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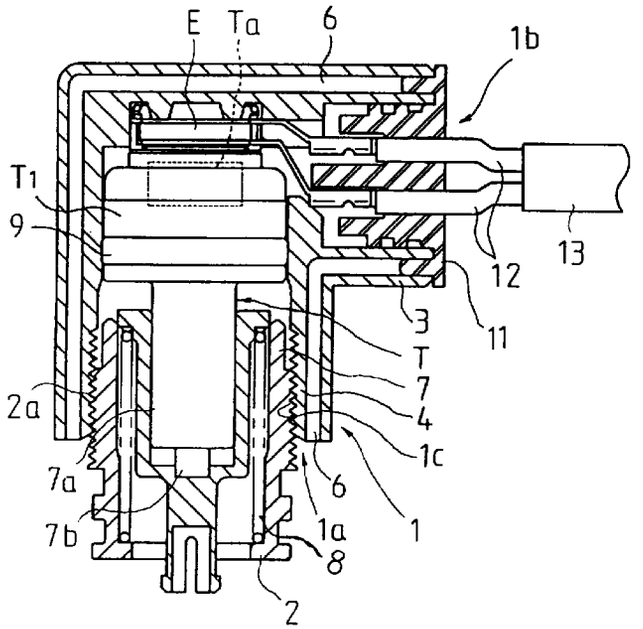
(54) Automatic starter for engine

(57) The present disclosure concerns an improved automatic starter for an engine designed to make a compact construction with fewer parts by eliminating a conventional thermally insulating cover and to enable smooth re-starting of the engine. The automatic starter comprises a case body 1 in which a heating means E having a thermo-element T with a piston 7b moving with thermal expansion and contraction of a thermally expanding unit Ta is housed to regulate fuel supply for stable arrangement and electric contact of the parts. The case body 1 is formed with a hollow 6 to divide the wall of the case body into an inner wall 4 and an outer wall 3 for thermal insulation and the hollow 6 can be filled with a thermally insulating material for excellent thermal insulation.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

a) Field of the Invention

The invention concerns an improved automatic starter provided on engines installed in motorcycles, motor scooters, automobiles, etc. In particular, the present invention concerns a compact automatic starter having an excellent thermal insulation around a thermo-element provided in the automatic starter for the engines.

b) Description of Related Art

In an engine using gasoline as fuel which is mixed with air at a fixed fuel-to-air ratio by a carburetor installed on the engine to feed into cylinders of the engine, an automatic starter is normally provided on the engine in order to ease starting the engine smoothly in a cold morning. The automatic starter is to increase the fuel-to-air ratio for better ignition of a gas mixture of the fuel and the air in the cylinders at low temperatures of the engine by actuating a valve to open a fuel-supply-inlet of an auxiliary fuel passageway provided along a gas mixture passageway to add fuel to the gas mixture flowing in the gas mixture passageway.

When the temperature of the engine reaches a predetermined operating temperature, the fuel-supply-inlet of the auxiliary fuel passageway is closed to return the fuel-to-air ratio to normal automatically.

The applicant previously proposed a type of automatic starter in Japanese Patent Application No. Hei 5-253360. In the type of the automatic starter, the valve is actuated by means of a thermo-element in which a thermally expanding unit expanding and contracting with a change in the temperature is included to open and close a fuel-supply-inlet.

The expansion and contraction of the thermally expanding unit move a piston to actuate a needle valve for opening and closing the fuel-supply-inlet.

While the temperature around the thermally expanding unit of the automatic starter is low at the beginning of starting the engine, the thermally expanding unit is contracted to keep the piston having the needle valve away from the fuel-supply-inlet and remain open toward the auxiliary fuel passageway.

After the engine is warmed up above a predetermined temperature, the fuel-supply-inlet should be closed forcibly by the needle valve The automatic starter is provided with a heating element on one side of the thermo-element to heat up the heating element with heat generated by electric current when a key-switch is turned on to expand the thermally expanding unit and move the piston having the needle valve to shut off the fuel supply by closing the fuel-supply-inlet.

If the thermal insulation of the thermally expanding unit of the automatic starter is poor, the thermally expanding unit remains contracted and the fuel-supply-inlet is kept open to supply excessive fuel to the gas mixture passageway. As a result, the engine cannot be restarted smoothly for a few minutes after the engine is turned off. For this reason the conventional automatic starters are provided with a thermally insulated cover each over the outer surface of the case body.

However, the thermally insulated cover over the outer surface of the case body makes the automatic starter larger and requires much works for the assembly of the automatic starter with a higher cost. A larger automatic starter hinders a freedom in designing of a compact motor scooter which requires as large compartment underneath the seat as possible for storing some items therein.

