PATENT SPECIFICATION (11) 1 600 333

1 600 333

(21) Application No. 9609/78 (22) Filed 10 Mar. 1978 (19)
(31) Convention Application No. 797502 (32) Filed 16 May 1977 in
(33) United States of America (US)
(44) Complete Specification Published 14 Oct. 1981
(51) INT. CL.[3] B61C 17/12
F02D 25/00
(52) Index at Acceptance
B7H X4
F1Q 5

(54) FUEL SAVER ARRANGEMENT FOR LOCOMOTIVES

(71) We, THE KANSAS CITY SOUTHERN RAILWAY COMPANY, a corporation duly organized under the laws of the State of Missouri, United States of America, of 114 West 11th Street, Kansas City, Missouri, United States of America do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to saving fuel in the operation of a multiple unit locomotive system.

Many locomotives in operation today are powered by diesel fuel. The cost of such fuel constitutes one of the greatest expenses involved in the operation of a train system. Rising fuel prices have placed a great economic burden on the nation's railroads, necessitating the curtailment of fuel usage. Since the amount of fuel consumed by a diesel locomotive is directly proportional to the power output of the unit, any reduction in the output power of one or more of the units will result in a proportional fuel savings.

A typical locomotive system is made up of two or more diesel locomotives arranged in tandem. One of the locomotives is designated as the lead unit and serves as the control center for the entire system. The other locomotives are called trailing units and each is assigned a specific location within the system. All of the locomotives in the system are mechanically and electrically connected together and each trailing unit responds to the throttle setting of the lead unit. In order to accommodate the relatively great loads encountered by today's railroads, a locomotive system must be made up of several diesel units which form an integrated system. In most cases, the greatest percentage of the locomotive's "run" requires only a minimum amount of locomotive power for moving the train and its load along the track. Maximum power output from all of the units of the system is only required when the train system is moving along an upgrade or starting from a stationary position. Even though the system need not operate at maximum power during the entire "run", the locomotive system must be provided with enough diesel units to meet the periods of high power demand.

At the present time, the extra diesel units which are provided solely for periods of high demand cannot be selectively reduced in power during periods of low power demand without affecting the overall operating efficiency of the system's safety equipment. Instead, the best way to reduce fuel consumption at the present time is to cut back the output power of all of the diesel units in the locomotive system. In other words, all of the units within the system are operated at less than maximum power. Operating all of the individual locomotive units at less than maximum power decreases the overall operating efficiency of the system and consequently provides only limited fuel savings.

According to one aspect of the invention there is provided a locomotive system comprising a plurality of locomotive units each having a power output level normally controlled by throttle control circuitry which is common to all of the locomitive units, and a fuel saver arrangement comprising a plurality of override circuits corresponding to the respective locomotive units, each override circuit being normally open and being operable when completed to override said throttle control circuitry in a manner to reduce the power output level of the corresponding locomotive unit independently of the throttle control circuitry and the power output level of the remaining units, and selector means associated with the override circuits for selectively completing the override circuit corresponding to at least one selected locomotive unit which is to have its power output level reduced, said selector means having a normal setting wherein each override circuit is in its normally open condition to permit the throttle control circuitry to control the power output level of all the locomotive units, and a fuel saver setting wherein the override circuit corresponding to said selected locomotive unit is completed to thereby reduce the power output level of the selected unit.

According to another aspect of the invention there is provided a fuel saver arrangement for a multiple unit locomotive system including a plurality of electrically interconnected locomotives each having a power output level normally controlled by throttle control circuitry which is common to all of the locomotives and which normally maintains each locomotive at the same power output level, said fuel saver arrangement comprising an override circuit for each locomotive adapted for connection to the throttle control circuitry, each override circuit having a normally open condition wherein the throttle control circuitry is unaffected and each override circuit having a completed condition wherein the override circuit overrides the throttle control circuit in a manner to reduce the power output level of the corresponding locomotive irrespective of the condition of the throttle control circuitry; a normally open fuel saver switch disposed in a circuit which is common to each override circuit to thereby maintain each override in its normally open condition when the fuel saver switch is in its normally open condition; and a selector switch having a plurality of settings corresponding to the respective override circuits, said selector switch completing the override circuit corresponding to the setting of the selectorswitch when the fuel saver switch is closed, whereby the power output level of at least one selected locomotive can be reduced by closing the fuel saver switch and positioning said selector switch in the setting corresponding to the override circuit of said selected locomotive.

