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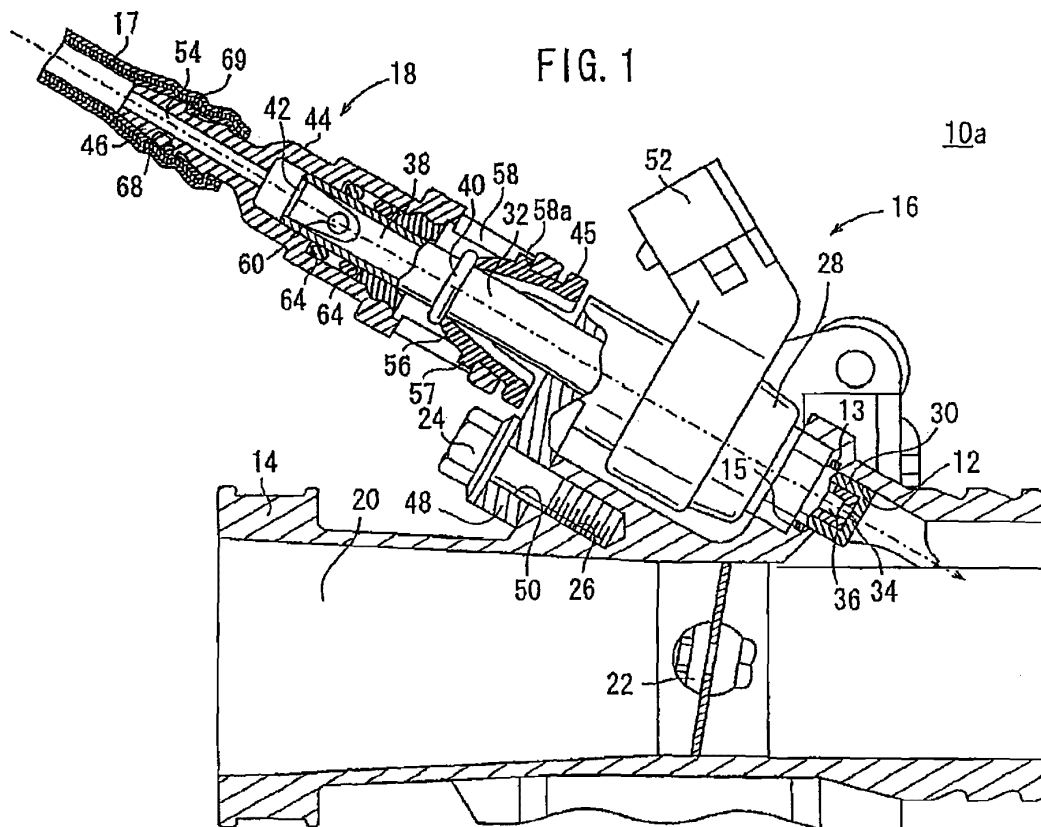
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(54) **Fuel injection system and fuel injection valve device used in fuel injection system**

(57) A fuel injection system (10a) includes: a fuel hose (17); a fuel supply tube (18) having one end integrally connected with the fuel hose (17); a fuel injection valve device (16) provided with a nozzle portion (30) having an injection port (34) for supplying a fuel introduced from a fuel tank through the fuel hose (17) to a combustion

chamber of an internal combustion engine through a connection tube (32) and connected with the other end of the fuel supply tube (18); an intake path (20) communicating with the combustion chamber; and an intake pipe (14) to which the nozzle portion (30) of the fuel injection valve device (16) is attached.



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Description

[0001] The present invention relates to a fuel injection system for supplying a fuel to a combustion chamber of an internal combustion engine, and a fuel injection valve device used in the fuel injection system.

[0002] Any related fuel injection valve devices has a nozzle portion having an injection port injecting a fuel to a combustion chamber of an internal combustion engine, and a housing incorporating a valve element opening/closing the injection port, a driving portion opening/closing the valve element, and a flow path for supplying a fuel.

[0003] As an example of such fuel injection valve device, JP-A No. 2003-49740 discloses a technical idea that in a fuel injection valve holding device for holding a fuel injection valve device in which a fuel-outlet-side end portion is inserted to an mounting hole of an intake pipe structure of an engine, a joint cap fitted to an outer peripheral portion of a fuel-inlet-side end portion and connecting between the fuel hose and the fuel injection valve is held by a fixing holder provided to a bracket to erect from an outer surface of the intake pipe structure. Owing to such construction, the number of components or manufacturing cost can be reduced.

[0004] The present invention has been accomplished in view of the above technical idea, and an object of the present invention is to further facilitate attachment and maintenance of a fuel injection system that can respond to a demand for installation in a narrower space or characteristics of a connected fuel hose, and a fuel injection valve device used in the fuel injection system and to provide a fuel injection system that realizes reduction in the number of components, size, and costs, and a fuel injection valve device used in the fuel injection system.

[0005] This and other objects are achieved by the invention with a fuel injection system according to claim 1.

[0006] A fuel injecting system according to the present invention includes: a fuel hose; a fuel supply tube having one end integrally connected with the fuel hose; a fuel injection valve device provided with a nozzle portion having an injection port for supplying a fuel introduced from a fuel tank through the fuel hose to a combustion chamber of an internal combustion engine through a connection tube and connected with the other end of the fuel supply tube; and an intake path communicating with the combustion chamber, the nozzle portion being attached toward the intake path.

[0007] According to the above construction, in the case of supplying a fuel from the fuel tank to the combustion chamber through the fuel injection valve device by way of the fuel supply tube integrally connected with the fuel hose, the fuel supply tube can be easily connected with the fuel injection valve device. Hence, attachment of the fuel supply tube to the fuel injection valve device and maintenance are facilitated. Further, the structure for attaching the fuel injection valve device to the intake path is simplified, making it possible to reduce the number of components, size, and manufacturing costs of the injection fuel system.

tion fuel system.

