April 21, 1964 S. ROHRBACH 3,129,826

ELEVATORS FOR ARTICLES

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FIG. 1

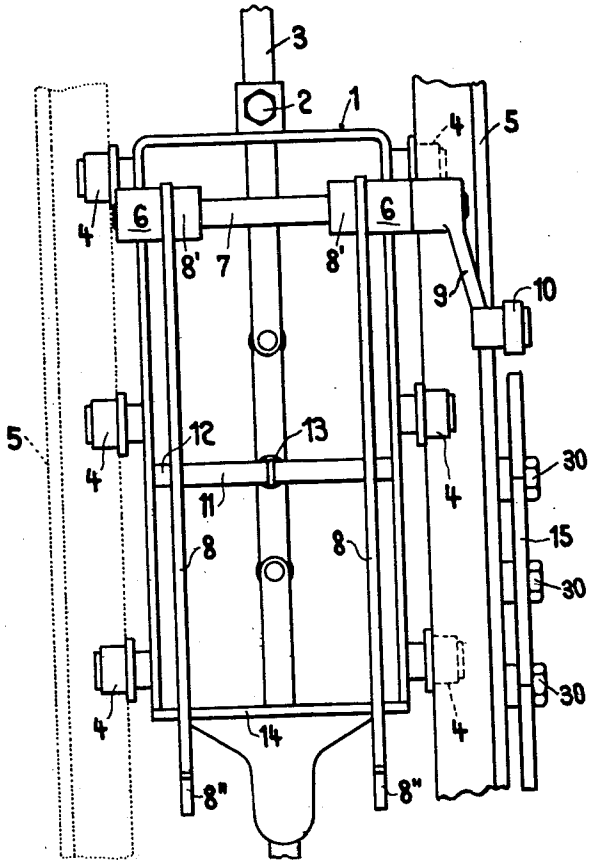
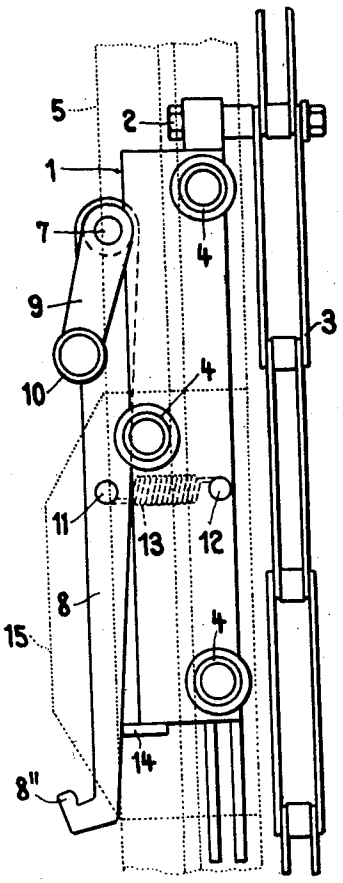


FIG. 2



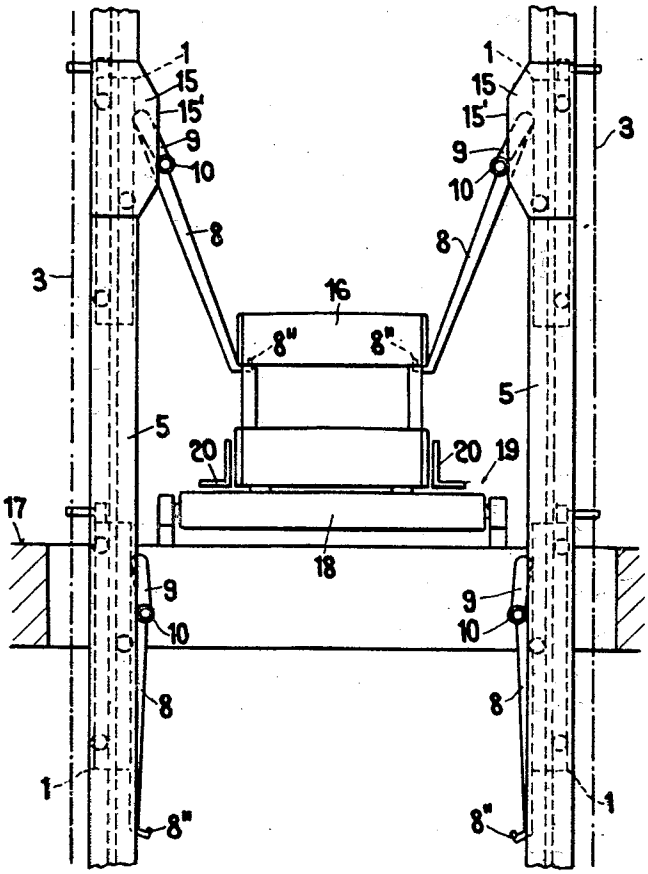
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FIG. 3



