July 21, 1964 C. A. DETLOFF ETAL 3,141,517

VEHICLE VACUUM-PRESSURE DOOR LOCK SYSTEM

Original Filed Oct. 26, 1959 3 Sheets-Sheet 1

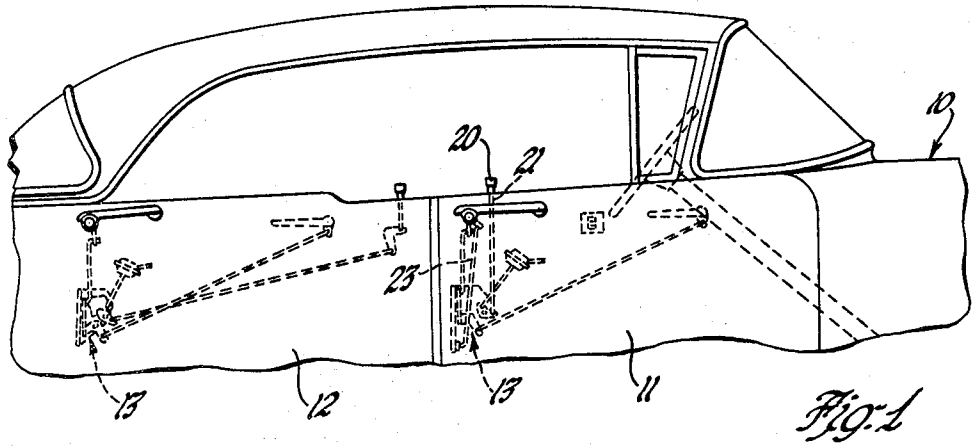


