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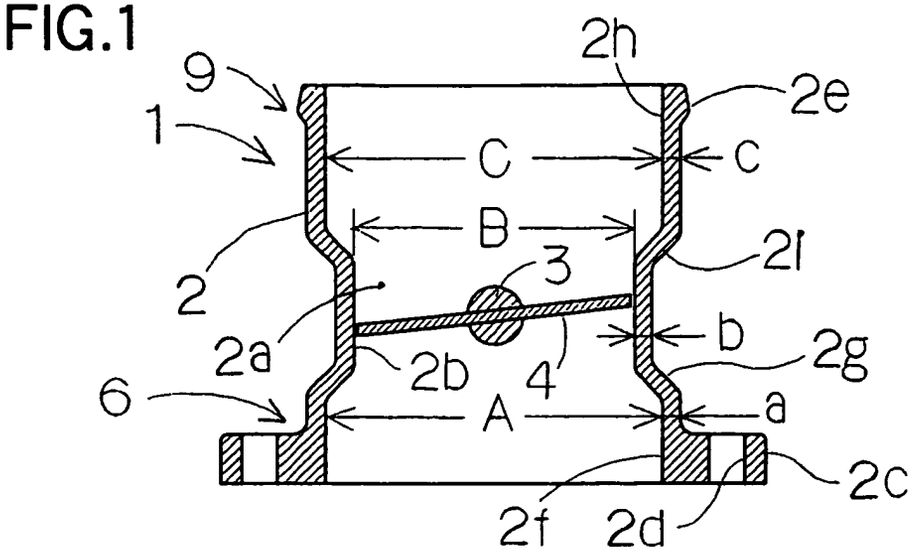
(54) Intake apparatus for internal-combustion engine

(57) An intake apparatus (1) wherein no excessive stress-induced strain occurs in an intake air measuring portion of a throttle body (2) and hence accurate intake air control can be performed when the amount of intake air is small is provided. An air duct hose-side engagement portion (9) and an intake manifold-side engagement portion (6) of the throttle body are provided with enlarged-diameter portions (C,A), respectively, which have an inner diameter larger than the inner diameter of the intake air measuring portion. The enlarged-diameter portions have a wall thickness (c) smaller than the wall thickness (b) of the measuring portion. Accordingly, strain is absorbed by the enlarged-diameter portions and cannot reach the measuring portion. Therefore, no excessive stress-induced strain occurs in the measuring portion, and accurate intake air control can be performed when the amount of intake air is small.

FIG.1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an intake apparatus for an internal-combustion engine. More particularly, the present invention relates to an intake apparatus having a throttle body capable of preventing deformation of an intake air measuring portion during mounting.

2. Discussion of Related Art

[0002] In a fuel injection type internal-combustion engine, as shown in Figs. 4 and 5, a throttle body 31 is molded from a synthetic resin material and has an intake air measuring portion for controlling the amount of intake air. The throttle body 31 is mounted to an intake manifold 32 molded from a synthetic resin material by passing a plurality of bolts 35 through respective mounting holes 34 provided in a flange 33 of the throttle body 31, with a gasket 42 interposed between the flange 33 and the mating flange 37 of the intake manifold 32. Hollow annular fittings 36 capable of withstanding the fastening force of the bolts 35 are inserted into the flange 33 of the throttle body 31 during or after the molding process. Similarly, threaded fittings 38 having internal threads engageable with the bolts 35 are inserted into the flange 37 of the intake manifold 32 during or after the molding process.

[0003] The throttle body 31 has an intake passage 39 with a circular sectional configuration. The intake passage 39 extends through the throttle body 31. A throttle shaft 40 is rotatably fitted across the intake passage 39. A throttle valve 41 is secured to the throttle shaft 40. The throttle valve 41 is opened or closed by pivoting of a throttle lever (not shown) secured to one end of the throttle shaft 40, thereby changing the area of the gap between the outer peripheral portion of the throttle valve 41 and the inner wall of the intake passage 39 in the throttle body 31, and thus controlling the amount of intake air. In this way, the intake air is introduced into the internal-combustion engine.

SUMMARY OF THE INVENTION

[0004] The above-described structure suffers, however, from the following problems. When the throttle body and the intake manifold are formed from a synthetic resin material by injection molding, the flanges may be curved by shrinkage after the molding process, resulting in degradation of the flatness of the mounting surfaces thereof. In a case where the annular fittings are inserted into the flange of the throttle body after the injection molding process, the end surfaces of the annular fittings may tilt undesirably. If the flanges are fastened together with the bolts under these circumstances, a problem occurs as shown in Fig. 5. That is, when the second and subsequent bolts are tightened, the applied tightening force corrects forcedly the disagreement in flatness between the intake manifold mounting surface of the throttle body and the throttle body mounting surface of the intake manifold. Consequently, stress-induced strain occurs in the two mounting parts. The stress-induced strain may extend as far as the intake air measuring portion for measuring the amount of intake air admitted by the throttle valve in the throttle body (hereinafter referred to simply as "measuring portion"), causing the circular sectional configuration of the measuring portion to be deformed to an elliptical shape. In such a case, it may be impossible to accurately measure a small amount of intake air during idling, for example. In the worst case, the throttle valve may fail to operate.

