Feb. 11, 1936. J. DUNLOP 2,030,103

MOVING STAIRWAY

Filed Sept. 13, 1934

Fig. 1.

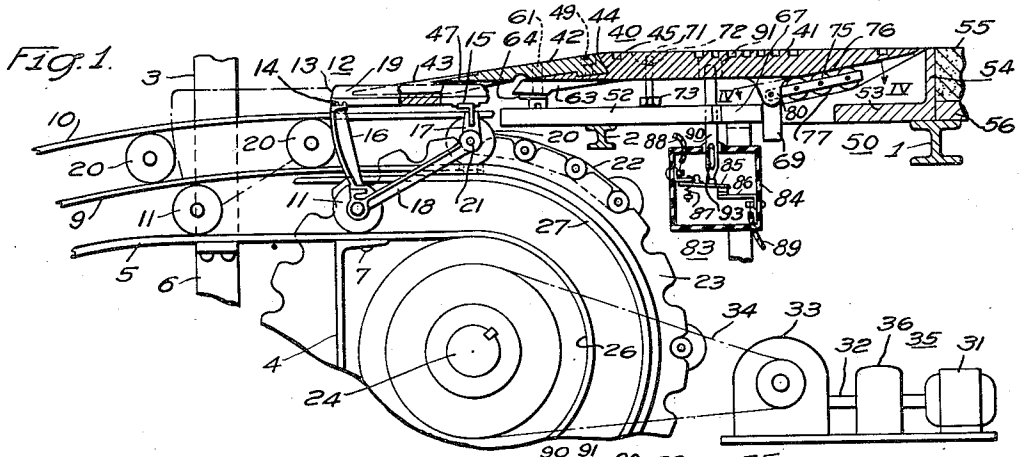


Fig. 2.

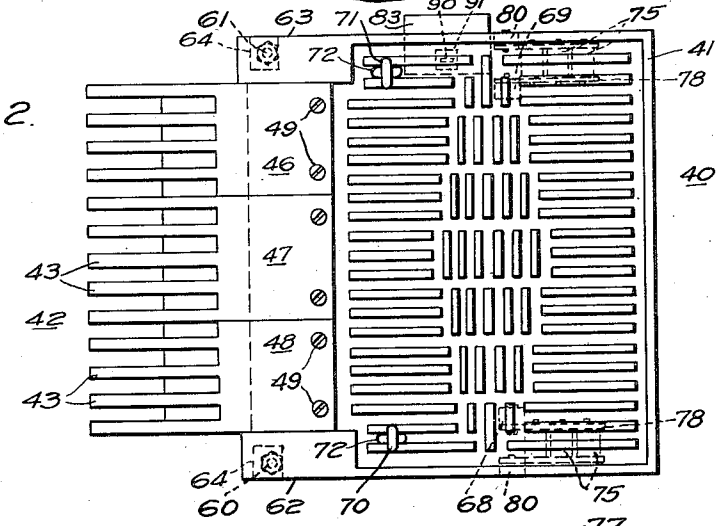


Fig. 3.

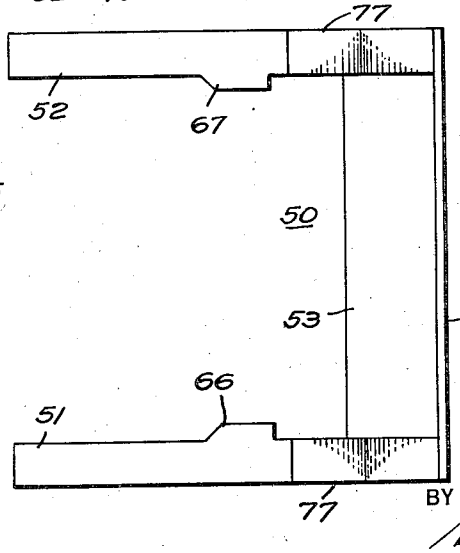
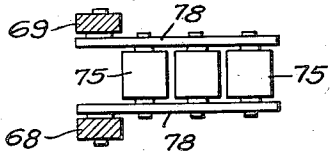


Fig. 4.



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2,030,103

MOVING STAIRWAY

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Application September 13, 1934, Serial No. 743,859

21 Claims. (Cl. 198—16)

My invention relates to moving stairways and more particularly to the combplates disposed at the upper and lower landings of such stairways for cooperation with the moving steps thereof.

One object of my invention is to provide a combplate construction for moving stairways which will increase the safety factor in the safe operation of the stairways.

Another object is to provide a combplate which may be quickly and economically constructed, placed in position and maintained in operation.

