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[54] **MATERIAL HANDLING OR TRANSFER EQUIPMENT**

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[52] **U.S. Cl.** **115/7**

[51] **Int. Cl.** **B63b 21/56**

[58] **Field of Search** 115/7, 8; 104/71, 72, 165, 104/166, 168; 272/32

[56] **References Cited**

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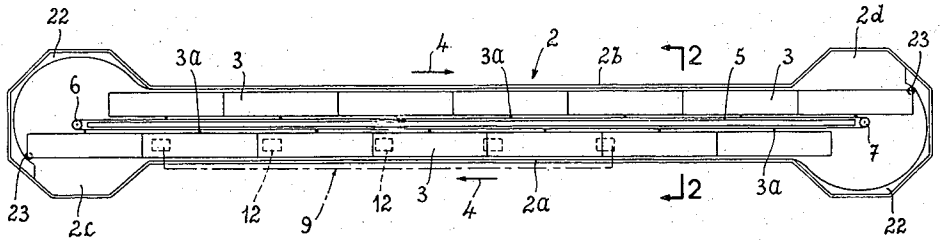
[57] **ABSTRACT**

For eliminating the exposure of an endless cable cooperating with an endless waterway to abnormal tractive efforts in transfer or handling apparatus of the type comprising a plurality of floating carriers traveling in end-to-end relationship in said waterway, a longitudinal member is secured to the bottom of each floating carrier to co-act with a power drive for propelling the floating carriers. Along the path of the longitudinal members and registering with each working station likely to exert a substantial retaining effort on said carriers is provided at least one power drive capable of co-acting with the longitudinal member of each floating carrier for moving same forwards to thus relieve the associated cable.