[0005] The above-described phenomenon becomes particularly remarkable when the rigidity of the flange of the intake manifold is higher than the rigidity of the flange of the throttle body.

[0006] Under these circumstances, an object of the present invention is to provide an intake apparatus so structured that when a throttle body made of a synthetic resin material is mounted to an intake manifold or the like, no excessive stress-induced strain occurs in the measuring portion of the throttle body, thereby allowing accurate intake air control to be performed when the amount of intake air is small.

[0007] The present invention made to attain the above-described object is applied to an intake apparatus for an internal-combustion engine that has a throttle body formed with a measuring portion for controlling the amount of intake air. The throttle body is further formed with an air duct hose-side engagement portion for leading intake air to the measuring portion and an intake manifold-side engagement portion for leading the intake air measured at the measuring portion to a combustion chamber. According to the present invention, the air duct hose-side engagement portion and the intake manifold-side engagement portion are provided with enlarged-diameter portions, respectively, which have an inner diameter larger than the inner diameter of the measuring portion. Moreover, the enlarged-diameter portions have a wall thickness smaller than the wall thickness of the measuring portion.

[0008] Preferably, an upstream enlarged portion is formed between the air duct hose-side engagement portion and the measuring portion, and a downstream enlarged portion is formed between the intake manifold-side engagement portion and the measuring portion. Both the upstream and downstream enlarged portions have a wall thickness smaller than the wall thickness of the measuring portion.

[0009] The throttle body of the intake apparatus may be made of a synthetic resin material.

[0010] The present invention offers the following advantageous effects. According to the present invention,

the air duct hose-side engagement portion and the intake manifold-side engagement portion of the throttle body are provided with enlarged-diameter portions, respectively, which have an inner diameter larger than the inner diameter of the intake air measuring portion. Moreover, the enlarged-diameter portions and the enlarged portions between the engagement portions and the enlarged-diameter portions each have a wall thickness smaller than the wall thickness of the measuring portion. Accordingly, strain is absorbed by the enlarged-diameter portions and the enlarged portions and cannot reach the measuring portion. Therefore, no excessive stress-induced strain occurs in the measuring portion, and accurate intake air control can be performed when the amount of intake air is small.

[0011] Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

[0012] The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a longitudinal sectional view of an intake apparatus according to an embodiment of the present invention.

Fig. 2 is a longitudinal sectional view showing exaggeratedly the intake apparatus in a state where a throttle body arranged according to the present invention has been secured to an intake manifold.

Fig. 3 is a longitudinal sectional view showing the intake apparatus in a state where an air duct hose has been secured to the throttle body.

Fig. 4 is a longitudinal sectional view showing an intake apparatus according to the prior art before the constituent parts thereof are assembled together.

Fig. 5 is a longitudinal sectional view showing exaggeratedly the state of the prior art intake apparatus after the constituent parts have been assembled together.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] A preferred embodiment of the present invention will be described below with reference to the accompanying drawings. In Fig. 1, an intake apparatus 1 comprises a throttle body 2 having an intake passage 2a. A throttle shaft 3 is rotatably fitted across the intake passage 2a. A throttle valve 4 is secured to the throttle shaft 3. The throttle valve 4 rotates together with the throttle shaft 3 to control the amount of intake air in cooperation with a measuring portion 2b of the inner surface of the intake passage 2a. A flange 2c is formed at the downstream opening of the throttle body 2. The flange 2c constitutes an intake manifold-side engagement portion 6 that is to be secured to an intake manifold 5 (see Fig. 2). The flange 2c is provided with a plurality of screw holes 2d for insertion of screws 7 (see Fig. 2). The intake manifold-side engagement portion 6 of the throttle body 2 has an enlarged-diameter portion 2f with an inner diameter A larger than the inner diameter B of the measuring portion 2b. A downstream enlarged portion (varied-diameter portion) 2g is formed between the measuring portion 2b and the enlarged-diameter portion 2f. The wall thickness *a* of the enlarged-diameter portion 2f and the wall thickness of the downstream enlarged portion 2g are smaller than the wall thickness *b* of the measuring portion 2b.

