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3,553,890

POWER-OPERATED DOOR GEAR

Filed Aug. 12, 1968

2 Sheets-Sheet 1

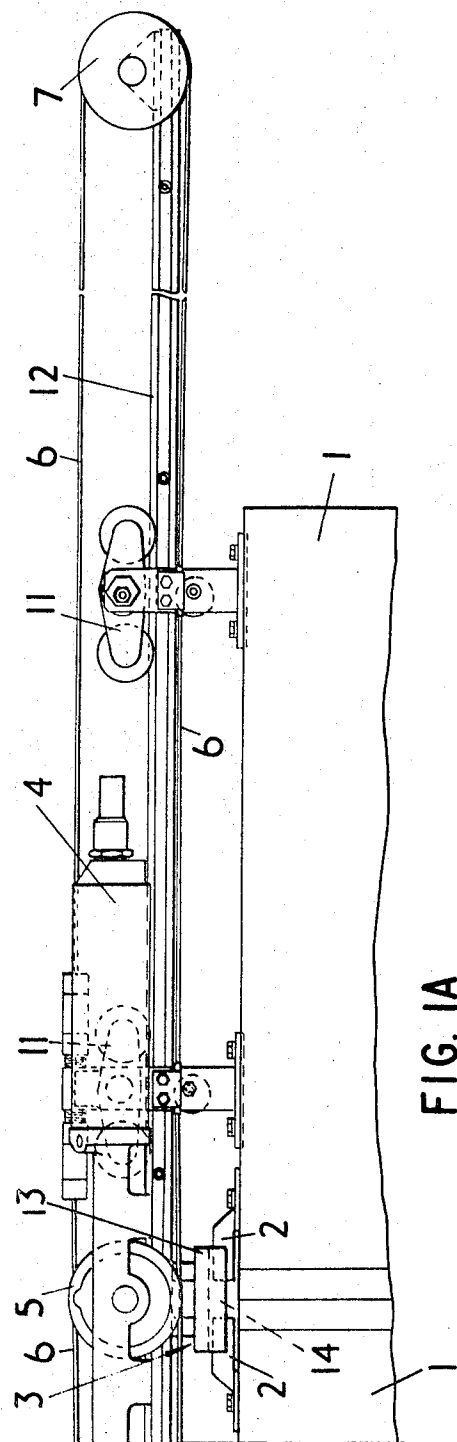


FIG. 1A

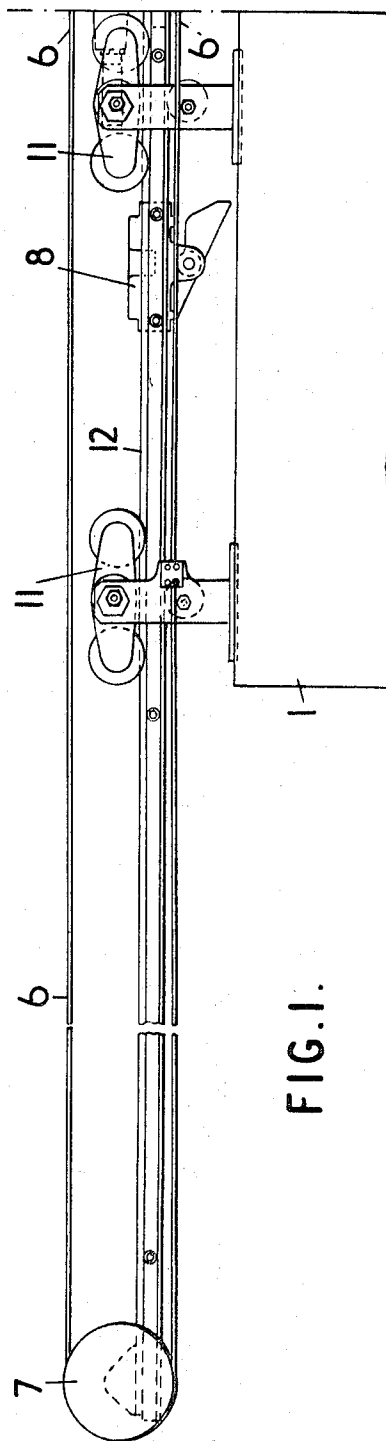


FIG. 1.

