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[73] Assignee **said Jensen assignor to said Jerome**

[54] **CONVEYING AND STORAGE APPARATUS**
12 Claims, 10 Drawing Figs.

[52] **U.S. Cl.** **214/16.4,** 198/129, 198/190
[51] **Int. Cl.** **B65g 1/06**
[50] **Field of Search** ..... 198/129; 214/16.4, 16.14 (F)

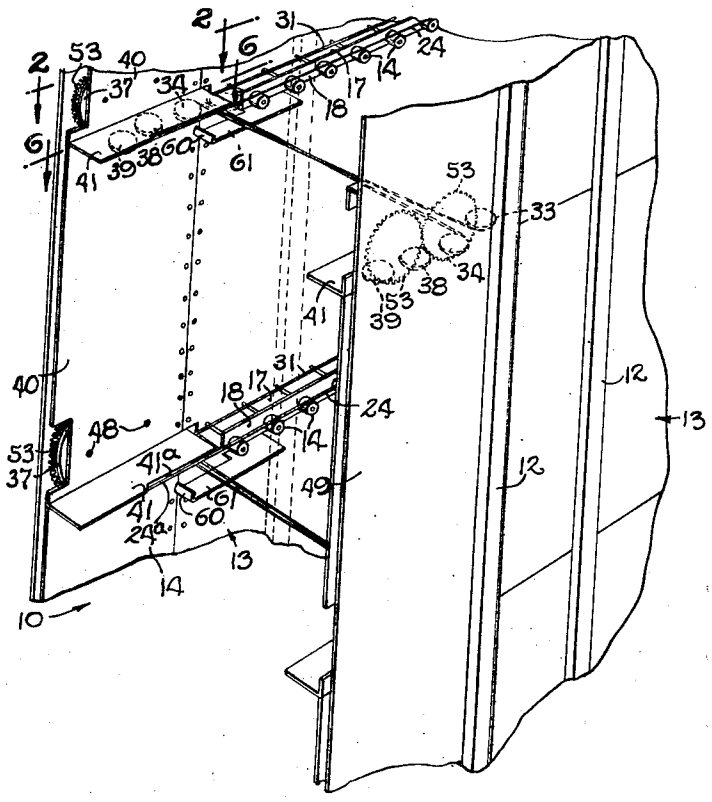
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ABSTRACT: An article storage apparatus having one or more elongated lanes defined between rows of vertical posts with pairs of horizontal side rails vertically spaced in each lane and fastened to the posts. On each rail is a row of load rollers having central peripheral grooves receiving the active runs of a cable conveyor comprising an endless cable trained around supporting pulleys located at both ends of each rail. The pulleys are disposed outside the rails, and guide wheels in out-of-the-way positions lead the cable outwardly onto the pulleys, back inwardly into the lane, and, at one end, cause the cable to cross over so that one endless cable forms both active runs for positive correlation of movement. The pulleys for adjacent lanes are mounted side by side in the walls between the lanes, and are provided with coaxial gears exposed at the ends of each wall for driving engagement with pinions on a forklift truck for loading and operating the conveyors. The forklift has an auxiliary belt conveyor for assisting the cable conveyor, and a latch is provided to anchor the truck in place.



