Oct. 26, 1965 R. L. LICH 3,214,036

CONTAINER TRANSPORTATION SYSTEM

Filed Nov. 13, 1962 4 Sheets-Sheet 1

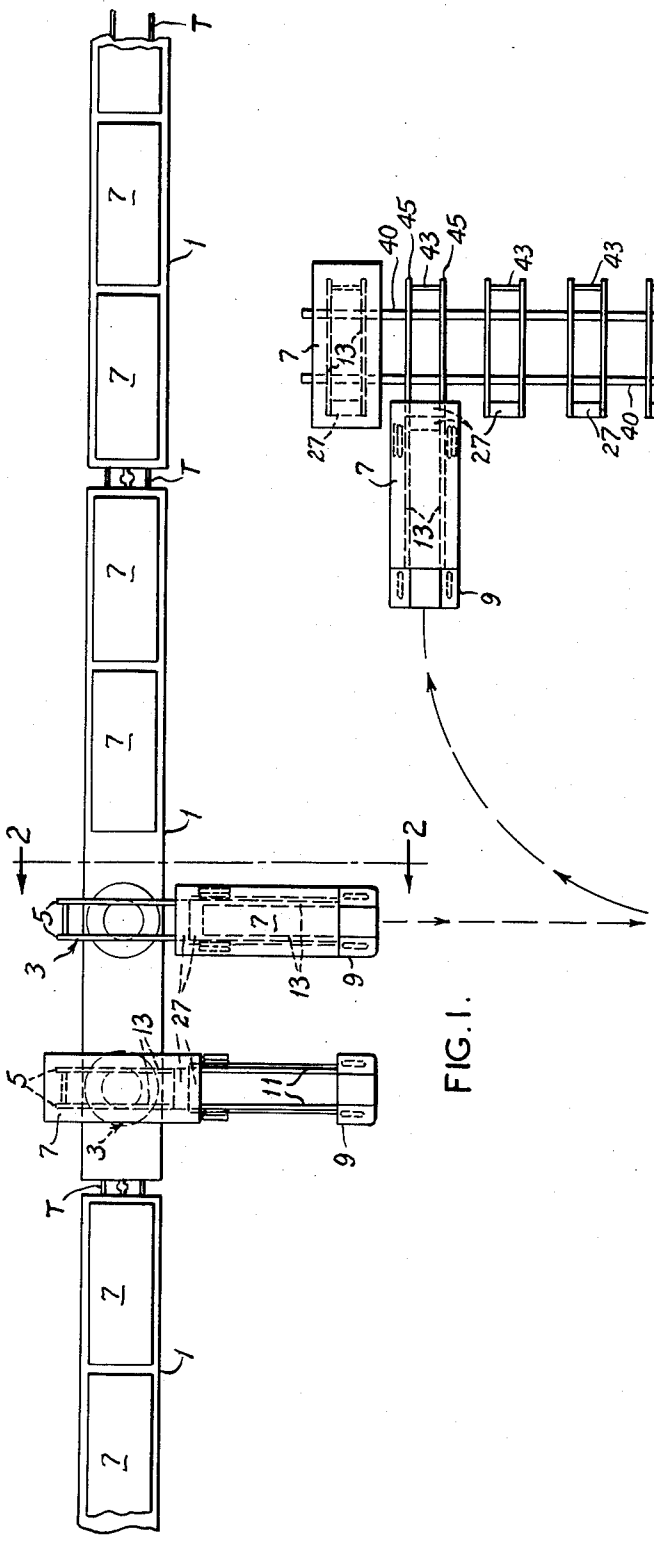

FIG. 1.

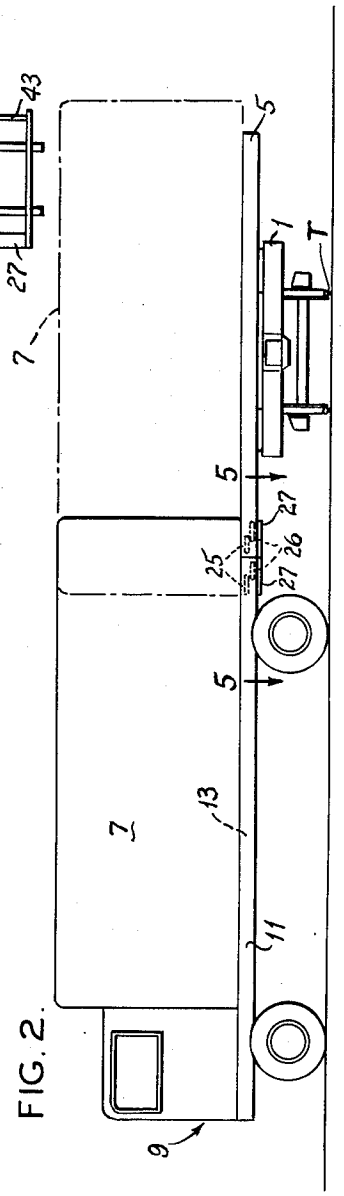

FIG. 2.

