May 5, 1953 F. G. MITCHELL 2,637,455

ENDLESS CONVEYER

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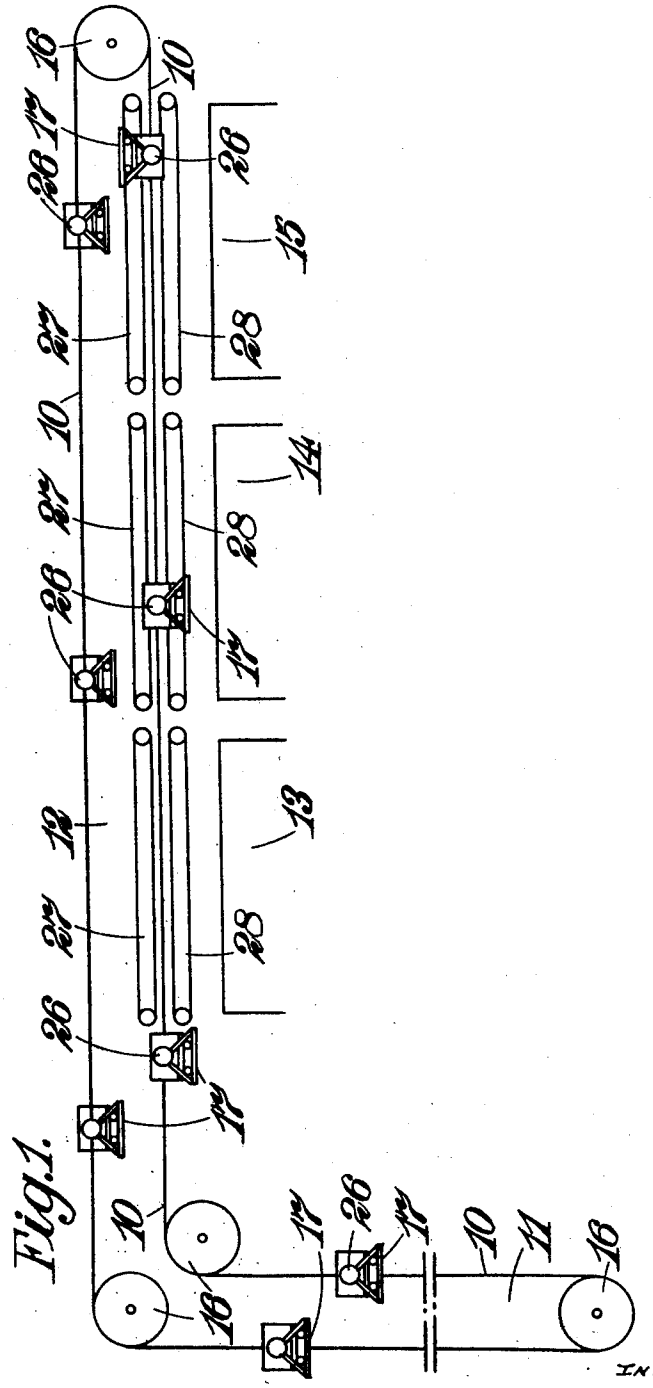


Fig. 1.

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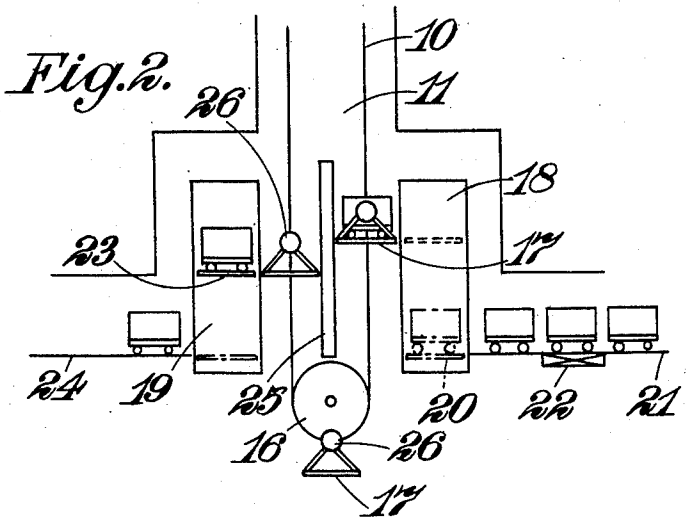
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Fig. 2.