FIG. 1

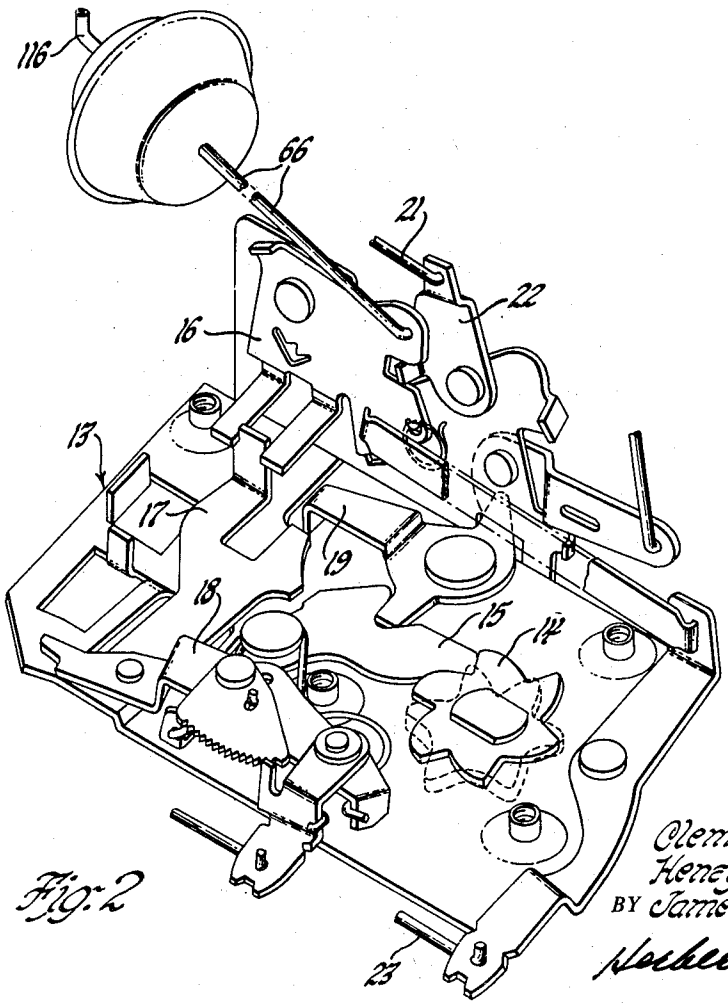


FIG. 2

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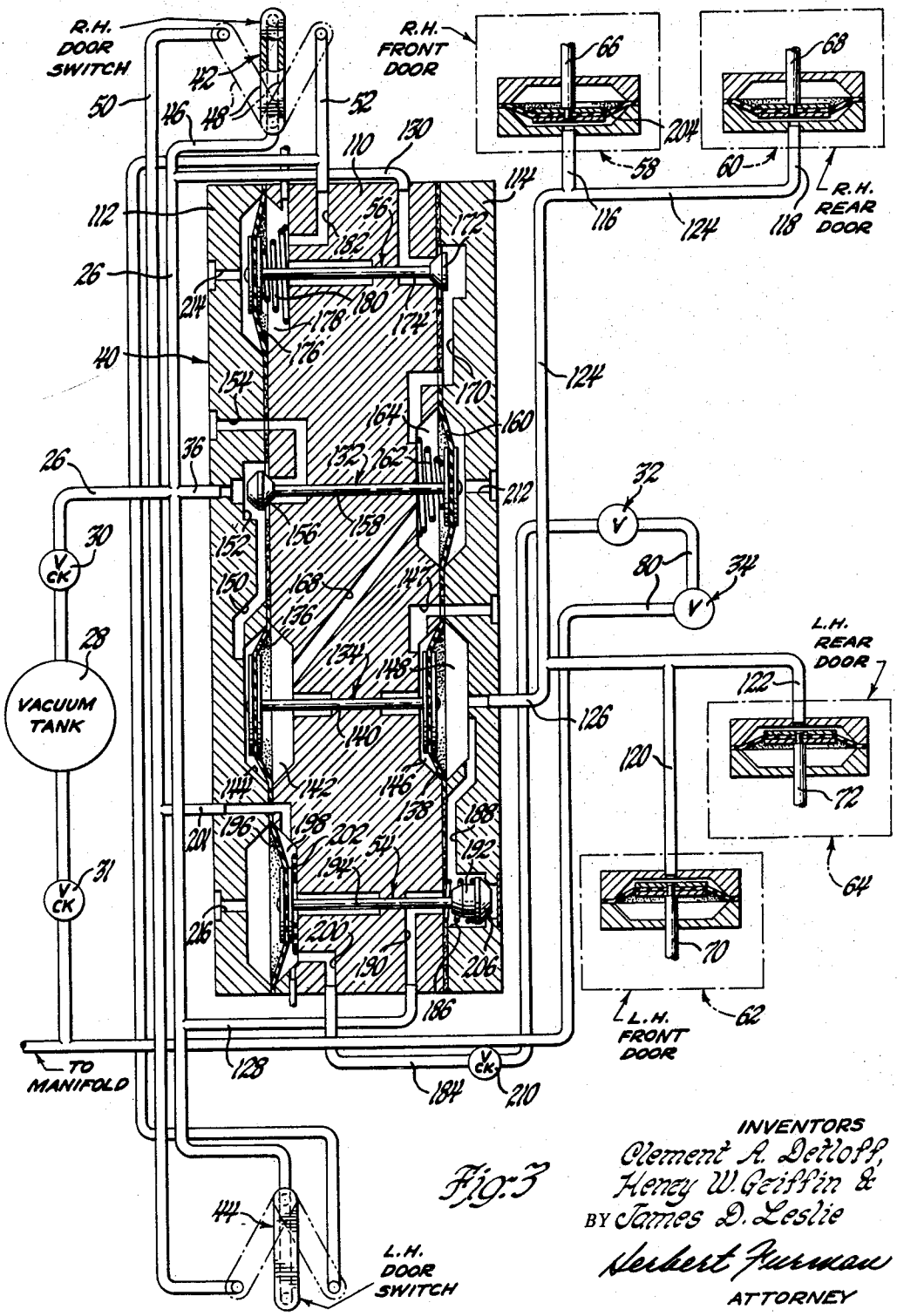