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2 Sheets-Sheet 2

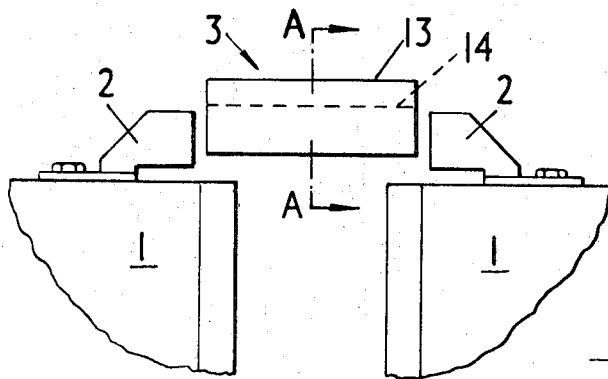


FIG. 2.

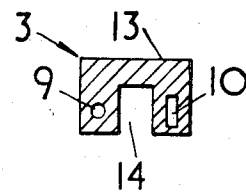


FIG. 2A.

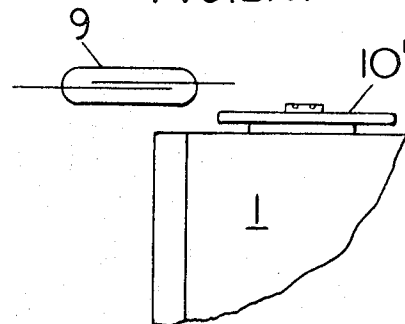


FIG. 2B.

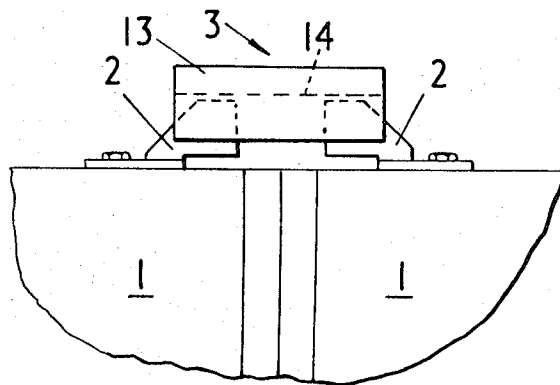


FIG. 3.

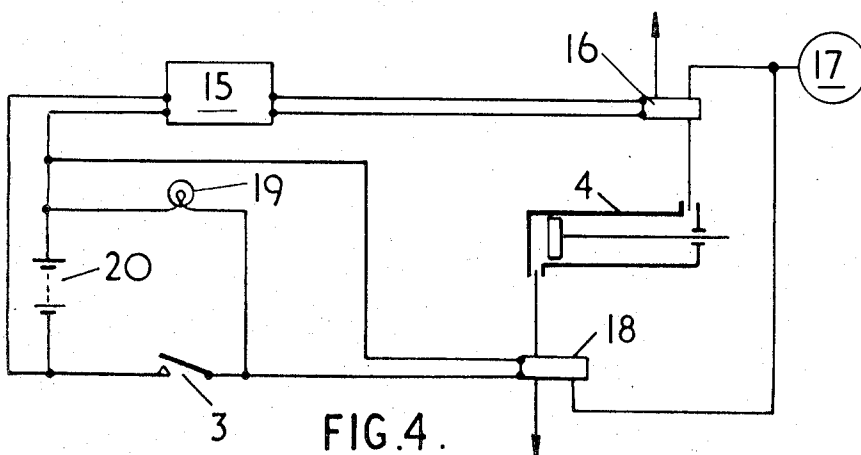


FIG. 4.

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POWER-OPERATED DOOR GEAR

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Int. Cl. E05f 11/54, 15/14

U.S. Cl. 49—32

8 Claims

ABSTRACT OF THE DISCLOSURE

A power-operated door operating gear in which a door position sensor applies power to open the door or doors when the door is or doors are moved manually away from the fully closed position. The sensor may provide a "door closed" signal to a remote operator, and may be interlocked with vehicle operating gear. The preferred sensor comprises a reed switch and a magnet for changing the state of the switch when the door is fully closed.

BACKGROUND OF THE INVENTION

It is becoming an increasing practice to operate doors of railway carriages by electrical or pneumatic means, particularly on trains travelling relatively short distances. The most common practice is to construct a door in such a manner that it comprises two leaves, which slide or fold apart to allow passengers to alight or to board the vehicle. Another practice which is increasing is to construct railway carriages so that they are heated or fully air conditioned, according to the nature of the climate in which they operate.

It will be seen that if such a train arrives at a station at a time of particularly inclement weather and all the doors are opened, then the air conditioning or heating equipment will be required to do an excessive amount of work to bring the atmosphere within the carriages to a comfortable level. It has therefore been found in practice, that the doors should be operated under power to the closed condition, but manually opened, so that in the event of a small number of passengers requiring to alight, or board, only those doors which are needed are used.