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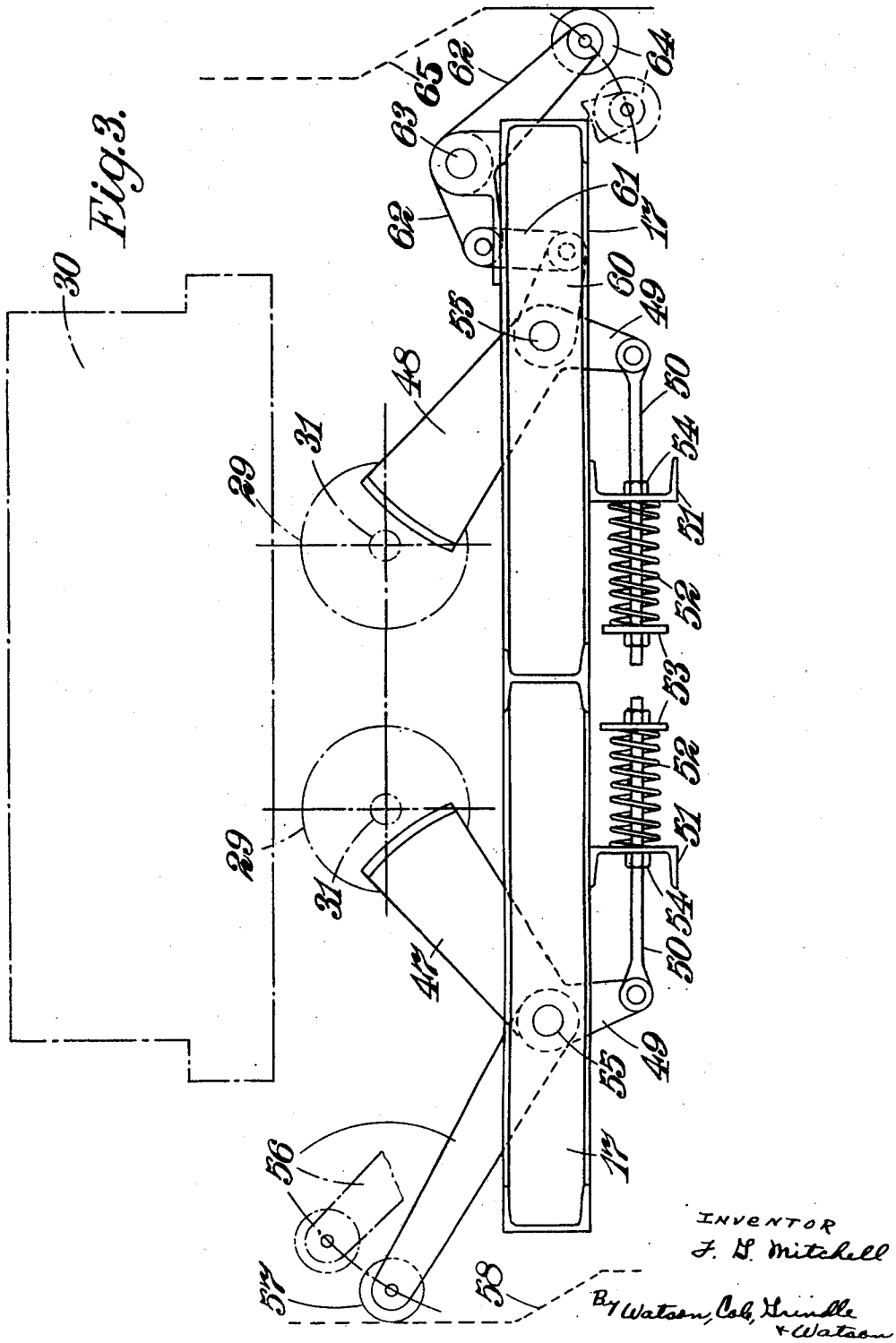
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Fig. 3.



