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PNEUMATICALLY OPERATED CLOSURE FOR DROP-BOTTOM HOPPER CAR

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FIG. 1.

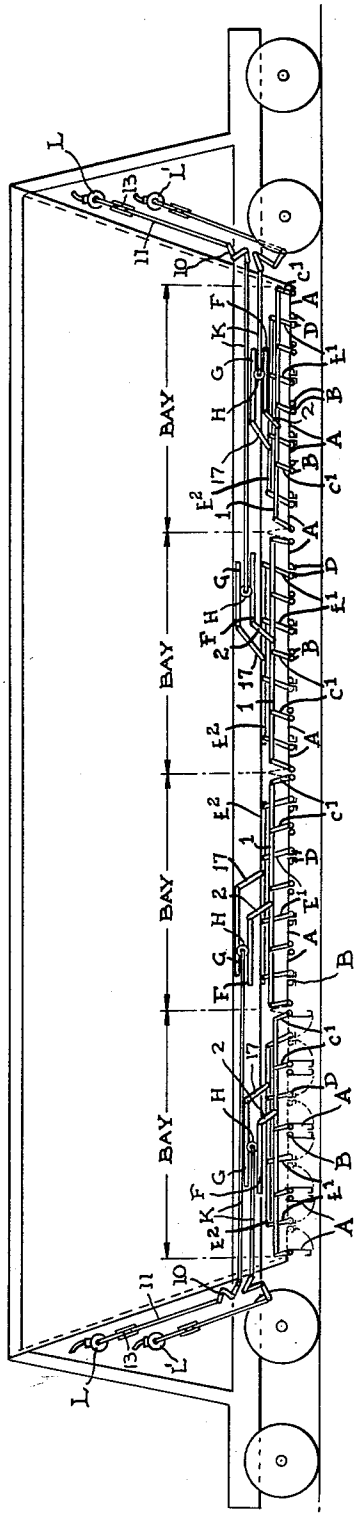
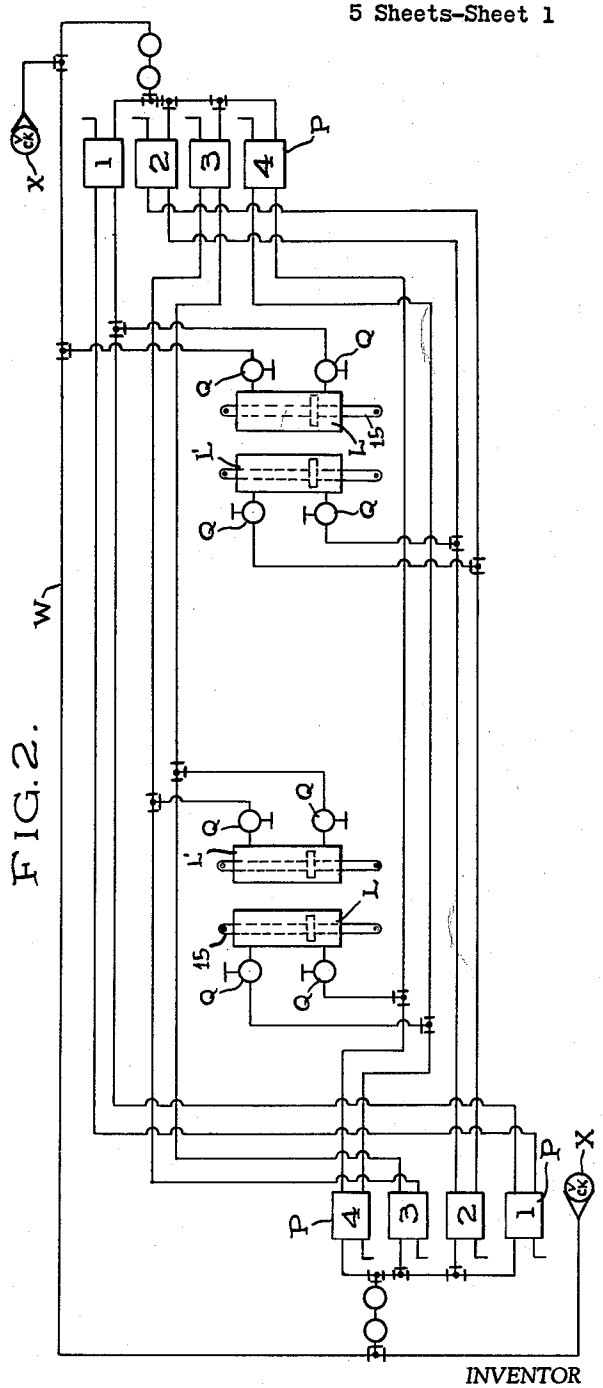


FIG. 2.



