UNITED STATES PATENT OFFICE.

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CONVEYING APPARATUS FOR ANNEALING FURNACES AND THE LIKE.


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To all whom it may concern:

Be it known that we, GUSTAV W. LANGE and GUSTAV M. LANGE, citizens of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Conveying Apparatus for Annealing Furnaces and the like, of which the following is a specification.

1. This invention relates generally to a conveying apparatus and more particularly to an apparatus for conveying cars into and out of annealing furnaces and the like.

2. Its chief object is to provide an improved conveying apparatus which permits of quick handling of the cars and which is so constructed as to afford maximum safety to workmen.

3. Another object of the invention is to provide reliable means for automatically releasing the cars from the propelling mechanism of the apparatus.

In the accompanying drawings:

4. Figure 1 is a plan view of the apparatus embodying the invention. Figure 2 is a side view thereof. Figure 3 is an enlarged fragmentary plan view of the propelling mechanism. Figure 4 is a vertical transverse section on line 4—4, Fig. 3. Figure 5 is a vertical longitudinal section on line 5—5, Fig. 3. Figures 6 and 7 are enlarged transverse sections on the correspondingly numbered lines in Fig. 1. Figures 8 and 9 are enlarged longitudinal sections on the correspondingly numbered lines in Fig. 1. Figure 10 is an enlarged sectional elevation of one of the cars showing its coupling member and the means for releasing the same from the propelling chain. Figure 11 is a front view of the car in position on the track. Figure 12 is an enlarged vertical transverse section on line 12—12, Fig. 10. Figure 13 is a detached front view of the coupling bolt. Figure 14 is a perspective view of the double-ended trip device. Figure 15 is a similar view of the single-ended trip device.

5. Similar characters of reference refer to like parts throughout the several views.

6. By way of example, this improved conveying apparatus has been shown in connection with an annealing furnace 15 to and from which cars are conveyed carrying material to be annealed. The furnace may be of any suitable and well-known construction; that shown in Figs. 1 and 2 being provided on one side thereof with a heating or annealing chamber 16 and a cooling chamber 17 arranged side by side lengthwise of said furnace, and on its opposite side with a preheating chamber 18 transversely in line and in communication with said cooling chamber. When there is a car located in each of the above mentioned chambers, the material in the chamber 16 is undergoing heat treatment, while the material in the neighboring chamber 17 is being cooled, the heat radiating from the latter being transmitted to the material in the preheating chamber 18. Figure 20 represents a main fire-track of usual construction extending lengthwise through the chambers 16 and 17 and terminating a suitable distance beyond the front and rear ends of the furnace, as shown in Figs. 1 and 2. Parallel with this main track and extending through the chamber 18 is an auxiliary or side track 21 joined at its ends to said main track by switches 22, 22. Movable over these tracks are the cars for conveying material successively through the chambers 16, 16 and 17, respectively. These cars may be of any suitable construction, but as shown in Fig. 10, for example, each car comprises a frame composed of longitudinal 1-beams 23 and cross beams 24 superposed on the latter. Mounted on the cross beams is a platform 25 of fire brick for supporting the material to be conveyed. Trackwheels 26 are arranged at the front and rear ends of the frame.

7. The cars are loaded and unloaded at the right hand end of the main track (see Fig. 1), four cars usually being employed for efficiently practising the invention, although three may be employed if desired. Of these four cars, three are located in the respective chambers 16, 17 and 18, while the fourth one, after having been loaded, is moved to the curved portion 21a of the auxiliary track, ready to be moved into the preheating chamber 18 upon the successive advancement of the cars to and from the respective chambers. This leaves the right hand end of the main track open to permit the car in the cooling chamber 17 to be propelled to that end of the track and unloaded, the car in the heating chamber being moved
into the cooling chamber, and the car in the preheating chamber being switched on to the main track and propelled into the heating chamber 16, after which the loaded car on the curved portion of the auxiliary track 21 is moved into the preheating chamber, thus completing the cycle.