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SHEET 1 OF 4

Fig. 1

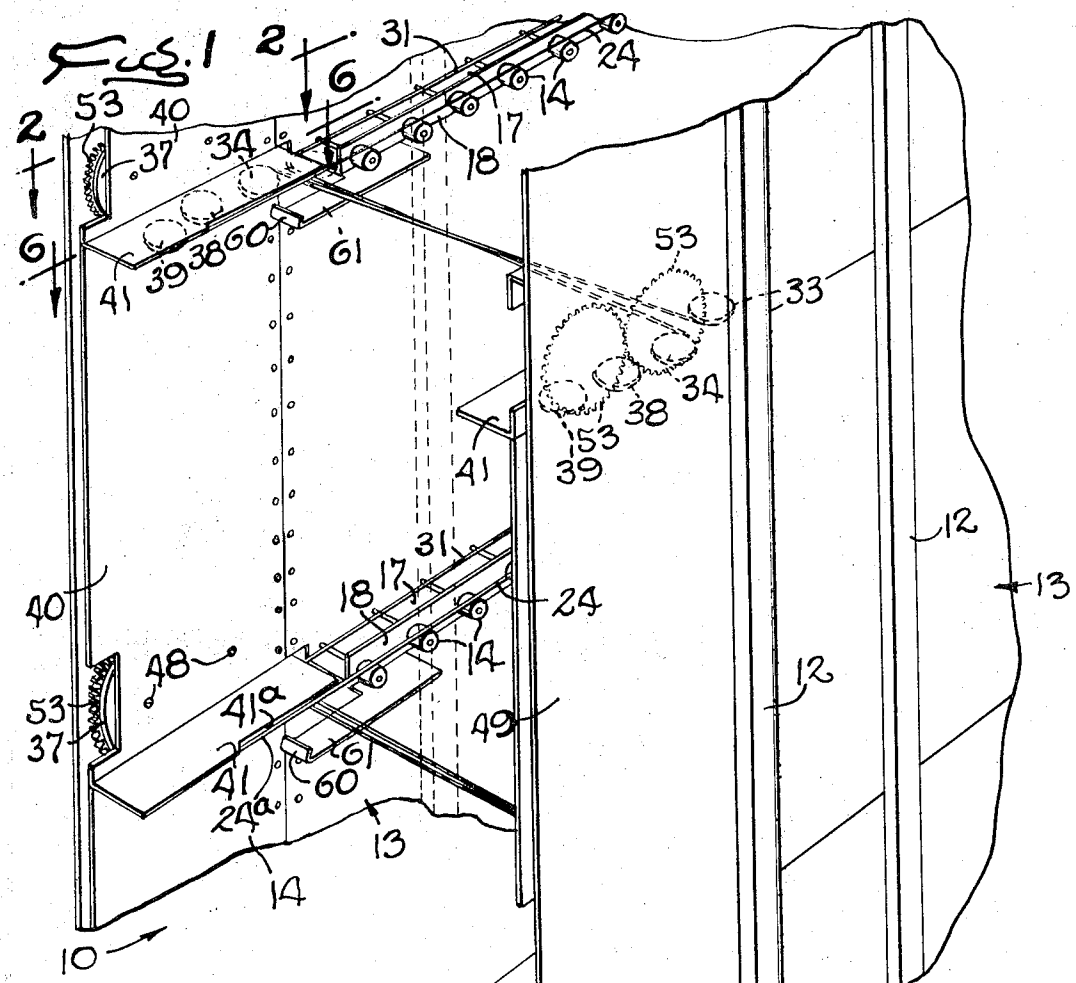
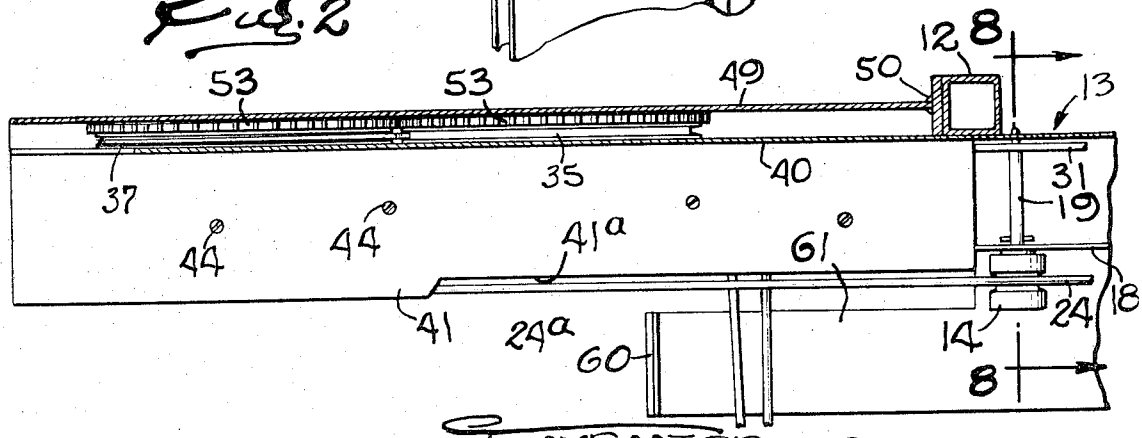


Fig. 2



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Fig. 3

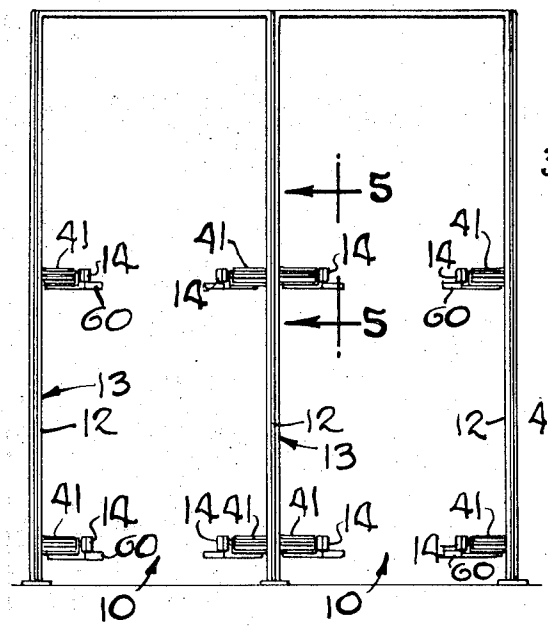
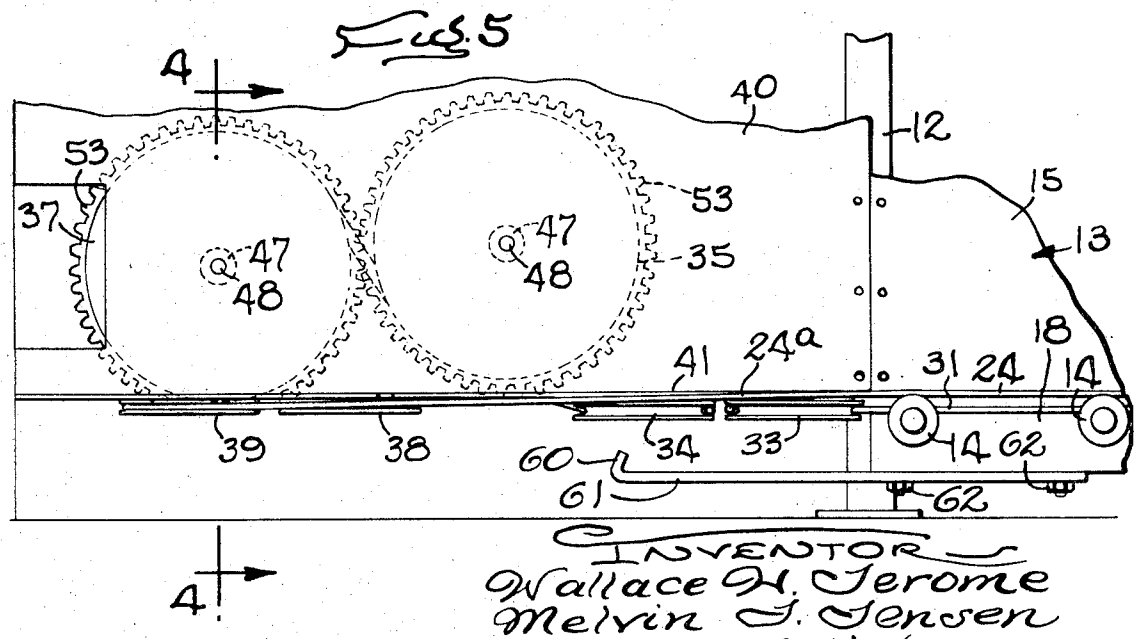


