Aug. 13, 1940. S. G. MARGLES 2,211,427

MOVING STAIRWAY HANDRAIL DRIVE

Filed Feb. 11, 1939 2 Sheets-Sheet 1

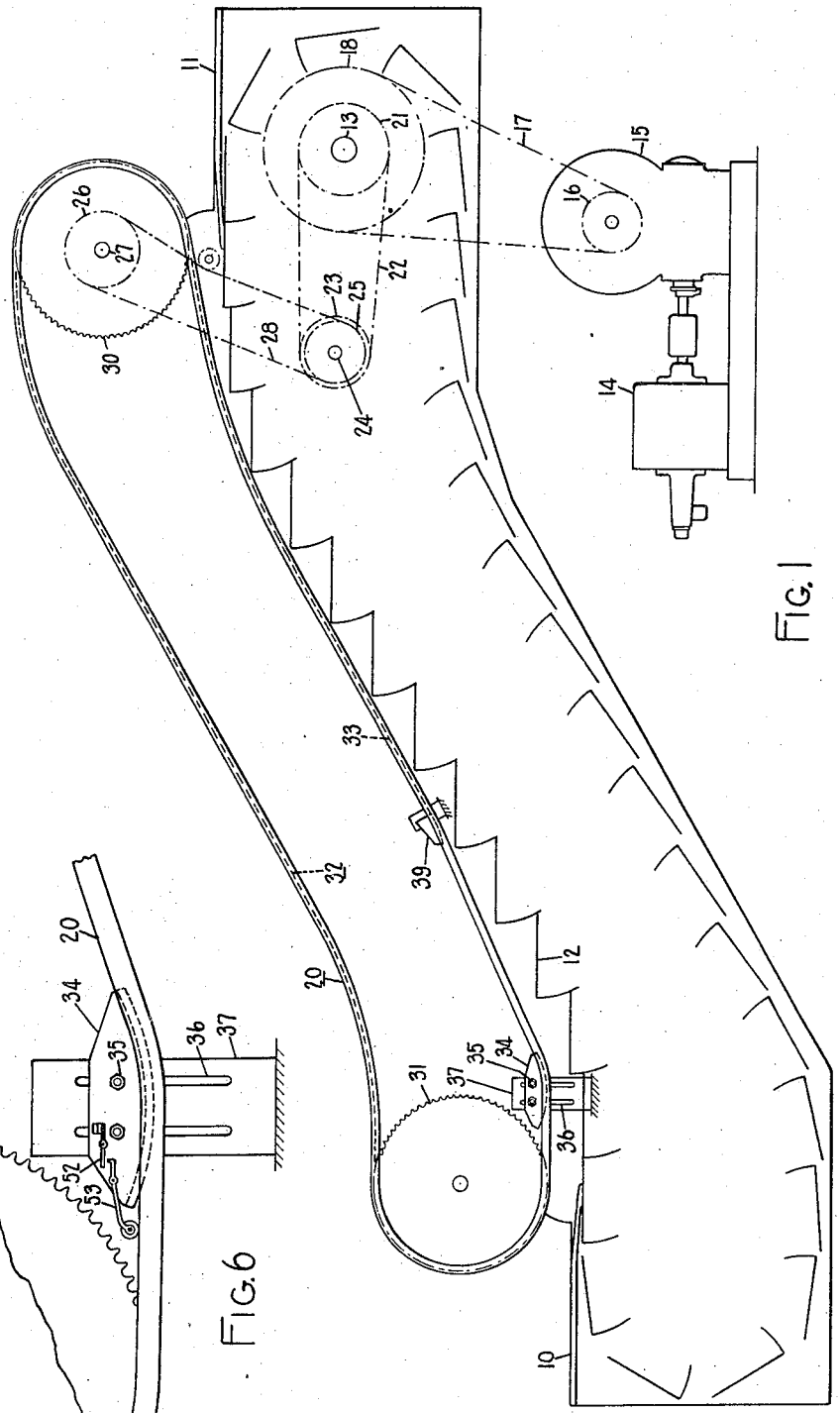


FIG. 1

FIG. 6

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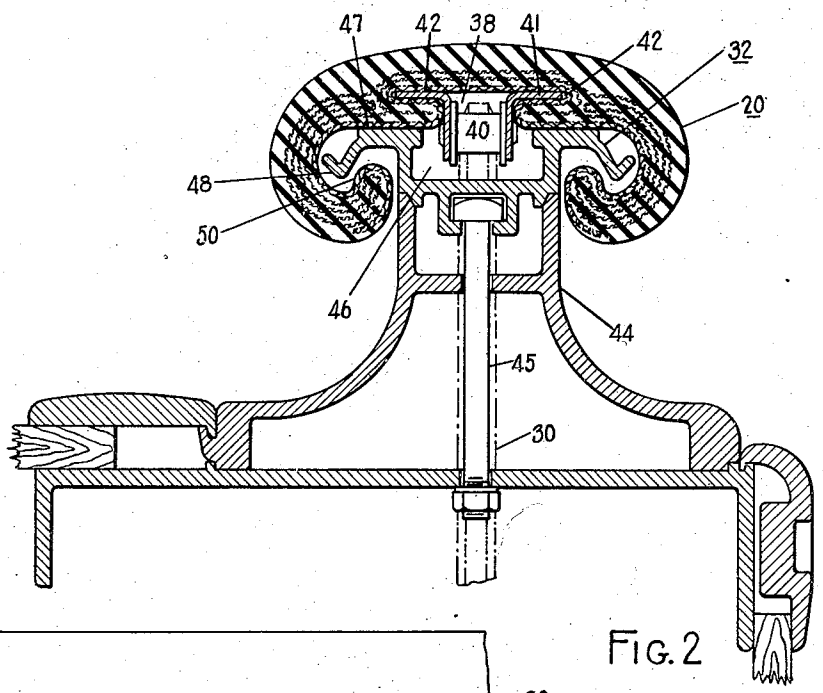


FIG. 2

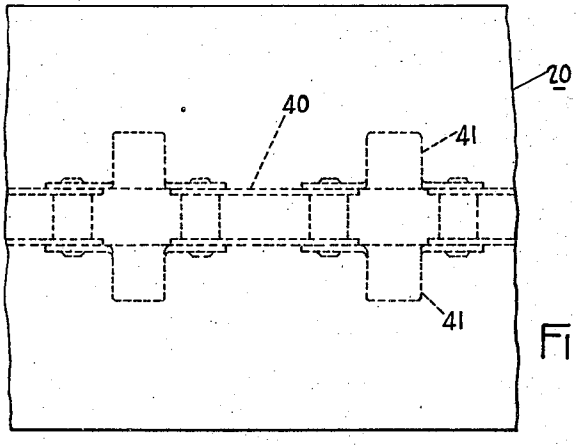


FIG. 3

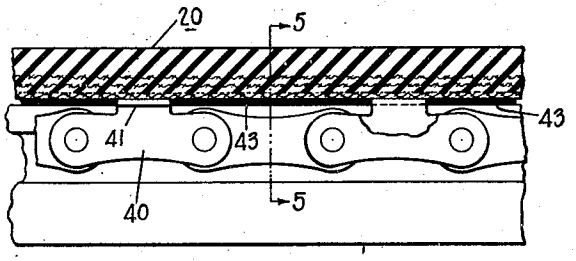


FIG. 4

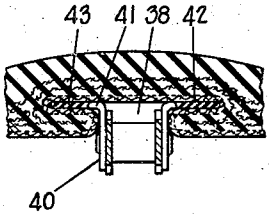


FIG. 5

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UNITED STATES PATENT OFFICE

2,211,427

MOVING STAIRWAY HANDRAIL DRIVE

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Application February 11, 1939, Serial No. 255,823

1 Claim. (Cl. 198—16)

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

Moving stairways are provided with moving handrails for the convenience of persons using the stairways. Two handrails are provided, one on each side of the stairs, and are arranged to be driven in synchronism with the steps. It has been the practice for a great many years to provide a traction drive for the handrails. In these arrangements, the handrail passes around newel wheels at the ends of the stairway. At one end of the stairway, the handrail passes from the newel wheel around tensioning wheels before returning to the incline, this newel wheel and at least one of the tensioning wheels being driven to drive the handrail. On both the upper run and the return run of the incline, the handrails slide on guides extending inside the handrail. With such drives, it is possible for the handrails to slip with respect to their driving sheaves. This results in relative motion between the handrails and the steps, which is undesirable.