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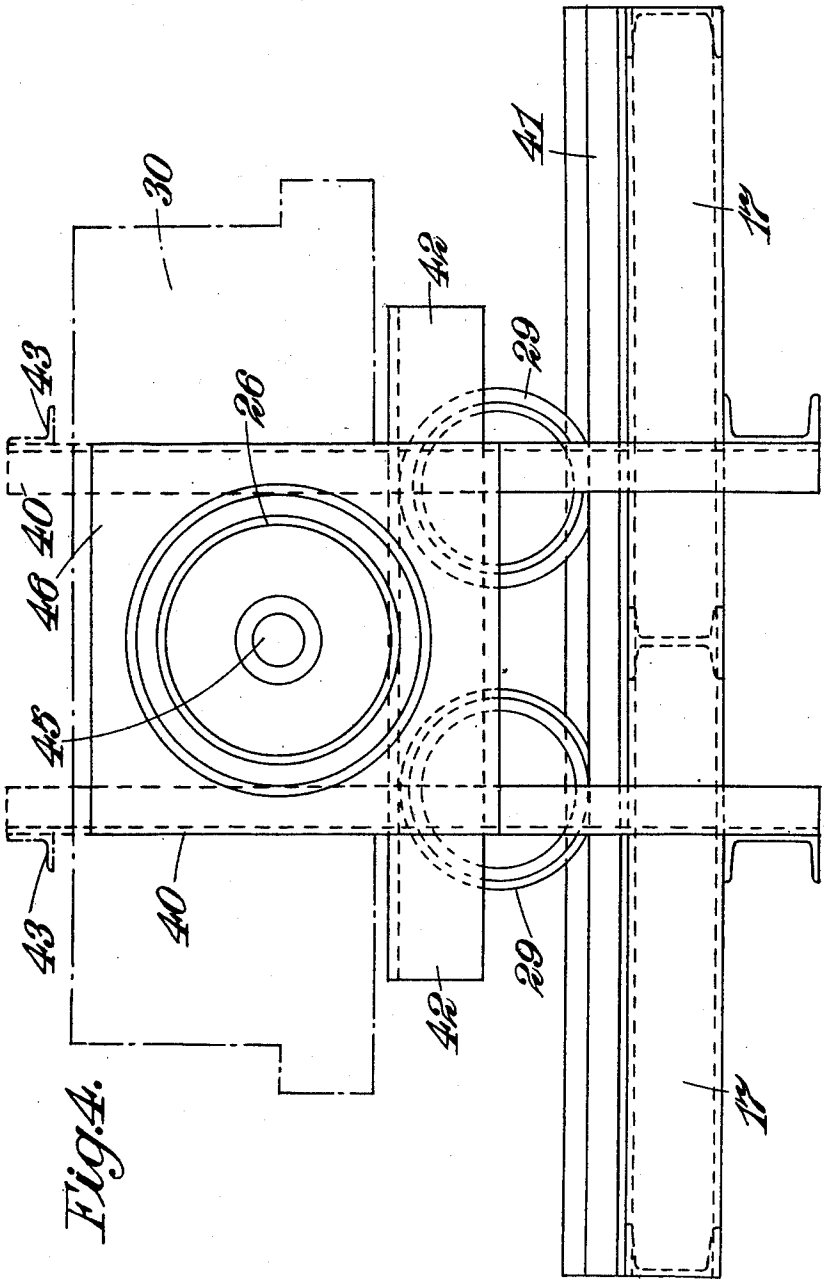


Fig. 4.

