United States Patent [19]

Taylor

[11] **3,807,550**

[45] **Apr. 30, 1974**

[54] **RECIPROCATING ACCUMULATION CONVEYOR**

[75] Inventor: **Edward W. Taylor,** Pico Rivera, Calif.

[73] Assignee: **A. J. Bayer Company,** Torrance, Calif.

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[21] Appl. No.: **287,600**

[52] **U.S. Cl.** **198/221**
[51] **Int. Cl.** **B65g 25/08**
[58] **Field of Search** 198/221, 127, 180, 225

[56] **References Cited**

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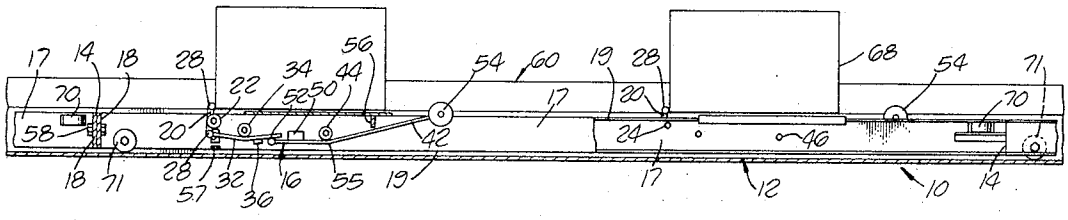
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Primary Examiner—Richard E. Aegerter
Assistant Examiner—Hadd Lane
Attorney, Agent, or Firm—Lyon & Lyon

[57] **ABSTRACT**

A reciprocating accumulation conveyor comprised of at least one car and generally a plurality of cars secured together to form a conveyor train, which is reciprocated back and forth along the longitudinal axis thereof by a reciprocating drive assembly which is fastened to one of the cars. Each car carries at least one pusher mechanism thereon. The boxes to be transported by the conveyor ride on a track disposed above the car or train and are moved in a forward direction along the track by the pusher assemblies carried by the cars. Each pusher assembly has a pushing bar pivotally mounted thereon and a sensing arm. The pusher bars push the boxes or containers along the track in one direction and pivot under any box or container which they encounter on the rearward movement of the train until the bar clears the box, whereupon it returns to the upright position to push forward another container. The sensing arm extends forwardly of the pushing bar and container and acts to release the pushing bar upon contacting a forwardly disposed container thereby preventing a collision and possible arcing of the boxes or containers.

10 Claims, 11 Drawing Figures



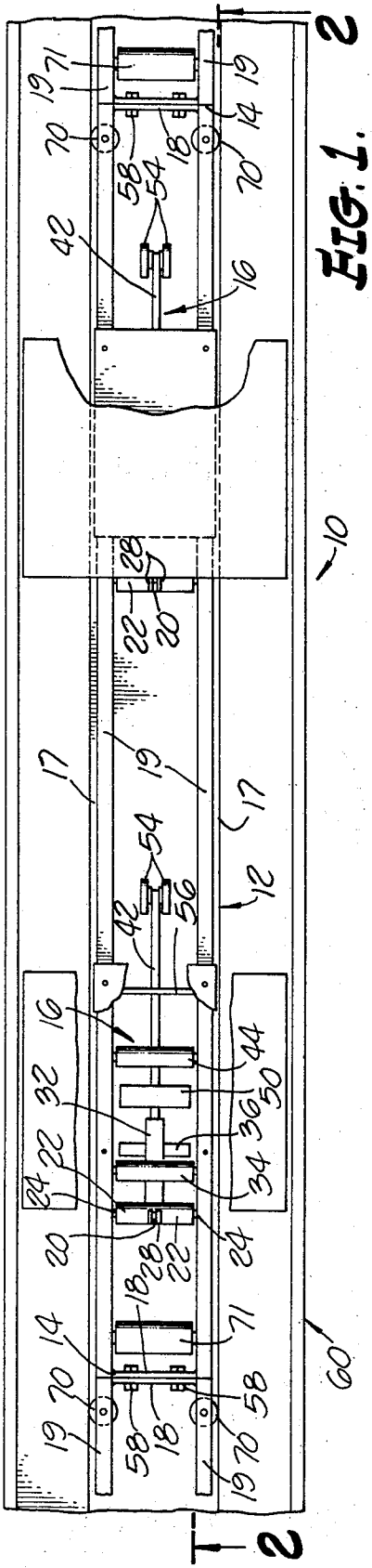


FIG. 1.

