

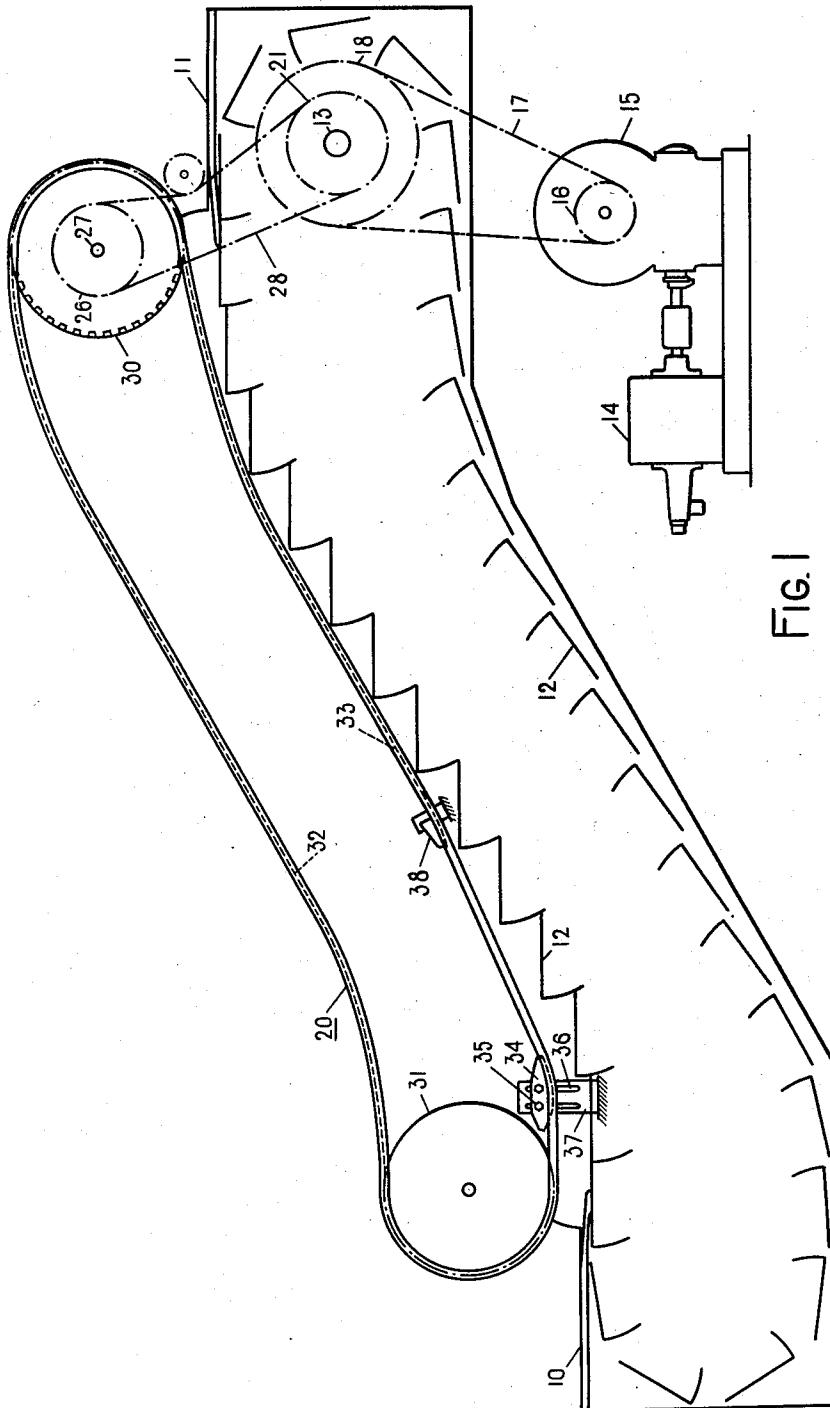
April 17, 1945.

