May 9, 1967 F. W. GILLESPIE 3,318,260

AUTOMATIC RAILWAY

Filed Dec. 13, 1963 2 Sheets-Sheet 1

Fig. 1

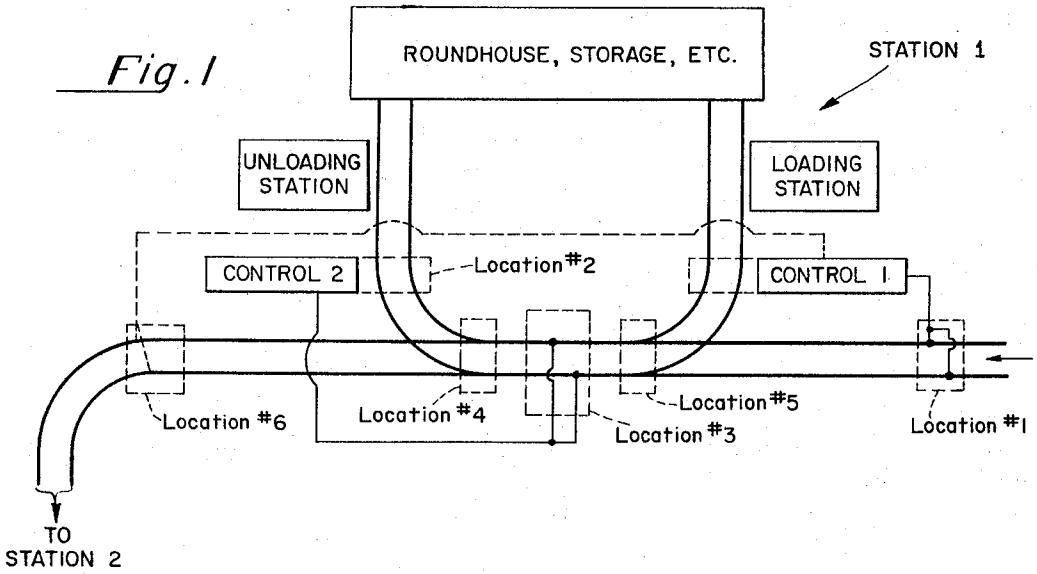
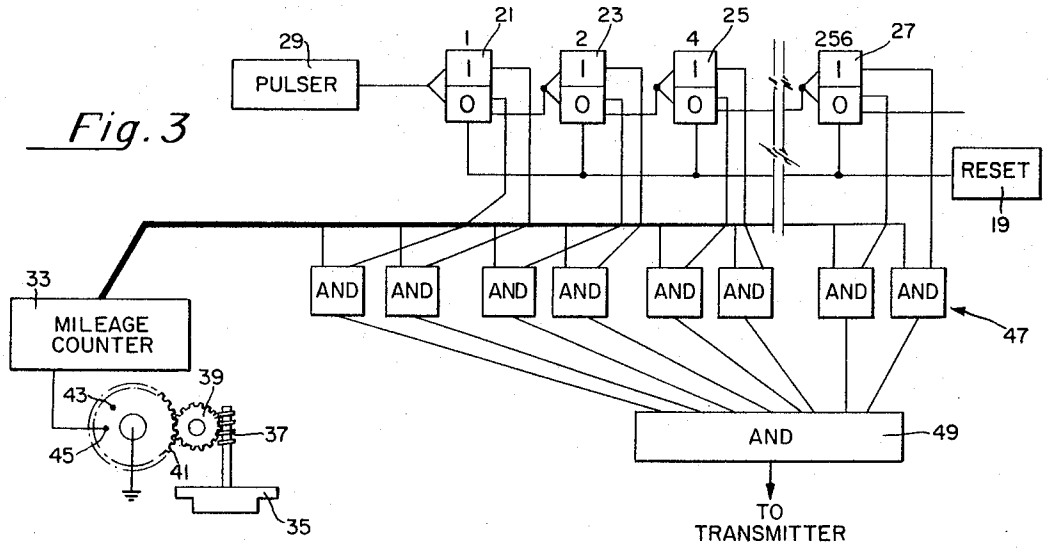