The means for propelling the cars along the track are preferably constructed as follows:

27, 28 represent endless sprocket chains which are adapted to travel in either direction and which are arranged centrally and longitudinally of the main track and the auxiliary track, respectively. The sprocket chain 27 is disposed in a longitudinal tunnel 29 extending below the track bed and passed around sprocket wheels 30, 31 suitably mounted at the extreme ends of the main track 20. The sprocket chain 28 is likewise disposed in a longitudinal tunnel 32 and passes around sprocket wheels 33, 34 suitably mounted near opposite ends of the auxiliary track 21. The sprocket wheels 30 and 33 at the left-hand ends of the track sections are loosely mounted at the opposite ends of a transverse driving shaft 35 journaled in suitable bearings 36 secured to the bottom of a transverse tunnel or pit 37 extending across the corresponding ends of the tunnels 29 and 32, as shown in Fig. 1. This pit may be provided with a suitable cover plate 37.

To prevent the upper and lower stretches of the sprocket chains 27, 28 from sagging, they are preferably supported on corresponding upper and lower longitudinal channel bars 38 and 39 suitably mounted in the upper and lower portions of the respective tunnels. As shown in Figs. 2, 6, and 11, the upper stretch of each sprocket chain is preferably below the plane of the surface of the track. The trackway may be filled in with cement 40 to make it flush with the floor. Arranged lengthwise over each tunnel and above and on either side of the sprocket chain therein are cover plates 41 between the opposing inner edges of which a comparatively narrow longitudinal opening or passage 42 is formed.

Each of the sprocket chains 27, 28 is provided at suitable intervals with coupling or tappet links 43 with which the car is adapted to engage so as to be propelled in the direction of movement of the chain. For this purpose, each car is provided at either end with a vertically movable coupling bolt or member 44 guided for movement in a suitable housing or casing 45 suitably fastened to the frame of said car. The lower end of this bolt is provided with a centrally reduced portion or tongue 46 forming downwardly facing shoulders 47 on its opposite sides, as shown in Fig. 13. The upper portion of this bolt is provided on one of its sides, preferably its inner side, with a rack 48. A pinion 49 mounted on a transverse shaft 50 suitably journaled in the frame of the car meshes with said rack for raising and lowering said bolt into and out of engagement with the propelling chain. To limit the downward movement of the bolt, the same is provided with a stop pin 51 extending through a slot 52 in the housing 45, as shown in Fig. 10. In the operative position of the bolt, said stop pin engages the lower end of its slot, thereby properly positioning said bolt in the path of one or the other of the coupling links 43 of the propelling chain. One end of the pinion shaft 51 is preferably provided with a hand wheel 53 for turning it. One side of this wheel is provided with a weighted segmental portion 54, which, in the inoperative or raised position of the bolt, as shown at the left in Fig. 10, overbalances the weight of the bolt 44 and thus serves to reliably hold the latter in such position.

It is to be noted that the cars are propelled by power along the main track and straight stretch of the auxiliary track, while they are moved by their momentum or by hand over the curved portions of said last-named track.

Means are provided for automatically releasing the coupling bolts of the cars from the tappet links of said chains at predetermined points in the movements of said cars to permit them to travel idly over the curved portions of the auxiliary track. These automatic releasing means are in the form of trip devices, which are preferably arranged and constructed as follows:

As shown in Fig. 1, two trip devices 55, 56 are provided, the former being located near the switching point at the right-hand end of the main track 20, and the latter being located near the left-hand end of the straight stretch of the auxiliary track 21. The trip 55 is double-ended, being adapted to release the bolts of cars traveling in either direction on the main track, and consists of a block having two horizontally disposed parallel side rails 57 and a central transverse web or connecting portion 58, the ends of the latter terminating a suitable distance from the corresponding ends of said side rails, and the bottom of said web extending below the bottoms of the side rails, as shown in Figs. 9, 10, and 14. The upper surface of the web portion is preferably flush with the upper surface of the side rails. This trip is secured to the cover plates 41, as shown in Fig. 12, so that its side rails rest directly on the upper side 59 of their inner ends, while the central web portion extends into the passage 42, formed between the opposing ends of said plates. The ends of the side rails are provided in their upper sides with inclines 59, while the
corresponding ends of the web portion are provided with similar inclines. As a car approaches the trip from either direction, the shoulders 57 of the coupling bolt 54 engage the inclines of the side rails and force the said bolt upwardly a distance equal to the thickness of said rails and clear of the respective tappet link of the sprocket chain 27. As the car continues under its own momentum, the lower end of the tongue 60 of the bolt engages the incline 60 of the web portion of the trip, thereby raising the bolt to the position shown at the left in Fig. 10; in which position it is clear of any obstructions along the track.

