Sept. 16, 1952 E. H. MUSGROVE 2,610,990

AIR ACTUATED TIME DELAY CONTROL SWITCH

Filed May 20, 1949 3 Sheets-Sheet 1

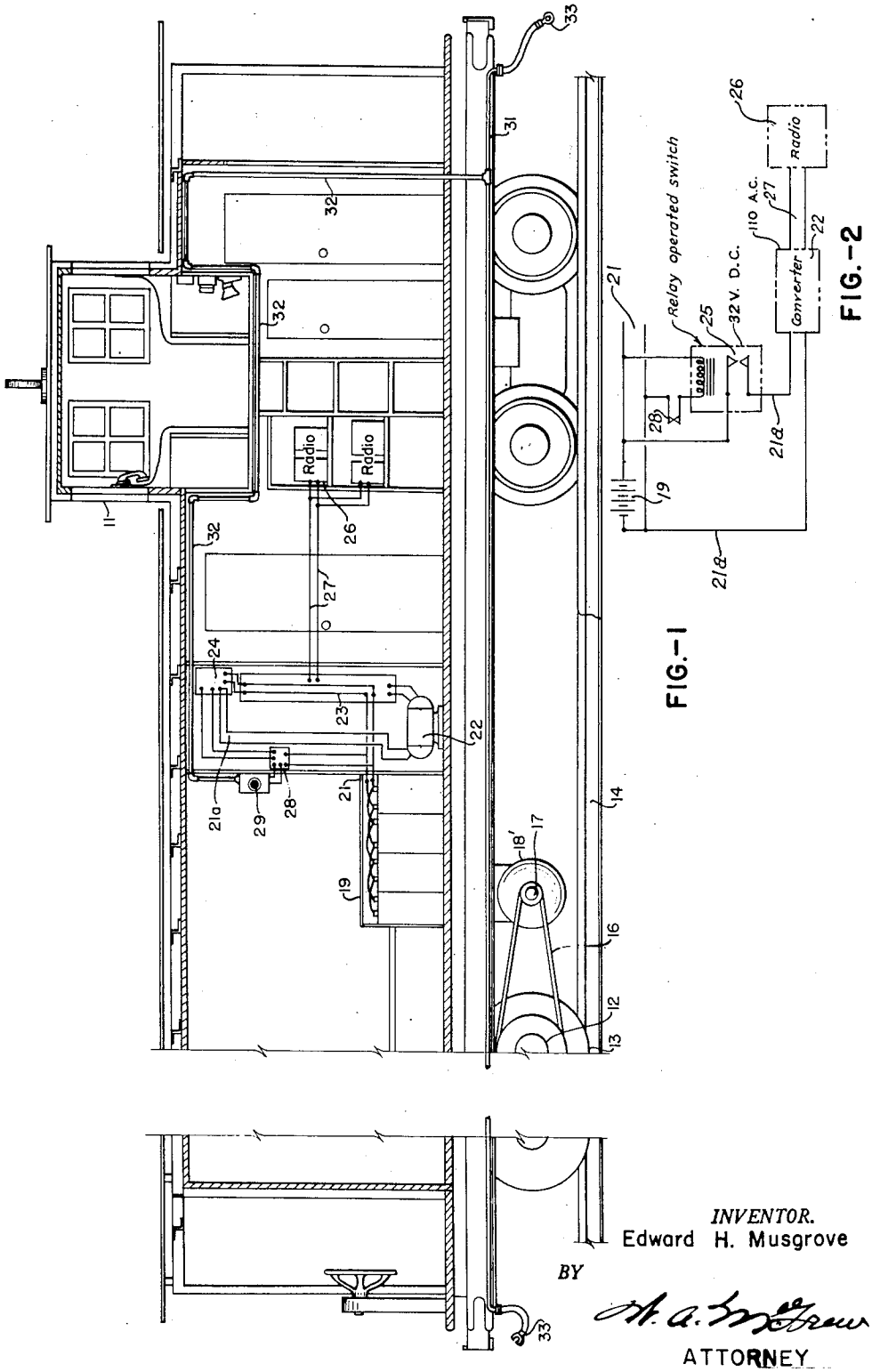


FIG.-1

FIG.-2

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AIR ACTUATED TIME DELAY CONTROL SWITCH

