Feb. 23, 1926. 1,574,197

L. P. HYNES

DOOR ENGINE CONTROL

Filed March 6, 1920 2 Sheets-Sheet 1

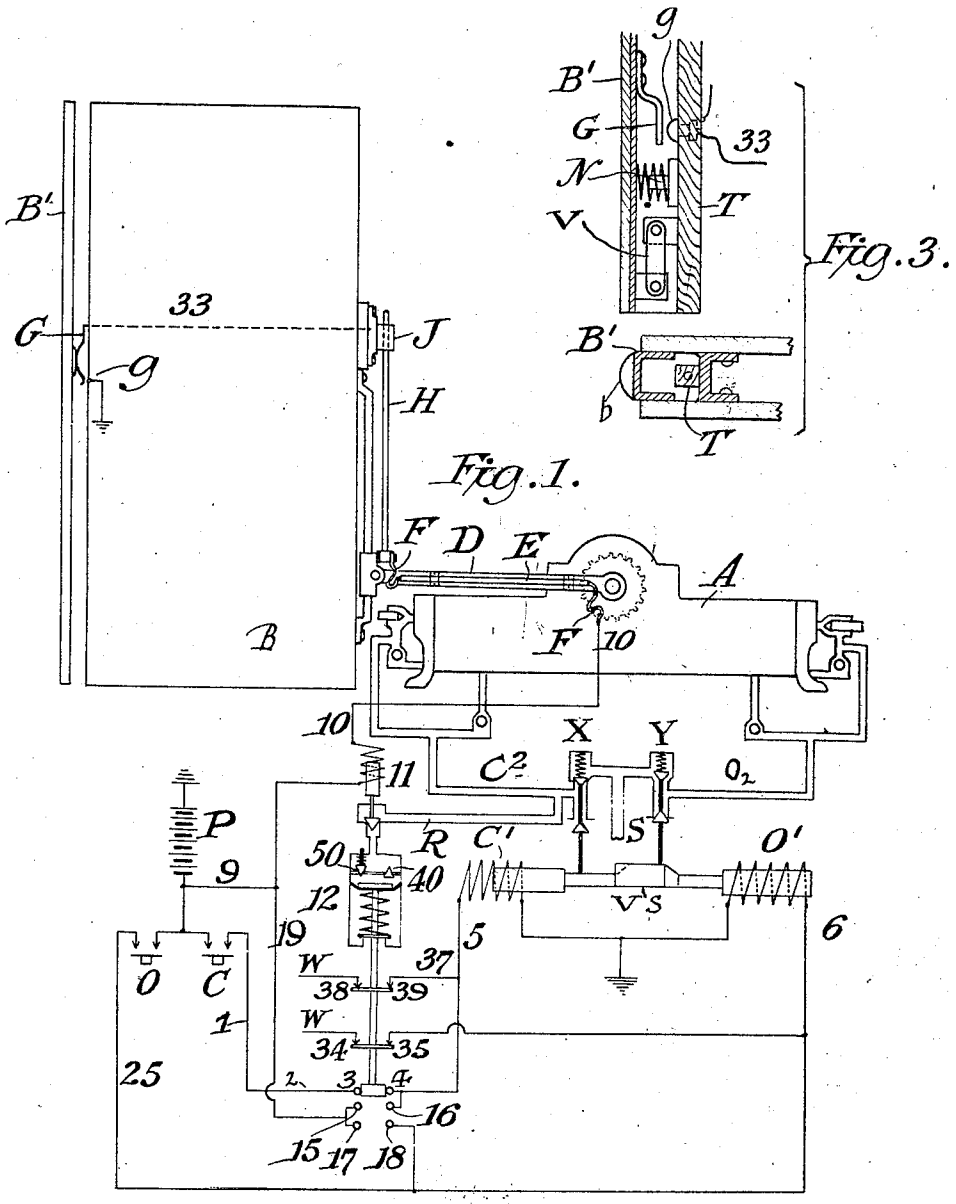


Fig. 1.