G. W. LAUTRUP ET AL
MOVING STAIRWAY HANDRAIL DRIVE

2,373,764

Filed Sept. 20, 1944

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

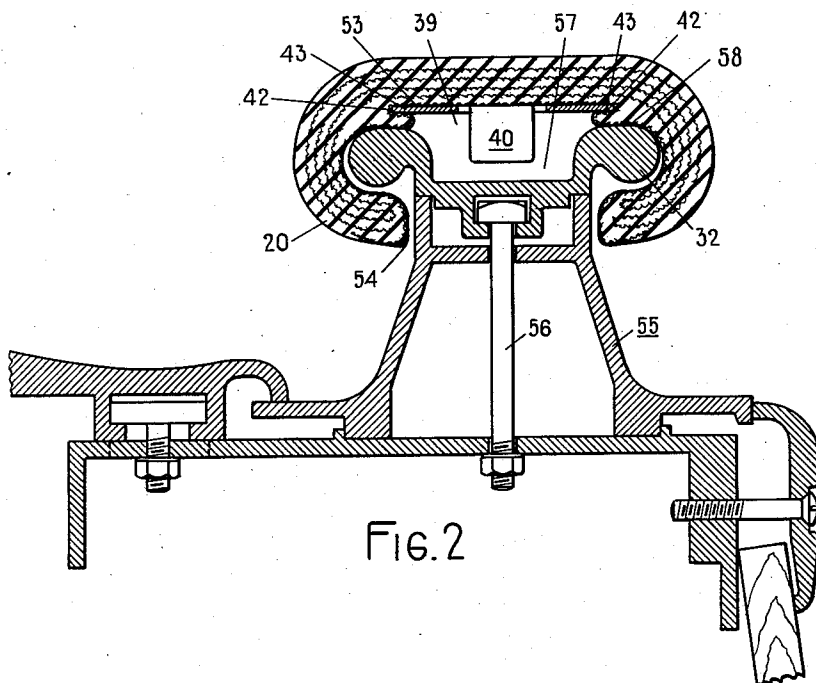


FIG. 2

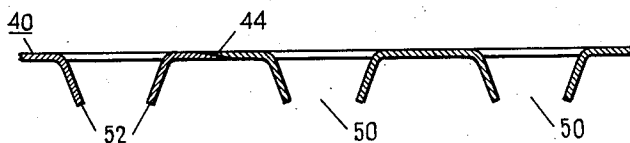


FIG. 5

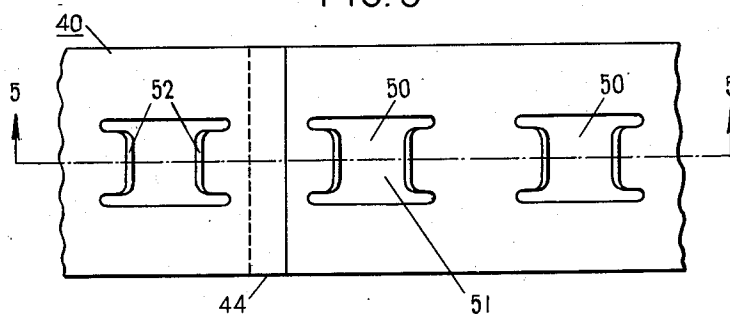


FIG. 4

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3 Sheets-Sheet 3

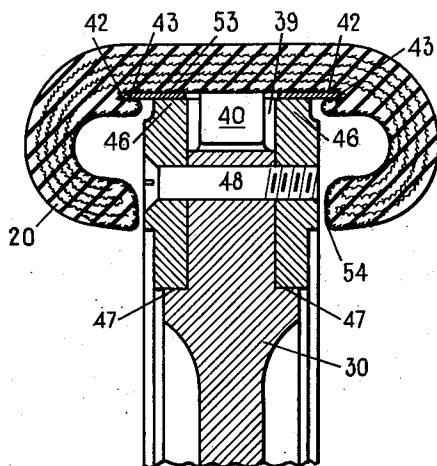


FIG. 3

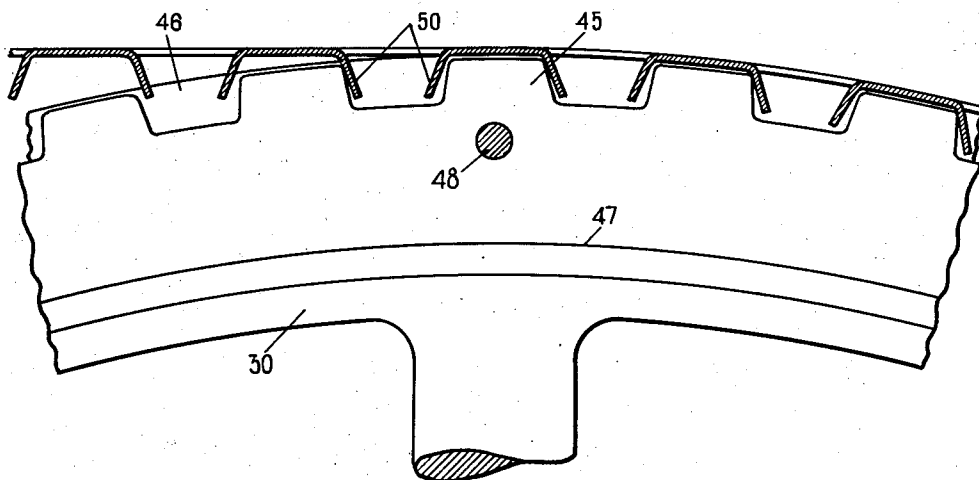


FIG. 6

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UNITED STATES PATENT OFFICE

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MOVING STAIRWAY HANDRAIL DRIVE

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8 Claims. (Cl. 198—16)

The invention relates to handrails of moving stairways and especially to the driving of the handrails.

Moving stairways are provided with two handrails; one on each side of the stairs, which are arranged to be driven in synchronism with the steps. It has been the practice for many years to drive these handrails by traction between the handrails and driving wheels. There are certain advantages in positive drives for handrails.

It is the object of the invention to provide a positive drive for a moving stairway handrail which requires a minimum of maintenance.

In carrying out the invention according to the arrangement which will be described, each handrail is provided on its inner side with a driving tape. The tape extends the full length of the handrail along the longitudinal center thereof, the edges of the tape extending into slots in the handrail to secure the tape to the handrail. A driving wheel is provided at one end of the stairway for driving the handrail through the tape in synchronism with the steps. The driving wheel is provided with teeth and teeth are formed on the tape for meshing with the driving wheel teeth. The teeth in the tape are in effect internal gear teeth and are formed