Fig. 3

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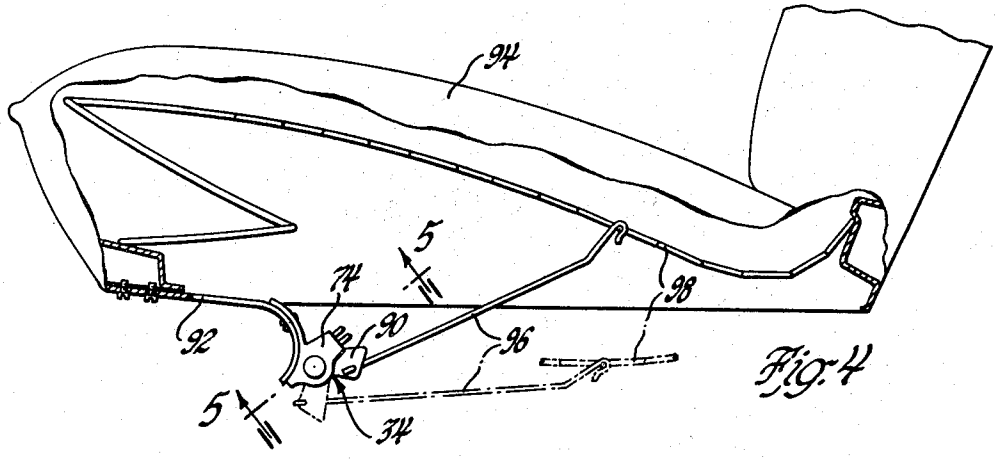


Fig. 4

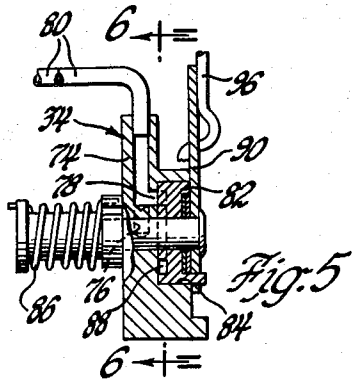


Fig. 5

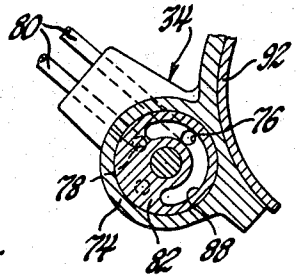


Fig. 6

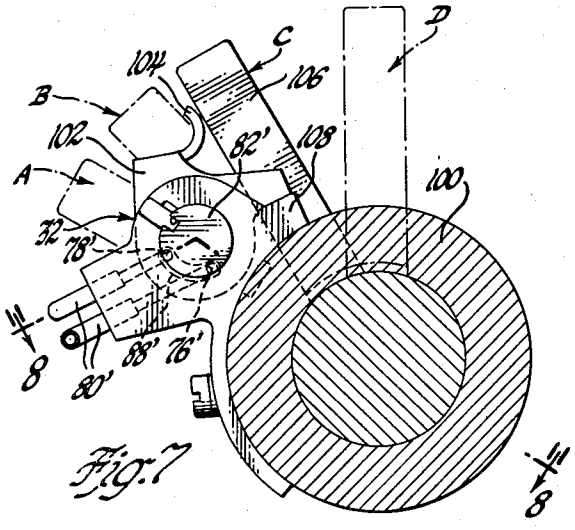


Fig. 7

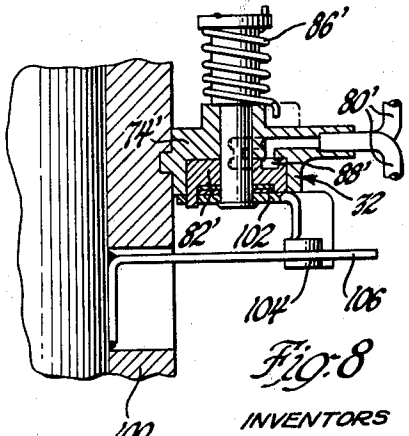


Fig. 8

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United States Patent Office 3,141,517 Patented July 21, 1964

3,141,517

VEHICLE VACUUM-PRESSURE DOOR LOCK SYSTEM

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Continuation of abandoned application Ser. No. 848,661, Oct. 26, 1959. This application Dec. 10, 1962, Ser. No. 243,408

11 Claims. (Cl. 180—82)

This invention relates to a door lock control system, and more particularly to a vacuum-pressure operated door lock control system for an automobile. This application is a continuation of applicants' copending abandoned application, Serial No. 848,661, filed October 26, 1959.

The present invention is an improvement over copending application Serial No. 764,662, Garvey et al., filed October 1, 1958, and now Patent No. 3,019,848. The present improvement resides in a unique control mechanism which permits the use of a single conduit communicating with each door lock servo mechanism for delivering either vacuum or pressure to the servo to lock or unlock the door locking mechanism.