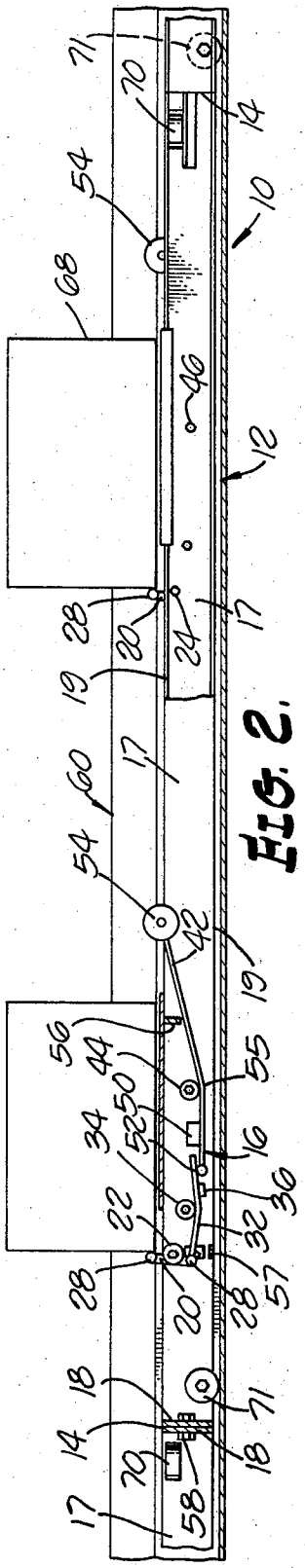


FIG. 2.

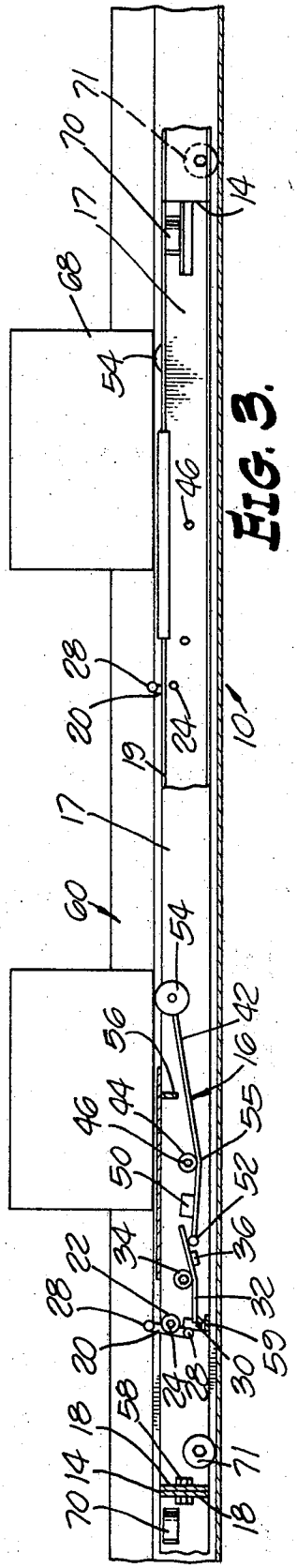


FIG. 3.

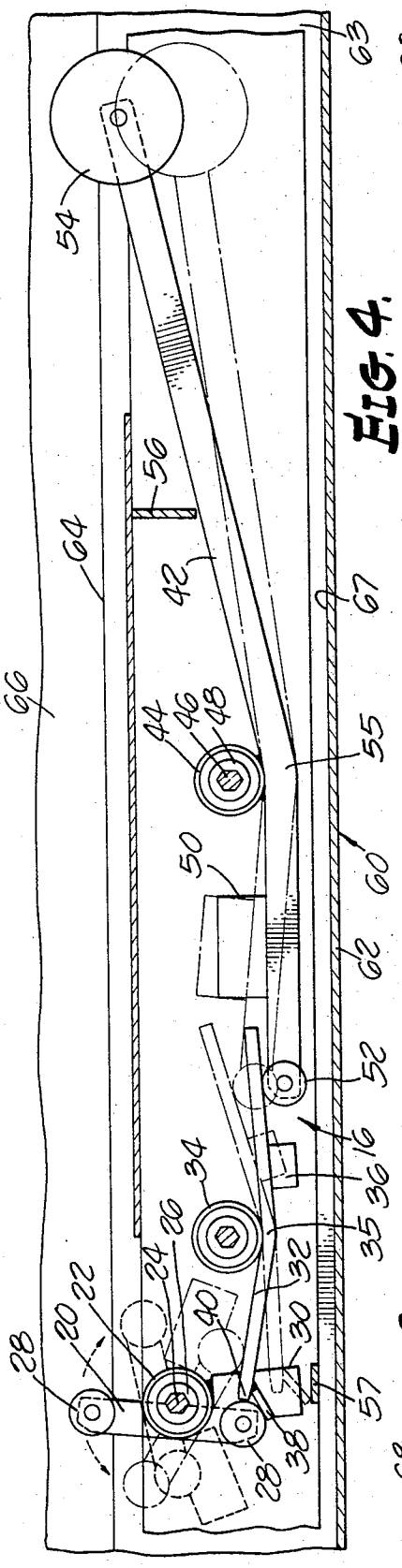


FIG. 4.

