

PATENT SPECIFICATION

(11) 1 587 483

1 587 483

- (21) Application No. 18925/78 (22) Filed 11 May 1978
(31) Convention Application No. 6438/77
(32) Filed 25 May 1977 in
(33) Switzerland (CH)
(44) Complete Specification published 1 April 1981
(51) INT CL³ B65G 17/06
(52) Index at acceptance B8A LA R12 S13



(54) A PLATE CONVEYOR SYSTEM

(71) We, INVENTIO AG of 6052 Hergiswil NW, Switzerland, a joint stock company organised under the laws of Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a plate conveyor system. Such a system finds use in transporting passengers.

In a known plate conveyor system wherein the plates are arranged to run as a conveyor belt, the length of each plate measured in the running direction of the conveyor belt is a multiple of the pitch of an endless driving chain. The plates are usually arranged above the chains and pivotably carried at one of their ends by prolonged joint axles of the chain links. Arranged on the prolonged joint axles are runners, by means of which the conveyor belt circulates on guide rails. At their other end, the plates are provided with slots, by means of which they are slideably carried on pivot axles of the plates respectively adjacent to them or on other prolonged joint axles of the chain links which likewise are provided with runners. For reasons of safety and to compensate the air gap necessary at the connecting locations of the plates, particularly at curved parts of the travel path, the ends of the plates are constructed comblike, wherein the comb teeth of the one plate are engageable into the gaps of the other plate.

Although this known plate conveyor belt has the advantage of requiring only a reduced number of plates in view of the relatively large length of plate, it displays the disadvantage, however, of hardly being suited for travel paths with an inclined part and horizontal access parts, as is the case in, for example, installations which connect two storeys of a building. To avoid the undesired buckling situation, endangering the safety as well as the comfort of the users, that arises at the connecting locations of the plates on the load-carrying surfaces of the conveyor belt on the transition from a horizontal into an inclined

plane, it is indispensable that this transition is executed in curves of large radius. In the case of very long plates, the curve radius may be up to twenty metres. Thereby, the access parts alone already substantially increase the total length of the installation for a given useful path of the conveyor belt.

A further disadvantage of this known plate conveyor belt resides in that the chain wheels arranged at the deflecting locations of the drive chains must possess a diameter conforming at least with the length of one plate, which requires a relatively large frame height for the corresponding parts of the installation. In case plates of very great length are used, it is often necessary at each deflecting location to provide a special device which holds the plates in a horizontal position, whereby the installation is made substantially more expensive.

When the plates used display a great length, then alignment deviations may arise through inaccuracies in fabrication or unequal wear, especially of the driving chains. Equally, a slight inclination of the axles carrying the plates may effect appreciable lateral and/or vertical displacements at the other end of the plates. The play usually provided between the running plates and the fixed balustrades and having permissible lateral and vertical values subjected to strict regulations, can thereby be abnormally enlarged, reduced or even eliminated. Thereby, it becomes not only very difficult to arrange the fixed balustrades above the load-carrying surfaces of the plates, but in case the arrangement of the balustrades takes place laterally of the plates, it is necessary to provide additional expensive devices for the lateral guidance of the plates.

The use of short plates would permit these different disadvantages to be avoided; in particular, an appreciable reduction of the curve radius at the transition from a horizontal into an inclined plane may be made possible. For a given length of the plates, this reduction of the radius would effect a substantial enlargement of the sector angle. In the known installations, in which the load-carrying surface of the plates is relatively far removed from the joint

axles of the driving chain, an appreciable enlargement of the air gap between the plates would take place at convex curves or a narrowing or even a disappearance of the same at concave curves. These differences in the width of the air gaps can be compensated partially by a prolongation of the comb teeth or gaps disposed at the plate ends. On the one hand, the danger of breakage would increase thereby and, on the other hand, objects or even fingers of children could be wedged in the interstices forming between comb teeth and gaps in convex curves. For this case, the size of the necessary gap is likewise subject to strict regulations.

It would therefore be of advantage to arrange the load-carrying surface of the plates in the same or nearly the same plane as the joint axles of the driving chains. This arrangement is virtually impossible in the known plate conveyor belts, since the axles pivotably carrying the plates also usually serve to connect the driving chains with each other.

