

Chain Conveyor

The invention refers to a chain conveyor according to the preamble of claim 1.

The chain conveyors discussed herein are used in general in storage shelves of rack storage facilities where they serve as a conveying means for the goods to be stored. The conveying means is usually looped over two deflections to form an endless conveying means, whereby there is provided, as the real conveying means, a conveyor chain provided with rollers. In order to save costs and weight, however, not the entire circulating conveying means is constituted as chain, but only about half of it, while the other half is constituted by a strap.

As a support for the goods to be stored, in most cases pallets are used. Upon storing the goods, the latter ones are laid onto the conveyor chain and, mostly by means of a fork lift truck, pushed into the storage rack. If the need arises, the goods are pulled out again by this fork lift truck.

The document WO 94/00370 entitled "Pallet-Support Rail and Slide-in Pallet-Storage Unit with Pallet-Support Rails and Pallet-Conveyor Track" discloses a chain conveyor of the generic concept discussed herein. This conveyor is provided with a roller chain, the supporting rollers thereof being connected to each other on both sides by means of a pair of lateral link plates, whereby each second link of the chain is designed as supporting strap member. The lateral link plates project downwards to such an extent that they can laterally guide the upper run of the roller chain along the rail, whereby, for this purpose, the rail is smaller in its width than the mutual distance of the two link plates of a pair. In its lower portion, the rail made of aluminum comprises a return channel in which the lower run of the roller chain is received, guided and supported.

The problems in connection with the chain conveyor discussed above consist in that the lateral link plates of the roller chain have to take both tractive forces as well as guiding forces. Thus, the lateral link plates cannot be made continuously of a material which has good self-lubricating properties, like PTFE, but they have to be manufactured, at least partially, of a high-strength material, for example steel. This design results in the disadvantage that the frictional values between roller chain and guiding rail are relatively high. This is also particularly true for the lower chain run received in the return channel because here additionally the intrinsic weight of the roller chain has to be supported by the lateral link plates. Due to the high frictional values arising between roller chain and supporting rail, the constructional length of a chain conveyor with such a design is limited. Moreover, it has shown that the frictional resistance is additionally increased by the tractive load of the lateral link plates simultaneously designed as guiding means.

Further problems in connection with a chain conveyor as discussed herein before consist in the fact that the chains used hereby can take only tractive forces. As soon as thrust forces act on the chain, what is always the case upon loading of goods, the danger exists that the chain folds by the mutual rotation of particular chain links that are subjected to thrust forces.

Particularly that chain portion which is situated between the pallet to be pushed in and the goods already stored is subjected to thrust forces to a high extent. The pallet to be pushed in exerts a tractive force onto the chain portion situated behind that pallet and guided around the front deflection. Since such deflections have a very small diameter due to the limited available space, they have a bad efficiency and are not suited for high tractive forces. The tractive force in the chain deflected around the deflection is transmitted via the elastic strap to the rear deflection which further decreases the efficiency, whereby it is to be considered that the mass of the stored goods can amount up to 20 tons.

It is understood that a folding of the chain is most undesirable under the explained circumstances because the total length of the chain is suddenly changed by this folding; in an extreme case, this can result in a rupture of the strap and in a damage of the deflections. Moreover, by a folding of the chain, a distance between the goods, that possibly has to be observed for the protection of the stored goods, can be changed. Also, it can happen that particularly light weight goods are raised and rotated out of the horizontal position upon a folding of the chain.

A folding cannot be avoided when conventional chains are used because the total length of the chains and the circulating conveying means, respectively, can vary to a large extent due to for instance temperature changes and expansion of the strap.

Thus, it is the object of the invention to improve a chain conveyor of the kind referred to in the preamble of claim 1 such that the chain can also take and transmit thrust forces.

This object is met by the characteristics listed in the characterizing portion of claim 1.

By providing chain links which have stop elements that limit a mutual rotation of adjacent chain links exceeding a certain angle of rotation in such a way that the roller chain can transmit thrust forces, the danger that particular portions of the chain are folded together is kept off and the disadvantages connected thereto are avoided.

Preferred embodiments of the invention are described in the dependent claims 2 to 10.

A further object of the invention consists in to provide a chain conveyor that is designed with means for laterally guiding the roller chain, which are simply arranged and can be manufactured at low costs, whereby the guide means shall present very low frictional resistances between roller chain and support rail.