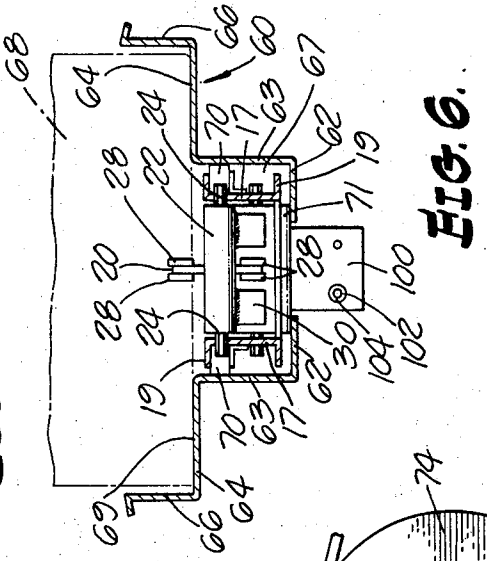


FIG. 6.

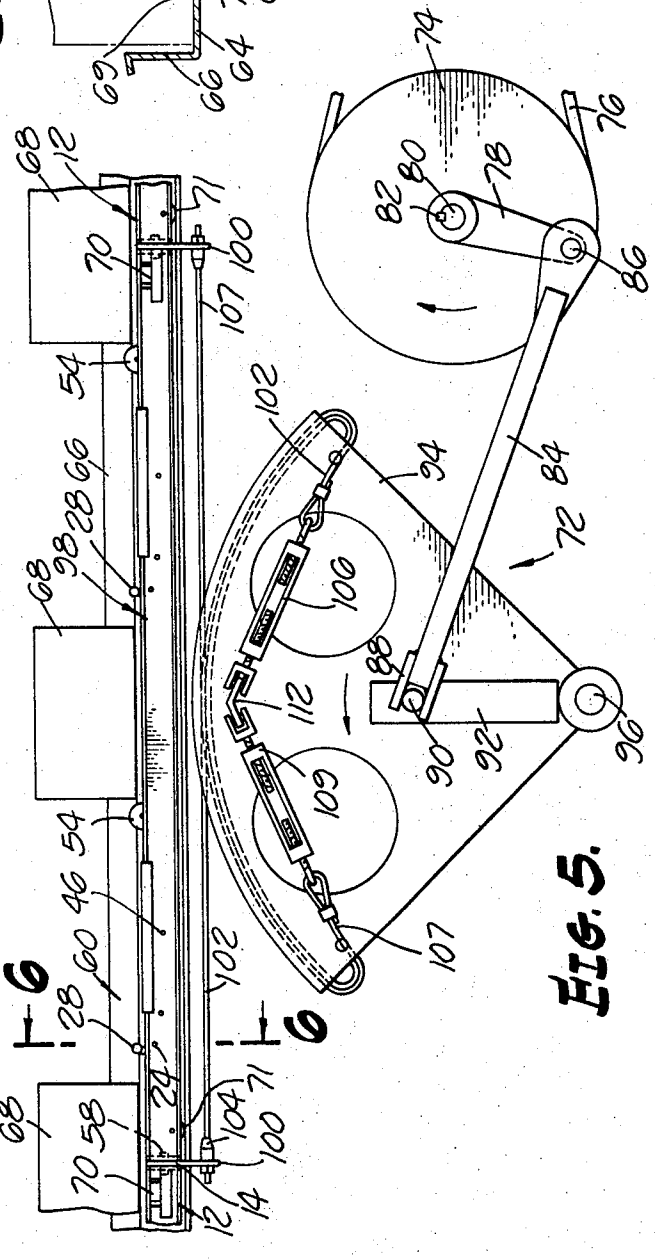


FIG. 5.

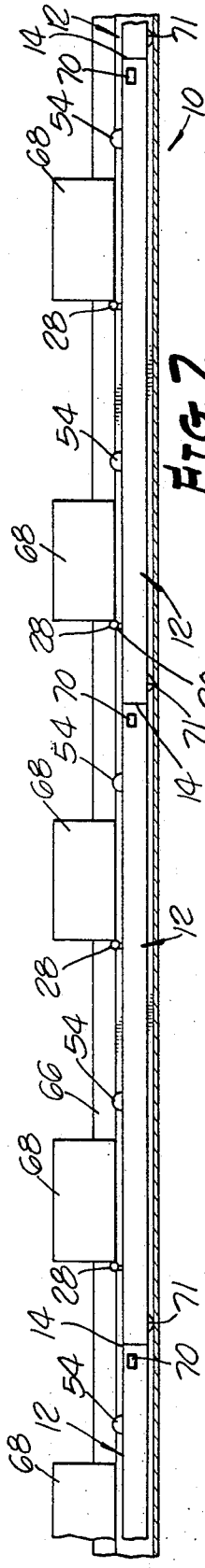


FIG. 7.