According to the present invention there is provided a conveyor system comprising a plurality of tandemly arranged plates, and drive means to cause the plates to run one behind the other along a given direction in at least one horizontal and/or at least one inclined plane, the drive means comprising two endless chains each arranged in a respective plane substantially parallel to the given direction and along a respective side of the plates, fastening means connecting each link of each chain to a respective one of the plates, and runner means associated with each one of the chains and arranged to support the tandemly arranged plates on guide rails, each of the plates being provided at each of the sides thereof with a prolongation extending over and being supported by the corresponding link.

Advantageously, in a conveyor system embodying the invention, the air gap provided between the plates may be made noticeably smaller and the total length of the installation may be substantially reduced by the use and by the special arrangement of relatively simple components.

Embodiments of the invention will now be more particularly described, by way of example, with reference to the accompanying drawings in which:

Fig. 1 shows, in plan view, a part of a conveyor system embodying the invention;

Fig. 2 shows a cross-section of the conveyor system of Fig. 1 along line A—A;

Figs. 3 and 4 each show a partial plan view of two variants of the conveyor system shown in Figs. 1 and 2;

Figs. 5 and 6 each show a cross-section of the system of Fig. 3 along line B—B and line C—C respectively;

Figs. 7 and 8 each show a cross-section of the system of Fig. 4 along line D—D and line E—E respectively.

Referring now to the drawings, the plate

conveyor system or belt partially illustrated in Figs. 1 and 2 is provided with plates 1 arranged behind each other and is arranged to move, in accordance with the kind of installation, in one of the arrow directions shown in Fig. 1. The plates 1 possess a nearly rectangular shape and preferably consist of a light metal alloy produced in a die-casting process. The load carrying surface 1.1 of the plates 1 is provided, in usual manner, with ribs 1.2 extending in the conveying direction. At each of its sides 1.3 and 1.4 parallel to the running direction and outside the load-carrying surface 1.1, each plate 1 is provided with a protrusion 1.5 or 1.6 which displays a prolongation 1.7 or 1.8, which extends outwardly at right angles and which represents a support part for the plate 1. For reasons of safety and to compensate the air gap necessary between the plates, the ends of the plates 1 are constructed to be comblike, wherein the comb teeth 1.9 of the preceding plate 1 are engageable with lateral play in the gaps 1.10 of the succeeding plate 1.

Two conventional endless driving chains are designated by 2. They display alternately wide chain links 2.1 consisting of two straps 2.3 and narrow chain links 2.2 consisting of two straps 2.4, wherein the wide chain links 2.1 are connected by means of joint axles 3 with the narrow chain links 2.2. Each chain 2 displays the same number of chain links and extends along the sides 1.3 and 1.4 of the plates 1 parallel to the running direction of the plate conveyor belt. A runner 4 is rotatably journaled on each joint axle 3 between the two straps 2.4 of a narrow chain link 2.2. The runners 4 serve to let the chains 2 run on guide rails (not shown). The two chains 2 are drivable synchronously by engagement of the runners into the tooth gaps of the chain wheels of driving devices (not shown).

The plate conveyor belt displays as many plates 1 as each chain 2 possesses wide chain links 2.1 and narrow chain links 2.2. As shown in Fig. 1, in which only two adjacent plates 1 are illustrated, the plates 1 lie alternately by means of the prolongations 1.7 and 1.8 of their lateral protrusions 1.5 and 1.6 on a wide chain link 2.1 and a narrow chain link 2.2. On the side facing the chain link and parallel to the running direction of the plate conveyor belt, each prolongation 1.7 and 1.8 displays at its end a projection 1.11, which with the side 1.3 or 1.4 of the plate 1 forms a guide in which a wide chain link 2.1 is guided. At the centre of the side 1.3 and 1.4 facing the chain link, each prolongation 1.7 and 1.8 beyond that displays two projections 1.12 and 1.13 which are arranged transversely to the running direction of the plate conveyor belt and which serve for the guidance of a narrow chain link 2.2.

A bore 2.5, in which is inserted a spacer sleeve 5, which displays a shoulder abuttable against the chain link, is disposed at the centre

of the straps 2.3 or 2.4 of each chain link 2.1 or 2.2. A fastening screw 6 is guided through a bore of the spacer sleeve 5 and screwed together with a bush 8, displaying a threaded hole 7 and sitting fast in the plate 1. The height of the shoulder of the spacer sleeve 5 corresponds to the thickness of the straps 2.3 and 2.4 of the chain links 2.1 and 2.2, so that by simple reversal of the position of the spacer sleeve 5, this can be used for the connection of a wide as well as also a narrow chain link 2.1 or 2.2, with the side 1.3 or 1.4 of the plate 1 with the use of the same fastening screws 6.