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ELEVATORS FOR ARTICLES

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FIG. 4

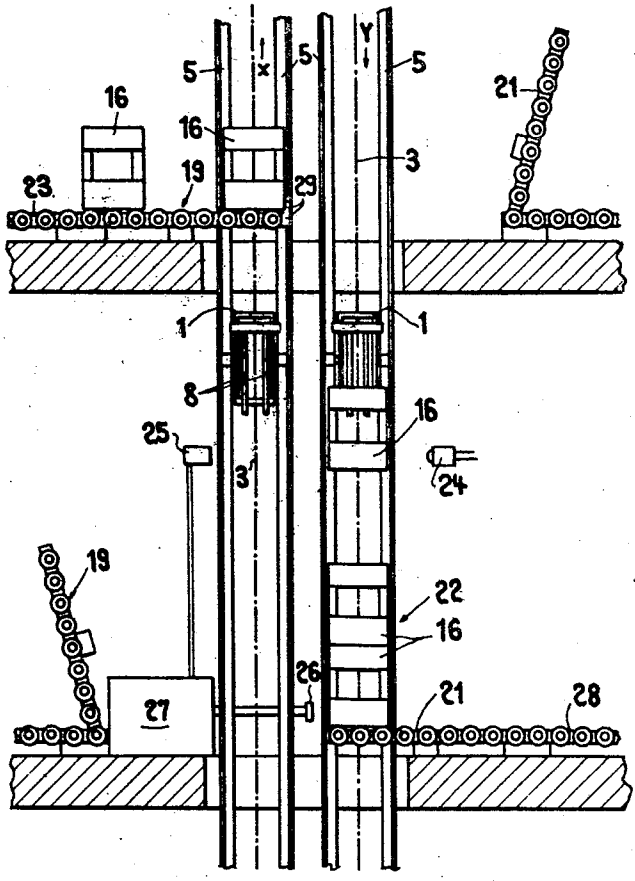
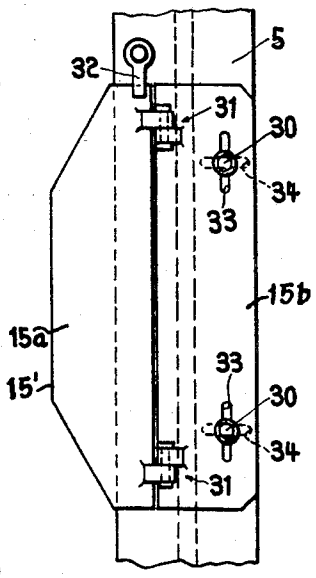


FIG. 5



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ELEVATORS FOR ARTICLES

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2 Claims. (Cl. 214—6)

This invention relates to elevators for conveying and piling articles, such as crates, boxes and the like, which elevators comprise endless flexible drive means, such as endless chains or the like, provided with carrying pendulums guided in guide means, such as guide rails or the like.

In prior elevators of this kind the carrying pendulums have adjustable guide means for the pieces or articles to be transported, horizontally adjustable carrying legs being mounted on said guide means in such a way that, in one end position, the carrying legs project into the conveying track for the pieces to be transported. Feeler members movable with the chains also project into said track and are provided so that, on their striking against stops arranged in the conveying track, they move the carrying legs out of the conveying track in order to deposit the transported pieces. Since the carrying legs which project in the one end position into the conveying track are held by spring action in said position, every transported piece lying in the conveying track is lifted from below by the carrying legs of the carrying pendulums articulated to the ascending chain strands. Therefore, if, for instance, in a four story building boxes are to be transported from the second to the third floor, the carrying pendulum lifts the box resting on an inlet grate of the second floor, transports the box upwards through the third and the fourth floor and, after having passed the upper chain return wheels, downwards through the fourth floor and deposits same on an outlet grate of the third floor. It will thus be understood that within the range of the ascending chain strands all the inlet grates from the ground floor to the second floor must be free from boxes. Otherwise these boxes would be transported upwards in an undesired manner resulting in service trouble.

