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71 Applicant: **HITACHI, LTD., 6, Kanda Surugadai 4-chome Chiyoda-ku, Tokyo 100 (JP)**

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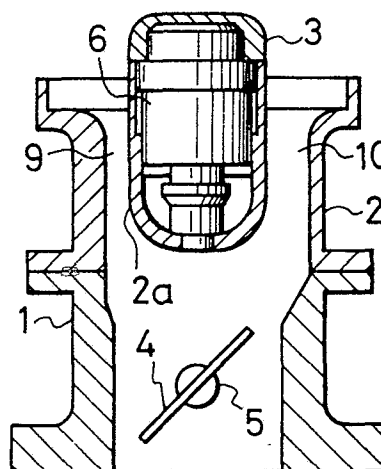
72 Inventor: **Yamada, Kinsaku, 18-14, Higashi-Ooshima 3-chome, Katsuta-shi Ibaraki 312 (JP)**

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74 Representative: **Patentanwälte Beetz sen. - Beetz jun. Timpe - Siegfried - Schmitt-Fumian, Steinsdorfstrasse 10, D-8000 München 22 (DE)**

54 **Fuel injection apparatus.**

57 The injector (6) is positioned at the center line of the injector main body (2). Two apertures (9; 10) are defined in the injector (6), the injector holder (3) and the injector main body (2). The area of the aperture (9) corresponding to the lower side of the throttle valve (4) is smaller than the area of the aperture (10) corresponding to the upper side of the throttle valve (4). The shaft center of the throttle valve shaft (5) is parallel to the center line of the supporting part of the injector holder (3). The inequality of the fuel flow caused by the throttle valve (4) can be reduced so that the equality of the fuel distribution of each cylinder of the automobile engine can be effected.



Title of the Invention:
FUEL INJECTION APPARATUS

Background of the Invention:

5 (Field of the Invention)

The present invention relates to a fuel injection apparatus, and more particularly a fuel injection apparatus suitable for distributing the fuel evenly to each cylinder of an automobile engine.

10 (Description of Prior Art)

As a conventional fuel injection apparatus for which the distribution performance of the fuel is considered, such the fuel injection apparatus for the automobile engine is proposed as described in the Scientific Lecture Meeting Text 841 1984-5 of Japanese Automotive Engineering Association.

The conventional fuel injection apparatus for the automobile engine is constituted with the throttle main body, the throttle valve, the injector provided in the injector housing and the injector holder etc, wherein the offset against the center of the throttle valve is given to the position of the injector.

In the above conventional fuel injection apparatus, the air is introduced through two apertures defined the injector housing, the injector holder and the throttle main body. The areas of the two apertures provided in the throttle main body are equal. However, no consideration is given for the point that the fuel distribution performance is affected by the air flow.

30 In the above conventional fuel injection apparatus, when the throttle valve is opened to 45°-50° or slightly more, the fuel is likely to be concentrated at the side or end which is lower than the shaft center of the throttle valve shaft. In other words, the fuel is likely to concentrated at the portion which is the lower side or
35 the downward side of the throttle valve, or the downstream side from the shaft center of the throttle valve shaft.

This happens not only because the fuel injected by the injector is likely to flow to the lower side due to the inclination of the throttle valve but also because the air is likely to flow in this direction.
5 Consequently, the fuel is more likely to be concentrated at the lower side of the throttle valve.

Summary of the Invention:

10 An object of the present invention is to provide a fuel injection apparatus wherein the fuel can be distributed evenly to each cylinder of the automobile engine.

15 Another object of the present invention is to provide a fuel injection apparatus wherein the satisfactory fuel distribution performance can be facilitated over the whole region of the opening rate of the throttle valve.

20 Further object of the present invention is to provide a fuel injection apparatus wherein the satisfactory fuel distribution performance can be facilitated over 45°-50° or slightly more of the opening rate of the throttle valve.

25 Still object of the present invention is to provide a fuel injection apparatus wherein the fuel can be prevented from being concentrated at one side of the throttle valve.

Furthermore object of the present invention is to provide a fuel injection apparatus wherein the fuel distribution performance is not affected by the air flow.

30 Stillmore object of the present invention is to provide a fuel injection apparatus wherein the fuel is not concentrated at the lower side of the throttle valve by the air flow.