According to a further aspect of the invention there is provided a method of reducing the power output of a multiple unit locomotive system which includes a plurality of locomotives each having a power output normally controlled by throttle control circuitry common to all of the locomotives, said method comprising the steps of selecting at least one of the locomotives which is to have its power output reduced and overriding the throttle control circuitry in a manner to reduce the power output of said one locomotive independently of the throttle control circuitry while said throttle control circuitry continues to control the power output of the remaining locomotives.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a frontal view of the control box located on the lead unit having a fuel saver switch and a unit selector switch;

Figure 2 is a frontal view of the fuel saver set-up switch located on each of the constituent units of the system;

Figure 3 is a block diagram of a locomotive system including five diesel units connected in tandem;

Figure 4 is a schematic diagram of the fuel saver arrangement of the present invention showing the control box and fuel saver set-up switch arranged to accommodate a locomotive system of five diesel units and particularly illustrating a positional setting for the lead diesel unit;

Figure 5 is a schematic diagram of a fuel saver set-up switch with the switch set in a "number two trail" positional setting;

Figure 6 is a schematic diagram of a fuel saver set-up switch set in a "number three trail" positional setting;

Figure 7 is a schematic diagram of a fuel saver set-up switch with the switch set in a "number four trail" positional setting;

Figure 8 is a schematic diagram of a fuel saver set-up switch with the switch set in a "number five trail" positional setting;

Figure 9 is a schematic diagram of the engine run circuitry located on each unit of the system; and

Figure 10 is a schematic diagram of a modification that must be made in the standard throttle control circuitry to keep the locomotive from stalling upon initiation of the fuel save function.

A typical locomotive system is shown in block form in Figure 3. As shown in this figure, the system is made up of five diesel locomotives generally designated by the numerals 10, 12, 14, 16 and 18. The locomotives of the system are arranged in tandem and are electrically coupled in any suitable manner well known in the art. In particular, these units are electrically interconnected by means of a standard 27-cable conductor means not shown in this figure. All of the diesel units are substantially identical to one another and any one of the units may be designated as the lead unit with the other units designated as the trailing units. However, for the purposes of discussion, locomotive 10 will be designated as the lead unit and locomotives 12, 14, 16 and 18 will be designated as the number two trail unit, the number three trail unit, the number four trail unit and the number five trail unit, respectively.

Each locomotive in the system is provided with its own independent throttle control circuit which, in the interest of brevity, is not shown, although such circuitry is well known to those skilled in the art. These throttle control circuits have multiple throttle positions with each position representing a different power output of the locomotive. Typically, a system will have eight throttle positions with each ascending number representing increasing power output. Even though each locomotive of the system is equipped with its own throttle control circuit, all of the trailing units respond to the throttle setting in the lead unit in the normal mode of operation. In other words, the power output of the entire system is dependent upon the power output of the lead unit.

Initiation of the fuel saving function of the present invention and selection of the locomotive to be placed in the throttle one power condition is regulated by the control box shown in Figure 1. This box is mounted on the lead unit in any suitable location for the convenience of the train engineer. As shown in Figure 1, the control box includes a fuel saver switch 26 for initiating the fuel save function and a unit selector switch 30 for selecting the locomotives to be reduced in power.

Referring now to Figures 1 and 4, the control box, fuel saver switch and unit selector switch are generally designated on these figures by the numerals 24, 26 and 30 respectively. The fuel save signal is provided to the control box in the form of a positive voltage signal by means of input line 50. Relay contact 52 is provided to inhibit the fuel save operation of the present invention whenever the throttle control circuit on the lead unit is set in the idle position. This relay contact is controlled by a relay solenoid not shown in these figures. Placement of the throttle control circuit on the lead unit in the idle position causes the solenoid to be energized thereby opening relay contact 52.

The fuel saver switch 26 is a two-position toggle switch or any other suitable type of switching means having two switching states. As shown in Figure 1, these two switching states include the normal operating position 28 and the fuel save position 29. In the normal operating position 28, the fuel saver switch is in an open position as shown in Figure 4.

The unit selector switch, on the other hand, is a six contact, two gang switch, or any other suitable type switching means having six different switching states and two separate sets of contacts. This switch includes two movable contacts 54 and 56 which move simultaneously in response to movement of rotatable switch element 32 (shown in Figure 1). This switch element is secured to the movable contacts 54 and 56 by means of mounting screw 33. An indicator arrow 34 is included on switch element 32 to denote which of the switch positions is activated.

Stationary contacts 60, 66, 68, 70, 72 and 90 and 92, respectively, represent the lead, second unit, third unit, fourth unit, fifth unit and second/third unit switch settings shown in Figure 1. As viewed in Figures 1 and 4, the unit selector switch is shown in the lead position while the second unit position is shown in broken lines.