[0008] Further, in the fuel injection system, the fuel injection valve device has a flow path for supplying a fuel introduced through the connection tube to the injection port, and a housing portion provided with the connection tube at one end in an axial direction of the flow path, and with the nozzle portion at the other end, and the fuel supply tube or the housing portion has a flange portion, and the fuel injection valve device is fixed to the intake pipe through the flange portion. In this case, the fuel injection valve device can be easily and securely fixed to the intake pipe. In addition, the fuel supply tube can be connected to the thus-fixed fuel injection valve device, so attachment of each component or maintenance of the fuel injection system is further facilitated.

[0009] Further, if the fuel hose and the fuel supply tube are made of a resin material, deteriorations due to a fuel or heat can be significantly suppressed. In addition, in the case of using the fuel hose made of a resin material, the fuel supply tube and the connection tube are easily connected in the fuel injection system, so the fuel injection valve device can be connected to the fuel supply tube with ease, and high attachment and maintenance efficiencies can be ensured.

[0010] Furthermore, it is preferable that the fuel hose and the fuel supply tube be integrally connected through a press-fitting process. Further, if the fuel supply tube and the connection tube of the fuel injection valve device are detachably attachable, the attachment and maintenance efficiencies of the fuel injection system are further improved.

[0011] A fuel injection valve device according to the present invention includes: a connection tube connected with one end of a fuel supply tube the other end of which is integrally connected with a fuel hose; and a nozzle portion having an injection port for supplying a fuel introduced from a fuel tank through the fuel hose to a combustion chamber of an internal combustion engine through the connection tube and attached to an intake pipe communicating with the combustion chamber.

[0012] According to the above construction, in the case of using the fuel supply tube having one end integrally connected with the fuel hose, the fuel supply tube and the fuel injection valve device can be easily connected, so the attachment and maintenance efficiencies of the fuel injection valve device are improved. Further, the structure for attaching the fuel injection valve device is simplified, making it possible to reduce the number of components and the size.

[0013] Further, the fuel injection valve device has a flow path for supplying a fuel introduced through the connection tube to the injection port, and a housing portion provided with the connection tube at one end in an axial direction of the flow path, and with the nozzle portion at the other end, and the housing portion has a flange portion for fixing the fuel injection valve device to the intake pipe. This construction is preferred because the attachment of the fuel injection valve device is further facilitated.

[0014] Further, if the connection tube is detachably attachable to the fuel supply tube, the attachment and maintenance efficiencies of the fuel injection valve device are more improved.

[0015] According to the present invention, the attachment and maintenance efficiencies of the fuel injection valve device in the fuel injection system can be improved. In addition, according to the present invention, it is possible to reduce the number of components, size, and manufacturing costs of the fuel injection valve device and the fuel injection system.

[0016] Hereinafter, a fuel injection system according to the present invention will be described in detail in relation to a fuel injection valve device used in the fuel injection system based on preferred embodiments with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of a fuel injection system according to a first embodiment of the present invention in a partially broken form;

Fig. 2A is a sectional view of a fuel hose of the embodiment, and Fig. 2B is a sectional view of how the diameter of the fuel hose of the embodiment is expanded;

Fig. 3 is a longitudinal sectional view illustrating a procedure of connecting components of the fuel injection system in a partially broken form;

Fig. 4 is a sectional view taken along the line IV-IV of Fig. 3;

Fig. 5 is a longitudinal sectional view of a fuel injection system according to a second embodiment of the present invention in a partially broken form;

Figs 6: Fig. 6A is a plan view of a flange plate of the embodiment, Fig. 6B is an explanatory view of how the two flange plates cover a groove portion of a housing portion, and Fig. 6C is an explanatory view of such a state that the two flange plates cover the groove portion of the housing portion; and

Fig. 7 is a longitudinal sectional view of a fuel injection system according to a third embodiment of the present invention in a partially broken form.

[0017] Referring to Figs. 1 to 4, a first embodiment of the present invention is described below. Fig. 1 is a longitudinal sectional view of a fuel injection system 10a according to the first embodiment of the present invention in a partially broken form.

[0018] As shown in Fig. 1, the fuel injection system 10a includes: an intake pipe 14 having a mounting hole 12 formed in an outer wall surface; a fuel injection valve device 16 fixed to the intake pipe 14 and supplying a fuel to an unillustrated combustion chamber of an internal combustion engine; and a fuel supply tube 18 connected to the fuel injection valve device 16 and supplying the fuel supplied from an unillustrated fuel tank storing the fuel to be supplied to the combustion chamber of the internal combustion engine through a fuel hose 17 toward the fuel injection valve device 16.

[0019] Further, the intake pipe 14 includes an intake path 20 communicating with the combustion chamber of the internal combustion engine and functions as an intake duct. A throttle valve 22 for opening/closing the intake path 20 is journaled into the intake path 20.

[0020] The mounting hole 12 is formed such that a fuel from a nozzle portion 30 of the fuel injection valve device 16 is injected into the intake path 20 on the downstream side of the throttle valve 22. Incidentally, a screw portion 26 is formed in a protruded outer wall surface of the intake pipe 14 on an upstream side of the mounting hole 12, and a bolt 24 is fastened to the screw portion 26 as described later. On the other hand, a ring-shaped groove portion 13 is formed on the inner peripheral surface of the mounting hole 12. A sealing member 15 for example an O-ring, is provided to the groove portion 13. Hence, the sealing member 15 is brought into contact with the outer peripheral surface of the nozzle portion 30 to prevent fuel from leaking from a gap between the mounting hole 12 and the nozzle portion 30.

[0021] The fuel injection valve device 16 has a housing portion 28 having a substantially cylindrical shape, a cylindrical nozzle portion 30 inserted to an end portion on the mounting hole 12 side, and a connection tube 32 protruding at an end portion opposite to the nozzle portion 30.