This object is met by the characteristics listed in the characterizing portion of claim 11.

In the following, the invention will be further explained, with the help of drawings. In these drawings,

Fig. 1 shows an individual chain link for a roller chain in three different views;

Fig. 2 shows a guiding element for the roller chain in three different views;

Fig. 3 shows a cross section through a support rail as well as through the roller chain;

Fig. 4 shows a top view of a portion of a roller chain equipped with chain links according to Fig. 1;

Fig. 5 shows a portion of the roller chain according to Fig. 4 in a side view.

The Fig. 1 show a chain link 1 for a roller chain in a side elevation, a front elevation and a top elevation. The chain link 1 is designed essentially U-shaped and comprises a base portion 10 as well as two legs 11, 12. The base portion situated between the two legs 11, 12 constitutes the top cover of the chain link 1. Both legs 11, 12 of the chain link 1 are provided with bores 13 which serve for receiving in each case a shaft for interconnecting the chain links 1 and for bearing and supporting a support roller.

The base portion 10 of the chain link 1 is provided with two recesses 16 arranged along one of the legs 11 and having a width b_2 that is greater than the wall thickness of a leg 11, 12. By providing these recesses 16, the assembling of several uniformly designed chain links 1 to a chain is favored inasmuch as one leg 11, 12 of a preceding or subsequent chain link 1, in each case rotated by 180° around the height axis, engages such a recess 16.

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Moreover, the base portion 10 is provided with a slot 15 running crosswise to its longitudinal axis. This slot serves for receiving a catch member made of an elastic material, as will be further explained herein below with the help of Fig. 2a.

The basic shape of such a chain link 1 is manufactured preferably by punching, while the U-shaped design is created by a subsequent bending of the punched out part.

The two end portions 17, 18 of the base portion 10 of a chain link 1 are preferably of oblique shape. On the other hand, the two end portions of the base portion can be provided with a stepping, as outlined by the broken lines L.

The one leg 12 is provided with two projections 14 towering above the top side of the base portion 10, whereby, due to manufacturing reasons, in each case the leg 12 adjacent to the shorter portion 17a, 18a of the base portion 10 comprises such projections 14.

In the Fig. 2, a guiding element 2 for the roller chain is shown in three different views. This guiding element 2 essentially consists of a guiding plate 21 as well as of a clamping part 24. Integrally formed at the inner side of the guiding plate 21, there is provided a strip member 23. The lower portion 26 of the guiding plate 21 serves for laterally guiding the roller chain, while the guiding plate comprises a rest surface provided at its top side and is designed to support the lower chain run of a circulating chain. The mode of operation of this guiding plate 21 will be further explained herein below with the help of Fig. 3.

The Fig. 2a show the catch member 19 in a side elevation, a front elevation and a top elevation. The catch member 19, preferably manufactured of rubber, serves as a rest for goods to be supported by the chain links. For fixing it in the slot machined into the base portion of the chain link, the catch member 19 comprises a holding portion 15 (*should read "20"*) which is correspondingly designed to the that slot. For fixing, the holding portion 15

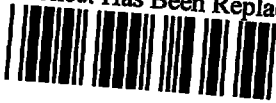


(*should read "20"*) is slid through the slot and, thereafter, the catch member is rotated by 90°. The catch member 19 preferably slightly towers above the projections of the chain link such that light goods do not rest on the projections, but on the catch member. However, by the elastic design of the catch member 19, it is ensured that heavy goods compress the catch member and, thereby rest against the projections, whereby a safe, non-positive connection between chain link and goods to be stored – pallet – is ensured.

Fig. 3 shows a cross section through a support rail 5 as well as a roller chain 8. The support rail 5 comprises, at its top side, a track surface 6 projecting upwards that is laterally limited by two guide faces. At the bottom side, the support rail 5 is provided with a hollow chamber H having an open bottom in which are provided two auxiliary rails 7 on which the guiding plates 21 of the guiding elements 2 rest with their rest surfaces 25 and on which the lower run 8b of the chain is vertically supported.

