United States Patent

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[33] **Japan**
[31] **43/11120;**
Feb. 23, 1968, Japan, No. 43/11121; Feb. 23, 1968, Japan, No. 43/11122

[54] **VEHICLE DOOR LOCK ARRANGEMENT**
12 Claims, 13 Drawing Figs.

[52] **U.S. Cl.** **180/113,** 70/264
[51] **Int. Cl.** **B60j 5/00**
[50] **Field of Search** 180/113, 112, 111; 70/264

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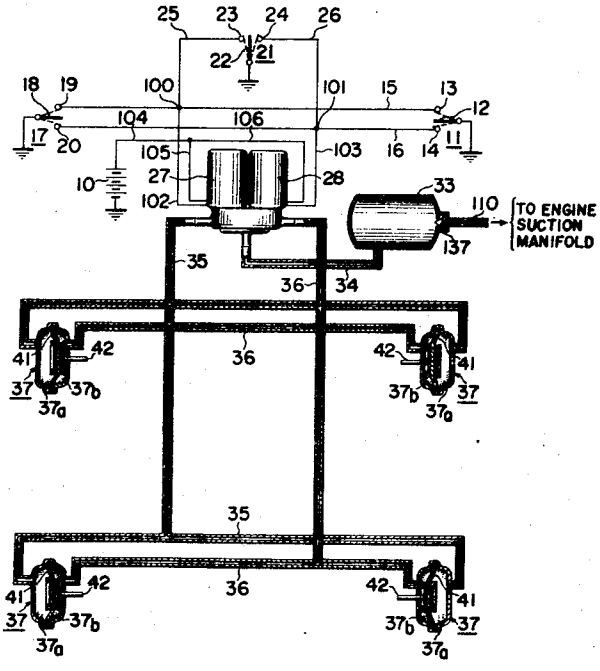
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Primary Examiner—Kenneth H. Betts
Attorney—Sughrue, Rothwell, Mion, Zinn & Macpeak

ABSTRACT: This invention relates to a door lock arrangement for an automotive vehicle having a plurality of vehicle doors, said arrangement comprising a door lock mechanism for each of said doors.

Each of the door lock mechanisms comprises a mechanical latching means consisting of a ratchet wheel and a ratchet pawl; and a pneumatic cylinders. Each of the door lock mechanisms is mounted on one of the vehicle doors. All the pneumatic cylinders are connected to a negative pneumatic pressure source such as the engine suction manifold. The cylinder space of each of the pneumatic cylinders is divided into two. The pneumatic communication of these two cylinder chambers is controlled by an electromagnetic valve assembly which is capable of being actuated by means of any one of a plurality of electric switches, at least one of which is manually operated by the vehicle driver and a separate one of which is actuated by a vehicle running sensing means such as a speed change lever.



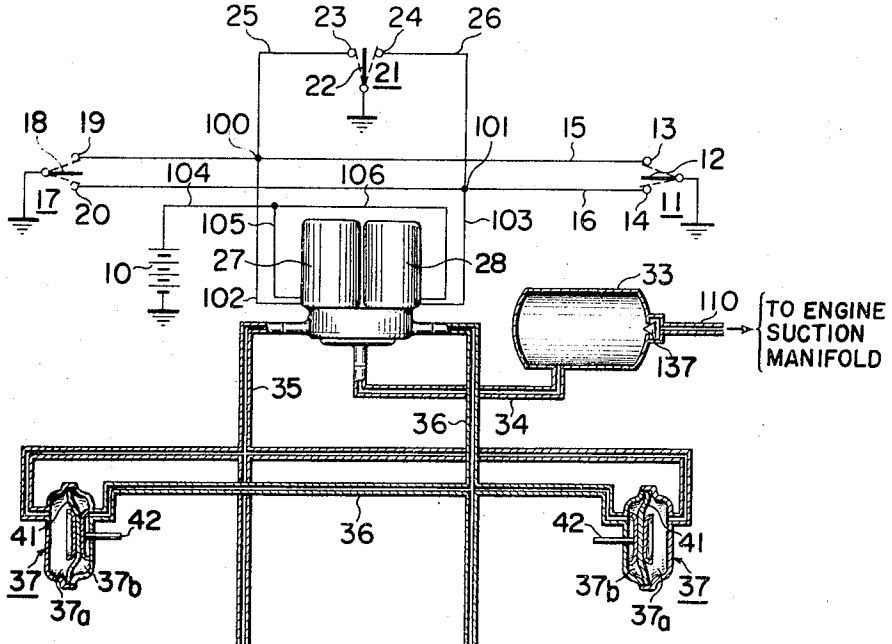


Fig. 1

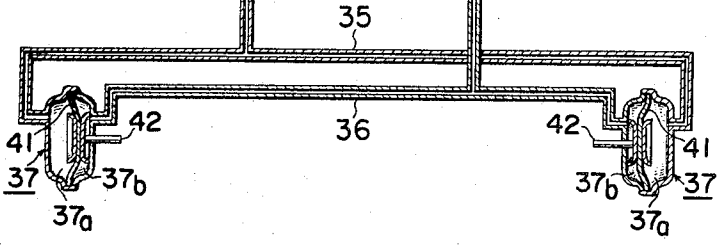


Fig. 2

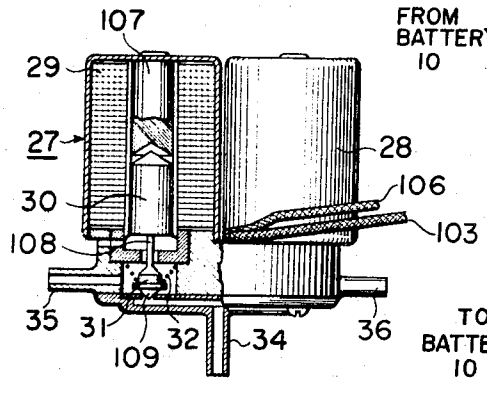
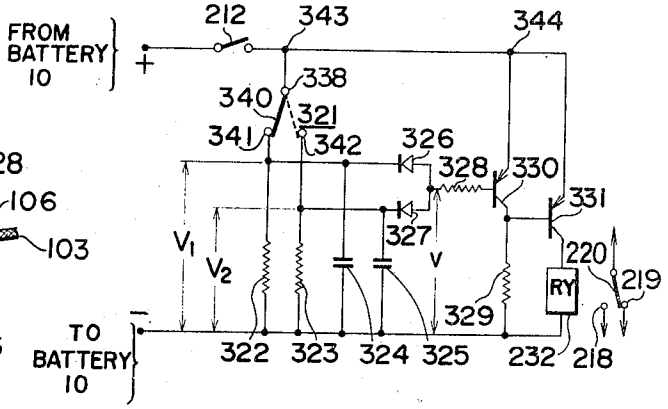


