United States Patent [19]

Colombot

[11] **3,709,150**

[45] **Jan. 9, 1973**

[54] VARIABLE SPEED ENDLESS CONVEYOR

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[22] Filed: **Dec. 2, 1970**

[21] Appl. No.: **94,425**

[30] **Foreign Application Priority Data**

Dec. 4, 1970 France.....6941465

[52] **U.S. Cl.**.....**104/25,** 198/110

[51] **Int. Cl.**.....**B65g 17/06**

[58] **Field of Search**.....104/25, 20; 198/16, 16 MS, 198/110

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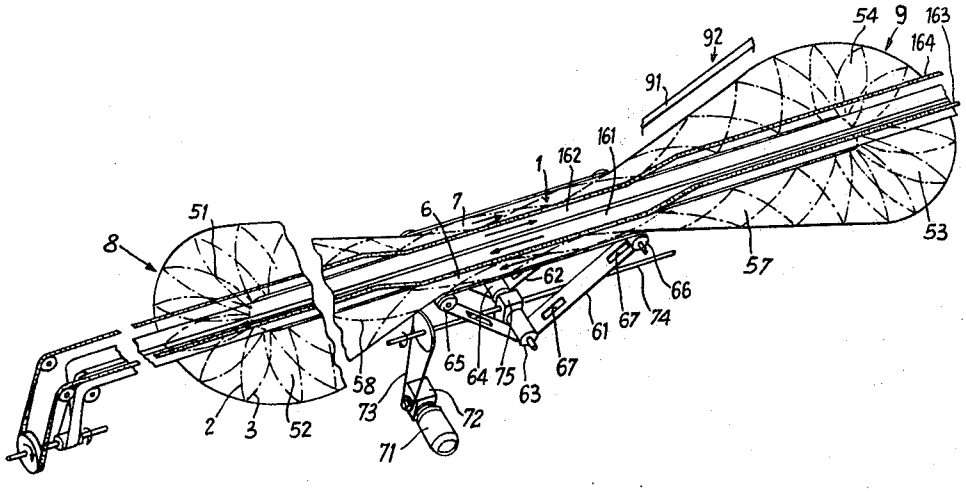
Primary Examiner—Gerald M. Forlenza
Assistant Examiner—D. W. Keen
Attorney—Larson, Taylor & Hinds

[57] **ABSTRACT**

The conveyor is constituted by an endless chain in the form of a horizontal closed loop. It is formed by at least one set of bars comprising a first series of bars and a second series of bars elastically deformable in the horizontal plane but rigid in the vertical plane, the bars of the first series being articulated on the bars of the second series, on one hand in the vicinity of the ends and on the other hand in the vicinity of the middle, thereby forming an uninterrupted sequence of curvilinear diamonds so that the four sides of a given diamond are obtained by means of four different bars. Means are provided for driving the chain, at low speed in at least two zones of a first type in which the diamonds are flattened perpendicularly to their forward direction, and at high speed in at least two other zones of a second type in which the diamonds are flattened in the forward direction. The speed of the chain varies in continuous manner in the portions of the chain situated between the two types of zones, the said bars bearing plate elements which partly overlap to form a horizontal receiving surface of continuous general configuration.

21 Claims, 16 Drawing Figures



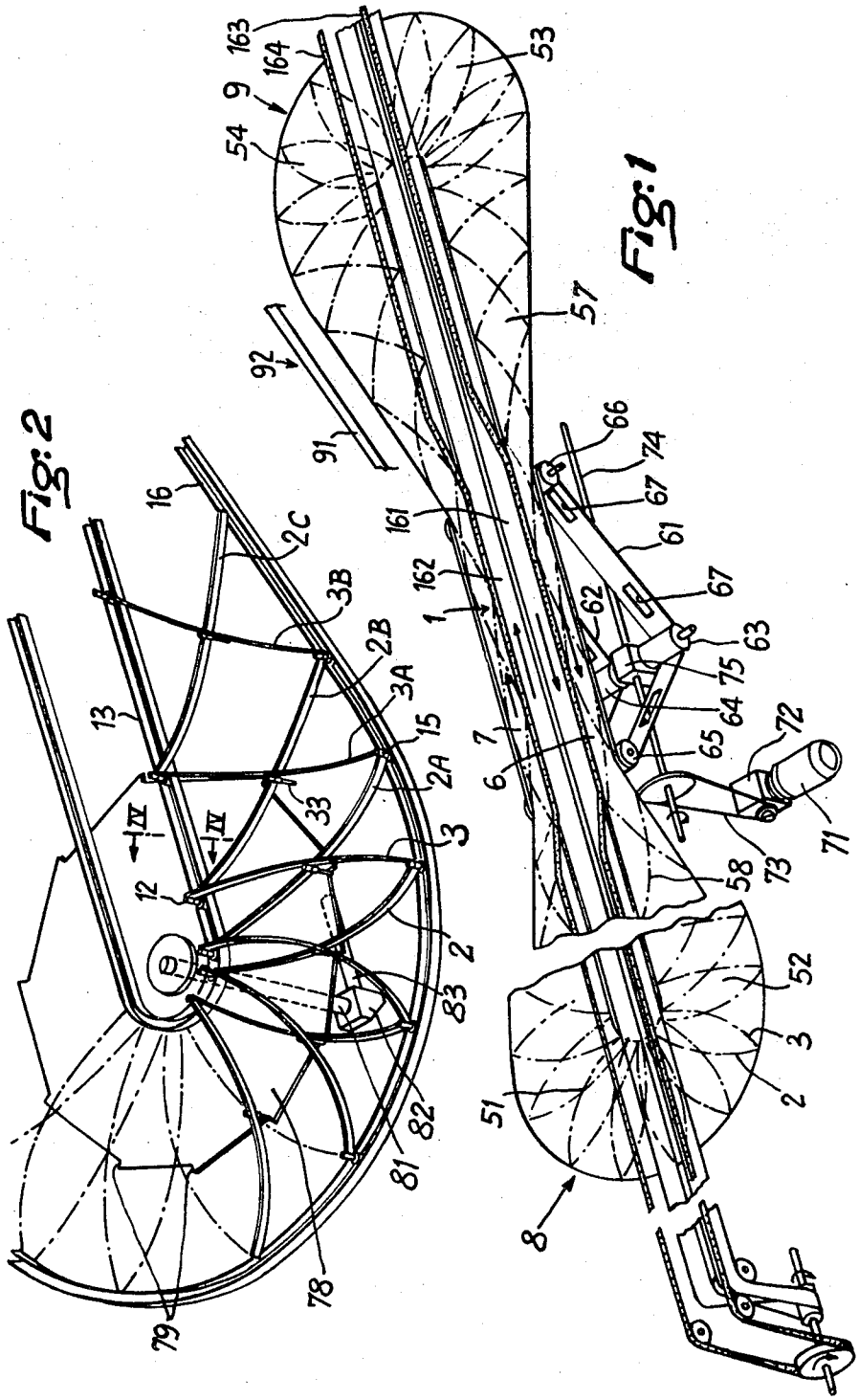


Fig: 1
Fig: 2
163
164
9
54
53
57
92
91
66
74
67
161
61
162
1
62
67
63
75
64
65
72
7
6
71
58
73
52
3
2
51
8
16
2C
3B
2B
3A
13
15
2A
33
3
12
II
II
2
83
82
81
78
79