[0022] The nozzle portion 30 is provided with an injection port 34 at its tip, and incorporates a valve element 36 for opening/closing the injection port 34; fuel is injected from the injection port into the intake path 20. The connection tube 32 includes a flow path 38 through which fuel supplied from the fuel supply tube 18 flows, and has a diameter-expanded portion 40 formed on the outer peripheral surface of the connection tube 32 at around the central position of the tube in the axial direction thereof, in a ring shape. The flow path 38 passes through the housing 28 and communicates with the injection port 34 of the nozzle portion 30. Fuel is introduced to the flow path 38 from an opening 42 of the connection tube 32 formed at an end portion opposite to the housing 28 side. Further, if the connection tube 32 is inserted and connected to a joint 44 of the fuel supply tube 18 as described below, the diameter-expanded portion 40 functions to engage with an engagement claw 56 of the joint 44 to thereby prevent the joint 44 from being separated from the connection tube 32. A detailed description thereof is given below.

[0023] A flange portion 48 is further provided at the end portion of the housing portion 28 where the connection tube 32 protrudes; the flange portion serves to fix the fuel injection valve device 16 to the intake pipe 14. A bolt insertion hole 50 is formed in the flange portion 48, and the bolt 24 is screwed to the screw portion 26 through the bolt insertion hole 50, thereby fixing the fuel injection valve device 16 to the intake pipe 14 (see Figs. 1 and 3).

[0024] A not-shown electromagnetic actuator is accommodated in the housing portion 28. The electromagnetic actuator includes a coil bobbin made of a synthetic

resin, for example, and moves the valve element 36 of the nozzle portion 30 forward and backward through a not-shown rod. Hence, a power-supplying connector 52 supplying power to the electromagnetic actuator is attached to the housing portion 28, and the power-supplying connector 52 is connected to not-shown driving means.

[0025] The fuel supply tube 18 is integrally connected with the fuel hose 17, and composed of the joint 44 and a retainer 45. The fuel hose 17 is press-fitted to a stepped fuel hose insertion portion 46 formed at one end of the joint 44, and integrally and externally engaged. Further, the retainer 45 is provided at the other end of the joint 44, and the joint 44 and the connection tube 32 of the fuel injection valve device 16 are detachably connected through the retainer 45. The retainer 45 can be moved backward and forward in the axial direction by fitting a projection 57 to a recess 58 of the joint 44. A flow path 54 passing a fuel supplied from the fuel hose 17 to the fuel path 38 of the fuel injection valve device 16 is formed in the fuel hose insertion portion 46.

[0026] Incidentally, it is preferred that the fuel supply tube 18, that is, the joint 44 and the retainer 45 be formed of a resin material, for example, PA12 (polyamide 12).

[0027] Then, at the time of connecting the fuel supply tube 18 integrally coupled with the fuel hose 17 to the fuel injection valve device 16, the connection tube 32 of the fuel injection valve device 16 is inserted into the joint 44 through the retainer 45, and the diameter expanded portion 40 of the connection tube 32 engages with the engagement claw 56 of the retainer 45. Further, at this time, the projection 57 formed at around the central portion of the retainer 45 is brought into contact with a side surface 58a of the recess 58 and fitted into the recess.

[0028] Hence, if the fuel injection valve device 16 and the fuel supply tube are connected, the retainer 45 is fixed due to the engagement between the diameter expanded portion 40 and the engagement claw 56 and between the projection 57 and the side surface 58a of the recess 58, with the result that the slippage from the connection tube 32 of the joint 44 is prevented with reliability. Further, a dome-shaped projection 60 of the connection tube 32 is fitted into a not-shown recess formed in the inner wall surface of the joint 44 to thereby attain whirl-stop between the fuel injection tube 18 and the connection tube 32.

[0029] Incidentally, if the connection tube 32 is inserted into the joint 44, the outer peripheral surface around the tip end of the connection tube 32 is brought into contact with two sealing members 64 provided along the inner peripheral surface of the joint 44, and thus a high degree of liquid tightness is held inside the joint 44. As the sealing members 64, an O-ring is preferred.

[0030] Further, the fuel hose 17 is made of a flexible resin material and is deformable when placed between the fuel tank of the internal combustion engine and the fuel injection valve device 16.

[0031] Referring to Figs. 2, the fuel hose 17 is de-

scribed in detail. Fig. 2A is a sectional view of the fuel hose 17 of this embodiment, and Fig. 2B is a sectional view of how the diameter of the fuel hose 17 is expanded before the fuel hose 17 is press-fitted to the fuel hose insertion portion 46 of the joint 44 and connected.

[0032] As shown in Fig. 2A, the fuel hose 17 is composed of, for example, a tube 17a made of PA 12 (polyamide 12) with the thickness of 0.55 mm and the inner diameter of 2.5 mm, a 0.2 mm-thick inner tube 17b made of ETFE (tetrafluoroethylene-ethylene copolymer) as an inner layer of the tube 17a, and a 1.0 mm-thick protective tube 17c made of EPDM (ethylenepropylene rubber) and provided for protecting the tube 17a from UV, strong acid, and chipping. At the time of press-fitting the thus-formed fuel hose 17 to the fuel hose insertion portion 46 of the joint 44, as shown in Fig. 2B, the diameter of the hose is expanded at a portion of a predetermined length L from an end portion where the fuel hose insertion portion 46 is inserted to form a diameter-expanded portion 66.

[0033] The fuel hose 17 is made of the aforementioned resin material, so deteriorations due to heat or a fuel can be considerably suppressed as compared with a conventionally popular rubber material.

[0034] Meanwhile, elasticity of the resin material is generally smaller than the rubber material. It is preferred that the outer diameter of the fuel hose insertion portion 46 be set slightly larger than the inner diameter of the fuel hose 17, for example, set to about 2.5 mm as the inner diameter of the tube 17a, because adhesion between the fuel hose 17 and the fuel hose insertion portion 46 is increased. Thus, in the fuel hose 17 of this embodiment, the diameter of a portion of the predetermined length L from the end portion of the fuel hose 17 is expanded in advance to form the diameter-expanded portion 66, making it possible to easily insert the fuel hose insertion portion 46 to the fuel hose 17, to enhance the adhesion between the fuel hose 17 and the fuel hose insertion portion 46, and to improve an efficiency in connecting the these components.