Fig. 7



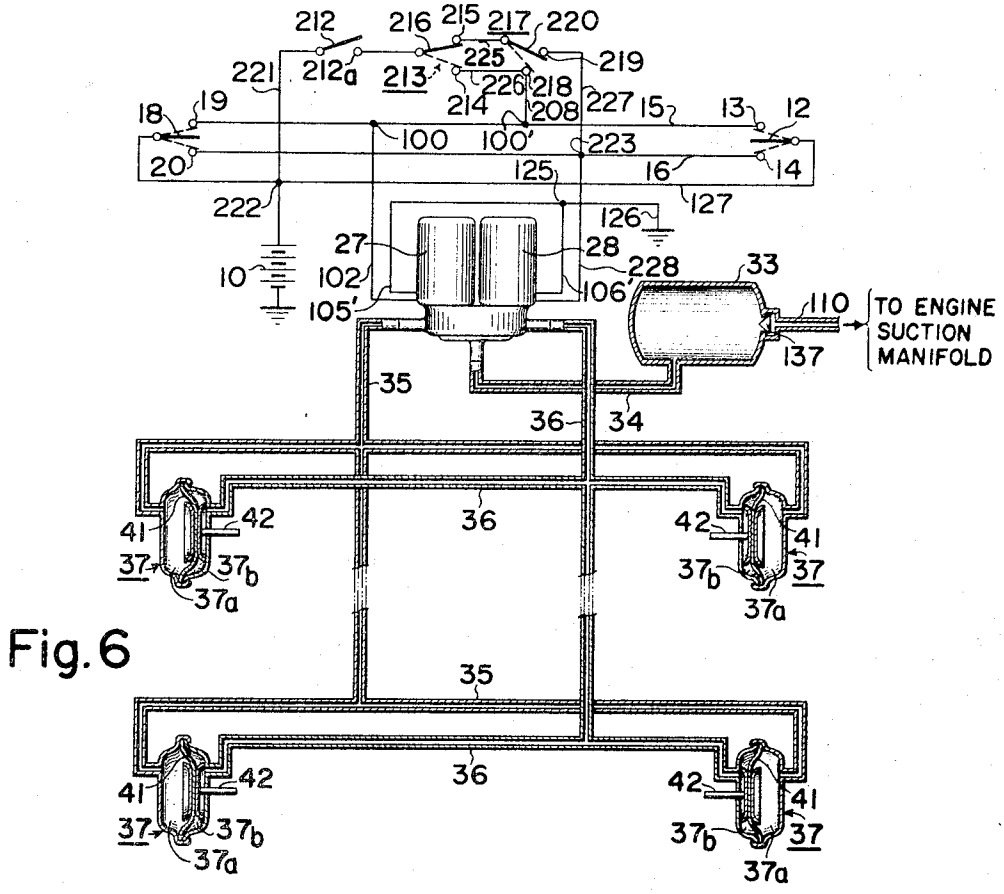


Fig. 6

Fig. 5

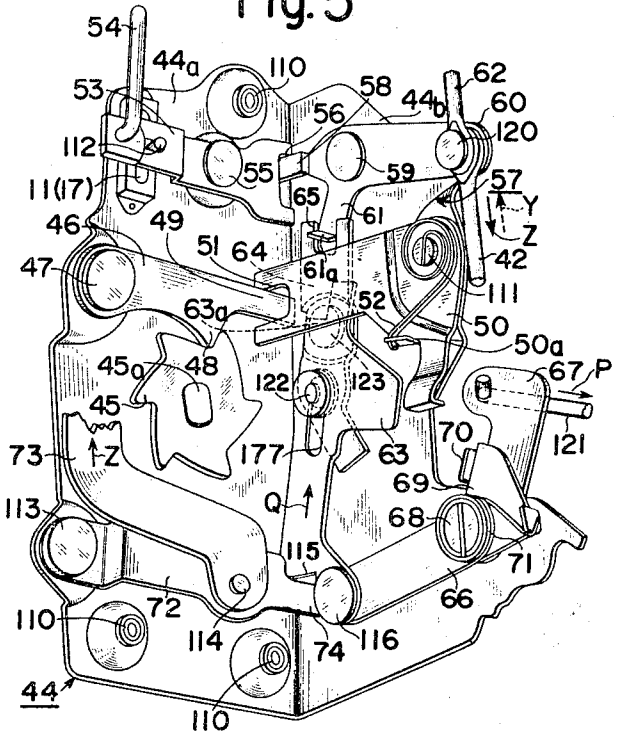


Fig. 8

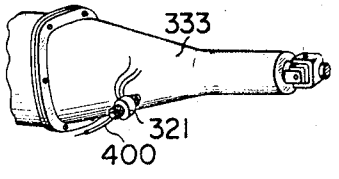
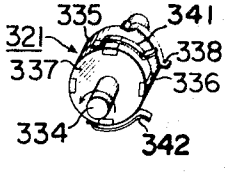


