ABSTRACT

An intake manifold for conveying air-fuel mixture from an inlet to an outlet includes a long duct and a short duct fluidly communicating between the inlet and the outlet, a junction defined at fluid connection between the long and the short duct, a flap valve and a pneumatic actuator. The junction is configured downstream of the inlet. The flap valve is disposed at the junction and a flap of the flap valve is displaceable between a first position in which the flap defines a first flow-path through said long duct circumventing the flap, and a second position in which said flap defines a second flow-path through the short duct without passing through the long duct. The pneumatic actuator regulates the movement of the flap between the first position and the second position.

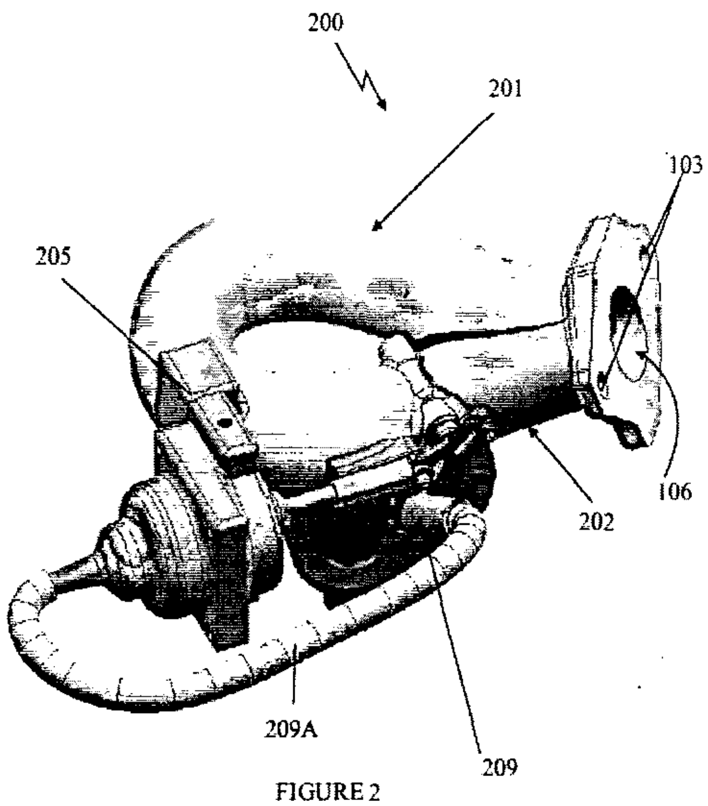

FIGURE 2

WE CLAIM:

1. An intake manifold for conveying air-fuel mixture from an inlet to an outlet, the inlet and the outlet being connected to the carburetor and the cylinder head of the engine respectively, , said manifold characterized by:

    - a long duct fluidly communicating between the inlet and the outlet;
    - a short duct fluidly communicating between the inlet and the outlet;
    - a junction defined at fluid connection between said long duct and said short duct, said junction configured downstream of the inlet;
    - a flap valve disposed at said junction, a flap of said valve adapted to be displaceable between a first position in which said flap defines a first flow-path of the air-fuel mixture wherein said air-fuel mixture passes through said long duct circumventing said flap when the engine operates at a lower speed, and a second position in which said flap defines a second flow-path of the air-fuel mixture wherein said air-fuel mixture passes through said short duct without passing through said long duct when the engine operates at a lower speed, said flap further adapted to disposed in an intermediate position between said first position and said second position to define a third flow-path of the air-fuel mixture wherein said air-fuel mixture partially flows through said long duct and the remaining air-fuel mixture flows through said short duct; and
    - a pneumatic actuator adapted to regulate the movement of said flap of said valve between said first position, said second position and an intermediate position between said first position and said second position.

2. The manifold as claimed in claim 1, wherein said inlet is configured with a plunger that moves to regulate opening of the inlet and defining a completely closed configuration in which said the air fuel mixture is restricted from entry into said manifold and a completely open configuration of said inlet in which the air-fuel

mixture is directed to pass through said short duct, said plunger further adapted to be displaced to an intermediate position in which the inlet is blocked by 50% or more, and the air-fuel mixture is directed to flow through said long duct.