along the longitudinal center line of the tape of inwardly extending pairs of lips. The driving wheel is provided with rims to each side of the teeth which are of a slightly greater diameter than the outside diameter of the driving wheel teeth. The portions of the tape between the teeth and the handrail slots run on these rims as the handrail passes around the driving wheel. Thus the load is supported on the rims of the driving wheel, limiting the central portion to the driving function. The handrail is guided on its upper and return runs on guides arranged to cooperate with the inner surface of the handrail.

Features and advantages of the invention will become apparent from the following description and appended claims.

In the drawings:

Figure 1 is a diagrammatic representation in side elevation of a moving stairway embodying the invention;

Figure 2 is an enlarged detail in cross-section of the handrail in Figure 1 on its upper run;

Figure 3 is an enlarged detail in cross-section of the handrail of Figure 1 as it passes around the driving wheel;

Figure 4 is a plan view of a section of the toothed tape;

Figure 5 is a longitudinal sectional view of the

same taken along the line 5—5 of Figure 4; and

Figure 6 is a fragmental end view of the driving wheel with the near rim removed, illustrating the meshing of the tape teeth with the driving wheel teeth.

Referring to Figure 1, the moving stairway extends between a lower landing 10 and an upper landing 11. In the arrangement illustrated, the stairway comprises an endless series of steps 12 driven at the upper end of the stairway by means of sprocket wheels through running gear chains. These sprocket wheels are mounted on and driven by the main drive shaft 13 of the stairway. This drive shaft in turn is driven by an electric motor 14 through reduction gearing 15, sprocket wheel 16, driving chain 17, and sprocket wheel 18 secured to shaft 13.