In addition to simplifying the door latching servo mechanism, the present invention greatly reduces the number of conduits or hoses which must be mounted in the vehicle doors to actuate a door locking mechanism of this general type. The mounting of a multitude of actuating mechanisms in vehicle doors such as automatic window regulating mechanisms, automatic door locking mechanisms and frequently ventilating or air conditioning mechanisms has become aggravated to the point that a very serious door space availability problem is at hand. The present simplified door locking mechanism is not only more economical to manufacture but considerably alleviates the aforenoted door space problem.

In the present invention a conventional door latching mechanism is provided and includes a locking device operatively connected to a pressure responsive diaphragm. The diaphragm in turn is controlled by a unique valve-pump mechanism which, under locking conditions, supplies a vacuum force to actuate the diaphragm in one direction or which, under unlocking conditions, provides a superatmospheric pressure to move the diaphragm in the other direction. In either case, e.g., locking or unlocking, the vacuum force or positive pressure force is supplied through the same single conduit.

The details as well as other objects and advantages of the present invention will be apparent from a perusal of the detailed description which follows.

In the drawings:

FIGURE 1 is a fragmentary side elevational view of an automobile incorporating the improved door lock control system;

FIGURE 2 is an enlarged isometric view of one of the door latches removed from the door of the automobile shown in FIGURE 1;

FIGURE 3 is a diagrammatic representation of the subject door lock control system;

FIGURE 4 is a fragmentary view of the front seat of the vehicle of FIGURE 1 showing a portion of the door lock control means, the structure being shown in solid lines in its normal valve closed position and in broken lines in the valve open position;

FIGURE 5 is an enlarged view along line 5—5 of FIGURE 4;

FIGURE 6 is a view along line 6—6 of FIGURE 5;

FIGURE 7 is a section through the steering column of the automobile of FIGURE 1, the transmission selector lever being shown in a plurality of different positions; and

FIGURE 8 is a view along line 8—8 of FIGURE 7.

This invention provides a door lock control system adapted particularly for use in an automobile and operating from a source of vacuum which, directly or indirectly, provides the force through which the vehicle doors are locked and unlocked. In its preferred embodiment, the invention utilizes vacuum which may be readily drawn from the engine manifold. The system incorporates safety features in that when the engine is running, when the transmission selector lever is in a drive position, and when the driver's seat is occupied, vacuum is applied to fluid pressure control operating means connected to the locking member of each door latch so that all doors are automatically locked and are held locked against manual operation. There is also a manual control means available whenever the automatic locking means is inoperative preferably comprising two similar control devices, one accessible to the driver and the other accessible to the front seat passenger, for manually locking and unlocking the doors. This manual control means is not connected directly to the engine manifold but is connected to a storage source of vacuum so that it can be operated when the engine is not running.

Referring now more particularly to the drawings, an automobile designated generally at 10 has front and rear doors 11 and 12. Each door is equipped with a door latch designated generally as 13. While various known forms of door latch may be utilized with the invention, a suitable latch is shown in the patent to Priestman 2,832,626 entitled "Door Latch—Adjustable Linkage Mechanism for a Push Button." In the latch of the Priestman patent, which latch is illustrated in FIGURE 2, there is a rotary bolt and ratchet unit 14 which is held by a detent 15 against rotation in one direction. The bolt cooperates with a striker on the automobile body in a conventional manner to hold the door closed. In order to open the door, the detent is swung out of engagement with the bolt to permit free rotation of the bolt in a door opening direction. The latch carries a locking member 16 which is pivoted on the lock frame and is movable between locked and unlocked positions and which is connected to outside detent operating means including an intermittent link 17 and a push button operated lever 18. When in unlocked position, the intermittent link is coupled to the detent through a multiplier lever 19. When the locking member 16 is swung counterclockwise to locked position, the intermittent link is uncoupled from the multiplier lever 19 so that the outside push button, the lever 18 and the intermittent link 17 merely "free wheel" without moving the detent.

The locking member may be swung between its locked and unlocked positions by means of a conventional inside garnish molding button 20 which is connected to the locking member by means of a rod 21 and motion transfer lever 22, and (in the front door only) by means of an outside operated conventional key lock device 23.