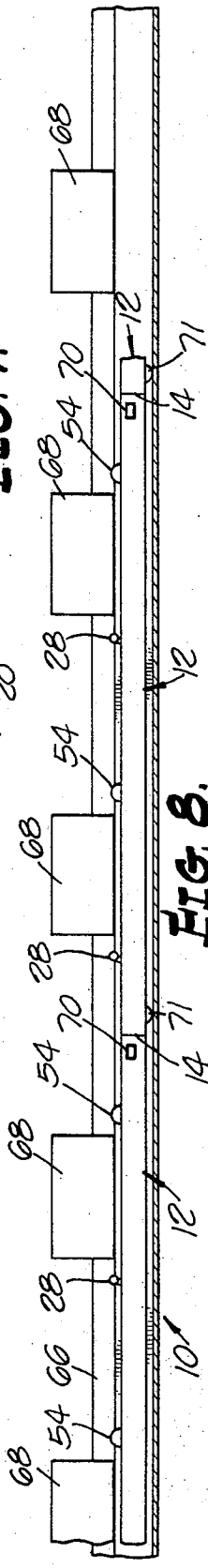


FIG. 8.

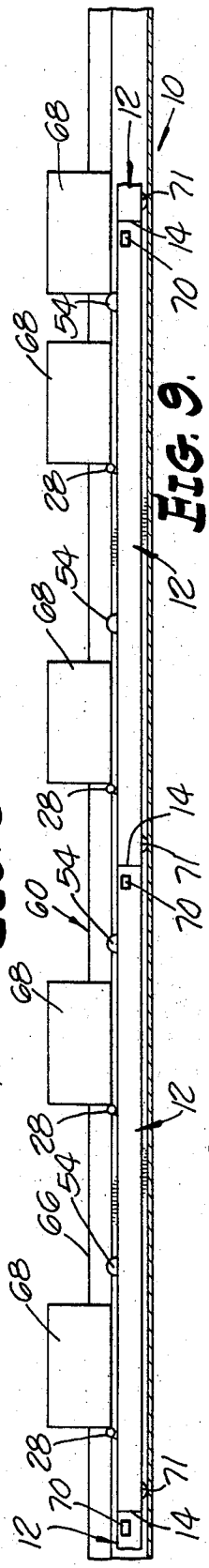


FIG. 9.

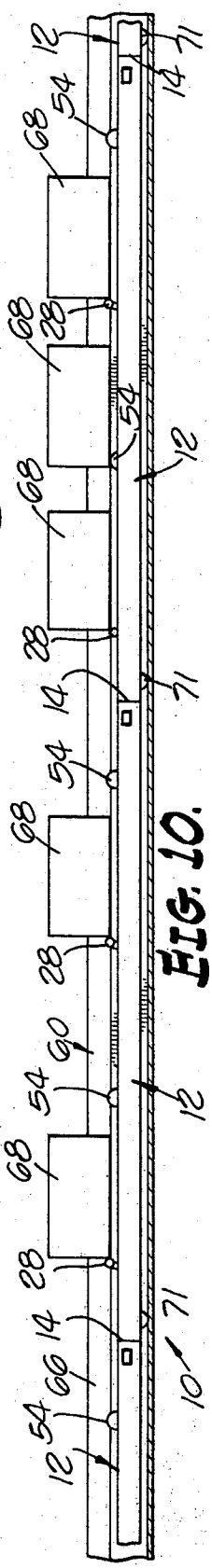


FIG. 10.

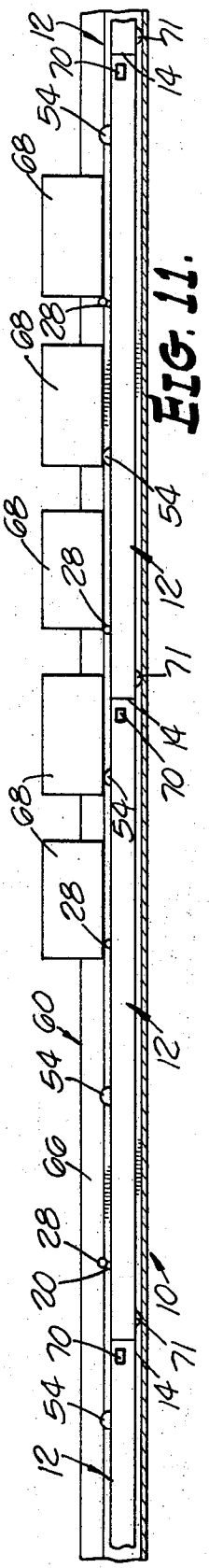


FIG. 11.