A further object is to provide a combplate construction for moving stairways which will cause the stopping of the stairways if an object becomes wedged between the combplate and the moving steps of the stairway or if the stairway steps get out of line and strike the combplate.

Another object is to provide for permitting a predetermined movement of the combplates when the pressure exerted against them by the stairway steps exceeds a predetermined amount.

It is also an object of my invention to provide a combplate which may be maintained in operative position without the use of fastening bolts, screws or wedges and which may be easily removed from their position on the stairway without the necessity of releasing any holding means.

Reference may be had to the accompanying drawing for a better understanding of my invention,

Figure 1 is a view, partly in side elevation and partly in section, of a portion of an upper landing of a moving stairway provided with a combplate constructed in accordance with my invention;

Fig. 2 is a top plan view of the combplate included in Fig. 1.

Fig. 3 is a top plan view of the supporting frame upon which the combplate rests when disposed in its position at the top of a stairway; and

Fig. 4 is a detail view taken along the line IV—IV of Fig. 1 of one of the gangs of rollers shown in Fig. 1 for facilitating the movement of the combplate when it is displaced by a predetermined force.

Referring more particularly to the drawing, I have illustrated the upper landing portion of a moving stairway as supported upon a suitable frame work, a small portion of which is shown as a pair of I beams 1 and 2, a vertical standard 3, and a strut 4. A track-rail 5 is supported upon the standard 3 by means of a bracket 6 and secured to the strut 4 by a rivet 7. A second track-rail 9 is disposed above the first track-rail 5 and maintained in position by the standard 3. A guard rail 10 is also mounted upon the standard 3 above the track-rail 9 in position to cooperate therewith. The track-rails 5 and 9 comprise the upper track for the moving stairway.

As shown, the moving stairway comprises an endless series of movable steps 12 which are disposed to move along the track rails 5 and 9 in accordance with the speed at which the stairway is to be operated. Each of the steps 12 comprises a step tread 13 disposed upon a frame comprising a pair of horizontal bars or joists 14 and 15 supported by suitable riser yokes 16 and 17. The lower ends of the riser yokes are suitably connected by bars 18 (only one of which is shown) to constitute a frame for the step tread.

Each of the tread plates 13 is provided with a plurality of suitable parallel cleats 19 disposed in alignment with the stairway. The step treads may be constructed of molded hardened material or any other suitable material. The cleats 19 should be of such dimensions and spaced apart such distances as will provide suitable supports for the feet of the passenger without permitting the heels of the passengers' shoes to enter the grooves.

The front part of the step indicated by the yoke 17 is supported by a pair of leading wheels 20. The rear portion of the step is supported by a pair of trailer wheels 11. With the step in its upper or stairway position, the trailer wheels 11 ride upon the track-rail 5 and the leading wheels 20 ride upon the track-rail 9.

The leading wheels 20 are mounted upon an axle 21 which extends through a gear chain 22 at each side of the step. Each of the gear chains 22 is supported upon and driven by a suitable sprocket wheel 23 at the side of the upper landing of the stairway. The sprocket wheels are firmly mounted upon and driven by a suitable driving shaft 24. The rotation of the sprocket wheels causes the gear chains 22 to move in accordance with the direction of operation of the sprocket wheels, thereby carrying the endless series of steps 12 around in their operative position.

Inasmuch as the gear chain on the sprocket wheels support the leading wheels of the steps, the leading wheels do not need to be supported by track-rails as they follow the gear chains around the sprocket wheels at the landings. But the trailer wheels 11 are not connected directly to the gear chains, therefore, the track-rail 5 is

continued by a curved section 26 to extend around the axis of the sprocket wheels. A curved guard rail 27 is disposed to guide the trailer wheels 11 along the curved track section 26.

An electric motor 31 is provided for driving the shaft 24 through a countershaft 32, a reduction gearing 33 and a driving chain 34. A spring-applied brake 35, provided with an electromagnetic releasing device 36, is disposed on the motor shaft 32 for stopping the stairway and preventing its operation when the motor 31 is deenergized.

Although any suitable control circuit may be provided for the motor and the brake, I prefer to employ the control circuit illustrated and described in the copending application of Edgar M. Bouton, Moving stairways, Serial No. 753,434, filed December 20, 1934.

A combplate 40 is provided adjacent to the position occupied by each step as it reaches its uppermost point in order to permit the passengers to easily step on or off the stairway. The combplate 40 comprises a weighted portion or comb base 41 and a comb 42 having a plurality of teeth 43 disposed to enter the grooves between the cleats 19 of each step as it moves through its uppermost position and thus cause the feet of the passenger to be transferred from or to the steps to the combplate as the stairway operates in the up or the down direction. If desired, the top face of the comb base may be molded with a cleat-like or corrugated surface to prevent the feet of the passengers from slipping as they enter or leave the stairway.