The roller chain 8 is constituted by a plurality of chain links 1 designed according to Fig. 1 and by supporting rollers 3, whereby in each case two chain links are interconnected by a shaft 28 in an articulated manner. The shafts 28 simultaneously serve for bearing the supporting rollers 3. Into the particular shaft 28, a guiding element 2 is inserted which towers below the chain link 1 at one side. At the other side, the clamping part 24 of the guiding element 2 engages the leg 12a whereby both the shaft 28 as well as the guiding element 2 can be fixed in the position shown here. Additionally, for securing the guiding element 2, a safety pin 29 can be provided, as illustrated, which is anchored in a self-locking manner. In order to form a chain of uniform chain links 1, these are arranged alternately rotated by 180° around their height axis, whereby the one chain links is offset with regard to the other chain link, as seen in longitudinal direction of the roller chain, by an amount corresponding to the wall thickness of a leg of a chain link. Besides the chain links 1, also the guiding elements 2 are arranged alternately rotated by 180°; this means, in

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other words, the guiding elements 2 are inserted into the particular shaft 28 alternately once from the left side and once from the right side, such that the roller chain 8 is guided on both sides of the track surface 6. The strip member 23 of the guiding element 2 extends along the bottom side of the particular leg of a chain link and prevents the guiding element 2 from being rotated, whereby the height of the strip member 23 approximately corresponds to the wall thickness of a leg of a chain link. It is to add that the roller chain 8 constitutes only approximately 60% of the circulating conveying means, while the remaining 40% consist of a strap that is fixed to the two end of the chain.

Fig. 4 shows a top view of a portion of a roller chain that is provided with uniform chain links 1 according to Fig. 1 as well as with guiding elements 2 according to Fig. 2. It can be seen from this illustration that the chain links 1a, 1b, 1c, 1d are arranged alternately rotated around the height axis by 180° and that the one chain link is offset with regard to the other chain link 1a, 1b, 1c, 1d, as seen in the longitudinal direction of the roller chain 8, by an amount of the wall thickness of the leg of a chain link 1a, 1b, 1c, 1d, such that in each case the one leg 11, 12 of a chain link engages the recess 16 (Fig. 1) in the base portion of the adjacent chain link. This design allows that the chain links 1a, 1b, 1c, 1d, also can take up and transmit lateral forces.

Moreover, it is evident that the mean length L of the base portion 10 at least approximately corresponds to the distance A of the axes of two adjacent supporting rollers 3. The base portion 10 preferably is shorter than the distance of the axes of two adjacent supporting rollers by approximately 0.5 to 3 mm, such that, the chain being in its stretched state, also a gap b in the order of 0.5 to 3 mm is created between the front faces of adjacent base portions 10b, 10c of adjacent chain links 1b, 1c. This design has the effect that the mutual rotational movement of adjacent chain links, exceeding a certain angle of rotation, is limited due to the fact that the front faces of adjacent base portions abut against



each other upon mutual turning back the chain links. In this connection, it is important that the front faces of adjacent base portions of adjacent chain links are designed correspondingly. A roller link designed in such a way, thus, can transmit thrust forces, without the danger that the chain folds together at certain portions.

Fig. 5 shows the portion of the roller chain according to Fig. 4 in a side view. In this illustration, the alternately arranged guiding elements 2 can be seen that tower below the chain links.

A chain conveyor designed in such a way is of very simple construction and can be manufactured at low costs, because both the chain links as well as the guiding elements are of uniform design. By the provision of stop members limiting the mutual rotating movement of adjacent chain links exceeding a predetermined angle in the above explained manner, the roller chain can also transmit thrust forces.

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1. Chain conveyor with a roller chain (8) and a supporting rail (5) for vertically supporting the roller chain (8), whereby the roller chain comprises a plurality of supporting rollers (3) which are interconnected by means of chain links (1), characterized in that the chain links (1) are provided with stop means that limit the mutual rotating movement of adjacent chain links (1) exceeding a predetermined angle in such a way that the roller chain (8) can transmit thrust forces.

2. Chain conveyor according to claim 1, characterized in that the predominant part of the chain links (1) is of U-shaped design such as to comprise two legs (11, 12) and a base portion (10) located there between, that the mean length (L) of the base portion (10) at least approximately corresponds to the distance (A) of the axes of two adjacent supporting rollers (3), and that the front faces (17, 18) of adjacent base portions (10) of adjacent chain links (1) are of corresponding design and act as stops.