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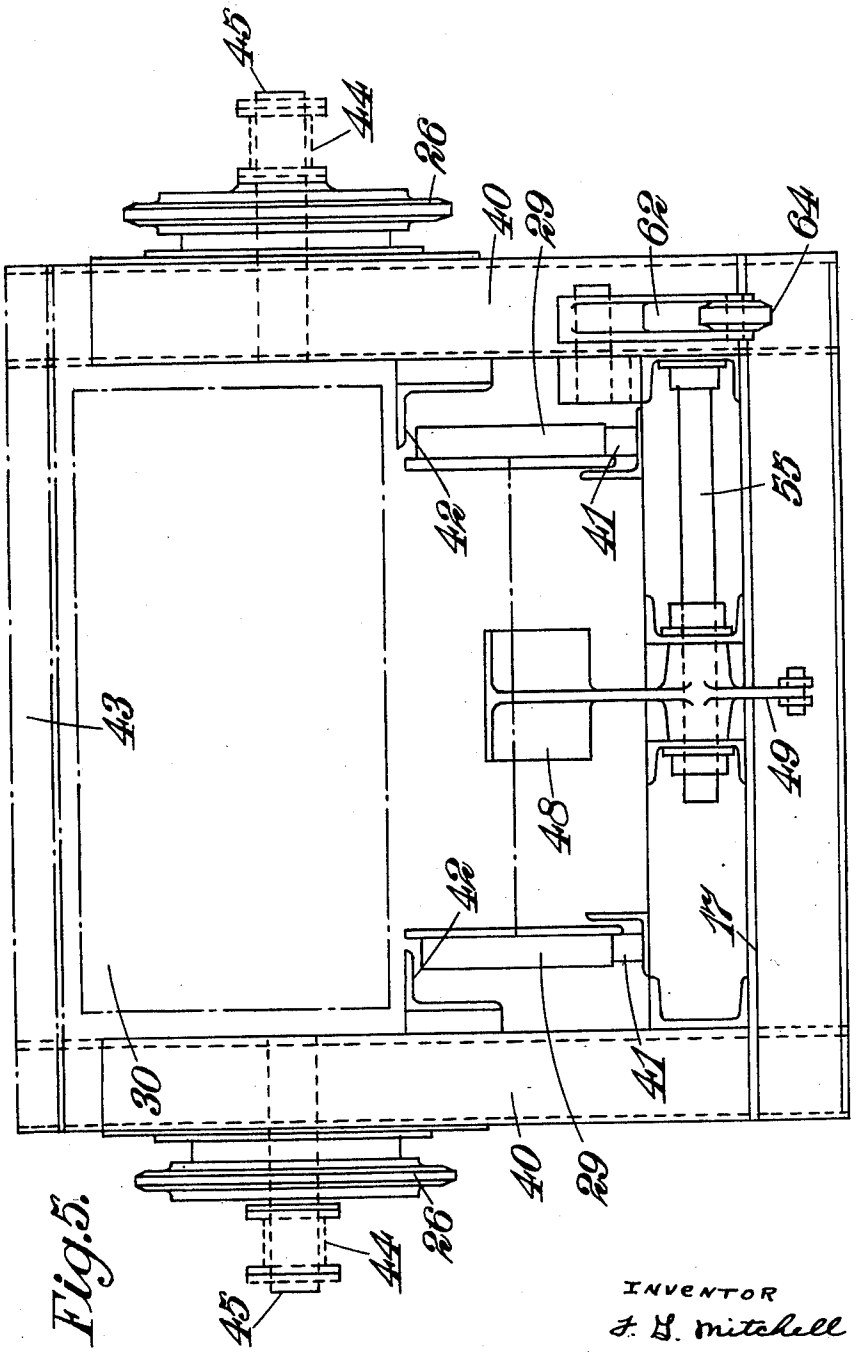


Fig. 5.