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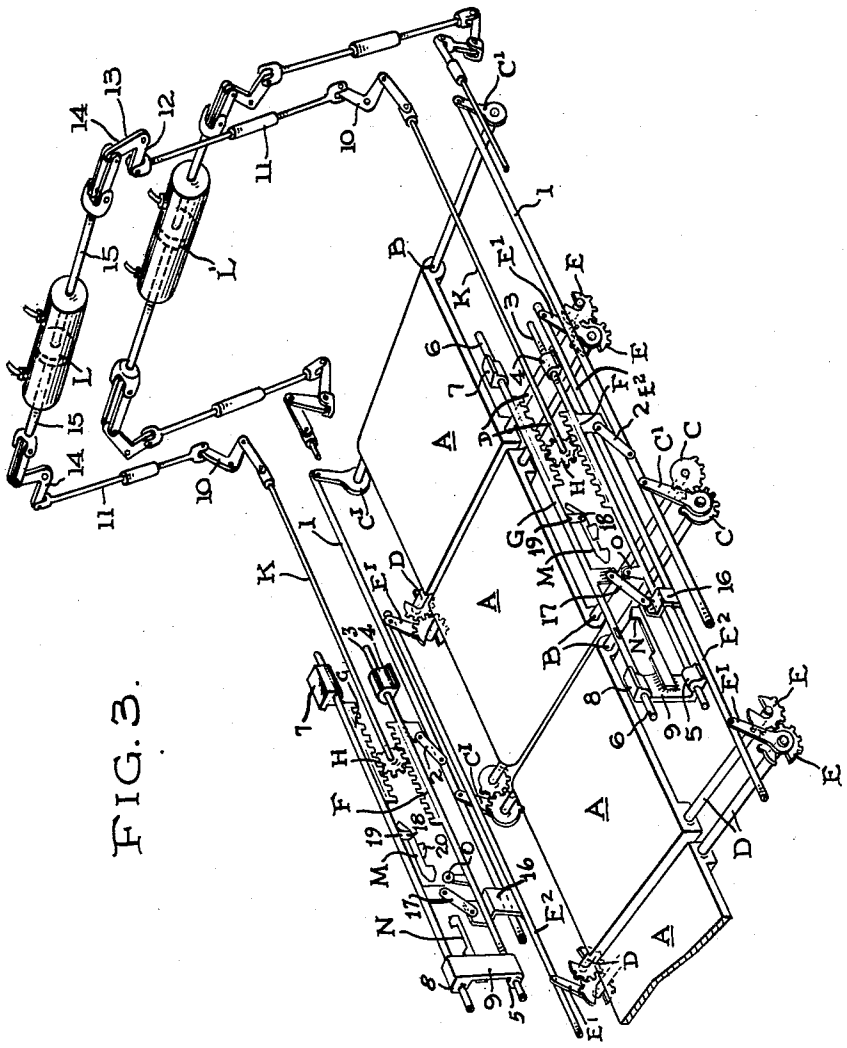

FIG. 3.

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FIG. 8.

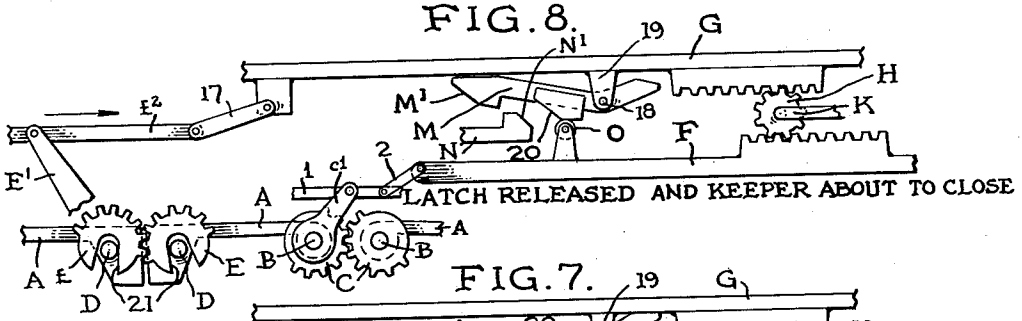


FIG. 7.

