United States Patent [19]

Hermann

[11] **3,800,707**

[45] **Apr. 2, 1974**

[54] **OVERHEAD CONVEYOR INSTALLATION**

[76] Inventor: **Horst M. Hermann,** Ulmenstr. 18, 7034 Maichingen, Germany

[22] Filed: **Apr. 19, 1972**

[21] Appl. No.: **245,320**

[52] **U.S. Cl.** **104/94,** 104/152, 295/1

[51] **Int. Cl.** **B61b 3/02**

[58] **Field of Search** .. 104/89, 93, 148, 94, 148 LM, 104/152, 149

[56] **References Cited**

UNITED STATES PATENTS

3,198,140	8/1965	Chadenson	104/94
3,059,591	10/1962	Chadenson	104/94
2,858,773	11/1958	Eldridge, Jr.	104/149
3,426,700	2/1969	Klamp	104/94
3,252,429	5/1966	Atanasoff et al.	105/150

Primary Examiner—Robert J. Spar
Assistant Examiner—Richard A. Bertsch

[57] **ABSTRACT**

An electrically powered overhead conveyor system for a series of suspended load-carrying carts consists of a number of drive assemblies to suspend the carts in rolling engagement with a hollow rail having a cross-section resembling an inverted U which encloses the drive assemblies, and at least one drive assembly for each cart includes a driving motor which is entirely contained within the hollow rail.

8 Claims, 3 Drawing Figures

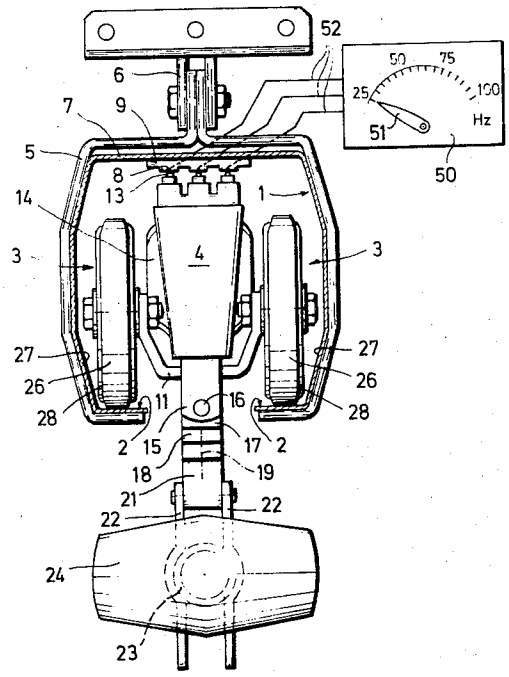


Fig. 1

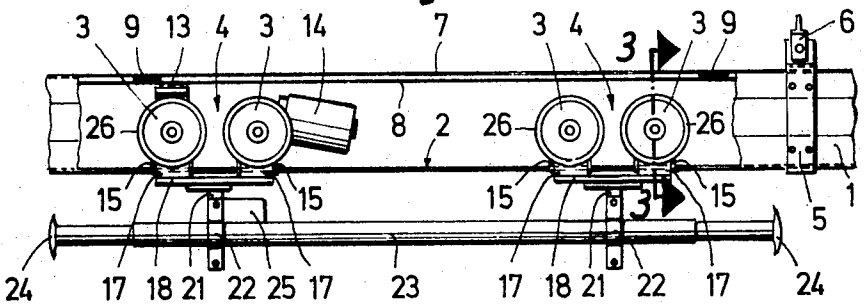

3
9
13
4
3
14
7
3
4
3
9
6
26
8
2
26
26
15
15
15
15
5
1
24
17
18
21
22
25
17
23
17
18
21
22
17
24