It is the object of the invention to provide a drive for the handrails which maintains the handrails in synchronism with the steps at all times.

The invention involves the provision of a positive drive for the handrails with the handrails guided between the ends of the stairway by the handrails themselves. In carrying out the invention, a sprocket chain is secured to each handrail on the inner side thereof and throughout the length of the handrail. The chain, and thus the handrail, passes over a sprocket wheel at each end of the stairway, one of these sprocket wheels being driven to drive the handrail in synchronism with the steps. The handrail extends directly from its run to the sprocket wheel and returns to its run directly from the sprocket wheel. The inner surface of the handrail is of material having a low coefficient of friction to cooperate with the guides to guide the handrail between the ends of the stairway with a minimum of friction. The chain extends along the longitudinal center of the handrail and is secured to the handrail by lugs formed at intervals on the chain links and extending into slots in the handrail. The chain is positioned so that its pitch line corresponds with a longitudinal line through the center of bending of the handrail so that the radii of bending of the chain and handrail coincide at the curves.

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

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 of Figure 1;

Figure 3 is a fragmental top view of the handrail;

Figure 4 is a fragmental view of the handrail in longitudinal cross-section;

Figure 5 is a view along the line 5—5 of Figure 4; and

Figure 6 is a schematic view of a broken-handrail switch.

