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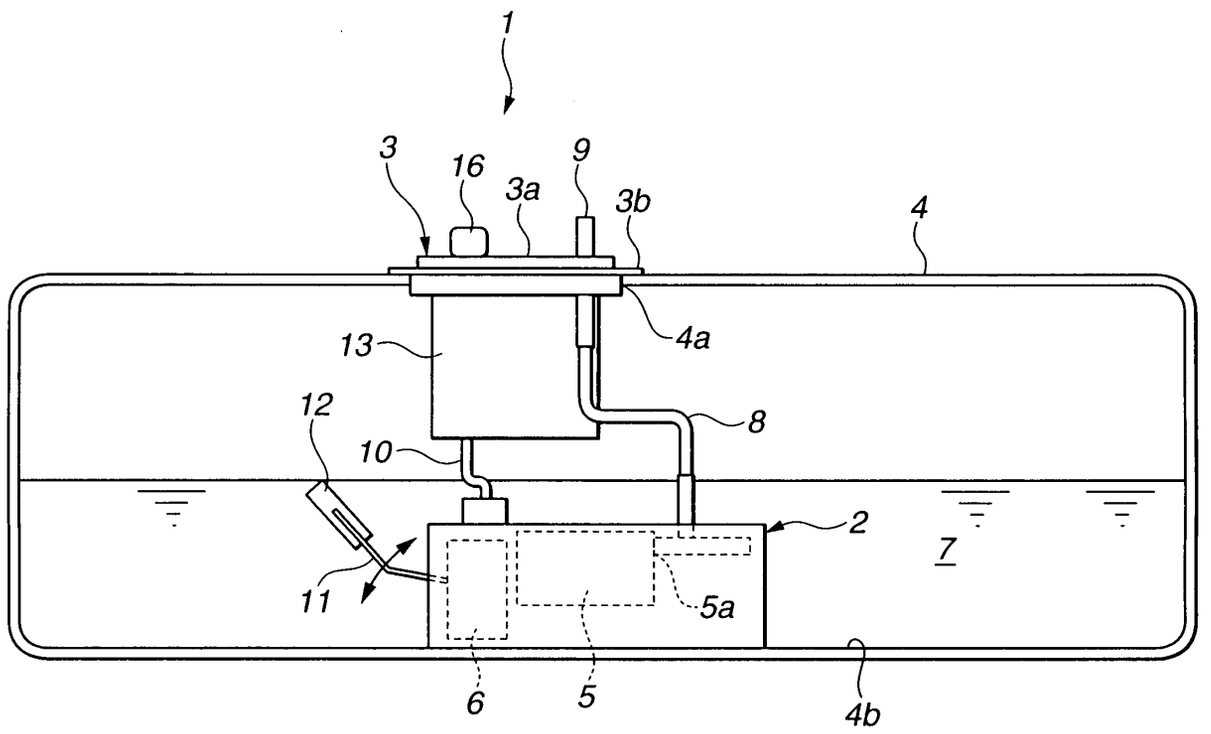
(54) Fuel supply apparatus

(57) In a fuel supply apparatus (1) a fuel pump (5) is disposed in a fuel tank (4) and a fuel tank cover member (3) is disposed at a top portion of the fuel tank. An electronic circuit section (13) is fixedly integrated into the fuel tank cover member (3), and the electronic circuit section (13) includes a pump controlling section that controls the fuel pump (5). Moreover, the electronic circuit section (13) is molded into the fuel tank cover member (3) by using resin.

FIG.1



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Description

BACKGROUND OF THE INVENTION:

a) Field of the Invention

[0001] The present invention relates to a fuel supply apparatus.

b) Description of the Related Art

[0002] Various kinds of fuel supply apparatuses have been previously proposed. A Japanese Patent No. 3371409 issued on November 22, 2002 exemplifies a previously proposed fuel supply apparatus which is equipped with a fuel pump in an integrated fashion and is attached as a cover (or, a lid) of a fuel tank so as to cover and close an opening of a top (or, upper) surface of the fuel tank. The fuel pump is disposed inside the fuel tank and serves to suck fuel inside the fuel tank and deliver the sucked fuel to outside of the fuel tank.

[0003] Furthermore, a top surface of this previously proposed fuel supply apparatus has a recess portion. A fuel pump controller acting as a control circuit for the fuel pump is inserted into the recess portion from outside of the fuel tank in a removable fashion.