For greater detail regarding the construction and operation of the latch 13, reference may be made to the aforenoted Priestman patent. The novel lock control system of the present invention includes a fluid pressure controlled operating device connected to the locking member 16 of each door latch 13 effectively in parallel with the garnish molding connection and with a key lock connection so that no modifications of a conventional door latch are necessary to adapt it for use with this lock control system.

FIGURE 3 shows diagrammatically the construction and arrangement of the novel lock control system. A conduit 26 connects with the automobile engine manifold in a well known manner so that whenever the automobile

engine is operating, a vacuum is drawn in this line. A vacuum storage tank 28 is connected through a check valve 30 to the conduit 26 to provide a source of vacuum which is available when the engine is not running. A check valve 31 is provided between the manifold and tank 28. The manifold conduit 26 incorporates in series therewith a normally closed shift valve designated generally as 32 (see FIGURES 7 and 8 for details) and a normally closed seat valve designated generally at 34 (see FIGURES 4–6 for details). Conduit 26 includes a branch connection 36 leading to a valve-pump device indicated generally at 40 (see FIGURE 3 for details).

In general parallel relationship with the elements described above and, together with these elements forming a fluid control circuit, are two manual selector devices designated respectively as 42 and 44. Selector device 42 is connected by a line 46 to the vacuum supply line 26. An adjustable connector member 48 communicates at its fixed end to vacuum supply conduit 46 and is adapted to connect at its free end with either conduits 50 or 52 to initiate locking or unlocking operation of mechanism 40. Locking and unlocking conduits 50 and 52 respectively connect with valve devices 54 and 56 which are part of the valve-pump mechanism 40 and the purpose of which will be considered subsequently in greater detail. Selector device 44 is merely a parallel connected duplicate of selector 42 and therefore further description thereof is unnecessary.

In each door there is a fluid pressure controlled operating device connected to the locking member of the door latch. The system illustrated here is adapted for use with a four-door automobile and the four operating devices are designated by the reference numerals 58, 60, 62 and 64, respectively. Each of these operating devices is similar to the other and each is connected to its respective operating member of the door latch by means of rods 66, 68, 70 and 72, respectively.

Before proceeding with a description of the operation of the door locking system, a brief explanation of the construction of the control valves and operating devices will be given. The seat valve 34, which is shown in FIGURES 4–6, has a valve body 74 with inlet and outlet ports 76 and 78 for connection to conduit 80 which leads from vacuum supply conduit 26. A sealing member 82 is seated for rotary movement in a recess 84 in the valve body and is biased by a torsion spring 86 toward an open position wherein an arcuate valve opening 88 in the sealing member connects the inlet and outlet ports 76 and 78. Rotation of the sealing member beyond open position is blocked by stop lugs on the sealing member and valve body. An operating lever 90 is connected to the sealing member 82. The seat valve 34 is mounted on the front seat frame 92 at the driver's side beneath the seat cushion 94 and the lever 90 is connected by a wire link 96 to the seat spring 98. With the seat in its normal unoccupied position, the valve is held closed by the seat spring 98. The weight of a seat occupant depresses the seat cushion 94 and the seat spring 98, swinging the connecting link 96 downwardly as shown in broken lines in FIGURE 4 so that the torsion spring 86 on the valve opens the valve.

The shift valve 32 is of the same internal construction as the seat valve 34 described above, and the same reference characters with the addition of a prime (') are used to indicate corresponding parts. The valve body 74' is mounted on the steering column 100 by an integral mounting extension. An actuating extension 102 projects from the sealing member 82' and is formed with a hooked shape pick-up 104 against which the transmission selector lever 106 of the automobile abuts. When the transmission selector lever is in park or neutral position (A or B in FIGURE 7), it holds the valve closed against the force of the torsion spring 86'. As the transmission selector lever is moved from park or neutral to drive position (C in FIGURE 7), the spring 86' causes the sealing member 82' to turn sufficiently that the arcuate valve opening 88' in the sealing member 82' provides communication between the inlet and outlet ports 76' and 78' in the valve body. Further rotation of the sealing member is prevented by the stop lug 108 so that if the transmission selector lever is moved into its low drive position (D in FIGURE 7), the valve stays open.

