

TRAVELATOR, MOVING RAMP OR ESCALATOR**FIELD OF THE INVENTION**

The present invention relates to a travelator, moving ramp or escalator as defined in the preamble of claim 1.

BACKGROUND OF THE INVENTION

In prior art, a travelator, moving ramp or escalator is known which comprises a power means and a conveyor having an end driven by the power means and a non-driven end. The conveyor comprises a first drive element and a second drive element, which are disposed at a distance from each other and parallel to each other, each being implemented as an endless loop. The drive elements are usually link chains or toothed belts.

A number of conveyor platforms, such as pallets, are arranged one after the other and secured to the first and the second drive elements. At the driven end of the conveyor, the first drive element is passed over a first driving pulley rotated by the power means and at the non-driven end over a first diverting pulley. The second drive element is passed at the driven end of the conveyor over a second driving pulley rotated by the power means and over a second diverting pulley at the non-driven end. Arranged at the driven end are synchronizing means for mutual synchronization of the first driving pulley and the second driving pulley.

The elongations of the drive elements at the non-driven end of the conveyor may be different.

In conventional prior-art travelators, moving ramps and escalators, the transport length of the conveyor is reasonably short and the link chains usually em-

ployed as drive elements are of a very heavy design. For example, the effective diameter of the driving pulley may be of the order of 60 cm and the chain pitch 130 - 150 mm. The difference of elongation of the link chains on opposite sides does not become very large and no problem arises.

Today, however, there is a need for travelators, moving ramps and/or escalators in which the transport distances are very long and in which the distance between the driving and diverting pulleys of the drive elements are consequently also very long. For example, in very long travelators, the distance between the driving and diverting pulleys is long, e.g. of the order of 100 meters.

Further, there has arisen a need for low-construction travelators, moving ramps and escalators designed to be mounted directly on a fixed base, such as a floor, without any special pits formed in the fixed structure, such as the floor of a building, for embedded mounting of the frame and machinery of the travelator. In the frame structure of a travelator, moving ramp or escalator mounted on a fixed base there is very little space for the drive machine of the conveyor, and therefore the diameter of the driving and diverting pulleys can not be very large and correspondingly the drive elements used, such as link chains or belts, are also quite thin, so their elongations and accordingly the difference of elongation may become large enough to cause problems. For example, if the drive elements used in a 100 m long conveyor are link chains with a pitch of $5/8"$, then the elongation of the link chain may be as much as about 30 cm. The difference of elongation of the link chains used as first and second drive elements may be e.g. about 10 cm. The difference of elongation becomes the more pronounced the longer and thinner the chains are.

The difference of elongation may be due to different tolerances of the chains and/or different wear resulting from uneven loading of the conveyor. Uneven loading again may be due to the fact that passengers usually stand on the right-hand side of the conveyor. Therefore, the drive element on the right-hand side undergoes greater elongation than does the drive element on the left-hand side.

In prior art, as the diverting pulleys at the non-driven end of the conveyor are in no way synchronized with each other and because the transport platforms are fastened to both drive elements, the difference of elongation accumulating at the non-driven end of the conveyor leads to a problematic situation where the transport platforms especially near the non-driven end of the conveyor tend to move in a position differing from the mutually parallel position at the driven end, that is to say, in an oblique position relative to the transport direction, which may result in the transport platforms being stuck on their guide rails, thus stopping the conveyor.

OBJECT OF THE INVENTION

The object of the present invention is to overcome the above-mentioned drawbacks.

A specific object of the invention is to disclose a travelator, moving ramp or escalator in which it is possible to use longer and thinner cheap drive elements requiring a lower tolerance accuracy than before.

A further object of the invention is to disclose a travelator, moving ramp or escalator in which unequal

wear of the drive elements causes less problems than before.

A further object of the invention is to disclose a travelator, moving ramp or escalator in which the load is better distributed between the drive elements.

Yet another object of the invention is to disclose a travelator, moving ramp or escalator in which the transport platforms are prevented from getting into an oblique position relative to the transport direction at the non-driven end of the conveyor.

BRIEF DESCRIPTION OF THE INVENTION

The invention is characterized by what is disclosed in the characterization part of claim 1. Other embodiments of the invention are characterized by what is disclosed in the other claims. Inventive embodiments are also presented in the description part and drawings of the present application. The inventive content disclosed in the application can also be defined in other ways than is done in the claims below. The inventive content may also consist of several separate inventions, especially if the invention is considered in the light of explicit or implicit sub-tasks or in respect of advantages or sets of advantages achieved. In this case, some of the attributes contained in the claims below may be superfluous from the point of view of separate inventive concepts. Within the framework of the basic concept of the invention, features of different embodiments of the invention can be applied in conjunction with other embodiments.

According to the invention, the conveyor comprises second synchronizing means, which have been arranged at the non-driven end for mutual synchronization of

the first diverting pulley and the second diverting pulley.