3. The manifold as claimed in claim 1, wherein said flap valve is adapted to prevent exit of air-fuel mixture through said short duct in said first position of said flap of said flap valve.

4. The manifold as claimed in claim 1, wherein said flap valve is adapted to prevent exit of air-fuel mixture through said long duct in said second position of said flap of said flap valve.

5. The manifold as claimed in claim 1, wherein said pneumatic actuator comprises:

    - a chamber;
    - a diaphragm partitioning said chamber into a first section and a second section, said first section having an opening communicating with the atmosphere, said second section being in fluid communication with the internal environment of said manifold, such that, the pressure within said manifold is communicated directly to said second section;
    - a compression spring adapted to bias the displacement of said diaphragm;
    - a connecting rod cooperating with said diaphragm at one end, said connecting rod adapted to reciprocate along with said diaphragm corresponding to the pressure difference between said first section and said second section; and
    - a flap operating linkage adapted to translate the reciprocating movement of said connecting rod to angularly displace said flap valve between said first position and said second position.

6. The manifold as claimed in claim 4, wherein said second section is in fluid communication with the internal environment of said manifold via a communicating tube.

7. The manifold as claimed in claim 4, wherein said diaphragm is a deformable diaphragm to amplify the reciprocating movement of said connecting rod.

8. The manifold as claimed in claim 4, wherein said flap operating linkage consists of:

    - a flap supporting element adapted to support said flap valve, said flap supporting element adapted to rotate about an axis substantially perpendicular to said connecting rod; and
    - a link adapted to displace said flap supporting element, said link adapted to cooperate with said connecting rod via a coupler element, said link being adapted to translate the linear movement of said connecting rod to the angular displacement of said flap valve.

9. The manifold as claimed in claim 1, wherein said flap of said flap valve is adapted to be angularly displaceable between said first position and said second position.

Dated this 31st day of December, 2013

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This application is a divisional application to Indian Patent Application No. 1936/MUM/2013 issued on June 3, 2013, the entire contents of which, is specifically incorporated herein by reference.

FIELD OF THE DISCLOSURE

The present disclosure relates to internal combustion gasoline engines.

More specifically, the present disclosure relates to an intake system for internal combustion gasoline engines using a carburetor per cylinder.

BACKGROUND

An intake system for internal combustion engines includes an air filter, a connecting tube, a carburetor, an intake manifold and an intake port which leads the air and fuel mixture to combustion chamber. The power and torque required for driving a motor vehicle and the like, is developed in the cylinder of the engine by combustion of the fuel. The requirement of power and torque during engine operating condition depends on load encountered, for example, in the case of motor vehicles the load depends upon various factors like road conditions and weight of the vehicle and the like. To cater the power requirements at different load conditions, the intake conditions has to be varied by accelerator control as the power and the torque developed by the engine, largely depends upon the amount of charge taken in the cylinder through the plunger opening.

Conventionally, the plunger position of carburetor determines the engine operating range. The engine operating range is determined by the mechanical movement of a plunger that regulates the power and torque generated by the engine.

Particularly, in case of motor vehicles the requirement of power and torque such as in normal city driving conditions is achieved at lower engine speeds at a part open throttle condition and such as on highways it is achieved at higher engine speeds at a wide open throttle condition. The engine power and the torque developed throughout the travel of carburetor plunger depend on various factors; one among them being the length and geometry of the intake manifold.

Various efforts have been made to achieve two peaks of the torque, one occurring at lower engine speed and one occurring at higher engine speed by changing e.g. the exhaust system characteristics. Also, efforts have been made to provide twin passages in the intake manifold wherein the flow to one of the passage is controlled with the help of a butterfly valve actuated through an external means. This however adds to cost, increased complexity, increased number of moving parts, decreased reliability, restriction in the flow path and the like.

Hence, there is felt a need for a system that can provide higher torque at both part open throttle conditions and at wide open throttle condition.