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UNITED STATES PATENT OFFICE

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ENDLESS CONVEYER

Frederick Gilbert Mitchell, London, England

Application February 27, 1951, Serial No. 212,843
In Great Britain April 25, 1950

7 Claims. (Cl. 214—46.24)

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This invention relates to endless conveyors, intended in particular for the elevation to the surface, from the bottom of a mine-shaft, of materials such as coal, stone and dirt, and of the type (hereinafter referred to as "the type described") comprising an endless movable chain, belt, cable or like carrier supporting at spaced intervals in its length, containers for the material to be handled.

The invention provides an endless conveyor of the type described wherein each container comprises a platform adapted to receive, support and provide a locked engagement for, a loaded wagon or mine-tub, and so pivotally articulated to the endless carrier as to be capable of being swung bodily (as a unit with the supported wagon) by rotation about its axis of pivoting to discharge the contents of the wagon, and wherein means are provided at a selected location or locations in the path of the conveyor to effect rotational movement as aforesaid of the platforms.

According to a feature of the invention the conveyor may comprise a vertical run at the lower end of which a loading lift and an unloading lift are positioned alongside the rising and falling strands respectively of the conveyor, each lift being adapted to receive and support a wagon and to be movable vertically at substantially the same speed as the conveyor strands and in alignment with a conveyor platform, whereby wagons may be transferred from the loading lift to the rising strand of the conveyor and from the falling strand to the unloading lift, without interrupting the movement of the conveyor. Convenient guide means are provided in order to prevent swinging movement of the conveyor platforms during transfer of wagons to and from the platforms.

According to a further feature of the invention the conveyor may comprise a vertical run extending from the bottom of a mine-shaft to a situation above surface level, and a horizontal run extending from the top of the vertical run over a plurality of bunkers or dumps sequentially arranged in the path of the horizontal run, combined with mechanisms arranged in association with the several bunkers for operation selectively to effect rotational movement of wagon-loaded platforms to discharge the contents of the wagons into the appropriate bunkers. The means for effecting rotational movement of the platforms may comprise toothed or friction wheels concentric with the platform suspension pivots, and movable chains or belts arranged to engage the toothed or friction wheels and by appropriate

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movement while so engaged to cause rotation of the platforms about their pivotal axes.

According to a still further feature of the invention, each wagon-supporting platform is equipped with movable stops arranged to be brought into engagement with front and rear portions of the wagon (e. g. the front and rear axles) and thereby lock it against forward and rearward movement on the platform, means being provided in the path of the conveyor for automatically effecting movement of the stops aforesaid out of their locking positions. The stops may be in the form of arms pivotally mounted on the platform and adapted to be swung into and out of the locking position, spring means being provided on the platform for constraining the stops towards the locking position, and operating levers being associated with the stops and arranged for co-operation with fixed cams or equivalent devices located in the path of the conveyor.

In one arrangement according to the invention each wagon-supporting platform is comprised by a U-shaped frame whereof the base is equipped with wagon-running rails and constitutes the platform proper and the side members are equipped with means for the pivotal articulation of the frame to the endless carrier. Conveniently the platform framework includes a bridge piece or pieces extending between the side members of the frame and arranged to lock a wagon supported on the platform against perpendicular movement in relation thereto.

An example embodying the foregoing and other features of the invention will now be described with reference to the accompanying drawings (partly diagrammatic) in which:

Figure 1 is a diagram showing the general arrangement of the whole conveyor plant;

Figure 2 is a diagram showing the loading and off-loading mechanisms employed at the foot of the mine-shaft;

Figures 3 and 4 are side elevations showing one particular construction of swinging platform and wagon locking means, and

Figure 5 is an end elevation of the arrangement illustrated in Figures 3 and 4.

Like reference numerals indicate like parts in the several figures.

