July 2, 1963 M. E. SILBERGER 3,095,979

OVERLOAD DEVICE

Filed April 8, 1960

FIG. 1

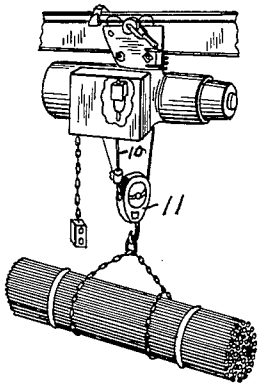


FIG. 2

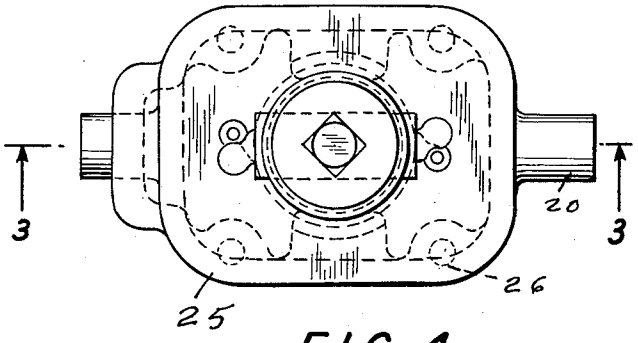


FIG. 3

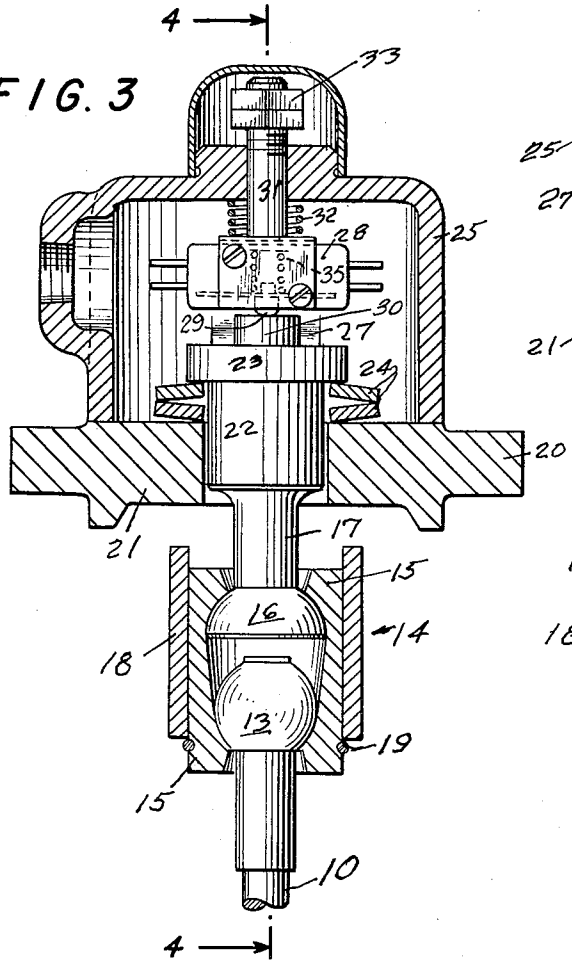
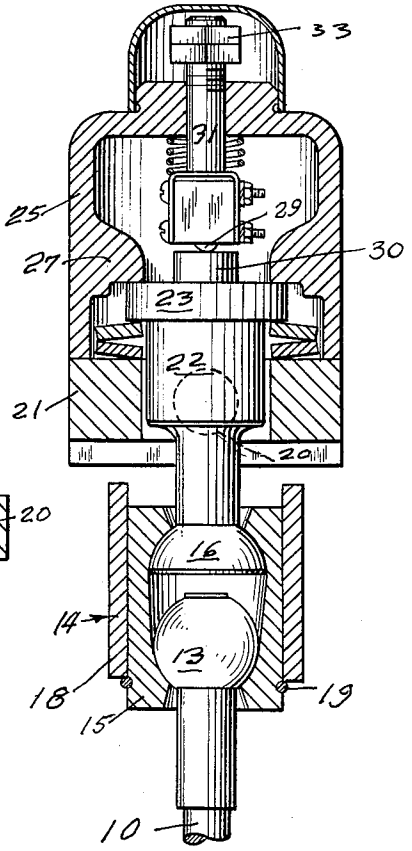


FIG. 4



INVENTOR.
Marvin E Silberger
BY
James T Bethell

United States Patent Office 3,095,979 Patented July 2, 1963

3,095,979

OVERLOAD DEVICE

Marvin E. Silberger, York, Pa. (% American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn.)

Filed Apr. 8, 1960, Ser. No. 20,975
3 Claims. (Cl. 212—134)

This invention relates to load measuring devices, and has particular reference to the automatic limitation of loads attempted to be moved by material handling devices.