RECIPROCATING ACCUMULATION CONVEYOR

BACKGROUND OF THE INVENTION

There are several different types of conveyors currently available for numerous different applications. One type of conveyor, and that with which this invention deals, is the accumulating conveyor. An accumulating conveyor transports containers, boxes or other items from one location to another, where, if the items thereon are not removed, will accumulate. A problem necessarily arises when, through one reason or another, items begin to accumulate at the forward end of the conveyor. Continued accumulation will cause the conveyor to back-up and often results in the items or containers being pressed together to the point of arcing above the conveyor. This presents a tremendous hazard both to the items and the workers in the area, as the arc will soon break causing the items comprising the arc to be thrown from the conveyor, resulting in breakage and often personal injury.

One method of preventing arcing is to deactivate the conveyor whenever excessive accumulation occurs. There are obvious disadvantages, however, in such an approach, as constant supervision is required as well as the loss of time during shutdown. A limited solution is found in U. S. Pat. No. 3,385,418, which teaches the use of a reciprocating conveyor to advance a work piece from one station to another. However, that patent teaches a system which incorporates a precise stroke as a result of fixed feeler plates and utilizes interconnected pushing assemblies which render the conveyor unsuited for hurried loading or long haul operation and necessitates total shut down to repair a single mechanism. In addition, that system comes to a complete stop when the conveyor line is full, thereby requiring various electrical controls, limit switches, their electrical circuitry and installation and maintenance costs. In addition to U. S. Pat. No. 3,385,418, the prior art shows other conveying systems which circumvent the problem of arcing. However, none of the systems taught thereby are suited for general operation conditions. They generally require exact loading and are not capable of conveying articles over great distances.

SUMMARY OF THE INVENTION

Briefly, the invention is comprised of a least one and generally a plurality of conveyor cars secured together to form a conveyor train which is caused to undergo reciprocating movement by a drive assembly. Each car carries at least one pusher assembly which operates during the forward stroke of the conveyor train to push the container or other item disposed thereover on a track above the cars in the forward direction. During the rearward stroke, each assembly is directed under the item therebehind, whereupon each item will again be moved forwardly by the succeeding forward stroke of the conveyor train. Each pusher assembly has associated therewith a sensing arm which renders the pushing assembly inoperative during the forward stroke when the space between successive containers or items being conveyed reaches a set minimum distance.

It is the principal object of this invention to provide an accumulating conveyor which continually advances containers or other items along a track or supporting rails and automatically releases an item being moved

therealong at a predetermined distance behind any forwardly disposed stationary item to prevent contact.

It is another object of this invention to provide an accumulating conveyor which is adaptable of operation over varying distances.

It is still a further object of this invention to provide an accumulating conveyor which prevents contact between adjacent items or containers being conveyed thereby despite imprecise loading.

It is yet another object of this invention to provide an accumulating conveyor which prevents contact between adjacent items or containers being conveyed thereby which is of simple construction and economical to manufacture and service.

IN THE DRAWINGS

FIG. **1** is a plan view of a conveyor car having two pusher assemblies thereon.

FIG. **2** is a sectional side view of a conveyor car taken along line **2—2** of FIG. **1.**

FIG. **3** is a sectional view of the same conveyor car. The car having moved to the left with respect to the containers thereon.

FIG. **4** is a side elevation of the pusher assembly.

FIG. **5** is a side elevation of the drive conveyor car and drive mechanism.

FIG. **6** is a sectional view of the conveyor car taken along line **6—6** in FIG. **5** and showing the container support track.

FIGS. **7** through **11** are a schematic representation of the movement of the containers on the conveyor system from left to right as the conveyor system undergoes reciprocating movement.

Referring now in detail to the drawings, the accumulating conveyor generally designated **10,** is comprised of at least one and generally a plurality of conveyor cars **12** which are secured together at **14** in end to end relationship to form the conveyor or conveyor train. The number of cars which is used in the train is determined by the distance which the conveyor is to span as well as other considerations such as the size of the items to be conveyed. Each car **12** has a pair of parallel side walls **17** and end walls **18,** each side wall having an outwardly extending flange member **19** at the upper and lower ends thereof. Each car **12** carries at least one pusher assembly, generally designated **16.** The number of pusher assemblies per car is generally determined by the length of the individual cars, fabrication considerations and again the size of the items being conveyed. In the embodiment shown in the drawings, each car **12** carries two pusher assemblies **16.**

The pusher assembly is most clearly shown in FIG. **4** and contains a pusher bar **20** which is rigidly secured to and centrally disposed of on a pusher support **22.** The pusher support **22** is pivotally mounted at both ends thereof to the two side walls **17** of the conveyor car **12.** The pivotal mounting is accomplished in the illustrated embodiment by the use of studs **24** which are rigidly secured to the side walls **17** and extend into support **22.** Ball bearings **26** are carried by the support and are disposed about the studs **24** thereby providing low frictional rotation of the support **22** and pusher bar **20** with respect to the conveyor car **12.** A pair of rollers **28** are positioned on each end of the pusher bar **20.** A weight **30** is rigidly affixed to the underside of the support roller **22** at a point forward of the lower portion of the pusher bar thereby tending to bias the pusher bar

in a slightly forward inclination with respect to the vertical axis, for reasons to be discussed.