Fig. 3.

Lee P. Hynes Inventor

By his Attorney

E. M. Bentley

Feb. 23, 1926. 1,574,197

L. P. HYNES

DOOR ENGINE CONTROL

Filed March 6, 1920 2 Sheets-Sheet 2.

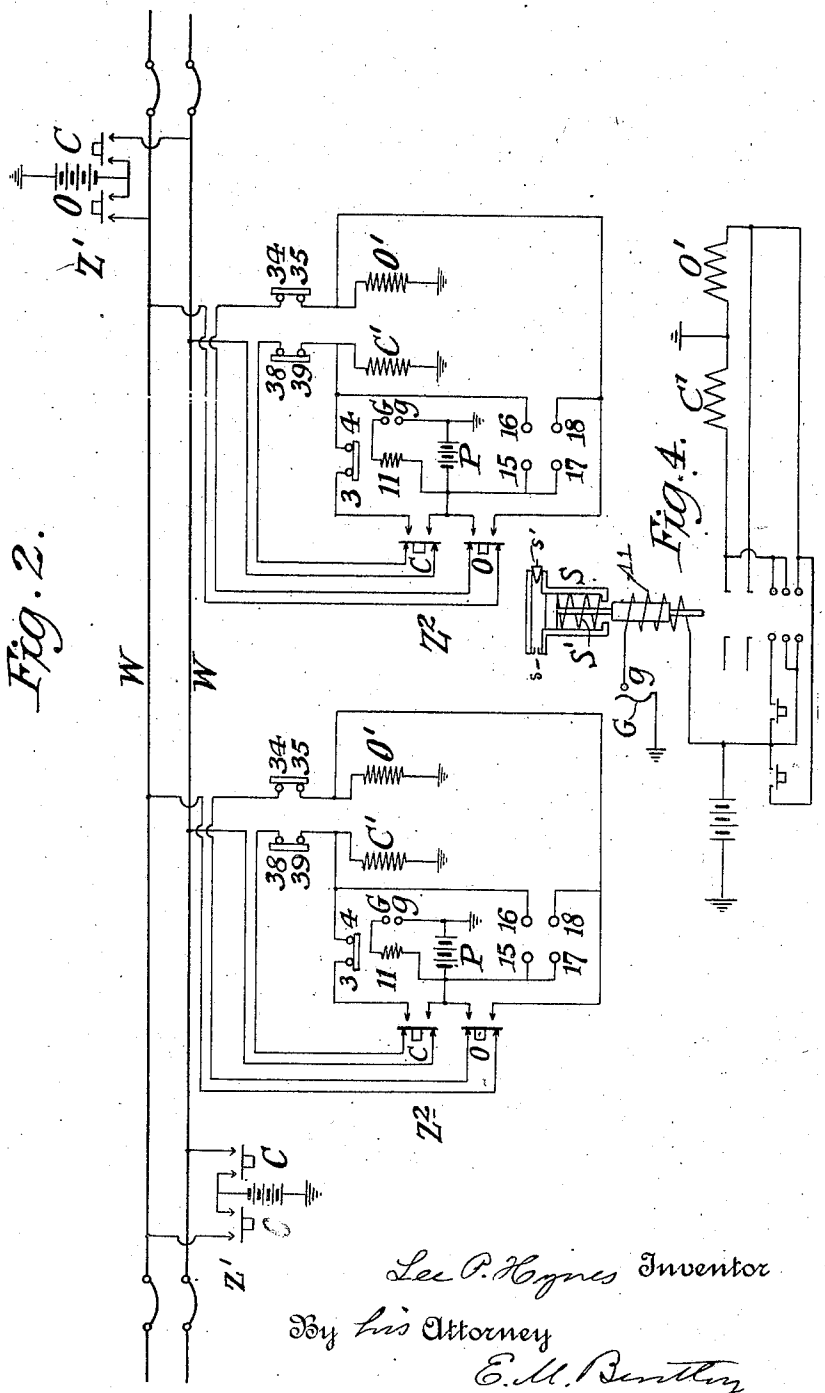


Fig. 2.

