LOAD RESPONSIVE BRAKE RELEASE

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This invention relates to a novel brake release structure, and more specifically relates to a novel brake release structure which can be used in hoist motor systems wherein an initial upward movement of the hoist load is required prior to release of the brake.

Brakes for use with hoists are commonly set by a spring force which is released by the energization of a magnet. This is a common and well known fail-safe arrangement, and could be applied, for example, with the drum 12 to the type shown in cooped-up end Serial No. 212,335, filed July 25, 1962, entitled A.C.-Hoist Control System in the name of Ronald I. Bohn and assigned to the assignee of the instant invention.

Generally, in such hoist control schemes, the brake release coil and hoist motor are energized simultaneously. However, a torque developed by the motor may be insufficient at the first hoist position of the hoist controller to overcome the weight of the load, the result being that the load will move down instead of up.

The principle of the present invention is to provide a lost motion connection between the brake release control structure and the hoist motor, wherein brake release is possible only after the lost motion has been absorbed during the initiation of a hoisting operation. Thus, hoisting operation cannot be initiated by the operator unless he is at a controller position which provides sufficient torque for lifting the load.

In a particular embodiment of the invention, the lost motion connection cooperates with an auxiliary contact which is connected in series with the brake release magnet. Thus, the brake release magnet cannot be energized until the hoist motor has moved the load through a relatively small lost motion distance, thus assuring that upward motion can be initiated before the brake is released.

Accordingly, a primary object of this invention is to prevent release of a brake in a hoist control system until sufficient torque is available for assuring the upward motion of a load.

Another object of this invention is to remove, from the discretion of the operator, the determination of a controller position sufficient to move a load upwardly before release of a hoist brake.

These and other objects of this invention will become apparent from the following description when taken in connection with the accompanying drawings which illustrate a side plan view of a portion of the brake release structure of a hoist constructed in accordance with the invention.

Referring to the drawing, I have illustrated therein the output shaft 10 of a motor hoist which is, for example, connected to a hoist rope 11. The hoist rope 11 can go over an overhead series of pulleys (not shown), and then come inwardly to terminate in a lifting hook. As indicated by the arrows in the figure, the motor hoisting torque is in a clockwise direction, while load torque or the torque exerted on the motor by a load will be counterclockwise.

In accordance with standard techniques, a brake drum 12 of any standard type and which can have any desired length is secured to the output shaft 10 of the hoist motor. The drum 12 then cooperates with an appropriate brake shoe 13, which again can be of any standard type, and is carried from a brake cradle 14 by means of a pin 15 in the usual manner. The cradle 14 is then pivotally mounted to a support structure 16 at pivot 17.

In accordance with the present invention, cradle 14 receives pin 15 in a lost motion slot 16 which is elongated in a direction which is tangential to drum 12. A relatively strong spring 18 is then provided to the right of pivot 17 to normally bias shoe 13 into engagement with drum 12. In order to release drum 12, the cradle 14 carries a magnetic armature 19 which is in spaced relationship with respect to a magnet coil 20. The magnet coil 20 is provided with two energizing leads 21 and 22 which are connectable to any appropriate power source such as the terminals 23 and 24 of a D.C. source. The D.C. source is then connected to magnet coil 20 by the operation of a two-position switch 25.

When it is desired to lower a load secured to rope 11, the switch 25 closes at terminal 26 labeled "L" (for lower) so that the D.C. source is directly connected to magnet coil 20. The energization of magnet coil 20 attracts armature 19 and compresses spring 18 so that the cradle 14 rotates in a clockwise direction around pivot 17. This releases shoe 13 from drum 12 so that the lowering operation may proceed.

In accordance with the invention, and where the load is to be hoisted rather than lowered, the control switch 25 is connected to terminal 27 which is labeled "H" (for hoist).

An auxiliary switch means which includes stationary contacts 28 and 29 which cooperate with a movable bridge contact 30 is then carried from cradle 14. Contacts 28 and 29 are connected in series with the D.C. source terminal 27 and the magnet coil 20. Thus, in order for the magnet coil 20 to be energized, bridge 30 must be moved downwardly and into engagement with contacts 28 and 29. The bridge 30 is carried on a lever 31 which is pivotally mounted at pivot 32 wherein the switch structure is all carried from cradle 14. The left-hand end of lever 31 is held in engagement with the top of pivot pin 15 by means of a spring 33.