Fig. 3

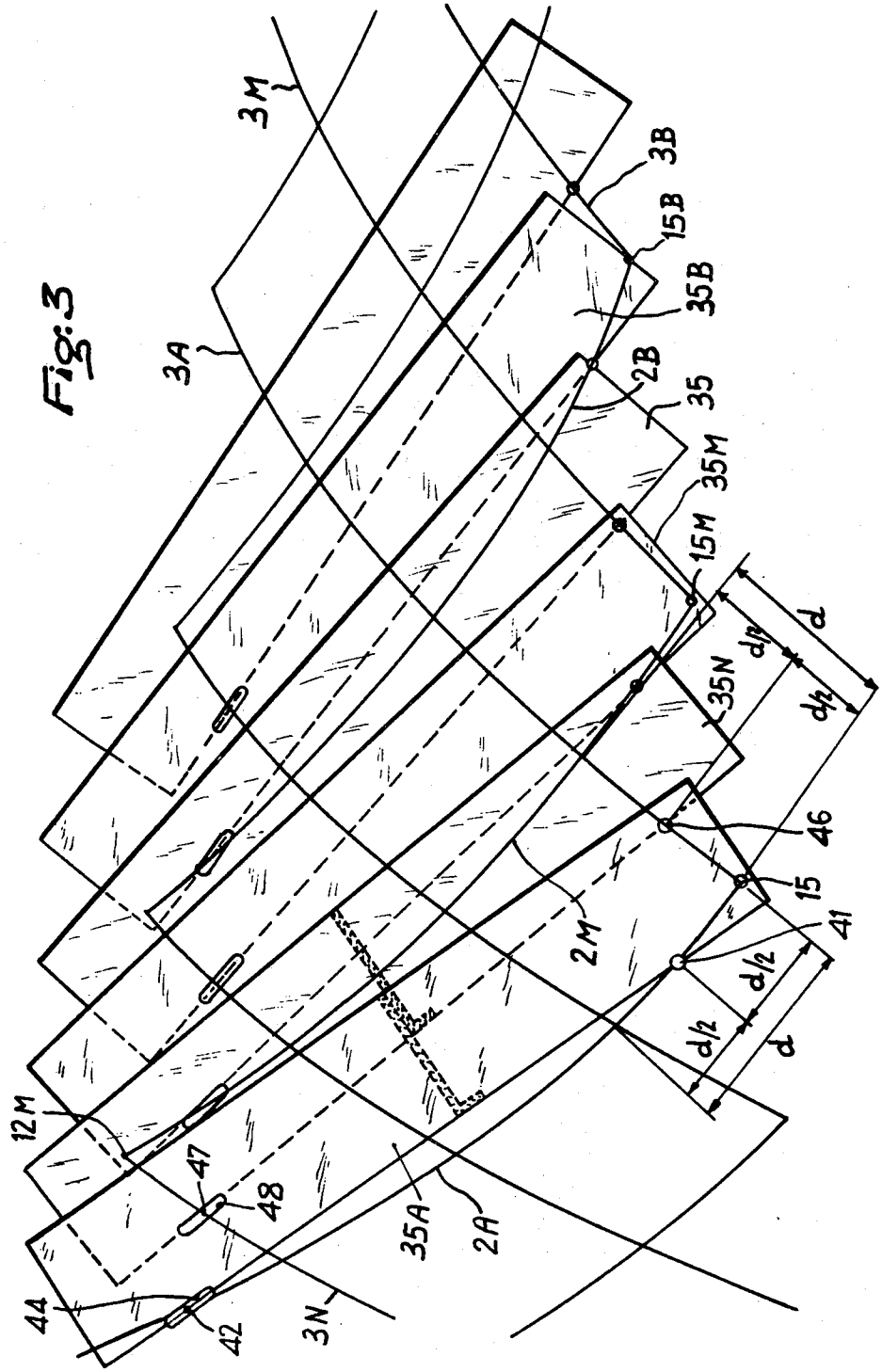

3M
3B
15B
35B
3A
2B
35
35M
15M
35N
d
d/2
46
15
41
2M
d/2
d/2
d
12M
47
48
35A
2A
44
42
3N

Fig: 4

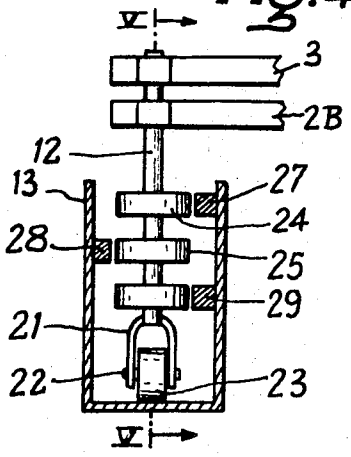


Fig: 5

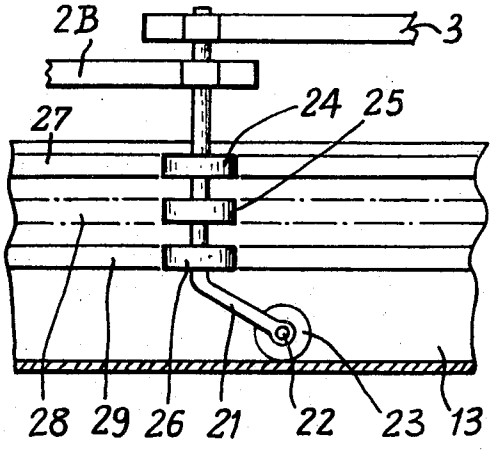


Fig: 15

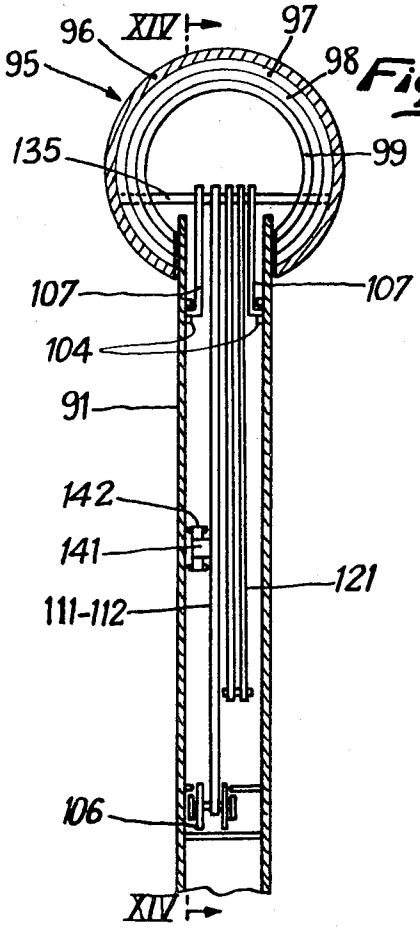


Fig: 16

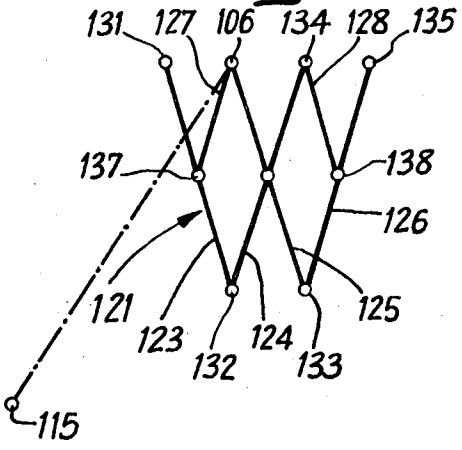


Fig.6.