Fig. 4

Fig. 5



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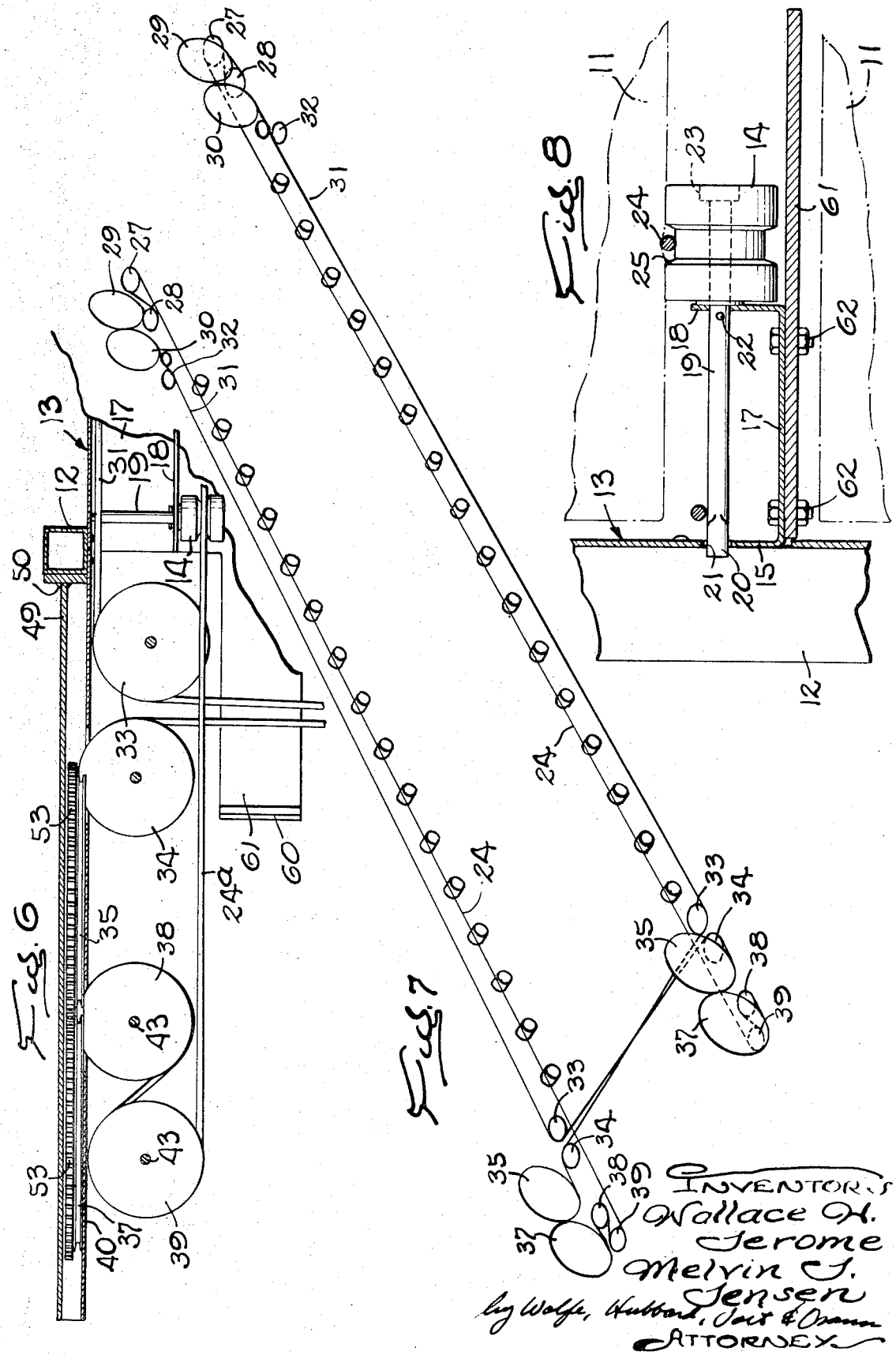