Reference is now made to valve-pump mechanism 40 shown in detail in FIGURE 3. Mechanism 40 includes a main body or casing 110 and cover casings 112 and 114. As already noted, only a single conduit 116, 118, 120 and 122 is utilized in supplying either vacuum or a positive pressure to each of the door locking devices 58, 60, 62 and 64. Inasmuch as each of these devices is identical the construction and operation of only one will be described. Conduit 116 is supplied from a common conduit 124 which in turn communicates through a connector passage 126 with mechanism 40. Vacuum from supply conduit 26 is supplied through connector passages 128 and 130 to valve devices 54 and 56 in mechanism 40. The same vacuum is also supplied through connector passage 36 to a third valve device 132. Mechanism 40 also includes a vacuum actuated pump device 134. Vacuum pump 134 includes a pair of spaced diaphragms 136 and 138 respectively peripherally clamped between casing 110 and cover casings 112 and 114 and interconnected by a central rod member 140. Diaphragm 136 coacts with casing 110 and cover casing 112 to respectively define chambers 142 and 144. Likewise diaphragm 138 coacts with casing 110 and cover casing 114 to define a pair of chambers 146 and 148. Diaphragm chamber 144 communicates through a passage 150 with a chamber 152 formed in valve device 132 while chamber 146 is atmospherically vented through passage 147. Valve chamber 152 communicates either with manifold vacuum through passage 36 or to atmosphere through an atmospheric vent passage 154, depending on the position of a movable valve member 156 which communicates through a rod 158 with a diaphragm 160 peripherally clamped between casing 110 and cover casing 114. A spring member 162 is disposed within a chamber 164 defined by casing 110 and diaphragm 160 and normally biases the diaphragm to the right permitting manifold vacuum to act on pump diaphragm 136 and thereby moving pump diaphragms 136 and 138 to the left as shown in FIGURE 3.

Chamber 164 of valve device 132 communicates through a passage 168 with pump diaphragm chamber 142 and also communicates through a passage 170 with valve device 56. Valve device 56 in turn is supplied with manifold vacuum from conduit 130. This source of manifold vacuum is normally blocked by a valve member 172 from entering passage 170. Valve member 172 is connected through a rod 174 with a diaphragm 176 peripherally clamped between casing 110 and cover casing 112. Diaphragm 176 defines a chamber 178 with casing 110 and includes a spring member 180 disposed therein normally biasing the diaphragm to the left thereby closing valve member 172. Diaphragm chamber 178 is also communicated through a connector passage 182 leading from unlocking conduit 52 of selector 42.

Valve device 54 includes a chamber 186 communcating through a passage 188 with pump diaphragm chamber 148 and also communicating through a conduit 190 with vacuum supply conduit 128. A valve element 192 is adapted to control the admission of manifold vacuum to chamber 186. Valve element 192 is connected through a rod 194 with a diaphragm 196 peripherally clamped between casing 110 and cover casing 112. Diaphragm 196 coacts with casing 110 to define a chamber 198 which communicates through a connector passage 200 with a conduit 184. A spring member 202 is disposed in chamber 198 and normally biases diaphragm 196 to the left thereby causing valve element 192 to block manifold vacuum from entering chamber 186.

The operation of valve-pump mechanism **40** can best be understood by now describing the overall operation of the automatic door locking mechanism. To lock all vehicle doors, connector **48** of selector **42** is moved so as to register with locking conduit **50**. This causes manifold vacuum to be admitted to connector passage **201** causing diaphragm **196** of valve device **54** to be moved to the right against the force of spring **202** thereby opening valve member **192** and admitting manifold vacuum to chamber **186**. Manifold vacuum is thereby admitted to passage **188**, pump diaphragm chamber **148**, hence to connector passage **126**, common supply conduit **124** and thence to individual conduits **116**, **118**, **120** and **122** where manifold vacuum will cause each pressure responsive diaphragm **204** to be actuated to lock the door latch **13**, supra. At the same time this is occurring, manifold vacuum has been transmitted through valve device **132** to pump diaphragm chamber **144** shifting both diaphragms to the left or charging position as shown in FIGURE 3. With this the locking cycle is complete.