Fig. 3



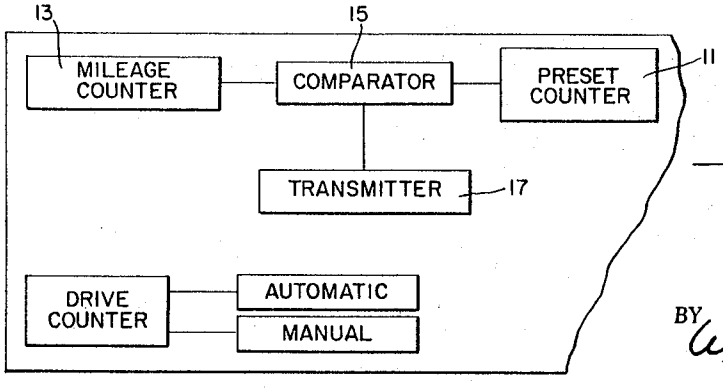


Fig. 2

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AUTOMATIC RAILWAY

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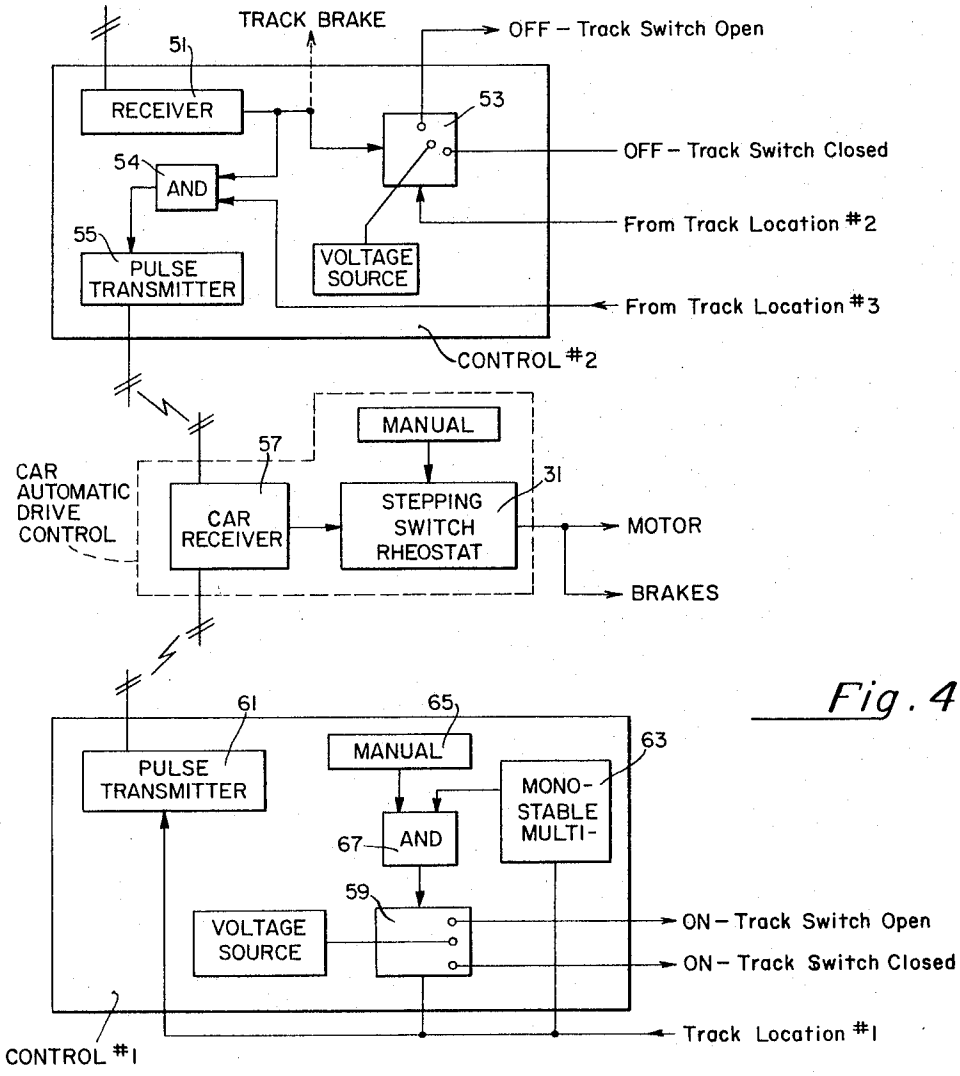