Filed May 20, 1949 3 Sheets-Sheet 2

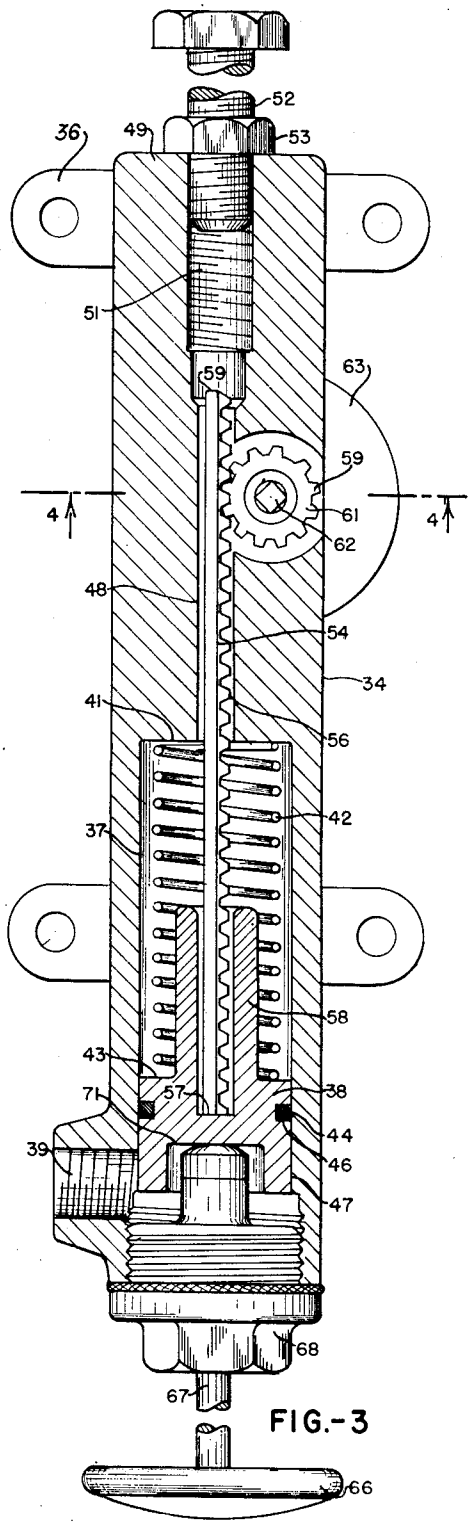


FIG.-3

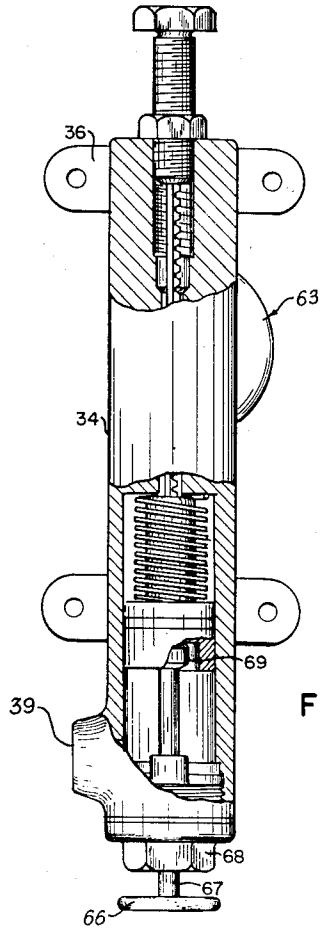


FIG.-4

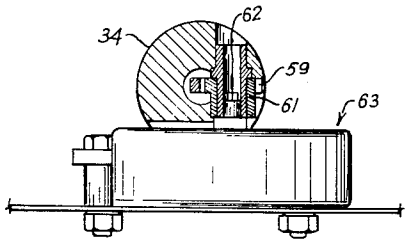


FIG.-5

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AIR ACTUATED TIME DELAY CONTROL SWITCH