The trip 56 is adapted to release the bolts of cars traveling on the auxiliary track 21 in the direction of the arrow, Fig. 1, and is similar in construction to the trip 55, except that it is single-ended instead of double-ended. As shown in Figs. 8 and 15, it consists of a block having two parallel side rails 61 and a transverse web portion 62 connecting the rear ends of said rails, the front end of said web portion terminating a suitable distance from the corresponding ends of the side rails. This trip is secured to the cover plates 41 in the same manner as the trip 55 and the bottom of its web portion extends below the bottoms of the side rails and into the passage 42 between said plates. The front or approaching ends of the side rails are provided with inclines 63, while the corresponding end of the web portion 62 is provided with a similar incline 64. The upper surface of the web portion is likewise flush with the upper surfaces of the side rails.

By providing the trip with two stopped inclines, one in advance of the other, and the coupling bolt with two corresponding contact faces, and the shoulders 47 and the lower end of the bolt, the height of said trip is reduced to a minimum in proportion to the distance through which the bolt is lifted, and the danger of stumping over it is correspondingly reduced, thereby affording safety to the workmen.

Any suitable means may be employed for driving the propelling chains 27, 28, but preferably by the means shown in Figs. 1, 3, 4 and 5 of the drawings, which are constructed as follows:

Fixed on the driving shaft is a gear 65 meshing with a pinion 66 mounted on a counter shaft 67 having a sprocket wheel 68 at one end to which power is transmitted from a reversible electric motor 69. The other end of the counter shaft is provided with a brake drum 70 with which a brake shoe 71 cooperates, the latter being actuated by a vertically swinging lever 72. As previously described, the sprocket wheels 27, 28 are loosely mounted on the shaft 35, and suitable jaw clutches 73, 74 are provided for coupling said sprockets with the driving shaft. These clutches are independently controlled by hand levers 75, 76.

The cars on the track are under the control of a single operator who positions himself so as to conveniently manipulate the clutch and brake levers.

The ends of each car may be provided with a pair of coupling hooks 77 whereby two or more cars may be coupled together. Each pair of hooks is preferably mounted on a transverse rod 78 suitably supported in the corresponding end of the car frame and provided at one end with a handle 79 for actuating said hooks.

The operation of this apparatus is as follows:

Assume cars loaded with material for heat treatment to be located in the respective chambers 16, 17 and 18 of the annealing furnace and the coupling bolts 44 of said cars to be in their operative positions, as shown at the right in Fig. 10. Also assume a loaded car to be on the curved portion 21 of the auxiliary track 21. When the treatment of the material in the heating chamber is completed, the operator starts the motor 69 and engages the clutch 73 to move the upper stretch of the propelling chain 27 of the main track 20 in the direction of the arrow A, Fig. 1. The cars in the heating and cooling chambers, being coupled with said chain, are thus propelled by it and at the proper time the clutch is disengaged to position the car, previously in said heating chamber, in the cooling chamber. The car advanced out of the cooling chamber is then propelled by the chain to the unloading point, the car in said cooling chamber being first disconnected from said chain by rotating the hand wheel 53 to elevate the coupling bolt to the position shown at the left in Fig. 10. Just before reaching the loading point the coupling bolt 44 of the car just removed from the furnace strikes the trip 56 and is thereby automatically lifted above the plane of the tappet links of the chain, after which said car is brought to a stop and unloaded. Upon disengaging the clutch 73, the operator reverses the motor and engages the clutch 74 to move the upper stretch of the propelling chain 28 of the auxiliary track 21 in the direction of the arrow B, Fig. 1. The car in the preheating chamber 18, being coupled with said chain, is thus propelled by it out of said chamber, and just before reaching the curved portion of the auxiliary track, the coupling bolt of this car engages the trip 56 and is automatically disengaged from said chain, whereupon the operator disengages the clutch 74 and stops the motor. This car is then pushed over the curved portion of the auxiliary track on to the main track, after which it is propelled by the chain 27 into the heating chamber.
16, in an obvious manner. The car on the curved portion 21 of the auxiliary track is now pushed on to the straight stretch of the latter, after which the car is propelled into the preheating chamber.

