UNITED STATES PATENT OFFICE

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LOAD LIFTING CONTROL FOR HOISTING APPARATUS

Russell E. Nelles, Millburn, N. J., assignor to The Union Manufacturing Company, New Britain, Conn., a corporation of Connecticut

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5 Claims. (Cl. 254—173)

1 My invention, although not limited in its use to any special apparatus, is particularly applicable for controlling the hoisting of loads in power hoisting apparatus, and for this reason such apparatus has been selected by me for the purpose of illustrating the invention herein, and an object of my invention, among others, is the provision of means whereby in a mechanism of this type embodying an apparatus which is suspended from overhead in a more or less movable and unstable condition and free to swing to a greater or lesser extent, certainty of control in the upper limit of its movement of a load being raised by the hoisting mechanism may be assured irrespective of its unstable condition regarding the support of the apparatus.

One form of an apparatus embodying the invention and in the construction and use of which the objects herein set out, as well as others, may be attained is illustrated in the accompanying drawings, in which—

Figure 1 is a view in side elevation of one form of the apparatus embodying my invention.

Figure 2 is a top plan view.

Figure 3 is a view in section on a plane denoted by the broken line 3—3 of Fig. 1.

Figure 4 is a side view on enlarged scale of the switch mechanism as suspended from the rotating drive shaft.

Figure 5 is a view in section on a plane denoted by the broken line 5—5 of Fig. 4.

Figure 6 is a bottom view of the same.

Figure 7 is a view in side elevation of the switch bracket and arm disconnected from the rest of the structure.

Figure 8 is a view in elevation of a length of the load line or cable illustrating means for adjustable positioning the tripper disk, this also being shown in Fig. 7.

Figure 9 is a detail view illustrating the manner of adjustable positioning the tripper disk to a cấp.

Figure 10 is a view similar to Fig. 9 but looking from a point of view at right angles to the point of view of Fig. 9.

While, as hereinbefore mentioned, this invention is not limited to use with any particular type of apparatus, it is peculiarly adapted for use in connection with power operated hoisting mechanism, such as is embodied in my patent for such mechanism, issued April 24, 1945, No. 2,374,450 to which patent reference is hereby made for a more thorough understanding of its method of application to the apparatus disclosed herein.

In the accompanying drawings the numeral 6 denotes a fragment of a housing such as is shown in my patent just mentioned and within which a driving mechanism operated by an electric motor is housed, the entire apparatus being suspended by any suitable means from overhead supports in a manner that will be readily understood by those skilled in the art and acquainted with the use of such mechanism and as especially disclosed in my patent above named. This driving mechanism comprises a driving shaft 10 which is connected with the hoisting mechanism in any suitable manner, this hoisting mechanism being enclosed in a housing comprising two housing members 8—9, the mechanism therein being partly omitted as not being essential to an understanding of the invention and which may be suspended by hooks 7.

In the use of the mechanism of this type it is essential that means be provided for automatically controlling particularly upward movement of a load being raised by the hoisting mechanism so that all danger of the load hook colliding with the housing or hoisting mechanism will be removed and at the same time it is found desirable in some cases to provide means for locating the power driving mechanism at different distances from the hoisting mechanism, as by lengthening of the driving shaft 10. Suitable means commonly employed for automatic control of upward hook movement to avoid overwind of the hook at the top of the lift embody electric switches which by contact of the hook with a controlling member will operate to shut off the power from the electric motor.

In accomplishing this purpose I provide a switch supporting bracket comprising a switch housing 11 in which the electric switch mechanism is contained, this housing having supporting ears 12 at opposite ends thereof which are bored for rotatable mounting upon the driving shaft 10, and a collar 13 secured to the driving shaft locates the switch against movement in one direction and a hub 14 of a spider 15 to be more specifically hereinafter described limits movement in an opposite direction. It will be understood that the switch is wired for electrical connection with the motor in a manner that will be readily understood and for which reason a more specific showing and description are omitted herein.