To unlock the doors, with engine not running, connector **48** of selector **42** is moved to register with unlocking conduit **52** whereby manifold vacuum is now admitted to connector conduit **182** shifting diaphragm **176** of valve device **56** to the right against the force of spring **180** thereby opening valve element **172** and admitting manifold vacuum to passage **170**. Manifold vacuum thereafter acts on diaphragm **160** of valve device **132** moving the diaphragm to the left against the force of spring **162** closing valve element **156** and at the same time venting pump diaphragm chamber **144** to atmosphere through conduit **154**.

The reduction of manifold vacuum in connector conduit **200** now permits spring **202** to move diaphragm **198** of valve device **54** to the left causing valve element **192** to block off manifold vacuum from chamber **186**. At the same time, the movement of valve **192** to the left permits a spring biased relief valve **206** to open under the influence of vacuum thereby quickly reducing the vacuum in chamber **186** and hence in pump diaphragm chamber **148** to substantially atmospheric pressure. Contemporaneously, manifold vacuum from diaphragm chamber **164** of valve device **132** is admitted through passage **168** to pump diaphragm chamber **142** moving diaphragms **136** and **138** to the right. The rightward or discharging movement of pump diaphagm **138** builds up a pressure in pump diaphragm chamber **148** which is now transmitted through connector conduit **126** and common supply conduit **124** to the conduits **116**, **118**, **120** and **122** causing the diaphragms **204** to be moved in the opposite or door latch unlocking direction.

The door locks are automatically locked when the driver's seat is occupied opening valve **34** and the transmission selector lever moved to a drive condition opening valve **32**. Under these conditions, manifold vacuum is supplied to diaphragm **196** of valve device **54** through conduits **184** and **200**. The locking operation will thereafter be the same as already described.

With the engine running, shift and seat valves **32** and **34** open, it is impossible to unlock the doors unless the shift valve is closed by shifting the transmission selector lever to neutral or park. With the transmission selector moved to neutral or park, the doors may be unlocked as previously described.

Thus it is seen, through the unique valve-pump mechanism **40**, that a single conduit system may be utilized to actuate the individual door locking devices **58**, **60**, **62** and **64** rather than the multiple conduit systems required by earlier devices such as that shown in the aforenoted Patent No. 3,019,848 to Garvey et al.

Vacuum storage tank **28** provides a vacuum source permitting operation of the locking system even when the engine is not running. To prevent loss of vacuum in tank **28** when the engine is not running and the trasmission selector lever is in the drive position, a check valve **210** is provided in conduit **184** between valve **54** and valve **32**.

The sides of diaphragms **160**, **176** and **196** not exposed to manifold vacuum are respectively vented to atmosphere through passages **212**, **214** and **216**.

We claim:

1. An automatic door locking mechanism comprising a door locking device, a pressure responsive servo mechanism operatively connected to said lock device and movable in one direction to lock said door and the other direction to unlock said door, a single conduit communicating with said pressure responsive servo mechanism, a vacuum source, a pressure control device connected to said single conduit and including a vacuum actuated pump for providing superatmospheric pressure, first conduit means communicating said pressure control device with said vacuum source, a selector device having locking and unlocking positions, second conduit means communicating said selector device with said vacuum source, a locking conduit communicating said selector device with said perssure control device whereby said latter device will transmit vacuum to said single conduit when said selector device is in locking position causing the pressure responsive servo mechanism to lock said door locking device, and an unlocking conduit adapted to communicate said selector device with said pressure control device whereby the latter device will transmit superatmospheric pressure to said single conduit when said selector device is in unlocking position causing the pressure responsive device to unlock said door locking device, said pump having a diaphragm, a first valve for admitting vacuum to one side of the diaphragm to charge the pump and a second valve causing said one side of the diaphragm to be opened to atmosphere and to admit vacuum to the other side of the diaphragm to discharge the pump.

2. An automatic door locking mechanism as set forth in claim 1 in which said pump includes a second diaphragm coupled to said first diaphragm for movement therewith, one side of the second diaphragm communicating with said single conduit, a third valve means for admitting vacuum to said one side of said diaphragm when the first diaphragm charges said pump and cutting off said vacuum when the first diaphragm discharges the pump, the discharging movement of the first and second diaphragms creating a superatmospheric pressure on said one side of the second diaphragm.