It will be observed that this apparatus permits of the expeditious and economical handling of cars with a minimum amount of manual labor; and by means of a unitary control danger of accidents is practically obviated. Furthermore, there are no open pits or obstructions to interfere with the safety of the workmen. By providing the trip devices at the points shown, the cars are automatically disengaged from the propelling chains without requiring special attention from the workmen.

We claim as our invention:

1. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, releasable coupling members on said cars arranged for connection with said propelling means, and means along said track for automatically releasing said coupling members from said propelling means, said releasing means being located in the path of movement of the coupling members to be directly engaged thereby.

2. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, releasable coupling members on said cars arranged for connection with said propelling means, means along said track for automatically releasing said coupling members from said propelling means, and means for holding said coupling members in released position.

3. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, coupling members on said cars movable toward and from said propelling means and arranged for connection therewith, and trip devices arranged along said track for automatically releasing said coupling members from said propelling means, said releasing means being so constructed as to release said coupling members from said propelling means by a step-by-step movement.

4. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means arranged centrally and below the surface of said track for propelling the cars along said track, coupling members mounted on said cars and movable into and out of engagement with said propelling means, and trip devices arranged along said track and above said propelling means for automatically releasing said coupling members from the latter, said trip devices being located in the path of movement of the coupling members to be directly engaged thereby.

5. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, coupling bolts mounted on said cars and movable toward and from said propelling means and arranged for connection therewith, and trip devices arranged along said track for automatically releasing said coupling bolts from said propelling means, the ends of said trip devices which face approaching cars being provided with inclined bolt-engaging faces disposed one behind the other, whereby the bolts are moved from said propelling means by a step-by-step movement.

6. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, coupling bolts mounted on said cars and movable toward and from said propelling means and arranged for connection therewith, each of said bolts having a downwardly-facing shoulder near its lower end, and trip devices arranged along said track for automatically releasing said coupling bolts from said propelling means, the end of said trip devices which face approaching cars being provided with bolt-engaging faces disposed one behind the other, the shoulders of said bolts being arranged to engage one of said faces and the lower ends of said bolts being arranged to engage the other of said faces.

7. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, coupling bolts mounted on said cars and movable into and out of engagement with said propelling means, each of said coupling bolts having a reduced portion at its lower end forming downwardly-facing shoulders on either side thereof, and trip devices arranged along said track for automatically releasing said coupling bolts from said propelling means, each of said devices consisting of a pair of spaced side rails and a web portion connecting the latter and terminating in rear of the front ends thereof, the shoulders of said bolts being arranged to engage the side rails and the lower reduced end of said bolts being arranged to engage the web portion of said trip device.

8. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, coupling bolts mounted on said cars and movable into and out of engagement with said propelling means, each of said coupling bolts having downwardly-facing shoulders.
on opposite sides thereof near its lower end, and trip devices arranged along said track above said propelling means for automatically releasing said coupling bolts from said propelling means, each of said devices consisting of parallel side rails and a web portion connecting the latter and terminating in rear of the front ends thereof, the shoulders of said bolts being arranged to engage the side rails and the lower reduced end of said bolts being arranged to engage the web portion of said trip device, the front ends of said side rails and web portion being provided with inclines and the bottom of said web portion extending below the bottoms of said side rails.

9. In a conveying apparatus of the character described, the combination of a track, cars movable on said track, means for propelling the cars along said track, vertically movable coupling bolts mounted on said cars and movable into and out of engagement with said propelling means, each of said bolts being provided on one of its sides with a gear rack, means along said track for automatically releasing said coupling bolts from said propelling means, a shaft arranged transversely of each car and having a pinion meshing with said rack, and a hand wheel for turning said shaft, one side of said wheel being weighted to hold the bolt of said car in its released position.

10. The combination with a furnace having two or more chambers arranged side by side, of a main track extending through one of said chambers, an auxiliary track joined at its ends to said main track and extending through the other of said chambers, cars movable on said tracks, propelling means for moving the cars on said main and auxiliary tracks, respectively, releasable coupling members on said cars movable into and out of engagement with said propelling means, means for controlling the latter, and trip devices arranged near one end of said main track and near the opposite end of said auxiliary track for automatically releasing said coupling members from said propelling means.

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