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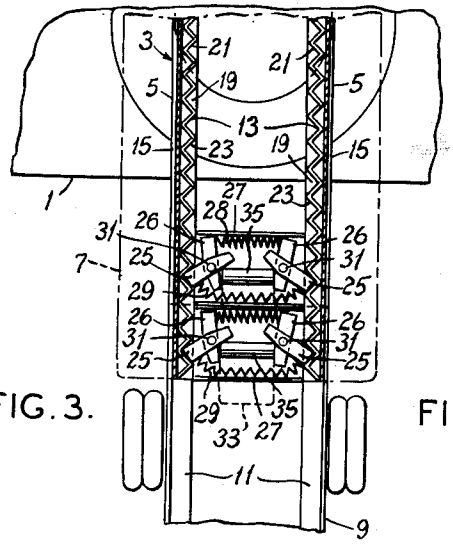

FIG. 3.

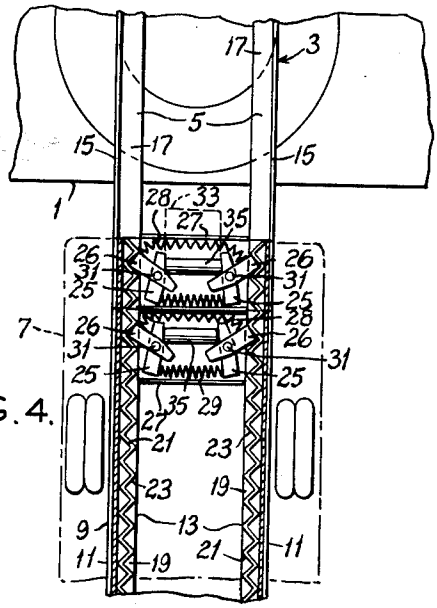

FIG. 4.

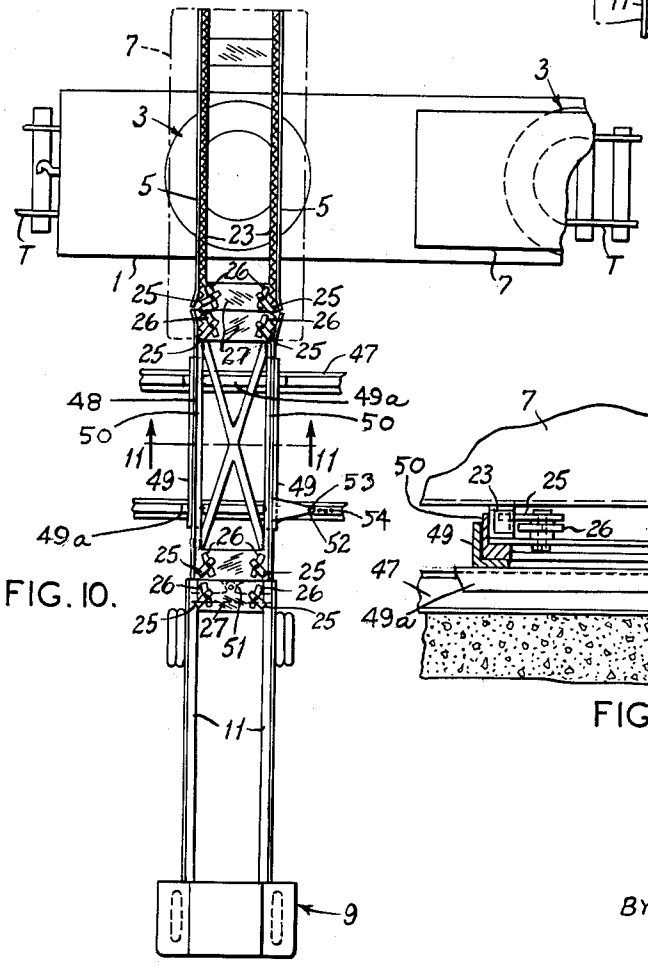

FIG. 10.