SUMMARY OF THE INVENTION:

[0004] In the previously proposed fuel supply apparatus disclosed in the above-described Japanese Patent, the pump controller can be inserted/removed from/to outside of the fuel tank. However, the recess portion for inserting the fuel pump controller needs to be produced at the top surface of the cover. Moreover, a connector for electrically connecting the fuel pump controller to the fuel pump also needs to be provided to a deep part of the recess portion. Hence, there is the problem that a cost of manufacturing is increased due to increased expense in time and effort for manufacturing the above-described previously proposed fuel supply apparatus.

[0005] It is, therefore, an object of the present invention to provide a fuel supply apparatus which is capable of reducing expense in time and effort for manufacturing and reducing a cost of manufacturing when an electronic circuits which includes at least a pump controlling section that controls a motion of a fuel pump is installed to the fuel supply apparatus.

[0006] According to one aspect of the present invention, there is provided a fuel supply apparatus, comprising: a fuel pump disposed in a fuel tank; and a fuel tank cover member disposed at a top portion of the fuel tank, an electronic circuit section being fixedly integrated into the fuel tank cover member, the electronic circuit section including a pump controlling section that controls the fuel pump.

[0007] The other objects and features of this invention will become understood from the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

[0008] Fig. 1 is a side view of a fuel supply apparatus in a preferred embodiment according to the present invention.

[0009] Fig. 2 is a perspective view of a fuel tank cover member in the fuel supply apparatus shown in Fig. 1.

[0010] Fig. 3 is a perspective view of an electronic circuit section which is integrated into the fuel tank cover member included in the fuel supply apparatus in the embodiment according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0011] Reference will hereinafter be made to the drawings in order to facilitate a better understanding of the present invention. In this preferred embodiment according to the present invention, a fuel supply apparatus which is installed inside a fuel tank for the vehicle equipped with an internal combustion engine is exemplified.

[0012] Fig. 1 is a side view largely representing a configuration of the fuel supply apparatus which is installed inside the fuel tank. Fig. 2 is a perspective view representing a fuel tank cover member in the fuel supply apparatus. Fig. 3 is a perspective view of an electronic circuit section which is integrated into the fuel tank cover member.

[0013] A fuel supply apparatus 1 according to this embodiment includes a fuel pump module 2 and a fuel tank cover member 3 (namely, a cover member for a fuel tank).

[0014] Fuel pump module 2 is installed (or, disposed) in contact with a bottom surface 4b of a fuel tank 4. Fuel pump module 2 includes, for example, a fuel pump 5 and a liquid-level sensor 6 in an integrated fashion (namely, fuel pump 5 and liquid-level sensor 6 are integrated into fuel pump module 2).

[0015] Fuel pump 5 sucks a fuel 7 reserved within fuel tank 4 and delivers (or discharges) the sucked fuel from an outlet port 5a. The fuel discharged from outlet port 5a is transferred to outside of fuel tank 4, namely, to a fuel injection valve of an internal combustion engine via a tube 8 and a pipe 9 which is projecting from an upper surface of fuel tank cover member 3. This fuel pump 5 is an electrically powered pump integrated with a motor. Operation of fuel pump 5 is controlled by a pump controlling section (not shown) installed in an electronic circuit section 13 as will be described later.

[0016] Liquid-level sensor 6 includes an arm 11 which can swing, and a float 12 connected to an end of arm 11. Liquid-level sensor 6 detects a remaining quantity of fuel 7 inside fuel tank 4 by detecting a swing angle of arm 11 in accordance with a position of float 12 which is floating on fuel 7. For example, if a resistance of a

predetermined electronic circuit is configured so as to vary according to the swing angle of arm 11, liquid-level sensor 6 can detect the swing angle of arm 11, namely, a height of a liquid level of fuel 7 by detecting the resistance.

[0017] Fuel tank cover member 3 is attached to fuel tank 4 so as to cover and close (or, put a lid on) an opening portion 4a defined by a top (or, upper) surface of fuel tank 4 (i.e., an opening portion 4a in a top portion of fuel tank 4). This fuel tank cover member 3 includes a base portion 3a whose thickness is predetermined (for example, several centimeters), a flange 3b overhanging around (or, surrounding) base portion 3a by a predetermined width (for example, several centimeters), and electronic circuit section 13 which is projecting and extending from underside of base portion 3a to a downward direction, namely into inside of fuel tank 4. Moreover, pipe 9 for delivering the fuel and a connector 16 for attaining an electrical connection between inside and outside of fuel tank 4 are provided to an upper surface of base portion 3a exposed to outside of fuel tank 4.