Referring now to Figures 2 and 4-8, the fuel saver set-up switch is generally designated on these figures by the numeral 34. This switch is located on each locomotive in the system and as shown herein is a five contact, four gang switch having first, second, third and fourth gang segments 74, 76, 78 and 80, respectively. Each gang segment is provided with a movable contact 100, 102, 104 and 106, and all of these contacts move simultaneously in response to movement of rotatable switch element 36 (shown in Figure 2). This element is secured to the movable contacts by means of mounting screw 37 and has an indicator arrow 38 superimposed thereon to denote the position of the switch.

Referring now specifically to Figure 4, this figure shows the electrical schematic for the lead locomotive 10 and particularly the electrical interconnection of the fuel saver set-up switch 34 and the control box 24 of the lead unit. The lead contact 108 on the first gang segment of the fuel saver set-up switch is connected directly to the second unit stationary contact 66 of the unit selector switch by means of conductor line 110. Similarly, the lead contacts 112, 114 and 116 on the second, third and fourth gang segments of the fuel saver set-up switch are electrically connected to the third unit, fourth unit and fifth unit stationary contacts 68, 70 and 72 by means of conductor lines 118, 120 and 122, respectively. Stationary contacts 90 and 92 represent the second/third units position of the unit selector switch and are respectively connected to the lead contact of the first and second gang segments of the fuel saver set-up switch. Stationary contact 90 is connected to the lead contact 108 by means of conductor lines 124 and 110. Stationary contact 92, on the other hand, is connected to the lead contact 112 of the second gang segment 76 by means of conductor lines 126 and 118.

The movable contacts of each gang segment are electrically connected to a different train line wire. Movable contact 100 is electrically connected to train line wire 128 by means of conductor line 130 while movable contacts 102, 104 and 106 are electrically connected to train line wires 132, 134 and 136 by means of conductor lines 138, 140 and 142, respectively. These train line wires are part of a twenty-seven cable electrical group used to electrically interconnect all of the locomotives of the system.

Each gang segment of the fuel saver set-up switch is also connected to the throttle control line 144 of the lead unit by means of a different stationary contact. For example, the first gang segment 74 is electrically connected to throttle control line 144 by means of its number 2 trail stationary contact 146 and conductor line 148. Similarly, the number 3 trail contact 150 on the second gang segment 76 is connected to throttle control line 144 by means of conductor 152. The fourth trail contact 154 on the third gang segment 78 and the fifth trail contact 156 on the fourth gang segment of the fuel saver set-up switch are also electrically connected to the throttle control line 144 by means of conductor lines 158 and 160 respectively.

It should be pointed out at this time that the lead contact 60 of the unit selector switch is not connected to any of the gang segments of the fuel saver set-up switch. This contact is rather connected directly to the throttle control line 144 on the lead unit via conductor line 162.

Figures 5-8 show the electrical schematics for the trailing units 12, 14, 16 and 18 of the locomotive system shown in Figure 3. The Number two, three, four and five trail units are respectively represented by Figures 5, 6, 7 and 8. The trailing units shown in Figures 5-8 are only equipped with a fuel saver set-up switch as shown in these figures.

The fuel saver set-up switch on the Number two trail unit is shown in Figure 5. Since this locomotive is the number two trail unit of the system, the fuel saver set-up switch is set in the number two trail position as shown in this figure. In the number two trail position, movable contacts 100, 102, 104 and 106 are respectively connected to the second position stationary contacts 162, 164, 166 and 168. The movable contacts are also connected to the appropriate train line wires 128, 132, 134 and 136 by means of conductor lines 170, 172, 174 and 176 so that the movable contacts on corresponding gang sections are electrically coupled to the same train line wires. In other words, the movable contact on the first gang section of the fuel saver set-up switch on the lead unit and the movable contact of the first gang section on each trailing unit is connected to train line wire 128.

Likewise, train line wire 132 is connected to the movable contact of the second gang section of the fuel saver set-up switch on each locomotive of the system, and so forth. Each gang segment of the fuel saver set-up switch of the number two trail unit shown in Figure 4 is also connected to the throttle control line 178 by means of a different stationary contact. The number two trail contact 162 of the first gang segment, the number three trail contact 180 of the second gang segment, the fourth trail contact of the third gang segment are respectively connected to throttle control line 178 by means of line conductors 186, 188, 190 and 192.

The fuel saver set-up switches on the number three trail number four trail and number five trail units are shown in Figures 6, 7 and 8, respectively. As shown in these figures, the fuel saver set-up switches are set in their appropriate number three trail, number four trail and number five trail positions representative of the position within the system occupied by that particular unit. The electrical interconnection of these switches with the throttle control line and train line wires of those units is the same as in Figure 5 and for the purposes of brevity will not be described in detail for each of these units.