OBJECTS

Some of the objects of the system of the present disclosure, which at least one embodiment herein satisfies, are as follows:

An object of the present disclosure is to provide an intake system that enables good spread of torque throughout the engine operating range.

Another object of the present disclosure is to provide an intake system that is simple in construction.

Further, an object of the present disclosure is to provide a system that is reliable.

Yet another object of the present disclosure is to provide a system that involves minimal moving parts.

An added object of the present disclosure is to provide a system that facilitates improved combustion of fuel within an IC engine.

Another object of the present disclosure is to provide a system that is adaptable in compact space.

Other objects and advantages of the present disclosure will be more apparent from the following description when read in conjunction with the accompanying figures, which are not intended to limit the scope of the present disclosure.

SUMMARY

In accordance with the present disclosure there is provided an intake manifold for conveying air-fuel mixture from an inlet to an outlet, the inlet and the outlet being connected to the carburetor and the cylinder head of the engine respectively, the manifold characterized by:

- a long duct fluidly communicating between the inlet and the outlet;
- a short duct fluidly communicating between the inlet and the outlet;
- a junction defined at fluid connection between the long duct and the short duct, the junction configured downstream of the inlet;
- a flap valve disposed at the junction, a flap of the flap valve is displaceable between a first position in which the flap defines a first flow-path of the air-fuel mixture wherein the air-fuel mixture passes through the long duct circumventing the flap when the engine operates at a lower speed, and a second position in which the flap defines a second flow-path of the air-fuel mixture wherein the air-fuel mixture passes through the short duct without passing through the long duct when the engine operates at a lower speed. The flap further adapted to be disposed between the first position and the second position to define a third flow-path of the air-fuel mixture wherein the air-fuel mixture partially flows through the long duct and the remaining air-fuel mixture flows through the short duct; and
- a pneumatic actuator adapted to regulate the movement of the flap of the flap valve between the first position, the second position and an intermediate position between the first position and the second position.

Typically, the inlet is configured with a plunger that moves to regulate opening of the inlet and defining a completely closed configuration in which the air fuel mixture is restricted from entry into the manifold and a completely open configuration of the inlet in which the air-fuel mixture is directed to pass through the short duct, the plunger further adapted to be displaced to an intermediate position in which the inlet is

blocked by 50% or more, and the air-fuel mixture is directed to flow through the long duct.

The flap valve prevents exit of air-fuel mixture through the short duct in the first position of the flap of the flap valve.

The flap valve prevents exit of air-fuel mixture through the long duct in the second position of the flap of the flap valve.

Typically, the pneumatic actuator comprises:

- a chamber;
- a diaphragm partitioning the chamber into a first section and a second section, the first section having an opening communicating with the atmosphere, the second section being in fluid communication with the internal environment of the manifold, such that, the pressure within the manifold is communicated directly to the second section;
- a compression spring adapted to bias the displacement of the diaphragm;
- a connecting rod cooperating with the diaphragm at one end, the connecting rod adapted to reciprocate along with diaphragm corresponding to the pressure difference between the first section and the second section; and
- a flap operating linkage adapted to translate the reciprocating movement of the connecting rod to angularly displace the flap valve between the first position and the second position.

Typically, the second section is in fluid communication with the internal environment of the manifold via a communicating tube.

Alternatively, the diaphragm is a deformable diaphragm to amplify the reciprocating movement of the connecting rod.

Typically, the flap operating linkage consists of:

- a flap supporting element adapted to support the flap valve, the flap supporting element adapted to rotate about an axis substantially perpendicular to the connecting rod; and
- a link adapted to displace the flap supporting element, the link adapted to cooperate with the connecting rod via a coupler element, the link being adapted to translate the linear movement of the connecting rod to the angular displacement of the flap valve.

The flap of the flap valve is angularly displaceable between the first position and the second position.