[0015] An air duct hose-side engagement portion 9 is formed at the upstream opening of the throttle body 2. An air duct hose 8 (see Fig. 3) is fitted and secured to the engagement portion 9. The air duct hose-side engagement portion 9 of the throttle body 2 has an enlarged-diameter portion 2h with an inner diameter C larger than the inner diameter B of the measuring portion 2b. An upstream enlarged portion (varied-diameter portion) 2i is formed between the measuring portion 2b and the enlarged-diameter portion 2h. The wall thickness *c* of the enlarged-diameter portion 2h and the wall thickness of the upstream enlarged portion 2i are smaller than the wall thickness *b* of the measuring portion 2b. A rib 2e is formed on the outer periphery of the engagement portion 9 to prevent the air duct hose 8 from coming off. After the air duct hose 8 has been fitted to the engagement portion 9, a metallic band 10 (see Fig. 3) is fastened to the outer periphery of the air duct hose 8 to prevent the hose 8 from becoming dislodged.

[0016] Next, the operation of this embodiment will be described. As shown in Fig. 2, if the mounting surface of the throttle body 2 or the intake manifold 5 is strained, the flange 2c is distorted by an amount corresponding to the strain (shown by the chain double-dashed line). However, because the inner diameter A of the enlarged-diameter portion 2f is larger than the inner diameter B of the measuring portion 2b and the wall thickness *a* of the enlarged-diameter portion 2f and the wall thickness of the downstream enlarged portion 2g are smaller than the wall thickness *b* of the measuring portion 2b, the enlarged-diameter portion 2f and the downstream enlarged portion 2g are distorted more easily than the measuring portion 2b. Therefore, the strain is absorbed by the enlarged-diameter portion 2f and the downstream enlarged portion 2g and cannot reach the measuring portion 2b. It should be noted that the chain double-dashed line shows the state of the throttle body 2 before it is secured to the intake manifold 5.

[0017] In Fig. 3, when the band 10 for preventing dislodging is fastened to the outer periphery of the air duct hose 8 fitted to the engagement portion 9, the enlarged-

diameter portion 2h is strained (shown by the chain double-dashed line) by the fastening force. However, because the inner diameter C of the enlarged-diameter portion 2h is larger than the inner diameter B of the measuring portion 2b and the wall thickness c of the enlarged-diameter portion 2h and the wall thickness of the upstream enlarged portion 2i are smaller than the wall thickness *b* of the measuring portion 2b, the enlarged-diameter portion 2h and the upstream enlarged portion 2i are distorted more easily than the measuring portion 2b. Therefore, the strain is absorbed by the enlarged-diameter portion 2h and the upstream enlarged portion 2i and cannot reach the measuring portion 2b. It should be noted that the chain double-dashed line shows the state of the enlarged-diameter portion 2h before the air duct hose 8 and the band 10 are attached thereto.

[0018] It should be noted that the present invention is not necessarily limited to the foregoing embodiment but can be modified in a variety of ways without departing from the gist of the present invention.

Claims

1. An intake apparatus for an internal-combustion engine having a throttle body, said throttle body being formed with:

a measuring portion for controlling an amount of intake air;
an air duct hose-side engagement portion for leading intake air to said measuring portion; and
an intake manifold-side engagement portion for leading the intake air measured at said measuring portion to a combustion chamber;

wherein said air duct hose-side engagement portion and said intake manifold-side engagement portion are provided with enlarged-diameter portions, respectively, which have an inner diameter larger than an inner diameter of said measuring portion, said enlarged-diameter portions having a wall thickness smaller than a wall thickness of said measuring portion.

2. An intake apparatus for an internal-combustion engine according to claim 1, wherein an upstream enlarged portion is formed between said air duct hose-side engagement portion and said measuring portion, and a downstream enlarged portion is formed between said intake manifold-side engagement portion and said measuring portion, both of said upstream enlarged portion and downstream enlarged portion having a wall thickness smaller than the wall thickness of said measuring portion.

3. An intake apparatus for an internal-combustion engine according to claim 1 or 2, wherein said throttle body is made of a synthetic resin material.

