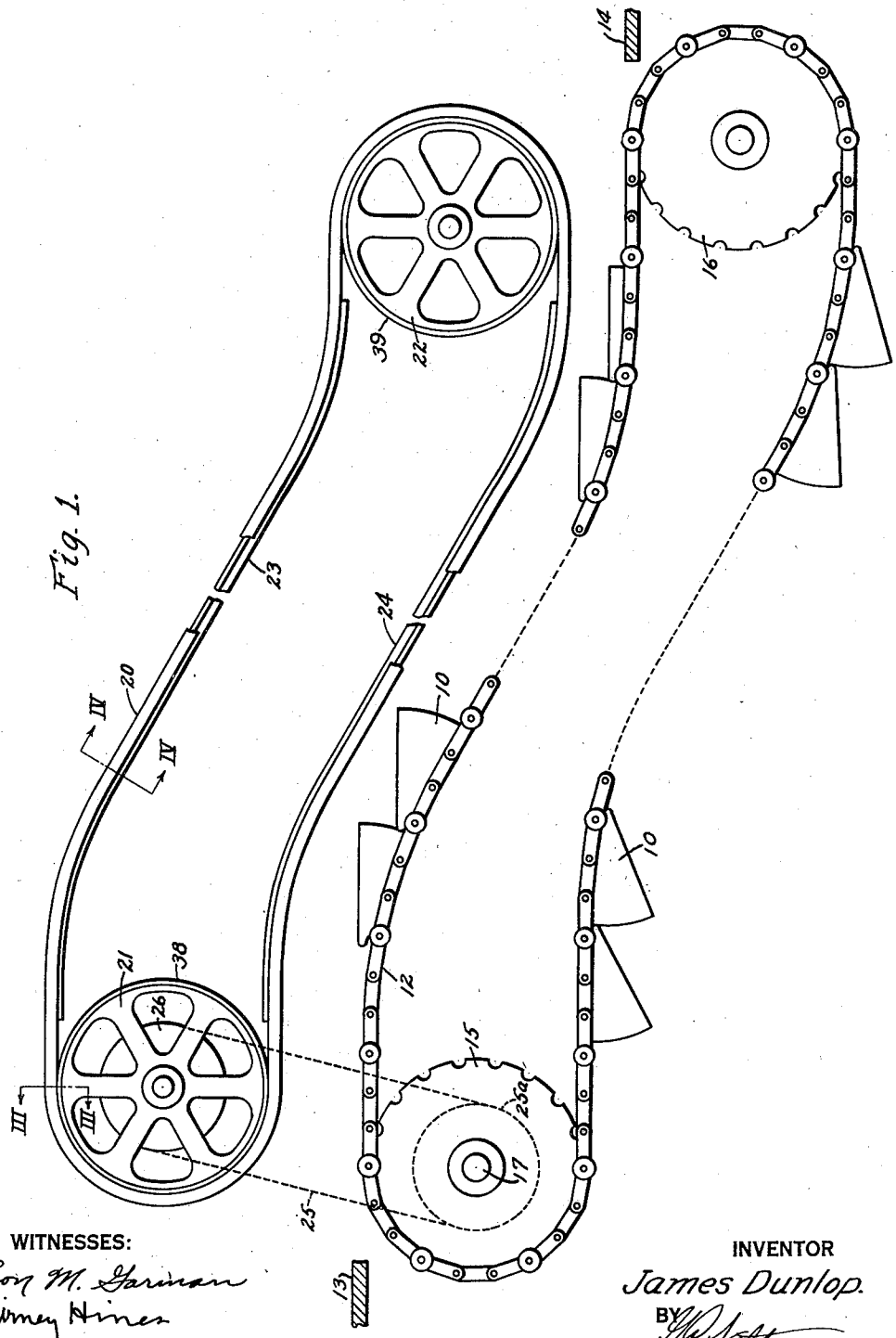
Dec. 24, 1940. J. DUNLOP 2,225,772

MOVING STAIRWAY

Filed April 27, 1940 2 Sheets-Sheet 1

Fig. 1.