Besides the above inconveniences the prior elevators show the further disadvantage that the carrying legs and feeler members, due to their interdependence as to position, demand a degree of precision which requires a very time-consuming and expensive manufacture and which cannot be maintained for a long time because the service of the elevator installations in question is very rude so that even after a relatively short service time troubles occur.

The above-described inconveniences are done away with by the invention in a satisfying manner. The elevator according to the invention is characterised in that spring-loaded grabs carrying feeler rollers cooperate with stationary cams and are articulated on the carrying pendulums in such a way that the grabs, as the feeler rollers engage the cams, are swung against the spring force into the conveying track and, after having engaged a piece from below, remain in this effective position due to the weight of the lifted article being transported until the article is put on a base such as, for instance, on top of a pile, whereupon the grabs under the effect of the spring force snap back to their ineffective initial position.

The grabs may constitute double levers, with the feeler rollers being mounted on the shorter arms of these levers.

The cams may be constituted by edge faces of plates preferably removably-mounted on the guide rails or other stationary parts.

If desired, these plates may be vertically and/or laterally adjustable. For instance, for this purpose the plates and guide rails are provided with slots or other oblong holes, whereby oblong holes of the plates extend obliquely or transversely to the oblong holes of the guide rails.

A counter, for instance, controlled by a photoelectric cell, may be provided at the piling place, whereby said counter controls a device for removing the pile from the conveying track as soon as a predetermined number of articles has been stacked.

Instead of providing a counter, the base at the piling place may be constituted as a weighing device which, when a predetermined pile weight has been reached, controls a device for removing the pile from the conveying track. The device for removing the pile may be formed as a pressure piston to push the pile out of the conveying track.

Other features will be apparent from the following description and the drawings.

The invention does not only result in the great advantage that inlet grates and boxes or other articles put thereon, when within reach of the ascending chain strands in stories below the loading place, do not hinder the service in any way, but also in the other advantage that the means controlling the grabs are not susceptible to trouble because of their simple structure. Finally, due to its various adjusting possibilities the installation can be used for conveying and piling pieces of the most different dimensions.

The drawings schematically illustrate by way of example a chain elevator according to the invention.

FIG. 1 is a front view of a carrying pendulum of the elevator;

FIG. 2 is a side view of said carrying pendulum;

FIG. 3 is a partial view of the elevator in reach of the ascending strands of the chains of the elevator;

FIG. 4 is a partial view extending over two stories of the complete conveying installation; and

FIG. 5 is an enlarged detail of FIG. 3 and illustrates the control mechanism of a carrying pendulum.

Referring now to FIGS. 1 and 2, the carrying pendulum or member **1** of the elevator is pendulously or swingingly suspended on the elevator chain **3** in a manner known per se by means of a screw bolt **2** and is guided in T-type guide-rails **5** by means of guide rollers **4** provided on the pendulum **1**. Near the upper end of the carrying pendulum **1** there are two bearing bushings **6** welded to the pendulum frame to receive a shaft **7** whose axis is horizontal and parallel to the swinging plane of the carrying pendulum **1**. To the shaft **7** and between the bushings **6** there are keyed grabs or grippers **8** with hubs **8'**, and an arm **9** is also keyed to the shaft **7**. The free end of said arm **9** carries a feeler roller **10**. The grabs **8** are rigidly connected together by means of a rod **11**. At the same level and parallel to the rod **11** there is fixed a pin **12** to the pendulum frame. A tension spring **13** is attached to **11** and **12** in such a way that the free ends of the grabs **8** are pulled against a lower rod **14** of the pendulum frame **1**. In this inactive position the grabs **8** are out of the conveying track of the pieces to be transported. In the present example, the free ends of the grabs **8** are equipped with hooks **8''** whose purpose will be described later on. The pair of grabs **8** rigidly connected with the arm **9** form together with the latter a double lever, the feeler roller **10** being mounted on the shorter arm of this double lever.