9 Claims, 5 Drawing Figures



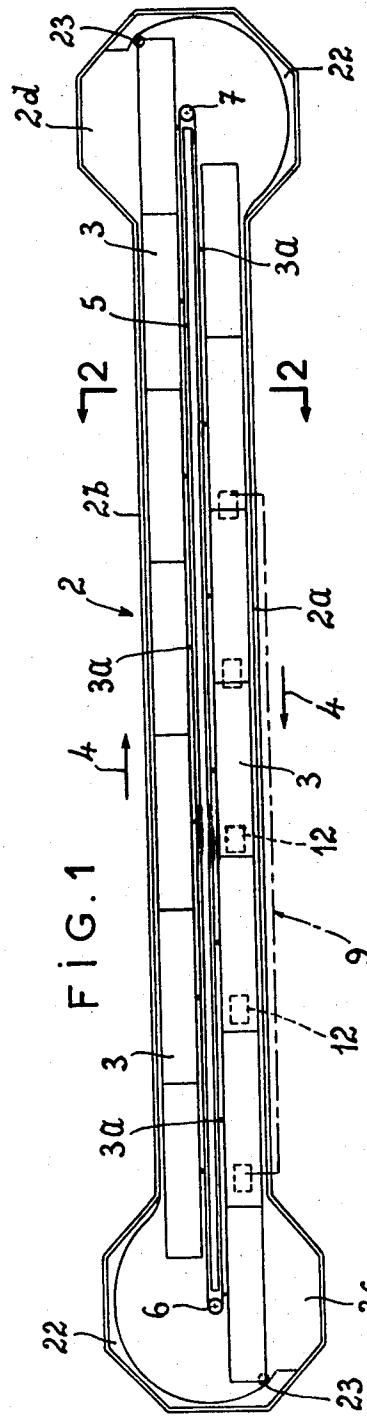


FIG. 1

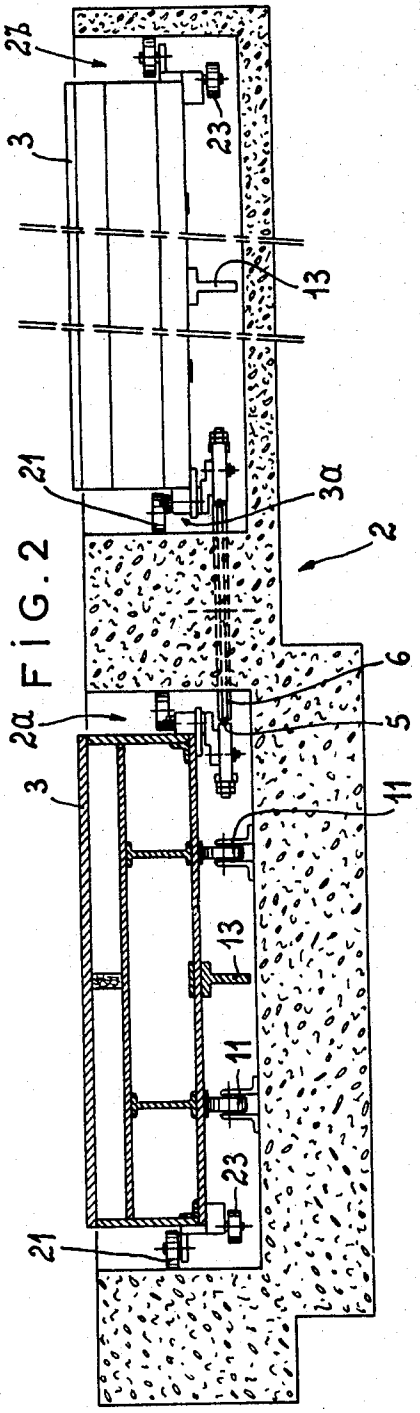


FIG. 2

FIG. 3

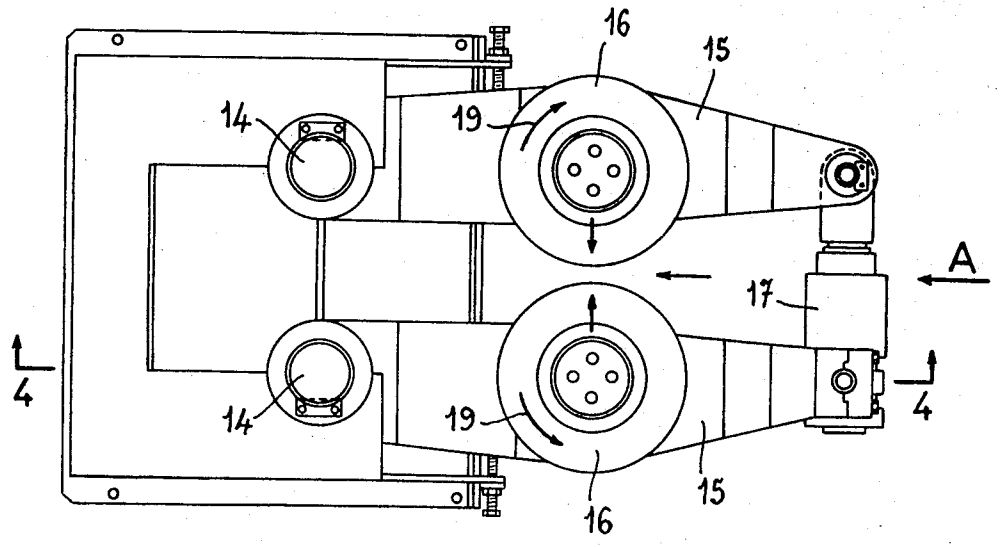


FIG. 4

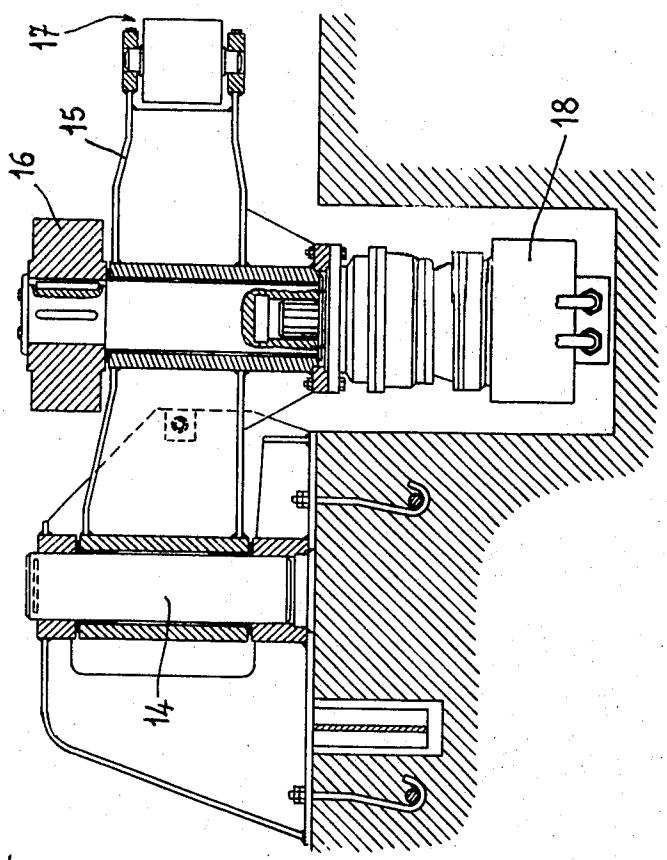
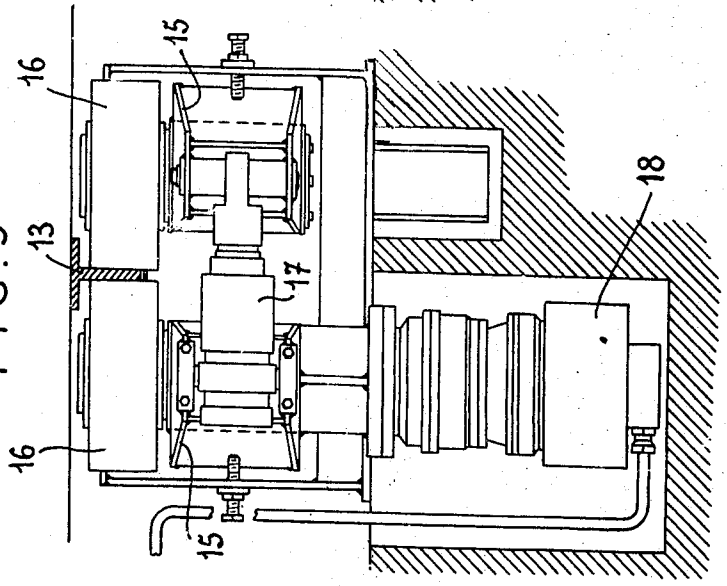


FIG. 5



MATERIAL HANDLING OR TRANSFER EQUIPMENT

BACKGROUND

1. Field of the Invention

The present invention relates to transfer or handling apparatus in general, and more particularly to apparatus of the type comprising essentially an endless waterway and a plurality of floating carriers or platforms each connected at at least one point to an endless cable or rope tensioned on grooved and driving pulleys in such a manner as to follow the path of said waterway.

2. Prior Art

In the above-indicated type of transfer or handling apparatus, the floating carriers or platforms are driven by at least one pulley which is operatively connected to a source of power. An installation of this type is described in Fr. Brev. No. 72 26 993 of 21 July, 1972.

When one or a plurality of the working stations through which the carriers are caused to pass exert a relatively high retaining effort on one or a plurality of said carriers, a very high tractive effort is exerted on the cable or rope, so that the latter must have a considerable thickness.