BRIEF DESCRIPTION OF ACCOMPANYING DRAWINGS

The intake system for automotive vehicles of the present disclosure will now be described with the help of accompanying drawings, in which:

Figure 1 illustrates a perspective view of a typical intake system for internal combustion engine in accordance with an embodiment of the present disclosure;

Figure 2 illustrates a perspective view of the intake manifold of **Figure 1**;

Figure 3 illustrates a cross-sectional perspective view of the intake manifold of **Figure 2**;

Figure 4 illustrates a perspective view a pneumatic actuator of the intake manifold of **Figure 2**;

Figure 5 illustrates the pneumatic actuator cooperating with the short duct of the intake manifold of **Figure 2**;

Figure 6 illustrates a cross sectional view of pressure switch of the pneumatic actuator of **Figure 2**;

Figure 7 illustrates a cross-sectional perspective view of the intake system of **Figure 2** depicting the flow of the air-fuel mixture through a long duct;

Figure 8 illustrates a cross-sectional perspective view of the intake system of **Figure 2** depicting the flow of the air-fuel mixture through short duct path; and

Figure 9 illustrates a graphical representation depicting the variation of Torque in Newton-meter with respect to engine speed in revolution per minute (rpm) for the intake system of **Figure 1**.

DETAILED DESCRIPTION

A system of the present disclosure will now be described with reference to the embodiments which do not limit the scope and ambit of the disclosure.

The embodiments herein and the various features and advantageous details thereof are explained with reference to the non-limiting embodiments in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

The intake system for automotive vehicles in accordance with the present disclosure is described herein below with respect to **Figure 1** wherein the key components of the intake system are generally referenced by numerals as indicated.

Figure 1 illustrates a perspective view of an intake system **1000** for an internal combustion engine. The intake system **1000** includes a carburetor **100**, an intake manifold **200**, a cylinder head **300** including an intake port and an air filter member **400**.

The carburetor **100** includes a plunger "P", a fuel reservoir and a mounting provision for mounting the carburetor **100** on the connecting tube. The plunger is mechanically displaceable by accelerator control. Intake air, filtered in the air filter member **400**, is introduced into the carburetor **100**. The intake air is mixed with the fuel contained in the fuel reservoir to form a desired air-fuel mixture corresponding to the fuel requirement of the Internal Combustion (IC) engine at a lower speed and a higher speed of operation.

Figure 2 illustrates a perspective view of the intake manifold **200** in accordance with the present disclosure. The intake manifold **200** cooperates with the carburetor **100** through mounting arrangements **103**. The intake manifold **200** includes an inlet **106** and an outlet **206**, illustrated in **Figure 3**, fluidly communicating the air-fuel mixture via a long duct **201** and a short duct **202**. The inlet **106** and the outlet **206** are selectively opened and closed corresponding to the engine speed and the desired torque by a flap valve **213**, shown in **Figure 3**. The intake manifold **200** further includes a pneumatic actuator **104**, particularly illustrated in **Figure 4**, for displacing the flap valve **213** between a first position and a second position to selectively block flow of the air-fuel mixture through the long duct **201** and the short duct **202**, of the intake manifold **200** shown in **Figure 3**, respectively.

The displacement of the plunger of the carburetor **100** enables regulating the opening of the inlet **106** between a fully closed condition, an intermediate condition and a wide-open condition. The carburetor **100** enables supplying a desired air-fuel mixture to the intake manifold **200**.

In the closed condition of the plunger "P" of the carburetor, the opening of the inlet **106** is closed to flow of air-fuel mixture. In the intermediate condition of the plunger "P", the opening of the inlet **106**, of the intake manifold **200** shown in **Figure 2**, is partially open to enable flow of air-fuel mixture there-through. In the wide-open condition of the plunger "P", the opening of the inlet **106** is fully open to enable flow of air-fuel mixture there-through.