[0018] As shown in Fig. 3, various kinds of circuit components 15 and connector 16 and others are mounted on a surface or an edge of a (circuit) board 14 in electronic circuit section 13. Electronic circuit section 13 includes electrical circuits which control electrical equipments (namely, fuel pump 5 and liquid-level sensor 6 and so on) inside fuel tank 4. In this embodiment, electronic circuit section 13 includes at least a pump controlling section (not shown) which controls (a motion of) fuel pump 5 and a detection processing section (not shown) which processes signals detected by liquid-level sensor 6. In addition, electronic circuit section 13 is electrically connected to circuits installed inside fuel pump module 2 via a harness 10 within fuel tank 4. Hence, motion control signals from electronic circuit section 13 to fuel pump 5 and signals detected by liquid-level sensor 6 are transmitted through harness 10. On the other hand, electronic circuit section 13 is electrically connected to electrical circuits disposed outside fuel tank 4 (for example, ECU) via connector 16 installed at upper side of electronic circuit section 13.

[0019] In this embodiment, as shown in Fig. 2, fuel tank cover member 3 is molded, in an integrated fashion, by resin (insulation resin) which coats (or, wraps) electronic circuit section 13 of Fig. 3. That is to say, almost all surface of electronic circuit section 13 is coated (or, covered) with the resin which forms base portion 3a, flange 3b and others of fuel tank cover member 3, although some electrical connection parts such as connector 16 are not coated.

[0020] In the related art, the recess portion for inserting the electronic circuit section in a removable fashion needs to be produced on the fuel tank cover member, and (for example) a connector for electrically connecting the electronic circuit section to the fuel pump also needs to be provided to the deep part of the recess portion. However, in this embodiment as described above, electronic circuit section 13 is integrated into and fixed into fuel tank cover member 3 (i.e., is fixedly integrated into fuel tank cover member 3). Hence, such recess portion and connector are not necessary in this embodiment. Thereby, an expense in time and effort for manufacturing is reduced and a cost of manufacturing can be reduced.

[0021] Moreover, in this embodiment, electronic circuit section 13 is molded into and integrated into fuel tank cover member 3 by resin forming. Hence, (for example) a seal member for preventing atmosphere within fuel tank 4 or outside air from entering into electronic circuit section 13 is not necessary to be attached separately. Thereby, an expense in time and effort for manufacturing is reduced and a cost of manufacturing can be reduced.

[0022] Furthermore, electronic circuit section 13 is disposed within fuel tank 4 in this embodiment. Hence, fuel tank 4 can protect electronic circuit section 13 from receiving a damage, even if, for example, a vehicle collision happens.

[0023] In the above-described (first) embodiment, fuel pump module 2 and fuel tank cover member 3 are configured separately each other. In a second preferred embodiment, a fuel tank cover member is configured as a fuel pump module which includes a fuel pump and others. This second embodiment can be also achieved according to the present invention and, has same advantages as those of the above-described (first) embodiment.

[0024] The other advantages and preferable technical issues with respect to the above-described embodiments will now be explained.

[0025] In the fuel supply apparatus according to the above-described embodiments, it is favorable that the board of the electronic circuit section is disposed in a vertical direction (i.e., a direction along with the surface of the board is a vertical direction). In this case, an end portion of the electronic circuit section is disposed at a lower position of the fuel tank. Hence, the harness between the electronic circuit section and the electrical equipments inside the fuel tank can be formed in a shorter shape. Moreover, especially when some components in addition to the electronic circuit section are installed in the fuel tank cover member, a layout for these components is more flexible than a case where the board of the electronic circuit section is disposed in a horizontal direction or an inclined direction. Hence, the fuel tank cover member can be configured (or, designed) to be more compact and lightweight.

[0026] Next, in the fuel supply apparatus according to the above-described embodiments, it is favorable that the electronic circuit section is molded (or, covered) after the electronic circuit section is equipped with the connectors for electrically connecting the electronic circuit section to the circuits outside the fuel tank. In this case, the connection is more assuredly performed, and an expense in time and effort for manufacturing and a cost of

manufacturing can be more reduced than a case where the connectors are installed in the electronic circuit section after the electronic circuit section is molded (or, covered).

[0027] This application is based on a prior Japanese Patent Application No. 2004-179583 filed on June 17, 2004. The entire contents of this Japanese Patent Application No. 2004-179583 is hereby incorporated by reference.