On the other hand, in certain known constructions, the carriers must remain in end-to-end contact at least along the straight sections of the waterway, so as to constitute a substantially continuous unitary platform. In this case, the cable must have a coefficient of elasticity sufficient to withstand variations in length of the carriers which are due to thermal expansion. Obviously, a high coefficient of elasticity is inconsistent with a proper transmission of relatively high tractive efforts.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to avoid the afore-noted inconvenience by providing, in transfer or handling equipment of the type broadly set forth hereinabove, on the one hand, a longitudinal member secured to each floating carrier and adapted to co-act with power means for propelling the floating carrier concerned and, on the other hand, on the path of said longitudinal members and registering with each working station likely to exert a substantial retaining effort on the carriers at least one power means capable of co-acting with the longitudinal member of each floating carrier for advancing the same.

Thus, the forces necessary for propelling or advancing the carriers in the areas or sections of the waterway where they are exposed to substantial retaining efforst are not transmitted to and through the cable which pulls the carriers only when they float substantially freely on the waterway.

Preferably, the number of power means for driving or pulling the floating carriers is such that any carrier subjected to a retaining force is also subjected to the action of a power means, the distance between any pair of successive power means being smaller than the length of said longitudinal member with which they co-act for advancing the floating carriers.

According to a simple form a embodiment of this invention, each longitudinal member associated with a floating carrier is attached to the lower face of this carrier and the power means are disposed on the bottom of the waterway, each longutidinal member of a floating carrier being attached to the lower face of said carrier so as to engage successively each driving power means during its travel.

Advantageously, each aforesaid longitudinal member consists of a section member having a flat web disposed vertically and each power means consists of a pair of rollers having vertical axes and pressed against each other so that their generatrices in mutual contact lie on the path of the vertical web of said section member, at least one of said rollers being a driving roller.

According to a specific embodiment of this invention, the two rollers of each pair are carried by two arms pivoted to two vertical axes and having their free ends interconnected by members adapted to normally hold them at a predetermined relative spacing slightly less than the thickness of the web of said longitudinal section member of each floating carrier and generating an elastic return force when said spacing is increased, for instance, by the passage of the web of one of said section members between the two rollers.

Advantageously, the endless cable interconnecting all the floating carriers is attached to each carrier at a lateral point located on the carrier side registering with said cable driving pulleys, and each floating carrier is equipped, at least on the opposite side, with at least two guide rollers adapted to react against the registering wall of said waterway. Thus, the pivoting torque created by the particular way of securing the cable to each floating carrier is neutralized by the bearing engagement between said rollers and the wall of the waterway which is opposite the wall adjacent said cable.

In case the waterway consists of two parallel rectilinear sections interconnected by two end pools, there is provided, according to another feature characterizing this invention and in order to facilitate the pivoting of said floating carriers in said end pools, on the one hand, a roller having a vertical axis which is secured to the lower face of each floating carrier and, on the other hand, a shoulder located in the bottom of each end pool and acting with respect to said last-named roller as a cam member capable of causing the pivotal movement of each carrier independently of the endless cable driving wheel, so as to free the front end of the next carrier.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawings:

FIG. **1** is a diagrammatic plane view from above showing the general structure of a typical embodiment of this invention, given by way of example;

FIG. **2** is a cross-section on enlarged scale along line **2—2** of FIG. **1**;

FIG. **3** is another plane view from above, also on enlarged scale, showing in detail the means for driving the floating carriers;

FIG. **4** is a section taken along line **4—4** of FIG. **3**; and

FIG. **5** is an end view taken in the direction of arrow A of FIG. **3**.

DETAILED DESCRIPTION

The transfer system of the invention comprises essentially a waterway **2** and a plurality (fourteen in the example illustrated) of floating carriers or platforms **3**.

The waterway **2** comprises two rectilinear sections **2***a* and **2***b* disposed as a function of the alignment of the

various stations of the production line with which this system is associated. The sections 2*a* and 2*b* are interconnected at their ends by pools 2*c* and 2*d*. To facilitate their construction, these pools 2*c* and 2*d* have in plane view a polygonal configuration. In this waterway, the floating carriers 3 travel in the direction of the arrows 4.