Fig. 3

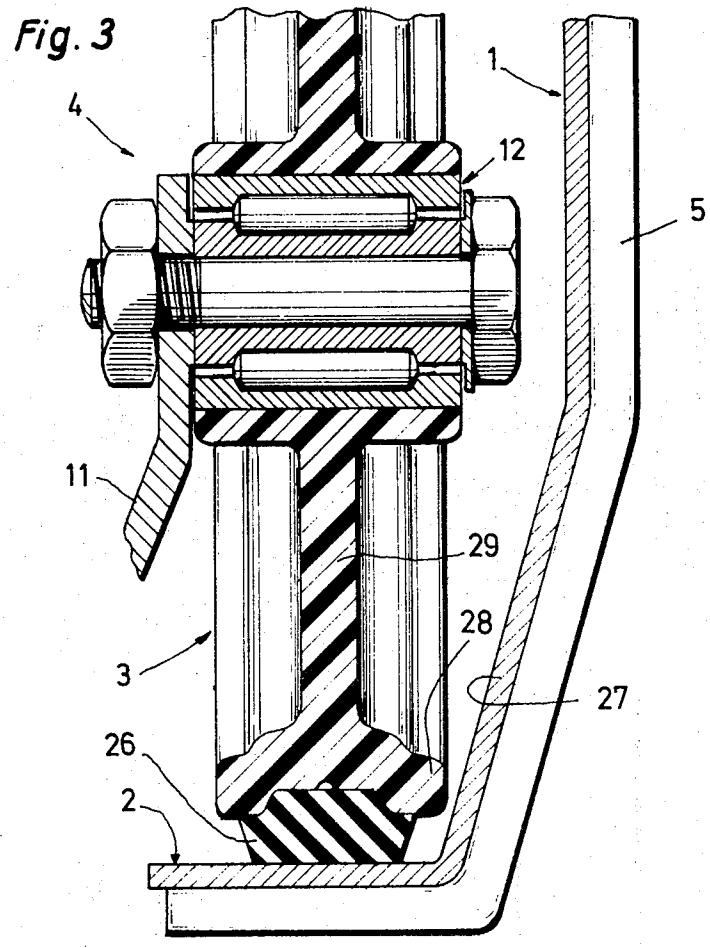
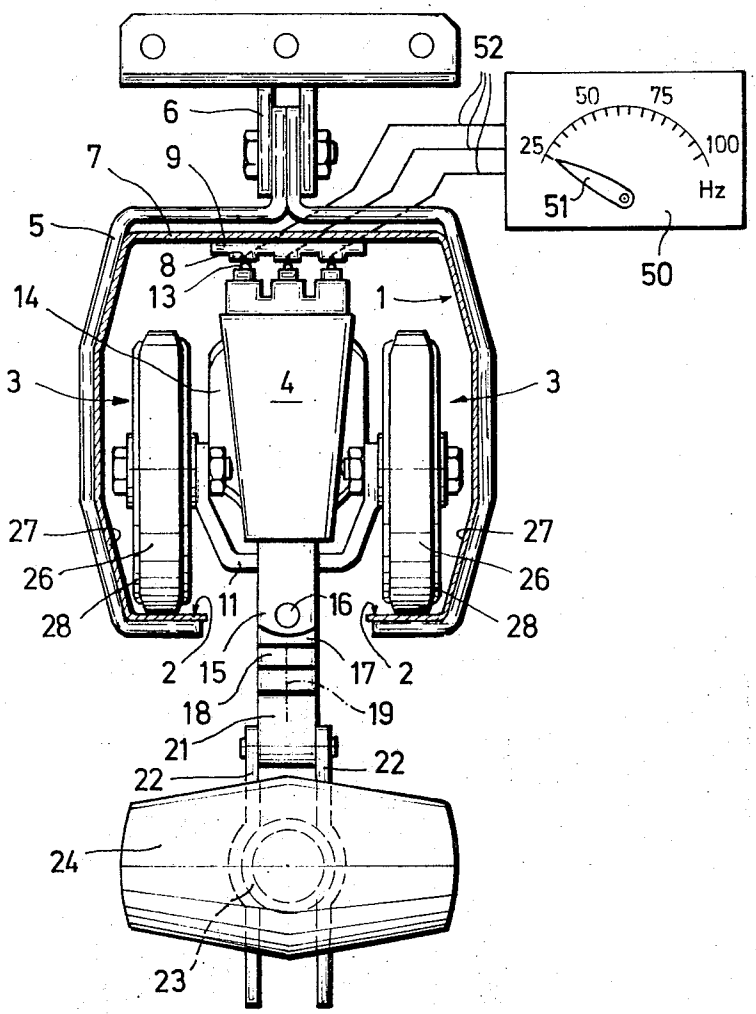