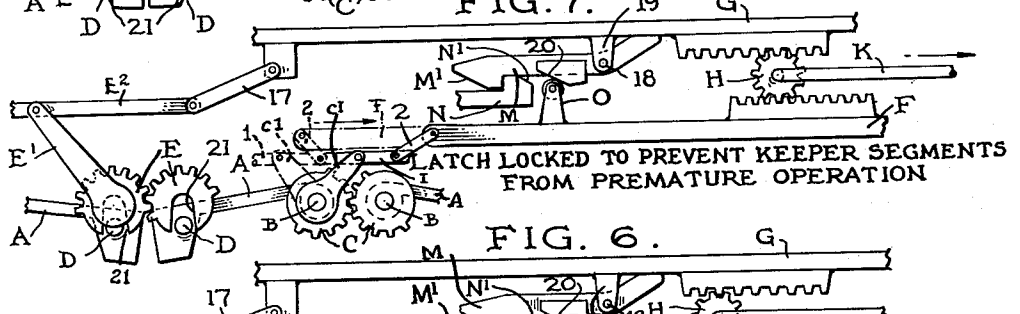


FIG. 6.

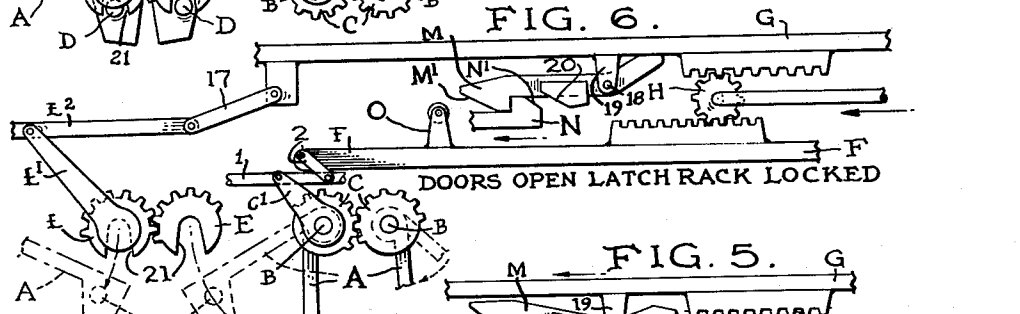


FIG. 5.

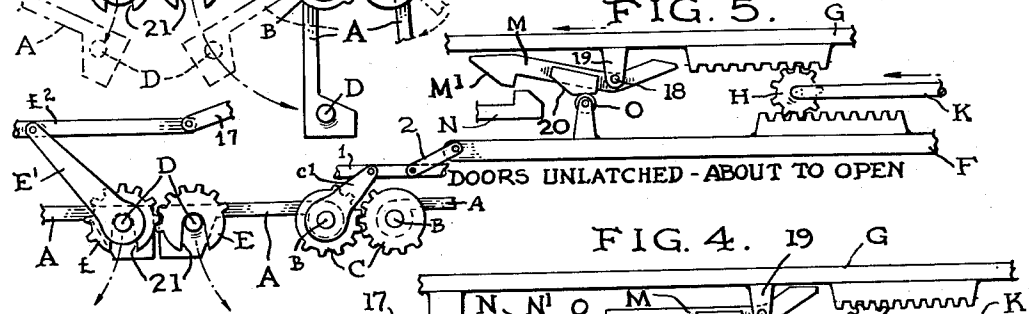
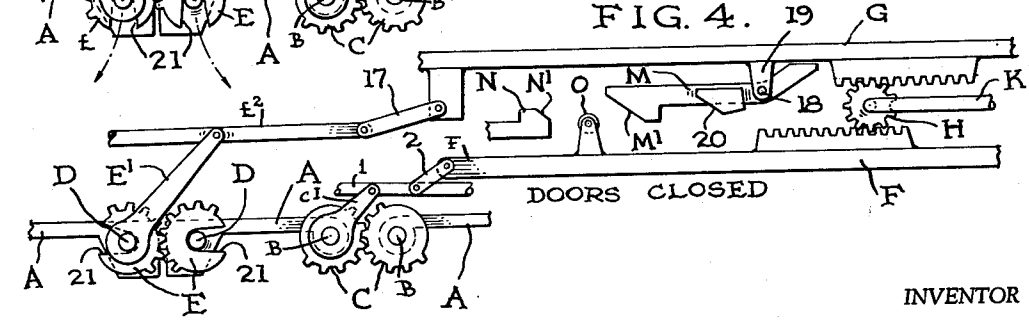


FIG. 4.



