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[54] **PRESSURE PASSAGE CHANGE-OVER DEVICE**

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[51] **Int. Cl.** **F16k 11/10**

[58] **Field of Search** 137/596.16, 596.17, 137/596.18, 625.63, 625.64, 625.65, 608

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Primary Examiner—Henry T. Klinksiek

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[57] **ABSTRACT**

A pressure passage change-over device which has at least two board-like members defining required pressure transmission passages. It may have a compact construction compared with the usual negative pressure passage change-over device which uses rubber hoses.

25 Claims, 3 Drawing Figures

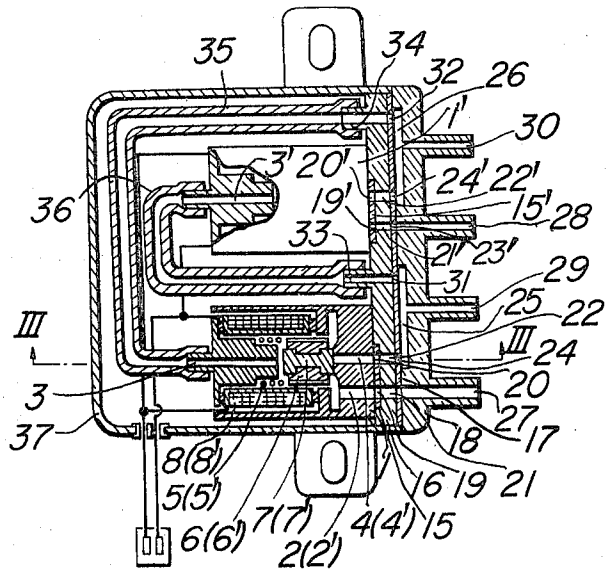


FIG. 1 PRIOR ART

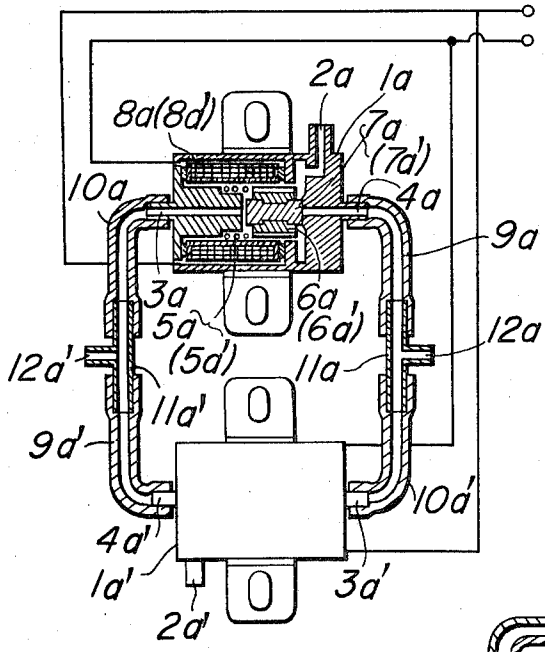


FIG. 2

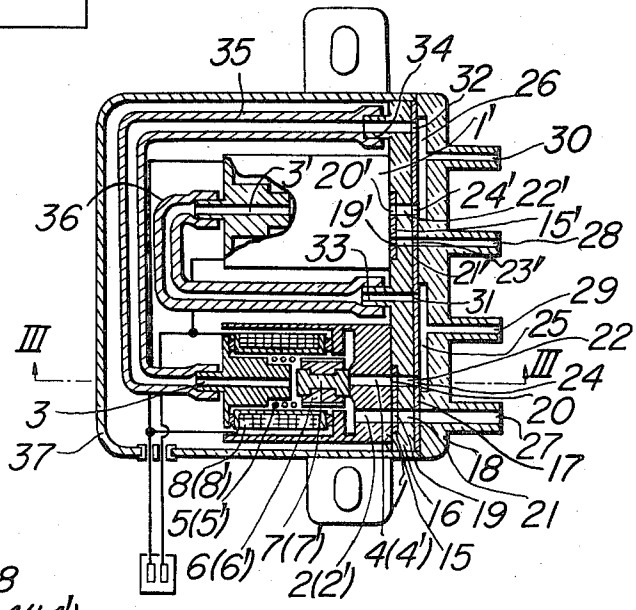
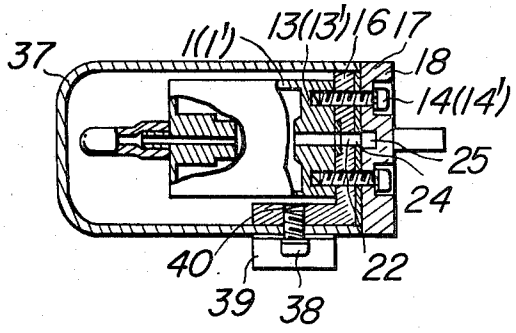