Fig. 4

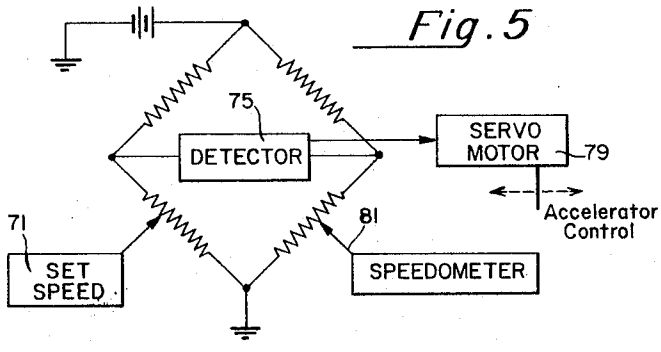


Fig. 5

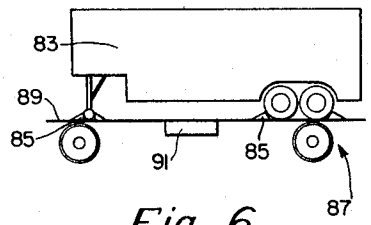


Fig. 6

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AUTOMATIC RAILWAY

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4 Claims. (Cl. 104—88)

This invention relates to an automatic train operation system and more particularly to automatic system for hauling freight in relatively small individual quantities or units.

Systems for automatically controlling train movements with or without an operator are well known in the art. However, such automatic control arrangements have always dealt with fully made up trains, i.e., a power device, such as a diesel engine, and a full component of cars. In handling freight such arrangements, as making up full trains, have led to a certain amount of undesirable delay. For instance, there is required a great deal of manipulating of cars in the train yards in order to couple together all the freight cars making up the train and this results in undesirable delays in movement of the freight. In addition, there is required some elaborate traffic control, which regulates the flow of the power devices (diesel engines and the like), in order to make it economical to bring such power devices from one part of the country to another. The foregoing economic traffic control can also readily provide delays.

The present invention provides a means for automatically controlling single units of freight such that there is virtually no delay in shipping items from one point to another.

Accordingly, it is an object of the present invention to provide an improved automatically controlled railway system.

It is a further object of the present invention to provide an automatically controlled railway system which eliminates virtually any delay in hauling freight from one place to another along the railroad line.

It is a further object of the present invention to provide an automatically controlled railway system which handles single units of freight.

In accordance with a feature of the present invention there is provided a plurality of individual freight cars, each having its own drive motor, its own mileage counter system which determines how far along the track it will travel automatically, and its own braking and motor control system to control its speed when it is switched off the main track.

In accordance with another feature of the present invention there are provided radio signal links between each freight car and each load-unload station in order to automatically switch the freight cars off the main track, when the travelling freight car is within a predetermined distance of the station (whereat it is to deliver its freight) and on to the main track when there are no travelling freight cars approaching within a predetermined distance of the station (whereat a car has been loaded).

In accordance with another feature, the present invention provides a control system at each load-unload station which automatically switches the track in order to enable an oncoming train to be shunted off the main track and in order to insure that the main track will not be switched if a freight car is within a predetermined distance of the station.

The foregoing and other objects and features of this invention will be best understood by reference to the following description of the invention taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a schematic of a track and a load-unload station in accordance with the present invention.

FIGURE 2 is a schematic block diagram of the control devices as found on each car.

FIGURE 3 is a more detailed schematic of the counters and compare circuit.

FIGURE 4 is a schematic of the radio links and controls operating between any load-unload station and any freight car.

FIGURE 5 is a schematic of an automatic speed control device.

FIGURE 6 is a pictorial schematic of one of the freight cars of the present invention with a truck trailer loaded thereon.

In the description of the present invention, many of the details of controls and safety measures normally found on a railway system will not be described. For instance, the devices for operating signals and gates at grade crossings will not be described since they are so well known and are of such a number of varieties. Further a number of the components will not be described in detail since such components are well known and their combination (not their detail) represents part of the novelty of the present invention. For instance, the radio transmitters and receivers employed in the present invention can be any one of a number of varieties and it would not detract from the present invention, since, as just mentioned, the invention lies in the combination of such components and not their details.

Referring to FIGURE 1, there is found a schematic layout of a railroad track and one of its control locations. Keeping in mind that the present invention includes self powered individual freight cars, consider that the individual freight cars travel east to west on FIGURE 1, commencing at point to the right of location No. **1**. It should be understood that freight cars as referred to in this specification means the type of freight car depicted in FIGURE 6 and which is primarily designed to handle truck trailers, although other types of freight can be carried. Assume further that a particular individual freight car has been sent from a station one hundred miles away and is scheduled to deliver its freight to station **1**.