All the carriers 3 are connected at a lateral point 3*a* located centrally of the side corresponding to the inner "bank" of the waterway 2 to an endless cable 5 tensioned between two pulleys 6 and 7 having vertical axes and disposed substantially centrally of the respective pools 2*c* and 2*d*.

The points 3*a* whereat the floating carriers 3 are attached to the endless cable 5 are disposed at a relative spacing corresponding to the length of a carrier so that both rectilinear sections 2*a* and 2*b* of waterway 2 the front and rear ends of the successive carriers are in mutual contact.

Due to the retaining efforts likely to be exerted on the floating carriers 3 during their passage through one or a plurality of the stations provided along the manufacturing line of the system, the cable 5 is not tractive and neither of the pulleys 6 and 7 acts as a driving pulley. In fact, as already mentioned, the front and rear ends of carriers 3 are constantly in edge-to-edge relation along the rectilinear sections 2*a* and 2*b* of the waterway so as to constitute a single, unitary platform along each sections 2*a* and 2*b*.

However, changes are likely to occur in the lengths of these carriers 3, for instance, on account of temperature variations, and the cable 5 must have a coefficient of expansion high enough to absorb these variations in the longitudinal dimensions of the carriers 3. However, such high coefficient of expansion has hitherto prevented the use of a cable 5 for driving the carriers 3 when a retaining effort is exerted on these carriers.

In the system of this invention, the carriers 3 are driven at as many points as required so that all the carriers submitted to a retaining effort will not be driven by the cable 5.

In the example illustrated in the drawing, the dash and dot lines 9 designate the station located on section 2*a* of the waterway and along which the carriers 3 undergo a retaining effort. This station may, for instance, correspond to a roller-type press incorporated in a production line for making sandwich-type isothermal panels. In this case, the floating carriers 3 are submitted to a vertical effort in the downward direction and retained in the horizontal plane (which is their normal direction of travel) by rollers 11 having horizontal axes which are carried by the bottom of the waterway 2, as shown in FIG. 2.

In this example, the station 9 covers a length corresponding substantially to four carrier lengths. To this end, five stationary driving systems 12 adapted drivingly to engage a section member 13 secured longitudinally to the lower face of each floating carrier are provided. To prevent a reaction torque from developing, each section member 13 is secured along the median plane or center line of the corresponding carrier 3 and, according to a simple embodiment of this invention, this section member 13 has a T-shaped cross-sectional contour with its web disposed vertically so that it can be engaged by each driving system 12.

FIGS. 3 to 5 inclusive illustrate on enlarged scale one of the driving systems 12 associated with each floating carrier 3. Basically, each system 12 comprises a pair of vertical transversely aligned pivot pins 14 secured to the bottom of the waterway 2. Each pivot pin 14 has fulcrumed thereon a horizontal lever 15 carrying a roller 16 having a vertical axis. Both levers 15 are interconnected at their free ends located beyond the rollers 16 by a ram 17 urging them toward each other, i.e., tending to move the rollers 16 together for mutual engagement. The minimum value of the gap left between the rollers 16 is set to be lower than the thickness of the web of said section members 13, and the levers 15 with their pivot pins 14 are so disposed that this gap be centered in relation to the longitudinal center line of the waterway section 2*a* in which they are immersed.

It is therefore clear that, each time a floating carrier of platform section 3 moves past the station 9, the web of the section member 13 associated therewith engages in succession the gap left between the rollers 16 of each station 12 disposed at spaced intervals along said waterway section 2*a*.

On the other hand, a hydraulic motor 18 is drivingly connected to each roller 16 of the pair so as to rotate the same in the same direction of the arrow 19 whereby when the web of one of said section members 13 engages the gap formed between the two rollers 16, this section member and consequently the carrier 3 associated therewith are driven in the direction of the arrow 4 (FIG. 1). As can be seen from FIG. 1, the cable 5 applies a tractive effort only to those floating carriers 3 to which no retaining effort is applied, the tractive effort transmitted to these carriers being produced only from the firve driving systems 12.