Fig. 6

Fig. 7

Fig. 8

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Fig. 9

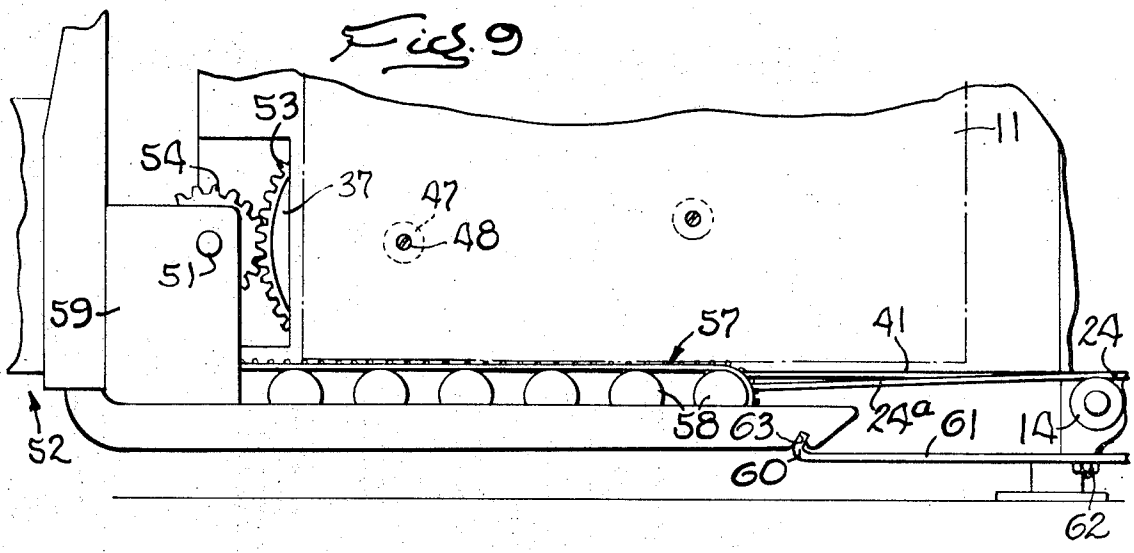
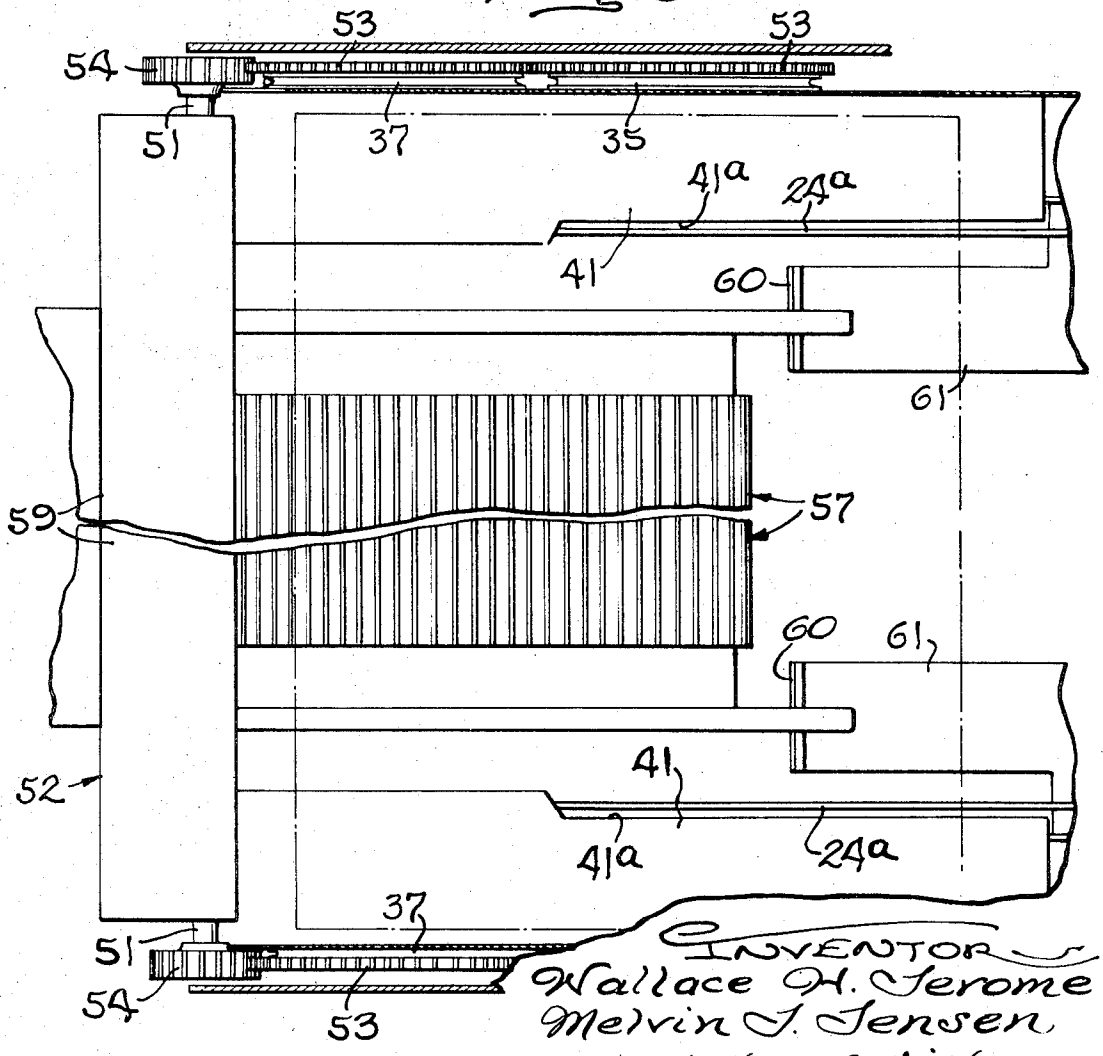