FIG.1

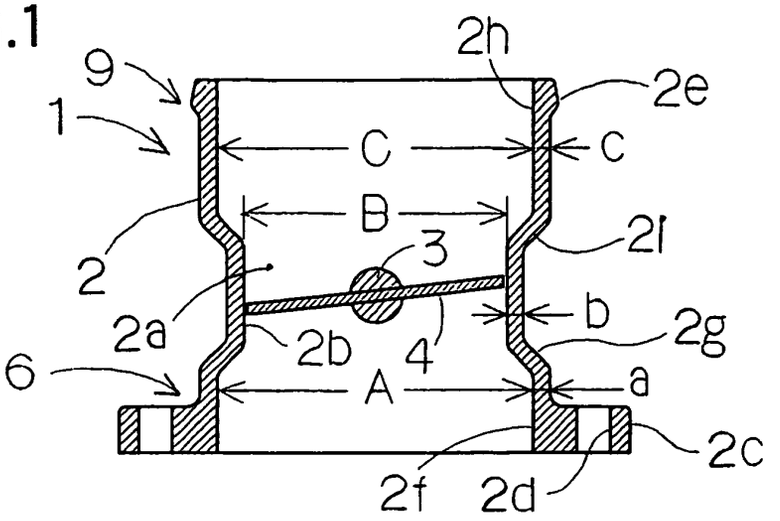

FIG.2

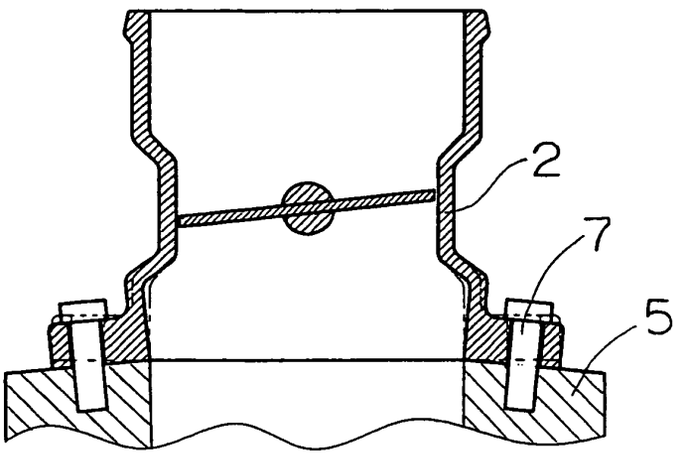

FIG.3

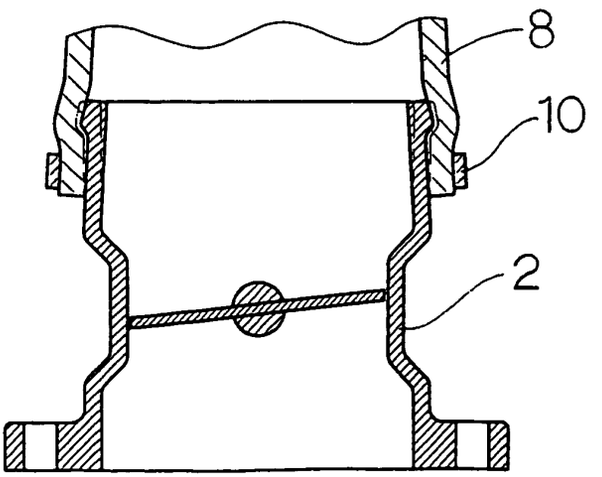

FIG.4

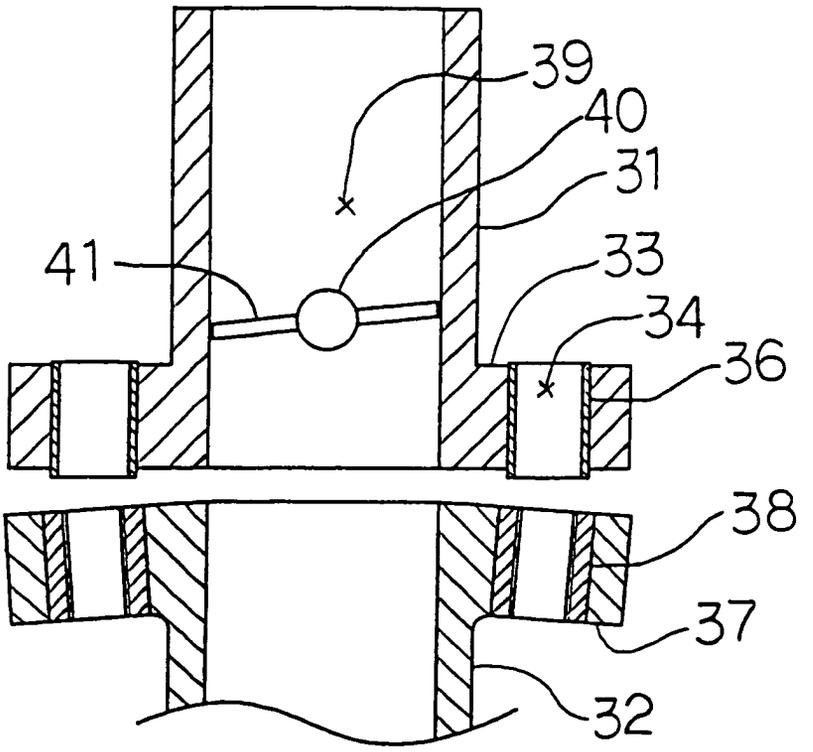

FIG.5