Fig. 4.

Lee P. Hynes Inventor

By his Attorney

E. M. Bentley

Patented Feb. 23, 1926. 1,574,197

UNITED STATES PATENT OFFICE.

LEE P. HYNES, OF ALBANY, NEW YORK, ASSIGNOR TO CONSOLIDATED CAR-HEATING COMPANY, OF ALBANY, NEW YORK, A CORPORATION OF WEST VIRGINIA.

DOOR-ENGINE CONTROL.

Application filed March 6, 1920. Serial No. 363,750.

To all whom it may concern:

Be it known that I, LEE P. HYNES, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Door-Engine Controls, the following being a full, clear, and exact disclosure of the one form of my invention which I at present deem preferable.

For a detailed description of the present form of my invention, reference may be had to the following specification and to the accompanying drawing forming a part thereof.

Fig. 1 is a general view of my apparatus.

Fig. 2 shows my device in a train system of door control.

Fig. 3 shows the details of the shoe and contact.

Fig. 4 shows modifications.

My invention relates to the control by electrical means of fluid-pressure door-engines (referred to hereinafter as pneumatic engines). It is particularly suited for car-door engines in systems wherein the doors of two or more cars of the train are operated in a group from a single control station.

In particular, it consists of an arrangement whereby if a door in the act of closing encounters an obstruction, it is automatically and instantly reversed and caused to open again, but, after the lapse of a predetermined time-interval, will be reversed a second time and again proceed to close. This time-interval is independent of the extent to which the door has opened in the meantime and also independent of the position, with relation to the door, of the yielding shoe or fender which has initiated the first reversal. Having once initiated that first reversal, which has started the door to opening, the shoe or fender has no further control of the door. It can only initiate that reversal, from the closing to the opening direction, of door-movement and its return to its distended position away from the door, and has no influence on the door, which can only make its second reversal, from opening to closing movement, after the lapse of a prescribed time-interval.

I furthermore provide for a single-wire circuit leading to the shoe contacts, which circuit is merely grounded on the door and metal of the car by the shoe contact, when the shoe is pressed inward towards the door. I also eliminate the sliding contacts now employed to maintain the electrical connection with the shoe contacts on the door as the door moves from one extreme position to the other, and in place thereof, I introduce the electrical connection at the rear of the door by means of a swinging conductor, which conductor is preferably mounted on the door-operating arm. The sliding contacts which I eliminate and the bars or strips on which said contacts travel are objectionable for several reasons and it is of importance to do away with them. Other features will be described hereinafter.

In Fig. 1, A represents a pneumatic door-engine which may be of any desired form that is susceptible of being controlled by electromagnets. For illustration, I have shown in outline a pneumatic engine of my invention which is now well known and requires no description except to say that it is provided with valves X and Y from which the pipe C^2 leads to the door-closing end (left) and pipe O^2 to the door-opening end (right) of the engine. The valves X and Y are operated by the solenoids C^1 and O^1 of which C^1 when energized admits air pressure from the source S to the door-closing end of the engine and O^1 to the door-opening end. Thus C^1 controls the closing action and O^1 the opening action of the door, the usual means being provided for the automatic arrest of the engine at the end of its closing or opening stroke.

