This invention relates to devices for actuating and protecting electrical switches.

Limit switches are used in industry in various applications and are frequently used in situations requiring repetitive actuation as by a plurality of trip arms, etc., on a conveyor line. In such applications the limit switch is continuously subjected to shock, vibration, etc., and, being of a mechanical construction for essentially light duty operation, is susceptible to rapid wear, damage, loss of adjustment, etc. It is an object of this invention to provide an actuating mechanism for use with a limit switch which isolates the limit switch from direct contact with the trip arms, as on conveyor lines, and which mechanism is of heavy duty, rugged construction to more readily withstand shock, vibration, etc., and which mechanism protects the limit switch from damage.

It is a general object of this invention to provide a device of a novel and improved construction for actuating and protecting limit switches.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description and the appended claims, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a pictorial view of the limit switch protective and actuating device of FIGURE 1 with parts shown broken away and others shown in section;

FIGURE 2 is a pictorial view of a body member of the device of FIGURE 1;

FIGURE 3 is a front elevational view of the limit switch protective and actuating device of FIGURE 1 with parts shown broken away and others shown in section.

FIGURE 5 is a side elevational view of the assembly of FIGURE 3 taken substantially along the line 4-4;

FIGURE 6 is a top elevational view reduced scale of the adapter member of FIGURE 5 shown with portions of the protecting and actuating device depicted in phantom.

FIGURE 7 is a fragmentary front elevational view of a modified form of the limit switch protecting and actuating device of FIGURES 1-4 for use with a pair of limit switches.

Looking now to FIGURES 1-4, a limit switch actuating and protecting device is generally indicated by the numeral 10 and is shown in assembly relationship with an assembly line (partially shown) which includes a frame member 12 and a conveyor line 14 which is movable relatively thereto in the direction of the arrow A. The device 10 in general includes a mounting plate 16, a body member 18 and a cam lever 20, all of which are of heavy cross-sections for rugged operation. The mounting plate 16 is elongated and generally rectangularly, uniformly shaped and can be secured to the frame 12 by screws or welding and provides means for attaching the device 10 to the frame 12. The mounting plate 16 has a pair of threaded bores 22 which are laterally centrally and laterally and permit the body member 18 to be mounted to and selectively positioned on the mounting plate 16 in a manner to be presently seen. The body member 18 (FIGURE 2) has a back wall 23 with a longitudinally extending slide groove 24 in its rear surface of a width substantially equal to the width of the mounting plate 16; the groove 24 receives the front portion of the mounting plate 16 and acts as a guide in positioning the body member 18 along one axis, up or down as shown in FIGURES 1-4. The back wall 23 of the body member 18 has a longitudinally extending through slot 26 which, with the body member 18 located on the plate 16, is in line with the threaded bores 22. A flat, elongated retainer plate 28 is located on the forward face of the back wall 23 and has a pair of holes 30 spaced identically with threaded bores 22 in mounting plate 16 and is secured thereto by bolts 32 which extend through the holes 30 and through slot 26 thereby clamping the body member 18 to the mounting plate 16. It can be seen that while the retainer plate 28 is fixed to the mounting plate 16, the body member 18 can be slidably positioned along the mounting plate 16 simply by loosening the bolts 32. In this regard, the width of the slide groove 24 is accurately formed relative to the width of the mounting plate 16 so that precise up-and-down adjustments can be made.

The body member 18 is substantially symmetrical about a longitudinally central line and has a pair of longitudinally extending, downwardly tapering side ribs 34 which extend transversely, outwardly from opposite sides of the back wall 23. The back wall 23 and side ribs 34 are connected at their upper ends by a top portion 36 which includes a pair of upwardly extending, transversely spaced lugs 38, which have transversely extending, aligned bores 40. In between the lugs 38 are located laterally, outwardly extending, downwardly inclined stop surfaces 42 which have downwardly extending bores 44; a coil spring 46 and a removable plug 47 are located in different faces of the bores 46 and serve a purpose to be presently described.

The cam lever 20 is pivotally mounted between the lugs 38 by a pin 48 which extends through the bores 44 in lugs 38 and through a bore 49 (FIGURES 3 and 4) in the lever 20. The pin 48 is secured to lugs 38 at its opposite ends by cotter pins 50; a bearing of similar metal or other suitable construction can be located between the pin 48 and the bore 49 in the lever 20.