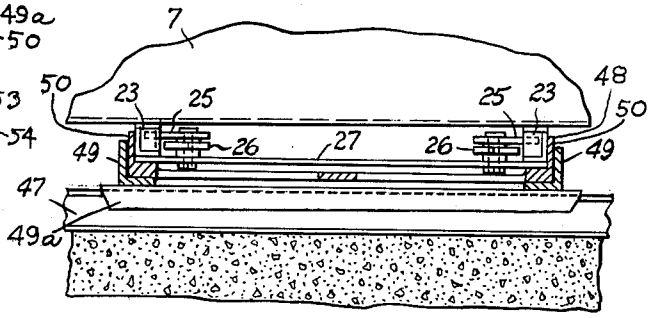

FIG. 11.

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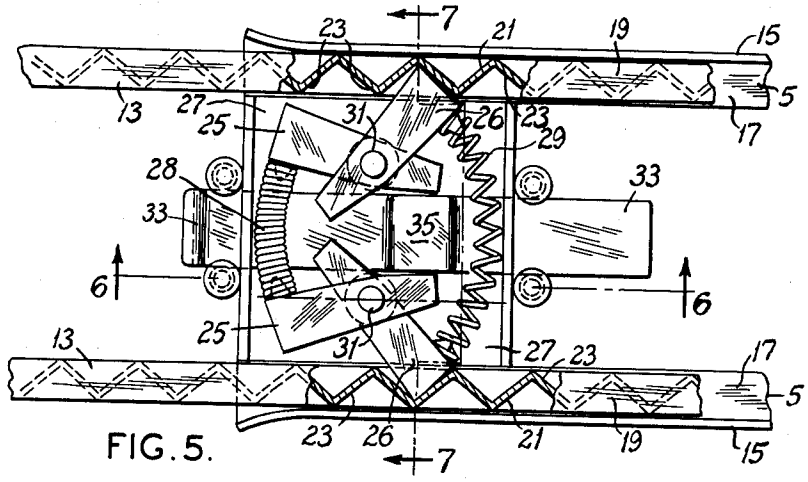

FIG. 5.

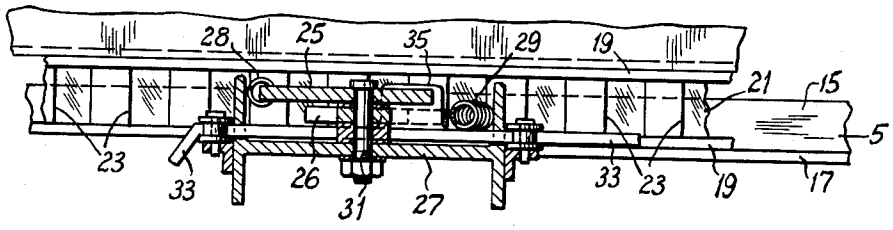

FIG. 6.

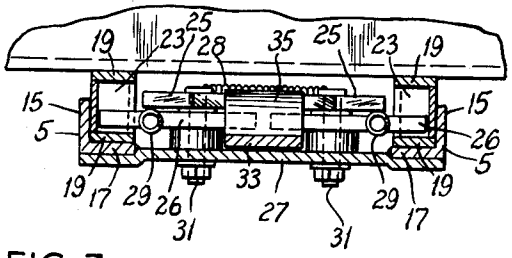

FIG. 7.

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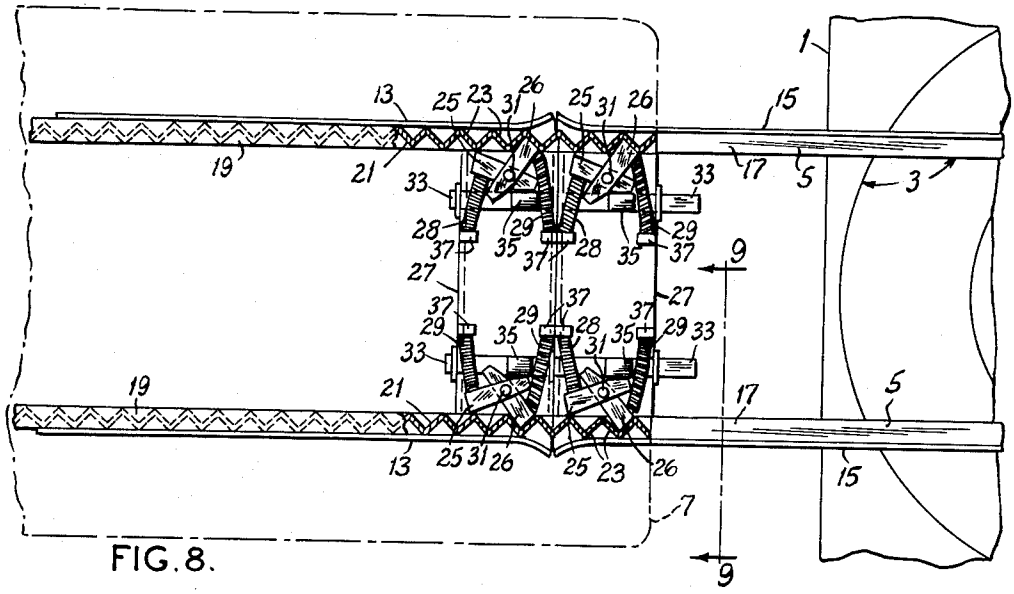