Summary of the Invention

An objective of the present invention is to eliminate the thermally insulated cover provided over the outer surface of the case body of the automatic starter in order to obtain a compact automatic starter through fewer parts assembly and a greater freedom in designing of a compact motor scooter, etc.

Another objective of the present invention is to improve the thermal insulation of the thermally expanding unit of the thermo-element to enable smooth re-starting of the engine.

The automatic starter according to the present invention is provided with a thermally expanding unit, which expands and contracts with a change in the outer temperature, on one side and a piston on the other side of a thermo-element which moves the piston forward and backward. A heating unit is provided on the one side of the thermo-element to forcibly move the piston. The heating unit is heated up by electric current turned on with starting the engine to expand the thermally expanding unit and move the piston to close a fuel-supply-inlet of an auxiliary fuel passageway provided along a gas mixture passageway supplying the gas mixture to the engine.

The automatic starter according to the present invention as set forth above is formed with a hollow in the wall of the case body of the automatic starter in which the thermo-element is housed. The wall of the case body is divided into an inner wall and an outer wall to form the hollow between the inner wall and the outer wall and a thermal insulation is provided in the hollow, thereby thermal conduction from the inner wall to the outer wall is reduced.

The automatic starter according to the present invention can reduce the heat radiation from the surface of the case body more effectively by filling the air, a liquid or a solid insulating material in the hollow formed in the case body.

Hence, the thermal insulation over the thermo-element can be achieved without the thermally insulated cover over the outer surface of the case body and thus the construction of the automatic starter can be more compact and less costly,

The automatic starter according to the present invention is provided with an excellent thermal insulation and therefore the automatic starter can also eliminate the difficulty in restarting the engine for a few minutes after the engine is turned off by preventing an excess supply of the fuel.

Other advantages of the automatic starter according to the present invention are fewer parts assembly and a compact construction with less cost as well as a greater freedom in designing of a compact motorcycle or motor scooter.

Brief Description of the Drawing

Figure 1 is a drawing showing a sectional side view of the automatic starter according to the present invention.

Figure 2 is a plan drawing of the automatic starter according to the present invention.

Description of the Preferred Embodiments

The preferred embodiments of this invention are described hereunder by referring to the accompanying drawings.

A case body 1 is a cylinder bended in an L-shape with both ends open having a heavy thickness. An opening 1a of the one end of the case body 1 is provided with a thread 1c and a rubber grommet 11 is coupled into an opening 1b of the other end of the case body 1 to prevent an entry of water or dust, etc. The opening 1a is coupled with a cylindrical holder 2 on the outer surface of which a screw 2a is formed tomate with the thread 1c. A thermo-element T moving a needle valve is included in the case body 1 and is held therein by the holder 2 not to remove therefrom.

The inner diameter of the case body 1 is tapered wider toward the opening 1a for easy insertion of the thermo-element T and a bottom 1e is provided at the one end of the thermo-element T in which a thermal sensor T having a thermally expanding unit Ta is provided. The portion where the inner diameter of the case body 1 varies is formed with a moderate slope 1d to guide the thermo-element T into the case body 1.

An O-ring 9 is mounted on the outer surface of the thermal sensor T. The thermo-element T is prevented from lateral movement in the case body by pushing the O-ring against the inner suface of the case body 1 as well as for the prevention of an entry of gasoline, etc.

A heating means E having 2 electrodes and a heating element pinched between the 2 electrodes is provided between the thermal sensor T and the bottom 1e of the case body 1.

The heating means E is to forcibly expand the thermally expanding unit Ta and is connected with a key-switch (not shown) of a motor scooter, etc. by lead wires 12 and 12 of the electrodes coming out of the opening 1b through the grommet 11.

Upon insertion of a key into the key-switch (the engine is ready to start), an electric current flows through the heating element to generate heat. A tube protector 13 is to tie the lead wires 12 and 12.

The heating means E is formed with a holder having a cup-shape. A side view of the holder is shown in Fig.1. The 2 electrodes are housed in the holder which is provided with nails and cuts on the edge of the holder in which the heating element is neatly placed and pinched between the 2 electrodes and secured tightly on the cuts by the nails as a mono-block unit. The holder is formed with an electrically insulated and elastic material such as nylon to prevent a displacement or poor contact of the electrodes as well as for ready installation of the heating means E. A piston 7b being moved with the expansion and contraction of the thermally expandng unit Ta is properly guided by a piston guide 7a provided on the other side of the thermo-element T.