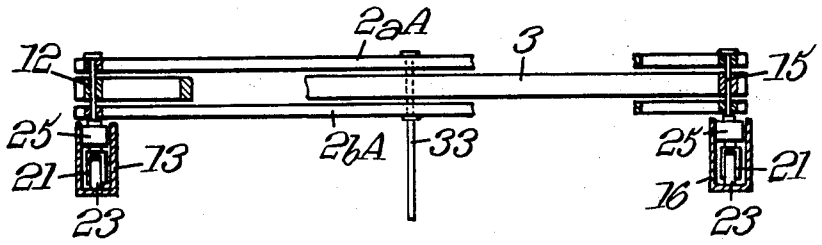
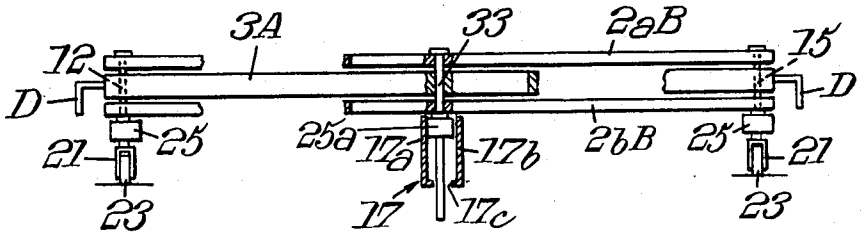


Fig.7.



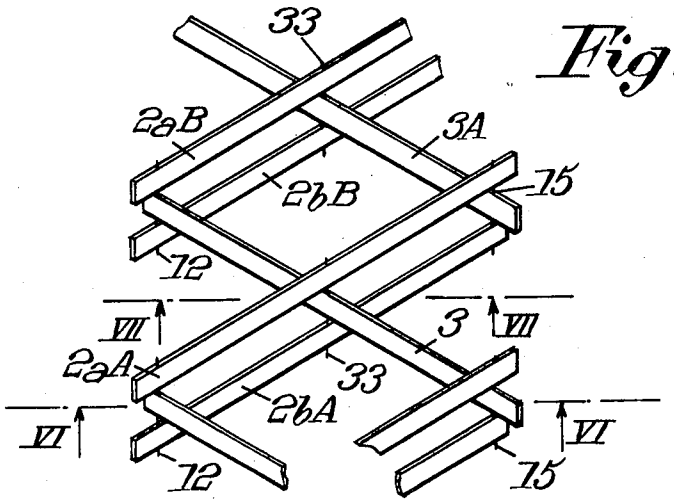


Fig.8

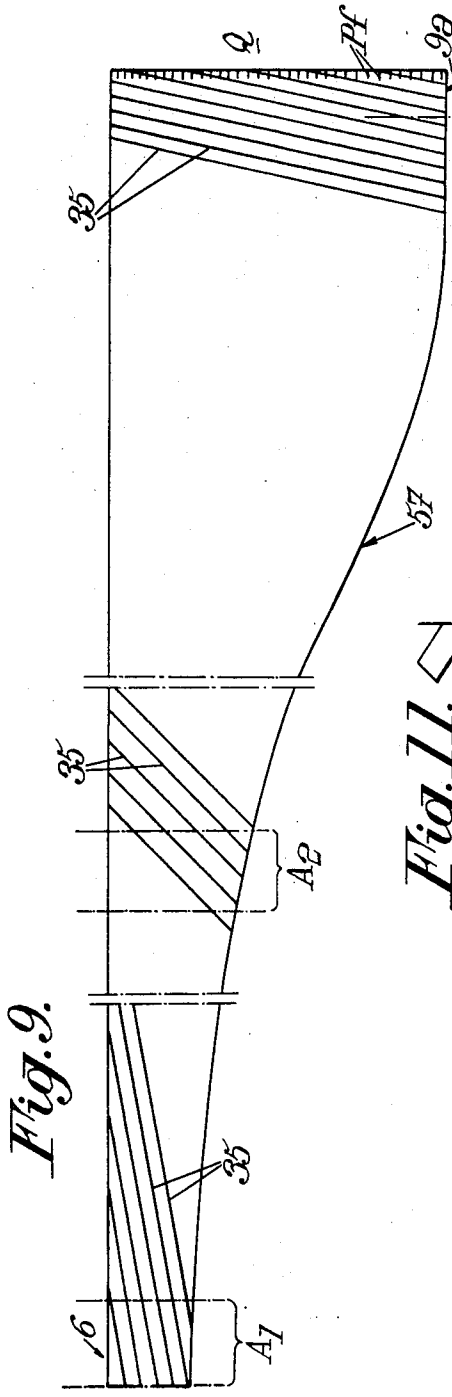


Fig. 9.

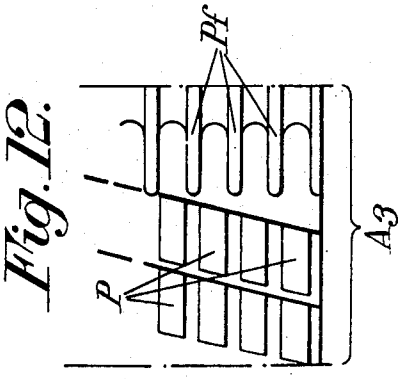


Fig. 12.

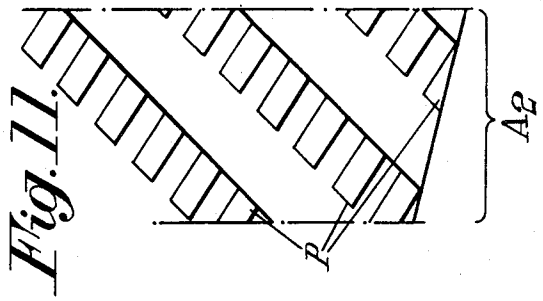


Fig. 11.

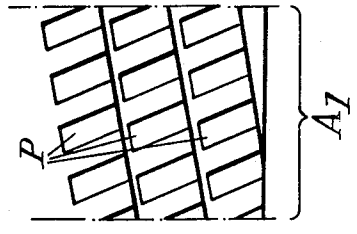


Fig. 10.