FIG. 3



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PRESSURE PASSAGE CHANGE-OVER DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improvements in the construction of a pressure passage change-over device, particularly employed in automobiles.

2. Description of the Prior Art

In the automobile, the negative pressure passage in the engine intake manifold (engine intake negative pressure passage) transmitted to a diaphragm has been utilized in various control means such as the ignition timing advancing means in the ignition distributor and cooler damper change-over mechanism. In recent days, the negative pressure passage in the engine intake manifold is also utilized to draw gasoline vapor from the gasoline tank and the like into the intake manifold for the purpose of preventing the gasoline vapor from being released into the atmosphere.

In utilizing the negative pressure passage of the engine intake manifold as the driving source as in the above manner, the negative pressure passage is usually on-off controlled or adapted to be suitably changed over to the atmospheric pressure passage. The on-off or change-over control is often effected by means of electric signals, and in such case electromagnetic valves are used.

The engine modification system, which functions to reduce the content of noxious components in the engine exhaust gas, and the automobile air conditioner often employ two or more electromagnetic valves. In such case, the electromagnetic valves are usually secured independently to respective brackets, and the piping is accomplished by using rubber hoses and T-shaped joints.

FIG. 1 shows a typical example of the prior-art negative pressure passage change-over device. This device comprises two electromagnetic, three-way change-over valves 1*a* and 1*a'* of entirely the same construction. When the solenoid coils 8*a* (8*a'*) are not energized, ports 2*a* and 2*a'* communicate through the respective valves with the respective ports 3*a* and 3*a'*, while ports 4*a* and 4*a'* are closed by inserts 7*a* (7*a'*) in respective plungers 6*a* (6*a'*) urged by springs 5*a* (5*a'*) and are not in communication with either the ports 2*a* and 2*a'* or the ports 3*a* and 3*a'*. As soon as the solenoid coils 8*a* (8*a'*) are energized, the plungers 6*a* (6*a'*) are moved against the spring force of the springs 5*a* (5*a'*), thus closing the ports 3*a* and 3*a'* to cut the communication thereof with the respective ports 2*a* and 2*a'* while opening the ports 4*a* and 4*a'* to render them into communication with the respective ports 2*a* and 2*a'*. The port 4*a* communicates via a rubber hose 9*a*, a T-shaped joint 11*a* and a rubber hose 10*a'* with the port 3*a'*. The port 3*a* communicates via a rubber hose 10*a*, a T-shaped joint 11*a'* and a rubber hose 9*a'* with the port 4*a'*. Thus, when the solenoid coils 8*a* (8*a'*) are not energized, a passage between ports 2*a* and 12*a'* and a passage between ports 2*a'* and 12*a* are formed, whereas when the solenoid coils carry current, a passage between ports 2*a* and 12*a* and a passage between ports 2*a'* and 12*a'* are formed.

In the prior-art device described above, however, the electromagnetic valves are separately mounted on the vehicle and rubber hoses are used for the piping. Therefore, much space is required for the installation

of the valves. Also, the electric wiring and piping are quite complicated, so that mis-wiring and mis-piping are very likely to result in the factory assemblage and maintenance servicing of the vehicle. This problem becomes particularly significant where many electromagnetic valves of the same configuration are used.

SUMMARY OF THE INVENTION

An object of the invention is to provide a negative pressure passage change-over device, which is small in size, simple in construction and totally free from the above problem.