A releasing bar **32** is pivotally mounted on the car forwardly of the pushing bar. The releasing bar is rigidly affixed by welding or the like to a support **34** which is pivotally secured to side walls **17** in the same or similar manner in which the pusher support **22** is secured. The releasing bar **32** has an upward bend at **35** therein about the underside of support **34** and has a weight **36** secured to the forwardly extended end thereof which acts to pivot the locking bar clockwise about the support **34.** The underside of the rearward end of the releasing bar has a stop **38** depending therefrom. As seen in the solid lines of FIG. **4,** in a relaxed position, the weight **36** on the releasing bar **32** causes the rearward half thereof to be raised. In this position, the stop **38** and rearward most end **40** of the releasing bar abut the lower rollers **28** on the pusher bar **20** to prevent counterclockwise rotation thereof, while not impeding clockwise rotation. If the forward end of the locking bar were, however, raised, the pusher bar would be free to rotate unimpeded in either direction.

The pusher assembly **16** also has an elongated sensing arm **42** which is pivotally mounted on the conveyor car **12** by means of a third support **44,** studs **46** and ball bearings **48.** A weight **50** is welded or otherwise securely affixed to the rearward portion of the sensing arm **42.** A small roller **52** is maintained on the rearward most end of the sensing arm and a pair of large sensing rollers **54** are mounted on the forward most end of the sensing arm. It should be noted that the sensing arm, as the releasing bar **32,** has a slight upward bend at **55** therein beneath the support **44** whereby the forwardly extending end thereof and sensing roller **54** are in a slightly elevated position with respect to the conveyor car **12.** It should be further noted that in the preferred embodiment, rollers **52** and **54,** as rollers **28** and the supports **22, 32** and **44** have ball bearing mountings for reducing the friction created by the movement of the pusher mechanism thereby allowing for smoother operation and reduced part wear. It can be seen in FIG. **4,** that when the sensing rollers **54** are depressed, the rearward end of the sensing arm **42** is raised thereby raising the forward end of the releasing bar and lowering the rearward end **40** thereof, whereby the lower rollers **28** on the pusher bar **20** are clear of the locking bar and stop **38,** allowing the pusher bar to rotate freely in either direction about studs **24.** If the depressing force on the sensing arm is removed, the weight **50** will cause the rearward end of the sensing arm to drop, lowering the forward end of the releasing bar, raising the rearward end thereof and thereby preventing any counterclockwise rotation of the pusher bar. The forward inclination of the pusher bar **20** caused by the forward mounting of the weight **30** on support **22** reduces any tendency of the pusher bar and support to make a complete clockwise revolution during operation and therefore assures smoother operation of the conveyor. A depending flange **56** is provided on the conveyor car **12** above the sensing arm **42** to limit the upward movement of the forward end of the sensing arm. A transverse flat retaining bar **57** straddles the bottom of the car **12** thereby preventing releasing bar **32** from depressing below the car profile.

As noted above, at least one of these pushing assemblies **16** is carried by each conveyor car, with two being shown on each car in the drawings. Disposed above the conveyor cars, the end walls of which are secured together by means of bolts **58,** is a track or rail **60,** one embodiment thereof being shown in FIG. **6.** The track shown therein is comprised of two sections, each having a car support portion **62,** lower side wall **63,** container support **64** and upper wall portion **66.** The support and wall portions of the track define a lower trough **67** and an upper trough **69.** The conveyor cars are adapted to move within the lower trough, while the containers **68** are positioned in the upper trough on the container support portion **64** of the track. The container support portion is displaced slightly above the pushing assemblies **16** except for the upper portion of the pushing bar **20,** upper rollers **28** carried thereby and sensing rollers **54.** To facilitate movement of the cars with respect to the track, which is stationary during the operation of the conveyor, a lower supporting roller **68** and a pair of side guide rollers **70** are provided on each car. The lower support roller **71** is positioned near one end of the car while the side rollers are mounted near the opposite end thereof. When the cars are secured together to form a train, the lower rollers **71** support the cars, while the side rollers guide the cars smoothly along the lower trough **67** formed by track **60.** When the conveyor train is complete, it should be apparent that one of the cars will carry an extra roller to properly support one of the end cars thereof. Extra side guide rollers may also be added to facilitate the movement of the train along the trough. It should also be noted that while the track **60** is shown horizontally disposed, it may be advantageous in some installations to tilt the track slightly with respect to the horizontal axis to facilitate access to the containers or other items moving therealong. Other embodiments of the track may also be utilized with the conveyor without affecting the operation.