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PNEUMATICALLY OPERATED CLOSURE FOR DROP-BOTTOM HOPPER CAR

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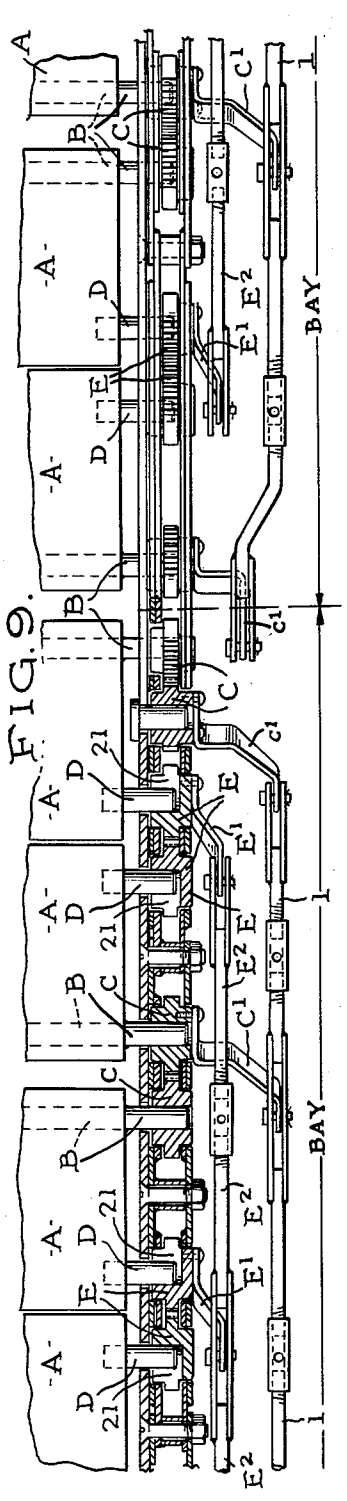

FIG. 9.

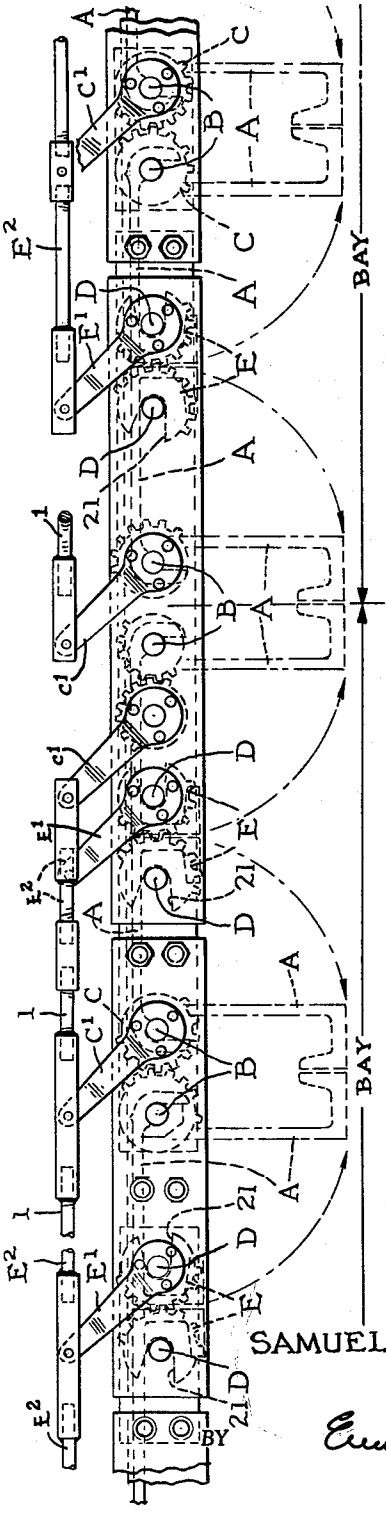

FIG. 10.

