United States Patent

[111] 3,620,346

[72] Inventors **Thomas A. Brooke; William C. Neller, both of Frodsham, England**

[21] Appl No. **881,773**
[22] Filed **Dec. 3, 1969**
[45] Patented **Nov. 16, 1971**

[73] Assignee **Dunlop Holdings Limited Birmingham, England**

[32] Priority **Dec. 7, 1968**
[33] **Great Britain**
[31] **58,246/68**

[54] **CONVEYORS**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **198/16,** 198/41, 198/193
[51] **Int. Cl.** **B66b 9/12,** B65g 15/30
[50] **Field of Search** 198/16–18, 41, 193; 308/10

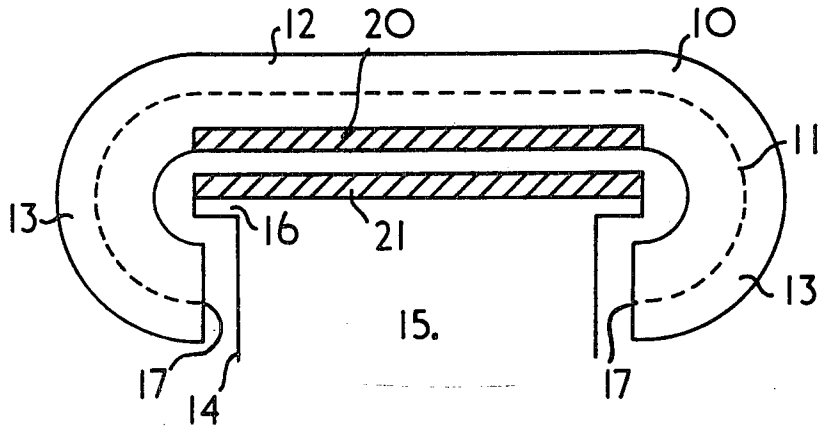
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Primary Examiner—Richard E. Aegerter
Attorney—Stevens, Davis, Miller & Mosher

ABSTRACT: The handrail for a passenger conveyor is formed of a flexible material having a layer of magnetized material on one surface. The magnetized layer cooperates with a support having means for providing a magnetic field, such as a further layer of magnetized material, which field repels the handrail, of which the following is a specification.



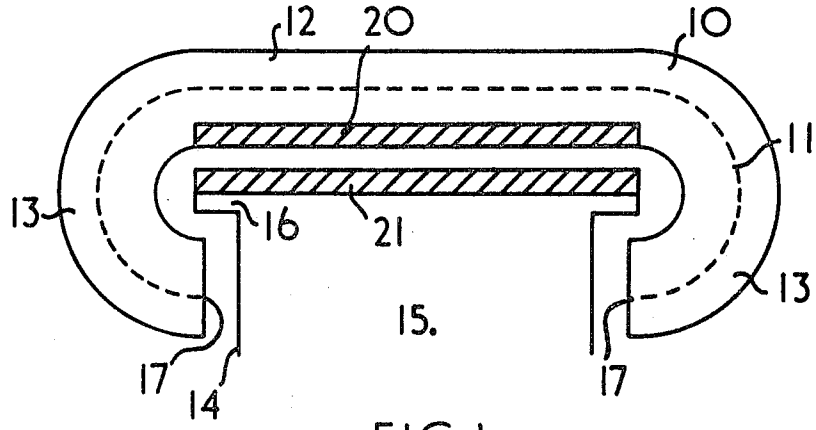

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FIG. 1

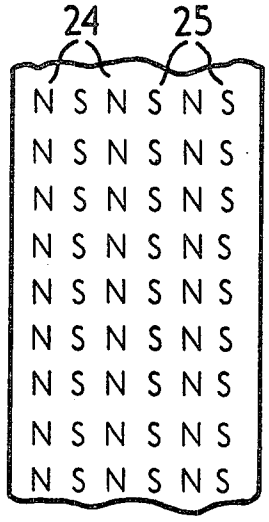

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25
N S N S N S
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FIG. 2