[0035] As shown in Fig 1, the groove portion 68 is formed in a ring shape on the outer peripheral surface of the fuel hose insertion portion 46, and the groove portion 68 is provided with the sealing members 69, for example, an O-ring. Thus, an adhesion between the fuel hose 17 and the fuel hose insertion portion 46 is further enhanced and, in addition, it is possible to prevent the fuel hose 17 from coming off from the fuel hose insertion portion 46 due to a creep that develops with time or prevent leakage of liquids from a gap between the fuel hose 17 and the fuel hose insertion portion 46.

[0036] Referring next to Fig. 3, description is made of a procedure of connecting the intake pipe 14 to the fuel injection valve device 16 and the fuel supply tube 18 in the fuel injection system 10a thus constructed. Fig. 3 is a longitudinal sectional view illustrating a procedure of connecting components of the fuel injection system 10a in a partially broken form. In this example, it is assumed that the fuel hose 17 and the joint 44 of the fuel supply

tube 18 are coupled in advance and integrally formed.

[0037] First, the fuel injection valve device 16 is connected with the intake pipe 14. In this case, the nozzle portion 30 of the fuel injection valve device 16 is inserted to the mounting hole 12 of the intake pipe 14 while the bolt 24 is fastened to the screw portion 26 through the bolt insertion hole 50 formed in the flange portion 48. Hence, the fuel injection valve device 16 is securely fixed to the intake pipe 14 with ease. Further, the injection port 34 formed at the tip end of the nozzle portion 30 is directed to the intake path 20, making it possible to inject a fuel to the intake path 20 from the fuel injection valve device 16.

[0038] Next, as described above, the connection tube 32 of the fuel injection valve device 16 fixed to the intake pipe 14 is connected with the fuel supply tube 18. In this case, since the fuel injection valve device 16 is fixed to the intake pipe 14, the connection tube 32 can be readily and securely inserted inside the joint 44 through the retainer 45.

[0039] Further, at this time, the diameter expanded portion 40 of the connection tube 32 engages with the engagement claw 56 of the retainer 45, and the projection 57 engages with the side surface 58a of the recess 58. Thus, the retainer 45 is fixed to prevent the joint 44 from coming off from the connection tube 32. As a result, the fuel injection valve device 16 and the fuel supply tube 18 are more securely connected together.

[0040] As described above, the fuel injection system 10a of this embodiment is constructed such that the fuel injection valve device 16 is fixed to the intake pipe 14, and the joint 44 of the fuel supply tube 18 is connected with the protruded connection tube 32 of the fuel injection valve device 16. Therefore, it is unnecessary to provide a fixing holder used in the related structure, and the number of components, the size, and the manufacturing costs can be reduced.

[0041] Further, in the case where the fuel hose 17 is made of a resin material, an operation of press-fitting the fuel hose 17 to the fuel hose insertion portion 46 and coupling these is required as mentioned above. Such a press-fitting operation is undesirable in a not-shown motorcycle or four-wheel vehicle incorporating an internal combustion engine, for example, in terms of working efficiency.

[0042] To that end, in this embodiment, the fuel hose 17 and the fuel supply tube 18 are integrally coupled in advance while the fuel injection valve device 16 is fixed to the intake pipe 14, by which the fuel supply tube 18 can be easily connected with the connection tube 32. Thus, even if the fuel hose 17 is made of a resin material, the connection of components of the fuel injection system 10a is easily carried out, and the working efficiency can be improved. In addition, deteriorations of the fuel hose 17 due to heat or fuel can be remarkably suppressed. Further, the joint 44 facilitates attachment/detachment of the fuel supply tube 18 to/from the fuel injection valve device 16. This improves attachment and maintenance

efficiencies of the fuel injection valve device 16 and in turn improves an efficiency of installing the fuel supply tube 18.

[0043] Next, a second embodiment of the present invention is described with reference to Figs. 5 and 6. Fig. 5 is a longitudinal sectional view showing a fuel injection system 10b according to the second embodiment of the present invention in a partially broken form. Here, in Fig. 5, the same reference numerals as those of Figs. 1 to 4 denote identical or similar components. These components have similar functions and effects, and thus detailed description thereof is omitted here.

[0044] The fuel injection system 10b of this embodiment differs from the fuel injection system 10a of the above embodiment in that a fuel injection valve device 72 is provided in place of the fuel injection valve device 16. The fuel injection valve device 72 differs from the fuel injection valve device 16 in that a housing portion 74 replaces the housing portion 28.

[0045] The housing portion 74 has a substantially cylindrical shape, and an annular groove portion 76 is formed in the outer peripheral surface near a portion where the flange portion 48 is formed in the housing portion 28. Two flange plates 80 (see Fig. 6A) as thin plates having a hook portion 81 and a bolt insertion hole 78 are stacked so as to hold the groove portion 76 in the directions indicated by arrows of Fig. 6B. Then, the bolt 24 is fastened to the bolt insertion holes 78 all together to thereby fix the fuel injection valve device 72 to the intake pipe 14.

[0046] Incidentally, one flange plate 80 may be used and fixed to the groove portion 76 of the housing portion 74 by means of bonding or welding to thereby combine the housing portion 74 and the flange plate 80.

[0047] As described above, according to the fuel injection system 10b of this embodiment, the fuel injection valve device 72 is fixed to the intake pipe 14 by means of the flange plate 80, so the flange portion 48 can be omitted, and the fuel injection valve device 72 is simplified in shape. Therefore, a manufacturing cost of the fuel injection valve device 72 can be reduced. Further, the flange plates 80 and the housing portion 74 can be separated only by slightly loosening the bolt 24 from the screw portion 26, with the result that the maintenance efficiency is further improved.

[0048] Next, a third embodiment of the present invention is described with reference to Fig. 7. Fig. 7 is a longitudinal sectional view showing a fuel injection system 10c according to the third embodiment of the present invention in a partially broken form.