Fig. 10



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CONVEYING AND STORAGE APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to article storage systems and apparatus of the type in which articles are arranged in rows on generally horizontal roller conveyors with several such conveyors vertically spaced in a storage lane and several lanes arranged in side-by-side relation for full utilization of available storage space within the system. More particularly, the invention relates to such systems having power-driven conveyors cooperating with the roller conveyors for advancing articles along the row, thereby permitting insertion of new articles at one end of the row, controlled advance of articles through the storage space, and eventual removal of the articles from the other end. Such systems are particularly adapted for use in warehouses, refrigeration compartments, and vehicles such as trucks and railroad cars.

SUMMARY OF THE INVENTION

The general object of the present invention is to provide an improved and compact conveying and storage apparatus that affords optimum utilization of available storage space by minimizing the space required by the structural elements and the conveyor parts. In addition, the apparatus is easily incorporated in any available space, is extremely versatile in operation, being freely reversible and capable of either continuous or intermittent operation, and is easily accessible for maintenance required in service use. For these purposes, the rollers are journaled on elongated rails extending along the opposite sides of the lanes and arranged in vertically spaced tiers or zones that may extend from the floor all the way to the ceiling of the storage space, and the central portion of each lane is left open for unobstructed access from at least one end of the lane. To incorporate the conveyor without using additional space, cable runs extend along the tops of the rows of rollers and are trained around supporting and driving wheels adjacent the ends of the structure compactly mounted in out-of-the-way positions in the space between adjacent lanes and zones as required by the supporting structure. All obstructions to product movement are eliminated, and positive and equal product movement on both sets of rollers is insured by a novel cable arrangement. The invention also resides in providing drivable means at both ends of each conveyor, and in the novel manner of adapting the conveyors to be driven as an incident to the loading of an article on the conveyor.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective view taken at one end of a conveying and storage lane embodying the novel features of the present invention.

FIG. 2 is an enlarged fragmentary cross-sectional view taken substantially along the line 2–2 of FIG. 1.

FIG. 3 is an end view on a reduced scale illustrating the manner of arranging two or more such lanes in side-by-side relation.

FIG. 4 is an enlarged fragmentary cross-sectional view taken in a vertical plane through the supporting and driving wheels at one end of the combined lanes shown in FIG. 3, the view being taken substantially along the line 4–4 of FIG. 5.

FIG. 5 is a fragmentary side elevational view taken along the line 5–5 of FIG. 3.

FIG. 6 is an enlarged fragmentary cross-sectional view taken in a horizontal plane and substantially along the line 6–6 of FIG. 1.

FIG. 7 is a schematic perspective view showing the conveyor cable and its supporting and guiding wheels.

FIG. 8 is an enlarged fragmentary cross section taken substantially along the line 8–8 of FIG. 2 and showing a carton in conveying and storage position in the lane.

FIG. 9 is a fragmentary side elevation at one end of a lane and showing the position of the platform of a lift truck during the transfer of a carton from the platform into the lane for storage.

FIG. 10 is a plan view of the elements shown in FIG. 9 with the carton position in broken lines. DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in the drawings for purposes of illustration, the invention is embodied in a new and improved conveying and storage apparatus forming one or more storage cubicals or lanes 10 (See FIGS. 1 and 3) each having a plurality of vertically spaced storage zones for receiving articles such as loaded pallets or cartons 11 at one end and moving the articles in rows through the lanes. One type of article that can be handled in a system of this type is a packaged food product that is to be frozen in the system and often stored therein prior to shipment. Typically, articles are loaded in to the lanes on one side of the system, advanced step-by-step through the lanes as additional articles are loaded, and eventually are removed from the other side and transferred to another facility. It will be evident from the following description, however, that the system and apparatus are highly versatile and suitable for use in a wide variety of warehousing operations as well as for use in shipping vehicles, and are capable of either continuous or intermittent operation with articles loaded and unloaded from either side.