[0028] Although the invention has been described above with reference to certain embodiments of the invention, the invention is not limited to the embodiments described above. Modifications and variations of the embodiments described above will occur to those skilled in the art in light of the above teachings. The scope of the invention is defined with reference to the following claims.

Claims

1. A fuel supply apparatus, comprising:

a fuel pump (5) disposed in a fuel tank (4); and a fuel tank cover member (3) disposed at a top portion of the fuel tank (4), an electronic circuit section (13) being fixedly integrated into the fuel tank cover member (3), the electronic circuit section (13) including a pump controlling section that controls the fuel pump (5).

2. A fuel supply apparatus as claimed in claim 1, further comprising a liquid-level sensor (6) that detects a remaining quantity of fuel (7) inside the fuel tank (4).

3. A fuel supply apparatus as claimed in any one of the preceding claims 1 and 2, wherein the electronic circuit section (13) controls an electrical equipment (5, 6) inside the fuel tank (4).

4. A fuel supply apparatus as claimed in claim 2, wherein the electronic circuit section (13) includes the pump controlling section and a detection processing section that processes signals detected by the liquid-level sensor (6).

5. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 4, wherein the electronic circuit section (13) includes a circuit board (14) and circuit components (15) mounted on the circuit board (14).

6. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 5, wherein the fuel tank cover member (3) covers an opening portion (4a) at the top portion of the fuel tank (4).

7. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 6, wherein the fuel tank cover member (3) covers an opening portion (4a) defined by a top surface of the fuel tank (4).

8. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 7, wherein the fuel tank cover member (3) is provided with a pipe (9) to deliver a fuel and a connector (16) to attain an electrical connection between inside and outside of the fuel tank (4).

9. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 8, wherein the electronic circuit section (13) is electrically connected to the fuel pump (5) via a harness (10) within the fuel tank (4).

10. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 9, wherein a resin is used in order to integrate and fix the electronic circuit section (13) into the fuel tank cover member (3).

11. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 10, wherein the electronic circuit section (13) is fixedly integrated into the fuel tank cover member (3) in such a way that the electronic circuit section (13) is coated with a resin which forms the fuel tank cover member (3).

12. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 11, wherein the electronic circuit section (13) is molded into and integrated into the fuel tank cover member (3) by means of resin forming.

13. A fuel supply apparatus as claimed in any one of the preceding claims 1 through 12, wherein the electronic circuit section (13) is disposed inside the fuel tank (4).

