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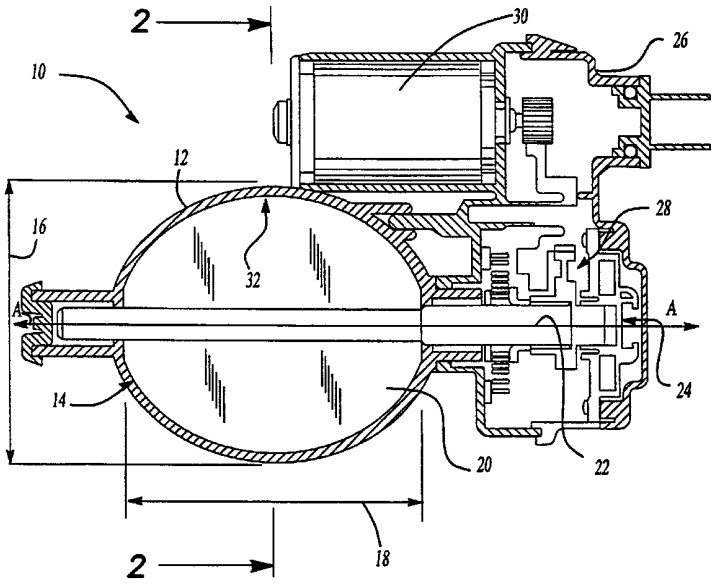
(54) Title: ELECTRONICALLY CONTROLLED THROTTLE VALVE WITH ELLIPTICAL BORE AND THROTTLE VALVE



(57) Abstract: The subject invention is a throttle body assembly having an elliptically shaped airflow passage and throttle valve such that the overall height of the throttle body is reduced. The air passage includes a contoured bore that allows the airflow passage to be fabricated to reduce the height of the throttle body. The throttle valve rotates between an open and closed position to regulate airflow through the airflow passage. The airflow passage includes a contoured shape and the throttle valve includes a periphery. The contoured shape is disposed in the airflow passage such that a predetermined distance between the edge of the throttle valve and the airflow passage is maintained for a predetermined amount of rotation of the throttle valve.

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ELECTRONICALLY CONTROLLED THROTTLE VALVE WITH ELLIPTICAL BORE AND THROTTLE VALVE

BACKGROUND OF THE INVENTION

This application discloses an elliptically shaped throttle body for mounted to an intake manifold of an automobile engine.

Typically, a throttle body is mounted to the intake manifold of an automobile engine and includes a throttle valve disposed within and airflow passage to regulate the flow of air into the intake manifold. Typically, the throttle body is fabricated by an aluminum casting process. The aluminum casting process requires additional finish machining to insure adherence of all critical dimensions. The shape of the airflow passage and the entire throttle body is limited by the capabilities of the finish machining processes. Non-standard shapes complicate and add cost to the manufacture of the throttle body, making use of non-standard shapes undesirable. Critical dimensions can be held more precisely and consistently in a plastic molding process compared to a cast surface from the aluminum casting process. Molding the throttle body from plastic reduces or eliminates the need for finish machining, is cheaper, and allows for the use of non-standard shapes.

The throttle valve disposed within the throttle body may also be fabricated from plastic. One design consideration of great importance in the design of the throttle valve is the amount of deflection that the throttle valve experiences during operation. Specifically, the intake manifold applies a vacuum load on the throttle valve during operation. The vacuum load will be greatest when the throttle valve is in the closed position. The applied vacuum load acts to deflect the edges of the throttle valves, and thereby creates a larger opening than is desired causing engine idle inconsistencies. Repeated deflection of the throttle valve may cause throttle plate degradation.

Automotive styling trends are directing the lower of the hood line of a motor vehicle, thereby creating smaller engine compartments, placing pressure on manufactures to reduce size of all under hood components.

For these reasons it is desirable and necessary to provide a throttle body having an elliptical profile to respond to consumer demand and to minimize deflection of the throttle valve.

SUMMARY OF THE INVENTION

The subject invention is a throttle body assembly proportioned such that the greatest width is larger than the greatest height.