3. Chain conveyor according to claim 2, characterized in that a gap (b) of less than 5% of the length of a chain link (1) exists between the front faces of adjacent chain links when the roller chain (8) is in its stretched state.

4. Chain conveyor according to claim 2 or 3, characterized in that the base portion (10) of the chain links (1) is designed as an upper cover of the roller chain (8) and, the roller chain (8) being in its stretched state, protects both the supporting rollers (3) as well as the supporting rail (5) from contamination.





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5. Chain conveyor according to one of the claims 2 to 4, characterized in that the two end portions (17, 18) of the base portion (10) of a chain link (1) comprise a stepping and/or are of oblique design.

6. Chain conveyor according to claim 5, characterized in that the chain links (1) are of one-piece design, and that the leg (12) adjacent to the shorter portion (17a, 18a) of the base portion (10) is provided with a projection (14) towering above the top side of the base portion (10).

7. Chain conveyor according to one of the claims 2 to 6, characterized in that the base portion (10) of the chain links (1) is designed at its top side as a rest surface for goods to be conveyed on the roller chain (8).

8. Chain conveyor according to one of the claims 2 to 7, characterized in that the base portion (10) is provided with two recesses (16) arranged along one leg (11, 12) and having a width (b) that is greater than the wall thickness of a leg (11, 12).

9. Chain conveyor according to one of the preceding claims, characterized in that the roller chain (8) consists of uniform chain links (1) which have a geometry different from a central symmetric shape, and that the chain links (1a, 1b, 1c, 1d) are alternately rotated around their height axis by 180°, whereby the one chain link with regard to the other chain link (1a, 1b, 1c, 1d) in each case is offset, as seen in the longitudinal direction of the roller chain (8), by the thickness of the wall of a leg (11, 12) of a chain link (1).



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10. Chain conveyor according to one of the preceding claims, characterized in that the base portion (10) is provided with a slot (15) running transverse to the direction of movement of the roller chain (8), and that a catch member (19) made of an elastic material is provided which comprises a holding part (20) designed correspondingly to that slot and being able to be inserted into the slot (15) and fixed in the base portion (10) by a subsequent rotation of 90°.

11. Chain conveyor according to claim 1, whereby the chain links (1) of the roller chain (8) are interconnected in an articulated manner by means of a shaft (28), and whereby the shaft (28) is designed simultaneously as a supporting axle for the supporting rollers (3), characterized in that the shaft (28) is hollow, and that a discrete guiding element (2) is inserted into the shaft (28) that towers below the chain link (10) at least at one side towards the guiding rail (5).

12. Chain conveyor according to claim 11, characterized in that the guiding element (2) is provided with a strap member (23) to be directed towards the chain link (10) and extending along the lower side of the leg of a chain link (10), whereby the height of the strip member (23) corresponds to maximally the thickness of the wall of a leg (11, 12) of a chain link (10).

13. Chain conveyor according to claim 11 or 12, characterized in that the supporting rail (5) comprises a track surface (6) at the top side which is laterally limited by two guiding faces (31, 32) situated below the track surface, and that each guiding element (2) comprises at least one lateral guiding member (21) which is adapted to cooperate with the guiding faces (31, 32).





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14. Chain conveyor according to one of the claims 11 to 13, characterized in that the guiding elements (2) are made of a plastic material which has good self-lubricating properties.

15. Chain conveyor according to one of the claims 11 to 14, comprising deflection devices located at the ends for deflecting the roller chain (8) and for dividing the same into an upper and a lower chain run (8a, 8b), whereby the supporting rail (5) comprises at its bottom side a hollow chamber (H) at least partially receiving the lower run (8b) of the chain, characterized in that the guiding elements (2) project over the chain links (1) of the lower chain run (8a) both downwards towards the guiding rail (5) as well as at least at one side, whereby the portion (26) of the guiding elements (2) towering below the chain links (1) is designed for guiding the upper chain run (8a), and whereby the guiding element (2) comprises a guiding surface (25) in that portion that projects laterally over the chain links (1) for guiding and vertically supporting the lower chain run (8b) which is at least partially received in the hollow chamber (H).

16. Chain conveyor according to one of the preceding claims, characterized in that both ends of the roller chain (8) are interconnected by a strap to a circulating endless conveying means, whereby the length of the roller chain (8) amounts to not more than 60% of the entire conveying means.