A number of different control systems have been evolved to achieve these results, the most common being to have a double acting air cylinder assemblage connected to the doors in such a manner that when pressure is applied to one side of the piston, the doors close and when the pressure is exhausted (e.g. to atmosphere) the force holding the door closed is removed, but the doors do not open until a passenger requiring to alight or board the train manually slides the door leaves apart.

A further development of this practice is to arrange that the doors close in the manner described above, but the doors are fitted with a handle, which when operated, actuates a switch mounted above the doorway. This switch in turn operates an electropneumatic valve which allows compressed air into the double acting cylinder assemblage in such a way as to cause the doors to open.

SUMMARY OF THE INVENTION

According to one aspect of the invention, there is provided an arrangement wherein the door itself, when

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moved manually in the opening direction, initiates the application of power to open it. It is envisaged that power will be applied in this manner only to open the door which has been actually moved by a passenger. Since power is thus applied locally, opening can be very rapid.

Preferably the door-closing force is maintained until the train has stopped or almost stopped, and is then removed entirely, i.e. the driver or other attendant releases air from the door-closing ends of the door-actuating cylinders, to permit rapid opening when desired by a passenger.

According to another aspect of the invention, the manual opening of a door actuates sensing means which, in addition to initiating powered opening of that door, signals to the driver or other attendant that a door is open, and/or prevents starting.

In one convenient arrangement, the sensing means is a reed switch arranged to be held in one state, preferably closed, by an associated magnet except when shielded by a ferrous or ferromagnetic member only when the door is fully closed. Alternatively, the switch may be stationary and the magnet mounted on the door, or vice versa, so that the switch will change its state only when the door is fully closed; preferably the switch is open when the door is fully closed. However, other sensors, e.g. cam-operated microswitches, could be used.

A convenient embodiment of this invention is illustrated in the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary view in elevation illustrating the left sliding door and the door-operating means;

FIG. 1A is a view similar to FIG. 1 illustrating the right door and door-operating means;

FIGS. 2 and 3 show a door sensing arrangement;

FIG. 2A is a cross-section on line A—A of FIG. 2;

FIG. 2B is a fragmentary view illustrating a further door sensing arrangement; and

FIG. 4 is a schematic diagram of one possible form of control circuit.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, doors 1 hang from carriages 11 which run on a track 12, and the normal practice is to construct the edges of the doors in rubber, so as not to harm any passengers caught therebetween. Mounted on top of each door leaf is a shield 2 constructed in mild steel or other ferrous metal. These shields 2, when the door is closed, enter a reed switch assembly 3, shown in more detail in FIGS. 2 and 3. A double acting air cylinder assemblage 4, through a rack and pinion, causes a pulley 5 to rotate. Wrapped around this pulley is a continuous cable 6, which passes around two jockey wheels 7. One of the door leaves is connected to the bottom run of the cable and one to the top run. When the pulley 5 rotates, the cable is caused to move, the top run in one direction and the bottom run in the opposite direction, therefore, the door leaves will move together or apart as required. The method of operation is as follows:

On wishing to start the train, the driver from his controls at 15 causes an electrical signal from a source 20 to pass along the length of the train, which operates an electropneumatic valve 16 at each doorway and causes air to pass from reservoir 17 into one side of the cylinder assemblage 4. This rotates the pulley and causes the doors to be brought together. When the two door leaves abut,

the shields 2 enter the reed switch assembly and cause the reed switch to change its state, thus causing an electrical signal which indicates to the driver, e.g. by colored lamps 19, that the doors are closed.

It is then safe for him to start the train and to proceed to the next station. On reaching this station, the driver causes a further electrical signal to pass along the length of the train, which releases air from the cylinder assemblage 4 and removes the force which has held the door closed. The release of this air means that the doors can now be opened by a passenger wishing to alight from, or board, the carriage. The passenger sliding the doors apart will disengage the shields from the reed switch assembly 3, which causes an electrical signal to pass to a further electropneumatic valve 18 which allow air under pressure to enter the cylinder assemblage from reservoir 17 in such a way as to cause the doors to open rapidly. This means that even large doors can be easily opened by an old person or by children once the driver has given his permission by operating the valve 16 releasing the air from the closing side of the cylinder assemblage. Furthermore, since the doors are operated locally, they can be arranged to move apart at a high speed.

In some cases it may be a requirement to add a positive lock to hold the doors shut, and which lock is disengaged by the air pressure causing the doors to open. Whether or not this lock is employed depends upon the force holding the doors in the closed position when the train is running.