The throttle body of the preferred embodiment defines an elliptically shaped air passage and throttle valve such that the overall height of the throttle body is reduced. The air passage includes a contoured bore that allows the airflow passage to be fabricated to reduce the height of the throttle body. The throttle body mounts to an intake manifold of an internal combustion engine and defines an airflow passage having a height and width. The throttle valve rotates between an open and closed position to regulate airflow through the airflow passage. The airflow passage and the throttle valve have an elliptical shape such that the greatest width is larger than the greatest height. The airflow passage also includes a contoured shape and the throttle valve includes a periphery. The contoured shape is disposed in the airflow passage such that a constant distance between the periphery of the throttle valve and the airflow passage is maintained for a predetermined amount of rotation of the throttle valve. Further, the contoured shape in combination with the elliptical shape of the bore provides for greater control of airflow thought the airflow passage at smaller throttle valve openings because a ratio of contoured surface to contoured surface area is greater for an elliptically shaped bore than in similar circular bores.

The subject invention utilizes plastic molding to accomplish the objectives of having smaller more compact components to satisfy current demands and reduce the amount of throttle plate deflection caused by vacuum load. Further, the subject invention provides a contoured air passage that provides additional control of airflow through the throttle body.

BRIEF DESCRIPTION OF THE DRAWINGS

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiment. The drawings that accompany the detailed description can be briefly described as follows:

Figure 1 is a front view of an throttle body with an elliptically shaped airflow passage and throttle valve, and

Figure 2 is a cross-sectional view of the throttle valve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, the subject invention is a throttle body assembly 10 for mounting to an intake manifold of an internal combustion engine. Referring to Figure 1, the throttle body assembly includes a throttle body 12 defining an airflow passage14 having a height 16 and width 18. A throttle valve 20 mounts to a shaft 22 for rotation about an axis A. The throttle valve 20 rotates between open and closed positions to regulate airflow through the airflow passage 14. The shaft 22 includes a first end 24 that extends out of the airflow passage into a housing 26. A linkage assembly 28 driven by an electric motor 30 is disposed within the housing 26.

The airflow passage 14 and the throttle valve 20 are proportioned such that the greatest width 18 is larger than the greatest height 16. The shape formed by the throttle body 20 may be any square or curvilinear shaped. The preferred embodiment of the subject invention is an electronically controlled throttle body assembly fabricated from plastic. The throttle body assembly 10 includes a throttle body12 defining the airflow passage 14. Preferably the airflow passage 14 is elliptically shaped. The elliptically shape of the airflow passage 14 provides an area equal to round airflow passages and provides a reduced height assembly.

The throttle valve 20 mounted to the shaft 22 is elliptically shaped to correspond to the shape of the airflow passage 14. The throttle valve 20 of the preferred embodiment is molded from plastic. The intake manifold (not shown) to which the throttle body 12 mounts produces a vacuum load. The vacuum load produced by the

intake manifold will pull on the throttle valve 20 causing a deflection at an edge 32 of the throttle valve 20. The elliptical shape of the throttle valve 20 reduces the distance from the edge 32 of the throttle valve 20 to the shaft 22 as compared to a traditional round throttle valve. Reducing the distance between the edge 32 of the throttle valve 20 and the shaft 22 increases the rigidity of the throttle valve 20, thereby reducing or eliminating the amount of deflection.

The throttle body 12 is mounted at the top of the engine and is very close to the hood of the automobile. The elliptically shaped throttle body 12 provides for additional space between the hood and the throttle body 12 and also allows lowering of the hood line toward the engine.

Referring to Figure 2, the airflow passage 14 includes a contoured shape 34 on the downstream side of the throttle valve 20. The contoured shape 34 is disposed such that a predetermined distance between the edge 32 of the throttle valve 20 and the airflow passage 14 is maintained for a predetermined amount of rotation of the throttle valve 20. The throttle valve 20 regulates airflow through the airflow passage 14 by changing the amount of area available for the flow of air. Without the contoured shape 34 the change of area accompanying rotation of the throttle valve 20 is constant throughout the entire rotation of the throttle valve 20.

The contoured shape 34 of the airflow passage provides for different rates of change in the airflow passage dependent on the position of the throttle valve 20. The contoured shape 34 will match a radial path 36 of the edge 32 throttle valve 20 through a portion of throttle valve 20 rotation and taper away from the throttle valve 20 as the throttle valve 20 is rotated toward the open position. This configuration provides for the airflow area to change at differing rates depending on the position of the throttle valve 20. Further, the contoured shape combined with the elliptical shape of the throttle valve 20 and the airflow passage 14 provides for more control over the airflow at smaller throttle valve 20 openings. Greater control results from a greater ratio of contoured surface to contoured surface area provided by the elliptical shape of the throttle valve 20 and the airflow passages 14 as compared with a circular airflow passage and throttle valve.