Each storage lane 10 is bounced by bounded by two rows of upright supports such as posts 12 that are spaced apart according to the loads to be sustained in service use, and each zone within a lane is defined between two elongated side rails 13 extending along and fastened to the adjacent sides of the posts, for example, by rivets or bolts. The primary support for cartons within a zone is provided by two rows of load rollers 14 journaled on the side rails for rotation about horizontal axes and projecting into, and part way across, the zone level with the row of load rollers on the rail on the opposite side of the zone. For positive, controlled movement of cartons along the rollers, a power-driven conveyor is incorporated in each storage zone, the components of the conveyor occupying otherwise wasted space, and is driven to advance the cartons positively and evenly along both rows of rollers thereby insuring that the cartons will not turn or jam between the side rails.

Herein, each of the side rails 13 is J-shaped in vertical transverse cross section (See FIG. 8) with a vertical portion 15 formed as a sideplate lying flat against the sides of the posts 12 of one row, a horizontal portion 17 turned inwardly at a right angle from the lower margin of the sideplate, and an upturned longitudinal flange 18 forming a shallow channel extending along each rail and of approximately the same depth as the diameter of the rollers 14. The latter are telescoped onto the inner end portions of elongated horizontal axles 19 inserted through the flanges and extending across the channels with flattened outer ends 20 fitted snugly in slots 21 in the sideplates. Pins 22 outside the rail flange cooperate with heads 23 on the inner ends of the axles to hold the roller assemblies in place.

The power-driven conveyor includes two cable runs 24 extending along the tops of the two rows of load rollers 14 as shown most clearly in FIGS. 1, 7 and 8, each roller being formed with a central peripheral groove 25 receiving and guiding the associated run and aligned with the grooves in the other rollers in the row to confine each cable run to a straight line path through the storage zone parallel to the side rails 13. While two separate cables might be satisfactory in some instances, the two cable runs in the preferred embodiment are portions of a single endless cable trained around sets of supporting and guiding wheels at each end of each side rail so that the two active runs overlying the rollers must move in unison and at the same rate, regardless of any slippage that may occur at the supporting wheels. It will be seen that the thickness or diameter of the cable is larger than the depth of the grooves to insure that the cable engages the undersides of articles 11 as shown in FIG. 8.

At the right ends of the side rails 13, the active runs 24 of the cable are trained around grooved guide wheels 27 (FIG. 7) supported for rotation in a horizontal plane and disposed outside the cable path, tangent to the path, so that the cable is guided laterally outwardly in passing around these wheels. After reversing its direction around the guide wheel, each run of the cable passes around a similar horizontal guide wheel 28 and then is led onto a larger support wheel or pulley 29 mounted for rotation in a vertical plane outside the plane of the associated sideplate 15. Beside this pulley is a second support pulley 30 which holds the cable down for engagement with a major portion of the first pulley and guides it downwardly for the return run 31 which herein lies just inside the sideplate (See FIG. 8) and below the level of the tops of the rollers 14. Since there are one or more posts 12 between the two sets of wheels at the ends of each rail, guide wheels are provided at 32 in a horizontal plane to guide the return run inwardly form the support pulley 30 outside the plane of the sideplate to the position shown in FIG. 8. This completes the set of wheels at the right end of each side rail. It will be evident that a wear-resistant rub strip would serve the same purpose as the wheel 32.

At the left end of each rail (See FIGS. 6 and 7), the cable passes around a guide wheel 33 rotating in a horizontal plane, and then turns 90°, crossing the lane to the set of wheels on the other rail. Then, on each side, the cable is guided around a small horizontal wheel 34 onto two supporting pulleys 35 and 37 similar to the pulleys 29 and 30, and finally is guided back to the active run 24 around two horizontal wheels 38 and 39 beside the pulley 37. It will be seen in FIGS. 1 and 2 that the posts 12, the side rails 13, and the rows of rollers 14 preferably terminate short of the left end of the lane 10, and the space between each first post and the end of the lane is covered by a plate 40 that constitutes a continuation of the sideplate 15 of the rail and forms an end section for the lane. This cover plate is formed with an inturned loading flange 41 along its lower margin generally level with the tops of the rollers 14, as shown in FIG. 5.

The guide wheels 33, 34, 38 and 39 are supported under the loading flanges 41 on vertical pins 43 (FIG. 4) held by screws 44 on the flanges, and the pulleys 35 and 37 are supported outside the cover plates 40 on antifriction bearings 45 carried on a center post 47 held in place by screws 48 threaded into the opposite ends of the center post through the two cover plates on opposite sides of the supporting posts 12. A vertical divider plate 49 is centered in the space between the planes of the opposite sides of the supporting posts and welded at 50 (FIG. 2) or otherwise attached to the end post to cooperate with the cover plates in defining two out-of-the-way pulley compartments compactly provided in this available space. This divider plate preferably extends all the way to the floor to provide the primary support for the supporting wheels and the cover plates. Since the flanges 41 are generally level with the roller tops, the cable is inclined downwardly at 24^a, and the edge of each flange preferably is notched as at 41^a (See FIGS. 1 and 2).