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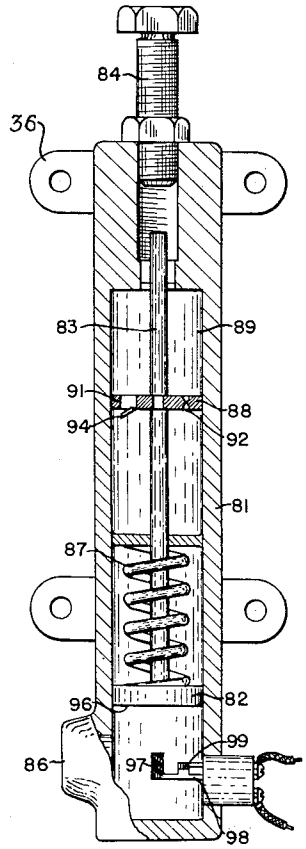


FIG.-7

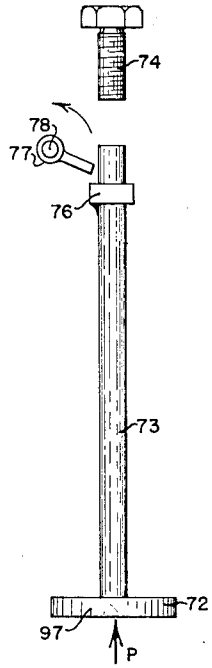


FIG.-6

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AIR ACTUATED TIME DELAY CONTROL SWITCH

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Application May 20, 1949, Serial No. 94,449

12 Claims. (Cl. 171—97)

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This invention pertains to a power control time delay switch for use on railroad rolling stock or other transportation vehicles. More particularly this invention pertains to a switch of the foregoing type which may be connected in the air system of a train or other vehicle in such manner as to limit the time during which electrical power may be used after the train or vehicle is no longer being used.

In keeping with general modernization programs the railroads and others interested in transportation are providing their rolling stock and equipment with a greater number of electrically powered devices. As the number of electrical devices and equipment is increased the possible power drain on the conventional battery system is likewise increased. Accordingly unless the operators of the rolling stock or equipment are properly attentive to all their multifarious duties and gifted with a power of memory beyond that usually observed, the expensive batteries provided will sometimes be damaged when the operators forget to turn off the main power supply upon leaving the equipment at destination or unloading dock.

The railroads are now providing radio intercommunication between the caboose and engine of freight trains, and during operation this intercommunication system is normally left on. If the main control switch is not turned off when the freight train is pulled into a terminal for unloading or other purposes it is entirely possible that the batteries will be discharged to such an extent that they will not again provide power when needed. In addition such a complete draining of the power reserve of the batteries will necessarily damage the plates and in some instances make replacement of the batteries necessary.

Because of the increased use of electrical power and because of the frailties of human nature, it has been found necessary and desirable to develop an automatic means for cutting off the electrical power when railroad rolling stock or other types of transportation vehicles are not in use. The applicant has found that this purpose can well be served by the use of a main electrical power control switch which is itself actuated by the air system of the train or vehicle. Actuation of this power control switch through the medium of the air system has been found especially desirable and effective inasmuch as the air pressure in the air system is generally relieved whenever the rolling stock or vehicle is put out of service. Necessarily the air system is put

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out of service whenever the engine is uncoupled from the train or the tractor is uncoupled from conventional trailer trucks. Accordingly, the air system can be provided with an effective and reliable electrical power control switch to regulate the use of electrical power when the transportation vehicle is out of use. As an added feature of this invention, further means are provided for a time delay of variable duration between the time that the air system is uncoupled and the electrical power is positively cut off. This provides the electrical power often desirable for a short period of time after the train has been uncoupled while preventing the use of electrical energy for long periods of time unless necessary.