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PNEUMATICALLY OPERATED CLOSURE FOR DROP-BOTTOM HOPPER CAR

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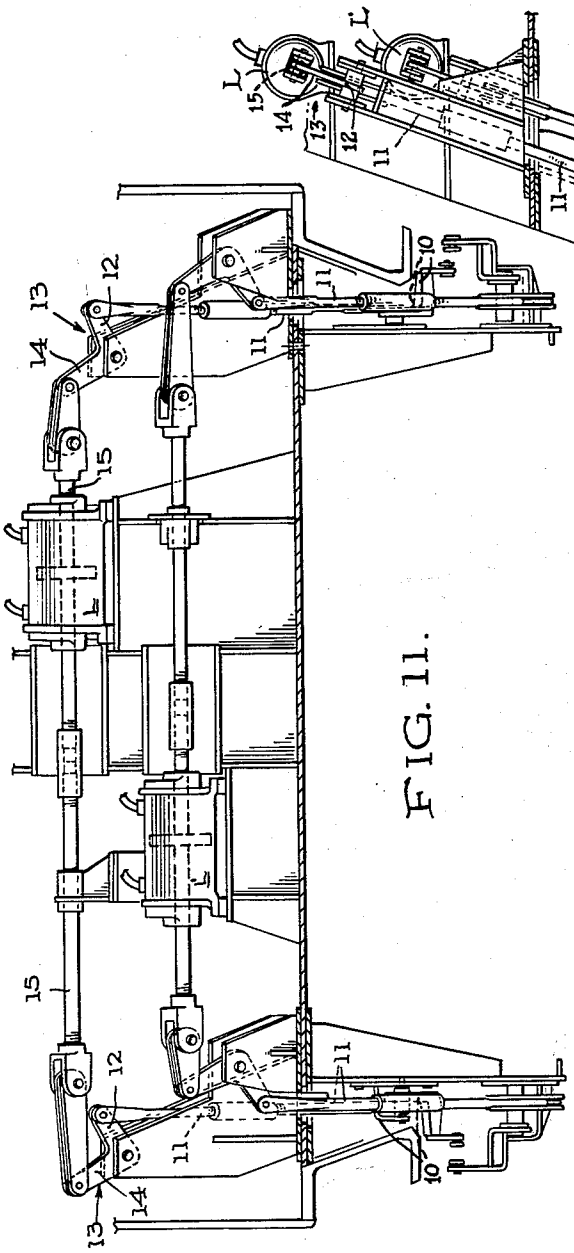

FIG. 11.

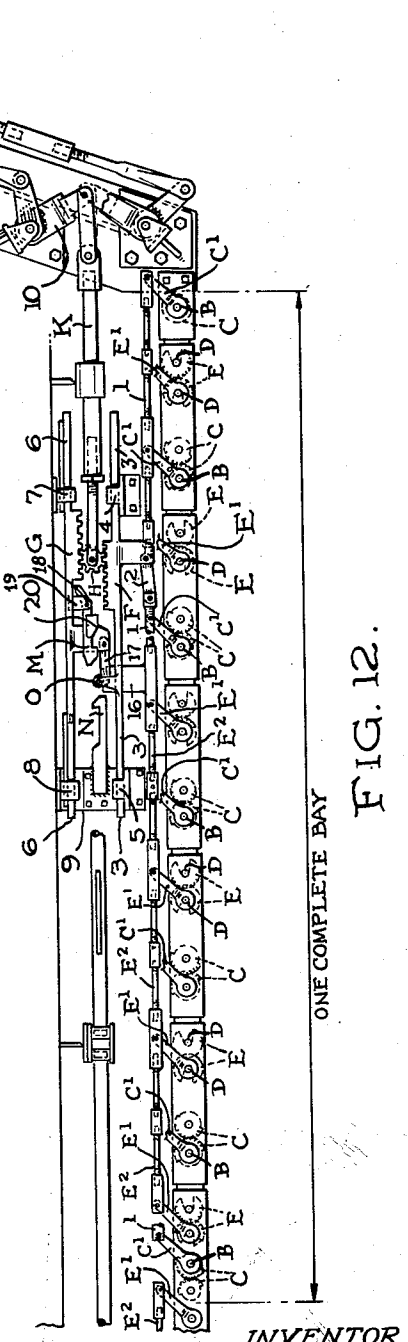

FIG. 12.

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United States Patent Office 3,166,024 Patented Jan. 19, 1965

3,166,024

PNEUMATICALLY OPERATED CLOSURE FOR DROP-BOTTOM HOPPER CAR

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Filed June 8, 1962, Ser. No. 201,097
5 Claims. (Cl. 105—240)

This invention relates to the opening and closing of the doors provided on a gondola or hopper type car, and more particularly, relates to the novel arrangement of pneumatic and mechanical means for the sequential control of unlatching, opening, closing, and latching said doors.

The particular type of car to which the invention is directed is one whose side and end walls converge toward the bottom of the car to provide longitudinally restricted discharge openings normally closed by load supporting doors pivotally mounted on the car body transversely thereof.