In this example the apparatus is designed for the elevation of materials such as coal, stone and dirt from the bottom of a mine-shaft to surface level and for the horizontal conveyance of the material above surface level to various storage receptacles or dumps. The conveyor comprises endless carrier chains 10 arranged to provide

a vertical run 11 extending from the foot of the mineshaft to a situation above surface level and a horizontal run 12 extending from the top of the vertical run over receiving bunkers 13, 14, 15, of which there may be any desired number corresponding to the various classes or grades of material to be handled. The carrier chains 10 are supported by pulleys 16 of which one or more may be driving pulleys. At equal intervals in their length the carrier chains 10 support wagon-receiving platforms 17 each of which is so pivotally coupled to the carrier chains that it may be rotated about its pivotal axis through 180° in order to capsize supported wagons 30 and thereby to discharge the contents of the latter. Each platform 17 is furnished with means, e. g. automatic in action, for locking a wagon securely in position.

Loading and unloading lifts 18, 19 are provided at the bottom of the mine-shaft, the loading lift 18 being adjacent to the rising strands of the carrier chains 10 while the unloading lift 19 is adjacent to the falling strands. The lifts 18, 19 are arranged for vertical movement alongside the rising and falling strands of the conveyor and at substantially the same linear speed as the latter. The arrangement is such that when the platform 20 of the loading lift 18 is at the bottom of its travel a full wagon standing on a marshalling track 21 (which may include a weight table 22) may be transferred, by gravity or otherwise, on to the lift platform. The loading lift 18 is so driven in synchronism with the carrier chains, that its platform 20 will commence its upward movement when in register with a conveyor platform 17 on the rising strands of the carrier. The lift being driven at the same speed as the conveyor, the two platforms will move upwardly in alignment so that the loaded wagon on the lift may be passed by gravity or otherwise on to the conveyor platform. When this transfer has been completed the lift platform 20 will be returned to the lower limit of its travel ready to receive a further loaded wagon from the marshalling track 21 and to ascend in alignment with the next conveyor platform to arrive at the foot of the lift. The platform 23 of the unloading lift 19 is arranged to commence its downward travel when in alignment with a conveyor platform 17 on the falling strands. Here again the lift is arranged to move at the same speed as the conveyor so that the lift platform 23 and conveyor platform 17 will descend in alignment, during which time an empty wagon may be transferred from the conveyor to the unloading lift. When the lift platform 23 reaches the lowest point in its travel the empty wagon may be passed out of the lift on to a track 24 suitably arranged to receive the empty wagons. By means of the mechanism just described transfer of wagons to and from the conveyor may be effected with minimum impact and, as already indicated, without interrupting the continuous movement of the conveyor. Vertical guides 25 are provided in order to prevent the carrier platforms from swinging while transfer of wagons to and from the conveyor is taking place.

The pivotal axis of each conveyor platform 17 is positioned above the centre of gravity of the combination of platform and wagon with contents. Concentric with the pivotal axes of the platforms, toothed or friction wheels 26 are provided, these wheels being arranged for engagement by mechanisms which are located above the three bunkers 13, 14, 15 and are selectively operable to effect rotation of the engaged carrier platform with the wagon supported thereon through 180°. Each operating mechanism may conveniently comprise two endless chains or belts 27, 28, extending horizontally above and below the lower lap of the horizontal run 12 of the conveyor, with a gap between the upper and lower chains into which the toothed or friction wheels 26 will be received. The arrangement is such that normally the operating chains 27, 28 will travel at the same speed as the conveyor so that no turning effort will be applied to the wheels 26. Provision is however made for causing the upper and lower chains 27, 28 to travel at different speeds in order to effect turning movement of the wheel 26 associated with a conveyor platform and so to capsize the supported wagon and to discharge its contents into the bunker. When the platform with its supported wagon passes beyond the influence of a turning mechanism it may be allowed automatically to swing back (by the action of gravity) to the erect position. However, in order to enable the material to be discharged with a minimum of impact on the moving parts, it is preferable that the platform and empty wagon should be returned to the vertical position under control. For this purpose the movement of the operating chains or belts 27, 28 may be so arranged that when the tub has been emptied, say at the middle of a bunker, the platform will be swung back to the erect position under the control of the chains. While it is possible to arrange to drive the chains 27, 28 so that the platform is rotated first through 180°, or less, in one direction to empty the wagon, and then through the same amount in the reverse direction, a simpler arrangement is to arrange for the platform to be rotated completely through 360°.

