This invention relates to a safety device for an escalator and in particular it relates to a safety device which is operated when free movement of an escalator step into the comb plate at the end of the escalator run is obstructed.

Escalators are commonly provided at the upper and lower ends of the step travel with a comb plate having teeth which project between spaced ribs on the step tread surfaces of the escalator steps. The main purpose of the comb plates at the two ends of the escalator step travel is to prevent injury to passers riding on the escalator or damage to their clothing or belongings caused by movement of the step tread surface beneath the floor plate at the end of the escalator.

Normally the comb plates are adequate for their intended purpose; but under unfavorable circumstances it is possible for the tip of a person's shoe to be caught in the gap between two steps, or in the space between the floor plate and the step tread surface. Not only can such an occurrence be damaging to the person or property, but it may also cause damage to the escalator mechanism by the forces created in the steps and drive mechanism.

Furthermore, under certain conditions a step may slide slightly out of line due to wear in the chains by which the step is propelled, or other circumstances, and thus reach the comb plate with the ribs in the step surface aligned with the teeth of the comb plate instead of between the teeth, and this can obviously cause serious damage to the escalator mechanism.

The present invention is directed to an improved apparatus for switching off the drive motor current in a case where a step has a portion of the tread surface between the comb plate and the step is obstructed in any manner so as to produce a condition wherein dangerous pressure is exerted upon persons or property on the escalator or to the escalator mechanism itself.

The operating principle of the present safety device is such that it may be employed either at the upper comb plate or the lower comb plate of an escalator; and the operating mechanism for the safety device is both simple and rugged.

The invention is illustrated in a preferred embodiment in the accompanying drawing, which is a schematic vertical sectional view through the escalator mechanism adjacent the upper comb plate.

Referring to the drawing, an escalator includes a series of steps 1 having upper tread surfaces 2 provided with parallel ribs 2a, said steps being suitably carried on a pair of chains, such as the chain 3, which pass around sprockets 3a. Each step has a pair of upper guide rollers 4 and of lower guide rollers 5 which are supported and guided, respectively, by pairs of upper and lower guide rails 6 and 7.

At the upper end of the escalator run, and positioned above the chain 3, is a comb plate, indicated generally at 8, which includes parallel comb teeth 8a between which the ribs 2a of the step travel pass as the steps slide beneath the comb plate.

In the lower guide rail 7 is a pivotally movable guide rail section 9 carried upon a pivot 9a, and beneath the free end of the movable rail section 9 is a supporting bracket 10 which supports a compression spring 11 that resiliently urges the section 9 into a position where it is continuous with the rail 7 in spite of any normal load which may be applied to the steps 1. In contact with the underside of the step, and extending through the compression spring 11 and a hole in the bracket 10, is a plunger 12, and below the plunger is a normally closed electrical switch 13 having an actuating rod 13a aligned with the plunger 12. The movable rail section 9 is vertically aligned with a lower guide roller 5 when the leading end 11 of the step is immediately ahead of the comb plate teeth 8a.

Operation of the safety device is believed to be clear from the foregoing description and accompanying drawing. If an obstruction jams between the ribs 2a and comb plate teeth 8a, or if excessive wear in the mechanism causes a step to move laterally out of its proper position, force created by the obstruction of the step in the comb plate will exert a horizontal force substantially in the plane of the step tread 2 and this force, acting in the opposite direction from the driving force of chain 3, and at a different level, will create a force couple that exerts a vertical pressure through the guide roller 5 upon the movable rail section 9. If this force is great enough to depress spring 11, it will permit plunger 12 to contact switch actuating rod 13a and open the normally closed switch 13. Switch 13 is wired into the escalator control circuit through wires 14 and 14a, so that when switch 13 is opened, the control circuit is broken and the escalator drive motor is stopped.

In view of the possibility that under some circumstances an excessive vertical force might act through the guide rollers 4, the upper guide rail 6 may also be provided with a movable section 15, pivoted at 15a, having a bracket 16 supporting a compression spring 17 for normally retaining the movable rail section 15 aligned with rail 6. The safety device associated with upper guide rail 6 also has an actuating plunger 17 which may open a normally closed switch 18 through a plunger 18a, switch 18 being wired into the escalator control circuit by wires 19 and 19a.

A similar safety arrangement may be utilized at the lower comb plate of a descending escalator. For such an assembly, a counter-guide rail 20, which is positioned in spaced relationship to the top of guide roller 5, may be provided with a suitable switch actuating mechanism which operates in response to an upward pressure of guide roller 5 against the counter-guide rail 20.

The foregoing description is given for clearness of understanding only, and it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

1. In an escalator having a comb plate with parallel comb teeth, a pair of parallel drive chains below the level of said comb plate, a series of steps pivotally mounted on said chains, each step having a tread surface which normally passes beneath the comb teeth and upstanding ribs which normally pass between said teeth, upper guide rollers on each step adjacent said pivotal mounting, lower guide rollers on each step on axes which are aligned both longitudinally and vertically from the upper rollers, upper guide rails guiding said upper rollers, lower guide rails guiding said lower rollers, said rails and rollers cooperating to guide the step tread surfaces into close sliding relationship with the comb plate, and a control circuit, safety drive stop means comprising, in combination: a generally vertically movable rail section, pivoted at 15a and vertically from said guide rails and so positioned that it is vertically aligned with a guide roller when the leading end of a step is immediately ahead of the comb plate; spring means resiliently urging said movable rail section into and maintaining it in a position where it is continuous with said one of said guide rails
3. in spite of any load normally placed on it by any one of said steps during normal operation of the escalator; a normally closed safety switch in the control circuit; and means actuated by movement of said rail section to open said safety switch, the relative positions of said comb plate, said chain, said upper rollers and said lower rollers being such that a horizontal force necessarily created by obstruction of a step at the comb plate, in combination with an opposite horizontal force exerted at a lower level on the step by the drive chain, creates a force couple that rocks the step on its pivotal connections with the chains so that the guide roller with which the movable rail section is vertically aligned may place sufficient force on said section to overcome the spring means and move said movable rail section to open said normally closed safety switch.

2. The combination of claim 1 in which the movable guide rail section is pivotally mounted adjacent one end, and the means actuated by movement of the section is adjacent the opposite end of said section.

3. The combination of claim 1 which includes a guide rail which supports a guide roller and a counter guide rail above and in close spaced relationship to said roller, and in which the movable section is in the supporting guide rail.

4. The combination of claim 1 in which the movable rail section is pivotally mounted adjacent one of its ends which is nearest the comb plate, the spring means is a compression spring which bears against said bar at a point remote from its pivot, and the means actuated by movement of the bar is adjacent the end of said bar opposite its pivot.

5. The combination of claim 1 in which the means actuated by movement of the movable guide rail section includes a switch actuating plunger which directly actuates the safety switch.

References Cited in the file of this patent

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