Fig. 9



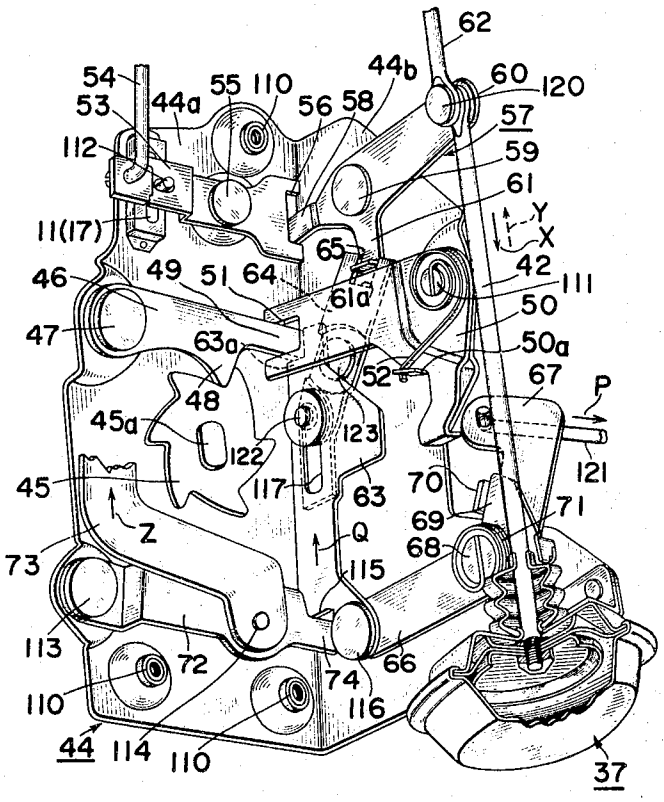


Fig. 3

Fig. 10

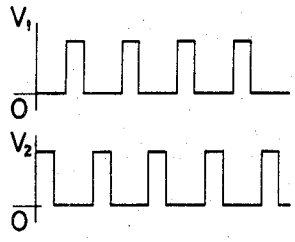


Fig. 11

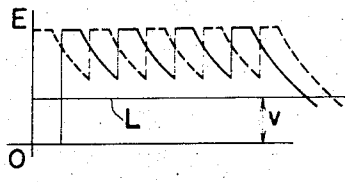


Fig. 4

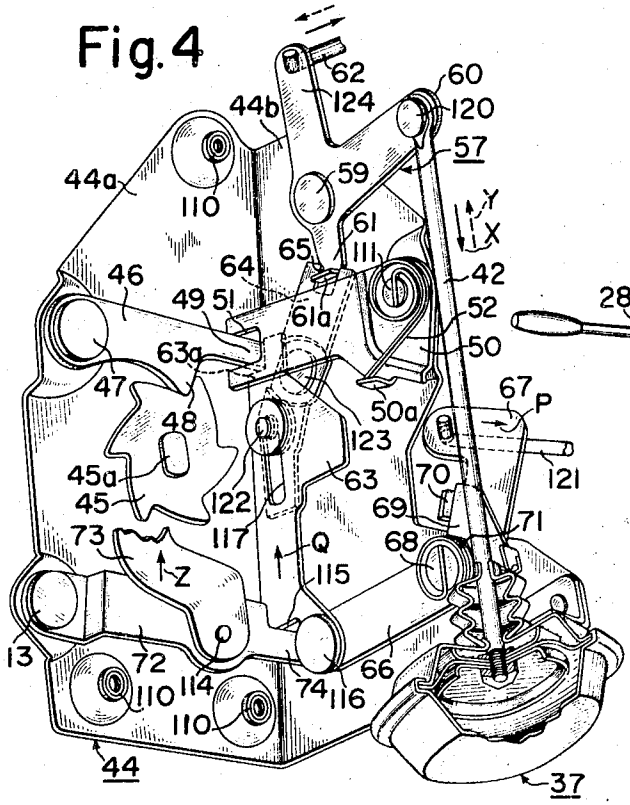


Fig. 12

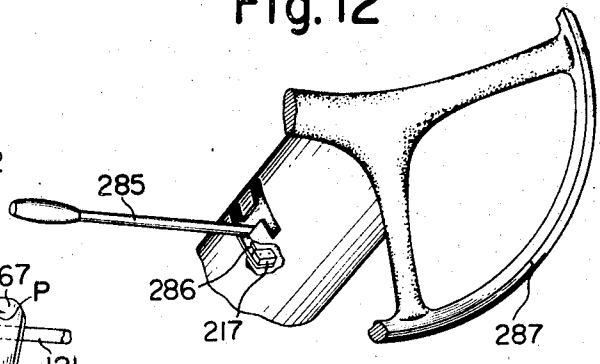
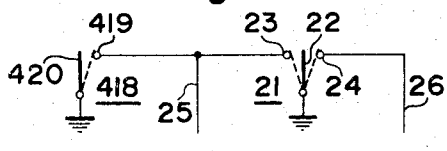


Fig. 13



VEHICLE DOOR LOCK ARRANGEMENT

This invention relates to improvements in or relating to door lock arrangements utilizing pneumatic pressure as the necessary power for locking and unlocking operation of the same.

Such accident may be feared in the use of conventional automotive door lock mechanisms that a passenger should unintentionally touch the inside door handle and turn it in the door-opening direction, resulting in a sudden opening of the door, while the vehicle is running, and the passenger may be thrown out from the vehicle on the road. It is further a strong demand among car utilizers to prevent an invasion of unauthorized person from outside into the vehicle when it is parked. With most of conventional manually operated door lock mechanisms, the door lock operation must be separately carried out for each of the vehicle doors which means a highly troublesome job for the vehicle driver who may thus neglect carelessly the door-locking operation as a duty to him. If such a failure should happen to take place, said kind of accident may naturally be feared.

For obviating the aforementioned conventional drawbacks, it has been already proposed to perform a centralized control of door lock operation for all the vehicle doors by manipulating a manual key adapted for cooperation of each of conventional keyholes formed in the driver's and assistant's doors. In one type of this centralized control system, there are provided vacuum cylinders, each having a spring-urged diaphragm so as to divide the cylinder into two, only one of which is pneumatically connected with a convenient vacuum pressure source such as the suction manifold of the vehicle drive engine. Therefore, the door lock operation can be performed pneumatically and from a certain selected centralized position.

The main object of the present invention is to provide a combined electrical and pneumatic door lock arrangement, capable of performing either the door lock operation and the door unlock operation as desired from selected one of plural operating stations.

A further object of the invention is to provide a door lock arrangement of the above kind, capable of easily converting into a full automatic arrangement which is operatively connected with a conventional automotive speed control means such as a shift lever.

These and further objects, features and advantages of the invention will become more clear as the description proceeds by reference to the accompanying drawings which constitute part of the present specification and illustrate several preferred embodiments of the invention. It should be however stressly understood that these embodiments are given only for illustrating purposes and various and different modifications will easily occur to those skilled in the art upon read through the present specification. Thus, these modifications should fall within the scope of the present invention so far as they are included in the true and correct meaning of the appended claims.

It should be further noted that respective same reference numerals are used for same or similar constituents throughout several figures of the drawings irrespective of minor difference in their physical configuration so far as they perform similar functions, only for the purpose of avoiding superfluous complexity and assisting a better understanding of the invention and for easy comparison of several embodiments of the invention shown in the drawings with each other.

IN THE DRAWINGS

FIG. 1 shows a schematic connection diagram of the combined electrical and pneumatic circuit system employed in the first embodiment of the invention, wherein however several constituents are shown in section.

FIG. 2 is a partially sectional and detailed elevational view of an electromagnetically operated valve assembly shown in FIG. 1 and adapted for on-off control of pneumatic circuits leading from a vacuum source to respective vacuum cylinders mounted in vehicle doors.

FIG. 3 is a perspective and partially broken away view of one of the door lock mechanisms per se which is mounted in either the driver's door or the assistant's door.

FIG. 4 is a similar view to FIG. 3, illustrating a door lock mechanism per se which is fitted in any one of passenger's doors.

FIG. 5 is a similar view to FIG. 3 wherein all the constituents are positioned in their door-locking position.

FIG. 6 is a similar view to FIG. 1, showing the combined electrical and pneumatic circuit employed in the second embodiment of the invention.

FIG. 7 is a wiring connection of an automatic switch arrangement employed in the second embodiment and adapted for sensing the running and stopped condition of the automotive vehicle.

FIG. 8 is a perspective view of a pulse switch shown in FIG. 7, yet being illustrated as mounted on the housing of a conventional automotive transmission mechanism.

FIG. 9 is an enlarged and perspective detail view of the pulse switch shown in FIGS. 7 and 8.

FIGS. 10 and 11 are explanatory drawings for the illustration of the characteristic performance of the pulse switch.

