AUTOMATIC UNLOADER FOR HOPPER CARS
Larrance H. Gillick, Wilmette, Ill., Jose Menendez, Yonkers, N.Y., and Kristapas Dangrius, Wilmette, Ill.; assignors to Vapor Corporation, Chicago, Ill., a corporation of Delaware Filed Mar. 6, 1964, Ser. No. 74,319
1 Claim. (Cl. 214—58)

This invention relates in general to operation by remote control of an element or device mounted on a vehicle, and more particularly to operation by remote control of one or more discharge doors in a hopper car, and still more particularly to the automatic operation of discharge doors in a hopper car when moving the hopper car along a fixed station and to a particular position, although other uses and purposes may be apparent to those skilled in the art.

The present invention, as set forth in a preferred embodiment, relates to the operation of one or more discharge doors in a hopper car thereby eliminating manual control of the hopper car doors. A pneumatic operator is mounted on the hopper car and drivingly connected to one or more doors. A pilot valve or the like, also mounted on the hopper car, is positioned along one side thereof so that it may be responsive to actuating means mounted alongside the track, whereby movement of the hopper car so that the valve substantially aligns with the actuating means effects controlled opening of the discharge door of the hopper car. A lever having one end paddle-shaped is mounted adjacent the pilot valve and biased to a position whereby the pneumatic door operator maintains the door in a closed position. An electromagnet mounted alongside of the track serves to exert a force on the paddle-shaped end of the lever when they are in substantially alignment to move the lever and cause operation of the pilot valve, which, in turn, causes operation of the pneumatic door operator to open the door. Thus, the hopper car door is opened by remote control upon satisfaction of the condition of substantially aligning an electromagnet mounted alongside of the tracks with the pilot valve.

It is therefore an object of this invention to provide a device for remotely controlling the operation of an element carried on a vehicle. A further objective of this invention is to provide apparatus for remotely controlling the opening and closing of discharge doors in a hopper car.

Another object of this invention is to provide means for controlling the opening and closing of discharge doors in a hopper car upon movement of the hopper car along its tracks.

An additional object of this invention resides in the provision of controlling remotely the opening and closing of doors on a hopper car by an electromagnet means mounted alongside the track upon which the hopper car travels.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 2 is a fragmentary perspective view of a hopper car embodying the present invention and particularly showing the valve control and electromagnet control for operating the hopper discharge doors;

FIG. 3 is a perspective view with parts broken away for purposes of clarity of the pilot valve and operating mechanism adapted to be mounted on the side of a hopper car in accordance with the present invention;

FIG. 4 is a cross-sectional view taken through the hopper car and illustrating the door operator and the position of the parts when the doors are in closed position;

FIG. 5 is a view similar to that of FIG. 4, but showing the doors in open position; and

FIG. 6 is a schematic block diagram of the pneumatic circuitry applicable to operate the door operator shown in FIGS. 4 and 5.

Referring now to the drawings and particularly to FIGS. 1 and 2, the hopper car 10 is shown having wheels 11 received on rails or tracks 12 that are, in turn, supported by ties 13 spaced along a roadbed 14. As with conventional hopper cars, it includes side and end walls and a bottom, and being open at the upper end for receiving contents 15. Further, it is normal that the contents of a hopper car be discharged from and through the bottom, and accordingly openings must be provided in the bottom with doors for controlling the openings.

Referring now to FIGS. 4 and 5, doors 16, 17, 18, and 19 are provided in the bottom of the hopper car 10 to be opened and closed by means of a pneumatic door operator 20. The doors 16, 17, 18, and 19 are respectively pivoted at 16a, 17a, 18a and 19a so that they move between the position shown in FIGS. 4 and 5. The door operator 20 includes an oscillating drive shaft 21 having a crank 22 mounted thereon. One end of the crank has pivotally connected thereto a rod 23 that is, in turn, pivotally connected to a lever 24 that oscillates shaft 25. A bellcrank 26 is secured to the shaft 25 for rocking movement therewith. A link 27 is pivotally connected to one end of the bellcrank 26 and to the door 16, while a link 28 is pivotally connected to the other end of the bellcrank 26 and to the door 17. Thus, translation of the rod 23 oscillates the shaft 25 to change the relationship between the doors 16 and 17 and cause them to open or close.

Similarly, a rod 29 is pivotally connected to the other end of the drive crank 22 and, in turn, pivotally connected to a lever 30 fixed to a shaft 31. A bellcrank 32 is mounted to be rocked by the shaft 31 and, in turn, pivotally connected at one end to a link 33 and at the other end to a link 34. The link 33 is additionally pivotally connected to the door 19, while the link 34 is additionally pivotally connected to the door 18. Since the oscillation of the drive crank 22 opens and closes the doors 18 and 19. Thus, operation of the drive crank 22 simultaneously causes opening and closing of the doors 16, 17, 18 and 19. Further, the doors are shown in closed position in FIG. 4 and the position of the mechanical parts is illustrated when the doors are in closed position. In FIG. 5, the doors are shown in open position and the position of the mechanical parts related thereto are shown with the doors in this position.

