

AIR SWIRLING DEVICE FOR AN INTERNAL COMBUSTION ENGINE

5 The present invention relates to an air swirling device for an internal combustion engine. The air swirling device is used for a spark ignition internal combustion of a carburetor type or a fuel injection type, and a diesel engine of a high compression self-ignition type.

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 It is known that an increase of swirl flow in a combustion chamber of an internal combustion engine improves the flame propagation speed so that complete combustion is achieved. However, there are many problems which accompany
15 attempts at increasing air flow such as air resistance and the

like. Such known facts are shown in the following prior art documents. For example, Japanese patent publication Nos. 53-26247, 59-11722, and U.S. Patent No. 4,309,969 disclose a simple turbulence device, which includes an intake valve having a large intake resistance so that the swirling device does not create an uniform air flow. Japanese patent publication Nos. 60-17922 and 61-10645, U.S. Patent Nos. 4,424,777, 4,432,312, and 4,539,954 disclose a device having vanes which are disposed at the vicinity of an intake valve. Such devices have various disadvantages, such as for example, air resistance, reduced inlet air into the cylinder, varying air flows of intake manifolds and strong vibrations due to different swirl ratios and volumes of intake air. U.S. Patent Nos. 3,648,674 and 4,274,386 disclose a wire set and blades device disposed between a carburetor and an intake manifold. However, the device exhibits high friction so that the device provides a reduced amount of inlet air and is used only for a gasoline engine of the carburetor type.

In order to avoid such problems, U.S. Patent No. 4,962,642 issued to

the present inventor, discloses an air flow system for an
5 internal combustion engine comprising an air cleaner and a
swirling device disposed therein, having a plurality of
vanes for causing the air to swirl thereby improving the
properties of air fuel mixture and the performance of the
engine. However, this air flow system, generally, has
10 negative pressure disposed behind the plurality of vanes and
air flow frictions due to the swirl of the air so that the
air flow system has several disadvantages such as, for
example, decrease of the intake air, lower power, and no
fuel save.

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The present invention is intended to overcome the
above-described disadvantages of the conventional device.

According to the present invention there is provided
20 a swirling device for an internal combustion engine, said
swirling device comprising an annular plate mounted about an
axis in an air cleaner and a plurality of vane members
extending from one face of the plate, each vane member having
an edge connected to the plate, a free distal edge and at
25 least one elongate slit contained within the periphery of
the vane member, whereby as air passes through the air
cleaner the vanes create a swirling force and the slits tend
towards equalization of the pressure on the upstream and
downstream sides of the vanes.

One advantage of the air swirling device of the present invention is that it minimizes the restriction of air flow and prevents adherence of the fuel to the wall of the intake system and from generating negative pressure behind the vanes. This provides for a good mixture of air and fuel having good evaporation and fine and uniform fuel particle size which improves the acceleration of the vehicle driven by the engine. If there is a slight pedal acceleration, the amount of the injected fuel is lower thereby resulting in fuel savings.

Preferably each vane has at least one slit substantially parallel to an axis extending between the edge connected to the plate and the distal edge. Each vane may in addition or alternatively have at least one slit substantially perpendicular to the axis extending between the edge connected to the plate and the distal edge.

Further according to the present invention there is provided an internal combustion engine having an exhaust manifold and an intake manifold with a cylindrical inlet, an annular air filter mounted on said intake manifold, an annular filter element within said filter and a swirling device according to the present invention, wherein the said axis is co-axial with the axis of the cylindrical inlet of the intake manifold.

The present invention will become more fully understood from the detailed description given hereinbelow
5 and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

Fig. 1 is a cross-sectional view of the air flow
10 system of the swirling device for a gasoline engine of an internal combustion engine of the present invention;

Fig. 2(A) is a perspective view of a swirling device having a plurality of vanes with at least one slit disposed
15 therein, respectively, of the present invention;

Fig. 2(B) is a perspective view of an additional swirling device having a plurality of vanes with at least one slit disposed therein, respectively, of the present
20 invention;

Fig. 3(A) shows the air flow stream through the conventional air swirling device;

Fig. 3(B) shows the air flow stream through the air swirling device of the present invention; and

Fig. 4 is a front view of vanes of the swirling device of the present invention, having at least one elongated slit
5 disposed therein.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now in detail to the drawings for the purpose of illustrating preferred embodiments of the present invention, as shown in Fig. 1, a swirling device 3 is
10 disposed around the center of the air cleaner 2 for causing the air to swirl. As shown in Fig. 1, additional swirling devices 3 have a plurality of vanes 3', respectively, can be added in the portion between the carburettor 7 and intake manifold 8 in the same direction for increasing the swirling
15 air flow force which may be reduced while the swirling air passes the carburettor 7.