Railroad freight cars, especially those used in the bulk handling of freight, can only earn revenue and be economical to the shipper when they are utilized to the fullest extent to transport lading and the time involved in unloading is cut to a minimum. The labor cost of manual unloading including door opening, operating, and closing conventional hopper doors and outlets is additional expense which must be added to the cost of the commodity handled.

The primary object of the present invention is to provide a valve controlled pneumatic system associated with mechanical linkage means which will enable the doors of a car of the type described to be quickly unlatched, opened, closed and latched in rapid sequence, thus permitting unloading of the car with a minimum amount of time and labor, with consequent economy.

Broadly, the invention comprises a plurality of downwardly swinging doors pivotally mounted transversely of the openings in the car bottom. The doors are disposed in pairs, that is to say, the shafts on which the inner edge of each door is pivoted are in juxtaposed relation to each other. As thus arranged, the free or outer ends of each door of a pair of doors are in abutting relationship with each other when the doors are in closed position. The juxtaposed pairs of doors are connected to each other at their hinging axes by gear means so that they will move in unison when opened and closed. When in closed position, power operated rotary latch means engages with the free end of the door to retain the same in closed position.

A preferred and practical embodiment of the invention is shown in the accompanying drawings, in which:

FIGURE 1 is a diagrammatic illustration showing a complete hopper car including four bays and having the present invention applied thereto.

FIGURE 2 is a diagram illustrating the pressurized fluid circuits which control the sequence of door operation.

FIGURE 3 is a diagrammatic perspective view partially illustrating two pairs of doors of one bay, one back to back hinged pair being shown along with a single door locked at the end of a bay.

FIGURE 4 is a diagrammatic view of the latching mechanism and related door operating mechanism when the door sections are in locked position.

FIGURE 5 is a diagrammatic view showing the door sections unlocked, with the latch gear rack about to be locked in a situation where the doors will open by gravity when the latches are in open position.

FIGURE 6 is a diagrammatic view showing the doors open with the latch gear rack locked.

FIGURE 7 is a diagrammatic view illustrating the door sections preparatory to closing, the cam roller on the door gear rack starting to lift the latch on the latch gear rack.

FIGURE 8 is a diagrammatic view showing the door sections 2° before closed position, the latch on the latch gear rack being free, so that said rack will return to the position shown in FIGURE 4 to complete the cycle.

FIGURE 9 is a fragmentary detail plan view, partly in section, illustrating several of the door sections, their hinges, and the operating linkages for the latches and the doors.

FIGURE 10 is a fragmentary side elevation of the construction shown in FIGURE 9, some of the door sections being shown in lowered position by dotted lines.

FIGURE 11 is an end view showing a portion of the car to illustrate the fluid pressure cylinders and that portion of the linkage including the bell cranks connected with the cylinders. This figure shows two cylinders, one for operating a related bay, one cylinder being required for each bay. The same general arrangement prevails at the other end of the car for operating the door sections of two additional bays.

FIGURE 12 is a detail side elevation of the construction and arrangement shown in FIGURE 11.

Similar reference characters designate corresponding parts throughout the several figures of the drawings.

Proceeding now with the details of the invention, it may be pointed out as follows:

General description

The car shown in FIGURE 1 has four bays whose bottom outlets are openable and closable by a pair of door sections A—A. Each pair is provided at their suspension ends with hinge means B in the form of pins journalled in the car frame.

The medial door sections have the axes of their hinges arranged parallel and back to back; however, the last door section at each end of the car has its hinge pin disposed parallel to and adjacent the related end wall of the bay which it serves. The free edge of these last door sections does, of course, cooperate with the free edge of the door section closest to it to form a complete closure member for one of the bottom outlets.

The hinge pins B have secured thereto interlocking door turning segments C. One of these segments has a radial arm C^1 in the nature of a crank so that when power is applied through mechanism to be later described, the doors may operate through an angle of 90°.

The free edge portions of each door section have keeper pins D projecting from each side and which cooperate with the slotted door locking and releasing segments E mounted in close proximity on the car frame. In FIGURE 3, these pins D are shown elongated for purposes of illustration, but reference may be made to FIGURE 9 for correct scale. One of the segments E has a radial arm E^1.

The radial arms C^1 and E^1 of the interlocking door turning gear segments C and the slotted door locking and releasing segments E, respectively, are sequentially controlled by linkage connected with a lower rack F whose teeth project upwardly, and an upper rack G whose teeth project downwardly.

A pinion H is disposed between the racks F and G and is connected by a rod K through a link and lever system with the power cylinder L.