Another object of the invention is to provide a negative pressure passage change-over device comprising a plurality of electromagnetic valves either to switch or open and close negative pressure passages, and at least two integral board-like members defining said negative pressure passages and provided with connection ports, said electromagnetic valves being directly secured to one of said integral board-like members.

According to the invention, the negative pressure passage change-over device has at least two integral board-like members defining the required negative pressure passages, so that its construction may be compact compared to the usual negative pressure passages change-over device using rubber hose piping. Also, according to the invention since the electromagnetic valves are directly secured to one of the integral board-like members provided with connection ports, the rubber hose piping may be totally dispensed with or extremely reduced to simplify the piping and the electromagnetic valves may be arranged in a reduced space. Further, according to the invention by providing the connection ports to one of the board-like members, particularly the one constituting an end plate, the piping at the time of mounting the device on the vehicle may be extremely facilitated. Furthermore, the device has a rigid form, which is very convenient for handling, installation and removal.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view, partly in section, showing an example of the prior-art negative pressure passage change-over device.

FIG. 2 is a plan view, partly in section, showing an embodiment of the negative pressure passage change-over device according to the invention, which has the same function as that of the prior-art device of FIG. 1.

FIG. 3 is a sectional view taken along the line III—III in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 2 and 3 show a preferred embodiment of the invention, which has the same function as that of the prior-art device of FIG. 1. Referring to FIGS. 2 and 3, the embodiment comprises two, electromagnetic, three-way change-over valves 1 and 1'. The electromagnetic valves 1, (1') respectively have three ports 2, 3 and 4, (2', 3' and 4'). The port 2 (or 2') is always in communication with one of the other ports 3 and 4 (or 3' and 4'). When solenoid coil 8 (or 8') is not energized, the port 4 (or 4') is closed by plunger insert 7 (or 7') and is not in communication with the port 2 (or 2').

The ports 2 (or 2') and 4 (or 4') are open at the same end of the valve 1 (or 1'). The port 3 (or 3') is in communication with the port 2 (or 2') when the solenoid coil 8 (or 8') is not energized, but as soon as the solenoid coil 8 (or 8') is energized the plunger 6 (or 6') is moved against the spring force of the spring 5 (or 5'), so that the insert 7 (or 7') in the plunger 6 (or 6') closes the port 3 (or 3') to cut communication between ports 2 (or 2) and 3 (or 3').

As shown in FIG. 3, the two electromagnetic valves 1 and 1' are commonly made integral with a board-like support member 16, which is in turn made integral with a board-like end member 18, by means of bolts 14 and 14' screwed through the end member 18, a pad 17, the support member 16 and pads 15 and 15' into threaded holes 13 and 13' formed in the valves 1 and 1' at the end of the ports 2, 4 and 2', 4'.

The ports 2, 4 and 2', 4' of the electromagnetic valves 1 and 1' communicate with respective holes 19, 20 and 19', 20' formed in the pads 15 and 15', respective connection ports 21, 22 and 21', 22' formed in the support member, and with respective holes 23, 24 and 23', 24' formed in the pad 17. The end member 18 is formed on the inner side thereof, that is, on the side thereof facing the pad 17, with grooves 25 and 26 for forming required negative pressure passages. It is also provided with outwardly extending, external connection ports 27, 28, 29 and 30 respectively communicating with the ports 2 and 2' and the passages 25 and 26. The support member 16 is provided on the side thereof opposite the pad 17 with connecting ports 33 and 34 communicating via respective holes 31 and 32 formed in the pad 17 with the passages 25 and 26.

The port 34 communicates via a pipe 35 with the port 3 of the electromagnetic valve 1, and the port 36 communicates via a pipe 36 with the port 3' of the electromagnetic valve 1'. Numeral 37 designates a casing secured to the support member 16 by bolts 38 fastened into threaded holes 40 formed in the support member 16.

The terminals of the solenoid coils 8 and 8' of the electromagnetic valves 1 and 1' are connected in parallel inside the casing 37 and taken out of the casing at a two-terminal socket 41.