The tip of the piston 7b is projected from the end of the piston guide 7a to slide in the hole of the holder 2 and connected with a pushing unit 7 which covers the piston guide 7a and the tip of the piston 7b. The pushing unit 7 is constantly pulled inward in the case body 1 by a spring such as a coil spring 8 and thereby the thermo-element T is pushed against the bottom 1e of the case body 1 to regulate a axial movement of the thermo-element.

The thermally expanding unit Ta is expanded with the heat generated in the heating unit E by the electric current and extend the piston 7b and push the pushing unit 7 out of the case body 1 by opposing the pulling force of the coil spring 8 to close the fuel-supply-inlet with a needle valve (not shown) to shut off the fuel supply. When the electric current to the heating means E is turned off, the temperature surrounding the thermo-element T gradually goes down to contract the thermally expanding unit Ta and the piston 7a moves backward. Then, the pushing unit 7 having the needle valve is pulled back into the case body 1 to open the fuel-supply-inlet for fuel supply.

A hollow 6 is formed in the wall of the case body 1 circumferencially from the one opening 1a to the other opening 1b.

The hollow 6 can be formed together with the case body 1 when the case body 1 is formed through an injection molding process or after the case body 1 is molded the hollow 6 can be formed by an end-milling or an arc-processing. A thermally insulating means is provided in the hollow 6 to prevent the heat around the thermo-element T from radiating from the surface of the case body 1.

Air is most common as a thermal insulator but other solid or liquid thermal insulators such as urethane, foamed styrene, a rubber insulator or oil having low thermal conductivities can be used for effective prevention of the heat radiation from the surface of the case body 1.

The hollow 6 formed in the wall of the case body 1 divides the wall of the case body 1 into an inner wall 4 and an outer wall 3. The inner wall 4 is connected with the outer wall 3 by way of a connector 5. The connector

5 is preferably formed as small as possible within the range of permissible strength so that the thermal conduction from the inner wall 4 to the outer wall 3 can be minimized.

The thermal insulators to prevent the thermal conduction from the inner wall 4 to the outer wall 3 are not limited to such air, urethane, foamed styrene, insulating rubber or oil as set forth in the above preferred embodiments.

For instance, both opening ends of the hollow 6 can be closed and the air is removed therefrom to vacuum the hollow 6 for thermal insulation. Further, a gas such as nitrogen can be charged in the hollow 6 for thermal insulation. Merely closing both opening ends of the hollow 6 can shut off the air movement inward or outward for effective reduction of the thermal conduction from the inner wall 4 to the outer wall 3.

It is to be understood that this invention is not limited to the above description and the appended drawings, but rather various changes and modifications may be made without departing the spirit and scope of the invention.

Claims

1. An automatic starter for an engine comprising:

a thermo-element havng a thermally expanding unit which expands and contracts with a change in the outer temperature provided on one side of the thermo-element and a piston provided on the other side of the thermo-element which moves forward and backward with the expansion and contraction of the thermally expanding unit;

a heating means having an electric heating unit provided on the one side of the thermo-element to forcibly move the piston by heating up the heating unit with an electric current flown upon starting the engine to close a fuel -supply-inlet of an auxiliary fuel passagewy provided along a gas mixture passageway which feeds the gas mixture to the engine; and

a hollow provided in a case body in which the thermo-element is housed to divide the case body into a inner wall and an outer wall and a thermally insulating means is provided in the hollow not to conduct the heat from the inner wall to the outer wall.

2. A heating means comprising:

a holder molded with an electrically insulated and elastic material and having a cup-shape in which 2 electrodes and a heating unit pinched between the 2 electrodes are housed and forming a mono-block unit for an automatic starter for an engine which is comprised of :

a thermo-element havng a thermally expanding unit, which expands and contracts with a change in the outer temperature, provided on one side of the thermo-element and a piston being moved with the expansion and contraction of the thermally expanding unit provided on the other side of the thermo-element;

the heating means provided on the one side of the thermo-element to forcibly move the piston by heating up the heating unit with an electric current flown upon starting the engine to close a fuel-supply-inlet of an auxiliary fuel passagewy provided along a gas mixture passageway which feeds the gas mixture to the engine; and

a hollow provided in a case body in which the thermo-element is housed to divide the case body into a inner wall and an outer wall and a thermally insulating means is provided in the hollow not to conduct the heat from the inner wall to the outer wall.

3. The automatic starter for the engine according to Claim 1, wherein the heating means is a holder molded with an electrically insulating and elastic material and having a cup-shape in which 2 electrodes and a heating unit pinched between the 2 electrodes are housed and forming a monoblock unit.