The preferred embodiment includes a contoured shape 34 on the downstream 38 side of the throttle valve 20. The contoured shape 34 follows the throttle valve 20 from the closed position to a point approximately 30 degrees from the closed position.

The contoured shape 34 tapers away from the path of rotation 36 of the edge 32 of the throttle valve 20 to provide a greater rate of change corresponding to rotation of the throttle valve 20. The preferred embodiment of the contoured shape 34 includes the predetermined distance that varies along the 30 degrees of throttle movement. The contoured shape 34 in the preferred embodiment continually tapers away from the path of the edge 36 of the throttle valve 20 to gradually increase the rate of change of area through the airflow passage. The contoured shape 34 may follow the path of rotation of the edge 32 of the throttle body 12 further then that of the preferred embodiment to control the rate of change of the area through the air flow passage 14.

The throttle body assembly 10 of the preferred embodiment is fabricated from plastic and allows the contoured shape 34 to be molded into the airflow passage 14. The contoured passage 34 of the preferred embodiment is disposed only on the downstream side 38 of the throttle valve 20. It should be understood that a worker knowledgeable in the art would understand that a second contoured shape may be disposed on the upstream side 40 of the throttle valve 20. In such a configuration the contoured shape 34 extends about the throttle valve 20.

The foregoing description is exemplary and not just a material specification. The invention has been described in an illustrative manner, and should be understood that the terminology used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings. The preferred embodiments of this invention have been disclosed, however, one of ordinary skill in the art would recognize that certain modifications are within the scope of this invention. It is understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described. For that reason the following claims should be studied to determine the true scope and content of this invention.

CLAIMS

1. An throttle body mounted to an intake manifold of an internal combustion engine;

a throttle body defining an airflow passage having a height and width;

a throttle valve rotatable between open and closed positions to regulate airflow through said airflow passage; said throttle valve having a height and width;

said airflow passage and said throttle valve each have a greatest width and a greatest height, said greatest width is larger than said greatest height.

2. The assembly of claim 1, wherein said airflow passage and said throttle valve are elliptically shaped.

3. The assembly of claim 1, wherein said airflow passage includes a contoured shape and said throttle valve includes a periphery, said contoured shape disposed such that a predetermined distance between said periphery of said throttle valve and said airflow passage is maintained for a predetermined amount of rotation of said throttle valve.

4. The assembly of claim 3, wherein said contoured shape is disposed on a downstream side of said throttle valve.

5. The assembly of claim 3, wherein said contoured shape of said airflow passage is disposed on an upstream side of said throttle valve.

6. The assembly of claim 3, further including a shaft to rotate said throttle valve about an axis.

7. The assembly of claim 3, wherein said predetermined amount of rotation of said throttle valve is 30 degrees from said closed position.

8. The assembly of claim 1, wherein said throttle body is fabricated from a plastic material.

9. The assembly of claim 8, wherein said contoured shape is molded into said airflow passage.

10. The assembly of claim 1, wherein said throttle valve is fabricated from a plastic material.

11. The assembly of claim 1, wherein said valve rotates about an axis, said axis extending parallel to said width of said airflow passage.

12. A plastic electronically controlled throttle valve for a motor vehicle comprising;

a throttle body defining an air flow passage having a height and width;

a throttle valve rotatable between open and closed positions to regulate airflow through said airflow passage, said throttle valve having a height and width;

a shaft fixed to rotate said throttle valve about an axis;

said airflow passage and said throttle valve include a greatest width and a greatest height, said greatest width larger than said greatest height.

13. The assembly of claim 12, wherein said airflow passage and said throttle valve are elliptically shaped.

14. The assembly of claim 12, wherein said airflow passage includes a contoured shape and said throttle valve includes a periphery, said contoured shape disposed such that a predetermined distance between said periphery of said throttle valve and said airflow passage is maintained for a predetermined amount of rotation of said throttle valve.

15. The assembly of claim 12, further including an electric motor and a linkage assembly to rotate said shaft and said throttle valve between said open and closed positions.