In order to insure that the door locking segments E do not function prematurely during the door closing cycle, the upper rack G is provided with a movable latch arm M which cooperates with a stationary keeper arm N fixed to the car frame and a roller O as will later appear. A

second cylinder L^1 is actuated for operating the doors of the adjacent next bay.

The doors

The doors which retain the lading and also release it are in the form of paired door sections A.

In the example given, the car includes four bays. Each bay has four doors including two sections, or a total of eight sections. The bay at the left-hand end of FIGURE 1 has all eight door sections shown hanging downwardly in open position, while the doors of the remaining bays are in their horizontal closed position.

The door sections A are preferably made of extruded aluminum and are arranged to operate in pairs to provide maximum discharge capacity.

Each door section A is wider than it is long, so that outlets for the bays, as well as the doors, when open, have maximum clearance above the railway rails upon which the car travels. Thus, instead of the doors being mounted on hinges disposed longitudinally of the car, in accordance with common practice, the present invention arranges the hinges transversely across the car.

As shown in FIGURE 3, it will be seen that except for the end door sections, that is, the door section at the right-hand end of FIGURE 3, all other door sections have their hinge axes juxtaposed in back to back relation.

Door operating means

Bearing in mind that there are four bays, and that the doors of two bays are controlled from opposite ends of the car, as will be seen from FIGURE 2, a description of the operation of the doors of one bay will apply to the others. Each of the hinge pins B is, as previously explained, provided with a gear segment C. However, in any case, one of the gear segments is provided with a radial arm C^1 which is connected to a rod **1**.

The rods **1** above referred to are pivotally connected by links **2** to the lower door gear rack F. This rack has its opposite ends **3** slidably mounted in guides **4** and **5** so that it may be moved first in one direction and then the other during the door operating cycle.

The upper latch gear rack G has its toothed portion facing the toothed portion of the rack F and has its opposite ends **6** slidable in guides **7** and **8**. The guides **5** and **8** are mounted on a fixed bracket **9** which carries the fixed pawl N, as shown in FIGURE 3.

The pinion H is disposed between the facing sections of the racks F and G and power is applied to said pinion through the rod K. This rod is in turn connected to one arm of bell crank **10**, whose other end is connected with adjustable rod **11**, and whose upper end is pivotally connected to arm **12** of bell crank **13** connected by arm **14** to the stem **15** of cylinder L.

One of the door keeper segments E is provided with a radial arm E^1, previously referred to, connected to latch bar E^2. This bar is provided with a bracket **16** of angular cross section and is connected by link **17** with the upper rack G. The latch M is pivotally connected at **18** to a downwardly extending projection **19** on the upper rack G and is provided on its underside with a cam surface **20** which is laterally offset in relation to the latch M. This surface cooperates with the roller O which extends upwardly from the lower rack F and is located in the same vertical plane as said cam surface. From the foregoing it will be apparent that the latch M and keeper N are in the same vertical plane and are thus offset from members O and **20**. This arrangement, together with the position of the member **20** on latch M, insures proper timing of the unlocking and locking sequence illustrated in FIGURES 4–8.

Assuming that the door sections A—A are in the closed position shown in FIGURES 3 and 4, it will be understood that they are held in this position because the keeper pins D are engaged in the radial slots **21** of the keeper segments E.

When power is applied to the rod K to which the pinion H is connected, it will be understood that since the upper or latch gear rack G is restrained by the action of the door keeper segments E, the pinion H will walk along the lower rack F and move the upper or latch gear rack G to open the latches by rotating door keeper segments E.

In other words, as rack G moves to the left in FIGURES 3 and 5, the latch M will be lifted as its surface M^1 passes over pawl surface N^1 so that eventually the nose of latch M engages behind the nose of the stationary pawl N. This operation will turn the door keeper segments E so that the slots **21** permit the keeper pins D on the doors to be released. This operation is shown in enlarged detail in FIGURES 4 and 5.

If the door sections fall by gravity, the rack F will be pulled along. On the other hand, if the free edges on the doors are stuck, when power is applied through rod K to gear H, the latter will advance the lower rack F which in turn, through the link **2** and door gear operating rod **1**, will actuate the radial arms C^1 of the door gear segments.

Assuming that the doors are open and the lading discharged, and it is desired to re-close the doors to the full line position shown in FIGURE 3, the power to the cylinder L is reversed. This causes the power through linkage system **10–15** to be applied to lower rack F which in turn is connected to the door gear operating rod **1** through links **2** and arms C^1.

Upper latch rack G is initially prevented from moving since the latch and pawl means M and N are engaged. However, as rack F travels to the right in FIGURE 7, it carries with it the roller O which engages the cam surface **20** to displace latch M from pawl N, thus permitting rack G to travel to the right in FIGURE 7.