1
4
12
5
11
29
28
3
27
26
2

Fig. 2


52
50
75
25
100
Hz
51
50
6
7
9
5
8
13
14
1
4
3
3
27
27
26
26
28
28
11
16
2
15
17
2
18
19
21
22
22
24
23

OVERHEAD CONVEYOR INSTALLATION

The invention relates to an overhead conveyor installation consisting of self-contained rails suspended from the ceiling or from supports and of conveyor carts driven and guided on said rails by means of individual wheel drive assemblies.

Known overhead conveyor installations of this type are intended mostly for industrial plants where trained personnel operate the installation. Accordingly, it can be assumed that this personnel treat the dangerous parts of these installations, such as the driving motors, the wheels and other rotating parts, as well as power inlets, with the required care. Such precautions based on familiarity with operational hazards can not be expected when overhead conveyor installations are operated by untrained personnel or laymen, as is the case, outside of commercial operations, especially in hospitals or for example, for the conveyance of luggage by passengers in the case of airports. In this case, the known installations are too unsafe and thus dangerous.

The invention has for its initial object the provision of an overhead conveyor installation with a high safety factor which makes it foolproof as far as laymen are concerned and which is suitable for example, for hospitals, airports, railway stations, etc.

This object according to the invention is achieved by the fact that a separate motor is connected to every cart and that the rails are formed in the shape of hollow sections in such a way that they encompass the motors as well as their drive assemblies. In the case of a preferred embodiment of the invention, the live current-carrying rails also are disposed inside the hollow section of the rails and, of course, advantageously on the horizontal ceiling of the section. In this case, all the dangerous parts of the installation are covered up by the hollow sections of the rail in such a way that they normally are inaccessible and, therefore, are not dangerous to anyone.

Special advantages will result in the operation of the overhead conveyor installation according to the invention, by employing three-phase induction motors, each of which can be operated according to choice at various specific frequencies so that in this manner different control functions can be carried out.

Whenever the motor, as provided according to the invention, is to be housed inside the hollow section of the rails, it is important to distribute the driving force evenly, so that as small as possible a motor can be used. Therefore, according to another embodiment of the invention, provision is made for thhe purpose of an even distribution of the wheel load, and thus of the driving force, that the drive assemblies are connected swivelably with the conveyor carts in a plane that is perpendicular to the direction of movement and that the swiveling axis is essentially at the same height as the running surface of the rails.

It furthermore will result in improvement of the driving and running characteristics of the conveyor installation according to the invention, whenever the rims of the wheels disposed on the drive assembly are made of a material, such as rubber, etc., which is noiseless when running and if the rims of the wheels are provided with guide beads made of a synthetic material with a low friction coefficient, such as polyamide, by means of which the wheels are guided slidingly by the inside of the hollow rail sections. At the same time, the hollow

rails, at least in the area of the guide beads, can be lined with a similar synthetic substance. It furthermore is of advantage to form the rim integrally with the guide beads.

The subsequent description of preferred embodiments of the invention serves in connection with the attached drawing for further explanation of the invention.

FIG. 1 shows a side view partially broken away of an overhead conveyor installation according to the invention;

FIG. 2 shows a front view of the overhead conveyor installation of FIG. 1, on an enlarged scale as compared to FIG. 1;

FIG. 3 is a cross-section along line 3—3 in FIG. 1.

The overhead conveyor installation according to the invention, conprises a plurality of hollow sectioned rails 1 having an essentially inverted U-shaped cross section, whereby the rails are open at the bottom and the perpendicularly downwardly directed sides terminate in a pair of horizontally inwardly directed flanges which constitute the running surfaces 2 for the wheels 3 of a drive assembly 4. Rails 1 may be suspended from shackles 6 by means of stirrups 5 of a suitable shape which encases rail 1 from the outside and especially supports the running surfaces 2. Shackles 6 on their part can be suspended either from the ceiling of a room or from special supports.