The rear edge of the comb 42 is provided with a "dove-tail" section 44 disposed to fit into a cooperating groove 45 in the front portion of the comb base 41. The comb is divided into three sections 46, 47, and 48, as shown in Fig. 2. A plurality of screws 49 are disposed in the dove-tailed section of the comb to prevent sidewise movement of the sections and assist in maintaining the comb in position on the plate 41. If it is desired to remove one or more of the comb-sections and replace it with another because of broken teeth or any other reason, it may be done by raising the plate, removing the screws, sliding the dove-tailed sections sideways out of the dove-tailed groove and then replacing them in the groove with the substitute section in the desired position. Thereupon, the screws may be replaced and the plate dropped into its correct position.

The combplate 40 is supported in its position by a combplate frame 50 which rests upon the I-beams 1 and 2. The frame 50 comprises a pair of spaced apart arms 51 and 52 connected at their rear ends by a base member 53 provided with a wall or riser 54. The riser defines the rear edge of the frame and also provides a limiting section for a suitable flooring material 55, such as concrete or any other suitable composition, supported upon a plate 56, the edge of which rests upon a portion of the I-beam 1.

The combplate 40 is supported in its horizontal position by means of a pair of adjusting bolts 60 and 61 which are screwed into the underside of a pair of forward projections 62 and 63 on the comb base, in such position that the head of the bolt 60 will rest upon the arm 51 and the head of the bolt 61 will rest upon the arm 52 of the combplate frame 50. A plurality of shims 64 may be inserted between the heads of the bolts 60 and 61 and the projections 62 and 63 in order to adjust the combplate vertically so that the comb teeth will enter the grooves between the cleats 19 at the correct height.

It will also be observed that the adjusting bolts 60 and 61 are placed near the front end of the combplate so that the weight of the rear portion of the comb base will be sufficient to hold the comb teeth 43 in their correct position in the grooves between the cleats 19 after the combplate is adjusted to its vertical position by rotation of the adjusting bolts. When the combplate is in the proper position, the rear end of the combplates 41 rests upon the rear end of the comb-frame 50 and any forward movement of the combplate will be prevented by a pair of lugs 66 and 67 disposed on the inner faces of the frame arms 51 and 52 in position to be engaged by a pair of cooperating lugs 68 and 69 on the underside of the comb base 41.

A pair of rigging bolts 70 and 71 are mounted at the sides of the combplate about midway between the front end and the rear end. Each rigging bolt is provided with a loop at its upper end which drops into a groove 72 when the rigging is not in use and which may be pried out of the groove when it is desired to raise the plate. The lower end of each of the bolts 70 and 71 is provided with a nut 73 which impinges against the lower side of the plate and causes the combplate to rise when the rigging block is lifted upwardly.

The combplate 40 has been constructed in the manner described, that is, constructed in a manner to permit it to sit in place without being fastened firmly to the floor, so that if stairway steps catch the comb or some foreign body gets caught between the comb and the stairway step, the force applied to the comb by the step will be sufficient to overcome the inertia of the combplate and cause it to move rearwardly, and thus relieve the force being applied by the steps.

In order to bias the combplate to its correct position and at the same time permit it to move readily rearwardly from its position, a plurality of rollers 75 are disposed under each rear side edge of the comb base 41 in position to operate between inclined planes 76 on the comb base and inclined planes 77 on the rear portions of the arms 51 and 52 of the combplate frame. The rollers 75 are rotatably mounted between a pair of spacing bars 78 which are, in turn, mounted on lugs 68 and 69 and a pair of short lugs 80. The spacers 78 keep the rollers separated sufficiently to prevent undue friction between them. If desired, the downward extending lugs 68 and 69 may be made sufficiently long to impinge against the front edge of the frame base 53 when the plate is pushed out of position so as to limit the rear movement of the plate to a predetermined distance.

A safety switch 83 is mounted upon the stairway frame underneath the combplate and at one side thereof and out of the path traveled by the stairway steps in going around the sprocket wheels 23. The safety switch 83 comprises a box 84 in which is mounted a pair of cooperating contact members 85 and 86. The contact member 85 is biased away from the contact member 86 by a biasing spring 87. A pair of suitable conductors 88 and 89 are provided for connecting the contact members to the control circuit for the stairway motor 31 and the electro-magnetic brake 35. When the combplate is in its correct position, the contact member 85 is held against the contact member 86 by a pivotally mounted switch lever 90, the upper end of which is disposed in an aperture 91 on the underside of the

comb base 41. The lever 90 is provided with a slot 93 at its pivotal point so that if the combplate is raised, the biasing spring 87 will push the lever upwardly thus opening the contact members 85 and 86.