35 The present invention is to provide a fuel injection apparatus which injects a fuel from an upstream side of a throttle valve provided in a suction passage, characterized in that an injector is provided in the

suction passage in such a manner that areas of a pair of sections of the suction passage divided by the injector are unequal, and an axis of the throttle valve is parallel to a center line of a supporting part of the injector.

To prevent the fuel from being concentrated at one side or end, it is effective to move the position of the injector toward the upper side of the throttle valve, namely the injector is not positioned at the center line of the throttle main body. But this method adversely affects the fuel distribution when the throttle valve opening rate is low, because the fuel introduction is one-sided. Therefore, it is preferable that the injector be positioned at the center line of the throttle main body.

The present invention can be reduce the inequality of the fuel flow caused by the throttle valve in the wide range of opening rates of the throttle valve so that equality of the fuel distribution of each cylinder of the automobile engine can be effected.

Brief Description of the Drawings:

Fig. 1 is a plan view of a fuel injection apparatus which shows one embodiment of the present invention;

Fig. 2 is a sectional view taken along a line II-II of Fig. 1; and

Fig. 3 is a sectional view taken along a line III-III of Fig. 1.

Detailed Description of the Preferred Embodiments:

One embodiment of a fuel injection apparatus of the present invention will be hereinunder described with reference to Figs. 1 to 3.

An injector main body 2 is installed above a throttle valve main body 1 as shown in Fig. 2. An injector housing 2a is usually constructed solidly with the injector main body 2. The injector housing 2a is

maintained by an injector holder 3. The injector holder 3 is installed with the injector main body 2 and is positioned at the center line of the injector main body 2.

5 A throttle valve 4 is provided in the throttle valve main body 1 and provided in a suction passage by a throttle valve shaft 5. The shaft center of the throttle valve shaft 5 is arranged to be parallel of the axial direction of the injector holder 3.

10 An injector 6 is housed in the injector housing 2a and is positioned at the center line of the injector main body 2. The center line of the supporting part of the injector 6 or the center line of the injector holder 3 is parallel to the axis of the throttle valve 4. The fuel
15 is introduced through a fuel inlet 7 and returned to a fuel tank through a fuel outlet 8 as shown in Fig. 3 and injects the fuel from the upstream side of the throttle valve 4.

A pair of apertures 9 and 10 are defined
20 respectively by the injector housing 2a, the injector holder 3 and the injector main body 2. The injector 6 is provided in the suction passage in such a manner that areas of the sections of the suction passage divided by the injector 6 are unequal.

25 The area of the aperture 9 and the area of the aperture 10 are not equal as shown in Figs. 1 and 2. The area of the aperture 9 corresponding to the lower side or lower end of the throttle valve 4 is smaller than the area of the aperture 10 corresponding to the upper side
30 or upper end of the throttle valve 4.

The proportion of the area of the aperture 9 to the area of the aperture 10 is adapted about 30-40 to about 70-60.

35 The air is introduced through the apertures 9 and 10 defined by the injector housing 2a, the injector holder 3 and the injector main body 2. The quantity of the air is measured by a mass air flow meter and a pressure sensor

etc. The measured air quantity input is processed by a micro-processor and the injector 6 is driven by the output signal therefrom and injects the proper quantity of the fuel.

5 In this embodiment, the area of the aperture 9 and the area of the aperture 10 are not equal and the shaft center of the throttle valve shaft 5 is so arranged as to be parallel to the axial direction of the injector holder 3. Namely, as shown in Figs. 1 and 3, the center line of
10 the supporting part of the injector holder 3 is arranged to the injector main body 2 so as to be parallel and overlap over to the vertical level to the shaft center of the throttle valve shaft 5.

 Accordingly, the rate of the air flows to the
15 apertures 9 and 10 can be accurately controlled respectively in comparison with the conventional constitution of which the center line of the supporting part of the injector holder is intersected in the cross shape to the shaft center of the throttle valve shaft.

20 In the embodiment of the present invention, the air is introduced into the upper side of the throttle valve 4 and the lower side of the throttle valve 4 unequally in order to prevent the fuel from being concentrated at one side or end.