In operation, it will now be understood that the switch arm 30 will move downwardly with respect to contacts 28 and 29 only when the pin 15 moves to the bottom of slot 16. Thus, when the operator operates the controller for a hoisting operation which will close switch 25 to terminal 27 and apply appropriate voltages to the motor for hoisting torque, if the torque is insufficient to cause a hoisting operation, pin 15 will not move downwardly in lost motion slot 16 so that a circuit is not completed through magnet coil 20. Thus, the brake is not released.

When, however, the operator energizes the appropriate controller position on his controller so that the motor hoisting torque is sufficient to begin to lift the load, the motor shaft 10, drum 12 and brake 13 will all begin to rotate about the motor shaft axis so that pin 15 will move to the bottom of lost motion slot 16. This will cause bridging contact 30 to engage contacts 28 and 29 whereby an electrical circuit is completed to magnet coil 20 which causes the cradle 14 to rotate about pivot 17 to release the brake shoe 13.

Accordingly, it will be seen that a brake release structure is provided which is operable only when sufficient torque is applied to the motor to insure that a hoisting operation will follow the release of the brake.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of this invention be limited not by the specific disclosure herein but only by the appended claims.
What is claimed is:

1. A load responsive brake comprising a brake drum, a brake shoe, support means for said brake shoe, a brake engaging means, a brake release means, a motion responsive switch means, and a lost motion connection means; said lost motion connection means being connected to said brake shoe by said lost motion connection means, said support means being movable with respect to said brake drum between a brake engaging and a brake disengaging position; said brake engaging means comprising a biasing spring connected to said support means for normally biasing said brake shoe into engagement with said brake drum; said brake release means comprising magnet coil means energizable for moving said support means toward said brake disengaging position against the biasing force of said biasing spring; said lost motion connection means permitting rotation of said brake drum for a predetermined distance while said brake shoe engages said brake drum; said motion responsive switch means being operatively connected to said lost motion connection means; said switch means being closed when both said brake drum and said brake shoe rotate through said predetermined distance; and an energizing circuit for energizing said magnet coil; said energizing circuit being connected in series with said switch means.

2. The device substantially as set forth in claim 1 wherein said lost motion connection means includes a pin secured to one of said brake shoe or support means and an elongated slot in the other of said brake shoe or support means; said pin extending through said slot.

3. The device substantially as set forth in claim 2 wherein said slot is elongated in a direction which is parallel to a line tangent to said brake drum.

4. A brake control structure for a hoist to prevent release of a brake before sufficient lifting torque is provided by said hoist; said hoist having a motor; the shaft of said motor being operatively connected to a brake drum; said brake control structure including a brake shoe, support means for said brake shoe, a brake engaging means, a brake release means, a motion responsive switch means, and a lost motion connection means; said support means being connected to said brake shoe by said lost motion connection means; said support means being movable with respect to said brake drum between a brake engaging and a brake disengaging position; said brake engaging means comprising a biasing spring connected to said support means for normally biasing said brake shoe into engagement with said brake drum; said brake release means comprising magnet coil means energizable for moving said support means toward said brake disengaging position against the biasing force of said biasing spring; said lost motion connection means permitting rotation of said brake drum for a predetermined distance while said brake shoe engages said brake drum; said motion responsive switch means being operatively connected to said lost motion connection means; said switch means being closed when both said brake drum and said brake shoe rotate through said predetermined distance; and an energizing circuit for energizing said magnet coil; said energizing circuit being connected in series with said switch means whereby said brake shoe is released only when there is initial motion of said brake drum to assure sufficient lifting torque for said hoist.

5. In a brake; a brake drum having an engaged and disengaged position with respect to said brake drum, a brake shoe, a pivotally mounted cradle for supporting said brake shoe, and electrically energizable means for rotating said cradle to move said brake shoe from its said engaged position to its said disengaged position; said brake shoe being connected to said cradle by a lost motion connection; a switching means; said switching means having an operating member connected to said lost motion connection; said switching means being moved to a closed position responsive to relative movement between said brake shoe and cradle in said lost motion connection; and energizing means for energizing said electrically energizable means; said energizing means being connected in series with said switching means.

6. In a brake; a brake drum having an engaged and disengaged position with respect to said brake drum, a brake shoe, a pivotally mounted cradle for supporting said brake shoe, and electrically energizable means for rotating said cradle to move said brake shoe from its said engaged position to its said disengaged position; said brake shoe being connected to said cradle by a lost motion connection; a switching means; said switching means having an operating member connected to said lost motion connection; said switching means being moved to a closed position responsive to relative movement between said brake shoe and cradle in said lost motion connection; and energizing means for energizing said electrically energizable means; said energizing means being connected in series with said switching means.

No references cited.