From Fig. 1 it will be apparent that if the combplate is raised or moved from its correct position as by being caught on the moving steps or by some object being caught between the steps and the comb teeth, such movement will operate the pivotally mounted switch arm 90 to release the contact member 85 from the contact member 86 under the biasing effect of the spring 87. The opening of the contact members 85 and 86 will open the control circuit of the motor 31 and the brake 35 thereby stopping the motor and applying the brake and hence immediately stopping the stairway steps to prevent damage to the steps or to any object caught on the teeth of the combplate.

In view of the foregoing description, it will be seen that I have provided a combplate for moving stairways which will promote the safe operation of such stairways and which will, if a predetermined force is applied to it move out of position and stop the operation of the stairway. It will also be obvious that I have provided a combplate which may be readily removed at any time without the necessity of unloosening any fastening devices and which may be readily placed in operating position and adjusted without the necessity of employing a large number of tools. It will also be apparent that the combplate may be raised quickly in an emergency to release anything caught thereon. It is also apparent that if any of the comb teeth become broken, it will be necessary to replace only one section of the comb instead of providing a whole new comb as has been necessary in prior devices.

Although I have illustrated and described only one specific embodiment of my invention, it may be modified and changed in many ways without departing from the spirit and scope thereof.

I claim as my invention:

1. In a moving stairway having steps provided with grooves in their treads, a comb base disposed at one end of the stairway, a frame for supporting said comb base and preventing downward movement of any portion thereof but permitting upward movement thereof, and a plurality of comb teeth rigidly mounted on the comb base in position to enter the grooves in the treads of the steps as the steps pass under the comb, said comb base being sufficiently heavier than the comb teeth to more than overbalance the weight of the comb teeth and loading thereon of stairway passengers.

2. In a moving stairway having steps provided with grooves in their treads, a comb base disposed at one end of the stairway, a frame for supporting said comb base and preventing downward movement of any portion thereof but permitting upward movement thereof, a plurality of comb teeth rigidly mounted on the comb base in position to enter the grooves in the treads of the steps as the steps pass under the comb, said comb base being sufficiently heavier than the comb teeth to more than overbalance the weight of the comb teeth and loading thereon of stairway passengers, and means disposed between the comb base and the frame for vertically adjusting the position of the comb base on the frame.

3. In a moving stairway having steps provided with grooves in their treads, a comb base disposed at one end of the stairway, a frame for supporting said comb base and preventing downward movement of any portion thereof but permitting upward movement thereof, a plurality of comb teeth rigidly mounted on the comb base in position to enter the grooves in the treads of the steps as the steps pass under the comb, said comb base being sufficiently heavier than the comb teeth to more than overbalance the weight of the comb teeth and loading thereon of stairway passengers, a pair of forward projecting members on the comb base, and a pair of bolts screwed into the underside of the projecting members in position to cause their heads to rest upon the forward portions of the supporting frame when the comb base is in operative position on the frame whereby the vertical position of the comb base on the frame may be adjusted by rotating the bolts.

4. In a moving stairway having steps provided with grooves in their treads, a combplate comprising a weight rear portion and a plurality of comb teeth rigidly mounted thereon, means for supporting the combplate at the end of the stairway with its comb teeth disposed to enter the grooves in the steps as the steps pass under the combplate, and cooperating lugs disposed on the combplate and the frame for preventing forward movement of the combplate from its operative position and for limiting rearward movement of the combplate to a predetermined distance but permitting upward movement of the combplate.

5. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, and a combplate loosely mounted on the said frame with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate and a downwardly projecting lug disposed on said combplate to engage a cooperating portion of said frame for preventing forward movement of the loosely mounted combplate beyond its normal operative position.

6. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate, means for biasing the combplate to its forward position, means for limiting the forward movement of the combplate beyond its normal operative position and means for limiting rearward movement of the combplate to a predetermined distance.

7. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame, cooperating inclined surfaces on the combplate and the frame for biasing the combplate forwardly to the position where its comb teeth will enter the grooves in the treads of the steps as the steps pass under the combplate, and means for limiting the forward movement of the combplate to its normal operative position.

8. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted upon said frame, said combplate and said frame having cooperative inclined surfaces disposed to bias the combplate to its forward position, means for limiting the forward movement of the combplate to its normal operative position, and friction reducing means disposed between the said inclined surfaces.

9. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted upon said frame, said combplate and said frame having cooperative inclined surfaces disposed to bias the combplate to its forward position, means for limiting the forward movement of the combplate to its normal operative position, friction reducing means disposed between the said inclined surfaces, and means for limiting the rearward movement of the combplate to a predetermined distance.

10. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted upon said frame, said combplate and said frame having cooperative inclined surfaces disposed to bias the combplate to its forward position, means for limiting the forward movement of the combplate to its normal operative position, friction reducing means disposed between the said inclined surfaces, means for limiting rearward movement of the combplate to a predetermined distance, and means for adjusting vertically the position of the comb teeth in the grooves of the steps treads.

11. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame, a rear wall on said frame disposed adjacent to the rear portion of the combplate when the combplate is in its normal position, means for limiting forward movement of the combplate to its normal operative position, and cooperative inclined surfaces disposed on said combplate and said frame disposed to raise the rear edge of the combplate above the rear wall when the combplate is moved rearwardly.

12. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame, a rear wall on said frame disposed adjacent to the rear portion of the combplate when the combplate is in its normal position, means for limiting forward movement of the combplate to its normal operative position, cooperative inclined surfaces on said combplate and said frame disposed to raise the rear edge of the combplate above the rear wall when the combplate is moved rearwardly, a plurality of rollers disposed between the cooperating inclined surfaces on the combplate and the frame for reducing the friction therebetween, and means for spacing said rollers apart from each other to prevent binding thereof.

13. In a moving stairway having steps provided with grooves in their treads, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate, and cooperating portions disposed on the frame and the combplate for preventing rearward movement of the combplate beyond a predetermined distance from its normal operative position.

14. In a moving stairway having steps provided with groves in their treads, a combplate comprising a comb base and a plurality of comb teeth rigidly mounted thereon, a frame disposed at one end of the stairway for supporting the combplate with its teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate, said frame having a member projecting forwardly at each side of the steps and toward the steps, means disposed on the forward ends of said members for vertically adjusting the position of the combplate on the frame, a pair of lugs disposed on the underside of the comb base and a pair of recesses disposed on said frame to receive said downwardly projecting lugs for the purpose of preventing forward movement of the loosely mounted combplate beyond its normal operative position and for preventing rearward movement of the combplate beyond a predetermined distance from its normal operative position.

15. In a moving stairway having steps provided with grooves in their treads, a comb base, a frame for supporting the comb base at one end of the stairway, and a plurality of comb sections having their teeth disposed to enter the grooves of the treads of the steps as they pass under the comb sections said comb sections being mounted on the comb base by a dove-tail joint to prevent relative vertical movement between the comb sections and the comb base during service but permit relative lateral movement when it is desired to remove a comb section.

16. In a moving stairway having steps provided with grooves in their treads, a comb base, a frame for supporting the comb base at one end of the stairway, a comb divided into a plurality of sections, the forward part of the comb base and the rear part of the comb being provided with a dovetail joint to prevent vertical movement of the comb relative to the comb base but to permit lateral removal and replacement of the comb sections in the comb base.

17. In a moving stairway having steps provided with grooves in their treads, a combplate disposed at one end of the stairway with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the comb, means for driving the steps of the stairway, and means responsive to movement of the combplate from its normal operative position for rendering said driving means for said steps ineffective and for causing the stairway to stop.

18. In a moving stairway having steps provided with grooves in their treads, a combplate disposed at one end of the stairway with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate, means for driving the steps of the stairway, and means responsive to vertical movement of the combplate for stopping said driving means and said stairway.

19. In a moving stairway having steps provided with grooves in their treads, means for driving said steps, a frame disposed at one end of the stairway, a combplate loosely mounted on said frame with its comb teeth disposed to enter the grooves in the treads of the steps as the steps pass under the combplate, means for limiting forward movement of the combplate beyond its normal operative position, and means responsive to the rearward movement of combplate for rendering said driving means ineffective and causing the steps to stop.

20. In a moving stairway having steps provided with grooves in their treads, means for driving said steps, a frame disposed at one end of said stairway, a combplate mounted on said frame with the comb teeth disposed to enter the grooves in the treads of the steps as the steps pass to the combplate, and means responsive to the application of a predetermined force to the underside or the front end of the comb teeth for rendering said driving means ineffective and causing said stairway to stop.

21. In a moving stairway having steps provided with grooves in their treads, a combplate disposed at one end of the stairway with its teeth disposed to enter the grooves in the treads of the steps as the steps pass under the comb, means for driving the steps of the stairway, a switch and means responsive to movement of the combplate from its normal operative position for operating said switch to render said driving means ineffective and for causing the stairway to stop.

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