With the construction described above, when the solenoid coils 8 and 8' are not energized, the ports 2 and 2' are in communication with the respective ports 3 and 3' and the ports 4 and 4' are closed, so that a negative pressure passage from connection port 27 to connection port 30 is formed. As soon as the solenoid coils 8 and 8' are energized, the ports 3 and 3' are closed while at the same time opening the ports 4 and 4' to render them into communication with the respective ports 2 and 2'. At this time, communications between the adjacent connection ports 27 and 29 and between the adjacent connection ports 28 and 30 is established.

Although the foregoing embodiment has a least number of two electromagnetic valves to illustrate the fundamental construction according to the invention, the usefulness of the invention becomes more prominent when the number of the electromagnetic valves incorporated is increased. Also, although the required negative pressure passages are formed in the end member 18 in the preceding embodiment, they may as well be formed in the support member 16 or in a spacer such as the pad 17 intervening between the support member 16 and the end member 18.

A pressure passage change-over device according to this invention is not limited to a negative pressure passage change-over device but it is applicable to those devices in which a change-over of a negative pressure passage to an atmospheric pressure passage, a positive pressure passage to an atmospheric pressure passage, or a change-over between passages of any amount of pressure is to be effected.

We claim:

1. A pressure passage change-over device comprising:
- a support member having holes for forming a part of said pressure passage;
- a plurality of electromagnetic change-over valves mounted on said support member;
- an end member mounted on said support member at the opposite side of said change-over valves;
- said end member being provided with external connection ports and pressure passages communicating with said holes of said support member; and
- means including said valves for selectively communicating said ports with each other via said passages, holes and valves and closing the communication therebetween according to the operation of said electromagnetic change-over valves.

2. A pressure passage change-over device as in claim 1, wherein said electromagnetic change-over valves are mounted on said support member together with said end member by through bolts.

3. A pressure passage change-over device as in claim 1, including a cup-shaped casing secured to said support member to cover said electromagnetic change-over valves.

4. A pressure passage change-over device comprising:
- a support member having holes and pressure passages communicating with said holes;
- a plurality of electromagnetic change-over valves mounted on said support member;
- an end member mounted on said support member at the opposite side of said change-over valves;
- said end member being provided with external connection ports; and
- means including said valves for selectively communicating said ports with each other via said passages, holes and valves and closing the communication therebetween according to the operation of said electromagnetic change-over valves.

5. A pressure passage change-over device comprising:
- a support member having holes for forming a part of said pressure passage;
- a plurality of electromagnetic change-over valves mounted on said support member;
- an end member secured to said support member at the opposite side of said change-over valves;
- pad means located between said support member and end member for preventing pressure leakage;
- said end member being provided with external connection ports;
- said pad means having pressure passages communicating with said holes of said support member; and

means including said valves for selectively communicating said ports with each other via said passages, holes and valves and closing the communication therebetween according to the operation of said electromagnetic change-over valves.

6. A pressure passage change-over device comprising:

an end support means having plural sections of holes formed on one surface thereof, each of said plural sections having first, second and third holes, and plural sets of external connection ports on the other surface thereof, each of said plural sets having a pair of first and second external connection ports,

said plural sets being of the same number of said plural sections and being disposed corresponding thereto,

said first external connection port of each of said plural sets communicating with the first and third holes of the corresponding one of said plural sections through a divaricated pressure passage formed in said end support means,

said second external connection port of each of said plural sets communicating with the second hole of the corresponding one of said plural sections through a pressure passage provided through said end support means; and

a plurality of electromagnetic change-over valves, of the same number as said plural sections, mounted on said one surface of said end support means so as to correspond to said respective plural sections,

each of said change-over valves being provided with first, second and third ports,

the first and second ports and the third port of each of said change-over valves being in communication with the first and second holes of the corresponding one of said plural sections and the third hole of another one of said plural sections respectively;

the arrangement being such that communication between the pair of first and second external connection ports of each of said plural sets through the first and second ports of the corresponding change-over valve is changed into communication between the second external connection port of each of said plural sets and the first external connection port of the other one of said plural sets through the second and third ports of the change-over valve corresponding to said second external connection port when said electromagnetic change-over valves are operated.

7. A pressure passage change-over device according to claim 6, said device further comprising a cup-shaped casing secured to said end support means to cover said electromagnetic change-over valves.