The switch comprises an actuating plunger 16.
extending out at one end of the housing and which constitutes a part of the operating mechanism of the switch. A switch actuating lever 17 is pivotally mounted between ears 10 projecting from the bottom edge of the housing 11. A tripper arm 20 comprises a tempered spring rod bent into generally U-shape having substantially parallel sides with the free ends of said sides extending through a tripper arm supporting bar 21, said bar being pivotally mounted for limited angular movement in the housing 11. A tripper arm supporting stud 22 secured to and extending downward from the switch actuating lever 17, as shown in Fig. 4. This tripper arm is curved diagonally downward and also extends horizontally to vertically underlie the space between the hoisting housing members 8-9 which houses the hoisting mechanism, a portion only of which designated generally by the numeral 23 is shown herein and which comprises a load line or cable 24 as found in the hoisting mechanism of my patent hereinafore referred to. A tripper disk 25 is mounted on the load line 24 above the load hook underlying the tripper arm, said disk being of a diameter greater than the interval between the sides of the tripper arm, said disk being mounted on the load line at such point that it will make contact with the tripper arm at a location to raise said arm to actuate the switch before the hoist hook reaches a dangerous position with respect to the hoisting mechanism housing. 

From what has now been said it will be seen that the switch housing which requires to be supported in a substantially stationary position nevertheless makes use of a rotateably mounted member, i.e., the driving shaft 10 and this mounting arrangement is so constructed that the power housing may be located at such distance as may be desired from the hoisting mechanism. The tripper arm 20 is of light spring construction which is permitted by reason of the pivotal supports for said arm and the switch actuating lever 17, and this produces a contacting arrangement between the lever and the load line or cable such that there is no liability of undue or sudden jar or strain being transmitted to any of the parts when contact of the tripper disk 25 with the arm 20 takes place.

The main purpose of this invention has to do with a hoisting mechanism in which power is employed for operating said mechanism and I have therefore so arranged the parts that in cases where hand operated hoisting mechanism is employed this improved power operated equipment may be connected with and attached to conventional hoisting mechanism in common use with little trouble and expense as hereinafore explained and which enables the power operated mechanism to be suspended adjacent the hoisting mechanism in a manner herein illustrated and as further disclosed in my patent hereinafore referred to.

Attention is particularly called to the construction and mounting of the tripper arm which comprises an important feature of the invention and which, because of flexible and resilient characteristics, reduces to a minimum any chance for injury to the mechanism comprising the switch and its relation with the load line or hoisting cable. The double length construction of the tripper arm enables such arm to be composed of comparatively small spring wire imparting extreme resiliency and a yielding characteristic under excessive strains, and yet at the same time having rigidity enough for the effective action on and operation of the electric switch, and this resiliency is enhanced by the pivotal mounting which enables yielding movement of the arm in both horizontal and vertical planes, and there is therefore little liability to injury of any of the parts comprising the switch and its connection with the load line. The term “load line” is used herein to describe any flexible member whether it be cable, chain, rope or other device of any similar character.

In the construction of the device, as will have been readily appreciated by those skilled in the operation of hoists of this type, a push button or other well-known device for opening and closing an electric circuit having been operated in connection with the power driven apparatus, the shaft 10 will be rotated to operate the hoisting mechanism and the load line 24 with a load on the hook at the lower end thereof will be raised by the hoisting mechanism. This upward movement of the load line will continue until manual operation of the switch for controlling the power unit is effected. If, however, by inadvertence, accident, or mistake, the manual switch does not take place, the load line 24 will continue its upward movement until the disk 25 comes in contact with the arm 20 and the latter being raised as to its outer end the electric switch 11 will be operated to open the power circuit, thereby stopping the movement of the load line 24 before the hook comes into contact with the hoisting mechanism to the injury thereof.