Control system

The control system for the cylinders L^1 shown in FIGURE 2 is conventional, with the exceptions which will be noted.

The air supply which may be self-contained or from a track-side source is applied to the supply manifold W through check valves or self-sealing disconnects X. This is essential to the operation of the valves and, in the case of external supply, prevents the entrance of dirt to the system.

The valves P which are located conveniently at the corners of the car are piped in parallel, to allow for a choice of two or more operating locations. The valves are of "center-closed" design which will prevent interaction between valves, or the loss of air through valves other than the one being actuated.

As mentioned previously, manual operation of the doors may be necessary in the event that compressed air is not available. The system is normally closed so that manual operation would be prevented by air trapped in the system and in the cylinders; therefore, provision must be made for this emergency operation.

This emergency is provided for by the quick-exhaust valves Q. These valves, which are pressure-sensitive, will open to the exhaust position when a pressure drop occurs in the lines where they are located. Because the valves are spring-loaded to the exhaust position, they will remain in that position after being actuated.

In normal operation with a loaded car and with control valves P in neutral position, air pressure is standing on the close side of the cylinder, and the open side is vented to atmosphere through the quick-exhaust valve Q in the open line. If manual operation is necessary, the control valves at any position on the car are placed to the open position. As a result, pressure is released and the quick-exhaust valves Q on the close side of the cylinder will be opened to exhaust, and the entire system will be vented to atmosphere so that the linkage to operate doors and latches will be opposed by no trapped air in the cylinders.

I claim:

1. A hopper type car having a plurality of bottom outlets,

(*a*) a pair of door sections of greater width than depth for each outlet and having free meeting edges,

(*b*) axially aligned hinge pins rigidly secured to each of said door sections and projecting from the edges of the sections opposite the free edges, said hinge pins journalled transversely of the car to suspend the door sections across the width of the outlets,

(*c*) door operating means for each hinge pin,

(*d*) a radial arm for said door operating means,

(*e*) keeper pins projecting outwardly from the bottom corner portions of the door sections,

(*f*) door keeper segments having radial slots for receiving the keeper pins and connected for simultaneous turning movement alternately from a horizontal position to a vertical position to release and hold said keeper pins,

(*g*) a radial arm on one of said door keeper segments,

(*h*) and combined reversible power and sequencing means connected with the said radial arms of the door operating means and the radial arms of the door keeper segments to first cause the free edges of the door sections to be released from closed position and then moved downwardly to open position, and thereafter returned to closed and locked position.

2. A hopper type car having a plurality of bottom outlets,

(*a*) a pair of door sections of greater width than depth for each outlet and having free meeting edges,

(*b*) axially aligned hinge pins rigidly secured to each of said door sections and projecting from the edges of the sections opposite the free edges, said hinge pins disposed transversely of the car to suspend the door sections at the edges opposite their meeting edges,

(*c*) door operating gear segments on said hinge pins,

(*d*) keeper pins projecting outwardly from the bottom corner portions of the door sections,

(*e*) door keeper segments having radial slots for receiving the door keeper elements and connected for simultaneous turning movement,

(*f*) a radial arm on at least one of said door keeper segments,

(*g*) and combined reversible power and sequencing means connected with the said radial arms of the door gear operating segments and the radial arms of the door keeper segments to first cause the free edges of the door sections to be released from closed position and then moved downwardly to open position, and thereafter returned to closed and locked position.

3. A hopper type car according to claim 2, wherein,

(*a*) the combined power and sequencing means includes a lower door gear operating rack and an upper latch gear rack with their teeth in facing relation,

(*b*) a pinion engaging both racks,

(*c*) and a rod connecting said pinion with the power portion of said sequencing means.

4. A hopper type car according to claim 3, wherein,

(*a*) the lower gear operating rack has a link connection with the door operating gear segments on the hinge pins,

(*b*) and the upper latch gear rack has link connections with the door keeper segments.

5. A hopper type car according to claim 3, wherein,

(*a*) the lower gear operating rack has a link connection with the door operating gear segments on the hinge pins,

(*b*) and the upper latch gear rack has link connections with the door keeper segments,

(*c*) and said upper gear rack has a pivoted latch for temporary engagement with a keeper on the frame of the car, and said pivoted latch carries an offset cam portion which cooperates with an upstanding cam on the lower door gear rack.

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LEO QUACKENBUSH, *Primary Examiner.*