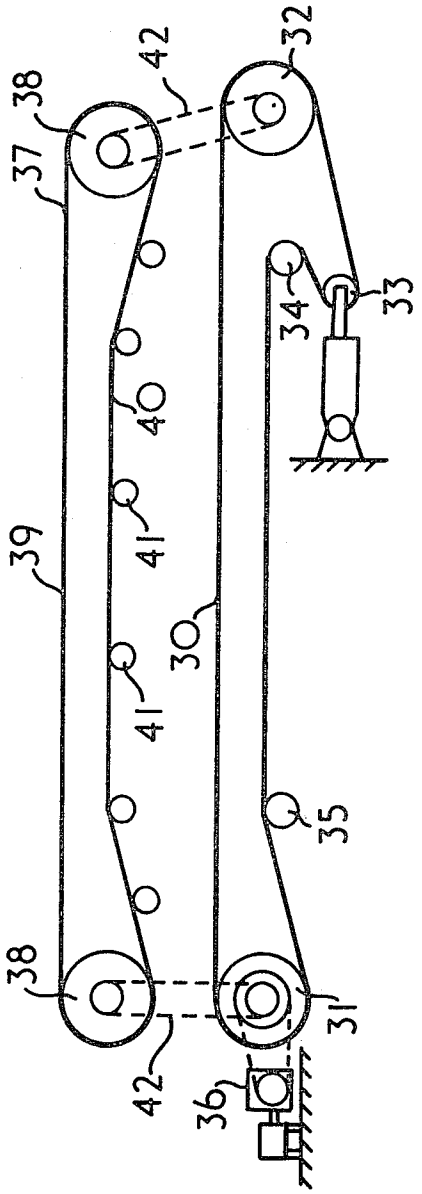


FIG. 3

CONVEYORS

This invention relates to passenger conveyors, and in particular to moving handrails for use in such conveyors.

The term "conveyors" is intended to represent various forms of passenger-conveying means, including conveyors using a flat surfaced belt which may be level or inclined at a relatively small angle, and conveyors in which individual platforms move out of a level path to form individual steps and return to a level path, and which might be called moving stairs or escalators.

In conveyors used for carrying passengers, it is necessary to provide some form of handrail; to prevent passengers falling off the conveyor; to prevent embarking and disembarking at other than intended stations; and to provide means for passengers to hold on to while travelling on the conveyor. Usually the handrail is in the form of a flexible belt in sliding contact with support means. Where there is a change in path from a level path to an upwardly inclined path, and from a downwardly inclined path to a level path, means must be provided to ensure that the handrail follows a curved path, the path concave when viewed from the side. This is usually provided by making the belt of a somewhat C-shaped cross section which cooperatively engages with a support having a T-shaped cross section. At a change from an upwardly inclined path to a level path and from a level path to a downwardly inclined path, the belt follows a convex path.

Considerable friction can arise in the movement of the handrail and such friction can limit the length of handrail which can operate as one length.

According to a feature of the present invention, a handrail for a passenger conveyor comprises a flexible polymeric composition having a tensile member embedded therein, and a flexible polymeric layer having a magnetizable material dispersed therein.

According to another feature of the present invention, a passenger conveyor comprises a movable passenger-carrying platform or series of connected platforms; a handrail movable with the platform or platforms; a support for the handrail; and drive means for the handrail and the platform or platforms; the handrail comprising a flexible polymeric composition having a tensile member embedded therein, and a flexible polymeric layer having a magnetized material dispersed therein; and the support arranged to provide a magnetic field causing repulsion of the handrail.

The invention will be readily understood by the following description of a particular embodiment, and modifications thereof, by way of example, in conjunction with the accompanying drawings, in which:

FIG. 1 is a diagrammatic cross section through a handrail and a support;

FIG. 2 is a diagrammatic plan view of a surface of the handrail illustrating a magnetic pole arrangement, and

FIG. 3 is a diagrammatic illustration of a conveyor with handrail.

Illustrated in FIG. 1, in cross section, is a handrail having a main portion 10 of a flexible polymeric material, with a tensile member 11 embedded therein. The tensile member 11 can be of various materials and in the present example is a single ply of textile fabric. As seen in FIG. 1 the handrail has a cross section somewhat of C-shape, having a main substantially straight center portion 12 and curved end portions 13.

The handrail is supported by a support member 14. Support member 14 is approximately of T-shaped cross section, having a relatively thick main portion 15 and a crosspiece 16 extending across the top of the main portion 15 and beyond the main portion at each side a short distance. The curved end portions 13 of the handrail extend round the ends of the crosspiece 16 with the extreme ends 17 extending below the ends of the crosspiece 16.

A layer 20 of flexible polymeric material having dispersed magnetizable material extends the length of the handrail, the width of the layer substantially equal to the width of the crosspiece 16 of the support. A layer 21 of flexible polymeric material having dispersed magnetic material extends along the top surface of the crosspiece 16. The two layers 20 and 21 are magnetized to provide a force which repels the handrail from the support. Conveniently the two layers are magnetized so that one surface of each layer constitutes one magnetic pole and the other surface of each layer constitutes the other magnetic pole. The polarity of the two confronting surfaces is the same, producing an upward thrust on the handrail over the length of the support.

The layers 20 and 21 are readily magnetized by subjecting each layer to a strong unipolar magnetic flux, that is a substantially linear magnetic field extending at right angles to the plane of the layer. This will produce layers having one surface as one pole and the other surface as the other pole. However other pole arrangements may provide, for example longitudinal zones of alternating poles may be produced, as indicated at 24 and 25 in FIG. 2.