The stairway has two endless moving handrails, one on each side thereof, the handrail 20 for one side thereof being illustrated. This handrail is driven from the main drive shaft 13 through sprocket wheel 21 secured to the main drive shaft. This sprocket wheel drives a sprocket wheel 26 on the handrail drive shaft 27 by a sprocket chain 28. Driving wheel 30 for the handrail is secured to the drive shaft 27. The handrail on the other side of the stairway is driven in a similar manner from a sprocket wheel on shaft 13. Each of the handrails passes at the lower end of the stairway around a wheel 31 which is preferably a wheel similar to driving wheel 30 with the teeth omitted, or a wheel like wheel 30 may be utilized. On the upper run of the stairway each handrail is guided between its ends by guide 32. Also, a portion of the lower run of the handrail is guided by guide 33. At the lower end of the stairway a guide shoe 34 is provided to lead the return run of the handrail onto or off the wheel 31. This guide shoe is bifurcated to straddle the driving tape. The guide shoe is adjustably mounted for vertical movement by bolts 35 extending into slots 36 in a bracket 37 and serves as a tensioning device to take up any slack in the handrail. At the lower end of guide 33, a rounded guiding member 38 is provided to lead the handrail off at different angles to accommodate the position of shoe 34.

Referring now to Figures 2 and 3, the handrail is C-shaped in cross-section and is of rubber reinforced with canvas. The inner surface of the handrail is covered with one or more layers of canvas to facilitate sliding of the handrail on its guides 32 and 33. The handrail is provided

throughout its length with a pocket 39 in its inner surface to receive a driving tape 40, preferably of steel. Slots 42 extend sidewise into the handrail from the pocket 39. The edges 43 of the tape extend into these slots to secure the tape to the handrail. Also the tape may be further secured by cementing as with rubber cement. Both the handrail and its driving tape are joined at their ends to form a closed loop, the ends of the tape being scarfed as indicated at 44 in Figures 4 and 5 with the overlapping surfaces brazed together.

Referring to Figures 3 and 6, the driving wheel 30 is preferably provided with involute teeth 45 formed around the middle of the periphery thereof. The outer diameter of this toothed portion of the driving wheel is slightly less than the diameter of the pitch circle, the outer portions of the teeth being absent. A rim 46 is provided on each side of the toothed portion of the wheel, these rims being centered on shoulders 47 and secured to the wheel as by screws 48.

Referring also to Figures 4 and 5, to form the teeth 50 in the tape for meshing with the teeth of the driving wheel, H-shaped apertures 51 wider than the driving wheel teeth are punched in the tape, with the distance between the centers of the apertures lengthwise of the tape equal to the circular pitch of the driving wheel teeth. After the punching operation, all burrs are removed to prevent fatigue cracks. The oppositely disposed lips 52 formed in the punching are then bent inwardly, i. e., toward the opening in the handrail when installed, forming the teeth. These teeth are in effect internal gear teeth. The portions 53 of the tape to each side of apertures 51 exclusive of that extending into slots 52 (see Figure 3) run on the rims 46. The diameter of these rims is such that the line of bending of the tape coincides with the pitch circle of the driving wheel teeth. The outside diameter of the toothed portion of the wheel is less than the diameter of the rims so that the load is supported on the rims and operating clearance is provided between the tops of the driving wheel teeth and the flat portion of the tape. In forming teeth 50 the distance between adjacent lips 52 of adjacent tape teeth is made such as to provide clearance for the flanks of the driving wheel teeth. The contour of the lips and the length thereof are made such as to cause the tape teeth to run on and off the driving wheel teeth smoothly and to prevent the lips catching on the driving wheel teeth. Also, the width of the lips is less than the distance between the rims of the driving wheel, the clearance between the tips 54 of the C formation of the handrail and the rims being such as to prevent the sides of the lips catching on these rims.

The guide 32 for the upper run of the stairway is illustrated in Figure 2. This guide, which is preferably of brass, extends from the lower end to the upper end of the stairway and is secured at intervals to the stairway balustrading 55 by means of bolts 56. The guide is formed with a center pocket 57 to provide operating clearance for the tape teeth 50 and with flat portions 58 to each side of the pocket for slidably supporting the handrail. The guide 33 for the lower run of the stairway is of a similar construction but is inverted.