At the station one hundred miles away (the sending station), the number one hundred or possibly ninety-nine would have been set in the preset counter **11** of FIGURE 2. FIGURE 2 represents the control arrangement as found aboard each freight car. All of the controls would be found in control box **91** of FIGURE 6 while the drive motor would be located adjacent the wheels. However, in FIGURE 2, the system is laid out for simplicity with respect to the explanation.

Having set the value of one hundred (miles) in preset counter **11**, the station operator would have manually started the motor on the individual freight car and manually switched the main track switch at a location similar to location #5 in FIGURE 1. The freight car would then move to control **1** location at the sending station one hundred miles away. If no travelling freight cars were within two miles (or any other suitable predetermined distance, depending on the speed of the freight cars) of the station, the car would move on to the main track and travel therealong.

As the individual freight car travelled along the main track it would keep a record of the miles travelled. When it reached one hundred miles, the count (one hundred) in the mileage counter **13** (FIGURE 2) would be com-

pared with the preset value of one hundred from the preset counter and find a true comparison, in comparator **15** (FIGURE 2). In response to the true comparison a radio signal would be transmitted from transmitter **17** (FIGURE 2).

Again considering FIGURE 1, assume that the individual freight car records one hundred miles in the vicinity of location #**1**. Transmitter **17** transmits a signal which can be received in approximately a one mile to two mile radius in response to the true comparison described above. The signal transmitted by transmitter **17** is received at the control **2** location of station **1**. The control mechanism at the control **2** location switches the track at location #**4** in order to lead the oncoming freight car from the main track. Since our hypothetical freight car was set to travel to a station one hundred miles away and its mileage counter has recorded one hundred miles then it should be removed from the main track at the next closest station. In our example the next closest station is station **1**.

As the freight car approaches the switched track at location #**4** it passes through location #**3**. The presence of the freight car at location #**3** causes a signal to be sent to the freight car. The last-mentioned signal causes the motor speed to be cut and the brakes to be applied, so that when the freight car leaves the main track it will be easily brought to a full stop for unloading.

When the individual freight car travelled through location #**1**, it caused a signal to be sent to control **1** location. This last-mentioned signal caused the main track switch at location #**5** to be closed (or insured that it was already closed) so that the oncoming freight car could pass location #**5** toward location #**4**. As will be discussed later, the signal from location #**1** will also inhibit any freight cars awaiting the entry into the main track from moving thereon. The circuitry of location **1** and control **1** act as a safety measure to prevent an accident by virtue of an open switch at location #**5** or between a freight car entering the main track with another car when the latter is entering the critical area.

In the present system the individual freight cars are considered to be travelling no closer than two miles apart. Obviously, the system could be arranged to have them travel a minimum of one quarter of a mile apart or five miles apart. Under the above two mile limit it should be noted that location #**1** is two miles from location #**5**. Therefore, a freight car cannot enter the main track if an oncoming freight car is within two miles of the entry point. This arrangement insures that the two mile minimum distance is held on the trailing side of the car movement.

If the system were to dictate that the minimum distance between cars should be one quarter of a mile, then location #**1** would be located one quarter of a mile from location #**5**.

In order to insure that the system will maintain two miles (or whatever distance is chosen) at the leading side of the car movement, location #**6** can be introduced. If a freight car passes through station **1**, the signals generated by its presence at location #**1** insure that the switch is closed at location #**5** (as described above). This same freight car passing through location #**6** insures that the switch at location #**5** cannot be open to allow a car entry until the moving freight car is two miles from location #**5**, the point of entry on the main track. It follows that location #**6** is located two miles from location #**5** and of course would be located at some other distance for another minimum car distance arrangement. A signal from location #**6** may only provide a green light or some other indication to an operator at control #**1** location.

In general the present invention provides a railway system upon which self propelled cars travel at a fixed rate, for instance fifty miles per hour. Each of the individual freight cars can be readily loaded with a truck trailer or other forms of freight as soon as it is received. Each of

the individual cars has its preset counter set to the distance which it has to travel, and each car is then entered onto the main track at fifty miles per hour when there is an assurance that a moving freight car is not within the prescribed minimum distance between cars. In our example, the minimum distance is two miles, but as mentioned the minimum distance can be more or less than two miles. When a freight car has travelled its preset distance, it transmits a signal to the station closest to the location whereat it has clocked or recorded its preset mileage. It is preferable to set the mileage slightly less, than more, than the actual distance between stations, since the individual cars will continue to transmit the signal until it has been routed off the main track at the correct location. If an individual freight car were to pass the proper station before recording its preset distance (as a result of presetting the distance to a value greater than the correct distance) it would travel on to the next station beyond the correct one before being routed off the main track.