[0049] The fuel injection system 10c of this embodiment differs from the fuel injection system 10a of the above embodiment in that a fuel injection valve device 82 replaces the fuel injection valve device 16, and a fuel supply tube 84 replaces the fuel supply tube 18. The fuel injection valve device 82 differs from the fuel injection valve device 16 in that a substantially cylindrical housing portion 86 not provided with the flange portion 48 is used.

In addition, the fuel supply tube 84 differs from the fuel supply tube 18 in that a joint 90 replaces the joint 44.

[0050] A flange portion 94 having a bolt insertion hole 92 is formed near the recess 58 of the joint 90. The flange portion 94 has substantially the same shape as the flange portion 48 of the fuel injection valve device 16.

[0051] Thus, in this embodiment, at the time of connecting the fuel supply tube 84 with the connection tube 32 after inserting the nozzle portion 30 of the fuel injection valve device 82 to the mounting hole 12 of the intake pipe 14, the bolt 24 fastens the fuel supply tube 84 and the fuel injection valve device 82 all together through the bolt insertion hole 92.

[0052] As described above, the fuel injection system 10c of this embodiment is structured such that the flange portion 94 formed in the joint 90 fixes the fuel supply tube 84 and the fuel injection valve device 82 all together to the intake pipe 14. This makes it possible to prevent the fuel supply tube 84 from shaking or rattling at a node between the fuel supply tube 84 and the fuel injection valve device 82, for example, to omit an operation of fixing the fuel hose 17 to a predetermined member of the internal combustion engine. Further, the flange portion 48 can be omitted, so the fuel injection valve device 82 can be simplified in shape. A manufacturing cost of the fuel injection valve device 82 can be further reduced.

[0053] As set forth above, the present invention is described based on the respective embodiments. However, the present invention is not limited thereto but may adopt various other modifications without departing from the scope of the invention.

[0054] For example, as the fuel hose 17, any hose can be used without particular limitations insofar as having characteristics required of a fuel hose for passing a fuel such as gasoline. However, the layered structure of the tube 17a, the inner tube 17b, and the protective tube 17c described in the above embodiment is preferred. Further, the fuel hose 17 and the fuel supply tubes 18 and 84 may be made of any resin material without particular limitations. A polyamide resin and a fluororesin can be preferably used.

[0055] Further, the fuel injection valve device 16 is attached to the intake pipe 14, but the present invention is not limited thereto. The nozzle portion 30 of the fuel injection valve device 16 can be directly attached to a cylinder head or the like of the combustion chamber to be directed to the intake path to the combustion chamber.

Reference numerals

[0056]

10a, 10b, 10c... Fuel injection system
12... Mounting hole
16, 72, 82... Fuel injection valve device
18, 84... Fuel supply tube
22... Throttle valve
26... Screw portion

30... Nozzle portion
34... Injection port
38, 54... Flow path
46... Fuel hose insertion portion
50, 78, 92... Bolt insertion hole
14... Intake pipe
17... Fuel hose
20... Intake path
24... Bolt
28, 74, 86... Housing portion
32... Connection tube
36... Valve element
44, 90... Joint
48, 94... Flange portion
80... Flange plate

Claims

1. A fuel injecting system (10a, 10b, 10c) comprising:
 - a fuel hose (17);
 - a fuel supply tube (18; 84) having one end integrally connected with the fuel hose (17);
 - a fuel injection valve device (16; 72; 82) provided with a nozzle portion (30) having an injection port (34) for supplying a fuel introduced from a fuel tank through the fuel hose (17) to a combustion chamber of an internal combustion engine through a connection tube (32) and connected with the other end of the fuel supply tube (18; 84); and
 - an intake path (20) communicating with the combustion chamber,
 - the nozzle portion (30) being attached toward the intake path (20).
2. The fuel injection system according to Claim 1, wherein the fuel injection valve device (16; 72; 82) has a flow path (38; 54) for supplying a fuel introduced through the connection tube (32) to the injection port (34), and a housing portion (28; 74; 86) provided with the connection tube (32) at one end in an axial direction of the flow path (38; 54), and with the nozzle portion (30) at the other end, and the fuel supply tube (84) or the housing portion (28; 74) has a flange portion (94; 48; 80), and the fuel injection valve device (16; 72; 82) is fixed to the intake path (20) through the flange portion (94; 48; 80).
3. The fuel injection system according to Claim 1 or 2, wherein the fuel hose (17) and the fuel supply tube (18; 84) are made of a resin material.
4. The fuel injection system according to any one of Claims 1 to 3, wherein the fuel hose (17) and the fuel supply tube (18; 84) are integrally connected through a press-

fitting process.

5. The fuel injection system according to any one of Claims 1 to 4,
wherein the fuel supply tube (18; 84) and the connection tube (32) of the fuel injection valve device (16; 72; 82) are detachably attachable. 5
6. A fuel injection valve device for use in a system according to one of the preceding claims, comprising: 10
- a connection tube (32) connected with one end of a fuel supply tube (18; 84) the other end of which is integrally connected with a fuel hose (17); and 15
- a nozzle portion (30) having an injection port (34) for supplying a fuel introduced from a fuel tank through the fuel supply tube (18; 84) to a combustion chamber of an internal combustion engine through the connection tube (32) and attached to an intake path (20) communicating with the combustion chamber. 20
7. The fuel injection valve device according to Claim 6, wherein the fuel injection valve device has a flow path (38, 54) for supplying a fuel introduced through the connection tube (32) to the injection port (34), and a housing portion (28; 74; 86) provided with the connection tube (32) at one end in an axial direction of the flow path (38; 54), and with the nozzle portion (30) at the other end, and 25
- the housing portion (28; 74; 86) has a flange portion (48; 80; 94) for fixing the fuel injection valve device (16; 72; 82) to the intake path (20). 30
- 35
8. The fuel injection valve device according to Claim 6 or 7,
wherein the connection tube (32) is detachably attachable to the fuel supply tube (18; 84). 40