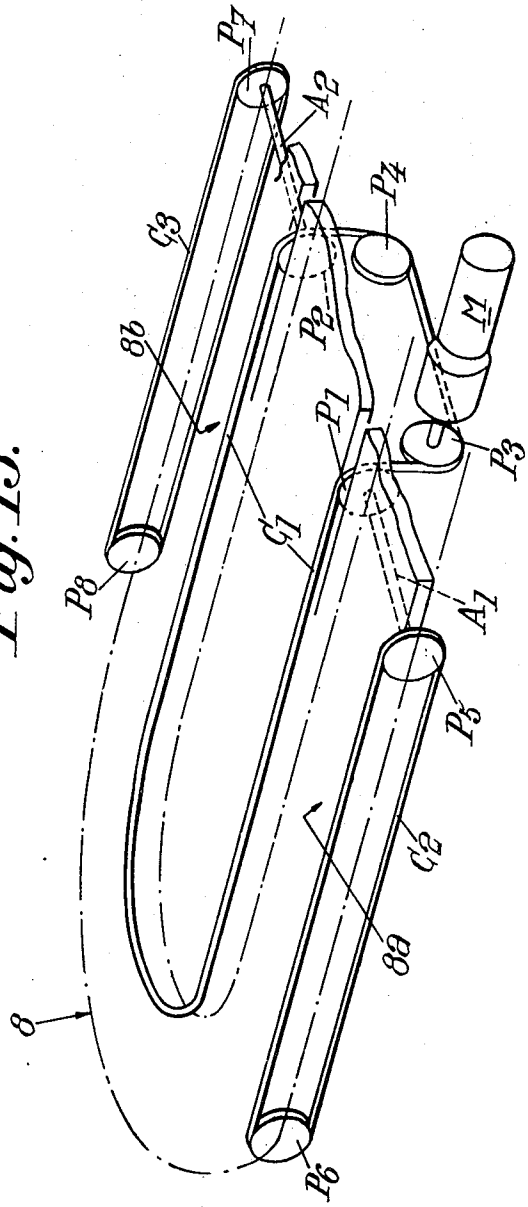
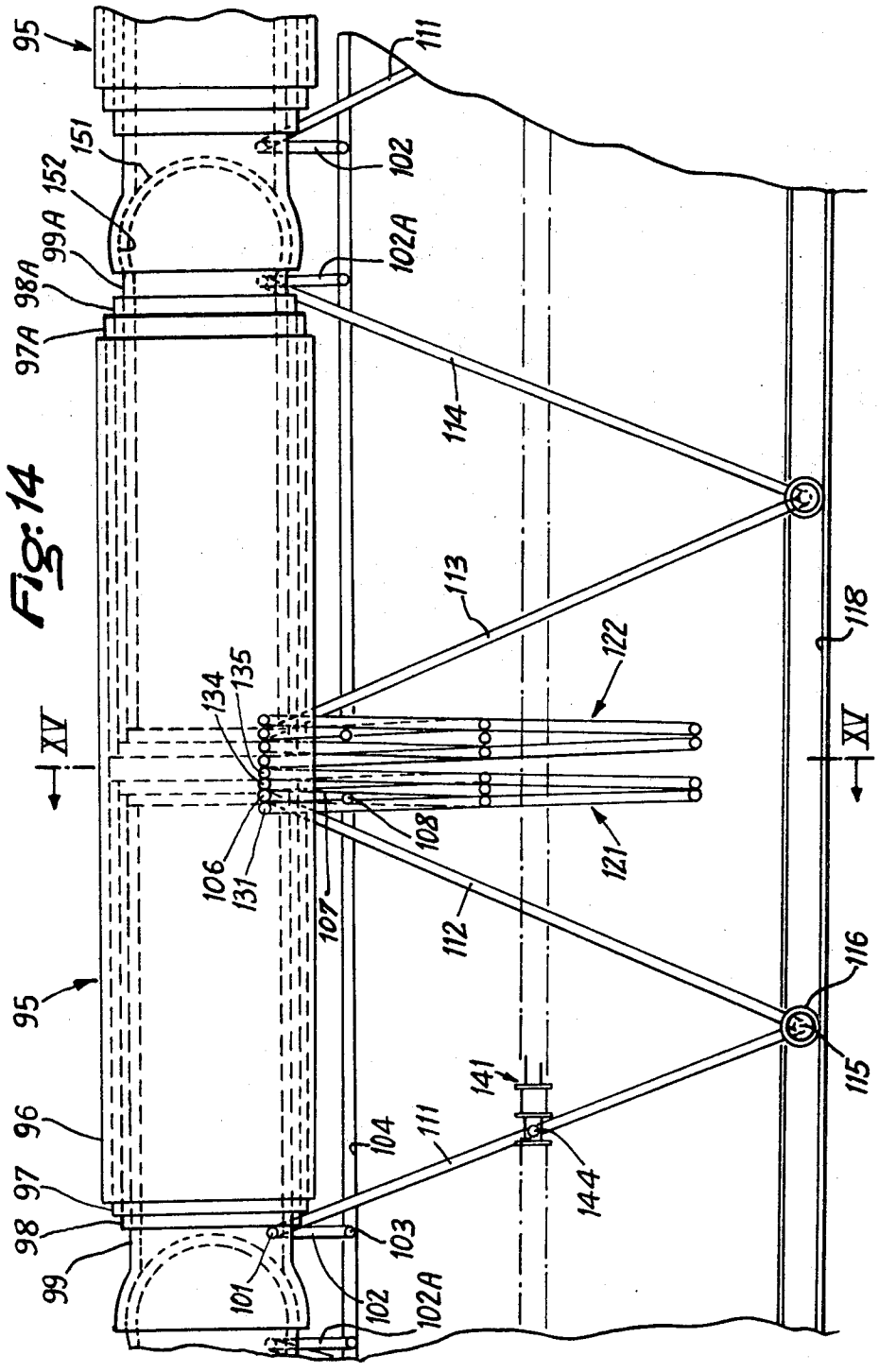


Fig. 13.


95
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99A
102A
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97A
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144
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102
102A

Fig. 14

VARIABLE SPEED ENDLESS CONVEYOR

The invention relates to a conveyor, especially for persons, of the type which enable rapid transfer of passengers between a loading or mounting zone and an unloading or dismounting zone in which the conveyor advances sufficiently slowly for the mounting and dismounting of passengers to be possible without difficulty in spite of the continuous movement of the conveyor.

It has a special object of providing a conveyor of the type concerned with responds better than those already existing to the various desiderata of practice, especially as regards simplicity of structure, safety of operation and cost price.

The conveyor according to the invention, which has the form of an endless chain in the form of a horizontal closed loop, is characterized by the fact that it is formed by at least one set of bars elastically deformable in the horizontal plane but rigid in the vertical plane, these bars being articulated on one another, on one hand in the vicinity of the ends and on the other hand in the vicinity of the middle, thereby forming an uninterrupted succession of curvilinear diamonds so that the four sides of a given diamond are obtained by means of four different bars, means being provided to drive the chain, at low speed in at least two zones of a first type in which the diamonds are flattened perpendicularly to their direction of advance, and at high speed in at least two other zones of a second type in which the diamonds are flattened in the direction of advance, the speed of the chain varying in continuous manner in the portions of the chain situated between the two types of zones, the said bars bearing plate elements, like scales or tiles, which partially overlap to form a horizontal receiving surface of continuous general configuration.

This conveyor hence resembles a moving carpet capable of being stretched and of being compressed, so that when its compressed parts are moved at a certain speed, its stretched parts are moved at a greater speed.

In a preferred embodiment, the conveyor comprises a handrail constituted by telescopic tubular elements driven in synchronism with the corresponding portions of the conveyor chain that they accompany.