FIG. 12 is a perspective view of an automatic switch means which is operatively connected with a conventional shift lever of the automotive vehicle.

FIG. 13 is a part of the electrical circuit shown in FIG. 1, yet modified for the adaption thereof to the third embodiment of the invention.

Now referring to the accompanying drawings, several preferred embodiments of the present invention will be described in detail.

In FIGS. 1–5, the first embodiment is shown, of which FIG. 1 illustrates a combined electric and pneumatic circuit employed therein.

In FIG. 1, numeral 10 represents a conventional automotive storage battery fitted on an automotive vehicle, not shown, which is fitted in turn with the door lock arrangement according to this invention. Numeral 11 denotes generally a conventional outside key switch which is fitted on the driver's vehicle door, not shown, said switch comprising a movable contact 12 and a pair of stationary contacts 13 and 14 and constituting a normally open switch as shown. The movable contact 12 is earthed as shown, while stationary contacts 13 and 14 are connected through respective conductors 15 and 16 to stationary contacts 19 and 20, respectively, the latter contacts constituting part of a further switch unit, generally shown at 17, which has equally a movable contact 18 and constitutes again a normally open switch as shown. This switch unit 17 is fitted on a assistant's vehicle door, although not shown. Conductor 15 constitutes main lead of a door lock circuit, while conductor 16 constitutes main lead of a door unlock circuit, as will become more clear as the description proceeds.

There is provided a further switch unit, generally shown at 21 which is mounted on either a conventional automotive instrument panel, not shown, or on the conventional arm rest of the driver's door, although not shown. This switch unit 21 comprises a movable contact 22 and a pair of stationary contacts 23 and 24 and constitutes a normally open switch as shown. This switch acts as a control means for establishing from inside of the vehicle a locked or unlocked condition of the door lock mechanisms for the vehicle doors at the vehicle driver's will, as will be described more in detail hereinafter. The movable contact 22 is earthed as shown, while the stationary contacts 23 and 24 are connected to junction points 100 and 101 through respective conductors 25 and 26, respectively, said junctions 100 and 101 being provided on the door lock circuit conductor 15 and door unlock circuit conductor 16, respectively.

Door lock solenoid assembly 27 and door unlock solenoid assembly 28 are provided, the former solenoid 27 being connected through a conductor 102 to junction 100 and, in the similar manner, door unlock solenoid 28 is connected through a conductor 103 to said junction 101.

Solenoid assemblies 27 and 28 are adapted for being fed with current from accumulator 10 through a common lead 104 and respective branch leads 105 and 106.

As seen from FIG. 2, solenoid assembly 27 comprises an actuating coil 29, a stationary magnet core 107 and a movable plunger 30 cooperating therewith. The plunger 30 is connected rigidly with a valve member 31 through a stem 108, said valve closing normally a valve seat at 109 under the influence of an urging spring 32 when the solenoid coil 29 is not energized.

Negative air pressure reservoir 33 is connected through check valve means 137 and a connecting piping 110 to a conventional air intake manifold of the engine, not shown, of the automotive vehicle. On the other hand, said reservoir 33 is connected through a piping 34 to a door lock piping 35, said valve 31 and valve seat 109 being provided for on-off control of the pneumatic connection between both pipings 34 and 35, as will be most clearly understood by reference to FIG. 2.

Although not shown for avoidance of complexity of the drawing, another solenoid assembly 28 is designed and arranged substantially in the same manner with those of the solenoid assembly 27. In this case, however, the valve and valve seat similar to those shown at 31 and 109, respectively, are arranged for on-off control of the pneumatic communication between both pipings 34 and 36, the latter acting as a door unlock piping, as will be more fully described hereinafter.

Vacuum cylinders commonly denoted 37 for simplicity are provided on the driver's door, assistant's door and two left and right passenger's doors, respectively, although not specifically shown. These cylinders 37 are provided each with a diaphragm which is denoted with a common reference numeral 41 again for simplicity. The interior space of each of these vacuum cylinders is divided into two, as shown most clearly in FIG. 1. One of the thus divided interior spaces at 37*a* of all the vacuum cylinders is connected with said door lock piping 35, while the remaining one of said spaces at 37*b* of all the vacuum cylinders is connected with said door unlock piping 36. Diaphragms 41 are provided with respective actuator rods, these rods being denoted with a common reference numeral 42 only for simplicity.

Next, referring to FIGS. 3, 4 and 5, the door lock mechanisms proper will be described in detail.

In FIG. 3, door lock base 44 is formed substantially into an angular member, comprising two panel members 44*a* and 44*b* fabricated from a steel sheet stock and bent up perpendicularly to each other. Panel member 44*a* is fixedly attached to the driver's door or the assistant's door, as the case may be, by means of a plurality of fixing screw means commonly shown at 110. A rotatable ratchet wheel 45 is mounted on said panel member 44*a*, said wheel 45 having a shaft 45*a* which extends substantially perpendicular to the drawing paper and projects through the free end surface of the related vehicle door, the projecting shaft end carrying as conventionally a pinion adapted for mechanical engagement with a striker pin fixedly mounted on a door pillar, although not specifically shown by virtue of its popularity. The ratchet wheel 45 is normally prevented positively from its turning, indeed, by the engagement with a ratchet pawl 46 with its engageable tooth projection 48, as shown. The pawl 46 is pivotably mounted at 47 on the panel member 44*a* and formed with an extension arm 49 which is kept normally in engagement with the forked end at 51 of a ratchet pawl return lever 50.

Return spring 52 is provided for the return lever 50, one end of the spring abutting against a stop projection 50*a* formed integrally with the lever and the other end of said return spring being wound around the pivot 111 of the lever, so as to urge resiliently the latter to rotate in counterclockwise direction in FIG. 3 so that the ratchet pawl 46 is urged to rotate in the engaging direction with the ratchet wheel 45.

Numeral 53 denotes a conventional outside key lever which is linked with one end of a connecting rod 54, the latter serving as a motion-transmitting member for transmitting occasional door lock or door unlock motion from the side of the door key when the latter is intentionally operated by an authorized person such as the vehicle driver from outside of the vehicle. The lever 53 is operatively connected with outside door switch unit 11 or 17, as the case may be, through a pin-and-groove connection shown at 112.