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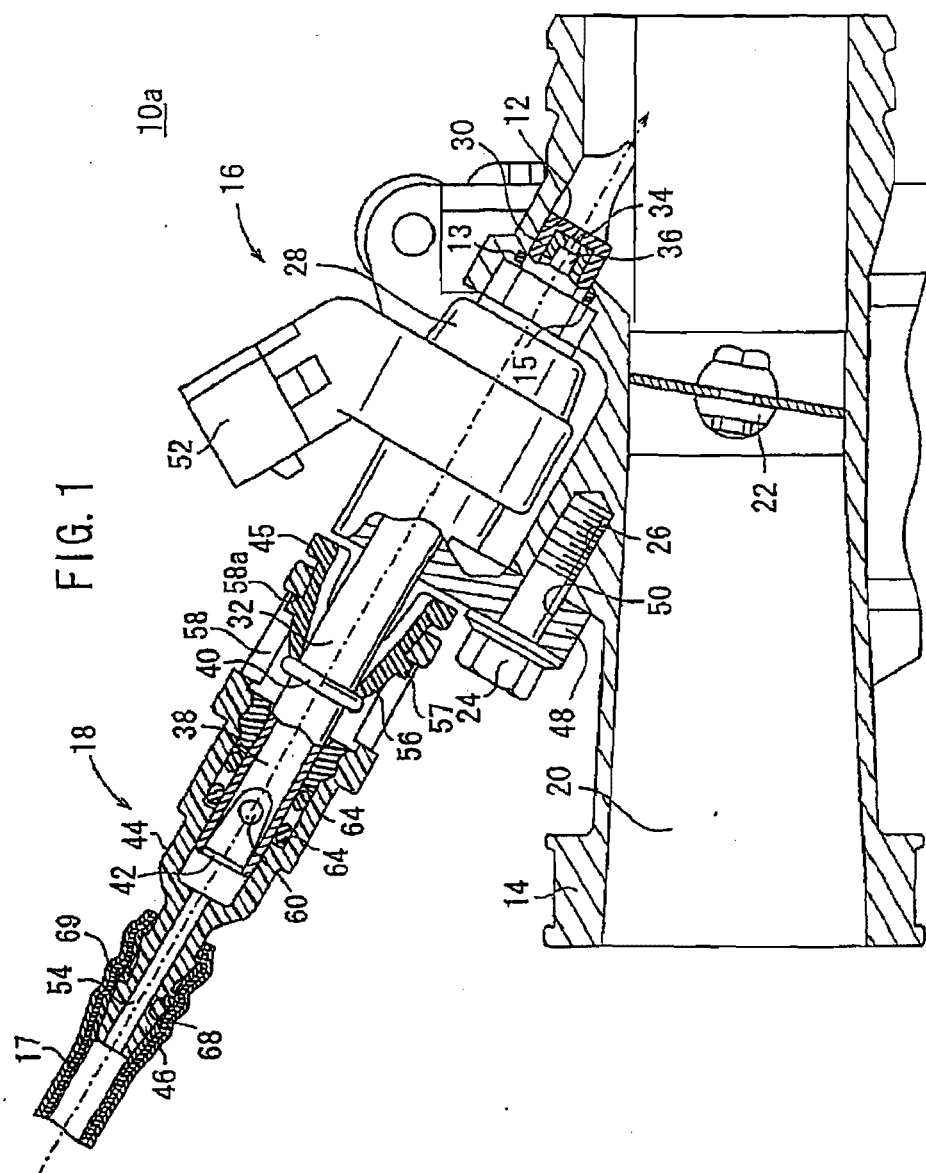