The invention has the advantage that the second synchronizing means equalize the error arising from unequal elongation of the drive elements or from other errors between the two drive elements so that the load is evenly distributed on both. This makes it possible to use thinner and more stretchable drive elements than before, which can be manufactured to less strict tolerances than before. Furthermore, the invention makes it possible to produce a longer travelator, moving ramp or escalator designed to be mounted on a fixed base than before.

In an embodiment of the invention, the first synchronizing means at the driven end comprise a first synchronizing shaft to which a first power means is connected to rotate it; a third driving pulley mounted on the first synchronizing shaft; a third diverting pulley mounted on the same shaft with the first driving pulley; a third drive element, which is passed as an endless loop over the third driving pulley and the third diverting pulley; a fourth driving pulley mounted on the first synchronizing shaft at a distance from the third driving pulley; a fourth diverting pulley mounted on the same shaft with the second driving pulley; and a fourth drive element, which is passed as an endless loop over the fourth driving pulley and the fourth diverting pulley.

In an embodiment of the invention, the synchronizing means at the non-driven end comprise a second synchronizing shaft; a fifth driving pulley mounted on the second synchronizing shaft; a fifth diverting pulley mounted on the second synchronizing shaft; a sixth diverting pulley mounted on the same shaft with the first diverting pulley; a fifth drive element, which

is passed as an endless loop over the fifth diverting pulley and a sixth diverting pulley; a seventh diverting pulley mounted on the second synchronizing shaft at a distance from the fifth diverting pulley; an eighth diverting pulley mounted on the same shaft with the second diverting pulley; and a sixth drive element, which is passed as an endless loop over the seventh diverting pulley and the eighth diverting pulley.

In an embodiment of the invention, the axis of rotation of the first diverting pulley is on the same first axis line with the axis of rotation of the second diverting pulley. The second synchronizing shaft is at a distance from the said first axis line.

In an embodiment of the invention, the second synchronizing shaft is outside the track of motion of the transport platforms.

In an embodiment of the invention, the second synchronizing shaft is inside the track of motion of the transport platforms, arranged between an upper transport portion and a lower return portion of the transport platforms. Using this arrangement, the length of the structure can be reduced.

In an embodiment of the invention, the axis of rotation of the first driving pulley is on the same second axis line with the axis of rotation of the second driving pulley. The first synchronizing shaft is at a distance from the said second axis line.

In an embodiment of the invention, the first synchronizing shaft is outside the track of motion of the transport platforms.

In an embodiment of the invention, the first synchronizing shaft is inside the track of motion of the

transport platforms, arranged between the upper transport portion and the lower return portion of the transport platforms. This arrangement allows the length of the structure to be reduced.

In an embodiment of the invention, the first drive element and the second drive element are link chains.

In an embodiment of the invention, the first drive element and the second drive element are toothed belts.

In an embodiment of the invention, the travelator, moving ramp or escalator is a low-construction travelator, moving ramp or escalator mounted on a fixed base, such as a floor or other support.

LIST OF FIGURES

In the following, the invention will be described in detail with reference to embodiment examples and the attached drawings, wherein

Fig. 1 presents a diagrammatic side view of an embodiment of the drive arrangement of the conveyor of the travelator, moving ramp or escalator of the invention, and

Fig. 2 presents a top view of the drive arrangement shown in Fig. 1.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 and 2 are diagrams representing a low-construction horizontal travelator mounted on a fixed base, such as a floor or other support, which means that no pit needs to be made in the fixed base for the travelator machinery. In the following description of an example, the invention is described in connection

with a travelator, but it is obvious that corresponding principles of the invention can be applied to moving ramps and escalators as well.

The travelator comprises a conveyor 2, which in this case is a pallet conveyor. The conveyor 2 is mounted on a conveyor frame 28. The conveyor frame 28 lies on a floor base throughout its length. Secured to the conveyor frame 28 are usually two balustrades 29 extending alongside the conveyor 2 throughout its length on either side of it.

In this description, that end of the conveyor 2 which in Fig. 1 and 2 is the right-hand end and by which the conveyor is driven by a power means 1 is referred to as the driven end 3. The other end of the conveyor 2, which is not provided with a power means, is referred to as the non-driven end 4.

The conveyor 2 comprises a first drive element 5 and second drive element 6, which are at a distance from each other and parallel to each other, each being formed as an endless loop. A number of transport platforms 7, which in the example are pallets, have been arranged one after the other and each one of them is fastened from one side oriented in the transport direction to the first drive element 5 and from the other side oriented in the transport direction to the second drive element 6. The first and the second drive elements 5 and 6 may be link chains or alternatively toothed belts.