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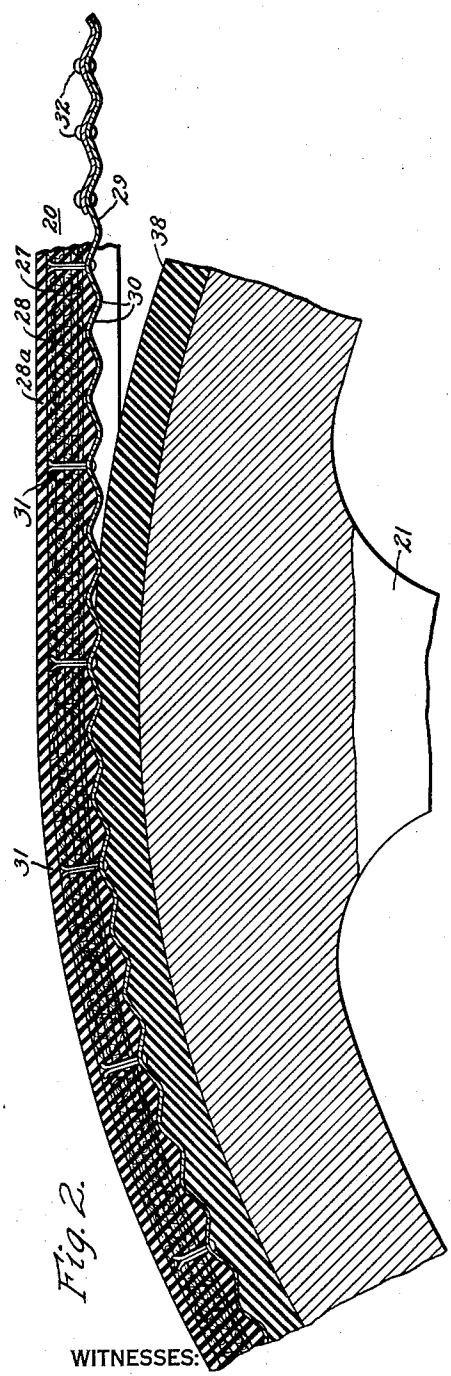


Fig. 2.

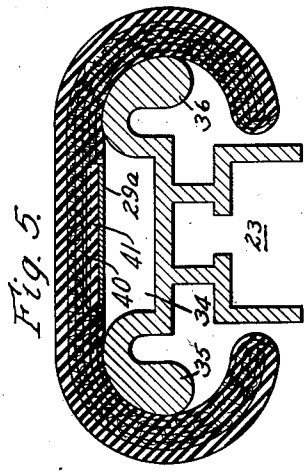


Fig. 5.

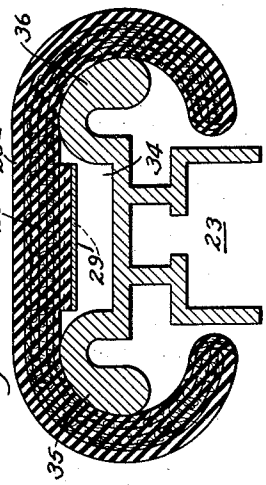


Fig. 4.

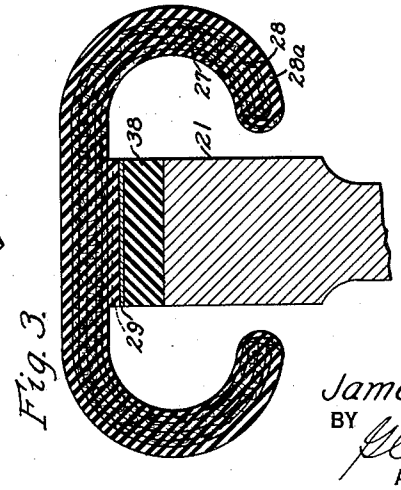


Fig. 3.



Fig. 6.

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Patented Dec. 24, 1940 2,225,772

UNITED STATES PATENT OFFICE

2,225,772

MOVING STAIRWAY

James Dunlop, Ridgewood, N. J., assignor to Westinghouse Electric Elevator Company, Jersey City, N. J., a corporation of Illinois

Application April 27, 1940, Serial No. 331,995

10 Claims. (Cl. 198—16)

My invention relates to moving stairways and, more particularly, to the handrails and their supporting and operating means for such stairways.