3. An automatic door locking mechanism as set forth in claim 2 in which said third valve means includes a spring biased valve member adapted to momentarily vent said one side of the second diaphragm to atmosphere when the third valve means cuts off vacuum, the valve member being closed during the discharge movement of the pump diaphragms.

4. An automatic door locking mechanism as set forth in claim 3 in which the actuation of the first, second and third valves of the vacuum actuated pump is controlled by said selector device.

5. A motor vehicle having an internal combustion engine for its propulsion, a body compartment for its driver and passengers, multiple doors for ingress into and egress from the compartment, each door having its own latch mechanism and a lock mechanism cooperating therewith, each lock mechanism being powered to a locking and unlocking position by a servo motor comprising a chamber with one wall thereof being in the form of a flexible imperforate member, said member having operative connection to said lock mechanism, all of said chambers being connected together and to the intake manifold of said engine by an imperforate interconnecting conduit, in combination with a manually controlled pressure pump means for producing superatmospheric air pressure, and valving means actuated by operation of said pump means for establishing communication between the source of pressure and said interconnecting conduit.

6. In combination with a motor vehicle having a door

with a latch lock mechanism and a servo motor connected to the latch locking member thereof for locking the door through the latch, said motor vehicle having a source of suction, a pump serving as a source of positive pressure, means for operating the pump, a power line for establishing communication between the suction source and the servo motor to actuate the latch locking member for locking the door when connected to the suction source, said pump being connected to pressurize the servo motor for reversing the latter to unlock the door, and valve means to close off the suction source from the servo motor when the pump is operative.

7. In a vehicle body having a plurality of closure members, each closure member having a latch mechanism and locking means for placing the latch mechanism in either locked or unlocked condition and power operating means for actuating said locking means, a source of positive pressure, a source of negative pressure, single conduit means connected to each of said power operating means, and control means for selectively and alternately connecting each of said sources to said conduit means to operate said power operating means and selectively and alternately actuate said locking means and place said latch mechanisms in either locked or unlocked condition.

8. In a vehicle body having a plurality of closure members, each closure member having a latch mechanism and locking means for placing the latch mechanism in either locked or unlocked condition and power operating means for actuating said locking means, pump means for producing positive pressure, a source of negative pressure, single conduit means connected to each of said power operating means, and control means for selectively and alternately connecting said source or said pump means to said conduit means to operate said power operating means and selectively and alternately actuate said locking means and place said latch mechanisms in either locked or unlocked condition.

9. In a vehicle body having a plurality of closure members, each closure member having a latch mechanism and locking means for placing the latch mechanism in either locked or unlocked condition and power operating means for actuating said locking means, a source of negative pressure, negative pressure operated pump means for producing positive pressure, single conduit means connected to each of said power operating means, and control means for selectively and alternately connecting each said source or said pump means to said conduit means to operate said power operating means and selectively and alternately actuate said locking means and place said latch mechanisms in either locked or unlocked condition.

10. In a vehicle body having a plurality of closure members, each closure member having a latch mechanism and locking means for placing the latch mechanism in either locked or unlocked condition and power operating means for actuating said locking means, a source of negative pressure fluid, pump means for producing a pulse of positive pressure fluid, single conduit means connected to each of said power operating means, and control means for selectively and alternately connecting said source or said pump means to said conduit means to operate said power operating means and selectively and alternately actuate said locking means and place said latch mechanisms in either locked or unlocked condition.

11. In a vehicle body having a plurality of closure members, each closure member having a latch mechanism and locking means for placing the latch mechanism in either locked or unlocked condition and power operating means for actuating said locking means, a source of negative pressure fluid, negative pressure fluid operated pump means adapted to be connected to said source for producing a pulse of positive pressure fluid, single conduit means connected to each of said power operating means, and control means for selectively and alternately connecting said source to said conduit means or said source to said pump means and said pump means to said conduit means to operate said power operating means and selectively and alternately actuate said locking means and place said latch mechanisms in either locked on unlocked condition.

References Cited in the file of this patent

UNITED STATES PATENTS

2,848,057	Forster	Aug. 19, 1958
2,974,742	Tyler	Mar. 14, 1961
3,070,183	Horton	Dec. 25, 1962
3,070,184	Riester	Dec. 25, 1962