Referring to FIG. 3, the cooperation of the above-mentioned parts of the elevator will now be explained. FIG. 3 illustrates a portion of the installation along the ascending strands of the elevator chains **3** with a pair of carrying pendulums **1** in two different positions, and the guide rails **5**. At a certain level above the floor **17** plates **15** are

fixed to the guide rails **5**. Each of the plates **15** has an edge **15'** which is formed to act as a cam. An article **16** which is to be transported, for instance, a crate, rests on an inlet grate **19** arranged immediately above the floor **17** and constituted by rotatably connected rollers **18**. Two adjustable bars **20** of L-shaped cross-section serve for lateral guidance of articles **16**. As can be seen from the lower portion of FIG. 3, the pull of the spring **13** (FIG. 2) holds the lower pair of grabs **8** out of the conveying track. The grabs **8** are in their outward or inoperative position as long as the carrying pendulums **1** which are moved upwards by the chains **3** are not in reach of the plates **15**. However, on continued upward movement of the carrying pendulums **1** and when the feeler rollers **10** run over the cams **15'** of the plates **15** the grabs **8** are swung inwardly into their inward or operative positions and thus into the conveying track of the articles being transported, and the hooks **8''** of the grabs **8** engage the article on the inlet grate **19** from below. When the article has been lifted by the grabs **8**, the tension spring **13** (FIG. 2) will no longer be able to swing the grabs **8** out of the conveying track even though the feeler rollers **10** on further upward movement disengage the cams **15'** since there is a safe connection between the hooks **8''** of the grabs **8** and the parts of the lifted piece **16** engaged by the hooks **8''**, which connection can only be interrupted when the piece **16** is deposited on a support, such as, for instance, the uppermost piece of a pile **22** (FIG. 4) placed on an outlet grate **21**, whereupon the grabs **8** under the action of the spring **13** snap back to their initial or inoperative position. From the above it will be understood that the chain elevator according to the invention can be used not only for transporting but also for piling articles.

FIG. 4 schematically illustrates an elevator portion extending over two stories. This installation is designed in such a way that the pieces **16** to be transported are conveyed from the upper to the lower story where they are stacked and afterwards transported to another place on the same floor. On the upper floor an inlet grate **19** forming the end of a well-known roller conveyer **23** is swung into the conveying track of the ascending portion of the chain elevator. The articles **16** coming from the roller conveyor **23** arrive on the inlet grate **19** and are stopped at the free end of the grate by stopping means **29**. As soon as the two feeler rollers **10** (FIG. 3) of the next carrying pendulum **1** suspended from the chain strands moving in the direction of the arrow *x* arrive at the plates **15** provided in the upper story, the cams **15'** swing the grabs **8**, which were hitherto out of the conveying track into said track so that the grabs **8** engage the piece **16** deposited on the inlet grate **19** in the manner described above and convey it in the direction of the arrow *x*. After having passed the upper chain return wheels (not shown) the article moves on in the direction of the arrow *y*. On this downward motion the piece **16** passes freely the upper story since the outlet grate **21** on this story is swung upwards and, therefore, lies outside the travel path of the piece **16**. As soon as, on continued downward movement, the piece **16** strikes upon the uppermost article of the pile **22** stacked on the outlet grate **21** of the lower story the above referred to safe connection between the hooks **8''** (FIG. 3) and the engaged lower parts of the piece **16** is undone, so that the grabs **8** release the transported piece in the above-described manner and snap back to the inoperative position under the action of their spring. The now empty carrying pendulum **1** continues its downward motion, passes the lower chain return wheels (not shown) and moves afterwards again up in the direction of the arrow *x*. It will be clear that the descending article **16**, rather than striking upon a stack or articles on the lower floor, may strike directly against the outlet grate **21** which is shown to be swung into the traveling path of the articles being transported.

In order that the pile **22** on the outlet grate **21** of the lower floor will not exceed a predetermined height

and will be removed as soon as said height is reached, there is provided a counter comprising a luminous source **24** and a photoelectric cell **25** (FIG. 4), which counter controls a device **27** provided with a pressure piston **26** for removing the pile **22**. When the transported piece **16** passes through the optical axis of the counter the light ray thrown from the light source **24** onto the photoelectric cell **25** is interrupted. The impulse occurring thereby and which, if desired, may be amplified operates a stepping mechanism which, after a predetermined number of control operations, releases the operating mechanism of the pressure piston **26**. The piston **26** moves the pile **22** out of the conveying track onto the roller conveyer **28** and, afterwards, returns to its initial position. The pile on the roller conveyer **28** is now moved on manually or automatically.