In constructing moving stairways, it is customary to provide movable flexible handrails and means for causing the handrails to travel with the stairway steps so that passengers riding on the steps may take hold of the handrails and steady themselves while the steps are carrying them from one floor to another.

Heretofore considerable difficulty has been experienced in maintaining the handrails under sufficient tension to cause them to operate in accordance with the movement of the steps. Hence, the majority of handrail installations have included additional sheaves and tensioning wheels over which portions of the handrails have been looped to secure the necessary amount of tension in the handrails. In addition to requiring extra sheaves and tightening wheels, such a construction increases the length of the handrails and requires a wide, roomy balustrade to permit the installation of the additional wheels, etc.

One object of my invention is to provide a stairway handrail and balustrade which shall be simple and easy to construct, install, and maintain in operation.

Another object is to provide a handrail which may be operated solely by its newel wheels and which shall not require any tightener wheels for increasing its tension.

A further object is to provide a stairway handrail which may be installed in a simple narrow balustrade.

It is also an object of my invention to provide a moving stairway handrail which will itself at all times maintain sufficient tension over its newel wheels to permit it to be driven by one of the newel wheels without the addition of any extra driving wheels or tightening wheels.

For a better understanding of my invention, reference may be had to the accompanying drawings, in which:

Figure 1 is a skeleton-like view in side elevation of a moving stairway provided with a handrail constructed in accordance with my invention;

Fig. 2 is an enlarged sectional view of a portion of one of the newel wheels and the handrail mounted thereon;

Fig. 3 is an enlarged view taken along the line III—III of Fig. 1;

Fig. 4 is an enlarged view taken along the line IV—IV of Fig. 1;

Fig. 5 is a view in cross-section of another form of the handrail in which a tension spring is vulcanized directly to the inner canvas face of the handrail; and

Fig. 6 is a view in side elevation of a modification of the tension spring portion of the handrail of Fig. 2.

Referring more particularly to the drawings, I have illustrated a moving stairway as comprising an endless series of movable steps 10 disposed to be moved along tracks (not shown) by gear chains 12 between an upper landing 13 and a lower landing 14. The gear chains may be supported at the lower landing and at the upper landing by suitable sprocket wheels 15 and 16. The sprocket wheels and chains may be driven in any suitable manner as by a motor (not shown) connected to the shaft 17 upon which the sprocket wheels 15 are mounted. Any suitable truss or frame (not shown) may be provided for supporting the moving steps between the upper landing and the lower landing.

A travelling handrail 20 is provided at each side of the steps to move with the steps and at substantially the same speed as the steps. The handrail 20 is mounted upon a newel wheel 21 at the upper landing and upon a newel wheel 22 at the lower landing. A metal guide rail 23 extends underneath the upper section of the handrail between the newel wheels 21 and 22 for guiding the upper portion of handrail in its movement from one newel wheel to the other newel wheel. Similarly, a metal guide rail 24 is disposed above the lower section of the handrail for guiding and supporting it as it makes its return travel from one newel wheel to the other.

A sprocket chain 25 is disposed over a sprocket wheel 25a mounted on the axle 17 of the driving sprocket and over a sprocket wheel 26 attached to the upper newel wheel 21, so that the upper newel wheel will drive the handrail in accordance with movement of the stairway steps.

Inasmuch as considerable difficulty has heretofore been experienced in maintaining the handrails under proper tension by reason of their tendency to be permanently deformed by stretching when in use, I have provided a novel form of handrail construction which embodies a tension spring and means for increasing the frictional engagement between the handrail and its driving means.

As illustrated in the drawings, the handrail may be constructed of a plurality of layers of

strips 27 (Fig. 3) of textile material such as canvas which are bonded and held together by impregnating them with rubber or rubber-like material 28 and vulcanizing them to constitute an endless belt-like body of flexible resilient material. In constructing the belt, its outer edges are turned inwardly so that it appears somewhat like the letter C in cross-section. A heavy layer of rubber 28a is vulcanized to the outer surface of the handrail to provide a smooth resilient surface for the hands of the passengers travelling on the stairway.