Referring now to Figures 3, 4 and 5, these show, by way of example, details of one particular construction of wagon-supporting platform and wagon-locking means. The platform proper is constituted by the base 17 of a U-shaped frame comprising spaced upright members 40 secured at their lower ends to the sides of the base structure. Running rails 41 for the wagon are mounted on the upper surface of the base. The truck 30, when in position on the platform, is restrained against movement perpendicular to the platform by means of angle iron bars 42 secured to the uprights of the U-shaped frame and arranged to overhang the wagon wheels 29. Alternatively, or in addition, angle-iron bars 43 may be provided across the top of the frame.

The endless carrier comprises twin chains, to which each wagon-supporting platform is pivotally articulated at 44 by means of pins 45 aligned parallel with the platform and secured to the side members 40 of the platform frame. The pivotal axis provided by the pins 45 is located above the centre of gravity of the combination of platform and loaded wagon. The toothed or friction wheels 26 (previously referred to) are rigidly secured, at positions co-axial with the pivot pins 45, to platework 46 forming parts of the side members 40 of the platform frame.

In order to prevent movement of a wagon while supported on a platform, in either direction along the platform rails, stops 47, 48 are provided to form abutments (as shown in Figure 3) for the wheel axles 31. The stops 47, 48 are in the form of bell crank levers pivotally mounted on the platform base structure and each having a lower arm 49 linked to a tie-rod 50 passing through a

base frame member 51 and there encircled by a spring 52 in compression between the frame member 51 and a washer 53 secured to the inner end of the rod. Stop nuts 54 are also provided on the tie-rods, and the arrangement is such that normally the stops 47, 48 are maintained by the springs 52 in the abutment position shown in Figure 3. The lever stops 47, 48 are keyed to shafts 55 at the outer ends of which means are provided for rocking the shafts and so operating the stop levers. Different operating means are provided for the outgoing and incoming sides of the platform.

On the outgoing side, a single lever 56 carrying a roller 57 is keyed to the shaft 55. The normal position of the lever 56 is shown in full lines in Figure 3. A fixed cam surface 58 is provided on the structure of the off-loading lift 19 in a position to co-operate with the lever roller 57 when a platform descends into proximity with the off-loading lift. When the roller 57 comes into contact with the stepped face of the cam 58 the lever 56 will be swung into the position shown in dotted lines in Figure 3, thus depressing the stop 47 clear of the wagon axle 31 and permitting the wagon to pass off the platform on to the off-loading lift.

On the incoming side of the platform (right hand side of Figure 3), the shaft 55 of the stop 48 has keyed to it a short crank 60, the outer end of which is coupled by a link 61 to one arm of a bell crank lever 62 (pivotally mounted at 63 on the platform base) having its other arm carrying a roller 64 arranged to co-operate with a fixed cam surface 65 attached to the structure of the loading lift 18. As the platform 17 rises, the roller 64 will engage the stepped surface of the cam 65 and will be depressed (to the position shown in dotted lines in Figure 3) to lower the stop 48 and thereby to permit a full wagon to be transferred from the loading lift on to the rising platform of the conveyor.

Provision may be made by electrical or other means to ensure the automatic unloading of the contents of any particular tub into the bunker corresponding to the contained material; and all necessary electrical inter-locking devices would be provided to ensure that should any irregularity occur at any point of the system, the whole of the apparatus would be brought to rest so that the reason for such irregularity could be investigated.

The arrangement at the top and bottom of the mineshaft may be varied to suit particular conditions. For example, lifts may be used on the surface, to remove tubs from the top of the elevator.

