening of the limit switch will break the circuit to the starting coil also, as both the starting coil and the running coil are in the up circuit of the motor which includes the limit switch.

With the limit switch open the motor can be reversed however as the limit switch is not in the down circuit which may be traced in Figure 5 from 8 through 10, 1, 17, 2, CS, SC, 4, 20 and 7 to 9, part of the current dividing at 2 and passing through 18, 6, upwardly through RC, 3 and 19. Thus the starting coil is energized in the same direction as in the up circuit but the running coil is energized in the reverse direction for reversing the motor and the current from the supply terminal 8 does not have to go through the limit switch which would be open as illustrated in Figure 5 due to having operated in its safety capacity by reason of a load imposed on the hoist.

After the load is released, all or part of it may be removed and the hoist again operated in the normal manner. The arrangement is such however that when the hoist is rendered inoperative by an overload it can still be operated in the lowering direction for releasing the load.

In order to prevent the U-shaped link 23 from being opened excessively, I provide a screw 39 threaded into the arm 26 and adaptable to engage a shoulder 40 of the lower arm of the U-shaped member 23 after the arm has been spread sufficiently to open the limit switch LS. The operating point of the limiting switch may be adjusted by means of the screw 25 and the screw 39 is then adjusted to a point where it permits opening of the limit switch and a slight additional amount of opening movement of the U.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. Safety load limiting means for hoists and the like comprising a mechanical connecting link of expansible character, a switch carried thereby and responsive to the weight of the load on said link, said link being physically interposed in the line of hoist and connected in the up circuit of the hoisting motor independent of the down circuit thereof.

2. Safety load limiting means of the character disclosed comprising a loop shaped frame open at one side and responsive to the weight of a load to be hoisted, said loop being interposed in the line of hoist between a support and the load, a switch supported on said loop and electrically connected in circuit with the hoist motor to de-energize the same upon an attempt being made to hoist greater than a predetermined load, said switch being normally closed and having an actuating element responding to spreading of said loop under load to be opened when the load is greater than a predetermined value.

3. For use with a hoist motor or the like having a switch provided with independent up and down circuits; a load responsive link mechanically connected between the hoist and a support therefor, a safety load limiting switch supported by said link and normally closed upon normal loads and opened by imposing excessive loads on the hoist, said switch being electrically connected in the up circuit of the motor, the electrical connections eliminating the limit switch from the down circuit thereof.

4. An expansible device, and a safety load limiting switch carried by said expansible device and physically connected between a hoist supporting means and a load engaging hook operated by a hoist, said switch, upon excessive loading of the hoist, being operative to open a circuit therethrough and being electrically connected in the up circuit of the hoist motor to render it inoperative.

5. A safety load limiting switch electrically interposed in the lifting circuit only of a hoist, and means for operating said switch comprising a C-shaped element which is extensible in proportion to the load imposed thereon, normally cooperates with said limiting switch to retain the same closed and permits the same to open upon the load exceeding a predetermined value.

6. A safety load limiting switch for the lifting

circuit only of a hoist, and means for operating said switch comprising a loop element open at one side and extensible in proportion to the load imposed thereon, normally cooperates with said limiting switch to retain the same inoperative, and permits the same to operate to render the lifting circuit inoperative upon the load exceeding a predetermined value.

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