The door is indicated at B and the fender or shoe at B^1. The swinging arm by which the engine drives the door is shown at D. On this arm D, I mount a tube E of insulating material through which extends a flexible insulated wire F which is connected to the lower end of a vertical rod H that moves with arm D and passes through a sleeve J affixed to door B. From sleeve J, a wire extends through the interior of the door to a contact spring G on the front edge which is subject to the inward pressure of shoe B^1. When the shoe moves toward the door, it forces the spring G against a contact g which is grounded through the metal of the door and its bearings and thereby a circuit is established from battery P by wire 9, magnet 11, wire 10 to the aforesaid flexible

wire F and thence to ground. The magnet 11, when energized opens a valve in pipe R and admits air pressure to a small cylinder 12 and the piston therein operates certain switches to accomplish the effects desired as a result of the closure of the shoe contacts G and g by the pressure of the shoe when the door meets an obstruction in closing. These effects will be described later. The aforesaid pipe R is connected with the pipe C^2 at a point outside of the door-closing valve X. Since no air pressure exists in pipe C^2 except when the door is closing and the pipe is delivering pressure air to the closing end of the engine, it follows that pipe R and cylinder 12 will also be dead at all other times than the closing period,—that is, they are subject, like pipe C^2, to the main closing valve X. Cylinder 12 is provided with a check valve 40 which opens freely for the inflow of air to the cylinder but shuts off the outflow therefrom. A second check valve 50 is oppositely arranged but with an adjustable restriction for the outflow. Consequently, the switches operated by cylinder 12 will act instantaneously when magnet 11 admits air from pipe R to the cylinder, but will come back slowly when the air pressure is exhausted from pipe R by the valve X. This dash-pot effect in cylinder 12 may be adjusted to any desired degree, and it determines, as will be explained later, the time during which the door moves backward towards its opening position after it has been reversed by the shoe. Moreover, the shoe can do nothing more than close the circuit of magnet 11 aforesaid which admits air to cylinder 12. After that has occurred, it is immaterial whether the contacts G and g are open or closed, since it is now only the valve X which can release the pressure air trapped in cylinder 12 and even if valve X is opened to exhaust, the air in 12 can only flow out at the rate established by the restricted valve 50.

The first act of cylinder 12 is to break the connection at contacts 34, 35 and 38, 39 which cuts off the coils C^1 and O^1 from the train-line wires W, W. By this means, the shoe-action on any one door B does not affect any other door on the car or train. Under normal conditions, the magnets C^1, O^1 are controlled respectively by the push-buttons C and O, it being only in an emergency when a door is obstructed while in the act of closing, that the parts just mentioned, viz, cylinder 12 its control magnet, 11, and the shoe contacts come into play. If button C is pressed, momentarily, current flows from battery P via wire 1, wire 2, contacts 3 and 4, wire 5 to the coil C^1 and thence to ground. The momentary action of coil C^1 will thereupon work valve X, closing the exhaust opening of pipe C^2 and opening the inflow connection to pipe C^2 from supply pipe S. That condition of the valve X will be automatically maintained under ordinary circumstances until the door reaches the end of its closing run. In the aforesaid emergency, however, cylinder 12 will act to break the aforesaid connection between 3 and 4 and establish a new connection between 17 and 18 (in passing, a connection is also made between 15 and 16 which has no effect, because it merely energizes coil C^1 which has already acted to produce the existing condition). This new connection between 17 and 18 establishes a circuit directly from the battery P, by wires 9 and 19 to wire 6, coil O^1 and to ground. The exciting of coil O^1 will obviously reverse the engine and start the door toward its open position which involves, of course, the lifting of valve Y and the dropping of the previously lifted valve X to the position shown in Fig. 1. That opens pipes C^2 and R to the atmosphere permitting the piston in cylinder 12 to be moved back to its normal position at the end of the cylinder, under the influence of its spring. That occurs but slowly, the door in the meanwhile traveling towards its open position. According to the adjustment of check valve 50, a period of time will elapse before the switch actuated by cylinder 12 comes back to a position where it bridges points 15 and 16. When that occurs, it energizes door-closing coil C^1 and the second reversal of the door from its opening to its closing direction of movement takes place. The door then completes its closing run unless the obstruction is again encountered when the described action is repeated.