In use, the various cars **12** comprising the conveyor are bolted or otherwise secured together and the containers to be transported are placed on the track **60** thereover. The cars are then caused to undergo reciprocating movement on and with respect to the track by a drive assembly **72,** generally shown in FIG. **5.** The drive assembly comprises a power source (not shown) which acts to rotate drive pulley **74** by means of belt **76.** A first crank **78** is secured to the drive pulley by means of a center shaft **80** and locking pin **82.** The opposite end of crank **78** is pivotally attached to a second crank **84,** through crankshaft **86.** The second crank **84** has a bifurcated end **88** in which rests drive pin **90.** The drive pin is secured to the bifurcated end of the second crank through a locking pin (not shown) and rotatably mounted in support **92.** Support **92** is in turn affixed to a dual channelled quarter pulley **94** which rotates about shaft **96.** One car in the conveyor train is the drive car **98** and has a pair of apertured plates **100** disposed at each end thereof and held between the adjacent cars by securing bolts **58,** as shown in FIG. **5.** A first drive wire **102** is secured to one of the plates **100** through a fitting **104** and is directed therefrom through a channel in the quarter pulley **94** and fastened to a turnbuckle **106** located beneath the pulley channel. Another drive wire **107** is similarly attached to the other plate **100** and directed therefrom through the other channel in the dual channelled quarter pulley to a second turnbuckle **109.** The two turnbuckles are then joined through a bent fitting **112** and are adjustable to maintain the drive wires in a taut disposition during the

operation of the drive assembly. If desired, only one turnbuckle need to employed and the two drive wires would be secured to each end thereof. It can be seen that the rotation of pulley **74** causes reciprocating movement of the quarter pulley through the crank arrangement, thereby causing reciprocating movement of the drive car and drive train beneath the track and containers thereon. It should be noted that other methods of imparting reciprocating movement to the conveyor could be employed without affecting the functioning of the conveyor.

The operation of the pusher assemblies on the containers is easily understood with reference to the drawings. When the containers are placed on the track and the conveyor train is moving to the right as shown in FIG. **2**, the sensing rollers **54** are in the raised position due to the weight **50** which is secured to the sensing arm causing that arm to pivot in a counterclockwise direction, which, as noted above, lowers the rearward end of the sensing arm causing the forward end of the releasing bar to lower under the pressure of weight **36** secured thereto and the rearward end thereof to correspondingly raise, thereby preventing any counterclockwise movement of the pushing bar. Therefore when the conveyor cars move to the right the pushing bars **22** will come into abutment with the containers and continued travel of the cars in the forward direction (to the right) will cause the containers to be carried along the track **60** by the force of the pusher bars pushing against the containers, as the pusher bars are restrained against counterclockwise movement by the upraised position of the rearward end of the releasing bar. The forward movement of the containers will continue until either the end of the clockwise stroke of the one-quarter pulley, whereupon the cars will begin to move rearward or to the left as shown in FIG. **3**, or until the sensing rollers **54** abut a forwardly disposed container which was not removed from the forward end of the conveyor. In such a situation, the sensing roller would be depressed by the weight of the container, which, through the pivoting action of the sensing arm about roller **44**, raises the forward end of the releasing bar **32** and lowers the rearward end thereof, thereby freeing the lower end of the pusher bar **20** and allowing the pusher bar to undergo counterclockwise rotation. The pusher bar would then simply release the container, pivoting thereunder in a counterclockwise direction as the bar passed thereunder. The use of rollers **28** on the pusher bar reduce the friction as the bar passes under the container disposed thereover.

FIGS. **7–11** are illustrative of the above described procedure. In FIG. **7** the conveyor train has just finished its forward stroke (to the right) and begins its rearward movement. As the pusher assemblies pass to the rear, the pusher bars strike the forward edge of the rearwardly disposed containers and are caused to pivot in a clockwise direction as they pass thereunder. There is never any obstruction in the assembly to clockwise rotation of the pivot bars. FIG. **8** represents the end of the rearward stroke, whereupon the cars again move in the forward direction. The pusher bars then abut the rearward edge of the containers and due to the disposition of the releasing bar **32** caused by the upraised sensing rollers **54**, the pusher bars are prevented from undergoing counterclockwise rotation and hence begin to push the containers thereabove in the forward direction. If a container had been removed from the conveyor, the container next in line would be pushed forward to the location previously occupied by the removed container. If, however, a forwardly disposed container is not removed, as shown in FIGS. **7–11**, contact between containers is avoided by the releasing action of the pusher assemblies. When the forwardly extending sensing roller contacts a forwardly disposed container, the forward end of the sensing arm is then depressed, releasing the pushing bar and the container thereby preventing contact. This position is represented by FIG. **9**. As the forward movement continues, the third container is moved forward until the sensing roller of the pushing mechanism thereunder is depressed by the forwardly disposed container, whereupon the third container is released as seen in FIG. **10**. If none of the containers were removed from the conveyor and no new container added at the rearward end thereof the conveyor would appear as seen in FIG. **11**. If a container were then removed, those containers rearwardly disposed to the removed container would be advanced one location by operation of the pushing mechanisms. It can be seen that the minimum distance which can be caused to occur between adjacent containers is the difference of the distance between the pusher bar and sensing roller of one pusher mechanism and the length of the container which is being moved thereby. Therefore by adjusting the length of the sensing arms **42**, this distance can be varied to suit particular operations.