FIG. 8.

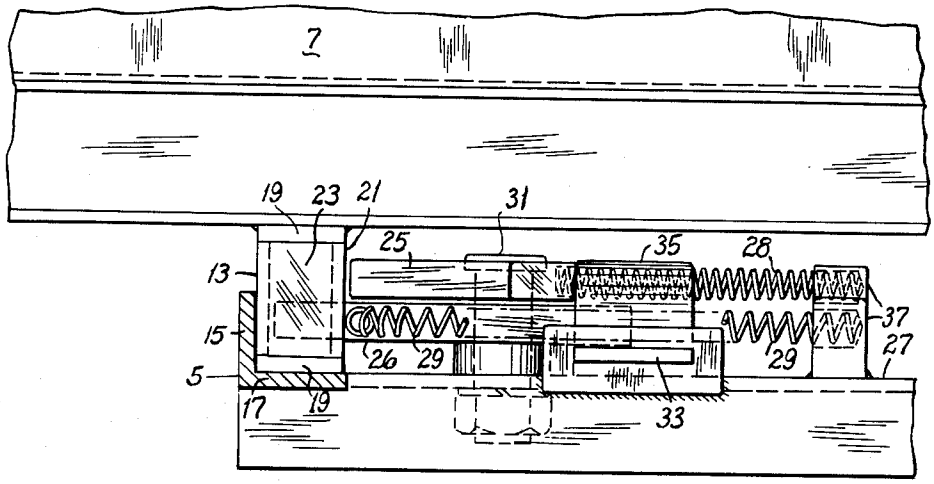

FIG. 9.

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3,214,036

CONTAINER TRANSPORTATION SYSTEM

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Filed Nov. 13, 1962, Ser. No. 236,914
12 Claims. (Cl. 214—38)

The invention relates to a system of transporting shipping containers by various means of transportation, such as by rail and highway, and consists particularly in improved means for transferring containers between railway cars, highway trucks and storage racks and the like.

In prior art arrangements, containers are shifted between highway trucks and railroad flat cars either manually or by the use of cranes, or power winches and the like, and in some instances by gravity. Each of these methods is disadvantageous in some respects. The manual method is obviously unsuitable for shifting large heavily loaded containers because of the amount of manpower required. The use of power winches requires that all trucks used to ship containers which are to be transferred in this manner be so equipped. The gravity method is disadvantageous in that it requires tilting of both container-mounting surfaces of the railroad car and the truck.

It is accordingly an object of the invention to provide a powered means for transferring containers between railway cars and highway trucks, in which all power is furnished by movement of the highway trucks.

It is a further object to provide an arrangement for transferring shipping containers between railway cars and highway trucks in which movement of the containers between the cars and trucks is effected by cooperation between pawl and ratchet devices and the movement of the truck.

It is a further object to provide means by which containers can be removed from railway cars, temporarily stored, and transferred to highway trucks, or vice versa, in which all motive power is supplied by movement of the highway truck.

It is a further object to provide a system for transferring containers between highway trucks, railroad cars, storage racks and the like, in which power is supplied solely by movement of the highway truck, and in which the transfer can be effected by a single movement of the truck in each direction or by small increments as may be requried by space limitations.

The foregoing and additional objects and advantages as will appear from the following description are attained by the structures illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view showing the general arrangement and operation of the system comprising the invention.

FIG. 2 is a view of a truck, a container mounted thereon, and an adjacent railroad car taken along line 2—2 of FIG. 1.

FIG. 3 is a horizontal schematic view corresponding to FIG. 2 and showing the mechanism set for transferring the container from a railroad car to a highway truck.