It should be pointed out that the stationary contacts of the unit selector switch could be directly connected to the appropriate trailing units of the system, thereby eliminating the need for the fuel saver set-up switch altogether. However, the inclusion of a fuel saver set-up switch standardizes the design of the fuel saver arrangement of the present invention so that the locomotives of the system may be interchanged with each other and with locomotives of other systems by simply changing the positional setting of the fuel saver set-up switch. Further flexibility is introduced into the arrangement by providing each locomotive with a control box that is interconnected with the fuel saver set-up switch as shown in Figure 4. If each unit within the system is equipped with a fuel saver set-up switch and a control box, then any unit within the system can be used as the lead unit.

Referring now to Figure 9, the control circuitry needed to place a particular locomotive in the throttle one position is shown in this figure. The locomotive selected is placed in the throttle one power condition by means of the engine run drop-out relay which overrides normal throttle control circuitry of the locomotive. The relay coil of the engine run drop-out relay is generally indicated at 194 while its relay contact is shown at 196 in its normal operating position. A second relay called the engine run extra relay is provided to remove the alarm from the system so that the alarm will not sound when the locomotive is in a throttle one power position. The solenoid of this relay is generally indicated at 198 and the contact of this relay is shown at 199. Relay contacts 200, 202, 204 and 206 are not pertinent to the present invention and are closed when the locomotive system is in motion. Relay contacts 205 and 207 are likewise not pertinent to the present invention but are open when the system is in motion.

In the normal operating condition, a positive voltage signal is sent through relay contact 196 to the engine run relay generally indicated at 208. The relay coil shown at 208 controls the switching state of a relay contact which is connected in series with the throttle control solenoids not shown in this figure. When the engine run relay is activated, a contact of this relay is closed thereby allowing the throttle control solenoids to regulate the speed of the engine. Once this relay is deenergized, its associate contact is open thereby overriding the normal control solenoid and automatically placing the locomotive in a throttle one power condition.

A second circuit within the locomotive which must be modified is shown in Figure 10. The circuit shown in Figure 10 monitors the throttle response of the locomotive. Relay coil 212 represents the loading characteristic of the engine generator. In order to keep the engine from stalling during the fuel save mode of operation, relay contact 210 is provided to remove the load characteristic 212 from the system when the locomotive is in the fuel save mode of operation. Relay contact 210 operates and responds to the engine run drop-out coil shown in Figure 9. This contact is opened when the relay is energized. Relay contacts 214 and 216 are not pertinent to an understanding of this invention and are closed when the locomotive system is in motion.

In operation, each fuel saver set-up switch is preset to its proper trail setting. In other words, the fuel saver set-up switch on the lead locomotive is present in the lead position while the fuel saver set-up switch on each trailing locomotive is set in the position representative of that locomotive's position within the system. For example, the fuel saver set-up switch on the number two trail unit is placed in the number two trail position, and so forth.

In the normal mode of operation, the fuel saver switch 26 is in the normal position 28 and all of the locomotives within the system respond to the throttle setting of the lead unit. Once full power is no longer required, the unit selector switch is set to indicate which unit or units of the system are to be reduced in power and the fuel saver switch is moved to the fuel save position 29 thereby initiating the fuel saving operation of the present invention. This operation is initiated by providing a fuel save signal to the throttle control circuitry on one or more of the locomotives to place that locomotive in a throttle one position regardless of the throttle setting on the lead locomotive. The fuel save signal is directed to the appropriate locomotive within the system by means of the unit selector switch 30 and the fuel saver set-up switch 34. Once full power is again required, the fuel save switch is returned to its normal position 28, thereby removing the fuel save signal from the system. The fuel save signal is a positive voltage signal which is provided to the control box by means of input line 50.

Closure of fuel saver switch 26 initiates the fuel saving operation by providing the fuel save signal to the movable contact 54 of the unit selector switch 30 by means of conductor line 58. The fuel save signal is then provided to one of the stationary contacts 60, 66, 68, 70, 72 or 90 depending upon the setting of the unit selector switch. Lead contact 60 is connected directly to the lead unit's throttle control line 144 so that the fuel save signal will be provided directly to the lead locomotive if the unit selector switch is placed in the lead position. Stationary contacts 66,68, 70 and 72 on the other hand, represent the second unit, third unit, fourth unit and fifth unit positions and respectively provide the fuel saver set-up switch 34 of the lead unit. When the unit selector switch is in the second/third unit position, movable contact 54 is in contact with stationary terminal 90 and the fuel save signal is simultaneously provided to lead contacts 108 and 112 of the first 74 and second 76 gang segments of the fuel saver set-up switch. The fuel save signal is sent from stationary contact 90 to the lead contact on the first gang segment 74 by means of conductor lines 124 and 110. The signal is also provided to movable contact arm 56 by means of conductor line 96. The fuel save signal is then transmitted to the lead contact on the second gang segment 76 of the unit selector switch by means of stationary contact 92 and conductor lines 126 and 118.