4. The automatic starter for the engine according to claim 1, wherein the hollow formed between the inner wall and the outer wall of the case body is filled with a thermally insulating material.

5. An automatic starter for an engine comprising:
a thermo-element means having a thermally expanding unit;
a heating means; and
a case body in which the thermo-element means is housed.

FIG. 1

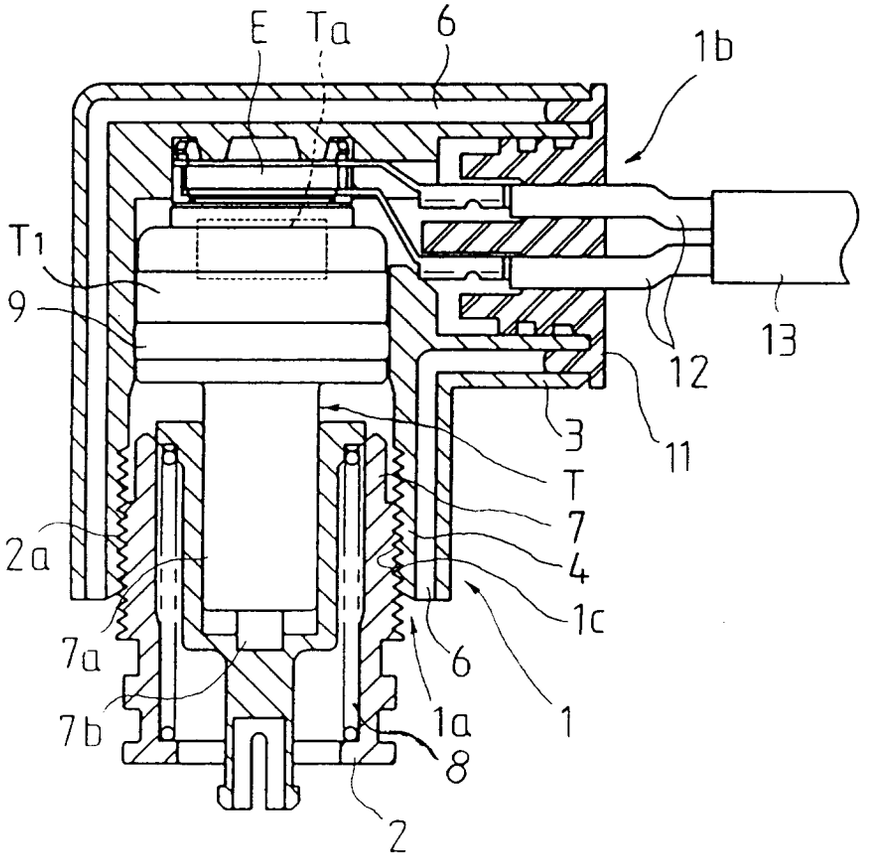
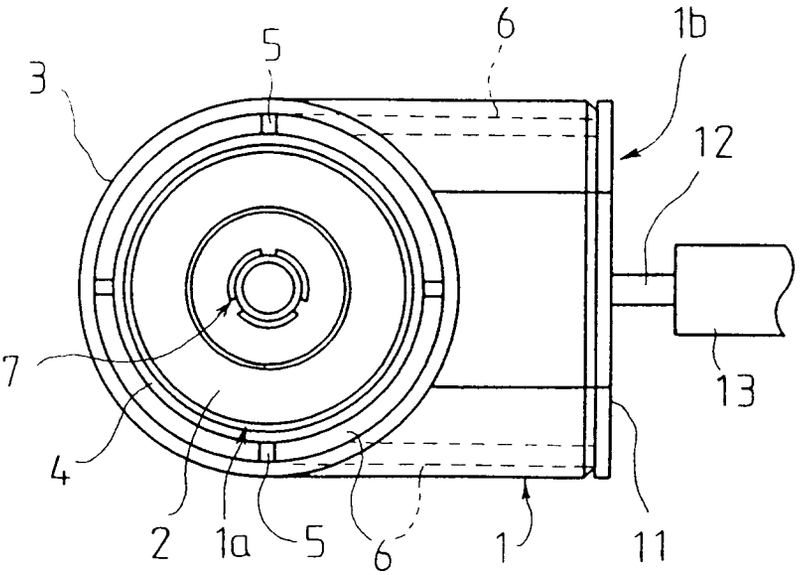

E
Ta
6
1b
T1
9
13
12
11
3
T
7
4
2a
1c
7a
6
7b
1a
1
8
2

FIG. 2


5
6
1b
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12
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1a
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