Placed on one side of the conveyor 2 at the driven end 3 of the conveyor 2 is a first driving pulley 8 rotated by a power means 1, and a first diverting pulley 9 is provided at the non-driven end. The first drive element 5 is passed over the first driving pulley 8 and the first diverting pulley 9.

Correspondingly, on the other side of the conveyor 2 at the driven end 3 of the conveyor 2 is a second driving pulley 10 rotated by the power means 1, and a second diverting pulley 11 is provided at the non-driven end. The second drive element 6 is passed over the second driving pulley 10 and the second diverting pulley 11.

At the driven end 3, the first driving pulley 8 and the second driving pulley 10 are mutually synchronized by first synchronizing means 12. The first synchronizing means 12 comprise as an essential functional part a first synchronizing shaft 14, to which the power means 1 is connected to rotate it. Mounted on the first synchronizing shaft 14 is a third driving pulley 15. A third diverting pulley 16 is mounted on the same shaft with the first driving pulley 8. A third drive element 17 is passed as an endless loop over the third driving pulley 15 and the third diverting pulley 16. A fourth driving pulley 18 is mounted on the first synchronizing shaft 14 at a distance from the third driving pulley 15. A fourth diverting pulley 19 is mounted on the same shaft with the second driving pulley 10. A fourth drive element 20 is passed as an endless loop over the fourth driving pulley 18 and the fourth diverting pulley 19. Thus, the driving power is transmitted to both drive elements 5 and 6 via the same synchronizing shaft 14.

A similar synchronization arrangement is also provided at the non-driven end 4 of the conveyor 2, where the conveyor 2 comprises second synchronizing means 13 for mutual synchronization of the first diverting pulley 9 and the second diverting pulley 11. The second synchronizing means 13 at the non-driven end 4 comprise as an essential functional part a second synchronizing shaft 21. A fifth diverting pulley 22 is mounted on

the second synchronizing shaft 21. A sixth diverting pulley 23 is mounted on the same shaft with the first diverting pulley 9. A fifth drive element 24 is passed as an endless loop over the fifth diverting pulley 22 and the sixth diverting pulley 23. A seventh diverting pulley 25 is mounted on the second synchronizing shaft 21 at a distance from the fifth diverting pulley 22. An eighth diverting pulley 26 is mounted on the same shaft with the second diverting pulley 10. A sixth drive element 27 is passed as an endless loop over the seventh diverting pulley 25 and the eighth diverting pulley 26. Thus, at the non-driven end 4 the load is equalized between the two drive elements 5 and 6 via the second synchronizing shaft 21.

As can be seen from Fig. 1 and 2, the conveyor 2 is a pallet conveyor of a flat shape. The pallets move from the entry end 4 of the conveyor 2 to its exit end 3 and vice versa along a transport track consisting of upper supporting guide rails provided in the conveyor frame 28. At the exit end 3 of the conveyor, maintaining their position and orientation, the pallets move onto a lower return track consisting of lower supporting guide rails provided in the conveyor frame, where the pallets 7 return in the opposite direction relative to the transport direction of the conveyor to the entry end 4 of the conveyor.

From Fig. 2 it can be seen that, as the axis of rotation of the first diverting pulley 9 is on the same axis line L_1 with the axis of rotation of the second diverting pulley 11, the second synchronizing shaft 21 is at a distance from the said first axis line L_1 outside the track of motion of the transport platforms 7. Similarly, at the other end of the conveyor 2, the axis of rotation of the first driving pulley 8 is on the same axis line L_2 with the axis of rotation of the second driving pulley 10 and the first synchronizing

shaft 14 is at a distance from the said second axis line L_2 outside the track of motion of the transport platforms 7. This arrangement permits the pallets 7 to move at the entry and exit ends of the conveyor from the lower return track to the upper transport track and vice versa past the synchronizing shafts 14 and 21.

The invention is not limited to the embodiment examples described above; instead, many variations are possible within the scope of the inventive concept defined in the claims.

List of reference numbers:

power means	(1)
conveyor	(2)
driven end	(3)
ei-käytetty pää	(4)
first drive element	(5)
second drive element	(6)
transport platform	(7)
first driving pulley	(8)
first diverting pulley	(9)
second driving pulley	(10)
second diverting pulley	(11)
first synchronizing means	(12)
second synchronizing means	(13)
first synchronizing shaft	(14)
third driving pulley	(15)
third diverting pulley	(16)
third drive element	(17)
fourth driving pulley	(18)
fourth diverting pulley	(19)
fourth drive element	(20)
second synchronizing shaft	(21)
fifth diverting pulley	(22)
sixth diverting pulley	(23)
fifth drive element	(24)
seventh diverting pulley	(25)
eighth diverting pulley	(26)
sixth drive element	(27)
first axis line	(L1)
second axis line	(L2)
conveyor frame	(28)
balustrade	(29)