It should be emphasized at this time that the unit selector switch shown in Figure 4 is a six position switch which is specifically designed for a five unit system. The first five settings of this switch are for individually designating any one of the five locomotives of the system as the unit to be reduced in power. The sixth setting, on the other hand, simultaneously reduces the output power of the number two trail and number three trail units. The number of switch positions can, of course, be varied to accommodate larger or smaller locomotive systems and different combinations of units for removal. Furthermore, it is not imperative to the prope operation of the system that the number of switch positions on the unit selector switch be exactly matched with the number of locomotives in the system. For example, a unit selector switch with a fewer number of switch positions than locomotives in the system will be able to individually control only a portion of the total number of units.

Similarly, a unit selector switch having more switch positions than locomotives has the capacity for adding additional locomotives to the system if this becomes desirable.

With fuel saver set-up switch on the lead unit placed in the lead position, movable contacts 100, 102, 104 and 106 direct the fuel save signal to the appropriate train line wires 128, 132, 134 and 136. These train line wires are then interconnected to the corresponding train line wires on each of the trailing units by means of jumper cables not shown. In this way, the fuel save signal is transmitted throughout the entire locomotive system.

Referring now to Figures 5-8, the train line wires on the trailing units which correspond to the train line wires shown in Figure 4 are designated by the numerals 128, 132, 134 and 136. These train line wires are electrically coupled to the movable contact of a particular gang segment of the fuel saver set-up switch on each trailing unit of the system. This connection is arranged so that the movable contacts on corresponding gang sections are electrically coupled to the same train line wires so that a fuel save signal on train line 128 will always be provided to the movable contact of the first gang segment. Similarly, a fuel save signal on train line 132 will always be directed to the movable contact on the second gang segment, and so on. Furthermore, each gang segment has a different stationary contact connected to the throttle control line of the locomotive. In this way, the fuel save signal will be provided to the throttle control circuitry on a particular locomotive only if the fuel save signal is provided to the movable contact of the appropriate gang segment of the fuel saver set-up switch by means of the proper train line wire.

For the purposes of discussion, it will be assumed that the unit selector switch 30 is set in the lead position as shown in Figure 4. In this position, closure of the fuel save switch 26 transmits the fuel save signal to the lead contact 60 by means of conductor line 58 and movable contact 54. This signal is then directed to the throttle control circuitry of the lead unit by means of conductor line 162 and throttle control line 144. Application of a fuel save signal to the throttle control circuitry of the lead unit overrides the normal throttle setting on this unit placing the unit in a throttle one position while leaving the trailing units unaffected.

However, if the unit selector switch is in the second unit position as shown in broken lines, then the fuel save signal will be directed to the second unit contact 66 by means of conductor line 58 and movable contact 54 upon closure of fuel save switch 26. The fuel save signal is then provided to the lead contact 108 on the first gang segment of fuel save set-up switch 34 on the lead unit by means of conductor line 110. Movable contact 100 and conductor line 130 then transmit the fuel save signal to train line wire 128 which transmits the fuel save signal throughout the locomotive system.

Referring now to Figures 5-8, the fuel save signal and train line wire 128 will then be provided to movable contact 100 and the first gang segment of the fuel save set-up switch shown in Figure 5 represents the switch located on the number two trail unit and shows the movable contacts of this switch in a number two trail position. With the movable contacts in the number two trail position as shown in this figure, the fuel save signal will be provided to the throttle control line 178 by means of the number two trail contact 162 and conductor line 186. Since the fuel saver set-up switches shown in Figures 6, 7 and 8 are respectively set in the number three trail, number four trail and number five trail positions, the movable contacts on the fuel saver set-up switches of these units will not be in contact with their number two trail contact so that the fuel saver signal will not be provided to the throttle control circuitry of these locomotives.

It is an added feature of the present invention that the power output of a plurality of units can be controlled simultaneously rather than individually. In that case, the fuel save signal is simultaneously provided to more than one unit merely by setting the fuel saver set-up switch of two different units to the same trail position. For example, the fuel saver set-up switch on locomotives 12 and 14 could both be set in the number two trail position. Thereafter, anytime the unit selector switch on the lead unit is placed in the second unit position the fuel save signal will be simultaneously provided to the throttle control circuitry on locomotives 12 and 14 thereby reducing the output power of these two locomotives.