The cam lever 20 has an arm portion 52 which extends to one side of bore 49 and is mounted to body member 16 with the arm portion 52 extending toward the side with the spring 46; the arm portion 52 has upper and lower cam surfaces 54 and 56, respectively. A stop engaging surface 58 (FIGURE 3) is located on the arm side of the bore 49 and is in confrontation with the stop surface 42 on that side of body member 16. A projection 60 extends from the stop engaging surface 58 and extends partially within the coil spring 46 to prevent the spring 46 from sliding. The spring 46 is in precompression and normally urges the arm portion 52 upwardly or in a counterclockwise direction, as viewed in FIGURES 1-4, to a position determined by the point of engagement of a projection 62 on the cam lever 52 at the opposite side of the bore 49 with the plug 47. The travel of the cam lever 20, and hence arm portion 52, in an opposite, clockwise, direction is limited to a position at which the stop engaging surface 58 on arm portion 52 engages the stop surface 42 on that side of the body member 18.

A limit switch 64, which can be of a construction well known in the art, is mounted to an attachment plate 66 which in turn is mounted to one of the side ribs 34 via bolts 68. Each of the side ribs 34 is provided with a pair of similarly located laterally extending through bores 70 for bolts 68 whereby a switch, such as switch 64, and plate 66 can be mounted to either side. As shown in FIGURES 1-4, the switch 64 is mounted on the right side of body member 18 and, of course, the cam lever 20 is mounted with its arm portion 52 extending to the right. If a switch, such as switch 64, and plate 66 were mounted on the left side of body member 16 then the cam lever...
20 would be mounted with the arm portion 52 extending to the left; at the same time, the spring 46 and plug 47 would be interchanged in their respective bores 44.

A switch arm 72 is pivotally mounted on the cam lever 20 at 25 and is movable between extreme positions for actuating or deactivating the circuit of switch 64. The switch arm 72 has a cam roller 74 at its outer end which is continuously, resiliently urged (by conventional means not shown) into engagement with the lower cam surface 46 on arm portion 52. Thus as the cam lever 20 is moved between the positions fixed by its stops the switch arm 72 is moved between its extreme positions.

In operation a plurality of trip arms, such as arm 76, can be fixed to the conveyor line 14 and positioned so as to engage the upper cam surface 54 as the conveyor 14 moves in the direction of the arrow A to pivot the cam lever 20 clockwise, and hence to move the switch arm 72 to one extreme position (as shown in phantom in FIGURE 3). As the trip arm 76 moves out of engagement with the arm portion 52, the spring 46 moves the cam lever 20 to its opposite extreme position, with the switch arm 72 following to its other extreme position.

Note that with the device 10, the limit switch 64 is not subjected to the shock loads as by direct engagement with the trip arms 76 and the initial impact loads, etc., are taken by the rugged cam lever 20. In addition, the clockwise movement of the cam lever 20 is limited by the positive stop provided by surfaces 42 and 58 on the body member 18 and cam lever 20, respectively; hence the switch arm 72 cannot be overdriven thus protecting the limit switch 64. As previously noted, the device 10 can be readily converted for use with a limit switch on the opposite side while still utilizing the same basic elements.

With the apparatus of FIGURES 1-4 the position of the body member 18, and hence the switch 64, can be adjusted along one axis, i.e., vertically up or down. In FIGURES 5 and 6 the use of an adapter 78 permits adjustment along a second axis to permit both vertical and horizontal positioning. In the combination shown in FIGURES 5 and 6, the mounting plate 16 is mounted with its longitudinal axis extending horizontally. The adapter 78 is generally rectangularly shaped and is elongated and is secured to the mounting plate 16 with its longitudinal axis extending horizontally. The adapter 78 has a longitudinally extending slide groove 80 in its rear portion essentially equal to the front portion of the mounting plate 16; the groove 80 receives the front portion of the mounting plate 16 and acts as a guide in horizontally positioning the adapter 78. A longitudinally extending through slot 82 extends through the adapter 78 whereby the adapter 78 can be adjustably clamped to the mounting plate 16 via a flat retaining plate 84 (similar to retaining plate 23) and a pair of bolts 86. The adapter 78 has a pair of longitudinally extending ribs 88 on opposite sides which are connected at one extremity to a transversely, outwardly extending guide block portion 90. The guide block portion 90 is of a width to mateably fit within the slide groove 24 in the body member 18 and has a pair of threaded bores 92 which are spaced to receive the bolts 32 whereby the body member 18 can be adjustably clamped thereto via the retaining plate 23 and the vertical position of the body member can be adjusted. A substantial range of horizontal and vertical adjustment is obtained with the combination of FIGURES 5 and 6 since the adapter 78 can be assembled to extend to the left or to the right. In the combination of FIGURES 5 and 6 the attachment plate 66 and limit switch 64 have been omitted for the sake of clarity, it being understood that these elements can be connected to the member 18 in the manner shown in FIGURES 1-4 and as previously described.