In a modification, not illustrated, the layers 20 and 21 need not extend completely across the width of the crosspiece 16. A plurality of separate longitudinally extending strips, spaced apart, may be provided for the handrail, and for the support.

FIG. 3 illustrates diagrammatically, a conveyor of the type for conveying passengers along a level path. The passenger-carrying belt 30 passes round a driving roller 31 an idler roller 32, a tensioning roller 33 and two further idling rollers 34 and 35. Driving roller 31 is driven by a motor 36. One handrail 37 is shown. Handrail 37 passes round two nonmagnetic rollers 38, one at each end of the conveyor. The top run 39 will be supported by a support, for example as in FIG. 1, situated along the side of the conveyor. The return run 40 of the handrail is supported by rollers 41, one or more of which can act as tensioning rollers. The rollers 38 are driven, via belts or similar devices 42, and the associate rollers and support, is provided at each side of the conveyor.

In operation, the magnetic repulsion between handrail and support has the effect of causing the handrail to experience a lower frictional resistance to movement, than conventional handrails in which, for example a rubberized canvas surface on the inside of the handrail slides over a fixed support surface.

The magnetizable material can vary, barium ferrite being a particularly effective material. Other materials include strontium ferrite and lead ferrite.

If desired, special techniques may be adopted in manufacturing the magnetic layers, to produce an anisotropic material in which the magnetic material is orientated in the flexible polymeric composition in such a manner that the product has a higher remanence than otherwise similar but isotropic material in which the magnetic material has a random orientation.

Although in the embodiment described above, the layer 21 on the support 14 is of a flexible polymeric material, it may be of a rigid magnetic material, for example of orientated resin-bonded ferrite or sintered barium ferrite.

The magnetic layers may also extend around the inner surfaces of the curved end portions 13 and also on the end surfaces of the crosspiece 16. This will provide forces tending to resist any rubbing between the side surfaces of the support and the handrail, as when the handrail is packed sideways by passengers.

The material used for the handrail may vary. Natural rubber may be used, and other materials include polyvinyl chloride, and sulfonated chlorinated polythene.

The layer on the handrail may be magnetized before or after application to the handrail. Where the flexible polymeric material for the magnetizable layer is cured, magnetization can be before or after curing.

The handrails described above may be provided with small guide and support rollers. Such rollers should preferably be of a nonmagnetic and low friction material such as nylon, and may be arranged to support the handrails against both vertical forces, and forces tending to push the handrail against the side edges of its support.

Handrails according to the invention may be provided with various drive mechanisms instead of that described in the first embodiment. For example where the handrail is used in association with a passenger conveyor belt the handrail and the belt may be urged into frictional engagement with each other on their return flights, or, where the handrail is being used in association with a long-distance conveyor, friction or positive drive mechanisms engaging the inside surface of the handrail may be provided at intervals along its length. Alternatively a linear motor may be used to drive such a handrail, the magnetic part of the linear motor driving system being formed by the magnetic part of the handrail itself.

In operation, a satisfactory average clearance between the mutually repelling surfaces of handrails according to the invention and their supports is from one-eighth of an inch to three-eighths of an inch. The clearance does not vary greatly under the varying forces applied by passengers, because the repulsion between the two magnetic layers is inversely proportioned to the square of the distance between them, and thus increases rapidly with slight displacement of the layers towards each other.

Having now described our invention—What is claimed is:

1. A passenger-carrying conveyor comprising: a movable passenger-carrying platform; a handrail movable with the said platform; support means for the said handrail; drive means for the handrail, said handrail support means comprising a rigid support member extending upwardly adjacent the side of the platform and a layer of magnetized material extending along the top surface of the support member; the handrail comprising a flexible polymeric material having a tensile member embedded therein, and a layer of magnetized material dispersed therein, such that the magnetized layers in the handrail and support means repel each other and support the handrail above the support means.

2. A passenger-carrying conveyor as claimed in claim 1 wherein both the layers containing magnetized material comprise a flexible polymeric material having magnetized material dispersed therein.

3. A passenger-carrying conveyor as claimed in claim 2, the support member comprising a main body portion and a crosspiece extending across the top of the main body portion, the ends of the crosspiece extending either side of the main body portion; the handrail of a cross section, viewed transverse to the longitudinal axis of the handrail, having a substantially straight center portion and curved end portion, the curved end portion curving round and down and extending beneath the ends of the crosspiece.

4. A passenger-carrying conveyor as claimed in claim 3, including a layer of magnetized material on each end of the crosspiece of the support, and wherein the flexible polymeric layer of the handrail extends for the inner surfaces of the curved end pieces of the handrail cross section, whereby sideways movement of the handrail, relative to the support, is opposed.

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