Recognizing the problems and conditions as they are, the applicant provides means for eliminating these problems and satisfying the following objects:

To provide a device for conserving battery power in transport carriers by preventing inadvertent expenditure of electrical energy when the carrier is not in use while further providing for emergency use as necessary.

To provide an electrical power control switch operable in accordance with changes in the pressure of the air system of conventional transport carriers to regulate the expenditure of electrical energy when the carrier is not in use.

To provide an electrical power control switch operable as set forth above having means for delaying the time of electrical power cutoff for a predetermined period after the change of pressure within the air system.

To provide various means for use with an electrical power control switch for delaying the time of power cutoff in transport carriers for predetermined periods measurable subsequent to the time that the carrier is put out of use.

To provide a device for conserving battery power in transport carriers in accordance with the principles of this invention as set forth below.

Briefly stated this invention provides a mechanism which may be connected into the air system of conventional types of transport carriers to regulate the opening and closing of a main electrical power control switch. Essentially the device consists of an air cylinder connected in the air system and having a piston for reciprocal movement within the cylinder. Movement of the piston is transmitted by suitable means to energize a time delay control mechanism which in turn throws the electrical power control switch to an on or off position as desired after the ex-

piration of a short time interval. By means of this device the applicant provides a mechanism for conserving battery power by preventing the inadvertent expenditure of such power for a prolonged period after the transport carrier is out of use to thereby maintain a desirable power level in the batteries.

The details and working arrangement of the features of this invention are best shown and described in the following description and drawings in which:

Fig. 1 is an elevation in partial cross section showing the arrangement of the device of this invention in relation to the electrical power system of a modern caboose provided with various electrical devices;

Fig. 2 is a schematic wiring diagram of a circuit used according to this invention;

Fig. 3 is an elevation in partial section showing a first embodiment of this invention in which a rack is used to drive a time delay device;

Fig. 4 is another elevation in partial section of the device of Fig. 2 showing further features of this embodiment;

Fig. 5 is an end elevation of the embodiments shown in Fig. 3 showing other features of this invention;

Fig. 6 is an elevation of a modified form of piston for use in air cylinders of substantially the same construction as those of Figs. 2 and 3; and

Fig. 7 is an elevation in partial section showing the features of a further embodiment of this invention incorporating a dashpot action for time delay purposes.

Referring now to the drawings, the general features and working arrangement of this device will best be understood with reference to Figs. 1 and 2. In these figures the applicant shows the installation of his invention within the caboose 11 of a modern freight train. As is general practice, the caboose 11 is provided with a generator-battery system adapted to be driven from the axle 12 upon which wheel 13 is likewise mounted. When wheel 13 rotates due to the movement of the caboose 11 along the track 14, the axle 12 will rotate thereby causing movement of the generator drive belt 16. Drive belt 16 in turn causes rotation of the pulley and shaft 17 of generator 18 to generate electrical current which is conducted by suitable means to the battery 19 or directly to the main power circuit 21 within the caboose 11, which is connected directly to the battery. Preferably the electrical energy delivered from the generator 18 to the battery 19 or main power circuit 21 is regulated in voltage through use of a voltage regulator (not shown). If a voltage regulator is to be used, it may be mounted within the cabinet 23 to regulate the flow of current to the converter 22. Likewise other switching means may be provided within the cabinet 23 and switch box 24 to allow for various types of circuit interconnection in the electrical system. For the purposes of this invention it will be adequate to assume that all the power passing from either the battery 19 or the generator 18 must be carried through the main power circuit 21, and thence through the circuit 21a to the converter 22. In the circuits shown the converter 22 steps up the voltage from 32 volts D. C. to 110 volts A. C., and it is this stepped up power that is delivered to the radio gear 26 through the lines 27. Power of the same voltage is likewise connected to other circuits having terminals within the cabinet 23 or switch box 24 to energize other electrical apparatus as necessary.