CLAIMS

1. A travelator, moving ramp or escalator, comprising
- a power means (1), and
 - a conveyor (2) having a driven end (3), which is driven by the power means (1), and a non-driven end (4), which has no power means, said conveyor comprising
 - a first drive element (5) and a second drive element (6), which are at a distance from each other and parallel to each other, each being formed as an endless loop,
 - a number of transport platforms (7), such as pallets or stairs, which are arranged one after the other and secured to the first drive element (5) and to the second drive element (6),
 - a first driving pulley (8), which is disposed at the driven end (3) and over which the first drive element (5) is passed, said first driving pulley being rotatable by the power means (1),
 - a first diverting pulley (9), which is disposed at the non-driven end (4) and over which the first drive element (5) is passed,
 - a second driving pulley (10), which is disposed at the driven end (3) and over which the second drive element (6) is passed, said second driving pulley (10) being rotatable by the power means (1),
 - a second diverting pulley (11), which is disposed at the non-driven end (4) and over which the second drive element (6) is passed,
 - first synchronizing means (12) arranged at the driven end (3) for mutual synchronization of the first driving pulley (8) and the second driving pulley (10), characterized in that the conveyor (2) comprises second synchronizing means (13), which have been arranged at the non-driven end (4) for mutual

synchronization of the first diverting pulley (9) and the second diverting pulley (11).

2. A travelator, moving ramp or escalator according to claim 1, characterized in that the first synchronizing means (12) at the driven end (3) comprise

- a first synchronizing shaft (14), to which the power means (1) is connected to rotate it,

- a third driving pulley (15), which is mounted on the first synchronizing shaft (14),

- a third diverting pulley (16), which is mounted on the same shaft with the first driving pulley (8),

- a third drive element (17), which is passed as an endless loop over the third driving pulley (15) and the third diverting pulley (16),

- a fourth driving pulley (18), which is mounted on the first synchronizing shaft (14) at a distance from the third driving pulley (15),

- a fourth diverting pulley (19), which is mounted on the same shaft with the second driving pulley (10), and

- a fourth drive element (20), which is passed as an endless loop over the fourth driving pulley (18) and the fourth diverting pulley (19).

3. A travelator, moving ramp or escalator as defined in the preamble of claim 1 or 2, characterized in that the second synchronizing means (13) at the non-driven end (4) comprise

- a second synchronizing shaft (21),

- a fifth diverting pulley (22), which is mounted on the second synchronizing shaft (21),

- a sixth diverting pulley (23), which is mounted on the same shaft with the first diverting pulley (9),

- a fifth drive element (24), which is passed as an endless loop over the fifth diverting pulley (22) and the sixth diverting pulley (23),

- a seventh diverting pulley (25), which is mounted on the second synchronizing shaft (21) at a distance from the fifth diverting pulley (22),

- an eighth diverting pulley (26), which is mounted on the same shaft with the second diverting pulley (10), and

- a sixth drive element (27), which is passed as an endless loop over the seventh diverting pulley (25) and the eighth diverting pulley (26).

4. A travelator, moving ramp or escalator according to claim 3, characterized in that the axis of rotation of the first diverting pulley (9) is on the same first axis line (L_1) with the axis of rotation of the second diverting pulley (11); and that the second synchronizing shaft (21) is at a distance from the said first axis line (L_1).

5. A travelator, moving ramp or escalator according to claim 4, characterized in that the second synchronizing shaft (21) is outside the track of motion of the transport platforms (7).

6. A travelator, moving ramp or escalator according to claim 4, characterized in that the track of motion of the transport platforms comprises an upper transport portion and a lower return portion; and that the second synchronizing shaft (21) is inside the track of motion of the transport platforms (7), arranged between the transport portion and the return portion.

7. A travelator, moving ramp or escalator according to any one of claims 3 - 6, characterized in that

the axis of rotation of the first driving pulley (8) is on the same second axis line (L_2) with the axis of rotation of the second driving pulley (10); and that the first synchronizing shaft (14) is at a distance from the said second axis line (L_2).

8. A travelator, moving ramp or escalator according to claim 7, characterized in that the first synchronizing shaft (14) is outside the track of motion of the transport platforms (7).

9. A travelator, moving ramp or escalator according to claim 7, characterized in that the first synchronizing shaft (14) is inside the track of motion of the transport platforms (7), arranged between the transport portion and the return portion.

10. A travelator, moving ramp or escalator according to any one of claims 1 - 9, characterized in that the first drive element (5) and the second drive element (6) are link chains.

11. A travelator, moving ramp or escalator according to any one of claims 1 - 10, characterized in that the first drive element (5) and the second drive element (6) are toothed belts.

12. A travelator, moving ramp or escalator according to any one of claims 1 - 11, characterized in that the travelator, moving ramp or escalator is a low-construction travelator, moving ramp or escalator mounted on a fixed base, such as a floor or other support.