FIG. 4 is a view corresponding to FIG. 3 but showing the transfer mechanism set for transferring a container from a highway truck to a railroad car.

FIG. 5 is a top view partially sectionalized, along line 5—5 of FIG. 2 of the reversible pawl devices.

FIG. 6 is a longitudinal vertical sectional view along line 6—6 of FIG. 5.

FIG. 7 is a transverse vertical sectional view along line 7—7 of FIG. 5.

FIG. 8 is a top view of a modified reversible pawl device.

FIG. 9 is an end view of the pawl device illustrated in FIG. 8, taken along line 9—9 thereof.

FIG. 10 is a top view of a modified rail-to-highway transfer arrangement including intermediate temporary storage racks between the railroad cars and highway trucks.

FIG. 11 is a transverse vertical sectional view along line 11—11 of FIG. 10.

Referring now to the drawings, in FIG. 1, track T supports railroad flat cars 1, on the decks of which are mounted a plurality of turntables 3 each having a pair of parallel spaced side rails 5 of angle cross-section and adapted to support, in a manner to be described in more detail hereinafter, box-like shipping containers 7. For rail travel, the turntables are aligned lengthwise of the car, and are rotatable to positions transverse of the car for loading and unloading. For transportation of the containers to off-rail points, highway trucks, generally indicated at 9, are provided with longitudinally extending rails 11 having the same transverse spacing as turntable side rails 5, thus being adapted for alignment with turntables 5 when the latter are positioned transverse of the car, and for slidably mounting containers 7 in the same manner as they are mounted on the turntables. The system accordingly permits transfer of containers between the highway trucks and flat cars 1 by rotating the turntables until they are transverse of the flat car, backing the truck until its rails are aligned with turntable side rails 5 and causing the container to move along the track formed by rails 5 and truck rails 11 onto the turntable or onto the truck as may be desired. The containers are each provided with depending longitudinal sills 13 spaced apart transversely of the containers the same distance as the inner surfaces of the upstanding webs 15 of the angle-section rails 11 and turntable side rails 5, so as to be adapted to rest on the horizontal webs 17 of rails 11 and turntable rails 5, which may be suitably lubricated to facilitate slidabe movement of the container sills 13 therealong. Each container sill 13 has vertically spaced top and bottom flanges 19 connected by a vertical web 21 corrugated vertically to form a ratchet bar having a succession of V-shaped teeth 23.

As schematically shown in FIGS. 3 and 4, the rear ends of truck rails 11 and the forward ends of railroad car turntable side rails 5 each support reversible pawls 25 and 26 which are biased transversely outwardly into engagement with teeth 23 of container sills 13 by springs 28 and 29 respectively and are selectively retracted as desired in a manner which will be more fully described below. In FIG. 3, the pawls 25 are released and pawls 26 are retracted on both the highway truck and the railroad car turntable, so that pawls 25 engage the rearward surfaces of container sill teeth 23, thus preventing movement of the container away from the highway truck. By moving the highway truck forwardly from the position shown in FIGS. 2 and 3, the engagement between truck-mounted pawls 25 and container teeth 23 will cause the container to move forward as the truck moves. After moving substantially the full length of the container, or as far as the truck can be conveniently moved, the truck is backed up and the container, restricted against rearward movement on the turntable by the engagements of turntable pawls 25 with the rearward surfaces of teeth 23 moves forward on the truck rails. Movement of the container from the position shown in FIG. 2 can be accomplished either in one movement or several incremental movements depending upon how much space the truck has in which to move. As soon as the container is in the forward truck-mounted position shown in FIG. 2, the truck can be driven away with the container.

FIG. 4 shows pawls 25 on both the truck and flat car retracted and pawls 26 released and resiliently biased against the forward faces of container sill teeth 23 so as to prevent forward movement of the container relative

to the turntable and highway truck and to assist the truck in transferring the container to the flat car turntable. To perform the operation of transferring a container from truck to turntable, the truck is backed until its rails **11** are aligned and in abutting relation with the ends of turntable side rails **5**. When this occurs the overhanging rear portion of container **7** will have engaged pawls **26** on the turntable by means of the forward surfaces of teeth **23** of the container sills **13**, and the truck can be driven forward until the forward end of the container is over the rear end portion of truck rails **11**. With truck pawls **26** engaging the forward faces of the adjacent container sill teeth **23**, the truck is then backed up, its rearward movement being transmitted to the container by means of pawls **26** and the opposing teeth **23** until the container is fully seated on the turntable, after which the truck may be driven off and the turntable rotated to its normal position lengthwise of the car.