It may be noted that when the door is fully closed the valve shifter VS is moved to neutral position by suitable means (such for instance as the mechanism disclosed in Letters Patent 1,479,386, of January 1, 1924), whereupon both admission valves X and Y are seated by their springs, and both exhaust valves are opened to the atmosphere. Therefore any air which may remain in pipe C^2 is at atmospheric pressure, and under these conditions the engagement of the contacts G and g will have no effect to reverse the engine, even if the valve operated by the coil 11 should be opened. In other words the valve X being closed no fluid pressure can enter cylinder 12. Thus the door cannot then be opened by pressing in the shoe B^1 against the door; only when there is pressure in the door-closing end of the engine will the emergency device be operative. Said emergency device is also independent of pressure variations in the engine cylinder since it is connected back of the needle-valve which determines the cylinder pressure and so receives the full outside pressure at all times. The shoe required for closing con-

tacts G, g, is very light and needs have but a short movement—about a quarter of an inch or less. Hence, it is quick and delicate in action, and can cause no injury by its impact against a passenger, the reversal taking place instantly, because there are no cumbersome mechanical parts to be moved by a heavy shoe before reversal can take place. I am therefore enabled to use a shoe that will enter a groove in the edge of the door instead of a heavy grooved shoe fitted outside of the door edge. For example, in Fig. 3, the shoe B^1 is in the form of a sheet iron channel set in a recess in the edge of the door with a rubber guard b on its exposed face. In the bottom of the recess is a wooden strip T from which the shoe is suspended at top and bottom by links V and from which it is held spaced by springs N placed at suitable intervals. The wire 33 is in this case connected to the contact points g instead of springs G, there being a series of such points fixed at intervals to the wooden strip T. The contact springs G are then attached to the shoe at points opposite the respective points g. Obviously a slight inward movement of the shoe will bring one or more of the springs G against the points g and thereby ground the latter through the metal of the shoe and door.

By making the second reversal dependent on a lapse of time instead of on the position of the door or the relation of the door and shoe, it becomes possible to give an adequate time for the escape of a passenger, who may be the cause of obstruction to the door closure, without undue delay in the ultimate closing. Such adequate time is not afforded when the reversal occurs at the instant the shoe is relieved of the obstruction pressure while it causes undue delay if the door makes a complete opening run before the second reversal.

Still another advantage of my present apparatus is that, upon the first reversal from closing to opening direction, the door is free from interference by the closing push-button C, since the then open contacts 3 and 4 are in the current route from battery P through the push-button contacts to coil C^1; the alternative route from the battery to said coil through contacts 15 and 16 is also open.

In Fig. 2, I have shown my arrangement in a train system wherein it is particularly valuable because it renders the automatic retraction of the doors extremely quick and sensitive and also enables the train wires to be permanently connected to the local door circuits, instead of to relays which in turn close the local door circuits. I thus eliminate the cost of such relays and the additional contacts which they involve. In Fig. 2, the stations for train operation are indicated at Z^1, Z^1 and those for local door-operation at Z^2, Z^2.

In Fig. 4, I have shown a modification wherein the magnet 11 operates the shifter switch directly, instead of through the intervention of cylinder 12. In that event a dashpot is employed, the same consisting of a piston working in a casing S, and connected with the core of the magnet 11, said piston being held normally at one end of the casing by a spring S′. Said casing is provided with a normally open port s and a second port controlled by a check valve s'. The magnet acts the instant the door shoe contacts are closed, to withdraw the piston against the tension of its spring S′, the check valve s' moving to open its port so that there is no atmospheric resistance to the movement of the piston. When the door shoe contacts have been separated the spring S′ returns the piston to its normal position, the check valve s' closing automatically, and the return movement of the piston is retarded because the port s is of sufficiently small diameter to prevent a rapid discharge of the air from the cylinder. This arrangement manifestly gives a timed return of the reverser from door-opening to door-closing conditions after the door-opening movement has been initiated by the door-shoe. In all cases it is necessary to cut off from the local door-opening and door-closing circuits containing coils O^1 and C^1, the train-wires W, W, before the reverser acts to shift the battery connection to door-opening coil O^1. Otherwise the door-opening coils O^1 at other doors might also be energized, since the wires W, W are normally connected to valve-operating coils on a number of doors. It is, however, only the particular door which have encountered the obstruction that needs to be reversed and pulled back. The circuits leading to push-buttons O and C are, like wires W, W controlling circuits leading to a remote manual control station, and of these two circuits the one leading to button C should also be cut off, (as it is by contacts 3 and 4) since otherwise button C might be pushed and interfere with the emergency opening of the door. It is less important to cut off the wires to button O, because it can not, of course, interfere with the opening of the door, and in some cases it is desirable to have it remain connected, as is the case shown in Fig 1, since by means of it the door can be thrown wide open by a doorman in the event of a passenger being hit by the closing door; but if it is disconnected the door will merely vibrate to and fro, between its quick reversal to the opening direction by the shoe and its retarded automatic reversal to closing direction, so long as the obstruction remains to be hit by the shoe, or until the emergency period is ended. The need for this cutting off the manual control circuits