Various changes and modifications may be made in carrying out the present invention without departing from the scope and spirit thereof. Insofar as these changes and modifications are within the purview of the appended claims, they are to be considered as part of the invention.

I claim:

1. An accumulation conveyor for use in combination with a reciprocating drive means for forwardly transporting items along a track comprising at least one conveyor car disposed below said track, said conveyor car having elongated side portions and parallel end walls, at least one pusher assembly carried by said conveyor car, said pusher assembly being comprised of a first support extending between said elongated side portions and pivotally mounted therebetween, a pusher bar rigidly affixed to said support, means carried by said pivotally mounted support for biasing said pusher bar in a substantially vertical position, a second support extending between and pivotally secured to said side portions of said conveyor car forwardly of said first support, an elongated arm rigidly affixed to said second pivotally mounted support, said arm having a raised forward portion, means for biasing the raised forward portion of said arm above the upper surface of said conveyor car, a third support extending between and pivotally secured to said side portions of said conveyor car between said first and second supports, a releasing bar rigidly affixed to said third pivotally mounted support and extending between said pusher bar and said elongated arm, the forward end of said releasing bar extending over the rearward end of said elongated arm, means for biasing said releasing bar downwardly upon the portion of said arm disposed thereunder so that the rearward end of said releasing bar prevents forward rotation of said pusher bar when said end is an elevated position and releases said pusher bar when disposed in a lowered position, and attachment means carried by

said conveyor car and adapted to be secured to said drive means for imparting reciprocating movement to said conveyor train.

2. The combination of claim **1** wherein said pusher bar biasing means maintains said pusher bar in a forward inclination with respect to a vertical axis passing therethrough.

3. The combination of claim **2** including means for reducing the friction between said releasing bar, said pushing bar and said elongated arm during movement thereof.

4. The combination of claim **3** including means for limiting the upward movement of the forward portion of said elongated arm.

5. The combination of claim **4** wherein said friction reducing means comprises rollers mounted on each end of said pusher bar and the rearward end of said elongated arm.

6. The combination of claim **5** including a roller mounted on the raised forward end of said elongated arm to facilitate movement of said raised end under a stationary item positioned on said track.

7. An accumulation conveyor for use in combination with a reciprocating drive means for forwardly transporting items along a track comprising at least one conveyor car disposed below said track, said conveyor car having elongated side portions and parallel end walls, at least one pusher assembly carried by said conveyor car, said pusher assembly being comprised of a pusher bar pivotally mounted on the conveyor car, means for biasing said pusher bar in a substantially vertical position, an elongated arm having a raised forward portion and being pivotally mounted on said car forwardly of said pusher bar, means for biasing the raised portion of said arm above the surface of said conveyor car, a releasing bar mounted on said car and extending between said pusher bar and said elongated arm, said releasing bar abutting said pusher bar and preventing forward rotation thereof when the forward portion of said elongated arm is above the surface of said conveyor car and pivoting out of engagement with said pusher when the forward portion of said elongated arm is in a lowered position thereby releasing said pusher bar, and attachment means carried by said conveyor train and adapted to be secured to said drive means for imparting reciprocating movement to said conveyor train.

8. An accumulation conveyor for use in combination with a reciprocating drive means for forwardly transporting items along a track comprising at least one conveyor car disposed below said track, said conveyor car having elongated side portion and parallel end walls, at least one pusher assembly carried by said conveyor car, said pusher assembly being comprised of a pusher bar pivotally mounted on the conveyor car, means for biasing said pusher bar in a substantially vertical position, an elongated arm having a raised forward portion and being pivotally mounted on said car forwardly of said pusher bar, means for biasing the raised forward portion of said arm above the surface of said conveyor car, a releasing bar mounted on said car and extending between said pusher bar and said elongated arm, the forward end of said releasing bar extending over the rearward end of said elongated arm, means for biasing said releasing bar downwardly upon the portion of said arm disposed thereunder so that the rearward end of said releasing bar prevents forward rotation of said pusher bar when said end is in an elevated position and releases said pusher bar when disposed in a lowered position, and attachment means carried by said conveyor train and adapted to be secured to said drive means for imparting reciprocating movement to said conveyor train.

9. The combination of claim **8** wherein said pusher bar biasing means maintains said pusher bar in a forward inclination with respect to a vertical axis passing therethrough.

10. The combination of claim **9** including means for reducing the friction between said releasing bar, said pushing bar and said elongated arm during movement thereof.

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