Outside key lever 53 is formed with a forked end 56 and pivotably mounted at 55 on the panel element 44*a*, said forked lever end being operatively connected with an arm 58 of inside key lever 57 which is formed practically into a T-lever having further arms 60 and 61 and pivotably mounted at 59 on the second panel member 44*b*. Arm 60 is linked with one end of a connecting rod 62 at 120 which is operatively connected with a conventional locking button, not shown, by means of which an intentional door lock or unlock operation can be made from inside of the vehicle. As seen, vacuum cylinder rod 42 of the related vacuum cylinder 37 is linked at its one end by the pivot 120 with the same lever arm 60. Lever arm 61 is operatively connected at 61*a* with the forked end 65 of an intermediate lever 64, the latter serving for selective positioning of lock control lever 63 into its locking or lock-releasing position, as occasion may demand. This control lever 63 acts to transmit or interrupt the ready door-open movement transmitted from outside or inside of the vehicle to the ratchet pawl 46 and is connected linkedly at its lowermost end with inside lift lever 66 at 116. This lever 66 is pivotably mounted at 68 on the second panel element 44*b* and formed with an integral extension arm 69 which is kept in operative connection with a projection 70 formed integral with inside open lever 67, the latter being equally mounted pivotably at 68 on the second panel member 44*b*. A return spring 71 is coiled around the pivot pin 68 and the inside lift lever 66 is urged thereby resiliently to return to its normal position without being lifted. This inside lift lever 66 serves for transmitting the ready door-open movement which has been transmitted through connecting rod 121 from the related inside door handle, not shown, to the inside door open lever 67, further to the lock control lever 63.

Outside lift lever 72 is pivotably mounted on the first panel element 44*a* at 113 and outside handle link member 73, only partially shown, which is pivotably connected with its lowermost end at 114 with the lever 72 at its intermediate point between the both end extremities, said lever 73 being operatively connected with an outside door handle, not shown, for transmitting motion from the latter to ratchet pawl 46. The free end 74 of outside lift lever 72 is kept in operative engagement with a recess 115 formed on the lowermost end of lock control lever 63.

The lever 63 is formed with a longitudinal slot 117 at an intermediate place between its end extremities, said slot being slidably receiving a pin 122 which is studded on the intermediate lever 64 in proximity to the lower end thereof. The lever 64 is in turn pivotably mounted at 123 on the second panel member 44*b*. Lock control lever 63 is formed at its uppermost end with a recess or shoulder 63*a* for normally receiving the ratchet pawl end 49.

The operation of the door lock arrangement so far shown and described is as follows:

When an authorized person such as the vehicle driver desires to perform a door-lock operation from outside of the vehicle, he inserts driver's key, not shown, into a keyhole formed in the driver's or assistant's door, not shown, and turns manually it in the door-locking direction, thereby motion is transmitted through connecting rod 54 to outside key lever 53 for turning it in clockwise direction in FIG. 3. By this operation, movable contact 12 or 18, FIG. 1, as the case may be, is brought through tongue-and-groove connection 112 into contact with upper stationary contact 13 or 19. Thus, in the former case, current will be conveyed from the positive pole of battery 10, through conductors 104 and 105, door lock solenoid coil 29, conductor 102, junction 100, conductor 15, stationary contact 13 and movable contact 12 to earth, thence back to the negative pole of battery 10. In the latter case, current will be similarly conveyed from the positive pole of bat-

tery 10 through conductors 104 and 105, door lock solenoid coil 29, conductor 102, junction 100, conductor 15, stationary contact 19 and movable contact 18 to earth, thence to the negative pole of battery 10.

With energization of solenoid coil 29 in this way, electromagnetic plunger 30 is attracted against stationary magnetic core 107, thus the valve member 31 being caused to elevate in its position from contact with the mating valve seat 109 against the urging action of valve return spring 32. In this way, negative pneumatic pressure will be conveyed from vacuum reservoir 33 through connection piping 34, now opened valve passage at 109 and connecting piping 35 to the respective door-locking chambers 37*a* of all the vacuum cylinder assemblies 37, thereby the respective vacuum cylinder rods 42 being lowered from the position shown in FIGS. 3 and 4 downwards, as hinted by respective full lined arrows X. With the rod 42 thus lowered, inside key lever 57 is turned in clockwise direction about its pivot 59 in FIG. 3 and intermediate lever 64 is turned in counterclockwise direction about its pivot 123 by virtue of the operative connection of projection 61*a* with the forked upper end 65 of lever 64, resulting in the clockwise turning of lock control lever 63 about its pivoted lowermost end 116 and thus bringing the shouldered upper end 63*a* of the latter lever 63 into disengagement from contact with the extension 49 of ratchet pawl 46, as seen from FIG. 5 which illustrates this locked condition of the door lock mechanism.

Under these operative conditions, even when the outside handle link 73 is moved intentionally upwards as hinted by arrow Z by manipulating the related outside door handle, not shown, in the unlocking direction, thereby outside lift lever 72 being pivoted in counterclockwise direction about its pivot 113 and lock control lever 63 being lifted upwards as hinted by arrow Q thanks to the slidable engagement of slot 117 with guide pin 122, no motion can be transmitted to the ratchet pawl 46 which is thus kept in its engaging position with ratchet wheel 45 for assuring the locked position of the mechanism.

Under the locked conditions shown in FIG. 5, even when the driver manipulates the related inside door handle, not shown, in the door lock releasing direction, so as to pull the connecting lever 121 in the right-hand direction in FIG. 5 for moving the inside open lever 67 substantially in the same direction as hinted by arrow P, no motion will be transmitted to the ratchet pawl 46 as in the foregoing case. More specifically, with the inside open lever thus moved, inside lift lever 66 is turned in clockwise direction in FIG. 5 about its pivot 68, thereby lock control lever 63 being lifted again upwards thanks to the pivoted connection at 116. Since in this case, the pawl end 49 is kept in disengagement with the upper shouldered end 63*a* of control lever 63, any motion can be transmitted again from the latter to ratchet pawl 46. Therefore, also in this case, the pawl 46 is kept in positive engagement with ratchet wheel 45 and thus the mechanism is kept in its door-locking position, even though the inside open lever should have been operated in the aforementioned way.

When it is desired to unlock the mechanism from outside of the vehicle, the driver or the like authorized person inserts his key into the door keyhole and turn it in the door unlocking direction. By this operation, motion is transmitted through connecting rod 54 to outside key lever 53 to turn it in counterclockwise direction in FIG. 5 about its pivot 55 so that movable contact 12 or 18 is brought into contact with respective lower contact 14 or 20 thanks to the provision of the pin-and-groove connection at 112. Thus, current is now conveyed from the positive pole of battery 10 through conductors 104 and 106, door unlock solenoid 18, conductors 103 and 16, stationary contact 14 or 20 and movable contact 12 or 18 to earth, thence back to the negative pole of the battery 10. Thus, a solenoid coil similar to 29 is energized and a plunger with its valve member, being similar to those denoted 30 and 31, respectively, are raised in their position. In this way, negative pneumatic pressure will be conveyed from reservoir 33 through connecting piping 34, the now opened valve opening similar to that denoted 109 and piping 36 to the door unlocking chamber 37*b* of each of all the vacuum cylinders 37. Thus, all the vacuum cylinder rods 42 are lowered as shown by dotted line arrows Y in FIGS. 3 and 4, thus lock control lever 63 being moved from the position shown in FIG. 5 to that shown in FIG. 3 or 4 and the upper shouldered end 63*a* of lever 63 being brought into operative engagement with the extension 49 of ratchet pawl 46. Under these operative conditions, when inside open lever 67 or outside handle link 73 is actuated as before, so as to lift lock control lever 63 from the position shown in FIG. 3 or 4, the ratchet pawl 46 is turned in counterclockwise direction in FIG. 3 or 4, respectively and therefore the ratchet wheel 45 is brought into its disengaged or unlocked position. Thus, any door opening operation will become effective under these unlocked conditions of the mechanism shown in FIG. 3 or 4.