Since a plate 1 is associated with each chain link 2.1 and 2.2 and each chain link 2.1 and 2.2 is connected with one side of the corresponding plate 1, it is possible not only to use very short plates 1, but beyond that to arrange the load-carrying surface 1.1 of the plates in the plane determined by the joint axles 3 of the driving chains 2. The radius of the curves at the transition from horizontal to inclined planes can thus be made appreciably smaller, which results in a substantial reduction of the total length of the installation with a great air gap having to be provided between the plates 1.

Figs. 3, 5 and 6 show a variant of the plate conveyor belt of Fig. 1, in which the plates are designated by 9 and only one of the prolongations, which form the support parts 9.2, is illustrated. The plates 9 are of nearly the same shape as the plates 1 of the aforescribed embodiment and are similarly arranged with respect to the two endless driving chains 2. For the connection of a wide or narrow chain link 2.1 or 2.2 with one of the sides 9.1 of the plate 9, the middle projections 9.3 and 9.4 of the support part 9.2 possess a downwardly directed prolongation 9.5. This as well as also the straps 2.3 or 2.4 and the plate 9 display bores 9.6 which lie on a common axis and in which a bolt 10 is journaled. The securing of the bolt 10 takes place through an elastic lamella 11, which engages into an annular groove of the bolt 10 and which in its turn is connected substantially shape-lockingly with the support part 9.2. To avoid any possibility of a longitudinal displacement of the plate 9, the support part 9.2 is provided transversely to the running direction of the plate conveyor belt with rib 9.7 and 9.8, which engage into corresponding recesses of the straps 2.3 and 2.4 of the chain links 2.1 and 2.2.

In the variant shown in Figs. 4, 7 and 8, each chain link 2.1 and 2.2 is connected with the side 12.1 of a plate 12 by means of an anchoring element 13, which displays a spigot 13.1 engageable in a bore 2.6 of the straps 2.3 and 2.4 of the chain link 2.1 and 2.2. The anchoring element 13 is clamped fast to the support part 12.2 of the plate 12, by means of a screw 14 and a nut 15, wherein the screw 14 is guided in an outer guide bore 12.4 for the fastening of a narrow chain link 2.2. To avoid

any possibility of a longitudinal displacement of the plate 12, the side of the support part 12.2 facing the chain link possesses, apart from the guide projections 12.5 and 12.6 of a wide and a narrow chain link 2.1 and 2.2, ribs 12.7 and 12.8, which engage in corresponding recesses of the straps 2.3 and 2.4.

Since these different arrangements permit the use of relatively short plates 1, 9 and 12, the fixed balustrades, of which only the metal pedestal sheets 16 and 17 are illustrated in Fig. 1, may without difficulty and with minimum play be arranged above the load-carrying surface of the plates 1, 9 and 12.

Runners 4 may be differently arranged. They could, for example, be rotatably journaled on prolongations of the joint axles 3 extending at the outside of the chain links 2.1 and 2.2. Instead of a respective one of the runners 4 being associated with each joint axle 3, they could also be arranged at a multiple of the spacing corresponding to the pitch. It is also possible to associate the runners 4, not with the joint axles 3, but, for example, to journal them rotatably on other axles fastened to the straps 2.3 and 2.4 of the chain links 2.1 and 2.2 or on prolongations of fastening elements 6 and 10 connecting the chain links 2.1 and 2.2 with the plates 1 and 9.

Another possibility of avoiding the longitudinal displacement of the plates 1, 9 and 12 consists in providing each of the same in place of the ribs 9.7, 9.8, 12.7 and 12.8 at the support parts 9.2 and 12.2 at at least one side 9.1 and 12.1 with a lobe which displays a recess engageable with the prolongation of a joint axle 3 of a chain link 2.1 and 2.2.

WHAT WE CLAIM IS:—

1. A conveyor system comprising a plurality of tandemly arranged plates, and drive means to cause the plates to run one behind the other along a given direction in at least one horizontal and/or at least one inclined plane, the drive means comprising two endless chains, each arranged in a respective plane substantially parallel to the given direction and along a respective side of the plates, fastening means connecting each link of each chain to a respective one of the plates, and runner means associated with each one of the chains and arranged to support the tandemly arranged plates on guide rails, each of the plates being provided at each of the sides thereof with a prolongation extending over and being supported by the corresponding link.