Referring now to Figure 9, the engine run circuit is shown in this figure. The fuel save signal is provided to the engine run dropout relay coil 194 by means of the throttle control line generally designated by the numeral 193. Energization of the engine run dropout relay coil 194 causes engine run dropout relay contact 196 to be switched from its normal state shown in Figure 9 to contact terminal 218. Movement of relay contact 196 removes the power signal from the engine run relay coil 208 thereby deenergizing this relay. Deenergization of engine run relay coil 208 causes the corresponding relay contact (not shown in Figure 9) to be opened, thereby overriding the normal throttle control circuitry and placing the locomotive in a throttle one power condition. The engine run relay contact is connected in series with the control governor solenoids which regulate the speed of the engine. By opening the switch contact of the engine run relay, the governor solenoids are removed from the system and the locomotive is automatically placed in a throttle one power condition. In the fuel save operating condition, the engine run dropout relay contact with terminal 218 thereby providing an activation signal to engine run extra relay 198. Activation of this relay causes engine run extra relay contact 199 to be opened thereby removing the alarm from the system.

Referring further to Figure 10, activation of the engine run drop relay coil 194 (shown in Figure 10) also opens the engine run dropout relay contact 210 shown in this figure. By opening this circuit, load characteristic 212 is removed from the throttle control circuitry so that placement of the engine in a throttle one power condition will not cause the engine to stall.

WHAT WE CLAIM IS:

1. A locomotive system comprising a plurality of locomotive units each having a power output level normally controlled by throttle control circuitry which is common to all of the locomotive units, and a fuel saver arrangement comprising a plurality of override circuits corresponding to the respective locomotive units, each override circuit being normally open and being operable when completed to override said throttle control circuitry in a manner to reduce the power output level of the corresponding locomotive unit independently of the throttle control circuitry and the power output level of the remaining units, and selector means associated with the override circuits for selectively completing the override circuit corresponding to at least one selected locomotive unit which is to have its power output level reduced, said selector means having a normal setting wherein each override circuit is in its normally open condition to permit the throttle control circuitry to control the power output level of all of the locomotive units, and a fuel saver setting wherein the override circuit corresponding to said selected locomotive unit is completed to thereby reduce the power output level of the selected unit.

2. A locomotive system according to claim 1, wherein said selector means comprises a multiple position selector switch having a plurality of settings corresponding to the respective override circuits, and a normally open fuel saver switch common to each override circuit to maintain each override circuit in its normally open condition when the fuel saver switch is in its normally open position, said fuel saver switch upon closure thereof effecting completion of the override circuit corresponding to the setting of the selector switch, thereby reducing the power output level of the selected locomotive unit.

3. A locomotive system according to claim 2, wherein said selector switch and fuel saver switch are both located within a single one of the locomotive units.

4. A locomotive system according to claim 3, comprising a plurality of multiple position set-up switches located within the respective locomotive units, each set-up switch having a selected position wherein the override circuit for the corresponding locomotive unit is completed through the set-up switch when said fuel saver switch is closed and said selector switch is in a setting corresponding to the locomotive containing the set-up switch.

5. A fuel saver arrangement for a multiple unit locomotive system including a plurality of electrically interconnected locomotives each having a power output level normally controlled by throttle control circuitry which is common to all of the locomotives and which normally maintains each locomotive at the same power output level, said fuel saver arrangement comprising an override circuit for each locomotive adapted for connection to the throttle control circuitry, each override circuit having a normally open condition wherein the throttle control circuitry is unaffected and each override circuit having a completed condition wherein the overrride circuit overrides the throttle control circuit in a manner to reduce the power output level of the corresponding locomotive irrespective of the condition of the throttle control circuitry; a normally open fuel saver switch disposed in a circuit which is common to each override circuit to thereby maintain each override circuit in its normally open condition when the fuel saver switch is in its normally open condition; and a selector switch having a plurality of settings corresponding to the respective override circuits, said selector switch completing the override circuit corresponding to the setting of the selector switch when the fuel saver switch is closed, whereby the power output level of at least one selected locomotive can be reduced by closing the fuel saver switch and positioning said selector switch in the setting corresponding to the override circuit of said selected locomotive.

6. A fuel saver arrangement according to claim 5, comprising a multiple position set-up switch for each locomotive, each set-up switch being included in the override circuit for the corresponding locomotive and each set-up switch having a position wherein the corresponding override circuit is completed through the set-up switch when said fuel saver switch is closed and said selector switch is in the setting thereof correspond-

ing to the override circuit of the set-up switch.

7. A fuel saver arrangement according to claim 6, comprising a plurality of train line wires for extending between the locomotives to electrically interconnect them, said train line wires forming portions of the respective override circuits which extend between the selector switch and the respective set-up switches.