For the purpose of illustration and explanation, the device is shown as part of an electric hoist utilizing a cable as the lifting element but, as will appear, the invention is by no means limited to such structure. Any load handling devce, such as a lift truck, jib crane, portal or other types of cranes, can utilize the invention with only trifling modifications.

The desirability of load limiting devices has long been recongized, in particular, in connection with hoists and cranes. Because competitive conditions require that a hoist be relatively inexpensive, and, at the same time, give long service under adverse conditions, the designers are limited in the safety factors which can be built into their products. In fact, users frequently overload hoists depending upon the safety factors to prevent breakage. The resulting wear under such conditions is excessive and the hazard to life and property very high. Another source of trouble is running the hoist with slack in the sling chains and jerking the load upward, which, if the load is near the capacity of the hoist, unduly strains many parts of the mechanism.

As a hoist in many installations is available to anyone on the floor who wishes to use it, and many who have only occasional need for it are ignorant or indifferent to the limitations on its use, it would seem desirable to arrange a hoist so that it cannot be abused by overloads engendered by attempts to lift large weights or by various faulty practices which produce excessive and unsafe impact stresses on the hoist. Because acceleration stresses are indetectable until they have occurred, one method of prevention or discouraging practices generating them is to penalize the operator if the hoist is so operated. As a general proposition, a great deal of the abuse of a hoist is a result of any attempt to hurry up a task, and a hoist which requires an additional time to perform a certain duty, if incorrectly used, is soon treated with caution.

With the above in mind, it is a primary object of the present invention to prevent as far as possible, the imposition of impact and acceleration loads on the hoist, by rendering such action non-profitable to the operator.

It is a further object of the present invention to provide a hoist with a device to prevent it from lifting any but a predetermined load.

It is a further object of the present invention to provide a device for a hoist which can be readily adjusted for a required load.

It is a further object of the present invention to provide a hoist with a safety device which prevents overloading the hoist but interferes with the normal operation of the hoist as little as possible.

Referring now to the drawings, which illustrate a preferred form of device embodying the present invention:

FIG. 1 is a pictorial representation, partly in section, showing one type of hoist to which the present invention is adapted;

FIG. 2 is a top view of the actuating device;

FIG. 3 is a section taken on line 3—3 of FIG. 2; and,

FIG. 4 is a section taken on line 4—4 of FIG. 3.

Briefly, the present invention contemplates a load responsive unit which controls an electrical circuit which, in turn, controls the operation of the hoist and/or various signal devices. In the particular example selected for illustration, the hoist is electrical, but the same device may be readily adapted to hydraulic devices, if necessary, by the use of suitable solenoid valves or the like. As shown in FIG. 1, the hoist used for illustrative purposes employs cable **10** as the lifting agency, which cable is secured at one end, passing around a traveling block **11** and wound on an electrically driven drum. In the usual arrangement, the dead end of the cable is secured to some part of the hoist frame. In the present device, the cable **10** is supplied with a ball fitting **13** which is received within a suitable terminal **14**, forming part of the mechanism with which this invention is chiefly concerned. The terminal comprises a pair of semi-cylindrical sleeves **15**, suitably bored to receive and retain the ball fitting **13** and a somewhat similar ending **16** on a reciprocable member **17**. The two half cylinders are held together by an outer sleeve **18**, which is retained in place by a spring ring **19**. This particular ending is selected to permit ready replacement of the cable without the necessity of hammering or heating or other rough treatment on the member **17**.

In order to support the entire device, trunnions **20** are provided, forming part of a platform **21** and capable of transmitting the entire load from the wire rope end to the hoist frame. The member **17** has an enlarged portion **22** extending through an opening in the platform, and a head **23**, too large to pass through said opening. Between the head **23** and the upper surface of the platform **21** are one or more Bellville springs **24**. These springs, a common article of commerce, are essentially conical washers of spring material, which flatten under load. It is the flattening of these springs which gives the motion necessary to operate the electrical part of the device.

By way of example, a pair of these springs are shown, with their concave surfaces toward each other. It will be appreciated that for a given load, the flattening of the springs will result in twice the movement of the member **17** which would result if but a single spring were used. Conversely, if the springs both faced in the same direction, the motion would be one-half of that which results from the arrangement shown, and the load which can be carried by the latter arrangement is twice that which can be carried by the first-mentioned arrangement. It therefore can be appreciated that any number of springs can be piled, either all facing the same way, facing alternately up and down, or any combination of them, to give the proper load bearing ability and deflection sufficient to operate the part of the device now to be described.