Inside the hollow sectioned rails 1, electrical conductor rails 8 are disposed on the horizontal ceiling 7, the number of said rails depending on the type of power used, which in the case of use of a three-phase motor would be three. Rails 8 are separated from the ceiling 7 of rail 1 by insulators 9.

Each of the drive assemblies 4 comprises a pair of straps 11 on each of which two wheels 3 opposite each other are mounted by means of ball bearings 12. Furthermore, three upwardly directed sliding contacts 13 are connected with a frame 11, shown in FIG. 2 and at the extreme left in FIG. 1, which take the current from rails 8 and feed it by means of suitable wiring (not shown) to a driving motor 14. Motor 14 includes a drive mechanism connected with another pair of wheels with its drive mechanism encased by a common housing rigidly connected with a strap 11 supporting said wheels, as seen in FIG. 1. Strap 11 provided with the current collecting sliding contacts 13 and strap 11 carrying driving motor 14 are connected jointedly with one another into a first drive assembly 4. The connection of the two straps 11 is accomplished in such a way that two shackles 15 projecting downwards, are connected with each strap 11. Between these shackles 15, a bushing element 17 is mounted swivelably by means of a hinge bolt 16 (see FIG. 2). Pairs of bushing elements 17 are connected with one another by means of a connecting bar 18. On bar 18, a loop 21 is suspended for rotation around a perpendicular axis 19 indicated in dotted lines in FIG. 2, by conventional support means, on which loop a suspending rod 23 is attached by means of shackles 22. This suspending rod constitutes a part of a conveyor cart, not shown, and connected with it. On the basis of the joint effect imparted by means of bolt 16, the conveyor cart is connected swivelably with the drive assembly 4 in a plane perpendicular to the direction of movement, whereby the horizontal longitudinal swiveling axis defined by bolt 16 lies at the same level as the running surface 2 of the

rails. As a result of that, a particularly even distribution of the wheel load will be obtained as well as of the driving force produced by motor **14**, so that the output of the motor can be kept relatively low.

As can be gathered from FIG. **1**, the wheel assembly **4** lying on the left side in this drawing consists of a right-hand and left-hand pair of wheels. The left-hand pair of wheels is connected (compare FIG. **2**) with the sliding contacts **13**, while the driving motor **14** with its drive mechanism is disposed on the right-hand pair of wheels. The drive mechanism of the motor is positively connected with at least one running wheel **3** of the right-hand pair of wheels, said running wheel constituting the driving wheel. The pair of drive assemblies **4** lying on the left-hand side in FIG. **1** are also connected with another pair of drive assemblies **4** lying on the right-hand side via the suspension rod **23**, whereby each of the pairs of drive assemblies **4** with respect to the rod **23** are rotatable around the above mentioned vertical axis **19** (FIG. **2**). Whenever rod **23** is connected with a conveying cart in this way, a compact and yet flexible unit will be obtained, which can move especially through curved sections of rail having small radii of curvature.

As can be seen from FIG. **1**, the driving motor **14** with its gear mechanism is disposed entirely within hollow rail section **1** and is enclosed and covered by this rail in such a way that it is practically inaccessible from the outside. This covering of the driving motor together with the arrangement of live conductor rails **8** on ceiling **7** of rail **1** constitutes a safety factor of considerable value.

Motor **14** can be a three-phase induction motor which can be operated according to choice at variable frequencies adjustable in stages or continuously. The frequency range can extend, for example, from between 25 to 100 Hz and in the case of a preferred embodiment, it will comprise three stages, namely, 25, 50 and 100 Hz. In this manner, the motors **14** of various conveying carts are individually controllable by means of corresponding selection of frequencies.