The air-fuel mixture enters the intake manifold **200**, illustrated in **Figure 3**, through the inlet **106** from the carburetor **100**. The long duct **201** and the short duct **202** are connected to each other or merge with each other at a junction **203**, more specifically, the short duct **202** and the long duct **201** merge along merging points to form the junction **203** that configures fluid communication between the long duct **201** and the short duct **202**. The junction **203** is configured downstream of the inlet **106** and the junction **203** is disposed away from the inlet **106**. The long duct **201** defines a flow path which is substantially longer than that of the short duct **202**. The long duct **201** and the short duct **202** enable conveying the air-fuel mixture from the inlet **106** to the outlet **206** depending on the requirement of the IC engine. When the IC engine operates at a lower speed, the air-fuel mixture is conveyed from the inlet **106** to the outlet **206** via the long duct **201**. On the other hand, when the engine operates at a higher speed, the air-fuel mixture is conveyed from the inlet **106** to the outlet **206** via the short duct **202**.The outlet port **206** communicates the air-fuel mixture to the intake port of the cylinder head **300** and hence supplies the required air-fuel mixture to the IC engine.

The long duct **201** and the short duct **202** of the intake manifold **200** shown in **Figure 3**, functions in a manner, such that, when the plunger is displaced to fully open the inlet **106**, the air-fuel mixture flows through the short duct **202**. Further, when the plunger "**P**" is displaced to the intermediate position so as to block the inlet **106** by 50% or more, the air-fuel mixture flows through the long duct **201**. The junction **203** is profiled such that the flow of the air-fuel mixture through the long duct **201** and the short duct **202** define a pre-determined angle there-between. The junction **203** is defined such that the plane containing the junction **203** divides the inlet **106** into substantially equal halves. Further, the plane containing the junction **203** defines a pre-determined angle with a vertical plane, substantially perpendicular to the operating plane of the inlet **106**.

The flap valve **213** is positioned such that the outlet of the air-fuel mixture from the long duct **201** or the short duct **202** is selectively restricted corresponding to the engine speed. The flap valve **213** is displaceable between the first position and the second position to block exit of the air fuel mixture through the short duct **202** and the long duct **201** respectively. The flap valve **213** prevents exit of the air-fuel mixture through the short duct **202** in the first position of the flap valve **213**. The flap valve **213** prevents exit of air-fuel mixture through the long duct **201** in the second position of the flap valve **213**.

The displacement of the flap valve **213** is enabled by operation of the pneumatic actuator **104**, illustrated in **Figure 4**. The pneumatic actuator **104** cooperates with wall mounting provisions **207** of the intake manifold **200** through provisions **217** by a locking arrangement **218**, shown in **Figure 5**. The mounting provisions **217** are constrained within the provisions **207** by a screw (not shown in Figure). The pneumatic actuator **104** includes a pressure switch **205**, a connecting rod **208** and a flap operating linkage **101**.

The sectional view of the pressure switch **205** is particularly illustrated in **Figure 6** and includes a chamber **105** which is partitioned by a diaphragm **105A** into a first section **105B** and a second section **105C**. The diaphragm **105A** includes a support surface **105I** for supporting the compression spring **105G**. The first section **105B** is provided with an opening **105D** to enable communicating the first section **105B** with the atmosphere. The second section **105C** is in fluid communication with the internal environment of the intake manifold **200**, particularly the outlet **206**, shown in **Figure 3**, such that, the pressure within the second section **105C** varies with the variation in pressure at the outlet **206** of the intake manifold **200**. The second section **105C** defines a nozzle **105H** distal from the diaphragm **105A**. The fluid communication of the second section **105C** with the internal environment of the intake manifold **200** is facilitated by the communicating tube **209A**. The communicating tube **209A** cooperates with the nozzle **105H** at one end and a provision **209**, which communicates with the internal environment of the intake manifold **200**, at the other end, as illustrated in **Figure 2**. The first section **105B** and the second section **105C** include a first resting surface **105E** and a second resting surface **105F**. During operation of the pressure switch **205**, the diaphragm **105A** is deformed and is caused to rest on either of the first resting surface **105E** and the second resting surface **105F**.