A switch 28 is provided in parallel with the main power circuit 21 to energize a circuit inclusive of a relay thereby actuating the main power switch 25. The position of this switch 28 is regulated by the power control device 29 which is the main feature of this invention. Before referring to Figs. 3, 4 and 5 which show a preferred form for the power control device 29, it should be noted that the device 29 is connected in the air system 31 of the train and of the caboose 11 by means of pipes 32. Thus, whenever the air couplings 33 of the caboose 11 are interconnected with similar couplings 33 of other cars and the air compressor in the engine is driven, air pressure will be transmitted through the train air system to the caboose 11 and through the air system 31 of the caboose to the power control device 29.

Referring now to the aforementioned Figs. 3, 4 and 5 the features of one embodiment of this invention will be more fully described. In these figures it will be noted that the applicant provides an air cylinder 34 having suitable mounting lugs 36 attached thereto. The air cylinder 34 is provided with a cylindrically shaped opening 37 in which a piston 38 is placed for reciprocal movement. While the structure of this power control device 29 is generally cylindrical and is provided with a cylindrical opening 37 therein, it is to be understood that throughout the description and claims of this application the term "air cylinder" is used in accordance with a common machine usage to designate any type of structure usable for this same purpose notwithstanding the fact that it may be of other than circular cross section. This broader usage of the term is fully warranted inasmuch as it is not at all necessary that the power control device or the piston 38 be of circular cross section. The air cylinder 34 is provided at one end with an air entrance opening 39 through which air under pressure may be introduced to cause movement of piston 38 toward the bottom 41 of the cylindrical opening 37. When arranged for use in the system described above the air opening 39 will be connected with the pipes 32 as previously shown and described in connection with Fig. 1. If desired a moisture and solids materials trap may be installed in the line 32 adjacent opening 39 to prevent injury to the air cylinder 34.

A spring 42 is positioned within the cylindrical opening 37 so that one end thereof is engaged with the bottom 41 while the other end thereof is engaged with a shoulder 43 on said piston 38. The spring 42 tends to move the piston 38 away from the bottom 41 whenever the air pressure in the air system is relieved or reduced below a predetermined pressure. In order to prevent any passage of air under pressure from the opening 39 back into the cylindrical opening 37, packing 44 or a ring or other pressure retaining device is placed in a groove 46 formed in the cylindrical face 47 of piston 38. This packing 44 prevents any disruption of the balance between the air pressure and the spring pressure 42.

The air cylinder 34 is further provided with a smaller elongated passage 48 which passes through the body of the air cylinder 34 from the bottom of the cylindrical opening 37 to the end of the air cylinder 34 opposite from the air opening 39. At this opposite end 49 of the air cylinder 34, the passage 48 is provided with threads 51 for the reception of an adjusting screw 52 which may be locked in any adjusted

position by moving the lock nut 53 downwardly into engagement with the end of the air cylinder 34. A rod 54 having gear teeth 56 cut in one face thereof to provide a rack is arranged for reciprocal movement through passage 43 and cylindrical opening 37. One end 57 of the rod 54 is engaged within a boss 58 formed on the piston 38. The opposite end 59 of the rod 54 is arranged for free movement within the passage 48 throughout the length of a stroke determined by the position of the adjusting screw 52. Thus the piston 38 may be moved through the cylindrical opening 37 under the influence of the air pressure until either the boss 58 comes in contact with the bottom 41 of the opening 37 or until the end 59 of rod 54 comes into contact with the adjusting screw 52. The gear teeth 56 of rod 54 are arranged for engagement with the teeth 59 of a gear 61 which is in turn engaged to a square shaft 62 of a time delay control mechanism 63. For the embodiments shown the time delay control 63 is of such nature that the shaft 62 rotates freely in a first direction to energize the mechanism of the time delay control 63 and is arranged for regulated movement in an opposite direction by means of an internal escape mechanism or the like. When properly arranged, the rod 59 rotates the shaft 62 in said first direction as the piston 38 is moved toward the bottom 41 of the cylinder 37 under the influences of air pressure. When the rod has moved through its full stroke as limited by either the adjusting nut 52 or the boss 58, any further movement of the shaft 62 must be in a reverse direction. This movement in the reverse direction can only occur whenever the air pressure within the air cylinder 34 is relieved. Thus if the caboose 11 is uncoupled from the rest of the train and the air pressure is thereby released, piston 38 will return to its position as shown in Fig. 3 because of the force exerted by the spring 42. The rack 54 however, does not return with the piston, but slides free in boss 58. The rate of movement of the rack in this reverse direction, is limited by the mechanism within the time delay control device 63.