8. A method of reducing the power output of a multiple unit locomotive system which includes a plurality of locomotives each having a power output normally controlled by throttle control circuitry common to all of the locomotives, said method comprising the steps of selecting at least one of the locomotives which is to have its power output reduced, and overriding the throttle control circuitry in a manner to reduce the power output of said one locomotive independently of the throttle control circuitry while said throttle control circuitry continues to control the power output of the remaining locomotives.

9. A method according to claim 8, wherein said overriding step includes the steps of generating an electrical signal, and applying said electrical signal to said one locomotive in a manner to override the throttle control circuitry.

10. A locomotive system substantially as hereinbefore described with reference to the accompanying drawings.

11. A fuel saver arrangement for a multiple unit locomotive system including a plurality of electrically interconnected locomotives each having a power output level normally controlled by throttle control circuitry which is common to all of the locomotives and which normally maintains each locomotives at the same power output level, substantially as hereinbefore described with reference to the accompanying drawings.

12. A method of reducing the power output of a multiple unit locomotive system which includes a plurality of locomotives each having a power output normally controlled by throttle control circuitry common to all of the locomotives, substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1981.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

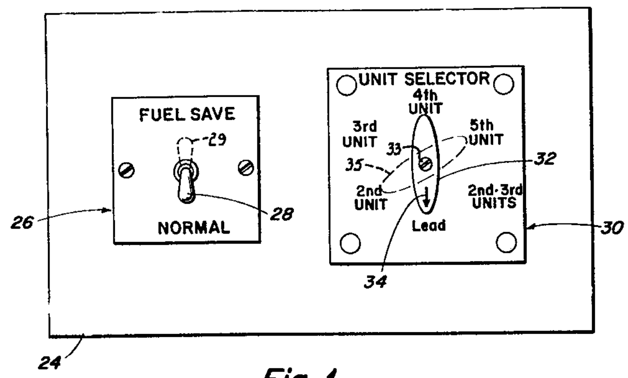

FUEL SAVE
29
NORMAL
28
26
UNIT SELECTOR
4th UNIT
3rd UNIT
5th UNIT
33
35
32
2nd UNIT
2nd-3rd UNITS
Lead
30
34
24

Fig. 1

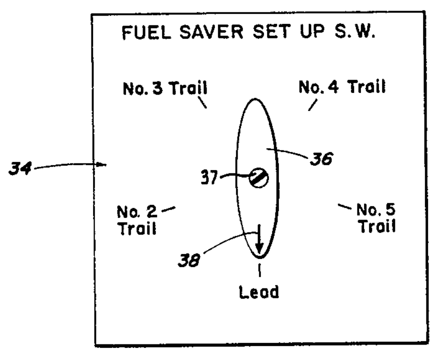
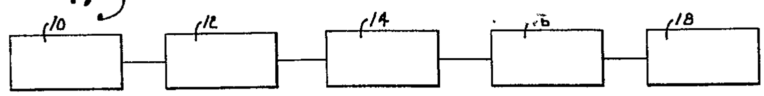

FUEL SAVER SET UP S.W.
No. 3 Trail
No. 4 Trail
34
36
37
No. 2 Trail
No. 5 Trail
38
Lead

Fig. 2

Fig. 3.



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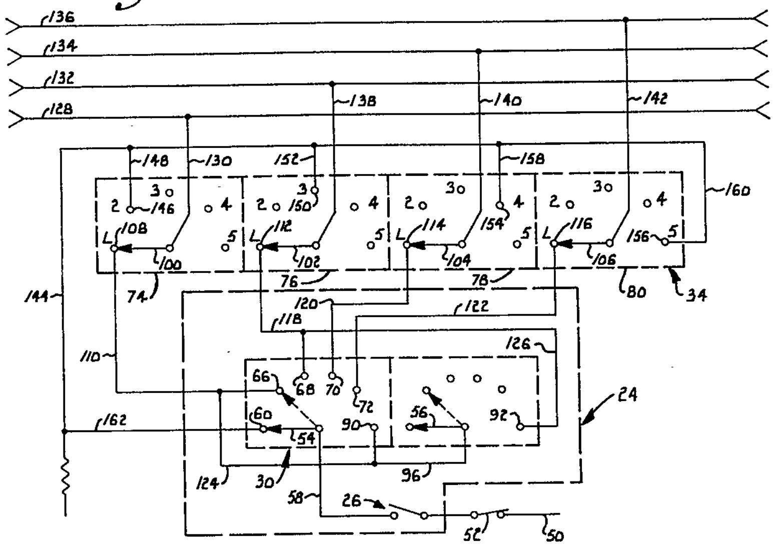