A compression spring **105G** is disposed within the second section **105C**. The compression spring **105G** enables biasing displacement of the diaphragm **105A**. The connecting rod **208** cooperates with the diaphragm **105A** at one end and the flap operating linkage **101** at the other end. The diaphragm **105A** is deformed either towards the first section **105B** or the second section **105C**, corresponding to the change in pressure within the second section **105C** with respect to the atmospheric pressure within the first section **105B**. The connecting rod **208**, cooperating with the diaphragm **105A**, is linearly displaceable with the deformation of the diaphragm **105A**.

The linear displacement of the connecting rod **208** is communicated to the flap operating linkage **101**. The flap operating linkage **101** includes a flap supporting element **214**, a pivot element **212**, and a link **211**. The link **211** cooperates with the connecting rod **208** via a coupler element **209**. The coupler element **209** includes a pin **210** having a cylindrical lobe **216**. The cylindrical lobe **216** slides along a slotted path defined within a guide **215**, illustrates in **Figure 5**, configured on the intake manifold **200** such that the slotted path of the guide **215** is substantially parallel to the path of linear displacement defined by the connecting rod **208** during linear displacement thereof. The flap supporting element **214** supports the flap **213** of the flap valve within the intake manifold **200**. The link **211** causes rotation of the flap supporting element **214** through the rotational motion of the pivot element **212** such that the flap **213** is displaced between the first position and the second position so as to selectively block flow of the air fuel mixture through the short duct **202** and the long duct **201** respectively. Thus, the link **211** enables translating the linear displacement of the connecting rod **208** to the angular displacement of the flap **213** through pivot element **212**.

The air-fuel mixture entering the intake manifold **200** flows through the long duct **201** when the engine operates at lower engine speeds while when the engine operates at higher speeds, the air-fuel mixture is caused to flow through the short duct **202**. The flow of the air-fuel mixture through the long duct **201** or the short duct **202** is achieved by the operation of the pneumatic actuator **104** which displaces the flap valve **213** between the first position and the second position. When the flap valve **213** is displaced from the first position and the second position, the air-fuel mixture is caused to flow through the long duct **201** and the short duct **202** respectively.

The pressure within the second section **105C** is variable corresponding to the pressure within the inlet manifold **200**, specifically the pressure at the outlet **206**. The pressure switch **205** operates with the change in pressure within the first section **105B** as compared to the atmospheric pressure acting in the second section **105C**. The pressure at the outlet **206** is less than the atmospheric pressure acting within the first section **105B**, at startup of the engine or when the engine operates at a lower speed and the plunger "P" of the carburetor blocks the inlet **106** by 50% or more. The pressure at the outlet **206** increases when the engine operates at a higher speed and the plunger "P" of the carburetor **100** is at the fully open condition.

Figure 7 illustrates the flap valve **213** in its first position and the flow of the air-fuel mixture when the engine operates at low engine speeds. The pressure at the outlet **206** when the engine operates at low speed the pressure at the outlet **206** is lower than the atmospheric pressure. The pressure at the outlet **206** is communicated through the communicating tube **209A** to the second section **105C** to actuate the operation of the pneumatic actuator **104**. Since the pressure within the second section **105C** is substantially lower than the atmospheric pressure acting within the first section **105B**, the variation of pressure between the first section **105B** and the second section **105C** causes the diaphragm **105A** to tend to be displaced towards the second resting surface **105F**, thereby creating a compressive force to act on the compression spring **105G**. However, the spring force of the compression spring **105G** restricts the movement of the diaphragm **105A** towards the second resting surface **105F** until the atmospheric pressure overcomes the spring force of the compression spring **105G**. The displacement of the diaphragm **105A** causes the connecting rod **208** to linearly move towards the second resting surface **105F**. This causes the link **211** to rotate the flap supporting element **214** thereby causing the flap valve **213** to be displaced to the first position so as to block passage of the air-fuel mixture through the short duct **202** while allowing the air-fuel mixture to flow to the outlet **206** through the long duct **201**. The flow of the air-fuel mixture through the long duct **201** causes turbulence and develops high torque required at lower engine speeds.