Consider now the details of the operating components. FIGURE 3 shows four stages of a binary counter which could have many more stages if necessary. The counter shown can be set to 511 miles or less. Initially, it is reset by a pulse from the reset pulser **19**. The pulse from reset pulser **19** resets each of the flip-flops **21**, **23**, **25** and **27** to their respective "zero" sides. The flip-flops can be any of the many well known Eccles-Jordon type circuits, many of which are described in the textbook, "Pulse and Digital Circuits," by Millman and Taub, published in 1956 by McGraw-Hill, New York.

The train operator sets the preset counter to the proper mileage it is supposed to travel by operating the pulser **29**. When the preset mileage is entered into the counter, it is ready to enter the main track. The mileage counter is also reset to zero by a reset signal.

The operator next manually sets the stepping switch **31** (FIGURE 4) to allow the motor to be driven and the brakes released. Such stepping switch motor controls and brake controls are well known and need not be described in further detail.

Assume initially that the freight car, with its preset counter properly set, enters the main track. The mileage counter **33** is the same type of binary counter as the preset counter made of flip-flops **21**, **23**, **25** and **27**. It should be understood that other types of counters can be used.

As the wheel **35** of the freight car rolls over the track a gear chain of gears **37**, **39** and **41** drive a pulsing device made up of points **43** and **45**. Obviously, the gear train shown is for illustrative purposes. Each time the contact **43** makes a full revolution, the freight car has travelled one mile. When contact **43** closes on contact **45** there is a pulse recorded by mileage counter **33**.

When mileage counter **33** has recorded the same number of pulses as the preset counter, the equivalent parts, or equivalent flip-flops, in each counter will be in the same conducting states. When the counters are in the same conducting state, or equal, each of the AND gates **47** will be fully conditioned and their outputs will fully condition AND gate **49**.

The output signal from AND gate **49** is transmitted to the transmitter of the freight car, shown as transmitter **17** in FIGURE 2. Transmitter **17** can be any one of a number of well known radio transmitters whose power part is designed to send a signal approximately one and one-half miles for our minimum car distance requirements. Obviously, the system would have to be assigned a frequency band upon which to broadcast.

The signal transmitted by transmitter **17** is received by receiver **51** (FIGURE 4). In response to the signal received by receiver **51** a transfer signal is transmitted to switch **53** to close the contacts to open the main "off-track" switch at location **4** (FIGURE 1). With the "off-track" switch open the car would be rounted off the main track at location #**4**.

As the car crosses location #2 it generates a signal which is transmitted to switch 53 (FIGURE 4) to reset the "off-track" switch closed so that the next car along the track will be able to pass through location #4 (FIGURE 1).

When the car passed through location #3 (FIGURE 1) the pulse transmitter 55 (FIGURE 4) was energized through AND gate 54 to transmit signal bursts to the car receiver 57 (FIGURE 4). The signal bursts step the stepping switch 31 which in turn slows down the drive motor and applies braking power to enable the car to come to a full stop on the unloading spur-track. If the match signal had not been transmitted to receiver 51 the AND gate 54 would not have passed the location #3 signal to the pulse transmitter 55.

Further back in time when the car passed through location #1 a signal was generated and sent to switch 59 (FIGURE 4) to close the "on-track" switch. This same location #1 signal energizes the pulse transmitter 61 which transmits a series of signal bursts. The signal bursts are received by the car receiver 57 which cause the stepping switch 31 to step and cut out the motor and apply the brakes. It is desirable to accomplish this last action since the car should not be driven if the "on-track" switch is closed for the main track and therefor open to the loading spur. Obviously, other safety means such as a warning light or bell could be employed and would serve to help the starting operator from manually starting the car to be entered.

In the embodiment shown in FIGURE 4, the signal from track location #1 is further transmitted to monostable multivibrator 63, which is transferred to its unstable side for a predetermined time. The predetermined time insures that the switch 59 cannot be manually set to open the "on-track" switch until after the car passing location #1 also passes through location #6. On the other hand a direct line from location #6 could be connected to control #1 as shown by the dashed line in FIGURE 1 to offer a control signal to insure that a car passing through a station location has a two mile lead before another car can be entered.