When the driver or the like authorized person wishes to bring about the door-locking conditions from inside of the vehicle, he must manually operate movable contact 22 of switch unit 21 so as to engage the contact with left-hand stationary contact 23 in FIG. 1, thus current being conveyed from battery 10 through 104; 105; 29; 102; 100; 25; 23 and 22 to earth, thence back to the battery 10. By the energization of door lock solenoid coil 29, all the vacuum cylinders 37 are caused to operate in the door-locking direction, and all the door locks shown in FIGS. 3 and 4 are brought into their locked conditions as before.

On the other hand, when the driver or the like person wishes to bring about the door-unlocking conditions of the lock mechanisms, he must manipulate the movable contact 22 so as to bring it into cooperation with the right-hand stationary contact 24. Thus, current will now flow from the positive pole of battery 10 through 104; 106; 28; 103; 101; 26; 24 and 22 to earth, thence back to the negative pole of battery 10. By the energization of door unlock solenoid 28, all the vacuum cylinders 37 are caused to operate in the reversed or door-unlocking sense, thus the mechanisms shown in FIGS. 3 and 4 are brought into their door-unlocking conditions as before.

In FIG. 4, the door lock mechanism per se adapted for being fitted to the passenger's door is shown, wherein however same or similar constituents are denoted with respective same reference numerals employed in FIGS. 3 and 5. The main difference of the present mechanism from that shown in FIGS. 3 and 5 resides in the deletion of several members such as 11 or 17, 53, 54, 56, 58, 110 and 112. In addition, inside lever 57 has been somewhat modified as shown for meeting with the deletion of the lever arm 58. Connecting rod 62 has been linked to the lever 57 at its newly provided arm 124 in place of the lever arm 60, this modification having however practically no influence upon the cooperation with the connecting rod 62.

Therefore, the construction and operation of the mechanism shown in FIG. 4 can easily be understood by reference to the attached reference numerals in consideration of the foregoing description of the door lock mechanism shown in FIGS. 3 and 5. It will be easily thought out from the foregoing that the aforementioned negative or vacuum pressure can be replaced by a positive or compressed air pressure, although not shown. In this modified arrangement, however, the door-locking operation is brought about in the reversed sense and vice versa.

FIG. 6 shows a combined electric and pneumatic circuit arrangement modified from that shown in FIG. 1 so as to be adapted for cooperation with the second embodiment of the invention.

In the circuit arrangement shown in FIG. 6, movable contacts 12 and 18 are permanently connected with each other by means of a connecting conductor 127 having junction point 222, in place of being earthed as adopted in the foregoing embodiment.

Normally open-type ignition switch 212 has a stationary contact 212*a* which is connected through conductor 224 of a movable contact 216 of a manual switch unit 213 which is

practically an inside door locking and unlocking control switch having a pair of stationary contacts 214 and 215. Contact 215 is connected through conductor 225 to movable contact 220 of an automatic switch 217, said contact 220 being kept normally in contact with stationary contact 219, while stationary contact 214 is connected through conductor 226 to stationary contact 218. Contacts 218, 219 and 220 constitute in combination said automatic switch 217 as shown.

Stationary contact 218 is connected through lead 208 to junction point 100', while stationary contact 219 is connected through lead 227 to junction point 223 on the lead 16. Junction 223 is connected through lead 228 to one end of solenoid 28, while another end of the latter is connected through lead 106' to junction point 125. On the lead 15, there are provided junctions 100 and 100', the latter having been described above, while the former junction 100 being connected through lead 102 to one end of solenoid 27, the opposite end of the latter being connecting through lead 126 to earth. This lead 126 carries said junction 125 which is connected through lead 105' to solenoid 27. The solenoids 27 and 28 may be constructed as shown and described hereinbefore by reference to FIG. 2. Movable contact 212 is connected through lead 221 and junction 222 to the positive side of battery 10, while the negative pole thereof is earthed.

Other constituents denoted with same respective reference numerals are similar to those employed in the foregoing first embodiment.

The mechanical door lock mechanisms may be similar to those shown in FIGS. 3 and 4 of the foregoing first embodiment.

As shown in FIG. 6, the automatic switch 217 is provided in the circuit for the inside door lock and unlock control switch 213. The place of provision of movable contact 220 of switch 217 may be preferably formed into the relay contact of a relay 232 employed in the automatic sensor shown in FIG. 7 which sensor is designed and arranged to sense automatically the stopped condition of the automotive vehicle, as will be more fully described hereinafter.

Or alternatively, the automatic switch 217 may be provided so as to cooperate with a conventional automotive shift lever 285 as shown in FIG. 12, as will be more fully described hereinafter.

Next, referring to FIG. 7, numeral 321 represents a pulse switch, while 322 and 323 represent resistors and 324 and 325 denote condensers, these circuit elements are electrically connected with each other as shown. Diodes 326 and 327, resistors 328 and 329, transistors 330 and 331 and relay 232 are provided in the circuit and connected with each other as shown.

Pulse switch 321 may be fitted to the attaching point of speed meter cable 400 of a conventional automotive transmission mechanism 333 as shown in FIG. 8. The detail arrangement of said switch 321 is shown in FIG. 9.

Referring to FIG. 9, shaft 334 coupled with said cable 400 is arranged to rotate when the transmission mechanism 333 is kept in motion. A rotor 337 is fixedly mounted on the shaft 334, substantial part of said rotor 337 being made of an insulating material except ring part 335 and contacting segments 336 which are made of suitable conducting material and electrically connected therewith. Although not shown, said ring 335 is connected with a certain power source, and the conductive segments 336 constitute in combination a kind of pulse-generating part. Practically, said ring 335 is connected through a conducting stationary brush 338 to said current source, not shown. There are provided further two brushes 341 and 342 which are mounted so that they are alternately brought into contact with one of said segments 336 when the rotor 337 is kept in rotational movement.

As easily supposed from FIG. 12, the shift lever 285 is arranged to operate at forward three stages and rear one stage of speed change. The switch 217 is mounted in close proximity to the highest speed change position of said shift lever 285. Thus, when the shift lever is manipulated to the highest speed position, the actuating pin 286 of switch 217 is actuated upon to the pushed in and the switch is turned on. Numeral 287 denotes the conventional steering handle which is however only partially shown.