The flexible bodies of canvas strips and rubber are made up in long pieces which are cut into proper lengths to suit the stairway to which they are to be applied and then the ends of the strip are spliced together and vulcanized to form an endless flexible body which may be mounted on the newel wheels.

In order to prevent the handrail from being permanently deformed by stretching after it is in use, I have provided a tensioning metal spring 29 extending along the inner face of the handrail. The tensioning spring is provided with a plurality of transverse corrugations 30 and is attached to the handrail by coating it with a rubber-like substance and vulcanizing it directly to the inner canvas face of the handrail body so that the metal spring, the canvas strips and rubber-like material will constitute a structurally integral body or belt. The width of the metal spring should be just sufficient to fit the tread of the newel wheels but leave the inner canvas face at each side bare to engage a pair of longitudinal shoulders 35 and 36 (Fig. 4) on the guide rails as the handrail slides thereon, thus keeping the friction between the handrail and its guides as low as possible.

The transverse corrugations 30 in the strip 29 are provided to cause the spring metal strip to hold the belt under a predetermined tension when it is used and to thereby oppose any tendency of the belt to assume a permanent stretching deformation as it continues in use over its newel wheels. The spring should be designed to have a very low stress so that it will at all times maintain the same tension.

The depth and width of the corrugations may be of any suitable size but will not have to be very large to give the spring strip sufficient tensioning characteristics to permit it to be stretched over the newel wheels so that it will oppose the tendency of the canvas and rubber handrail body to stretch into permanent deformation when in use. It will be observed that the corrugations or crimping in the spring strip will permit it to stretch to a certain degree, but, inasmuch as the strip is made of spring metal, it will prevent permanent stretching deformation of the handrail and hold it to a predetermined tension after it is installed and in use.

The spring metal strip may be constructed of steel or phosphorus-bronze tape or any other spring-like metal in the form of a tension spring which will lend itself to fabrication with the handrail and which will retain its tension indefinitely under the usual operating conditions of stairway handrails.

In attaching the spring metal strip to the handrail I prefer to mount it as closely as possible to the neutral longitudinal axis of the handrail to keep the strain on the vulcanizing between the strip and the handrail as low as possible. It is also desirable to have the spring strip located as near the drive surface as possible so that it will be near the center of flexing as it bends around the newel wheels.

Usually the attachment of the spring metal strip to the handrail by vulcanizing it to the underside of the belt body will be sufficient to prevent it from coming loose from the body. However, where desirable, a plurality of self-clinching rivets 31 may be driven directly through the spring strip and into the layers of vulcanized canvas forming the body of the handrail to hold the spring strip more securely in position.

The ends of the spring strip 29 may be overlapped and fastened together by any suitable method as by means of a plurality of rivets 32 at the point where the ends of the handrail body are spliced together.

In practice, the handrail will be so constructed that it will be necessary to stretch it slightly when mounting it on the newel wheels so that it will me maintained under a predetermined tension when in operation.

The guide 23 for supporting the upper portion of the handrail between the newel wheels is provided with a longitudinal channel 34 between its shoulders 35 and 36. The channel 34 permits the spring strip 29 to move along the guide without touching it, while the shoulders 35 and 36 engage the inner canvas face of the inturned edges of the handrail to support it firmly and to guide it in its travel from one wheel to the other. The guide may be constructed of any suitable metal which will permit the canvas faces of the handrail to slide over it freely. The guide rail 24 for the lower section of the handrail is constructed in the same manner.

The newel wheel 21 has a soft resilient tire 38 of rubber or rubber-like material vulcanized to it. The newel wheel and the tire are of less width than the guide and just wide enough to engage the spring metal strip on the inner face of the handrail. In operation, the corrugations of the spring tape will embed themselves in the tire, resulting in a very high coefficient of friction between the newel wheel and the handrail to prevent slipping such as would occur with canvas or metal or with a slack handrail.

The newel wheel 22 is provided with a similar resilient tire 39 which will receive the corrugations of the strip 29 and cause it to operate smoothly over the newel wheel.