A further variation of the apparatus of FIGURES 1-4 is shown in FIGURE 7. In FIGURE 7 a second limit switch 64a and mounting plate 66a are secured to the left side of the body member 18. A second spring 46a is substituted for the plug 47 in the associated bore 44 and a cam lever 20a is substituted for the cam lever 20. The cam lever 20a is substantially the same as the other as applied to the lever portion 94 causes actuation or deactuation of the limit switch 64a. The cam lever 20a is provided with a pair of stop engaging surfaces 58a for engaging the stop surfaces 42 on the body member 18 to provide a positive stop in either direction whereby both switches 64, 64a are protected. The springs 46 and 46a are seated in bores in the associated stop engaging surfaces 58a and are under a precompression to maintain the cam lever 20a centered; however, the springs 46, 46a can be selected such as to normally place the cam lever 20a in one of the other extreme positions, i.e., right or left. Substantial variations in circuit arrangement of switches 64, 64a can also be obtained.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. An actuating and protecting device for protecting and actuating a limit switch having a switch arm movable for actuating and deactuating the limit switch, said device comprising: a heavy sectioned body member, said body member for supporting a limit switch to said body member, a heavy sectioned lever member adapted to be engageable with the switch arm and pivoted secured to said body member for pivotally movement about a selected axis and away from said limit switch, first stop means comprising a pair of engageable surfaces on said lever member and said body member for limiting the movement of said lever member in a direction away from the limit switch, and second stop means on said lever member and said body member for limiting the movement of said lever member in a direction towards said limit switch to prevent said lever member from being engageable with said limit switch.

2. An actuating and protecting device for protecting and actuating a limit switch having a switch arm movable for actuating and deactuating the limit switch, said device comprising: a heavy sectioned body member, said body member for supporting a limit switch to said body member, a heavy sectioned lever member adapted to be engageable with the switch arm and pivotally secured to said body member for pivotally movement about a selected axis and away from said limit switch, first stop means comprising a pair of engageable surfaces on said lever member and said body member for limiting the movement of said lever member in a direction towards said limit switch to prevent said lever member from being engageable with said limit switch, second stop means on said lever member and said body member for limiting the movement of said lever member in a direction towards said limit switch to prevent said lever member from being engageable with said limit switch.

3. An actuating and protecting device for protecting
and actuating a limit switch having a switch arm movable for actuating and deactuating the limit switch, said device comprising: a heavy sectioned body member having a substantially symmetrical construction relative to one axis, means on said body member for supporting a limit switch to either of two sides of said body member on opposite sides of said one axis, a heavy sectioned lever member having a pivot support and having an arm portion extending away from said pivot support, said pivot support and said arm portion adapted to be in close proximity with the switch arm of the limit switch and for pivotal movement towards and away from the limit switch.

5. An actuating and protecting device for protecting and actuating a limit switch having a switch arm movable for actuating and deactuating the limit switch, said device comprising: a heavy sectioned body member having a substantially symmetrical construction relative to one axis, means on said body member for supporting a limit switch to either of two sides of said body member on opposite sides of said one axis, a heavy sectioned lever member having a pivot support and having an arm portion extending away from said pivot support, means for pivotally securing said lever member to said body member at said pivot support with said arm portion adapted to be in close proximity with the switch arm of the limit switch and for pivotal movement towards and away from the limit switch, first stop means on said lever member and said body member for limiting the movement of said lever member in a direction away from the limit switch, second stop means on said lever member and said body member for limiting the movement of said lever member in a direction towards the limit switch whereby damage to the limit switch is prevented, and spring means for resiliently urging said lever member to the limit position established by said first stop means.

6. An actuating and protecting device adapted to be mounted to a support member for protecting and actuating a limit switch having a switch arm movable for actuating and deactuating the limit switch, said device comprising: a heavy sectioned body member having a substantially symmetrical construction relative to one axis, means on said body member for supporting a limit switch to either of two sides of said body member on opposite sides of said one axis, a heavy sectioned lever member having a pivot support, means for pivotally securing said lever member to said body member at said pivot support with said arm portion extending in a direction towards either of said two sides of said body member and with said arm portion adapted to be in close proximity with the switch arm of the limit switch and for pivotal movement towards and away from the limit switch, first stop means on said lever member and said body member for limiting the movement of said lever member in a direction away from the limit switch, second stop means on said lever member and said body member for limiting the movement of said lever member in a direction towards the limit switch whereby damage to the limit switch is prevented from overtravel of said lever member, and spring means for resiliently urging said lever member to the limit position established by said first stop means.
7 stop surface and said second stop engaging surface for urging said one of said arm portions towards its associated limit switch.

References Cited by the Examiner
UNITED STATES PATENTS
2,338,365 1/1944 Thorp et al. __________ 200—172

8 3,156,805 11/1964 Baker et al. __________ 200—168 X
3,198,925 8/1965 Starrantino __________ 200—172

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