Several different types of mechanisms now well known to the time delay control art are well suited to the purposes of this invention. When properly installed, various of these mechanisms can be regulated so that movement from the position shown in Fig. 4 to the pressure relieved position shown in Fig. 3 will consume almost any desired time interval. For the purposes of this invention a time delay period of approximately twenty minutes has been found most useful. The lock nut 52 however makes it entirely possible to adjust the time delay period even though the mechanism of time delay control 63 is preset for a certain rate.

For the purposes of control, it is apparent that whenever the piston 38 and rack 54 have returned to their pressure relieved position as shown in Fig. 3, electrical contact points 28 arranged either within the time delay control 63 or adjacent to some portion of the piston 38 are opened to further open the main power control switch 25.

The air cylinder 34 shown in Figs. 3, 4 and 5 is provided with other features which make it especially useful as a time delay control device on transport vehicles. Oftentimes it is desirable to have electrical power within such vehicles even at times when the carrier is disconnected from motive equipment and in an out-of-use status. Whenever it is desired to have the use of various

electrical equipment within the vehicle, the operator, trainman or any of the maintenance personnel may close the electrical circuit through switch 28 by pressing the knob 66 located in one end of the air cylinder 34. Upon pressing the knob 66 the shaft 67 which passes through the air cylinder nut 68 will be moved reciprocally with respect to the nut 68. A button 69 on the end of the shaft 67 will then come into engagement with an interior face 71 of the cylinder 38. Further movement of the knob 66 then causes the piston 38 to be moved in its first direction thereby compressing the spring 42 and moving the rod 54 to its full limited position. Since there will be no air pressure in the cylindrical opening 37, the piston 38 will at once move back toward its pressure relieved position. The rack will tend to move in the same direction but such movement will be regulated by the time delay control 63 as previously explained due to the meshing of the gear 61 and the gear teeth 56. The electrical power within the carrier will stay on until the rack has returned to its full pressure relieved position when the electrical power will again be cut off. For general purposes the twenty minute time delay interval chosen will be adequate to assure the completion of any task which may be aided by the use of electrical power. At the same time, however, the batteries are again protected from inadvertent damage due to prolonged and unnecessary use. If continued use of the electrical power is actually necessary, the knob 66 may be pushed as many times as desired to allow the full period of use.

While it may at first seem inconvenient to have to keep pushing the knob 66, this inconvenience has proved to be desirable inasmuch as the battery power will be conserved for essential operation instead of being consumed for the convenience or pleasure of the operators or repairmen. In modern railroad operation where the passenger trains are presently provided with radio sets, moving pictures and other electical apparatus, it has been found that maintenance personnel are prone to use these facilities without regard to the limitations inherent in battery power. It has been the experience of those operating electrically equipped carriers that this type of unauthorized use has caused considerable damage to the batteries of the power source. When this complication is added to that resulting from inadvertent neglect of the main power switch, present arrangements represent a considerable loss in time and materials. The device of this invention as described is quite successful in preventing these inordinate losses and therefore represents a considerable improvement over prior arrangements.