Thus it is seen that the toothed tape and toothed driving wheel form a positive drive for the handrail. This form of positive drive obviates stretching and the construction of the teeth

with the operating clearances provided therefor minimizes wear. These factors together with the fact that no oiling of the tape is required reduces maintenance to a minimum. Also, the elimination of oil assures a clean handrail at all times. The drive is quiet as the tape has no joints and as there is no chance of any part of the tape catching on the driving wheel.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In combination; a moving stairway handrail of C-shaped cross-section; and a driving tape secured to the handrail on the inner side thereof, said tape having lips extending therefrom to form teeth.

2. In combination; a moving stairway handrail of C-shaped cross-section; and a driving tape secured to the handrail on the inner side thereof, said tape having lips extending therefrom toward the opening in the handrail to form internal gear teeth.

3. A moving stairway comprising; a handrail; a driving wheel for the handrail at one end of the stairway, said wheel having teeth arranged circumferentially thereon and a rim; and a tape secured to the handrail on the inner side thereof and extending longitudinally of the handrail for the full length thereof, said tape having lips extending therefrom to form teeth for meshing with said driving wheel teeth, a portion of the tape running on said rim.

4. A moving stairway comprising; a handrail; a driving wheel for the handrail at one end of the stairway, said wheel having teeth arranged circumferentially thereon and a rim on each side of the teeth; and a flexible tape secured to the handrail on the inner side thereof and extending longitudinally of the handrail for the full length thereof, said tape having inwardly extending lips to form teeth for meshing with said driving wheel teeth, portions of the tape at the sides of the tape teeth running on said rims.

5. A moving stairway comprising; a handrail; a driving wheel for the handrail at one end of the stairway, said wheel having teeth arranged circumferentially thereon; and a tape secured to the handrail on the inner side thereof and extending longitudinally of the handrail for the full length thereof, said tape having inwardly extending lips to form teeth for meshing with said driving wheel teeth, the teeth of the tape being formed so as to prevent their catching on said driving wheel as they mesh with the driving wheel teeth and disengage therefrom.

6. A moving stairway comprising; a handrail; a driving wheel for the handrail at one end of the stairway, said wheel having teeth thereon and a rim on each side of the teeth; and a flexible tape secured to the handrail on the inner side thereof and extending longitudinally of the handrail for the full length thereof, said tape having inwardly extending lips to form teeth for meshing with said driving wheel teeth, portions of the tape at the sides of the tape teeth running on said rims, the diameter of said rims being greater than the outside diameter of said driving wheel teeth, to cause the load to be supported on the rims.

7. A moving stairway comprising; a handrail; a driving wheel for the handrail at one end of the stairway, said wheel having teeth thereon and a rim on each side of the teeth; and a flexible tape secured to the handrail on the inner side thereof and extending longitudinally of the handrail for the full length thereof and joined at its ends to form a closed loop, said tape being formed with inwardly extending pairs of lips to provide teeth for meshing with said driving wheel teeth, portions of the tape at the sides of the tape teeth running on said rims, the diameter of said rims being greater than the outside diameter of said driving wheel teeth to cause the load to be supported on the rims, and the teeth of the tape being formed so as to prevent their catching on the driving wheel teeth as they mesh with the driving wheel teeth and disengage therefrom.

8. A moving stairway comprising; a handrail of C-shaped cross-section, said handrail being provided with a pocket in its inner surface along its longitudinal center and having slots extending sidewise oppositely from said pockets; a driving wheel for the handrail at one end of the stairway, said wheel having a central portion with teeth

5 and a pair of rims, one on each side of the teeth; and a driving tape in said pocket extending longitudinally of the handrail for the full length thereof, the edges of the tape extending into said slots to secure the tape to the handrail, said tape and handrail being joined at their respective ends to form a closed loop, said tape being formed along the longitudinal center line thereof with lips bent inwardly in pairs to provide teeth for meshing with said driving wheel teeth and being provided with a flat portion to each side of the tape teeth which flat portions run on said rims, the diameter of said rims being such as to cause the line of bending of the tape to coincide with the pitch circle of the driving wheel teeth and the outside diameter of said central portion being less than said diameter of the rims to cause the handrail load to be supported on the rims, and the teeth of the tape being formed so as to prevent their catching on the driving wheel teeth as the tape teeth mesh therewith and disengage therefrom.

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