8. A pressure passage change-over device according to claim 6, said end support means comprising a support member including said one surface thereof and an end member including said other surface thereof, said divaricated pressure passages being formed in at least one of said support member and end member.

9. A pressure passage change-over device according to claim 8, said respective electromagnetic change-over valves are mounted on said support member together with said end member by through bolts.

10. A pressure passage change-over device according to claim 8, said device further comprising a cup-shaped casing secured to said support member to cover said electromagnetic change-over valves.

11. A pressure passage change-over device according to claim 8, said divaricated pressure passages being formed in said support member.

12. A pressure passage change-over device according to claim 8, said divaricated pressure passages being formed in said end member.

13. A pressure passage change-over device according to claim 8, said divaricated pressure passages being formed extending over both said support and end members.

14. A pressure passage change-over device according to claim 6, said end support means comprising a support member including said one surface thereof, an end member including said other surface thereof, and a pad means, located between said support and end members, for preventing pressure leakage, said divaricated pressure passages being formed in at least one of said support member, end member and pad means.

15. A pressure passage change-over device according to claim 14, said respective electromagnetic change-over valves are mounted on said support member together with said end member and pad means by through bolts.

16. A pressure passage change-over device according to claim 14, said device further comprising a cup-shaped casing secured to said support member to cover said electromagnetic change-over valves.

17. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed in said support member.

18. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed in said pad means.

19. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed in said end member.

20. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed extending over both said support member and pad means.

21. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed extending over both said pad means and end member.

22. A pressure passage change-over device according to claim 14, said divaricated pressure passages being formed extending over said support member, pad means and end member.

23. A pressure passage change-over device comprising:

a support member having holes grouped into plural sections for forming a part of said pressure passage, each of said plural sections having first, second and third holes;

a plurality of electromagnetic change-over valves of the same number as said plural sections, said change-over valves being mounted on said support member so as to correspond to said respective plural sections, each of said change-over valves being provided with first, second and third ports, the first and second ports and the third port of each of said

change-over valves communicating with the first and second holes of the corresponding one of said plural sections and the third hole of another one of said plural sections respectively; and

an end member mounted on said support member at the opposite side of said change-over valves, said end member being provided with plural sets of external connection ports, said plural sets being of the same number of said plural sections and being disposed correspondingly thereto, each of said plural sets having a pair of first and second external connection ports, the first external connection ports of each of said plural sets communicating with the first and third holes of the corresponding one of said plural sections through a pair of pressure passages provided through said end member, the second external connection port of each of said plural sets communicating with the second hole of the corresponding one of said plural sections through a pressure passage provided through said end member, whereby the communication between the pair of first and second external connection ports of each of said plural sets through the first and second ports of the corresponding change-over valve is changed into the communication between the second external connection port of each of said plural sets and the first external connection port of the other one of said plural sets through the second and third ports of the change-over valve corresponding to said second external connection port when said electromagnetic change-over valves are energized.

24. A pressure passage change-over device comprising:

a support member having a plurality of holes;

a plurality of electromagnetic change-over valves mounted on said support member and connected to said holes of said support member for forming a plurality of pressure passages and for selectively opening and closing the communication of each of said passages; and

an end member having a plurality of external connection ports and mounted on said support member at the opposite side of said change-over valves, said external connection ports communicating with said holes of said support member through respective passages provided through said end member, whereby each of said external connection ports communicates with another external connection port and predeterminedly changes the mate of the communication according to the operation of said electromagnetic changeover valves.

25. A pressure passage change-over device comprising:

a support member having holes for forming a part of said pressure passage;

a plurality of electromagnetic change-over valves mounted on said support member and connected to said holes of said support member for forming a plurality of pressure passages and for selectively opening and closing the communication of each of said passages;

an end member having a plurality of external connection ports and secured to said support member at the opposite side of said change-over valves; and

pad means for preventing pressure leakage, said pad means having pressure passages for connecting said external connection ports with said holes of said support member through respective pressure passages provided through said end member, whereby each of said external connection ports communicates with another external connection port and predeterminedly changes the mate of the communication according to the operation of said electromagnetic change-over valves.

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