In elevators embodying endless chain conveyors of the type described it is known, for the purpose of reducing the maximum tension in the conveyor chains, to employ at each of several intermediate stations in the height of the elevator a rotary or endless tracking member which is externally driven and adapted to engage the rising and falling stretches of the chains. In this way the lift of the elevator is sub-divided in its height into a plurality of sections at the top of which only a part of the required total lifting force need be applied, i. e. a part proportional to the load on that portion only of the carrier which extends downwardly from the point of application to the intermediate tracking member at the top of the next lower section. If desired, a tension relieving device or devices of this kind may be employed in the drive to the conveyor chains of the present apparatus, particularly in association with the vertical run.

I claim:

1. An endless conveyor comprising an endless movable carrier supporting at spaced intervals in its length platforms, each platform being adapted to receive, support and provide a locked engagement for a loaded wagon and being so pivotally articulated to the endless carrier as to be capable of being swung bodily, as a unit with the supported wagon, by rotation about its axis of pivoting to discharge the contents of the wagon, and mechanism for effecting the said rotation, the said mechanism comprising wheels concentric with the platform suspension pivots, movable chain-like elements located at positions where the platforms are to be rotated and arranged to engage the wheels and means for driving the elements so that when a platform is not required to be rotated the speed of the elements is the same as that of the conveyor carrier, there being then no relative movement between the elements and the carrier and that when a platform is to be rotated the speed of the elements differs from that of the conveyor carrier, thereby producing relative movement between the elements and the carrier, which will cause rotation of the platforms while the elements engage the wheels.

2. An endless conveyor according to claim 1 comprising a vertical run extending from the bottom of a mine-shaft to a situation above surface level, and a horizontal run extending from the top of the vertical run over a plurality of bunkers or dumps sequentially arranged in the path of the horizontal run, the said mechanisms being arranged in association with the several bunkers for operation selectively to effect rotational movement of wagon-loaded platforms to discharge the contents of the wagons into the appropriate bunkers.

3. An endless conveyor according to claim 1, having a vertical run at the lower end of which a loading lift and an unloading lift are positioned alongside the rising and falling strands respectively of the conveyor, each lift being adapted to receive and support a wagon and to be movable vertically at substantially the same speed as the conveyor strands and in alignment with a conveyor platform, whereby wagons may be transferred from the loading lift to the rising strand of the conveyor and from the falling strand to the unloading lift, without interrupting the movement of the conveyor.

4. An endless conveyor according to claim 1 combined, for each wagon-supporting platform, with movable stops arranged to be brought into engagement with front and rear portions of the wagon to lock it against forward and rearward movement on the platform, means being provided in the path of the conveyor for automatically effecting movement of the stops aforesaid out of their locking positions.

5. An endless conveyor according to claim 1 combined, for each wagon supporting platform, with stops in the form of arms pivotally mounted on the platform and adapted to be swung into and out of abutting positions in relation respectively to the front and rear axles of the wagon to prevent forward and rearward movement of the wagon on the platform, spring means on the platform for constraining the stops aforesaid towards the locking position, and operating levers associated with the stops and arranged for co-operation with fixed cams located in the path of the conveyor to engage the levers in such manner as

automatically to effect movement of the stops out of the locking position.

6. An endless conveyor according to claim 1 wherein each wagon-supporting platform is comprised by a U-shaped frame whereof the base is equipped with wagon-running rails and constitutes the platform proper and the side members are equipped with means for the pivotal articulation of the frame to the endless carrier.

7. An endless conveyor according to claim 1 wherein each wagon-supporting platform is comprised by a U-shaped frame whereof the base is equipped with wagon-running rails and constitutes the platform proper and the side members are equipped with means for the pivotal articulation of the frame to the endless carrier, the U-shaped frame also including a bridge extending between the side members of the frame and arranged to lock a wagon supported on the platform against perpendicular movement in relation thereto.

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