Other features and advantages will be apparent from the detailed description which follows. This additional description relates to several embodiments of the conveyor according to the invention given purely by way of illustrative but non-limiting example, and with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of the whole of one embodiment of a conveyor according to the invention,

FIG. 2 shows, on a larger scale and with more details, a portion of FIG. 1;

FIG. 3 is a schematic plan view of a constituent part of a conveyor according to the invention;

FIG. 4 shows on a larger scale a partial section along the line IV—IV of FIG. 2;

FIG. 5 is a section along the line V—V of FIG. 4;

FIGS. 6 and 7 show schematically in section perpendicularly to the direction of advance in a rectilinear advancing zone, a conveyor according to the invention and constructed according to two variations;

FIG. 8 is a perspective view showing the constituent parts of an embodiment of a conveyor according to the invention corresponding to the variants of FIGS. 6 and 7;

FIG. 9 is a plan view showing schematically constituent parts of the conveyor at different points of its path,

FIGS. 10, 11 and 12 show on a larger scale details of FIG. 9;

FIG. 13 shows in diagrammatic perspective a portion of a conveyor according to the invention arranged in accordance with a variant;

FIGS. 14 and 15 show, respectively along the lines XIV—XIV of FIG. 15 and XV–XV of FIG. 14, a constituent part of a conveyor constructed according to the invention, and lastly,

FIG. 16 shows a detail of FIG. 14 in another position.

The embodiment of the variable speed continuous conveyor shown schematically as a whole in FIG. 1 is intended, for example, for the transportation of persons. It comprises an endless chain in the form of a horizontal closed loop formed from at least one set of bars auch as 2 and 3 (see also FIG. 2), elastically deformable in the horizontal plane but rigid in the vertical plane, these bars being articulated on one another, on one hand in the vicinity of their ends, and on the other hand in the vicinity of their middle, thereby forming an uninterrupted series of curvilinear diamonds so that each of the sides of a given diamond belongs to a different bar.

Means which will be more explicitly considered are in addition provided to drive the chain at low speed in at least two zones of a first type in which the diamonds are flattened perpendicularly to the direction of advance and, on the other hand, at high speed in at least two other zones of a second type in which the diamonds are flattened in the direction of advance, the speed of the chain varying in continuous manner in those of its parts which are situated between two types of abovesaid zones.

In the example shown, the loop formed by the endless chain 1 is flattened so as to have two neighboring parallel strands 6,7 which constitute the abovesaid zones of the second type, that is to say the principal portion of the conveyor, and which are linked at their ends by two portions 8,9 substantially in the form of semi-circles constituting the abovesaid zones of the first type. For the sake of clarity in the drawing and also because, in the example selected, the conveyor constitutes a relay of a rapid moving carpet, as will be explained below, that in FIG. 1, the two rectilinear strands 6 and 7 of the conveyor have been shown very short, but they could very well be of much greater length in the case of utilization without a rapid moving carpet.

The articulations of at least one of the ends of the constituent bars of the chain bear roller means and guidance means co-operating with a guide which is situated inside or outside the loop and which follow the contour which merges with the corresponding edge of the loop formed by the constituent chain of conveyor.

In the embodiment illustrated in FIG. 2, bars such as 2, 2A, 2B, 2C, etc. inclined in one direction constitute together a first series of bars, and bars such as 3, 3A, 3B, 3C, etc. inclined in the other direction constitute together a second series of bars. On the inner side of the loop, two successive bars belong respectively to two series of bars, for example the bars 3 and 2B, are articulated on one another in the neighborhood of their corresponding ends by a vertical axle such as 12 engaged

in a first guide or lower guide 13. In similar manner, two successive bars, such as 2A and 3A, belonging respectively also to two series of bars, articulated in the neighborhood of their corresponding ends, on the outside of the loop, on a vertical axle such as 15 engaged in a second guide or outer guide 16. The inner guide 13 and the outer guide 16 follow the general configuration of the whole of the conveyor and , in this example, they each have a section in the shape of a "U." In FIGS. 4 and 5, there is shown diagrammatically, on a larger scale, the shape and arrangement of the inner guide 13. The axle 12 on which are articulated the two bars 3 and 2B is extended, at its lower part, by an inclined fork 21 of which the two arms are traversed by an axle 22 on which is mounted a roller 23 which rests in the bottom of the guide 13. This roller is hence oriented by and supports the articulation axle chain of the bars whilst the chain moves. The axle 13 bears three horizontal centering rollers 24,25,26 which roll against the corresponding horizontal rails 27,28,29 rigidly fixed to the inner faces of two vertical walls of the guide 13. In the example, the rail 28 is fixed one of the guidewalls, at a level situated between those of the two other rails 27 and 29 fixed at the opposite wall of the said guide.

To form the curvilinear diamonds, the bars such as 2B of the first series art articulated on the corresponding bars such as 3A of the second series, by axles 33 situated in the middle of the length of the said bars.

The endless chain can be constituted by several superposed sets of bars each forming an uninterrupted series of diamonds, articulations being provided at each crossing of a bar of a given set with a bar of another set.

There is thus obtained several sequences of diamonds interlaced with one another. On the chain 1, rest rectangular scales such as 35A (FIG. 3) which are partly covered to form a horizontal receiving surface of continuous general configuration. Each scale such as 35A and 35N for example, is constituted by an angle element so as to present a sufficient rigidity. As can be seen in the lower sections of FIG. 3, each angle has a large horizontal support wing and a small vertical stiffening wing. In this example, for the needs of assembly of these scales, the chain is formed of several uninterrupted sequences of curvilinear diamonds interlaced in one another. In the embodiment shown, there are two sequences of diamonds, the first being formed by the bars such as 2A, 3A and 2B, 3B (FIG. 3) and the second by the bars such as 2M and 3M of which the outer articulation axles, such as 15M, occur between the articulation axles 15 and 15B of the bars of the first sequence.

The axles, such as 15M, can be engaged in the outer guide 16. The other ends of the bars which form intermediate diamonds are obviously articulated also on one another on axles, such as 12M, possibly engaged also in the corresponding inner guide 13.

Each plate elements, such as 35A, for example, is arranged lengthwise with respect to the bars of one of the series of bars such as 2A of the first set of bars and it is articulated, in the neighborhood of one of its ends, by an axle 41, on the bar 2A of the first series of bars and, in the neighborhood of its other end, by an axle 42 also on the bar 2A of this series of bars. So that the system may operate, one of the two articulation axles of each plate element such as 35A, for example the axle 41 borne by the bar 2A, pivots in a cylindrical hole of the plate element, whicst the other, that is to say the axle 42 can slide in a longitudinal slot 44 of the said plate.

In the embodiment shown, the following plate 35N is articulated, through its outer end, by means of an axle 46, not on the bar of the first series of bars, but on the bar 3A, of the first series, the other end of the said plate element being articulated on an axle 47 borne by a bar 3N of the first set of bars, this axle 47 being located also in a slot 48 of the plate element 35N.