As will be seen in FIGS. 3 and 4, this arrangement makes it possible to house the pulleys 35 and 37 for two adjacent lanes side by side in the space required for the row of posts 12, the guide wheels 33, 34, 38 and 39 being disposed substantially in the space otherwise occupied by the rollers 14 and the J-shaped section or channel 17, 18. While the details of the mounting of the wheels at the other end are not shown, it will be evident that this will be almost identical to that at the left end. Accordingly, a full system of lanes 10 and vertically spaced zones may be set up to occupy all of the available space in a storage area, from floor to ceiling and end to end, leaving only loading and unloading areas at the ends of the lanes. Except for these areas, the narrow spaces occupied by the posts 12 and the side rails 13 between lanes and the similar spaces between the storage zones of each lane, all space in the storage area may be employed for storage.

To install a system in a given room space for articles 11 of uniform size, the room space is divided by rows of posts 12 that are spaced according to the size of the articles to be handled so that the sideplates 15 of the rails 13 will be spaced to receive the articles with a close fit as shown in FIG. 8. The pairs of rails 13 are spaced vertically on and riveted to these posts to give sufficient height to each zone for the articles to be handled but spaced to insure that the tops of the articles will pass close to the undersides of the channels, also as shown in FIG. 8. The end sections including the pulleys 35 and 37, guide wheels 33, 34, 38 and 39, divider plates 49, and the cover plates 40 are assembled at the left ends of the lanes, and the similar assemblies are assembled at the right end. Herein, the sideplates 15 are shown as extending upwardly the full height of the zones, but it will be evident that they may be made narrower to leave open spaces between zones which will facilitate air circulation through the system.

When the apparatus has been installed, articles 11 may be loaded into the lanes from either end in any desired manner and fed across the loading flanges 41 onto the adjacent rollers 14, engaging the two cable runs 24 in the manner shown in FIG. 8. If an article is somewhat flexible, as is usually the case, its bottom will yield around the cables and settle onto the rollers. Then, when the cable runs are advanced in unison, the article is carried into and through the zone. Of course, a range of different sizes of cartons can be handled simultaneously, if desired.

Herein, the conveyor is adapted to be driven as an incident to the loading of articles 11 into the lane, by a power source such as a drive shaft 51 (FIGS. 9 and 10) on a forklift truck 52 used to load articles into the lane in one form of the invention, the drive shaft being coupled to selectively operable drive mechanism at least at one end of each conveyor. For this purpose, drivable means in the form of one or more gears 53 are built into the walls between the zones, and are exposed for engagement with pinions 54 carried on the ends of the drive shaft. In this instance, meshing gears 53 are formed coaxially with each set of pulleys 35, 37 (See FIGS. 4 and 5) and the left end of each wall is left open to expose one side of the nearest gear. The drive pinions are positioned on the forklift to be aligned with the gears and to mesh therewith as the lift is moved into position in the lane, level with one of the zones. After the pinions have meshed with the exposed gears, rotation of the pinions in the appropriate direction will advance the conveyor and the article into the zone, positively driving both pulleys 35 and 37 for optimum load-carrying capability.

Preferably, an auxiliary belt conveyor 57 is provided on the forklift as shown in FIGS. 9 and 10 to assist in feeding the articles into the zones. This may be simply an endless belt trained around a series of horizontal rolls 58 journaled on the lift so that the upper horizontal run of the belt supports the article to be transferred. The belt is driven in unison with the pinions 54 through a gearbox 59 providing the desired correlation of drive rates, and its upper run moves in the same direction as the active runs 24 of the cable. Latches for each zone in the form of upturned hooks 60 on the ends of spring arms 61, bolted at 62 (See FIGS. 5 and 8) to the undersides of the channels, interfit with notches 63 (FIG. 9) in the forklift 52 for positive positioning and anchoring of the truck in each loading position.

The pulleys 29 and 30 are similarly provided with exposed gears (not shown) for meshing with the drive pinions 54 when the forklift is positioned at the right end of the zone. Thus, the conveyor may be loaded and unloaded form either end, the drive shaft 51 of the lift simply being rotated in the appropriate direction to feed the conveyor and articles thereon in the desired direction.

Of course, this particular drive arrangement is only one way to operate the conveyors selectively from the ends of the zones, and different alternatives will be readily apparent to those skilled in the art. Moreover, it will be evident that zones can be sized to handle loaded pallets rather than individual cartons, and the supporting structure will be constructed with

sufficient strength to sustain the loads to be handled. When the system is set up for small individual cartons, the lift truck drive will not be used,. Instead, other suitable means will be provided for driving the conveyors and advancing the cartons as desired.

From the foregoing, it will be seen the the present invention provides a compact and versatile conveying and storage apparatus and system for which the possible applications and modifications are many and varied. With the components of the power conveyor built into otherwise wasted space required by basic structural components, the entire apparatus uses only the space necessary for these structural components but has all of the advantages of positive, controlled, and reversible product movement. The use of an endless cable with both active runs integrally tied together insures that the motion of the runs will be identical, regardless of any slippage that might occur at the drive pulleys. This, in turn, insures that articles will not "cock" and jam in moving through the zones, and eliminates the need for clearance to accommodate cocked articles. The driving of each conveyor from an outside source as an incident to the loading and unloading of cartons eliminates the need for individual actuators for the zones, and, even with the crossover cable runs at one end of each zone, the other end is completely open for unobstructed access by service personnel.