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, sprocket chain 22, and sprocket wheel 23 on counter shaft 24. A second sprocket wheel 25 on shaft 24 drives a sprocket wheel 26 on the handrail drive shaft 27 by a sprocket chain 28. Driving sprocket 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 24. Each of the handrails passes around a similar sprocket wheel 31 at the lower end of the stairway. 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 sprocket wheel 31 a guide shoe 34 is provided to lead the return run of the handrail onto or off the lower sprocket wheel. This guide shoe is bifurcated to straddle the driving chain. The guide shoe is adjustably mounted for vertical movement by bolts 35 extending into slots 36 in a feed bracket 37 and serves as a tensioning device to take up any slack in the handrail.

Referring now to Figures 2, 3, 4 and 5, 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 **38** in its inner surface to receive the driving chain **40**. This chain is of sprocket chain construction. The pocket **38** is of such depth that with the chain in place the pitch line of the chain coincides with a line extending longitudinally of the handrail through the center of bending of the handrail. The chain is secured to the handrail by means of lugs **41** which extend sidewise oppositely from the outer edges of corresponding links of the chain into slots **42** extending sidewise into the handrail from the pocket **38**. The chain is held in position longitudinally of the handrail by rubber fillers **43** in the slots between the lugs. These fillers are formed by putting liquid rubber compound in the slots during assembly. This liquid rubber compound does not adhere to the lugs but does bind to the handrail to form, when hardened, longitudinally yieldable retainers for the lugs. Both the handrail and its driving chain are joined at their ends to form a closed loop.

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 **44** by means of bolts **45**. The guide is formed with a center pocket **46** to provide operating clearance for the chain and with flat portions **47**, one on each side of the pocket, at the top for slidably supporting the handrail. The guide is also formed with V-shaped portions **48** which extend downwardly from the flat portions **47**. The tips **50** of the C formation of the handrail are turned upwardly as viewed in Figure 2 so as to hook in behind the V portions of the guide to prevent the handrail being forced off its guide, the top of the handrail being crowned slightly to provide the desired stiffness. Considerable running clearance is allowed between the handrail and the V portions **48** of the guide to enable the handrail to run freely on its guide.

The guide **33** for the lower run of the stairway is of a similar construction but is inverted. During this portion of the run the handrail slides on the V-shaped portion **48** of the guide. At the lower end of guide **33** the handrail is guided in such way that it may be led off at different angles to accommodate the position of guide shoe **34**. This is preferably effected by a separate rounded guiding member **39** at the lower end of guide **33**.

A broken-handrail switch may be provided for each handrail if desired. Such switch may be of the form schematically illustrated in Figure 6, wherein a switch lever **52** pivotally mounted on shoe **34** is biased into position where the movable contact carried thereby engages a stationary contact. This lever is adapted to be operated to separate the contacts by a second lever **53**, also pivotally mounted on shoe **34**. This second lever is provided with a roller which rolls on the handrail and thus supports the lever in position disengaging the contact lever. Should breaking of the handrail occur the roller drops, swinging the lever **53** counterclockwise to open the switch. The contacts of the switch are arranged in the circuits so as to cause the stopping of the moving stairway in case the handrail breaks.

With handrails arranged as above described, the guiding of the handrail is effected by the handrail itself, independently of the driving chain, avoiding the use of any lubricant for the chain other than for the chain joints. This is only a small amount of lubricant, that applied to the chain by the chain manufacturer being sufficient for several years' service, so that the possibility of any oil getting on the handrail is minimized. Positive drive of the handrail assures correct speed of the handrail, independent of rise, load or direction of travel. Tensile stresses in the handrail are minimized, eliminating resplicing of the handrail and prolonging its life. The driving mechanism for the handrail is simplified, permitting a decrease in the width of the balustrading.

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:

A moving stairway comprising; a series of steps; a pair of handrails, one on each side of the steps, each handrail being C-shaped in cross-section and of rubber reinforced with canvas; a sprocket chain for each handrail arranged on the inside of the handrail and extending longitudinally of the handrail for the full length thereof, each chain and the handrail for which it is provided being joined at their respective ends to form a closed loop, each handrail being provided with a pocket in its inner surface along the longitudinal center of the handrail to receive the sprocket chain, said pocket being of a depth such that the pitch line of the chain coincides with a line extending longitudinally of the handrail through the center of bending of the handrail; lugs on each of said chains extending oppositely at intervals sidewise from the links of the chain, said handrails having slots extending sidewise from said pockets to receive said lugs; fillers formed by providing liquid rubber compound in said slots during assembly for yieldably securing said chains to said handrails; guides for said handrails on the upper and lower runs of the stairway, said handrails having canvas linings on their inner surfaces for cooperating with said guides to guide the handrails between the ends of the stairway independent of said chains, said linings extending over the surfaces of said pockets and slots; sprocket wheels at the ends of the stairway around which said chains extend; and motor driven mechanism acting on said sprocket wheels at one end of the stairway for driving said handrails in synchronism with said steps.

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