The elevator according to the invention offers the great advantage that, contrary to prior elevators, articles within the conveying path are taken along on those floors where plates **15** with cams **15'** are provided. With no plates **15** and no cams **15'** on a floor it is thus possible to have an inlet or outlet grate extend into the conveying path on such a floor without effecting the operation of the elevator. On such a floor even unloading or loading may take place during the operation of the elevator. This is due to the fact that in places where plates **15** with cams **15'** are lacking the grabs **8** remain outside the conveying track and, therefore, perform no grabbing action. If, for example, pieces are to be transported from the third to the fourth floor, all the roller conveyers extending into or crossing the elevator shaft below the third floor can, due to the invention, be used without obstructing the conveying service as long as there are no plates **15** and cam surfaces **15'** on the lower floors. Therefore, it is most advantageous to mount the plates **15** removably, for instance, by means of screws **30** (FIG. 1), on the guide rails **5** or on any other stationary part. It is also possible to make the plates in form of two hinged sections **15***a*, **15***b* (see FIG. 5) so that the cam-bearing section **15***a* may be swung out of its operative position which is shown into its inoperative position. In FIG. 5, hinges are designated **31**. A clamp **32** is used to secure the section **15***a* in the operative position. The movement from the operative into the inoperative position may thus be effected without loosening a screw.

Removable, i.e., exchangeable control plates **15** offer the further advantage that plates with different kinds of cam faces can be used in order to obtain different motions of the grabs. In this way, strokes may be provided so as to grab narrower or wider articles, or the grabbing action may be advanced or delayed to have the grabs seize the articles on a different level. The action of the cams may to a certain degree be influenced by mounting the plates on their base, e.g., on the guide rails, to be vertically and/or laterally adjustable, for instance, by providing slots or other holes in the plates and guide rails (FIG. 5) which holes may intersect each other in any way. In FIG. 5, the holes **33** in the plate section **15***b* and the holes **34** in the rail **5** are shown to intersect each other rectangularly.

Of course, the plates may be mounted exchangeably or removably on the guide rails in any other manner known per se, such as, for instance, by means of a plug connection, by means of a bolt with an annular disc and a split-pin, by means of a dovetail-guide secured by a tapered pin or the like.

Another considerable advantage of the elevator according to the invention consists in its insensibility to rude service handling, which is due to the fact that only the cams require a certain precision while the remaining parts do not require a high manufacturing and service accuracy. The cams, in addition, are easily replaceable without long service interruptions and without high costs.

It is understood that the invention is not restricted to the embodiment as shown and described. Various modi-

fications are possible without exceeding the scope of the invention. Instead of the light source and the photo-electric cell another counter, such as for instance a mechanical impulse generator may be used. A counter could even be dispensed with and, in place thereof, the base of the piling place could constitute a weighing device controlling the device for removing the pile from the conveying track as soon as a determined weight of the pile is reached. The pressure piston of the removing device may be driven mechanically, pneumatically, hydraulically or electrically.

It also lies within the scope of the invention to replace the above-described positive connection between the grab ends and the parts of the engaged piece to be transported by a non-positive connection. Such a non-positive connection could, for instance, be obtained by giving the free ends of the grabs the shape of horizontal plates or straps and to provide their upper surface, on which the transported piece is supported, with sharp points or talons. On lifting the piece to be transported, these points or talons penetrate the material on the underside of the piece such as, for instance, a wooden box and due to the weight of the box cling to it very firmly so that the non-positive connection established thereby is greater than the spring force acting onto the grabs so that a safe transport of the box is guaranteed. This non-positive connection is only released when the box comes to bear on a base so that the grabs can again move back to their ineffective initial position.

I claim:

1. An elevator comprising

(1) a pair of spaced endless chains supported to move in parallel planes,

(2) stationary guide rails,

(3) pairs of opposite carrying members spacedly secured to said chains for swinging movements parallel to said planes,

(4) a shaft rotatably fixed to each of said members to extend parallel to said planes,

(5) pairs of opposite cam means spacedly supported by said guide rails,

(6) at least a single unit of grabbing means for each of said members,

(*a*) said unit of grabbing means being constituted by two grabbing arms and a third arm, said grabbing arms and said third arm forming a two-armed lever, said lever being keyed to said shaft to pivot thereabout for lateral movements from an outward or inoperative and nonobstructing position to an inward or operative position, and vice versa,

(*b*) said pairs of cam means being formed to cause said grabbing means to carrying out lateral swinging movements from said outward into said inward position,

(7) feeler means provided at the free end of said third arm to recurrently cooperate with said pairs of cam means, and

(8) resilient tension means connecting said members and grabbing means and normally urging said grabbing means into said outward position.

2. In the elevator according to claim 1, each unit of said pairs of cam means consisting of two hinged-together sections, one of said sections being secured to said guide rails, the other section being provided with a cam face.

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