We claim:

1. In a conveying and storage apparatus, the combination of, a plurality of parallel rows of vertical posts forming a plurality of elongated lanes between adjacent rows of posts, a plurality of vertically spaced pairs of horizontal rails in each of said lanes, the rails of each pair being fastened to the adjacent sides of two rows of posts level with each other and defining walls of predetermined width between adjacent lanes with spaces between adjacent rails, each of said rails being J-shaped in transverse cross section including a vertical sideplate fastened to a row of posts, an inwardly turned portion, and an upturned flange forming a channel, a row of load rollers on each rail having an axle spanning said sideplate and said flange, the roller being supported on the axle inside said flange and having a peripheral groove, an elongated conveyor for each pair of rails including an endless cable having active runs overlying the two rolls of rollers and received in said grooves, supporting pulleys at the opposite ends of each of said runs offset outwardly therefrom and disposed outside the plane of the associated sideplate, means guiding said cable outwardly from said active runs to pass around said pulleys and then back inwardly inside said sideplates to pass along the latter below the top edges of said flanges, said cable having two crossover runs traversing said lane at one end thereof, and mechanism at least at one end of each conveyor for driving the latter and thereby advancing said active runs simultaneously in one direction.

2. A conveying and storage apparatus as defined in claim 1 in which each of said conveyors has driving mechanism at both ends for selectively operating the conveyor in either direction.

3. In a conveying and storage apparatus, the combination of, a plurality of rows of upright posts forming a plurality of elongated lanes between adjacent rows of posts, a plurality of vertically spaced pairs of elongated rails in each of said lanes, the rails of each of said pairs being level with each other and mounted on the adjacent sides of the posts forming the lane thereby defining walls of predetermined width between adjacent lanes with spaces between the rails on each row of posts, a row of load rollers journaled on each of said rails and projecting into one of said lanes level with the row of rollers on the associated rail and spaced therefrom to leave the central portion of each lane open, an elongated endless conveyor for each pair of rails including upper active runs extending longitudinally of said lanes along the tops of said rows of rollers, supporting wheels for said conveyors adjacent the ends of said rails including pulleys disposed in said walls between the rails of adjacent lanes, first means guiding said upper active runs laterally out of the lanes and onto said pulleys, and means for driving each conveyor to advance said runs thereof simultaneously in one direction.

4. A conveying and storage apparatus as defined in claim 3 in which the pulleys for adjacent lanes are disposed side by side within said walls, the pulleys for one lane occupying not more than one-half of the lateral width of the space within the walls.

5. A conveying and storage apparatus as defined in claim 3 in which said conveyor runs are integrally joined into a single endless conveyor cable, and including additional means guiding said cable to cross over from one side of said lane to the other whereby both active runs must move together.

6. A conveying and storage apparatus as defined in claim 5 in which said first and additional guiding means comprise guide wheels supported in positions removed from the portions of the lane bounded on the sides by a pair of side rails, on the top by the undersides of two rows of rollers, and on the bottom by the next lower rows of rollers, thereby leaving such space available for full utilization as storage space.

7. A conveying and storage apparatus as defined in claim 3 further including drivable means attached to at least one of said pulleys for each conveyor, said drivable means being located at one end of the lane.

8. A conveying and storage apparatus as defined in claim 3 in which at least one pulley for each of said conveyors is drivingly associated with a drive gear, said drive gears being exposed for meshing engagement with an outside power source at the end of the associated lane thereby to drive said conveyors.

9. A conveying and storage apparatus as defined in claim 8 in which pulleys at both ends of each conveyor are drivingly associated with exposed drive gears whereby each conveyor is selectively operable from either of its ends.

10. A conveying and storage apparatus as defined in claim 3 in which said driving means include mechanism accessible from both ends of each conveyor for selectively driving the conveyor.

11. In a conveying and storage apparatus, the combination of, a plurality of rows of upright posts forming a plurality of elongated lanes between adjacent rows of posts, and a plurality of vertically spaced storage zones in each of said lanes, each storage zone comprising a pair of elongated horizontal rails level with each other and fastened to the adjacent sides of the posts defining the lane, a row of horizontal rollers journaled on each of said rails level with and spaced laterally from the rollers on the other rail to leave a passageway through the central portion of the zone, each roller having a peripheral groove longitudinally aligned with the grooves in the remaining rollers on the rail, an endless cable, an active run of said cable extending along the top of each row of rollers in said grooves and projecting above the rollers for engagement with articles to be conveyed and stored, a return run of said cable for each active run spaced below the latter, and supporting and driving means for said runs disposed between the planes of the opposite sides of the posts in each row thereof.

12. A conveying and storage apparatus as defined in claim 11 further including guide means leading the cable runs laterally outwardly for engagement with said supporting and driving means between said planes, said guide means being disposed substantially in vertical alignment with said rows of rollers thereby to occupy only space that is required for said rollers.