To form a housing, a suitable cover **25** is provided, secured to the platform **21** as by screws at **26** or the like. On its inner surface, the cover **25** carries a pair of projections **27**, arranged to limit the upward motion of the head **23**. It is intended that the Bellville springs be lightly compressed by the projections **27**, but the main reason for the projections is to protect the mechanism in the event a hook slips off the load, or other sudden release of the load occurs, which would cause the member **17** to be suddenly projected upward. Also, the projections **27** prevent oscillation of the load on the springs **24** beyond a slight oscillation possible before the member **23** engages the projections **27**.

A switch **28** is provided in the housing **25** which controls the proper circuit for stopping the hoist upon overload. The particular type of switch depends upon the way it is supposed to control the hoist, but the simplest would be a normally open switch which closes upon proper travel upward of the button **29**. If such a switch

were in the up control circuit, in series with the up button or its equivalent, it can be seen that the boss **30** must be in contact with the switch element **29** to close the switch and to permit the hoist to raise at all.

It is obvious that if the switch **28** were rigidly mounted, the device could be made to work to prevent lifting of overloads, provided the switch was capable of sufficient travel or the Bellville springs were held under sufficient compression by the projections **27** to limit travel of the boss **30** to which the switch plunger **29** can follow. However, such a mechanism will give no indication whatever of other improper treatment mentioned in the beginning.

For the purpose of making the device sensitive to impact overloads, the switch is resiliently mounted, a threaded stud **31** secured to the switch passing through an opening in the cover, and free to slide therethrough. A spring **32** between the housing and the switch urges the switch downward, and a pair of locknuts **33** on the stud serves to limit such movement. For the purpose of preventing tampering, a cover **34** may be secured in any convenient way to render removal readily detectable.

It can be seen that the location of the locknuts **33** on the studs can be varied to set the overload at which the switch opens, which it will do when the lower nut touches the housing and the boss **30** loses contact with the button **29**.

The spring **32** is selected to be of such compressive strength relative to the internal spring of the switch so that once the switch is opened, it cannot close until substantially all load is removed from the hoist, and the head of the member **17** comes into contact with the internal projections in the housing. This means, of course, that the spring **32** is substantially "weaker" than the switch spring **35** for all positions of the boss **30** below contact between the head **23** and the projections **27**.

Thus, an attempt to lift an overolad will stop the hoist when the nuts contact the cover, and the circuit will stay open until the load is sufficiently removed to compress spring **32** to resist upward movement of the switch body with a force sufficient to cause actuation of the switch.

In the case of an overload caused by impact, the switch acts exactly the same way and it will be necessary to remove the load by lowering the load until it is supported on the floor, before the load can be raised. It has been found that this behavior of the hoist soon forces the user to handle the hoist and loads with needed care and within safe bounds, to avoid the necessity of this additional operation.

It can be readily seen that the particular mechanism described can have its externals modified to adapt it to any instrumentality exerting a force, where it is desired to limit the force or signal that the force is about to be, or has been, exceeded. A typical application is in an elevator or lift, on a fork truck or the like, or on a jib or other type of crane to prevent a load from being raised which would be sufficient to overturn or overload it. Such applications are contemplated without the exercise of invention over the structure described.

I claim:

1. In a device for lifting indeterminate weights, means for causing operation of the device in a weight-lifting direction, an electrical circuit for controlling such operation, spring means operatively connected to said device and deflectable in response to the weight imposed on said device, switch means in said circuit operative in response to deflection of said spring means by a weight greater than a predetermined maximum to prevent operation of the lifting device in a weight-lifting direction, and means maintaining said switch in operation-preventing condition until reduction of the deflection of the spring means corresponding to reduction of the imposed weight to a predetermined value below the predetermined maximum.

2. In a weight-lifting device, an electrical circuit controlling the operation of the device in a weight-lifting direction, means including a spring causing relative movement of a pair of elements in response to imposition of a weight on the device, a spring normally open switch in said circuit, a resilient mount for said switch on one of said elements, the other of said elements bearing on the switch operation means, the resilient means being related to the switch spring to require reduction in the weight lifted to below a predetermined maximum upon operation of the switch by a weight greater than a second, larger predetermined maximum.

3. A safety device for a weight-lifting device to require removal of at least part of the weight being lifted in response to momentary acceleration of the weight-producing forces greater than a predetermined maximum comprising, an electrical circuit controlling the operation of the weight-lifting device in a weight-lifting direction, a switch in said circuit having a spring holding it normally open, a pair of elements mounted on the weight-lifting device moving relative to each other an amount proportional to the force exerted on the weight-lifting device, means supporting the switch on one of said elements in position for engagement of the switch operator by the other element to urge the switch operator in a closing direction, the mounting of said switch on the first mentioned element having resilient means permitting motion of the switch in a direction to open the switch.

References Cited in the file of this patent

FOREIGN PATENTS

814,642 Great Britain ---------- June 10, 1959