Referring to FIG. 5, the pawl device includes pairs of forwardly and rearwardly facing pawls **25** and **26**, each pair of which is mounted on a commmon vertical pivot pin **31**, fixed to turntable or truck crosstie **27**, axes **31** being spaced apart from each other transversely of the turntable and truck and being positioned well within the side rails. Pivot axes **31** are intermediate the ends of each of the pawls **25** and **26**, the outer end portions of which are adapted to be received and engage, respectively, the rear and forward surfaces of container sill teeth **23**. The inner longitudinal surfaces of the pawls are each formed with a spring seat boss near their outer extremities on which are seated springs **28** and **29** by which pawls **25** and **26**, respectively, are biased outwardly. For selectively retracting one set of pawls, a central slider **33** is mounted for slidable movement parallel to the turntable side rails between the separate pawl pivot axes **31** and is formed with an upstanding boss **35** adapted for selective engagement with the inner ends of pawls **25** and **26** so that when in engagement with the inner ends of pawls **25** as shown in FIG. 5, the outer ends of the pawls will be urged inwardly compressing spring **28** and pawls **26**, their inner ends being free, will be urged to their outermost position by spring **29**, the relative positions of the pawls can be reversed by sliding slider **33** to the left in FIG. 5 until upstanding boss **35** on slider **33** engages the inner ends of pawls **26** urging the outer ends therein inwardly in opposition to spring **29**, and freeing the inner ends of pawls **25** whereby spring **28** can urge their outer ends outwardly.

FIGS. 8 and 9 show another form of reversible pawl device in which the pawl devices on each side are entirely separate from each other, the springs **28** and **29** of the respective pawls **25** and **26** being seated at their inner ends against upstanding stationary abutments **37**.

In FIG. 1, in order to permit the removal of flat cars before delivery of all the containers received thereon to their consignees, a storage rack **40** mounting a series of trackways **43** each having parallel rails **45** similar in shape and spacing to the turntable side rails **5** and truck side rails **11**, is provided. Each of the trackways mounts at one end a pair of pawl devices similar to those used on the turntables and truck beds and as seen by the directional line in FIG. 1, a container can be transferred from the turntable to a truck, which in turn can back up to a trackway **43**, the pawls on the trackway and on the rear of the truck can be set to engage the forward faces of the container sill teeth **23** and the container can be mounted on the trackway merely by driving the truck forwardly until the rear end of its sills are beneath the forward end portion of the container and then backing the truck until the container, urged rearwardly by pawls **26**, is fully positioned on the storage trackway. All containers on the train can be similarly stored permitting the removal of the train, if necessary, and then the truck can pick the individual containers up one by one to deliver to various consignees.

Operation of the system as illustrated in FIGS. 1–9 is as follows: With loaded cars **1** positioned as shown in FIG. 1, turntables **3** are rotated from their traveling position aligned with the car bodies to unloading positions extending transversely of the car bodies, and a highway truck **9**, its rearwardly facing pawls **26** retracted and its forwardly facing pawls **25** extended, is backed up against the projecting end of one of the turntables, on which the forwardly facing pawls **26** are retracted and the rearwardly facing pawls **25** extended. Since the forward end of the container **7** projects beyond the end of the turntable, the rear surfaces of its teeth **23** of its ratchet bars **13** are engaged by forwardly facing pawls **25** on the truck. The truck is then driven forward, pulling the container with it until the rear end of the container is supported on the end of the turntable. The truck is thereupon reversed, but the container is restrained against rearward movement by turntable pawls, so that, as the truck moves rearwardly, toward the turntable, it underlies substantially the entire container, except the rear portion thereof resting on the turntable end. The truck is then moved forward, and the container, held against rearward movement on the truck, moves with the truck, and off the turntable. If there are a large number of containers, and it is desired to free the cars for other service at once, the highway truck can transfer the containers individually to storage rack **40**.

Transfer of the containers to storage trackways **43** of rack **40** is accomplished by retracting forwardly facing pawls **25** on both the truck and trackways, then backing the truck into alignment with storage trackway **43**. The overhanging rear portion of the container will then overlie the front of trackway **43** and trackway pawls **26** will grip the forward surfaces of container **23** preventing forward movement of the container. The truck is then moved forwardly until the front end of the container, restrained against forward movement, is supported on the rear end of the truck sills. When this occurs, the truck is moved rearwardly, and the container, restrained against forward movement relative to the truck by the engagement of track-mounted pawls **26** with the forward surfaces of container teeth **23**, will be moved rearwardly onto the rack. As soon as the container is completely seated on the rack, the truck can be used to transfer the remaining containers from car to storage rack.