25 The area of the aperture 9 corresponding to the lower side of the throttle valve 4 is smaller than the area of the opposite aperture 10 corresponding to the upper side of the throttle valve 4 so that the air flow is not concentrated at the lower side of the throttle
30 valve 4. Consequently, the fuel is not concentrated at the lower side of the throttle valve 4 by the air flow.

 With the constitution mentioned above embodiment, the problem of inequality of the fuel distribution as the throttle valve 4 is opened is alleviated by making the
35 areas of the apertures 9 and 10 different.

 When the opening rate of the throttle valve 4 is low, the quantity of the air flow is small and the flow

speed is also low, so that the inequality of the air flow has no effect on the fuel distribution performance.

5 In this embodiment, the injector main body 2 and the throttle valve main body 1 are constituted by two component parts, however the injector main body 2 and the throttle valve main body 1 may be constituted integrally with one component part.

Claims:

1. A fuel injection apparatus which injects a fuel from an upstream side of a throttle valve (4) provided in a suction passage, characterized in that
5 an injector (6) is provided in said suction passage in such a manner that areas of a pair of sections (9; 10) of said suction passage divided by said injector (6) are unequal; and an axis of said throttle valve (4) is
10 parallel to a center line of a supporting part of said injector (6).
2. A fuel injection apparatus comprising; a main body (1, 2); a throttle valve shaft (5) provided in said main
15 body (1, 2); a throttle valve (4) mounted on said throttle valve shaft (5); an injector holder (3) provided in said main body (1, 2); an injector (6) maintained by said injector holder (3); and a pair of apertures (9; 10) defined said injector (6), said injector holder (3) and
20 said main body (1, 2) characterized in that
areas of said pair of apertures (9; 10) are unequal; and a shaft center of said throttle valve shaft (5) is parallel to a center line of a supporting part of said injector holder (3).
- 25 3. A fuel injection apparatus according to claim 2, characterized in that
said injector (6) is positioned at a center of said main body (1, 2); and said area of said aperture (9)
30 corresponding to a lower side of said throttle valve (4) is smaller than said area of said aperture (10) corresponding to an upper side of said throttle valve (4).

4. A fuel injection apparatus according to claim 3, characterized in that

said area of said aperture (9) to said area of said aperture (10) is about 30-40 to about 70-60.

5

5. A fuel injection apparatus according to claim 4, characterized in that

10 said main body (1, 2) is constituted to an injector main body (2) and a throttle valve main body (1); said injector holder (3) and said injector (6) are provided in said injector main body (2); and said throttle valve (4) and said throttle valve shaft (5) are provided in said throttle valve main body (1).

FIG. 1

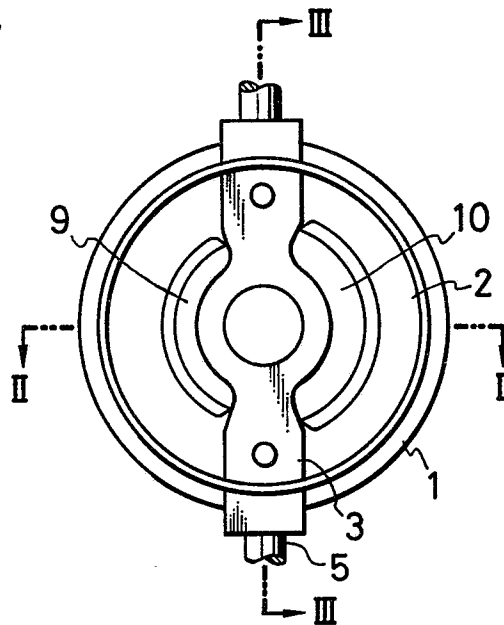


FIG. 2

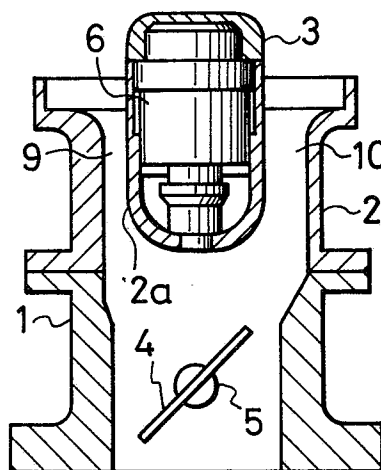


FIG. 3