As shown in Fig. 1, an additional swirling device 3 is inserted into the exhaust manifold entrance in the same direction for improving the swirling of the exhaust gas.
20 Furthermore, the swirling exhaust gas helps to reduce back-pressure thereby resulting in improved exhaustion and stronger intake

force. The swirling device 3 may be made of flexible materials.

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The air cleaner 2 is associated with an engine body 1 of a gasoline engine through a carburetor 7 and an intake manifold 8 (Fig.1). The engine body 1 is associated with an exhaust manifold 9. The swirling device 3 is inserted into
10 the inside of the air cleaner 2 by a bolt and a wing nut(not shown). As shown in Figs. 2(A) and 2(B), the swirling device 3 comprises a disc or cylindrical body 3a, 3b and a plurality of vanes 3' which extend radially from the body, with at least one elongated slit 3" disposed therein,
15 respectively.

As shown in fig. 4, each of vanes has at least one elongated slit 3". The slits 3" may be vertically or horizontally located in the vanes or vertically and
20 horizontally located in the vanes.

As shown in Figs. 3(A) and 3(B), the air flow stream according to the conventional air swirling device generates a negative pressure zone 5 and the swirling flow 6 disposed
25 behind the plurality of vanes (Fig. 3(A)). However, the air flow stream according to the present invention prevents from generating the negative pressure zone and the

swirling flow disposed behind the plurality of vanes 3' (Fig.3(B)).

In operation, when pistons 10 and intake valves 11 move downward, air flow filtered by the air cleaner element 2' is swirled by the vanes 3' of the swirling device 3, respectively, due to a reduced pressure in a combustion chamber 4. A revolution inertia force causes a high density of air which surge into the combustion chamber. At this time, in the carburetor 7 of the gasoline engine, fuel particles are gathered in the center of the swirling air flow for causing fuel and air to uniformly mix. And the swirling air flow center moves very fast so that the fuel does not adhere to the wall of the intake conduit and results in good engine and accelerator pedal response. Also, the swirling air flow is continuously maintained in the combustion chamber 4 so that the swirling air flow is continuously maintained in the exhaust manifold 9. Therefore, in the combustion chamber 4, the flame is scattered very well and the fuel is completely combusted for preventing noise, vibration and abrasion thereby causing longer engine life and stronger engine power.

The fast combustion is useful with advanced spark timing and

results in leaner combustion, lower air pollution and fuel savings. The combustion products (carbon and oxides) are concentrated in the center of the combustion chamber and can be easily exhausted to prevent carbon accumulation in the combustion chamber which could cause engine abrasion. The swirling action may continue in the same direction without any intake resistance as the gas leaves the combustion chamber.

With the swirling device having the plurality of vanes with at least one elongated slit disposed therein, respectively, being placed in the air cleaner, the carbon monoxide(CO) gas level can be reduced up to 17% at engine idle speed. The engine power can be increased up to 11%. Fuel economy can be improved up to 6% and NOx can be reduced up to 5%. These data were calculated and measured by the Korea National Industry Research Institute.

CLAIMS:

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- 5 1. A swirling device for an internal combustion engine,
said swirling device comprising an annular plate
mounted about an axis in an air cleaner and a
plurality of vane members extending from one face of
the plate, each vane member having an edge connected
10 to the plate, a free distal edge and at least one
elongate slit contained within the periphery of the
vane member, whereby as air passes through the air
cleaner the vanes create a swirling force and the
slits tend towards equalization of the pressure on the
15 upstream and downstream sides of the vanes.
2. A swirling device as claimed in claim 1, wherein each
vane has at least one slit substantially parallel to
an axis extending between the edge connected to the
20 plate and the distal edge.
3. A swirling device as claimed in claim 1 or 2, wherein
each vane has at least one slit substantially
perpendicular to an axis extending between the edge
25 connected to the plate and the distal edge.
4. A swirling device as claimed in claim 1 and
substantially as hereinbefore described with reference
to and as illustrated by the accompanying drawings.



5. An internal combustion engine having an exhaust manifold and an intake manifold with a cylindrical inlet, an annular air filter mounted on said intake manifold, an annular filter element within said filter and a swirling device as claimed in claim 1, wherein the said axis is co-axial with the axis of the cylindrical inlet of the intake manifold.
6. An engine as claimed in claim 5, wherein a cylindrical swirling device is mounted in said intake manifold and has vanes with slits.
7. An engine as claimed in claim 5 or 6, wherein a cylindrical swirling device is mounted in said exhaust manifold and has vanes with slits.
8. An internal combustion engine as claimed in claim 5 and substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.
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