When all the containers have been transferred from the cars to the loading rack, the cars may be removed if desired or loaded with additional containers from another storage rack, by the same truck, and then sent on their way. Transferring the containers from the truck to the cars is accomplished in the same manner as the transfer of the containers from the trucks to the storage racks. The truck may then be utilized to remove the containers individually from the storage rack and deliver them individually to the consignees. By this method, a single truck may be utilized at a terminal to handle a large number of containers, without tying up any railroad equipment any longer than is necessary to transfer the containers from the car to the truck and thence to the storage rack.

FIGS. 10 and 11 show another form of container storage system in which the storage rack comprises spaced beams **47** located parallel to the railroad track T and longitudinally slidably mounts frames comprising angle section side rails **49** extending transversely of the rack and crossties **49***a* resting on beams **47**. Frame rails **49** slidably mount, for movement transversely of rack beams **47**, trackways **48** having rails **50** similarly spaced to rails **5** of turntables **3** and truck side rails **11**. Both ends of each trackway **48** mount reversible pawls **25** and **26**, arranged as described hereinbefore, and the forward end, i.e., the end remote from the railroad track T is adapted for a pin connection, as at **51**, to the rear of a highway truck, so that by moving a flat car to such as position that one of its turntables can be rotated substantially into alignment with a trackway **48**, the frame **49**, **49***a*

can be slid lengthwise of the rack until the trackway and turntable are perfectly aligned. Then the trackway **48** can be pushed by the truck until its pawls nearest the railroad track engage the rear surfaces of the container sill teeth, after which the truck pulls the trackway away from the car, on which the turntable pawls have been set to engage the rear surfaces of the container sill teeth, and the truck can be moved backward and forward until the container is fully positioned on the trackway. For securing the trackways **48** against movement transversely of beams **47** each of the trackways is provided with a lateral bracket **52**, apertured at its end to receive a pin **53**, and the rails **47** are provided with spaced holes **54** registrable with the bracket aperture. All containers can then be transferred from the cars to the storage rack **47**, trackway **48** can be secured against movement on rack beams **47** by pins **52**, and the containers delivered to their consignees by transferring them one by one from the trackways to the truck in the same manner as has been described heretofore in connection with transfer of containers from car turntable to truck.

If the container storage rack arrangement shown in FIGS. 10 and 11 is provided, the operation is as follows: The flat cars are positioned so that when turntables **5** are rotated to their transverse positions, they will be substantially aligned with track rails **50** on storage rack **47**, frame **49** and trackway **48** are shifted lengthwise of the rack until the alignment is perfect, the turntable pawls **26** are retracted and pawls **25** extended as are pawls **26** and **25** on both ends of trackway **48**, the rear end of truck **9** is coupled by means of pin **51** to the forward end of trackway **48** and the truck pushes the frame under the projecting forward end of the container. The rear pawls **25** of trackway **48** thereupon engage the rear surfaces of ratchet bar teeth **23** on the container, and the truck is driven forward, pulling with it trackway **48** and the container, until the forward end of the container rests on the forward end of the turntable. The truck is then backed up but the container remains stationary since rearward movement of the container is prevented by the engagement of turntable pawls **25** with the rear surfaces of the container ratchet bar teeth. During this operation trackway **48** is backed under the container until the container is centrally positioned on the frame with its forward end projecting beyond the forward end of the trackway. Pin **51** coupling the truck to the trackway is then released, and pin **53**, securing the trackway against movement relative to the rack, is inserted, and the truck can be utilized to similarly transfer all containers on the train from the flat cars to the storage racks. If desired, the cars can then be removed, and the containers transferred in the usual manner from trackways **48** to truck **9** and individually delivered thereby to the consignees. This arrangement is advantageous over the first-described storage arrangement in that it greatly simplifies and reduces truck movements required to effect transfer of the containers from the cars to the storage rack. This storage rack can similarly be used in reverse order for storing containers awaiting shipment pending the arrival of the flat cars.

The details of the system may be modified substantially without departing from the spirit of the invention and the exclusive use of such modifications as come within the scope of the appended claims is contemplated.