The foregoing as described relates to a secondary or emergency control whereby carelessness or thoughtlessness on the part of the operator is automatically corrected to the point of stopping the hook at a definite predetermined position in the lift. Cycle of operations is as follows: Power mechanism is normally controlled by conventional controlling means, in this instance referring to a primary control, but in an emergency the secondary or emergency control becomes effective and will automatically stop the hook as described. When the operator lowers the hoisting hook the tripper disk drops away from the tripper arm thereby causing the switch mounted on the shaft 10 to again resume a normally closed position. This provides a closed circuit for the operator to resume hoisting operations.

Under certain conditions it will be essential that the position of the tripper disk 25 on the load line or cable 24 may be fixed in different places on such load line and I have therefore provided particularly efficient means for accomplishing this purpose, this being particularly shown in Figs. 7 and 8, this adjustable positioning means being omitted from a showing in Fig. 1 as it will be readily understood how it may be applied to such structure. This fastening comprises a bolt 26 which is inserted through one of the links of the chain comprising the load line 24 and with a nut 27 applied to the bolt in a manner common to structures of this sort.

With this arrangement it will readily be seen that the disk 25 may be placed in any position along the load chain or cable. The disk 25 may therefore be readily placed in any position desired.

In a similar device shown as securing a positioning disk 28 to a load line in the form of a cable in Figs. 9 and 10 a hub 29 is formed on the under side of the disk 28 and a bolt and nut...
assembly 31 are used for clamping the disk in any position desired along a cable 32.

I claim:

1. In power-driven hoisting mechanism, where-in a power unit with its power supply and control equipment and a hoisting unit with its hoisting mechanism including a load line are operatively connected in spaced-apart drive relation by a rotatable drive shaft the respective end zones of which are operatively connected with said units to form an assembly adapted to drive the hoisting mechanism from the power unit, the combination with such assembly, of an instrumentality operative to render the power means inactive under predetermined operating conditions, said instrumentality being normally inactive and being rendered active when the load line reaches a predetermined position within the hoisting range, means for mounting and supporting said instrumentality on said drive shaft in a definite position intermediate of and spaced from said units with the instrumentality mounting free from rotation with said shaft and free to swing thereon to permit free pivotal drive movement of the shaft, the instrumentality including a tripping element extending into the path of travel of the load line and normally permitting free movement of the latter, said load line carrying a definitely-positioned member movable with the load line and co-operative with the instrumentality to render such instrumentality active to cause inactivity of the power unit when the member reaches such predetermined position.

2. A combination as in claim 1 characterized in that the power unit includes an electrically-driven prime mover and its controls, and the instrumentality includes a switch electrically related with the prime mover controls, said switch being normally inactive to affect prime mover activity and being automatically active to affect such prime mover activity through movement of the tripping element by the load-line member when the latter reaches the predetermined position in the hoisting range.

3. A combination as in claim 1 characterized in that the drive shaft carries spaced members fixedly-positioned on and rotating with the drive shaft, said instrumentality including a casing having a pair of ears mounted on said drive shaft between said members with the latter defining the position of the casing in the length of the shaft, said casing ears being freely mounted on the shaft to thereby permit freedom of shaft rotation while retaining the instrumentality position.

4. A combination as in claim 1 characterized in that the tripping element is of elongated loop form for normal free movement of the load line therethrough with the loop mounted for pivotal movement on a vertical axis, the element being formed of spring metal to provide normal control action under load line member co-operation therewith and to permit element yield in the presence of over-running conditions of the load line.

5. A combination as in claim 1 characterized in that the instrumentality includes a pivoted actuator mounted on a horizontal axis and with one arm co-operative with an instrumentality switch to make and break a circuit to the prime mover controls of the power unit and having another arm providing a support for the tripping element, said tripping element support including a pivotal connection between the arm and element on a vertical axis, said element being of spring metal formation to thereby provide normal control action by the actuator under load line member co-operation with the element and permitting element vertical yield in the presence of overrunning conditions of the load line, whereby the tripping element is free to swing on its vertical pivot to compensate for swaying of the like of the load line and preserves the normal control action and vertical yield regardless of such swaying or other movement of the load-line.

RUSSELL E. NELLES.

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