By means of the fixing of the plate elements thus effected, the latter have, with respect to one of their positions at a given moment and in the course of periods of acceleration and of deceleration of the endless chain, a rotary movement increased by a translatory movement, the resulting movement being such that:

- two points placed on two consecutive plate elements, at a same distance from the large sides of the plate elements, and situated on a parallel to the axis of the chain remain, in the course of deformation of the chain, on a straight line parallel to the axis of the chain, as a result of which the foot of a passenger placed in the axis of the conveyor on several plate elements at once; does not turn and remains parallel to the axis of the conveyor in the zones of acceleration and of deceleration.
- two points placed on two consecutive plate elements at a same distance from the large sides of the plate elements and situated on a perpendicular of the axis of the chain remain, in the course of the deformation of the chain, on a perpendicular to the axis of the chain, due to which two feet placed side by side on a perpendicular to the axis of the chain and on assemblies of different plate elements remain on this perpendicular in the zones of acceleration or of deceleration.

It is to be noted that it is advantageous to select for the plate elements a size such that they extend beyond the endless chain, which enables the use, for a given width of conveyor, of a chain of substantially less width, that is to say constituted by means of bars shorter than the plate elements. The extension of the plate elements is preferably towards the outside of the loop, so as not to risk too great an overlap of the plate elements in the half-turn zones of the conveyor. The fixations are those described above.

End 8 (FIG. 1) of the conveyor comprises a loading zone or mounting area 51 for passengers and a discharge zone or dismounting area 52. In a similar way, the other end 9 of the conveyor comprises a loading zone or mounting area 53 and an unloading zone or dismounting area 54. In the proximal principal portions 6 and 7 of the conveyor, the inner guide 13 and the outer guide 16 are parallel and with a minimum spacing, whilst, in the zones or areas of loading and unloading 51 to 54, they are much more separated. This variation in separation is effected in a gradual manner between the high speed zones 6 and 7 and the slow speed zones 8 and 9 to take into account the gradual elongation of the diamonds which pass from a flat position in the direction of advance to a flat position perpendicularly to the direction of advance, this modification of shape corresponding to a gradual variation of the forward speed between the rapid zone and the slow zone. As a result, for certain constant given speed of

the conveyor chain in the main portions 6 and 7, the average speed of plate elements in an end zone, such as the loading zone 53 for example, is constant and much less whilst, in the intermediate zones such as zone 57 for example, situated between the loading zone 53 and the transport zone 6, the average speed of the plate elements is increasing since the width of the belt diminishes regularly between these two zones. Conversely, in the zone 58 for example, comprised between the transport zone 6 and the unloading zone 52, the average speed of the plate elements diminishes gradually.

The endless chain 1 is driven by a continuous movement in the zones where its speed is constant, that is to say, in this example, in the two principal transport zones 6 and 7 are high speed and in the two end zones enlarged in the form of a semi-circle at low speed.

The means used for this purpose can be constituted, for example, below this portion of the conveyor, by two perforated belts 61, 62 which pass, respectively, over two drive rollers 63, 64 and over two pairs of return rollers such as 65, 66 for example for the belt 61, which hold the upper strand of the corresponding belt applied against the lower surface of the movable chain of bars. In these perforations, such as 67 for example, of the belt 61, are engaged lower extensions of the vertical axles 33 (FIG. 2) of articulation at the center of the bars. Two belts 61, 62 are driven in reverse direction by the drive rollers 63, 64 self-rotated in reverse direction by an electric motor 71 through a transmission which comprises, in this example, a reducing gear box 72, a belt transmission 73 and a shaft 74 which passes through a drive gear box 75 of the shafts of the two rollers.

The drive of the chain at each end, for example the end 8, that is to say at the level of the slow speed zones, is constituted by a larger horizontal wheel 78 provided with teeth 79 intended to in mesh with the lower extension of the intermediate axles 33 of the braces. Wheel 78 is rigidly fixed to a vertical shaft 81 coaxial with the semi-circle formed by the end of the conveyor and driven by means of a return gear 82 by a horizontal longitudinal shaft 83 which turns in synchronism with the drive shaft 74 of the central part of the chain.

It is due to the fact that the constituent bars of the curvilinear lines are rigid in the vertical plane and elastically deformable only in horizontal plane that it is possible to ensure the support of the chain solely by rollers of the type 23 borne by the axles 12 and 15 of the end articulations without it being necessary to provide support rollers of the type generally used in devices of this nature.

To avoid introduction of the forces which could have the effect of raising the endless chain in the half-turn zones as well as in the acceleration and deceleration zones, it is advantageous to double one of the series or sets of bars as shown in FIGS. 6, 7 and 8, so that the doubled bars grip at the level of the end and middle articulations, the bars of the other series or set.

In FIG. 6, 7 and 8 it is assumed that it is the set of bars 2, 2A — which is doubled into bars 2*a*A, 2*b*A — and 2*a*B, 2*b*B —, gripping the bars 3, 3A.

In the embodiment of FIGS. 1 and 2 as well as in that of FIG. 6, it is assumed that the end articulations of the bars bear tracking and guidance means cooperating with two guides 13 and 16 situated respectively inside and outside the loop.

On the other hand, the embodiment of FIG. 7, the constituent chain of the conveyor bears at the level of middle articulation guide means constituted for example by a roller 25*a* provided on the articulation axle 33 and cooperating with the guide 17 constituted by two angle irons 17*a* and 17*b* in the form of an "L" which are facing through the small horizontal limb thereby forming a rail of which the general shape is that of a U, but leaving between the two small limbs of two L a slot 17*c* through which the axle 33 can pass as shown the figure.

In the case of the superposition of several sets of bars the said guide means can be provided also at the level of articulation of the bars of a first set on the bars of a second set.

In this embodiment, it suffices to provide at the level of the end articulations 12 and 15 only, support means for the chain, namely rollers 23.

In the Figure, there has however been shown, in addition to rollers 23, rollers 25, since it is advantageous to preserve, at least in certain places of the loop, lateral guides 13 and 16.

Of course, in this embodiment, the drive is the same as that in FIGS. 1 and 2.

To facilitate the operations of mounting and dismounting of the passengers, there is preferably provided between the slow constant speed zones 8 (or 9) of the conveyor and the variable speed zones 57 and 58 rectilinear zones 8*a*, 8*b* and 9*a*, 9*b* of low constant speed equal to that of the zones 8 and 9.

To ensure the drive of the conveyor in these zones, recourse is had, as shown in FIG. 13, to an assembly of three endless drive chains denoted respectively by C_1, C_2 and C_3, of which one, the chain C_1, is situated inside the loop formed by the zone 8 (or 9) and mates the whole of the semi-circular shape of the latter, the chains C_2 and C_3 being situated outside the loop on a portion of the length of the rectilinear zones of slow constant speed.

As shown in FIG. 13, the chain C_1 can be deformed in two orthogonal planes by passing successively over two pulleys P_1, P_2 and over two pulleys P_3, P_4, of which one is rotated by a motor M. This chain C_1 accompanies the conveyor in the half-turn zone, imposing on it thus the desired degree of compression in the inner portion at the turn and avoiding too great a straddling of the plate elements.

The chains C_2 and C_3 are conventional endless chains.

Drive means cooperating with the abovesaid chains are provided at the level of the end articulations.

In FIG. 7, there is shown curved fingers D borne by the bars 3, 3A . . . and of which the dimensions such that they can mesh with the chains C_1, C_2 and C_3.