arises from the fact that in my system the valve magnets are connected electrically to the train-wires, and also the car wires as a normal condition, and then cut off any individual door therefrom to operate it individually. That is in contrast to other systems wherein the train wires merely enter a relay magnet on each car and are not connected electrically to the valve magnet. It greatly simplifies the system to omit such relays and to rely upon the cutting off of individual doors from the common control circuit, such as the train-wires or a car wire which is common to two or more doors on one car.

What I claim as new and desire to secure by Letters Patent is:

1. An emergency reverser for door engines comprising an engine-valve shifter, emergency means for moving said shifter in one direction, automatically controlled means for moving the said shifter in the other direction, and means for temporarily retarding the operation of said automatically controlled means.

2. An emergency reverser for door engines comprising an engine-valve shifter, means for moving said shifter in one direction, an electro-magnetic device independent of and controlling said moving means, and a grounded emergency contact controlling said device.

3. An emergency reverser for door engines comprising a door engine, an engine-valve shifter, control means therefor, a door actuated by the engine and provided with a yieldable shoe, contacts controlled by said shoe, a swinging conductor in circuit with said contacts and movable with the door, and a stationary conductor connecting the swinging conductor with the valve-shifter control means.

4. An emergency reverser for door engines comprising engine-valve-shifting-means, a circuit controlling the same, said circuit including a swinging conductor, travelling reverser contacts controlling said circuit, and a yieldable member supporting one of said contacts, whereby the circuit may be closed by movement thereof in one direction.

5. An emergency reverser for door engines comprising engine-valve shifting means, travelling reverser contacts, a yieldable member controlling said contacts, a swinging conductor provided with a sliding extension in circuit with said contacts, and a stationary conductor between the swinging conductor and the valve shifting means.

6. An emergency mechanism for door-engines comprising an engine-reverser, means for automatically operating said engine-reverser on its door-closing run and thereby giving the door an opening movement, and a timed controller for said reverser, acting to return it to its door-closing position after the lapse of a predetermined time interval.

7. An emergency reverser for a door engine comprising a valve shifter, a yieldable door shoe governing the change of the valves of said shifter, from the door-closing to the door-opening position, and automatically timed means for effecting a subsequent change of said valves from the door-opening to the door-closing position.

8. An emergency reverser for a door engine comprising a valve shifter, emergency means for temporarily controlling said shifter, a yieldably supported grounded contact controlling said emergency means, a grounded circuit leading from said contact, and a relay in said circuit controlling said valve shifter.

9. An emergency reverser for a pneumatic door-engine comprising engine-valves, a pneumatic piston governing said valves and connected to the door-closing side of the engine, a control-valve for said piston, an electro-magnetic device for operating said control-valve and a yielding door-shoe controlling said electro-magnetic device.

10. An emergency reverser for a pneumatic door-engine, comprising a valve-shifter for changing the door movement from the closing to the opening direction, a yielding door-shoe governing said changing action of the shifter, automatically controlled means for governing the reverse action of said shifter to change the door movement from the opening to the closing direction, and means for temporarily retarding the action of said automatically controlled means.