Referring now to FIG. 6, a block diagram of the pneumatic circuitry for operating the pneumatic door operator 20 includes a conventional four-way master valve 35 connected to pneumatic cylinders 36 and 37 of the door operator 20 by means of lines 38 and 39, respectively. The door operator 20 also includes a gear box 40 of the usual type that responds to operation of the pneumatic cylinders 36 and 37 to drive the shaft 25 of the drive crank 22. A flow control valve 41 is also provided in the line 39. Air is supplied to the master valve 35 from an air reservoir 42 through a line 43, and a compressor (not shown) supplies air to the line 44 for the air reservoir 42. A check valve 45 is provided in the line 44 to prevent discharge of air from the reservoir 42, and a metering fitting 46 is provided in the line 44 between the check valve and the air reservoir.

Operation of the four-way master valve 35 is accom-
plished by any one of two three-way pilot valves 47 and 48. Only one three-way pilot valve need be provided, or any number greater than two may be provided, depending upon the particular installation. In the illustration, the pilot valves 47 and 48 are interconnected by a line 49, and each is provided with exhausts 47a and 48a, respectively. A double check valve 50 is arranged between the pilot valves and the four-way master valve to permit actuation of the master valve from either of the pilot valves. A line 51 interconnects the double check valve 50 with the master valve 35, and lines 52 and 53, respectively, connect the double check valve with the three-way pilot valves 47 and 48. An exhaust 35a is also provided on the four-way master valve 35. Thus, the three-way pilot valves serve to initiate operation of the four-way master valve which controls the pneumatic operator 20. The present embodiment is such that when a pilot valve is actuated, it causes operation of the master valve to, in turn, effect operation of the pneumatic operator 20 to open the doors in the hopper car. Conversely, deactivation of the pilot valve will effect closing of the hopper car doors.

In accordance with the present invention, the pilot valves may be mounted at any place along the side of the hopper car 10, and as shown in FIG. 1, the pilot valve 47 is mounted within a dust-free, tamper-proof box 54 at one end of the hopper car 10. As also seen in FIG. 3, the pilot valve 47 includes a button actuator 55 in alignment with a detent 56 mounted on one end of a lever 57 that is pivoted on the box 54. The other end of the lever 57 is paddle-shaped or provided with a paddle 59 extending vertically and facing the outside wall of the box 54 at the side of the hopper car 10. A spring 60 encircles a guide pin 61 extending from a fixed plate 62 within the box and is connected at one end to the plate 62 and at the other end to the paddle 59 to continually urge the paddle 59 toward the plate 62. Thus, movement of the paddle 59 toward the outer wall of the box 54 away from the plate 52 will rock the lever 57 on the pin 58 and cause the detent 56 to depress the button actuator 55 and operate the pilot valve 47. Operation of the pilot valve 47, in turn, causes operation of the four-way master valve 35 and the pneumatic operator 20 to effect opening of the hopper car doors. Conversely, movement of the paddle 59 away from the outer wall of the box 54 and toward the plate 52 causes closing of the doors by the door operator 20. The plate 59 is constructed of magnetically permeable material so that it may respond to a magnet field. In this regard, an electromagnet 63 in the form of an elongated bar is arranged along the tracks 12, and in the illustration, mounted on a tie 13 by means of a hinged bracket unit 64 so that it aligns with the paddle 59 of a pilot valve unit. The electromagnet 63 is mounted on a hinged bracket 64 so that the electromagnet may be arranged in a down position as shown in dotted lines in FIG. 2 and therefore not operative relative to the valve unit so that a hopper car may pass the area of the electromagnet without dropping its contents if so desired. But when the electromagnet 63 is in its upstanding position as shown in FIG. 2 in full lines, movement of the hopper car along this station effects opening of the hopper car doors and initiates an unloading cycle for the hopper car. Thus, it is seen that the present invention eliminates the need for any manual handling of a hopper car during the entire unloading cycle. Further, when the hopper car is moved out of the area of the electromagnet 63, the doors will automatically close. The electromagnet 63 may also be completely enclosed so that it requires no attention or maintenance, and the length of the electromagnet may be determined by the needs of the unloading area, wherein it may be increased or decreased in length.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claim.

The invention is hereby claimed as follows:

In a hopper car having a body with side and end walls and a bottom, at least one opening in the bottom to permit discharge of the contents from within the car, and a door over the opening adapted to be selectively opened and closed, said hopper car being mounted on tracks and movable therealong, means for opening and closing said door comprising, a pneumatic door operator mounted on said hopper car and drivingly connected to said door for opening and closing same, control means mounted along the side of the car in a tamper-proof box for operating said door operator, said control means including a pilot valve and a lever pivoted adjacent said valve for operating same having on one end thereof detent means for engaging said valve and at the other end a paddle-shaped portion of magnetic material, electromagnet means mounted along said tracks and selectably movable to a position in close alignment and spaced relation with the path of said paddle-shaped portion of said valve lever to move the lever and actuate the pilot valve thereby energizing said door operator to open said door, and spring means associated with said lever to return same to a normal position to effect closing of said door when said paddle-shaped portion of said lever is out of the influence of said electromagnet.

References Cited by the Examiner

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Inventor</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,739,542</td>
<td>3/1973</td>
<td>Bonanno</td>
</tr>
<tr>
<td>3,080,075</td>
<td>3/1963</td>
<td>Giesing</td>
</tr>
<tr>
<td>3,161,146</td>
<td>12/1964</td>
<td>Lutts et al.</td>
</tr>
<tr>
<td>3,173,381</td>
<td>3/1965</td>
<td>Charles et al.</td>
</tr>
<tr>
<td>3,187,684</td>
<td>6/1965</td>
<td>Orner</td>
</tr>
</tbody>
</table>

GERALD M. FORLENZA, Primary Examiner.

ROBERT G. SHERIDAN, Examiner.