In some cases a second reed switch assembly may be arranged at the extremity of the door opening. A shield on the outer edge of a doorleaf can be arranged to enter the switch and operate same in the door "open" position. The resulting electrical signal can then be used to indicate to the driver that the door or doors are open; the same signal can be arranged to operate an electropneumatic valve to exhaust the "opening" air pressure in the cylinder assemblage and thus allow the doors to be manually closed by a passenger. It is also visualized that this same switch, having had its state changed by the initial manual closing movement, i.e. the first increment of movement, withdraws the shield from the reed switch causing a signal which can be arranged to operate the "closing" electropneumatic valve thus admitting air to the closing side of the cylinder piston and thereby completing the door closing under power.

FIG. 2 illustrates the reed switch assembly 3. FIG. 2A shows that this switch assembly consists of a permanent magnet 10 and a reed switch 9 with a space 14 therebetween. It will be seen if nothing is interposed between the reed switch and the magnet then the full force of the magnetic flux will act upon the reed switch causing its contact to be closed. These components are contained in the flange parts of a channel-switch body 13 of a non-magnetic material, e.g. plastics, so that their supporting means does not influence the magnetic field. When the two shields 2 are brought together by the closing of the two door leaves as shown in FIG. 3, they enter the space 14 in the body between the magnet and the switch is shielded from the effect of the magnet and the contact of the reed switch will then open. When the door leaves 1 are apart, the contacts of the reed switch 9 are closed and the effect upon the reed switch of any stray magnetic field would be merely to cause the force closing the contacts to increase, so that there is no accidental manner in which the doors can be indicated to be closed when they are in fact open. The entry of just one of the shields 2 into the reed switch assembly 3 does not provide sufficient shielding between the magnet 10 and switch 9 to cause the contacts of the reed switch to change its state, and therefore the driver receives no "doors closed" signal. Therefore, any failure in the sympathetic linkage between one door leaf and the other, which results in one door leaf closing while the other remains open, will not cause a sufficient screen to enter between the reed switch

9 and the magnet 10, and the driver of the train will not be notified by the signalling device that all the doors are closed.

In FIG. 2B is illustrated a modified sensing means which includes a stationary reed switch 9' and a magnet 10' mounted on the door.

Certain railway systems will prefer that many of the above-described functions of the driver are replaced by automatic devices, for example, a speedometer can be used to give permission to each door operating device that the doors can be safely opened, when the speed of the train is so low as not to be hazardous to passengers entering or leaving. Similarly, an automatic interlock can be provided, e.g. instead of or in addition to the lamp 19, so that the train cannot be started until a signal indicating that all the doors are closed has been received.

It is further visualized that the signal received from the reed switches following the opening or closing manual initiation by the passenger can be transformed, from its inherent comparative low power, by the utilization of relays to amplify the switching capacity for the various duties required. Alternatively, the signals can be fed into transistorized units known as "solid state" or logic modules whereby a programmed response can be obtained from a specific sequence of input signals from the switches. For instance, following the "door open" sequence it could be arranged to close the doors after a set period of time, or give an audible or visual signal that the doors are about to close.

It is to be understood that the invention is not confined to doors of railway vehicles, or to biparting doors, but can be used with single doors, on road vehicles, or even on stationary installations.

I claim:

1. A power-operated sliding door gear for doors adapted to be moved between closed and opened positions, including power-operated door-actuating means operably related to the door, sensing means responsive to the door position for energizing the door-actuating means to move the door to the opened position in response to a manual door opening movement, the sensing means comprising at least one reed switch and an associated magnet for changing the state of the switch upon complete door closure.

2. The power-operated sliding door according to claim 1 including signalling means controlled by the sensing means for indicating the door closure to a remote operator.

3. The power-operated sliding door according to claim 1 in a vehicle, including an automatic interlock responsive to the sensing means for preventing the vehicle from starting unless every door is closed.

4. The power-operated sliding door according to claim 1 in which the sensing means comprises a stationary reed switch and a magnet mounted on a door.

5. The power-operated sliding door according to claim 1 in which the sensing means comprises a reed switch and magnet in fixed relative positions, and a shielding member for shielding the switch from the magnet.

6. The power-operated sliding door according to claim 5 in which the shielding member is affixed to a door and arranged to pass between the switch and the magnet when the door is in fully closed position.

7. The power-operated sliding door according to claim 6 for bi-parting doors having a shielding member for each door leaf and a common switch and magnet for both door leaves, the shielding action of a single shielding member being insufficient to cause the switch to change state when only one door leaf is in closed position.

8. The power-operated sliding door according to claim 1 in which the power-operated door-actuating means is a double-acting fluid-pressure cylinder, and including valve means under the control of a remote operator for admitting fluid to the cylinder for moving the door to the opened position and for exhausting said fluid, and

further valve means under the control of the sensing means for admitting fluid to the cylinder for moving the door to the closed position.

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318—466