Figure 8 illustrates the flap valve **213** in its second position and the flow of the air-fuel mixture when the engine operates at high speed. When the engine operates at high speed where the carburetor plunger "P" is opening the inlet **106** between 50% to fully open condition the pressure at the outlet **206** is nearly same as the atmospheric pressure. The pressure at the outlet **206** is communicated through the communicating tube **209A** to the second section **105C** so as to actuate the operation of the pneumatic actuator **104**. The pressure within the second section **105C** is substantially same as that of the atmospheric pressure acting within the first section **105B**. The variation of pressure between the first section **105B** and the second section **105C** causes the diaphragm **105A** to be displaced towards the first section **105B**. When the diaphragm **105A** is pushed towards the first section **105B** in the fully open condition of the plunger, the compression spring **105G** is in its extended configuration. The spring force of the compression spring **105G** helps in maintaining the diaphragm **105A** in the deformed condition within the first section **105B**. The displacement of the diaphragm **105A** causes the connecting rod **208** to be linearly displaced towards the first resting surface **105E**. This causes the link **211** to rotate the flap supporting element **214** and hence cause the flap valve **213** to be displaced to the second position so as to block passage of the air-fuel mixture through the long duct **201** while enabling the air-fuel mixture to flow to the outlet **206** through the short duct **202**. The flow of the air-fuel mixture through the short duct **202** enables in supply of air-fuel mixture within a short time and hence -improves quicker boosting of charge into the combustion chamber. Thus, high torque is achieved at when the engine operates at higher speed.

Thus, the intake manifold **200**, as envisaged by the present disclosure, enables selectively directing the air-fuel mixture through the long duct **201** at partially open condition of the inlet **106** and through the short duct **202** at fully open condition of the inlet **106**. This helps in achieving good spread of torque throughout the operating range of the IC engine.

TRAIL RESULTS

The intake manifold of the present disclosure mounted on an IC engine was tested for variation of the Torque in (Newton-meter) with respect to engine speed in revolution per minute (rpm). **Figure 9** illustrates a typical graphical representation depicting the variation of the Torque in (Newton-meter) with respect to engine speed in revolution per minute (rpm) for the intake manifold of the present disclosure and conventional intake manifold.

In **Figure 9,** curves **a1** and **a2** graphically represents Torque in Newton-meter Vs Engine speed (rpm), as produced by an IC engine wherein an intake system with the intake manifold of the present disclosure is installed, when the throttle is in fully open condition and in partially open condition respectively. Again, curves **b1** and **b2** in **Figure 9** represent the curve of Torque in Newton-meter Vs Engine speed (rpm) as produced by a conventional Intake system mounted on an IC engine operating in fully open condition and partially open condition respectively.

From **Figure 9**, it can be observed that in partially open condition of the throttle, the curve **a2** illustrates significant improvement in torque of the IC engine as compared with **b2**. Again, in the fully open condition of the throttle, the curve **a1** illustrates that the intake manifold of the present disclosure enables in generating torque which is substantially similar to that generated by conventional intake manifold as illustrated by the curve **b1**. Thus, the intake system of the present disclosure provides significant improvement in torque at partially open condition of the throttle without compromising with the performance of the IC engine at fully open condition of the throttle.

TECHNICAL ADVANCEMENTS

The present disclosure described herein above has several technical advantages including but not limited to the realization of:

- an intake manifold that enables good spread of torque throughout the engine operating range;
- an intake manifold that is simple in construction;
- an intake manifold that is reliable;
- an intake manifold with minimal moving parts;
- an intake manifold facilitating improved combustion of fuel within an IC engine; and
- an intake manifold adaptable in compact space.

Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

The use of the expression "at least" or "at least one" suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the disclosure to achieve one or more of the desired objects or results.

The numerical values given of various physical parameters, dimensions and quantities are only approximate values and it is envisaged that the values higher or lower than the numerical value assigned to the physical parameters, dimensions and quantities fall within the scope of the disclosure unless there is a statement in the specification to the contrary. Wherever a range of values is specified, a value up to 10% below and above the lowest and highest numerical value respectively, of the specified range, is included in the scope of the disclosure.