The advantages of this invention are not confined to the single embodiment shown and described. In fact there are various ways of accomplishing the objects of this invention. Separate means for accomplishing these objects are shown in Figs. 6 and 7. In Fig. 6 the inventor provides a piston 72 having a shaft 73 affixed thereto. The piston 72 and shaft 73 as shown may be placed for reciprocal movement in an air cylinder similar to that shown in Figs. 3, 4 and 5. As before explained the reciprocal movement of the piston 72 in a first direction is limited by an adjusting nut 74 similar in detail and in use to the adjusting nut 52 of Fig. 2. A collar 76 is provided on the shaft 73 and so positioned as to engage a cam member 77 rotatably mounted on the shaft 78 of a time delay control device (not

shown). In this arrangement movement of the piston 72 causes the collar 76 to come into contact with the cam member 77 thus rotating the shaft 78. When the shaft 78 is rotated in a predetermined direction, the time delay control mechanism will be energized. After the engagement between the collar 76 and the cam 77, the time delay control device chosen may be arranged to open the switch 28 after the expiration of a predetermined period, thus opening main power switch 25. Actually the operation of this second type of piston as shown in Fig. 6 is in many ways similar to the operation for the air cylinder 34 as previously described inasmuch as air pressure applied against face 79 of the piston 72 causes movement in the direction as indicated by the arrow P, and a spring or other type of resilient number forces the piston 72 back to its normal pressure relieved position by application of force in a direction opposite to that indicated by the arrow P.

A still further embodiment of this invention is shown in Fig. 7. In this figure it will be noted that the air cylinder 81 is likewise provided with a piston 82, a piston shaft 83 and an adjusting nut 84. Further the piston 82 is moved in a first direction by the introduction of air under pressure through air inlet opening 86, and a spring 87 is provided to force the piston 82 back to its normal pressure relieved position when the air pressure is released. Air cylinder 81 is distinguished from air cylinder 34, however, by the provision of a dashpot action to hinder and regulate the return movement of the piston 82.

The dashpot action incorporated requires the use of a second piston 88 attached to the shaft 83 and mounted for reciprocal movement within a closed cylindrical passage 89. The piston 88 is provided with a valve opening 91 and a metering jet 92. The cylindrical passage 89 is filled with a fluid compound preferably having a consistency and viscosity comparable to hydraulic fluid or even heavier oil. When the piston 82 is moved in its first direction under the influences of air pressure the fluid within the cylindrical passage 89 passes freely through the valve opening 91 thus offering but minor resistance to the movement of the piston 88. After the piston 82 has moved to its full limited position as governed by the adjusting nut 84, a check valve 94 mounted in the valve opening 91 will be closed and all communication between the portions of the cylindrical passage 89 on opposite sides of the piston 88 will be through the metering jet 92. Since the metering jet 92 is of relatively small size, the return of the piston 82 to its pressure-relieved position under the force exerted by the spring 87 will be relatively slow.

By adjusting the size of the metering jet 92 or changing the viscosity of the liquid within the cylindrical passage 89, the interval required to return the piston to its pressure relieved position may be changed. Within limited ranges other interval duration changes are possible by adjustment of screw 84. When the piston 82 does return to its pressure-relieved position, the outer face 96 of the piston 82 comes into contact with projection 97 on the switch arm 98. As a result of the contact between the piston 82 and the projection 97, electrical contact points 99 will be opened, thereby in turn opening the main power control switch 25.

It will be apparent from the foregoing decription that the device of this invention is adaptable to various changes and modifications. Accordingly the applicant does not wish to be limited to the specific forms shown and described but intends only to be limited within the scope of the hereunto appended claims.

What is claimed is:

1. A system for regulating the use of electrical power in railroad rolling stock having a generator-battery source of electrical energy and a pressure air system, comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions of use in said rolling stock, a switch in said circuit, an air cylinder connected in the air system of said rolling stock having a piston movable in one direction by the air pressure in said system, a force exerting mechanism contained within said cylinder for moving said piston in an opposite direction, and an energy transmitting member positioned along the reciprocal path of said piston at a predetermined point in its range of movement and operable by contact with said piston to actuate said switch.

2. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for regulating the use of electrical energy throughout said vehicle, and a time delay control mechanism operable by pressure variation in the air system of said vehicle in actuating connection with said switch.

3. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for regulating the use of electrical energy throughout said vehicle, and a time delay control mechanism operable by pressure variation in the air system of said vehicle in actuating connection with said switch to open and close said switch.

4. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for regulating the use of electrical energy throughout said vehicle, and a time delay control mechanism operable by pressure variation in the air system of said vehicle to control the opening and closing of said switch, said time delay control mechanism being adapted to open said switch only after the expiration of a predetermined time interval after said variation of pressure.

5. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for regulating the use of electrical energy throughout said vehicle, and a control mechanism operable after the pressure in said system is relieved, said control mechanism being in actuating connection with said switch.

6. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for reg-

ulating the use of electrical energy throughout said vehicle, and a time delay control mechanism in actuating connection with said switch, said time delay control mechanism being operable when the pressure in said system is relieved.

7. A system for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical energy and a pressure air system, comprising a main circuit for carrying electrical energy from said generator and battery, a switch in said main circuit for regulating the use of electrical energy throughout said vehicle, and a time delay control mechanism in actuating connection with said switch, said time delay mechanism being adapted to open said switch after the expiration of a predetermined time interval after said pressure is relieved.

8. A system for regulating the use of electrical power in railroad rolling stock having a generator-battery source of electrical energy and a pressure air system comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions of use in said rolling stock, a switch in said circuit, an air cylinder connected in the air system of said rolling stock having a piston movable in one direction by the air pressure in said system, a time delay control device adjacent said air cylinder, and an energy transmitting member positioned along the reciprocal path of said piston operable by contact with said piston for actuating said time delay control.

9. A system for regulating the use of electrical power in railroad rolling stock having a generator-battery source of electrical energy and a pressure air system comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions of use in said rolling stock, a switch in said circuit, an air cylinder connected in the air system of said rolling stock having a piston movable in one direction by the air pressure in said system, a time delay control device adjacent to and operable by said air cylinder, and energy transmitting means interconnecting said time delay device and said switch for controlling said switch.

10. A system for regulating the use of electrical power in railroad rolling stock having a generator-battery source of electrical energy and a pressure air system comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions of use in said rolling stock, a switch in said circuit, an air cylinder connected in the air system of said rolling stock having a piston movable in one direction by the air pressure in said system, a time delay control device adjacent to and operable by said air cylinder, and energy transmitting means interconnecting said time delay device and said switch for opening said switch after the expiration of a predetermined time interval.

11. A system for regulating the use of electrical power in railroad rolling stock having a generator-battery source of electrical energy and a pressure air system comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions for use in said rolling stock, a main switch in said circuit, an air cylinder connected in the air system of said rolling stock having a piston movable in one direction by the air pressure in said system, a force exerting mechanism within said air cylinder for moving said piston in an opposite direction, a time delay control device adjacent said air cylinder, an energy transmitting member positioned along the reciprocal path of said piston operable by contact with said piston for energizing said time delay control, and a second electrical switch operable by said time delay control after the expiration of a predetermined time internal for opening said main switch.

12. A mechanism for regulating the use of electrical power in transportation vehicles having a generator-battery source of electrical power and a pressure air system, comprising an electrical circuit for carrying electrical energy from said generator and battery to various positions of use in said transport vehicle, a main switch in said circuit, an air cylinder connected in said air system, a piston for reciprocal movement in said cylinder, means for introducing air under pressure into one end of said cylinder to move said piston in a first direction, resilient means within said cylinder for moving said piston in an opposite direction, an auxiliary cylinder within said air cylinder, a piston rod in engagement with said piston for movement therewith, an extension on said piston rod extending into said auxiliary cylinder, an auxiliary piston on said extension having openings therein, fluid in said auxiliary cylinder, said fluid and said auxiliary piston being adapted to provide a dashpot action for regulating the rate of movement in said opposite direction, and a second electrical switch positioned adjacent said piston when in its pressure relieved position to be opened by said piston, thereby opening said main switch.

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