What is claimed is:

1. In a transportation system, a pair of load-supporting structures relatively movable lengthwise toward and away from each other, a shipping container mounted on one of said structures for movement lengthwise thereof, a succession of spaced surfaces on said container facing in opposite directions lengthwise thereof with its end projecting beyond the end of said one structure nearest said other structure so as to overlap the adjacent end of said other structure when the two structures are near each other, pawl devices on each of said structures near the adjacent ends thereof, means for selectively engaging the pawl devices on both of said structures with correspondingly-facing surfaces on said container, and means resiliently biasing the pawl devices into engagement with the selected surfaces, to oppose lengthwise movement of the container in one direction responsive to relative movement of said structures toward each other and to cause its movement in the other direction responsive to relative movement of said structures away from each other, whereby to transfer said container from said one structure to the other.

2. In a transportation system, load-supporting structure comprising a pair of elements relatively movable lengthwise toward and away from each other, supported structure comprising a shipping container mounted on one of said elements for movement lengthwise thereof and projecting from the end of said one element nearest the other element so as to be in lapping relation with the adjacent end of said other element when the two elements are near each other and movable to a position on said other element wherein said supported structure projects from the end of said other element nearest said one element so as to be in lapping relation with the adjacent end of said one element, one of said structures having a series of surfaces spaced apart lengthwise of the structure and facing in opposite directions lengthwise thereof, a pair of pawl devices on the lapping portions of said other structure, means for selectively engaging both pawl devices with correspondingly-facing surfaces on said one structure, and means resiliently biasing said pawl devices into engagement with the selected surfaces, to oppose lengthwise movement of the supported structure in one direction responsive to relative movement of said elements toward each other and to cause its movement in the other direction responsive to relative movement of said elements away from each other, whereby to transfer said supported structure from said one element to the other.

3. In a transportation system according to claim **2**, separate vehicles mounting said load-supporting structure elements.

4. In a transportation system according to claim **3**, one of said vehicles being a railroad car and the other a highway truck.

5. In a transportation system according to claim **4**, the load supporting structure element on said flat car being mounted on a turntable and normally positioned lengthwise of the car and rotatable to positions substantially transverse of said car.

6. In a transportation system according to claim **5**, the load supporting structure element on said highway truck extending lengthwise thereof.

7. In a transportation system according to claim **2**, a vehicle mounting one of said load-supporting structure elements, there being a stationary mount for said other load-supporting structure element.

8. In a transportation system according to claim **7**, the mounting for said other load-supporting structure element being elongated transversely of said load-supporting structure element, said other load-supporting structure element being movable transversely of its length along said stationary mount to selected positions thereon.

9. In a transportation system according to claim **8**, said other load-supporting structure element being movable lengthwise of itself on said stationary mount, and means for connecting said other load-supporting structure element to said load-supporting structure element whereby to transmit lengthwise movements of said one to said other load-supporting structure element.

10. In a transportation system, a shipping container, a pair of vehicles movable relative to each other, similarly spaced parallel rails on both of said vehicles, the rails on each of said vehicles being adapted for abutting alignment with the rails on said other vehicle, said container being guidably supported on said rails and having a longitudinally-extending toothed ratchet bar, pawl devices

affixed on said vehicles adjacent the abutting portions of said rails, means for selectively engaging said pawl devices with oppositely facing surfaces of the teeth of said ratchet bar whereby to selectively oppose movement of said container in either direction lengthwise of said rails, and a pair of said ratchet bars spaced apart from and in parallel relation with each other, said bars being arranged for slidable support on said rails of said vehicles.

11. In a transportation system according to claim **10**, each of said pawl devices comprising a pair of pawls each pivoted intermediate its ends on a common pivot axis and means resiliently biasing each of said pawls toward an adjacent ratchet bar, there being a member movable parallel to said ratchet bar to two different positions in which it is selectively engageable with the ends of said pawls remote from said ratchet bar to cause selective rotation of said pawls about said axis in opposition to said bias whereby in one of said positions one pawl of said pair is engageable with surfaces of said teeth facing in one direction thereby to oppose movement of the container in that direction and the other pawl of said pair is disengaged from said teeth and in the other of said positions the other pawl of said pair is engageable with surfaces of said teeth facing in the opposite direction thereby to oppose movement of said container in said opposite direction, and the one pawl of said pair is disengaged from said teeth.

12. In a transportation system according to claim **11**, a second pair of pawls pivoted on a common axis adjacent the other ratchet bar, said movable member being similarly selectively engageable with said second pair of pawls, and said resilient biasing means associated with each of said first pair of pawls being seated at their opposite ends against corresponding pawls of said second pair.

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