When it is desired to bring the door lock mechanisms similar to those shown in FIGS. 3 and 4 into locked position from outside of the vehicle, the driver or the like person manipulates the movable contact 12 or 18 so as to bring it into contact with upper stationary contact 13 or 19 by outside door key operation as before.

Current will flow from the positive pole of battery 10 through 222; 223; 127; 12 (or 18); 13 (or 19); 15; 100; 102; 27; 105'; 125 and 126 to earth, thence back to the negative pole of battery 10. By energization of door lock solenoid 27, negative pneumatic pressure will be conveyed to door-locking chambers 37*a* of all the vacuum cylinders 37, thus the door mechanisms similar to those shown in FIGS. 3 and 4 are brought into their locked position as before for preventing unintentional opening of all of the vehicle doors.

On the contrary, when it is desired to bring the door lock mechanisms from outside of the vehicle into their unlocked position for making all the vehicle doors ready for intentional opening, the driver or the like authorized person will bring movable contact 12 or 18 into contact with respective lower stationary contact 14 or 20 by outside key operation as before. Then, current will flow from the positive pole of battery 10 through 222; 127; 12 (or 18); 14 (or 20); 223; 228; 28; 106; 125 and 126 to earth, thence back to the negative pole of battery 10.

Therefore, negative pneumatic pressure is conveyed from reservoir 33 to respective door unlock chambers 37*b* of all the vacuum cylinders 37 as before. Thus, the door lock mechanisms are brought into their unlocked position so that all the vehicle doors will become ready for intentional opening.

When it is desired to lock the door lock mechanisms from inside of the vehicle, the driver or the like person must close manually the switch 212 in the form of a conventional ignition key switch so as to cooperate with its mating stationary contact 212*a* and then operates movable contact 216 of switch unit 213 to its dotted line position in FIG. 6 so as to cooperate with the lower stationary contact 214. Thus, current will flow from the positive pole of battery 10 through junction 222, lead 221, movable contact 212, stationary contact 212*a*, movable contact 216, stationary contact 214, lead 226, stationary contact 218, lead 208, junction 100', lead 15, junction 100, lead 102, door lock solenoid 27, lead 105', junction 125 and lead 126 to earth, thence back to the negative pole of battery 10. With energization of door lock solenoid 27, all the door lock mechanisms are brought into their locked condition as before.

When it is desired to unlock the door lock mechanisms from inside of the vehicle, the driver or the like person must manipulate movable contact 216 of switch unit 213 from its dotted line position to its full line position shown in FIG. 6, so as to bring the movable contact into contact with upper stationary contact 215. Current will then flow from the positive pole of battery 10 through 222; 221; 212; 212*a*; 216; 215; 225; 220; 219; 227; 223; 228; 28; 106; 125 and 126 to earth, thence back to the negative side of battery 10. With energization of door unlock solenoid 28, all the door lock mechanisms are brought into their unlocking position ready for intentional opening of all the vehicle door as before.

With the present embodiment, it is also possible to control automatically the door lock and unlock operations depending upon the running or stopped conditions of the automotive vehicle. More specifically, the door lock mechanisms for all the vehicle doors are automatically brought into their locked conditions when the vehicle runs, while they are unlocked automatically when the vehicle stops to run. For this purpose, the vehicle stop sensing arrangement shown in FIG. 7 is employed.

When the vehicle is kept in its stopped conditions, movable contact 340 of pulse switch 321 is made contact with either

stationary contact **341** or **342** leading to resistors **322** or **323**, respectively. Thus, current will flow from the positive pole of battery **10** through **222**; **221**; **212**; **343**; **344**; emitter-base passage of transistor **330**; **328**; **327** (or **326**) and **323** (or **322**) to the negative pole of battery **10**, with transistor **330** being conductive by virtue of current flow through resistor **329** which is permanently connected to the collector electrode of transistor **330**. Since another transistor **331** is designed and arranged to become conductive when the first transistor **330** is interrupted (and vice versa), transistor **331** is not conductive at the present moment and thus relay **232** is not energized.

Under these conditions, when the vehicle starts to run, the transmission mechanism **333** operates and flexible shaft **440** operatively connected with the conventional inner working components, not shown, of the transmission will also rotate, thereby pulse switch **321** being brought into actuation. As briefly described hereinbefore, pulse switch **321** is designed and arranged as a rotary switch as shown in FIG. **9** and operates with its movable contact **340**, FIG. **7**, to alternatingly and reciprocatingly make with stationary contacts **341** and **342** for making resistors **322** and **323** alternatively conductive, thereby two mutually phase-shifted voltage pulse wave series are generated at the respective resistors **322** and **323**, as shown at V_1 and V_2 in FIG. **10**, resulting in the generation of two series pulsative voltages at respective condensers **324** and **325**, as shown at E in FIG. **11**. These pulsative voltages are applied as reversed voltage to the base electrode of transistor **330**. In this case, transistor **330** becomes conductive while transistor **331** becomes nonconductive, thereby relay **232** being energized and its relay contact **220** being transferred from stationary contact **219** to **218** which is connected with door lock circuit conductor **15** through lead **208** and junction **100'**.

Current will now flow from the positive pole of battery **10** through **222**; **221**; **212**; **212***a*; **216**; **215**; **220**; **218**; **208**; **100'**; **15**; **100**; **102**; **27**; **105'**; **125** and **126** to earth, thence back to the negative pole of battery **10**. Thus, all the door lock mechanisms are brought into their locked position for the effective prevention of any door opening during the running of the vehicle.

When the vehicle is stopped, the contact-transfer operation provided by pulse switch **321** is stopped automatically and the charges of respective condensers **324** and **325** are discharged and the reverse voltage applied to the base electrode of transistor **330** will drop. In this case, even when movable contact **340** of pulse switch **321** should be brought to its neutral position or into contact with either stationary contact **341** or **342**, the condenser charge at either **324** or **325** will drop, thus the reverse voltage applied to the base electrode of transistor **330** becoming reduced, which brings transistor **330** into conductive, while transistor **331** becomes nonconductive or off. It will be understood from the foregoing that when the vehicle stops the stopping will be positively and instantly sensed, irrespective of any occasional position of the movable contact of pulse switch **321**. With the transistor **331** thus turned off, the relay contact **220** of relay **232** will be transferred from engagement with stationary contact **218** back to that denoted **219**. This means that the movable contact **220** is transferred from the connection with door lock circuit conductor **15** to the connection with door unlock circuit conductor **16**. Thus, the unlock solenoid **28** is energized and all the door lock cylinders **37** are pneumatically brought into their unlocking position, as will be well understood from the foregoing.