11. An emergency reverser for a pneumatic door-engine, comprising a valve-shifter, a cylinder and piston controlling said shifter, a yielding door-shoe governing said cylinder and piston, and means whereby a reverse action of the cylinder and piston will change the door movement from the opening to the closing direction, and means for temporarily retarding said reverse action.

12. An emergency reverser for door engines comprising electrical valve shifting means, a cylinder and piston controlling said valve shifting means, electrical means controlling the movement of said piston, and a yieldable contact member controlling said electrical means.

13. An emergency reverser for door engines comprising electrical valve shifting means, a cylinder and piston controlling said valve shifting means, means for introducing pressure fluid into said cylinder, an electrically controlled valve governing the admission of pressure fluid to said cylinder, a yieldable contact member controlling the circuit to said valve, and a valve controlled

by the valve shifting means for governing the exhausting of pressure from said cylinder.

14. An emergency reverser for door engines comprising electrical valve shifting means, a cylinder and a piston controlling said valve shifting means, an electro-magnetic device for controlling the admission of fluid pressure to said cylinder, a yieldable contact member controlling the circuit to said valve, contacts in said circuit governed by said yieldable contact member, and a valve controlled by the valve shifting means for governing the exhausting of fluid pressure from said cylinder, said valve being in turn governed by said piston.

15. An emergency reverser for door engines comprising electrical valve shifting means, a cylinder and piston controlling said valve shifting means, means for introducing pressure fluid into said cylinder, an electrically controlled valve governing the admission of fluid pressure to said cylinder, a yieldable contact member controlling the circuit to said valve, a valve controlled by the valve shifting means for governing the exhausting of fluid pressure from said cylinder, an electro-magnet controlling the last mentioned valve, and contacts in circuit with said electro-magnet controlled by said piston.

16. An emergency reverser for a door-engine, comprising two valves for admitting air pressure to the respective sides of an engine to produce either its closing or opening action, electromagnets for the respective valves, three electric circuits, one including a door controlling switch for energizing the door-closing valve-magnet through a door-controlling switch, one for energizing the same valve magnet independently of said switch, one for energizing the door-opening valve-magnet, and contacts governed by a yielding door-shoe for closing each of the said three circuits.

17. An emergency reverser for a door-engine, comprising two valves for admitting air pressure to the two sides of said engine respectively for producing either the door-closing or the door-opening movement of the engine, magnets for said valves, circuits for said magnets, a cylinder, means for supplying said cylinder with air pressure from the door-closing side of said engine, a piston in said cylinder having means controlling the contacts in said circuits and emergency means controlling movement of said piston.

18. An emergency reverser for a door-engine, comprising a cylinder and piston, means controlled thereby for setting the engine valves in either the door-closing or the door-opening condition, a yielding door-shoe controlling the door-opening action of said cylinder and piston, an engine valve controlling the door-closing action thereof, and means for automatically delaying the action of said engine valve.

19. An emergency reverser for a door-engine, comprising a cylinder and piston, means controlled thereby for setting the engine valves in either the door-closing or the door-opening position, means whereby said cylinder is supplied with air pressure from the door-closing side of the engine, a valve controlling the exhaust of pressure from said cylinder, and a yielding door-shoe controlling the admission of pressure to said cylinder.

20. An emergency reverser for a door-engine, comprising a yielding door-shoe, electrical contacts controlled thereby, a magnet in circuit with said contacts, a cylinder, an admission valve for said cylinder controlled by said maget, an exhaust valve for said cylinder controlled by pressure within said cylinder, a piston in said cylinder, circuits containing switch contacts controlled by said piston, and valve-magnets in the circuits containing said switch contacts.

21. The combination with the door operating circuits in two or more cars of a train, of a train line normally connected with each of said circuits, an emergency reversing means for each door operating circuit, and means controlled by each reversing means for automatically cutting off the train line from the door circuits with which it is associated.