The suspension rod **23** connected with the conveyor cart includes at each of its ends a spring operated bumper **24** having damping means telescoping in the bar. The maximum suspended load on rod **23** can amount, for example, to 150 kg or more. In the case of this suspended load, a conveying speed of, for example, about 150 m/min can be achieved. Each of the rail sections **1** can be about 4 to 5 m. long. As an operating voltage, a three-phase current of, for example, 3×42 V is preferred with a view to the safety that is to be provided, whereby the driving motor has a rated capacity of about 150 Watts. A safety switch **25** operated by the spring bumpers **24** is disposed on the suspension rod **23**, which upon running into an obstacle or into the bumper of another conveyor cart, will switch off driving motor **14**.

In FIG. **2**, a three-phase voltage source is schematically indicated by numeral **50**, the frequency of which is continuously adjustable, by means of a control lever **51**, between 25 Hz. and 100Hz. The voltage source **50** is connected by wires **52** to the individual conductor rails **8**. In this manner it is possible to double the travel speed of a conveyor carriage along a particular section of the track forming the conveyor installation by changing the frequency of the voltage source **50** from about 50 Hz. to 100 Hz. A reduction of the frequency in a certain section of the track will result, along that section, to a corresponding decrease in the travel speed.

According to a further development of the invention as shown in FIG. **3**, the wheels **3** disposed on the drive assemblies **4** have wheel rims **26** made of a silently and elastically running raw material, such as rubber, etc. The lower sections **27** of the two sides of the hollow rail **1** each run slantingly inwardly and they cooperate with an annular guide bead **28** provided concentrically with reference to the axle of the wheel **3** with the aid of which bead the wheels are guided slidingly along the inside of the hollow rails **1** preferably lined likewise with some synthetic substance. Guide bead **28** is connected with rim **29** of wheel **3** or it can be made with said rim in one piece. Bead **28** may consist of a synthetic substance with a low friction coefficient, such as polyamide.

The conveyor carts of the overhead installation according to the invention, easily can overcome a gradient of up to 4 percent with a load of about 150 kg and a speed of about 150 m/min. For higher gradients up to 36 percent, an auxiliary drive motor can be provided on the drive assembly which likewise is completely covered up by the hollow rail sections.

I claim:

1. Overhead conveyor installation for transporting a plurality of individual carts, comprising a series of hollow rail sections having a generally inverted U-shaped cross-section to be suspended from overhead supports, and a plurality of drive assemblies including means to suspend a cart therefrom, each of said drive assemblies being confined within said hollow rail sections in load-bearing rolling engagement with the interior thereof, said drive assemblies including a pair of load-supporting wheels for rolling engagement with respective opposite lower interior surfaces of the hollow rail sections, the rolling surfaces of said wheels comprising a silently running composition, said wheels also including an annular bead comprising a material of low coefficient of friction for guiding contact with the respective inner sides of the hollow rail sections, at least one drive assembly for each cart including electric motor drive means completely enclosed within said hollow rail sections to propel said one assembly, and means to supply electrical energy to each of said electric motor drive means from a source of electricity.

2. The invention defined in claim **1**, wherein said means to supply electrical energy includes an electrically conductive rail extending along the interior of, and enclosed by, said hollow rail sections.

3. The invention defined in claim **2**, wherein said electrically conductive rail is disposed at the uppermost portion of the hollow rail sections.

4. The invention defined in claim **1**, wherein the electric motor drive means includes a three-phase motor capable of operation from electrical energy supplied at a plurality of different frequencies.

5. The invention defined in claim **4**, wherein said means to supply electrical energy includes common conductor means to supply three-phase electrical power at a plurality of frequencies to a plurality of electric motor drive means, each of said electric motor drive means being connected with only a single cart, each of said electric motor means being operably responsive to only one of said plurality of frequencies.

6. The invention defined in claim 1, wherein said means to suspend a cart includes two pivotally connected elements, one of said two elements being supported by said pair of wheels to position the axis of said pivotal connection at right angles to the axis of said wheels and in alignment with the horizontal plane of said lower interior surfaces.

7. The invention defined in claim 1, wherein said material of low coefficient of friction includes polyamide.

8. The invention defined in claim 1, wherein the rolling surfaces and the annular bead of said wheels is integrally formed of a silently running composition having a low coefficient of friction.

* * * * *