2. A system as claimed in claim 1, wherein each link of each of the chains comprises two spaced apart straps, the spacing between the associated straps of adjacent ones of the links being different, each of the prolongations being provided with at least one projection which in association with the corresponding side constitutes a guide to receive that one of the links having a greater spacing between the associated



(9)

of the straps 2.3 or 2.4 of each chain link 2.1 or 2.2. A fastening screw 6 is guided through a bore of the spacer sleeve 5 and screwed together with a bush 8, displaying a threaded hole 7 and sitting fast in the plate 1. The height of the shoulder of the spacer sleeve 5 corresponds to the thickness of the straps 2.3 and 2.4 of the chain links 2.1 and 2.2, so that by simple reversal of the position of the spacer sleeve 5, this can be used for the connection of a wide as well as also a narrow chain link 2.1 or 2.2, with the side 1.3 or 1.4 of the plate 1 with the use of the same fastening screws 6.

Since a plate 1 is associated with each chain link 2.1 and 2.2 and each chain link 2.1 and 2.2 is connected with one side of the corresponding plate 1, it is possible not only to use very short plates 1, but beyond that to arrange the load-carrying surface 1.1 of the plates in the plane determined by the joint axles 3 of the driving chains 2. The radius of the curves at the transition from horizontal to inclined planes can thus be made appreciably smaller, which results in a substantial reduction of the total length of the installation with a great air gap having to be provided between the plates 1.

Figs. 3, 5 and 6 show a variant of the plate conveyor belt of Fig. 1, in which the plates are designated by 9 and only one of the prolongations, which form the support parts 9.2, is illustrated. The plates 9 are of nearly the same shape as the plates 1 of the aforescribed embodiment and are similarly arranged with respect to the two endless driving chains 2. For the connection of a wide or narrow chain link 2.1 or 2.2 with one of the sides 9.1 of the plate 9, the middle projections 9.3 and 9.4 of the support part 9.2 possess a downwardly directed prolongation 9.5. This as well as also the straps 2.3 or 2.4 and the plate 9 display bores 9.6 which lie on a common axis and in which a bolt 10 is journaled. The securing of the bolt 10 takes place through an elastic lamella 11, which engages into an annular groove of the bolt 10 and which in its turn is connected substantially shape-lockingly with the support part 9.2. To avoid any possibility of a longitudinal displacement of the plate 9, the support part 9.2 is provided transversely to the running direction of the plate conveyor belt with rib 9.7 and 9.8, which engage into corresponding recesses of the straps 2.3 and 2.4 of the chain links 2.1 and 2.2.

In the variant shown in Figs. 4, 7 and 8, each chain link 2.1 and 2.2 is connected with the side 12.1 of a plate 12 by means of an anchoring element 13, which displays a spigot 13.1 engageable in a bore 2.6 of the straps 2.3 and 2.4 of the chain link 2.1 and 2.2. The anchoring element 13 is clamped fast to the support part 12.2 of the plate 12, by means of a screw 14 and a nut 15, wherein the screw 14 is guided in an outer guide bore 12.4 for the fastening of a narrow chain link 2.2. To avoid

any possibility of a longitudinal displacement of the plate 12, the side of the support part 12.2 facing the chain link possesses, apart from the guide projections 12.5 and 12.6 of a wide and a narrow chain link 2.1 and 2.2, ribs 12.7 and 12.8, which engage in corresponding recesses of the straps 2.3 and 2.4.

Since these different arrangements permit the use of relatively short plates 1, 9 and 12, the fixed balustrades, of which only the metal pedestal sheets 16 and 17 are illustrated in Fig. 1, may without difficulty and with minimum play be arranged above the load-carrying surface of the plates 1, 9 and 12.

Runners 4 may be differently arranged. They could, for example, be rotatably journaled on prolongations of the joint axles 3 extending at the outside of the chain links 2.1 and 2.2. Instead of a respective one of the runners 4 being associated with each joint axle 3, they could also be arranged at a multiple of the spacing corresponding to the pitch. It is also possible to associate the runners 4, not with the joint axles 3, but, for example, to journal them rotatably on other axles fastened to the straps 2.3 and 2.4 of the chain links 2.1 and 2.2 or on prolongations of fastening elements 6 and 10 connecting the chain links 2.1 and 2.2 with the plates 1 and 9.

Another possibility of avoiding the longitudinal displacement of the plates 1, 9 and 12 consists in providing each of the same in place of the ribs 9.7, 9.8, 12.7 and 12.8 at the support parts 9.2 and 12.2 at at least one side 9.1 and 12.1 with a lobe which displays a recess engageable with the prolongation of a joint axle 3 of a chain link 2.1 and 2.2.