FIG. 2A

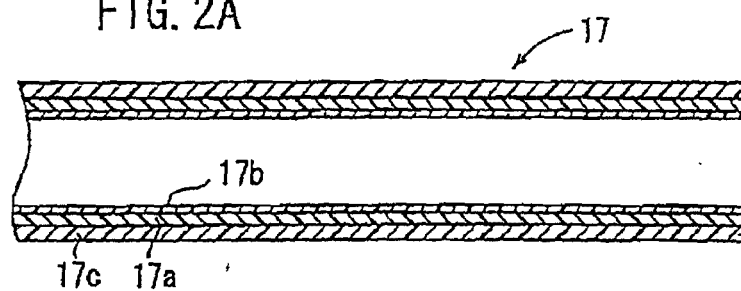


FIG. 2B

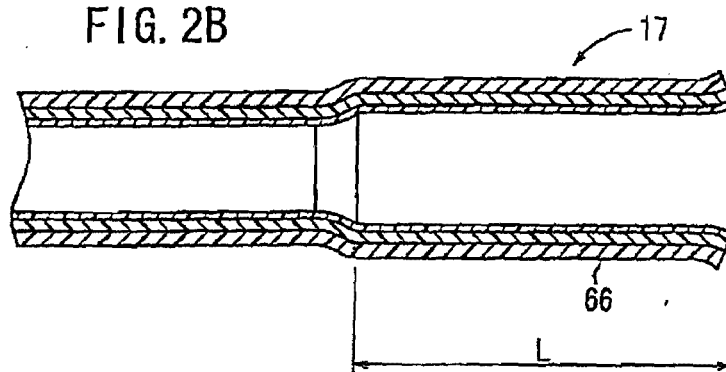


FIG. 3

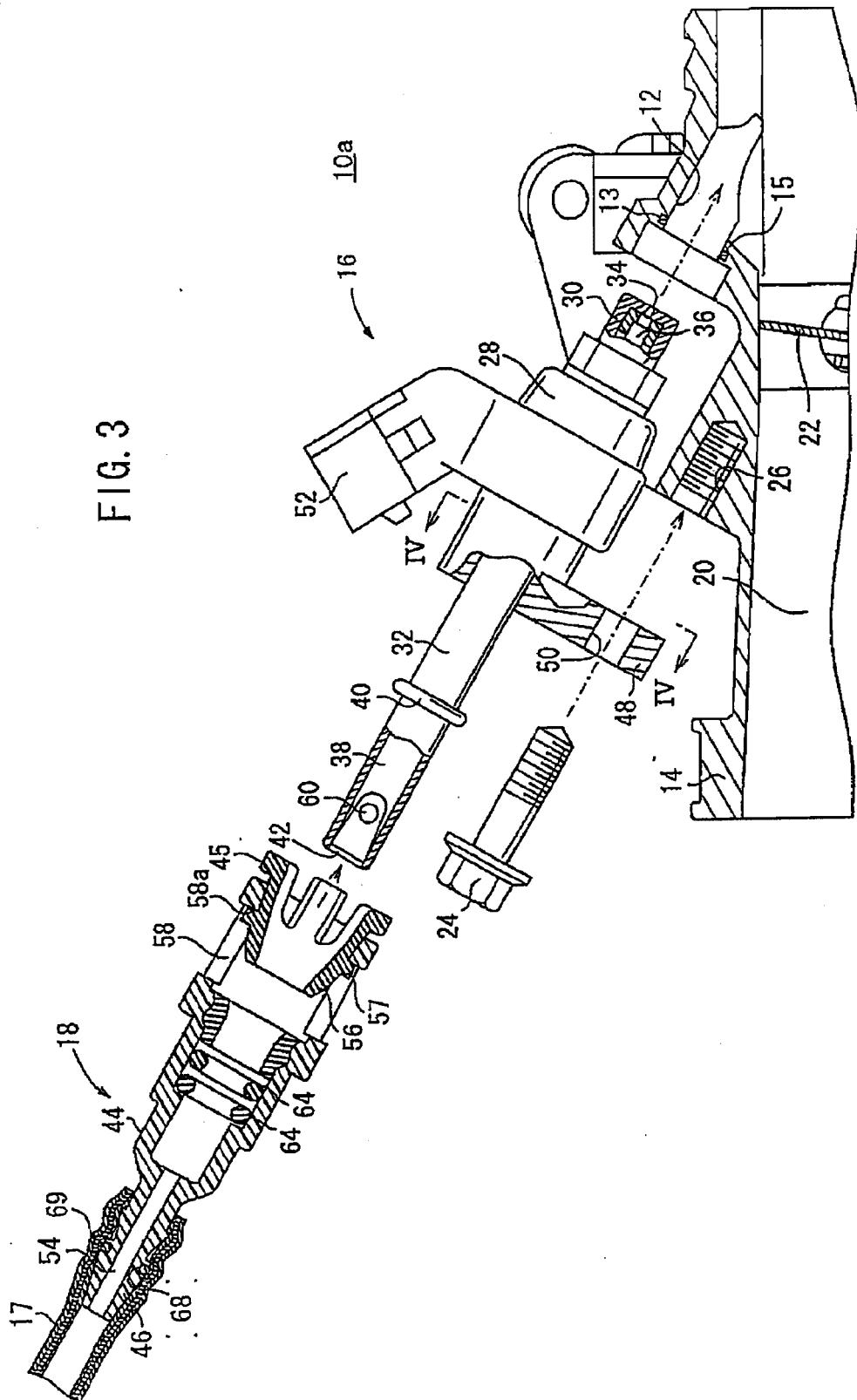
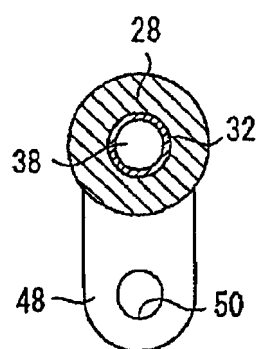