The chains C_2 and C_3 are tensioned respectively between two pulleys P_5, P_6 and P_7, P_8, the pulleys P_5 and P_7 being rotated by two shafts A_1 and A_2 keyed respectively on pulleys P_1 and P_2. The chain C_1 can be held tightened by means of a fixed guide, known in itself, not shown.

For the safety of the passengers of the conveyor and to avoid especially any danger at the end of the journey, the invention provides that the plate elements 35

bear combs P of which the orientation is such that when the conveyor is at its slowest speed, the grooves of the combs of two successive plate elements are in extension of one another and occur on a parallel to the axis of the conveyor so that these combs can then cooperate with a fixed comb. P_f borne by the arrival platform Q.

In FIG. 9, there is shown diagrammatically, in plan view, different sections of the conveyor between a zone 6 (or 7) and the beginning of a slow speed rectilinear zone (for example 9*a*) with the arrival platform Q placed on the latter, thus showing the rotation of the plate elements, and there is shown on a larger scale in FIGS. 10 to 12 three portions A_1, A_2 and A_3 of the sections concerned, corresponding to different orientations of the plate elements on the conveyor, these enlarged views showing the corresponding orientations of combs. It is to be noted that the combs are slightly inclined over a small dimension of the plate elements, the value of this inclination corresponding to that of the bars on the axis of the transporter at the level of the arrival platform.

Along each of the edges of the transported, especially (FIG. 1) in plumb with each other two inner 13 and outer 16 guides, there is provided a substantially vertical wall 91 over the upper portion of which a handrail 92 is moved at the same speed as the corresponding portion of the chain of the conveyor.

In the example, this handrail is constituted by a succession identical assemblies 95 (FIG. 14 and 15) of telescopic tubular elements. In the example, each assembly 95 is constituted by an outer tubular element 96 in one half of which can slide, to one another, three inner tubular elements 97, 98, and 99 and, in the other half, three symmetrical elements 97A, 98B and 99A. All these tubular elements are open at their inner portion, so as to be able to straddle the upper portion of the partition 91. To this end, each outer end of the inner tubular element such as 99 bears an axle 101 rigidly fixed to two feed 102 of which the inner end is provided with a roller 103 housed in a horizontal slide 104 of lying U-shaped section formed on the inner surfaces of the wall 91 which is a hollow wall. The inner end of the second tube such as 98 bears, in a similar manner, an axle 106 bearing two feet107 provided with a roller 108 engaged in the same slide 104.

The elongation and shortening of each telescopic assembly 95 is ensured by two systems of levers.

The first system of levers comprises, for each assembly 95, two levers 111, 112 at one of the end of the assembly and two identical other levers 113,114 at the other end. The upper end of the lever 111 is articulated on the axle 101 rigidly fixed to the inner tube 99, and the upper end of the lever 112 is articulated on the axle 106 rigidly fixed to the second inner tube 98. The two levers 111, 112 are articulated on one another by their inner ends on an axle 115 provided with a roller 116 which is housed in a horizontal guide 118 forming a crosspiece in he thickness of the wall 91. The vertical distance between this guide 118 and the upper slide 104 determines the relative position of the two two inner tubes 99 and 99A with respect to two tubes 98 and 98A in which they respectively slide directly.

The relative position of the other tubes, between themselves and with respect to four tubes 99, 99A, 98, 98A, is ensured by a second system of levers which comprises two groups denoted respectively by 121 and 122. For better understanding, the group 121 only is shown schematically in FIG. 16.

The group 121 comprises four large levers 123, 124, 125, 126 and two small levers 127, 128. The upper end of the large lever 123 is articulated on an axle 131 on the inner end of the inner tube 99 whilst its inner end is articulated by an axle 132 on the lower end of the large lever 124. The upper end of the large lever 125 is articulated on the axle 106 rigidly fixed to the second inner tube 98, whilst its lower end is articulate by an axle 133 on the lower end of the large lever 126. The upper ends of the two large levers 124 and 126 are articulated, by two axles 134, 135, respectively on the inner end of the third tube 97 and on the middle of the length of the fourth tube or outer tube 96. The upper end of the small lever 127 is articulated on the axle 106 and its lower end on an axle 137 situated in the middle of the length of the large lever 123. In a similar manner, the other small lever 128 is articulated, by its upper end, on the axle 134, and, by its lower end, on an axle 138 situated in the middle of the length of the large lever 126.

The assembly of levers 121 represented in FIG. 8 is hence formed of articulated parallelograms. Now, the horizontal distance between the two axles 131 and 106 is a function of the penetration of the inner tube 99 into the tube 98 in which it is mounted, so that any variation of this distance determines a corresponding variation between the axles 106 and 134 on one hand, and the axles 134 and 135 on the other hand, which determines the relative longitudinal positions of the tube 97 with respect to the tube 98, and of the tube 96 with respect to the tube 97.

The drive of the ramp is effected, in the zones where this ramp is moved at constant speed, for example, by a chain 141 which slides at constant speed in an inner horizontal guide 142, the linkage between the chain 141 and the ramp being effected, for example, by the engagement of one axle such as 144 fixed at the middle of the lever 111 and engaged in a link of the said chain.

Each telescopic tubular assembly 95 is connected to the following one, for example by a ball-joint system constituted by a male ball 151 formed at an outer end of the inner tube 99A and by a corresponding female part 152 formed in the adjacent end of the inner tube of the following assembly.

The operation of the assembly of the conveyor is as follows:

The chain 1 being driven at constant speed, as explained above, the plate elements are oriented substantially lengthwise over the principal portions 6 and 7 of the conveyor and are actuated with a relatively high speed of translation, whilst, in the enlarged portions 8 and 9 of the two ends of the conveyor, they are, on the other hand, substantially crosswise and they are actuated with a relatively slow speed of displacement. The variation in speed between the principal transport zone and the loading and unloading zones is effected gradually by zones of gradually increasing width when it relates to deceleration or progressively decreasing when it relates to acceleration. The passengers get on , for example at the area 51, then are transported by the narrow principal zone 7 and arrive at the area 54 of large width, from which they can easily dismount.

By way of example, there is shown a complementary arrangement comprising two rolling carpets **161**, **162**, (FIG. 1) which extend respectively along the principal portions **6** and **7** of the conveyor, for example at a speed equal to that of the said conveyor, the latter serving as intermediate means or relay to pass the passengers from the ground on to the rolling carpet **161** or even from this rolling carpet to the ground. There is indicated, at **163** and **164**, the handrails of the two supplementary rolling carpets **161**, **162**.

There can be envisage, for example, the provision of three conveyors arranged in series, namely: a first variable speed conveyor, for example of the type described above, covering a range of speeds of the order of 2 to 12 km/h, a second variable speed conveyor covering a rang of speeds of the order of 12 to 60 km/h, and a third conveyor constituted by a constant speed carpet of about 60 km/h for example.

This being the case, there is provided a conveyor of the type concerned, of which the features emerge sufficiently from the preceding description for it to be unnecessary to dwell on this subject and which has, with respect to those pre-existing, numerous advantages, such as that being simple in construction, of very great robustness and of being of relatively low cost price.