WHAT WE CLAIM IS:—

1. A conveyor system comprising a plurality of tandemly arranged plates, and drive means to cause the plates to run one behind the other along a given direction in at least one horizontal and/or at least one inclined plane, the drive means comprising two endless chains, each arranged in a respective plane substantially parallel to the given direction and along a respective side of the plates, fastening means connecting each link of each chain to a respective one of the plates, and runner means associated with each one of the chains and arranged to support the tandemly arranged plates on guide rails, each of the plates being provided at each of the sides thereof with a prolongation extending over and being supported by the corresponding link.

2. A system as claimed in claim 1, wherein each link of each of the chains comprises two spaced apart straps, the spacing between the associated straps of adjacent ones of the links being different, each of the prolongations being provided with at least one projection which in association with the corresponding side constitutes a guide to receive that one of the links having a greater spacing between the associated

10

1,587,483

4

4 straps than that of the adjacent ones of the links, and with at least one further projection arranged in a plane transverse to the given direction to receive that one of the links having a smaller spacing between the associated straps than that of the adjacent ones of the links.

5 3. A system as claimed in claim 2, wherein each plane containing the further projection is arranged substantially centrally of the corresponding side.

10 4. A system as claimed in either claim 2 or claim 3, wherein one of the straps of each of the links is provided with a bore, and each of the sides is provided with a threaded passage hole, each of the fastening means comprising a spacer sleeve inserted in the bore of the one strap of the corresponding link, and at least one fastening screw guided by the spacer sleeve and screwed into the threaded passage hole of the corresponding side.

15 5. A system as claimed in claim 4, wherein the spacer sleeve is provided with a shoulder having a height substantially equal to the thickness of the one strap of the corresponding link, the spacer sleeve being insertable into the bore of the one strap of the corresponding link in such a manner that any one of the links is connectible to the corresponding plate.

20 6. A system as claimed in either claim 4 or claim 5, wherein each of the passage holes is disposed in a bush provided in the corresponding plate.

25 7. A system as claimed in claim 1, wherein each link of each of the chains comprises two spaced apart straps, the spacing between the associated straps of adjacent ones of the links being different, each of the fastening means comprising a bolt guided, respectively, into a downwardly extending projection provided on the corresponding prolongation, into one of the straps of the corresponding link and into a bore provided on the corresponding side, and an elastic lamella engaging in an annular groove of the bolt and shape-lockingly connected to the corresponding prolongation to thereby secure the bolt.

30 8. A system as claimed in claim 1, wherein each link of each of the chains comprises two spaced apart straps, the spacing between the associated straps of adjacent ones of the links being different, each of the fastening means comprising an anchoring element provided with a spigot engaging a bore provided in one of

the straps of the corresponding chain link, and screw and nut means clamping the anchoring element to the corresponding prolongation, each of the corresponding prolongations being provided with bore means to receive the corresponding screw.

9. A system as claimed in any of claims 2 to 8, wherein each of the runner means is arranged between the straps of each link of the associated chain.

10. A system as claimed in any one of the preceding claims, comprising a plurality of axle members each connecting adjacent ones of the links.

11. A system as claimed in any of claims 2 to 10, wherein each of the prolongations is provided with ribs arranged in a plane substantially transverse to the given direction and being engageable by recesses provided on the straps of the corresponding link.

12. A system as claimed in claim 10, wherein at least one of the sides of each plate is provided with lobes each displaying a recess engageable by a prolongation of the axle member associated with the corresponding link.

13. A system as claimed in either claim 10 or claim 12, wherein each of the runner means is arranged concentrically with the axle member associated with each link of the associated chain.

14. A system as claimed in either claim 10 or claim 12, wherein each of the runner means is arranged concentrically with the axle member associated with predetermined ones of the links of the associated chain.

15. A conveyor system substantially as hereinbefore described with reference to and as shown in Figs. 1 and 2 of the accompanying drawings.

16. A conveyor system substantially as hereinbefore described with reference to and as shown in Figs. 3, 5 and 6 of the accompanying drawings.

17. A conveyor system substantially as hereinbefore described with reference to and as shown in Figs. 4, 7 and 8 of the accompanying drawings.

DR. WALTHER WOLFF & CO.,
6 Buckingham Gate,
London SW1E 6JP,
Chartered Patent Agents,
Agents for the Applicants.