It should be mentioned that even when manual unlocking effort is impressed upon any conventional door lock button, not shown, fitted to every vehicle door, an opening thereof can not be brought about, if the aforementioned automatic door lock arrangement has been brought into operation. For this purpose, the pneumatic effort provided by each of the vacuum cylinders adapted for pulling each actuating rod **42** in the downward direction shown by arrow Z is selected to be substantially larger than the normal manual effort transmitted to the rod from the side of the door locking pushbutton.

Therefore, it is absolutely and automatically assured that an opening of every vehicle door is not opened during running of the vehicle, which provides naturally a substantial convenience to car utilizers.

As preferable design figures to be adopted in the second embodiment, the following data may be adopted.

FIG. 7

resistor 329	3 kilohms
resistor 328	150 kilohms
resistor 323	10 kilohms
resistor 322	10 kilohms
condenser 324	50 mf.
condenser 325	50 mf.
voltage V_1	6–12 volts
voltage V_2	6–12 volts
voltage v	6–12 volts

FIG. 10

V_1	12 volts
V_2	12 volts

FIG. 11

E	12 volts

In the second embodiment, negative pneumatic pressure may be replaced by positive pneumatic pressure by employing slight modification of related parts.

In the third embodiment of the present invention, an automatic switch unit **418** comprising movable contact **420** and stationary contact **419** is added to the electrical circuit to the combined electrical and pneumatic circuit shown in FIG. **1** of the first embodiment. This automatic switch **418** has been designed to precisely corresponding to that **217** in FIG. **12** and arranged to be controlled by a shift lever **285** as before. Mechanical door lock mechanisms for every door are similar to those shown and described in FIGS. **3**, **4** and **5**.

Therefore, it can be well seen that automatic door locking and unlocking operations can be realized as before, in addition to the manual centralized operations, without further detailed analysis of the present embodiment.

The above described specific embodiments of the invention is capable of modification without departing from the scope thereof as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are as follows:

1. A door lock arrangement comprising:

a. a plurality of door lock mechanisms for automotive vehicle doors, each of said mechanisms being mounted on each of said vehicle doors and comprising a mechanical latching means and a pneumatically operated actuating cylinder connected to a common pneumatic pressure source, said pneumatically operated actuating cylinder including two cylinder spaces divided into a door locking chamber and a door unlocking chamber by a diaphragm piston, said mechanical latching means including a door lock base, a latch member rotatably mounted on said door lock base, a pawl pivotally mounted on said door lock base for engagement with said latch member to prevent the rotation thereof, an inside door latch actuating lever, an outside door latch actuating lever, a lock control lever operatively connected to said pneumatically operated actuating cylinder and said inside and outside door actuating levers and engageable with said pawl, said lock control lever being disengaged from said pawl and uncoupling both of said inside and outside door actuating levers from said pawl when said lock control lever is shifted to its door locking position by said pneumatically operated actuating cylinder;

b. a changeover means in the form of an electromagnetic valve means provided in a pneumatic circuit leading from said pneumatic pressure source and for selective supply and interruption of the supply of said pneumatic pressure to said locking or unlocking chamber of the cylinder;

c. electric switch means for controlling said changeover means and electrically connected thereto; and

d. an air pressure reservoir provided in said pneumatic circuit and between said pneumatic pressure source and said changeover means, said air pressure reservoir including a check valve.

2. Door lock arrangement as set forth in claim 5, wherein one of said electric switch means comprises an automatic switch which is operated by a sensing means which discriminatingly senses the running and the stopped conditions of the vehicle.

3. A door lock arrangement as set forth in claim 1, wherein said latch member comprises a ratchet wheel.

4. A door lock arrangement as set forth in claim 1, wherein said pneumatically operated actuating cylinder is operatively connected with a pivoted inside locking lever of said mechanical latching means, said inside locking lever being adapted for engagement with an intermediate lever so as to rotate in a predetermined direction to cause said lock control lever to be selectively positioned in its pawl engaging or pawl disengaging position.

5. A door lock arrangement as set forth in claim 4, wherein said intermediate lever is provided with a guide pin secured thereto, said guide pin being slidably received in a longitudinal slot formed in said lock control lever.

6. A door lock arrangement as set forth in claim 1, wherein said lock control lever is mechanically connected with an inside locking button.

7. A door lock arrangement comprising, a plurality of door lock mechanisms for automotive vehicle doors, each of said mechanisms being mounted on each of said vehicle doors and comprising a mechanical latching means and a pneumatically operated actuating cylinder connected to a common pneumatic pressure source, said pneumatically operated actuating cylinder including two cylinder spaced divided into a door locking chamber and a door unlocking chamber by a diaphragm piston, a changeover means in the form of an electromagnetic valve means provided in a pneumatic circuit leading from said pneumatic pressure source and for selective supply and interruption of the supply of said pneumatic pressure to said locking or unlocking chamber of the cylinder, electric switch means for controlling said changeover means and electrically connected thereto, wherein one of said electric switch means comprises an automatic switch which is operated by a sensing means which discriminatingly senses the running and the stopped conditions of the vehicle, said automatic switch being controlled by a transmission shift lever and an air pressure reservoir provided in said pneumatic circuit and between said pneumatic pressure sources and said changeover means, said air pressure reservoir including a check valve.

8. A door lock arrangement comprising:

a. a plurality of door lock mechanisms for automotive vehicle doors, each of said mechanisms being mounted on each of said vehicle doors and comprising a mechanical latching means and a pneumatically operated actuating cylinder connected to a common pneumatic pressure source, said pneumatically operated actuating cylinder including two cylinder spaces divided into a door locking chamber and a door unlocking chamber by a diaphragm piston;

b. a changeover means in the form of an electromagnetic valve means provided in a pneumatic circuit leading from said pneumatic pressure source and for selective supply and interruption of the supply of said pneumatic pressure to said locking or unlocking chamber of the cylinder; and

c. electric switch means for controlling said changeover means and electrically connected there, one of said electric switch means being an automatic switch which is operated by a sensing means which senses discriminatingly the running and the stopped conditions of the vehicle, said sensing means comprising a pulse switch operatively connected electrically to transistor circuit means, whereby the door lock mechanisms are brought into the locking position when the vehicle is in the running condition and said mechanisms are brought into the unlocking position when the vehicle is in the stopped condition.

9. Door lock arrangement as set forth in claim 8, wherein said transistor circuit means are provided with one pair of transistors and arranged to each other in the mode of a flip-flop circuit.

10. Door lock arrangement as set forth in claim 9, wherein there is provided a relay operatively connected electrically to said transistor means and energized thereby to bring the door lock mechanisms into the locking or unlocking position.

11. Door lock arrangement as set forth in claim 8, wherein said automatic switch is controlled by a transmission shift lever.

12. Door lock arrangement as set forth in claim 8, wherein each of said pneumatic cylinders is adapted to influence a lock control lever which is arranged to engage with or disengage from a ratchet pawl cooperating with a ratchet wheel which constitutes, together with said pawl, a main latch of the mechanical door lock mechanism for each of the vehicle doors.

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