16. The assembly of claim 12, wherein said axis extends parallel to said width of said air flow passage.

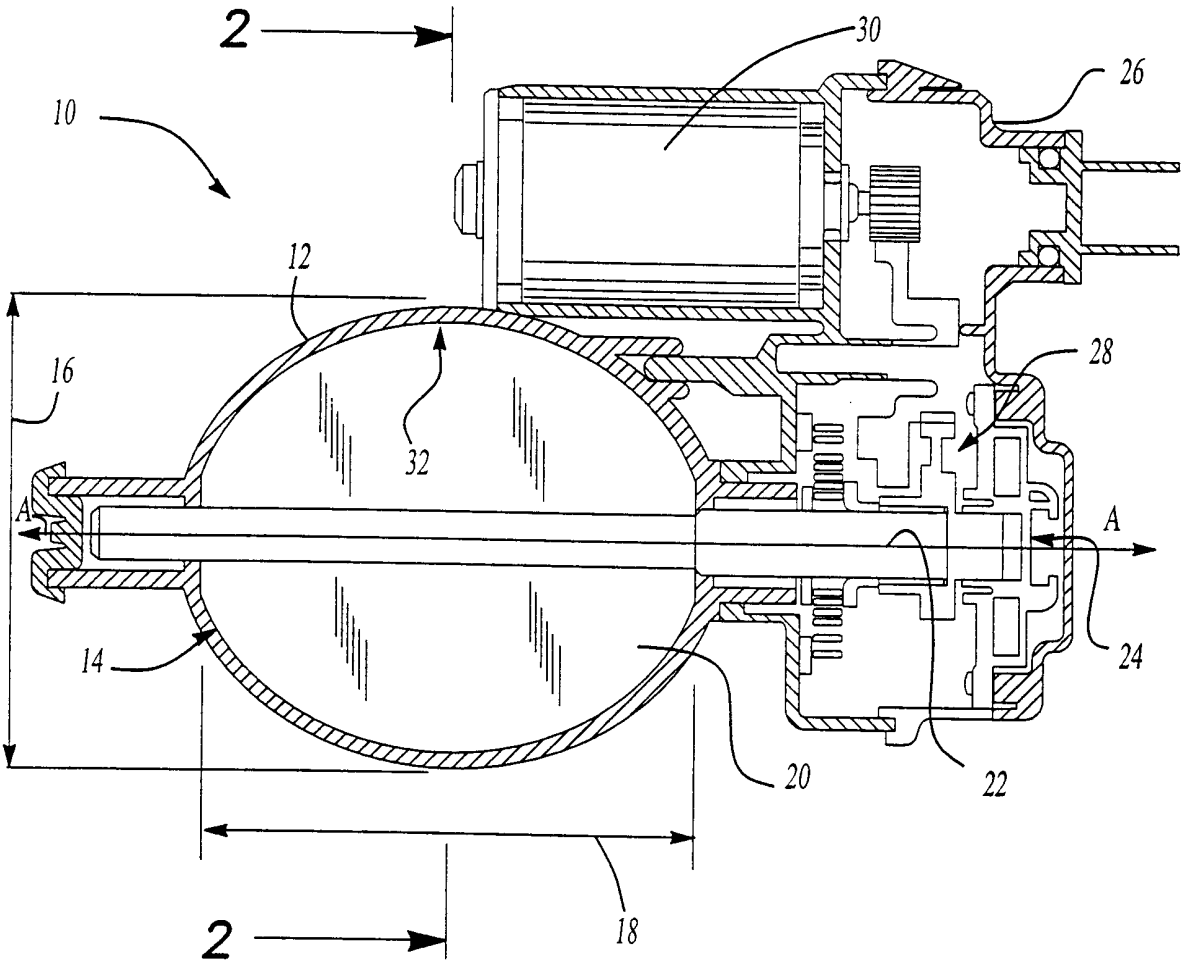

Fig-1

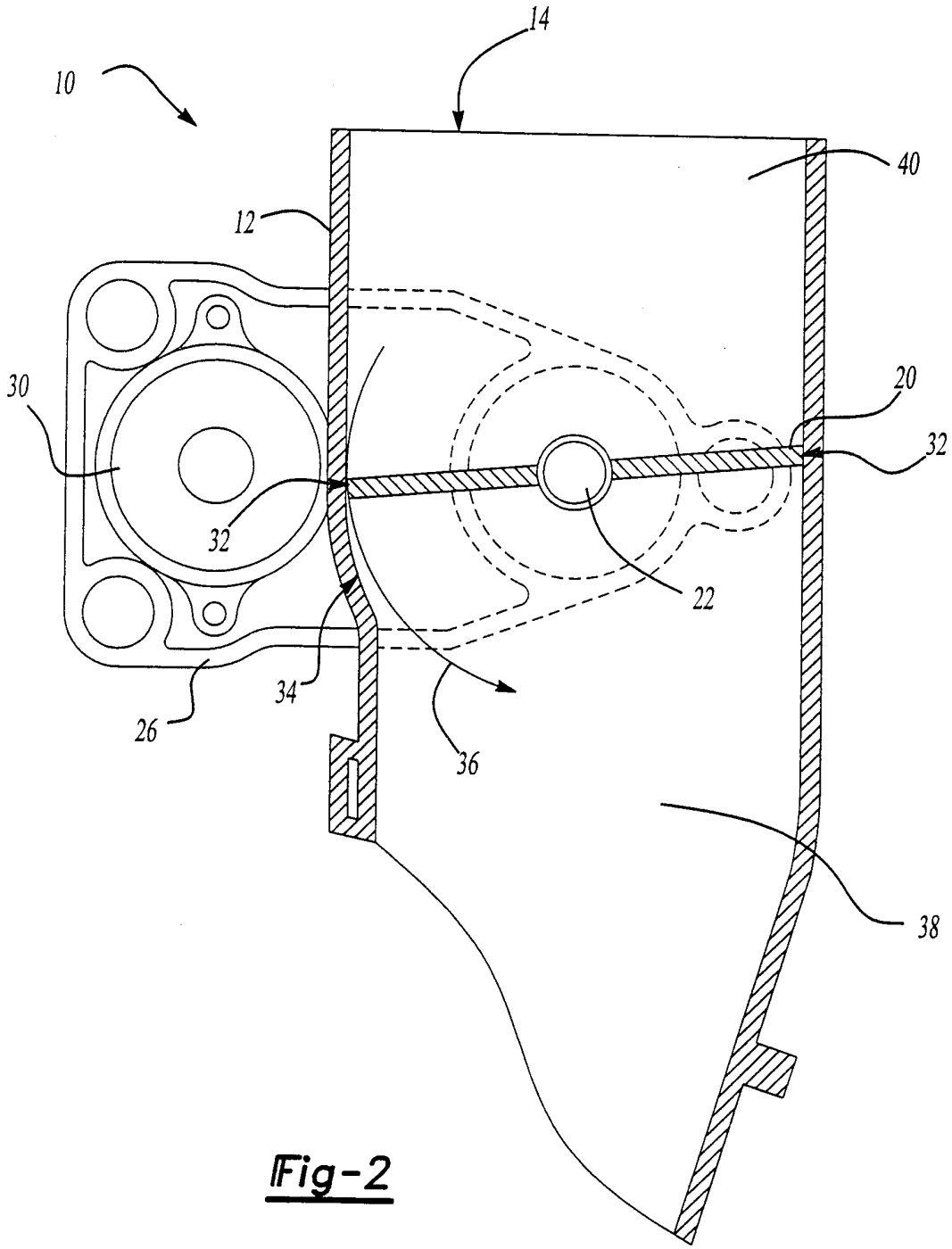

Fig-2

INTERNATIONAL SEARCH REPORT

Inte .tional Application No
PCT/CA 00/01330

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F02D9/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F02D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 615 861 A (POLLMANN HERBERT ET AL) 1 April 1997 (1997-04-01) column 2, line 45 -column 6, line 44; figures 1-3	1-6,8-11 12-16
Y	EP 0 869 266 A (HITACHI LTD) 7 October 1998 (1998-10-07) page 5, line 29 -page 9, line 31; figures 2-6	12-16
X	US 5 374 031 A (SEMENCE PIERRE ET AL) 20 December 1994 (1994-12-20) column 3, line 35 -column 6, line 26; figures 2-4A	1-11

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 February 2001	28/02/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Int ational Application No
PCT/CA 00/01330

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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