22. The combination with the door-operating circuits on two or more cars of a train, of a train-line normally connected with the operating circuits of each door, and individual door-controlled disconnecting means in each of the respective cars for the operating circuits of the respective doors, each disconnecting means being operable to automatically disconnect its local operating circuits from the train line.

23. The combination with the door-opening and door-closing circuits on two or more cars of a train, of a train-line for simultaneously operating two or more cars from a single point on the train, and an emergency reverser for each set of door operating circuits, and a travelling yieldable contact for changing from the door-closing to the door-opening circuits and retarded means for automatically changing from the opening to the closing direction of door-movement.

24. An emergency reverser for a door-engine, comprising a valve-shifter, a travelling contact member, means associated therewith for changing said shifter from the closing to the opening direction of door movement, means for automatically reversing said changing means independently of the said contact member, and means for retarding the action of said reversing means.

25. An emergency reverser for a door-engine, comprising valve controlling magnets, a shifting switch controlling said magnets, a pneumatic controller for said switch, means for supplying fluid pressure thereto, and a travelling member provided with a yieldable contact governing said pneumatic controller.

26. The combination with the respective door-opening and door-closing valve-magnets of a door-engine, of switch contacts for said magnets, and a pneumatic actuator for said contacts, and means so controlling said actuator as to cause it to act quickly for door-opening and more slowly for door-closing.

27. The combination with the electromagnetic valves of a pneumatic door engine, of a shifter switch therefor, a travelling member provided with a yieldable contact controlling said switch when the valves are in door-closing position, and automatically actuated retarded means for returning said switch to normal position, when the valves are in door-opening position.

28. The combination with the electromagnetic valves of a pneumatic door-engine, of a switch for shifting said valves from a door-closing to a door-opening position, a travelling member provided with a yieldable contact controlling the said shifting, and automatic retarded means for shifting said valves back to door-closing position after the lapse of a time interval.

29. The combination with local door-opening and door-closing circuits, of a controlling circuit leading therefrom to a manual control station, an emergency reverser, means actuated by said reverser for disconnecting said local door-closing circuit from said controlling circuit, and a travelling member having means for governing both the reverser and the said switch contacts.

30. The combination with local door-opening and door-closing circuits, of a controlling circuit leading therefrom to a manual control station, means for disconnecting the local door-closing circuit and energizing the local door-opening circuit, a travelling member having means for governing said disconnecting means, and automatic means for restoring the circuits to their normal condition independently of said travelling member.

31. The combination with two doors of a set of local door-opening and door-closing circuits for each door, an emergency reverser for each set of circuits, a controlling circuit common to both of said local circuits, means for disconnecting said controlling circuit from either set of local circuits, and a door-shoe on each door having means governing both the reverser and the switch-contacts at that door.

32. The combination with a set of local door-opening and door-closing circuits of a controlling circuit leading therefrom to a manual control station, an emergency reverser, means for disconnecting said controlling circuit prior to the action of said reverser, and an emergency device governing both the reverser and the switch-contacts.

33. The combination with a set of local door-opening and door-closing circuits of a controlling circuit normally connected thereto and leading therefrom to a manual control station, an emergency reverser, means for disconnecting said controlling circuit prior to the action of the reverser, an emergency device governing both the switch-contacts and the reverser to produce their consecutive action, and means for automatically reconnecting said controlling circuit at the end of the emergency period.

34. The combination with a door-engine, of an admission valve controlling the door-closing action of the engine, an electromagnet for setting said valve in open position subject to the subsequent valve-closing action of the engine at the end of its stroke, an admission valve controlling the door-opening action of the engine, a second electromagnet for setting said door-opening valve in its open position and also subject to the valve-closing action of the engine at the end of its stroke, and a travelling yieldable contact member acting to close the circuit of the said second magnet when the closing movement of the engine is impeded.

Signed at New York, county of New York, State of New York, this 5th day of March, 1920.

LEE P. HYNES.