The manual switch 65 (FIGURE 4) is ineffective through AND gate 67 unless the monostable multivibrator 63 has returned to its stable side.

Obviously, many of the safety and control features known to the railroad art where not mentioned because they are not related to the novelty of the present invention. However, it is expected that the present invention would be used with a control to detect a derailment, a control to signal at grade crossings and the like. It should also be understood that the approaches to the main track would be relatively long to enable the car to get its desired speed and that the speed would be maintained by automatic speed control means to compensate for rolling terrain. A simple bridge circuit with a servo motor to control the motor speed such as that shown in FIGURE 5 could be employed, although more sophisticated automatic controls might also be used. In FIGURE 5 the speed at which the train is to travel is set in the speed set device 71 (which can be simply a control dial to move potentiometer arm 73). The null detector 75 determines when the bridge is balanced. When the bridge is not balanced a signal drives the servo motor 77 whch in turn moves the accelerator lever 79 in either direction to speed up or slow down. When the actual speed of the car equals the set speed the speedometer arm 81 balances the bridge.

FIGURE 6 shows a trailer truck 83 secured (by means of braces 85) to one of the individual freight cars 87 used with the present invention. On the underside of platform 89 of freight car 87 there is secured a car control box 91 which holds all of the controls described in connection with FIGURES 2 through 5.

The present invention offers a great advantage to shipping freight because there is no time lost in making up freight trains or routing power packs (engines). As soon as a trailer truck or other freight load is received in the freight yard it is placed on an individual car and sent onto the main track. The distance that it should travel is set in a preset counter on the car and the freight car automatically travels to the predesignated station where it is shunted off the main track.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. An automatic railway system to be operated with individual self powered freight cars, wherein said railway system includes a main track and spur tracks with load-unload stations therealong and wherein there is included off-track and on-track switches in said main track in close proximity to said load-unload stations, comprising in combination: first counter means wherein the value of a distance to be travelled by an associated one of said individual freight cars can be recorded, said first counter means located on each of said individual freight cars; second counter means wherein the value of the distance actually travelled by an associated one of said individual freight cars is recorded, said second counter means located on each of said individual freight cars; comparison means coupled to each of said first and second counter means to compare the values in each counter means and in response to a match of said values transmit a radio frequency match signal; first radio frequency signal receiving means located at each of said load-unload stations to receive said match signal and thereby control an associated one of said off-track switches to cause an individual freight car transmitting a match signal to be shunted off said main track; each load-unload station having a main track signaling location disposed on its approach side which transmits a first oncoming-car signal in response to the presence of a freight car in said main track signaling location; and second signal receiving means located at an associated load-unload station and coupled to both an associated on-track switch and to said first main track signaling location to render said on-track switch passable to an oncoming freight car in response to said first oncoming-car signal.

2. An automatic railway system to be operated with individual self powered freight cars, wherein said railway system includes a main track and spur tracks with load-unload stations therealong and wherein there is included off-track and on-track switches in said main track in close proximity to said load-unload stations, comprising in combination: first counter means wherein the value of a distance to be travelled by an associated one of said individual freight cars can be recorded, said first counter means located on each of said individual freight cars; second counter means wherein the value of the distance actually travelled by an associated one of said individual freight cars is recorded, said second counter means located on each of said individual freight cars; comparison means coupled to each of said first and second counter means to compare the values in each counter means and in response to a match of said values transmit a radio frequency match signal; first radio frequency signal receiving means located at each of said load-unload stations to receive said match signal and thereby control an associated one of said off-track switches to cause an individual freight car transmitting a match signal to be shunted off said main track; second main track signaling position means, located on the approach side of each associated off-track switch, which transmits a second oncoming-car signal in response to the presence of one of said freight cars therein; and first control means located in an associated load-unload station to receive said second oncoming-car signal and transmit a control signal to the one of

said freight cars which caused the generation of said second oncoming-car signal to cause said last-mentioned freight car to slow down its speed.

3. An automatic railway system according to claim 1 wherein there is further included a pulse transmitter in said associated load-unload station, which in response to said first oncoming-car signal transmits a second control signal to any one of said freight cars which might be attempting to enter onto said main track over said on-track switch thereby causing said last-mentioned freight cars to stop moving.

4. An automatic railway according to claim 3 wherein there is further included a second control means at said associated load-unload station coupled to receive said first oncoming-car signal and to prevent said on-track switch from being unpassable for a predetermined time after the generation of said first oncoming-car signal.

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