As is self-evident, and as emerges already from the preceding description, the invention is in no way limited to those of its methods of application, nor to those of its methods of production of its various parts, which have been more particularly indicated; it embraces, on the contrary, all variations, especially,

that in which the mobile chain of support bars of the plate elements would be driven by friction on mobile horizontal belts, and

that in which the endless loop formed by the chain would have a general configuration approximating, for example, that of a corresponding circumference, for example, to the perimeter of a large exhibition.

What is claim is:

1. Variable speed endless conveyor constituted by an endless chain in the form of a horizontal closed loop, said loop being formed by at least one set of bars comprising a first series of bars and a second series of bars elastically deformable in the horizontal plane but rigid in the vertical plane, the bars of the first series being articulated on the bars of the second series, in the vicinity of the ends of the bars and in the vicinity of the middles of the bars, thereby forming an uninterrupted sequence of curvilinear diamonds so that the four sides of a given diamond are constituted by four different bars each bar forming part of two consecutive diamonds, means being provided for driving the chain in a direction along the loop, at low speed in at least two zones of a first type in which the diamonds are flattened perpendicularly to the direction along the loop, and at high speed in at least two other zones of a second type in which the diamonds are flattened in the direction along the loop, the speed of the chain varying in continuous manner in the portions of the chain situated between the two types of zones, the said bars bearing plate elements which partly overlap and remain throughout said loop in the same substantially horizontal plane to form a horizontal receiving surface of continuous general configuration.

2. Conveyor according to claim **1**, wherein the loop formed by the chain is flattened and comprises two neighboring parallel strands and two portions substantially in the form of semi-circles.

3. Conveyor according to claim **1**, wherein the endless chain is constituted by several sets of superposed bars each set forming an uninterrupted sequence of diamonds, articulations being provided at each crossing of a bar of a given set with a bar of another set.

4. Variable speed endless conveyor constituted by an endless chain in the form of a horizontal closed loop, said loop being formed by at least one set of bars comprising a first series of bars and a second series of bars elastically deformable in the horizontal plane but rigid in the vertical plane, the bars of the first series being articulated on the bars of the second series, in the vicinity of the ends of the bars and in the vicinity of the middles of the bars, thereby forming an uninterrupted sequence of curvilinear diamonds so that the four sides of a given diamond are constituted by four different bars each bar forming part of two consecutive diamonds, means being provided for driving the chain in a direction along the loop, at low speed in at least two zones of a first type in which the diamonds are flattened perpendicularly to the direction along the loop, and at high speed in at least two other zones of a second type in which the diamonds are flattened in the direction along the loop, the speed of the chain varying in continuous manner in the portions of the chain situated between the two types of zones, the said bars bearing plate elements which partly overlap and remain throughout said loop in the same substantially horizontal plane to form a horizontal receiving surface of continuous general configuration, wherein the end of a plate element of an odd row which occurs on the inner side of the loop is articulated on a bar of the first series of a first set and its opposite end is also articulated on the same bar of the first series of the first set, whilst the ends of a plate element of an even row which occurs also on the inner side of the loop is articulated on one of the bars of a second set and its opposite end on a bar of the second series of the first set.

5. Conveyor according to claim **4**, wherein one of the ends of each plate element is articulated on the corresponding bar through an axle mounted so as to be able to undergo a slight translation movement in the direction of the length of said plate element.

6. Conveyor according to claim **1**, wherein the articulations of at least one of the ends of the constituent bars of the chain bear roller means and guide means cooperating with a guide which is situated inside or outside the loop and which follows a contour which merges with the corresponding edge of the loop formed by the chain constituting the conveyor.

7. Conveyor according to claim **1**, wherein the chain bears at the level of the middle articulation of the bars, guide means cooperating with a guide, the end articulations of the bars bearing roller means which support the chain.

8. Conveyor according to claim **7**, wherein the roller means provided at the end articulations of the bars are arranged so that they can cooperate with lateral guides provided at least at certain places of the loop formed by the chain.

9. Conveyor according to claim 1, wherein each guide has a U-shape section, roller and support means borne by the end articulations comprising a vertical axle of which the lower end is provided with an orientable roller resting in the bottom of a lateral guide the guide means borne by the articulations being constituted by at least one directing roller co-operating with two inner lateral faces of the said guide, if necessary with the interposition of projecting horizontal rails.

10. Conveyor according to claim 1, when the drive of the chain is ensured by mobile drive elements in engagement with lower extensions of the middle articulation axles of the constituent bars of the said chain and described a path corresponding to that of the said axles, under the action of motor means to which they are connected.

11. Conveyor according to claim 10, wherein the mobile drive elements, arranged under parallel strands of the chain are constituted by a perforated belt or a horizontal endless chain of which the upper strand is in engagement with the lower extensions of the middle articulation axles of the chain.

12. Conveyor according to claim 10, wherein the mobile drive elements, arranged under each of the two end portions substantially in the form of semi-circles of the chain, are constituted by a gear wheel which is borne by a vertical drive shaft coaxial with the corresponding semicircle and of which the teeth are in engagement with the lower extensions of the middle articulation axles of the chain.

13. Conveyor according to claim 1, wherein the bars of one of the two series of bars which form successive diamonds of the chain are double so that they grip at the level of the articulations of the bars of the second series of bars.

14. Conveyor according to claim 1, wherein the loop comprises rectilinear zones of slow constant speed between circular zones of slow constant speed and zones of variable speed which connect them to rectilinear zones of high speed.

15. Conveyor according to claim 1, wherein the drive means for the semicircular zone and the constant low speed rectilinear adjacent zones comprise three drive chains of which one is situated inside the loop and corresponds in shape with the whole of the semi-circular shape of the latter, the two others being situated outside the loop on a portion of the length of the two constant speed rectilinear zones, said chains co-operating with drive means provided at the level of the end articulations.

16. Conveyor according to claim 15 wherein the drive means are constituted by hooks borne by one of the series of bars forming diamonds.

17. Conveyor according to claim 1, wherein the plate elements bear combs whose orientation is such that, when the conveyor is at its lowest speed, the grooves of the combs of two successive plate elements are in extension of one another and occur over a parallel to the axis of the conveyor so that the combs borne by the plate elements can then cooperate with a fixed comb borne by the arrival platform.

18. Conveyor according to claim 1, wherein the plate elements bound the surface limited by the diamonds towards the outside of the loop.

19. Conveyor according to claim 1, comprising a handrail constituted by telescopic tubular elements driven in synchronism with the corresponding portions of the conveyor chain which accompany them.

20. Conveyor according to claim 19, wherein the telescopic tubular elements which constitute the handrail comprise a series of identical assemblies each of which is formed by at least two telescopic tubular elements of which the open lower portion slides on a substantially vertical fixed wall, the longitudinal linkage between these two elements being ensured by two levers articulated on one another and bearing a roller which rolls against a fixed ramp of which the distance to the upper portion of the aforesaid fixed wall is, at each point of the conveyor, a function of the relative position of the plate elements, the drive of the handrail being ensured in constant speed zones by an endless inextensible flexible link which is moved along the fixed vertical partition at the speed of the endless drive chain of the plate elements and which is connected to a point of each assembly of telescopic tubular elements of the handrail.

21. Conveyor according to claim 20 in which each assembly of telescopic tubular elements of the handrail comprises more than two elements, wherein the supplementary elements are connected between themselves and to two first elements by a system of articulated braces.

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