FIG. 4



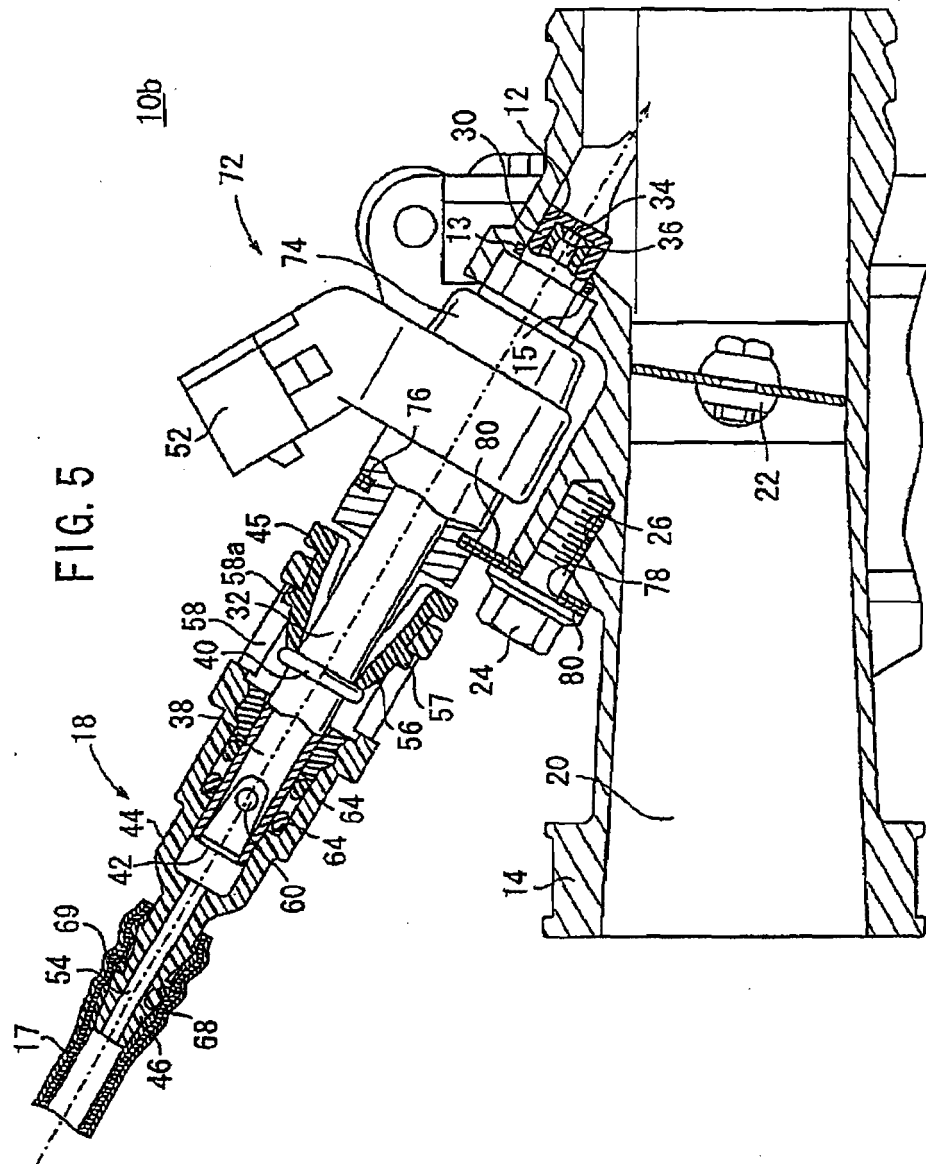


FIG. 6A

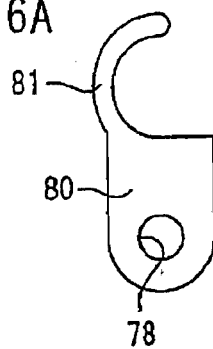


FIG. 6B

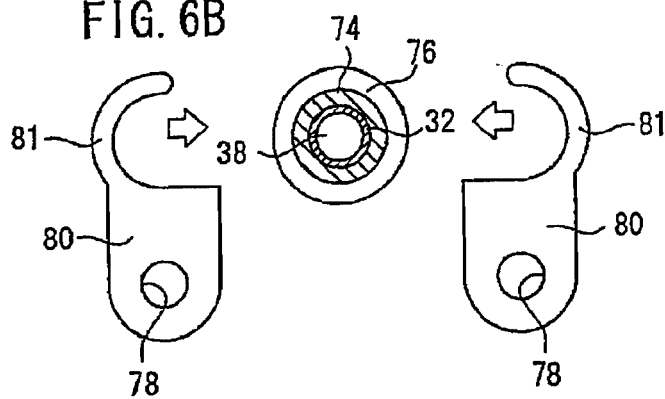
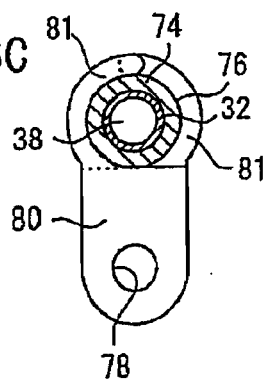
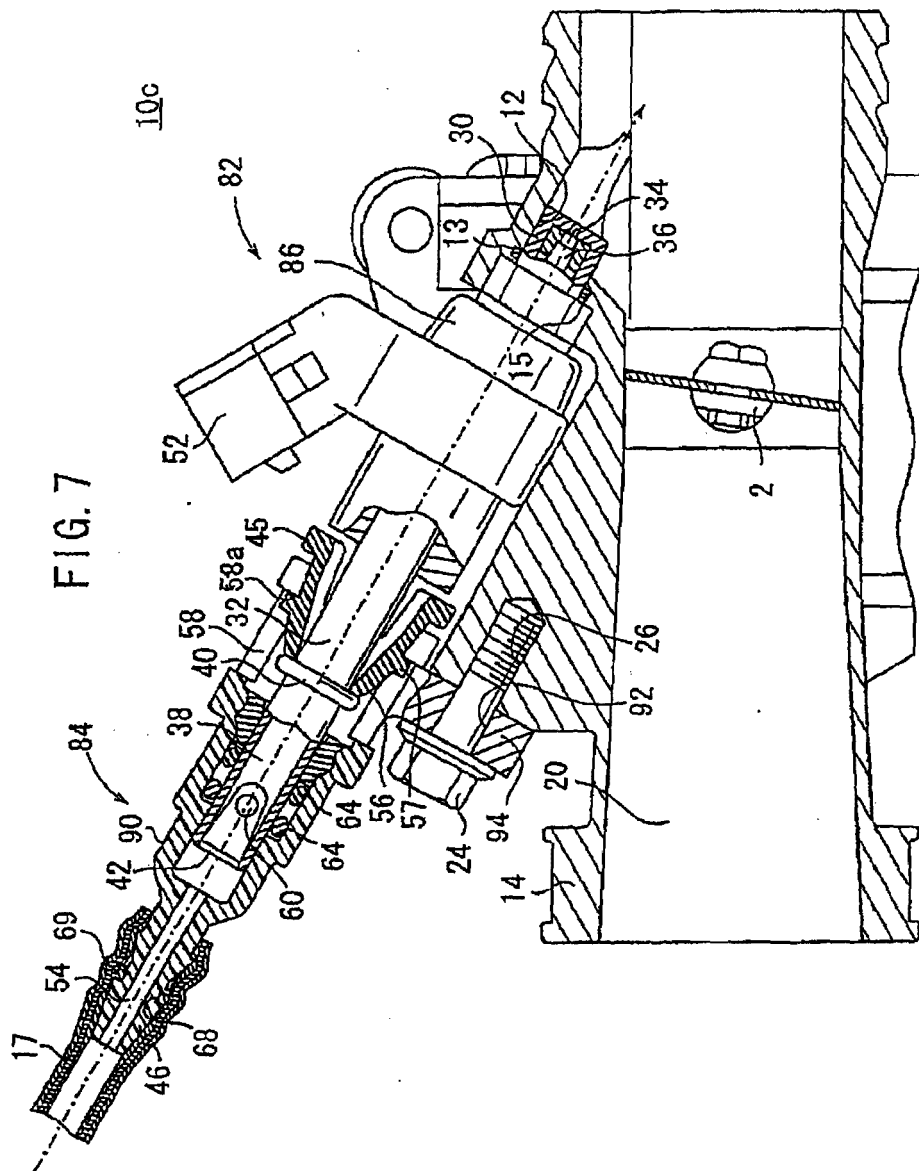


FIG. 6C





REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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