As also shown in FIG. 2, the carriers 3 are guided along each rectilinear section 2*a* and 2*b* of waterway 2 by lateral rollers 21 having vertical axes and capable of neutralizing pivoting torques possibly transmitted via the cable 5 or through any other force generated from one of the stations of the production line.

Finally, as will be readily understood, in each pool 2*c* or 2*d* the floating carriers 3 must make a complete halfturn (180°). However, if no means were provided to facilitate this pivoting movement, during this movement, which corresponds to a 180° rotation of a pulley 6 or 7, each floating carrier 3 would interfere with the forward movement of the following carrier. To cope with this difficulty, a shoulder 22 acting as a pivoting cam is provided in the bottom of each end pool 2*c* or 2*d*, this cam-forming shoulder 22 being engaged by a roller 23 having a vertical axis, which is level with said shoulder 22 and projects from the bottom of carrier 3. This roller 23 is located at the outer end of the front edge of each carrier 3, i.e., on the side of the outer bank of waterway 2.

As clearly shown in FIG. 1, the contour of this cam 22 is so designed that each carrier 3 is caused to pivot about itself before its cable connection 3*a* reaches the corresponding pulley 6 or 7.

With this structure, it is clear that, when the cable connecting point 3*a* engages the corresponding pulley 6 or 7, the rear edge of the carrier 3 concerned is properly retracted in relation to the front edge of the next carrier 3, so that it cannot interfere with the normal travel thereof.

It will now readily occur to those conversant with the art that this invention should not be construed as being strictly limited to the typical and exemplary embodiment described hereinabove and illustrated in the at-

tached drawings, since various modifications may be brought thereto without departing from the basic principles of the invention as set forth in the appended claims.

What is claimed is:

1. In apparatus including a waterway, a plurality of serially arranged floating carriers in said waterway, a cable extending along said waterway and connected to said carriers to move the latter along the waterway, and working stations along the waterway at which retaining influences may be exerted on the movement of said carriers, an improvement comprising longitudinal members on respective of said carriers independently of said cable and extending along said waterway at least at said stations and driving means at said stations for acting on the longitudinal members to advance the carrier along the waterway whereby to avoid transmitting said retaining influences to said cable.

2. The improvement claimed in claim 1 wherein said members are of at least substantially similar length and said driving means include sequential power means spaced apart by less than said length.

3. The improvement claimed in claim 2 wherein the said members are attached in depending relationship to said carriers.

4. In apparatus including a waterway, a plurality of serially arranged floating carriers in said waterway, a cable extending along said waterway and connected to said carriers to move the latter along the waterway, and working stations along the waterway at which retaining influences may be exerted on the movement of said carriers, an improvement comprising longitudinal members on respective of said carriers and extending along said waterway at least at said stations and driving means at said stations for acting on the longitudinal members to advance the carriers along the waterway whereby to avoid transmitting said retaining influences to said cable, said members being of at least substantially similar length and said driving means including sequental power means spaced apart by less than said length, the said members being attached in depending relationship to said carriers, the said members each including vertical webs, said power means including pairs of rollers with vertical axes of rotation straddling said webs.

5. The improvement claimed in claim 4 wherein said power means further comprise vertical pins, levers on said pins and including free ends, and means adjustably connecting said free ends to urge the rollers against said webs.

6. The improvement claimed in claim 4 for use with a waterway having side walls, said improvement further comprising at least one roller on each carrier for engaging one of said walls.

7. The improvement claimed in claim 4 for use with a waterway of endless construction including parallel paths connected by end pools for effecting turns of 180°, said cable being of endless form and being supported on pulleys adjacent said pools, said improvement comprising rollers depending from said carriers and shoulder means in the pools to perform a camming function on the latter said rollers to pivot the carriers independently of the movement of the cable around the pulleys.

8. The improvement claimed in claim 4 wherein the power means includes means to drive at least one roller of each pair.

9. The improvement claimed in claim 5 comprising means to retain the carriers in at least generally horizontal attitude.

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