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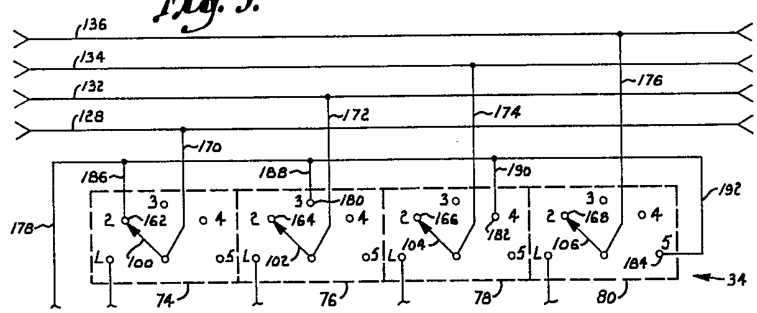

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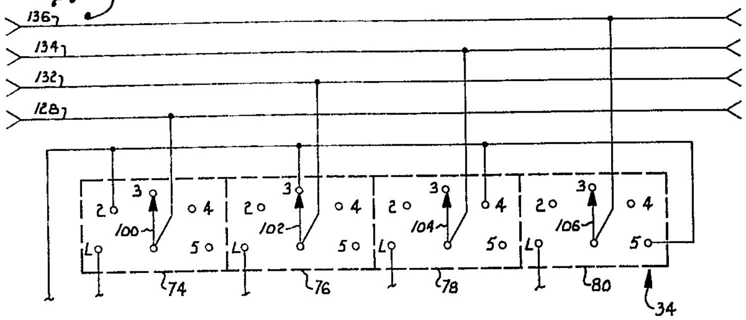

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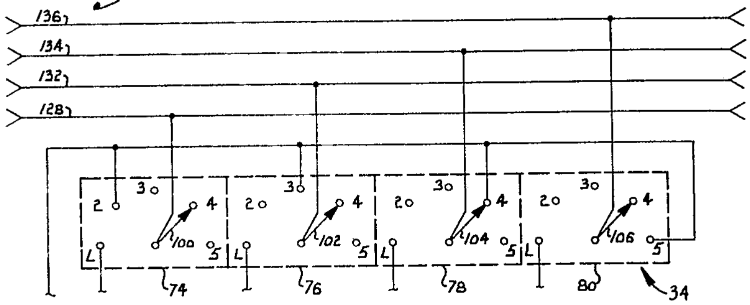

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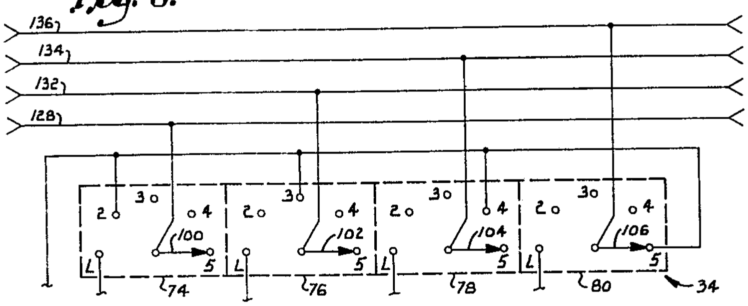

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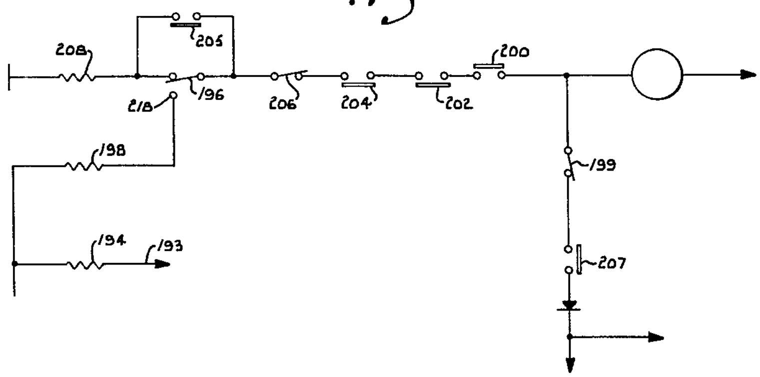
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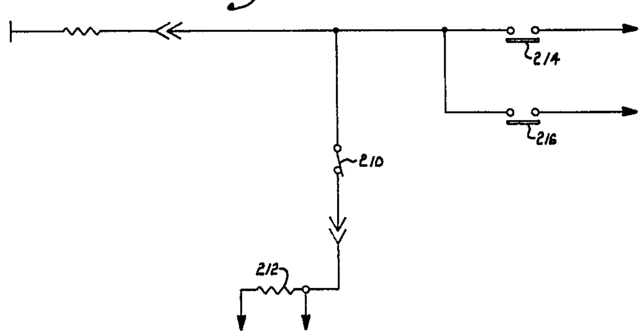
Fig. 10.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