The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms "a", "an" and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "including," and "having," are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

When an element or layer is referred to as being "on", "engaged to", "connected to" or "coupled to" another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly engaged to", "directly connected to" or "directly coupled to" another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.). As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as "first," "second," and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

Spatially relative terms, such as "inner," "outer," "beneath", "below", "lower", "above", "upper" and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein.

WE CLAIM:

1. An intake manifold for conveying air-fuel mixture from an inlet to an outlet, the inlet and the outlet being connected to the carburetor and the cylinder head of the engine respectively, , said manifold characterized by:

    - a long duct fluidly communicating between the inlet and the outlet;
    - a short duct fluidly communicating between the inlet and the outlet;
    - a junction defined at fluid connection between said long duct and said short duct, said junction configured downstream of the inlet;
    - a flap valve disposed at said junction, a flap of said valve adapted to be displaceable between a first position in which said flap defines a first flow-path of the air-fuel mixture wherein said air-fuel mixture passes through said long duct circumventing said flap when the engine operates at a lower speed, and a second position in which said flap defines a second flow-path of the air-fuel mixture wherein said air-fuel mixture passes through said short duct without passing through said long duct when the engine operates at a lower speed, said flap further adapted to disposed in an intermediate position between said first position and said second position to define a third flow-path of the air-fuel mixture wherein said air-fuel mixture partially flows through said long duct and the remaining air-fuel mixture flows through said short duct; and
    - a pneumatic actuator adapted to regulate the movement of said flap of said valve between said first position, said second position and an intermediate position between said first position and said second position.

2. The manifold as claimed in claim 1, wherein said inlet is configured with a plunger that moves to regulate opening of the inlet and defining a completely closed configuration in which said the air fuel mixture is restricted from entry into said manifold and a completely open configuration of said inlet in which the air-fuel

mixture is directed to pass through said short duct, said plunger further adapted to be displaced to an intermediate position in which the inlet is blocked by 50% or more, and the air-fuel mixture is directed to flow through said long duct.

3. The manifold as claimed in claim 1, wherein said flap valve is adapted to prevent exit of air-fuel mixture through said short duct in said first position of said flap of said flap valve.

4. The manifold as claimed in claim 1, wherein said flap valve is adapted to prevent exit of air-fuel mixture through said long duct in said second position of said flap of said flap valve.

5. The manifold as claimed in claim 1, wherein said pneumatic actuator comprises:

    - a chamber;
    - a diaphragm partitioning said chamber into a first section and a second section, said first section having an opening communicating with the atmosphere, said second section being in fluid communication with the internal environment of said manifold, such that, the pressure within said manifold is communicated directly to said second section;
    - a compression spring adapted to bias the displacement of said diaphragm;
    - a connecting rod cooperating with said diaphragm at one end, said connecting rod adapted to reciprocate along with said diaphragm corresponding to the pressure difference between said first section and said second section; and
    - a flap operating linkage adapted to translate the reciprocating movement of said connecting rod to angularly displace said flap valve between said first position and said second position.

6. The manifold as claimed in claim 4, wherein said second section is in fluid communication with the internal environment of said manifold via a communicating tube.

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7. The manifold as claimed in claim 4, wherein said diaphragm is a deformable diaphragm to amplify the reciprocating movement of said connecting rod.

8. The manifold as claimed in claim 4, wherein said flap operating linkage consists of:

    - a flap supporting element adapted to support said flap valve, said flap supporting element adapted to rotate about an axis substantially perpendicular to said connecting rod; and
    - a link adapted to displace said flap supporting element, said link adapted to cooperate with said connecting rod via a coupler element, said link being adapted to translate the linear movement of said connecting rod to the angular displacement of said flap valve.

9. The manifold as claimed in claim 1, wherein said flap of said flap valve is adapted to be angularly displaceable between said first position and said second position.

Dated this 31st day of December, 2013

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APPLICANTS' PATENT ATTORNEY

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