FIG.1

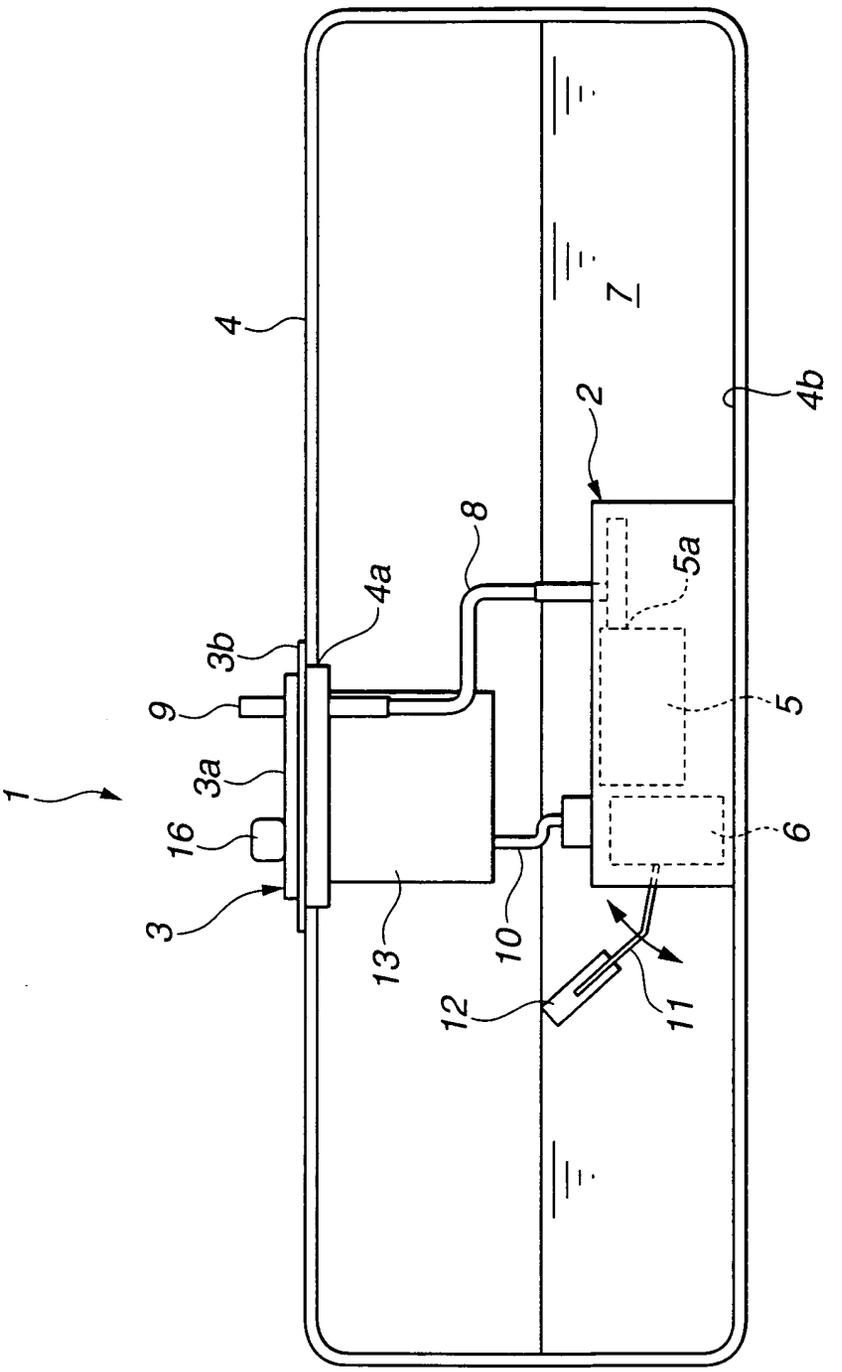

FIG.2

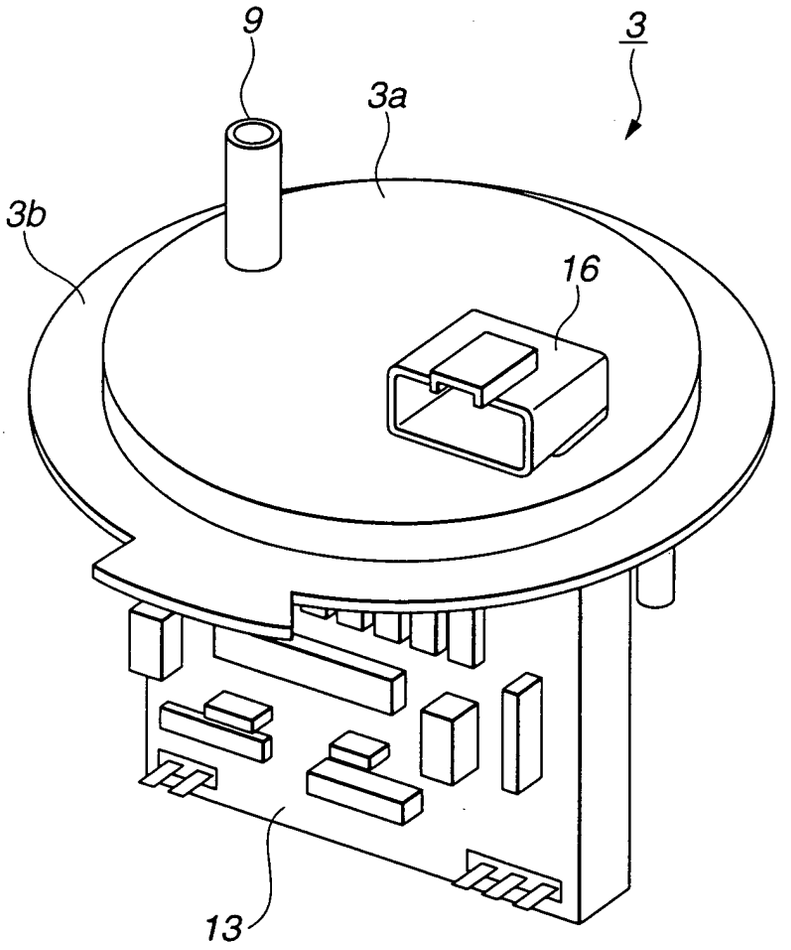

FIG.3