In another form of my improved handrail its inner face is cut away to a depth of, say, from $\frac{1}{16}$ to $\frac{1}{32}$ of an inch to provide a channel 40 which may be filled with a resilient material such as rubber 41. A tension spring metal strip 29a provided with a plurality of transverse corrugations, is disposed in contact with the rubber 41 in the channel 40 and vulcanized thereto. The spring metal strip may be coated with rubber or a substitute therefor on either one side or both sides (Fig. 6) before it is vulcanized to the handrail or it may be simply placed in position and vulcanized to the body of rubber and canvas, either at the time the belt is constructed or afterwards.

It will be obvious from the above construction that I have provided a moving stairway handrail which will retain its normal tension indefinitely, which will provide sufficient traction between itself and its driving newel wheel to cause it to operate smoothly and in accordance with the operation of the stairway steps, and that I have provided a handrail construction which may be used

in a very narrow balustrade which may be fitted with a narrow deckboard instead of the wide deckboard heretofore necessary.

Although I have illustrated and described only two forms of my invention, it is to be understood that changes therein and modification thereof may be made without departing from the spirit and scope of the invention.

I claim as my invention:

1. A moving stairway handrail comprising a flexible belt-like body and a tension spring attached to said body to oppose the tendency of the body to stretch when in operation.

2. A moving stairway handrail comprising a flexible belt-like body and spring metal strip attached to said body, said strip having transverse corrugations to cause it to oppose the tendency of the body to stretch when in use.

3. A moving stairway handrail comprising an endless body of flexible resilient material, a tension means for said body comprising a belt-like spring metal strip having an undulatory body, and means for attaching the strip to the inner side of the body of flexible resilient material to cause the spring metal strip to oppose any tendency of the body of flexible resilient material to stretch when in use.

4. A moving stairway handrail comprising an endless body of layers of textile material, a corrugated spring metal strip and a binder of vulcanized rubber-like material for holding the textile material and the spring metal strip in a structurally integral belt.

5. A moving stairway handrail comprising an endless body of layers of textile strips, an endless spring metal strip disposed in said endless body, said strip being provided with transverse corrugations permitting it to stretch but tending to maintain it in a predetermined condition, and a binder of rubber-like material for unifying the strips.

6. In a moving stairway, a handrail comprising a belt-like body of flexible material and a spring metal strip attached to the inner face of the belt-like body, said strip having transverse corrugations to cause it to oppose the tendency of the belt-like body to stretch when in use, a pair of newel wheels for supporting the handrail, said newel wheels having tires of resilient material for engaging the inner face of the corrugated strip and thereby secure frictional contact between the strip and the wheels, and means for driving one of the newel wheels to move the handrail in accordance with the movement of the stairway.

7. In a moving stairway, a handrail comprising a belt-like body of flexible material and a spring metal strip attached to the inner face of the belt-like body, said strip having transverse corrugations to cause it to oppose the tendency of the belt-like body to stretch when in use, a pair of newel wheels for supporting the handrail, said newel wheels having tires of resilient material for engaging the inner face of the corrugated strip and thereby secure frictional contact between the strip and the wheels, means for driving one of the newel wheels to move the handrail in accordance with the movement of the stairway, and a handrail guide disposed between the newel wheels, said guide having a pair of shoulders and a channel therebetween for engaging and supporting the handrail without engaging the corrugated strip.

8. In a moving stairway, a handrail comprising a belt-like body of flexible material with inturned edges and an endless corrugated spring metal strip attached to the center longitudinal inner face of the belt-like body, said strip being of less width than said belt-like body, a pair of newel wheels for supporting the handrail, said newel wheels having tires of soft resilient material for engaging the inner face of the corrugated strip and being of less width than the handrail, and a handrail guide disposed between the newel wheels for guiding the handrail from one newel wheel to the other, said guide having a pair of shoulders to engage the sides of the handrail and a channel between said shoulders to permit the spring metal strip to travel along the guide without touching it.

9. A handrail for a moving stairway comprising an endless body of layers of textile strips, said body having a channel extending along the central line of its inner face, an undulating spring metal strip disposed in said channel, and a binder of vulcanized rubber-like material for holding the said strips in a structurally integral body.

10. A handrail for moving stairways having a driving member, said handrail comprising an endless flexible body of canvas and rubber-like material, an undulating metal tension spring affixed to the inner face of the body, and a coating of rubber-like material disposed on the inner face of the tension spring to provide good traction between the handrail and its driving member.

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