

[54] **SUPERCHARGER FOR INTERNAL COMBUSTION ENGINE CARBURETION**

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[51] Int. Cl. .... **F02m 21/04**

[58] Field of Search ..... **48/180 R, 180 M, 180 C, 48/180 B, 180 S; 261/79 R; 123/141, 52 M, 119 C, 65 C, 119 CF, 119 CG; 137/808, 812, 813; 239/399, 402; 431/354; 259/4; 62/5**

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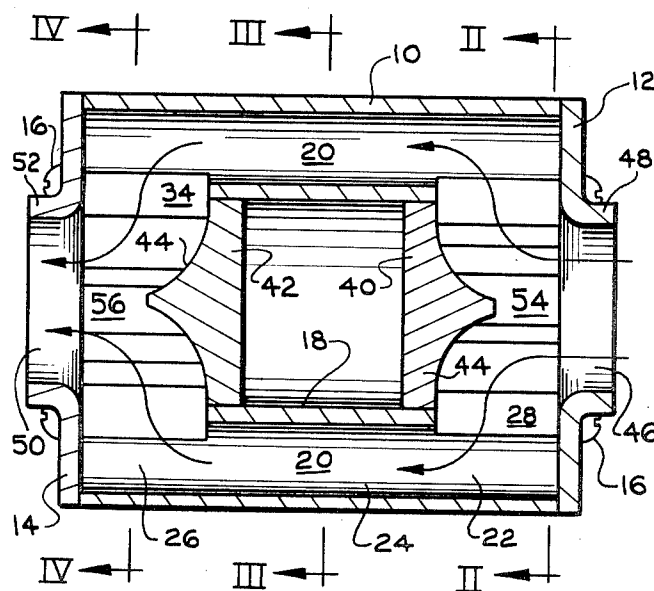
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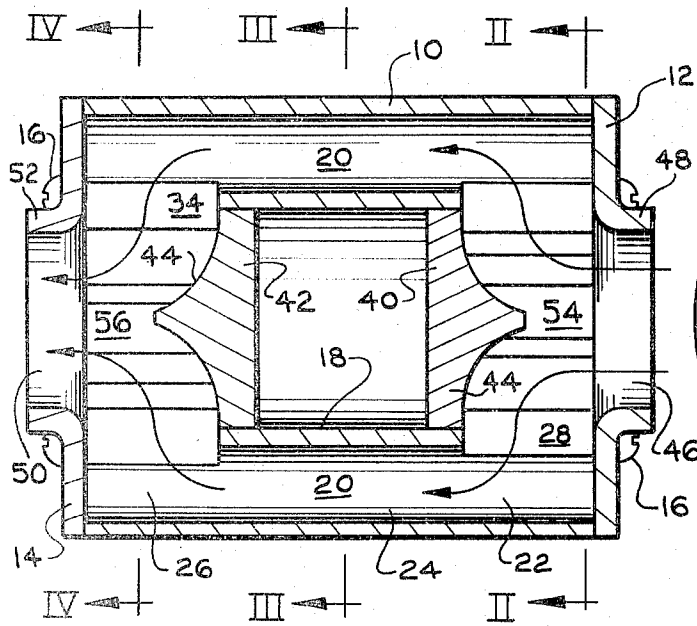
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[57] **ABSTRACT**

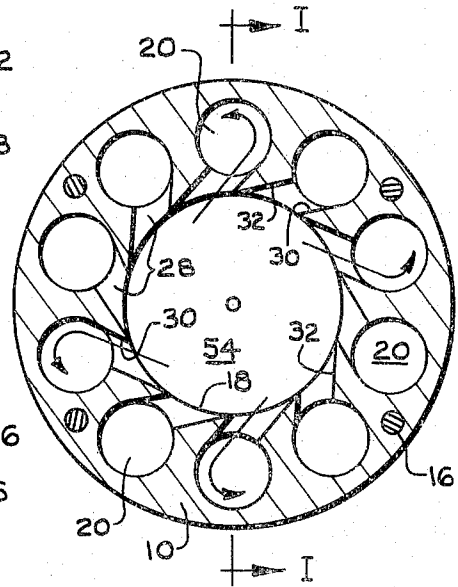
Apparatus for supercharging the air and gas fuel mixture of internal combustion engines wherein the dynamic supercharging produced is self-generated as cylinder charging pressures are created by the vortex motion of the moving gases. The supercharger utilizes the inertial characteristics of the flowing fuel gases as produced by the vortexing of the gases within a plurality of longitudinal passages. The vortexing gases within the passages are introduced into a larger chamber creating additional vortexing resulting in superior air and gas mixing and a high thermal efficiency within the combustion chamber.

**9 Claims, 4 Drawing Figures**

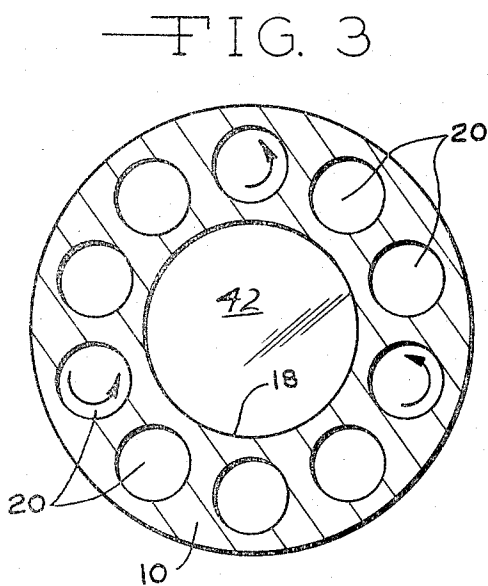




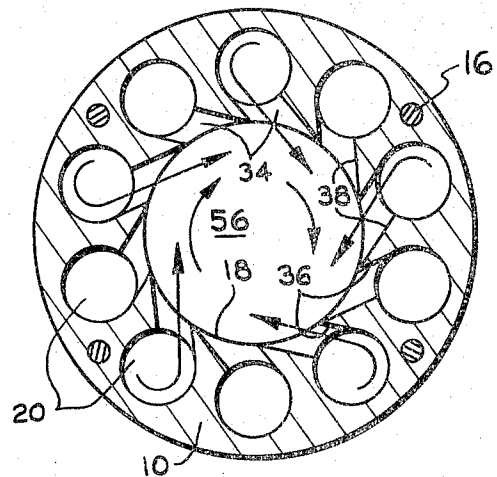
—FIG. 1



—FIG. 2



—FIG. 3



—FIG. 4

## SUPERCHARGER FOR INTERNAL COMBUSTION ENGINE CARBURETION

### BACKGROUND OF THE INVENTION

The invention pertains to apparatus for imparting to the gaseous fuel medium entering an internal combustion engine a vortexing motion which aids in the mixing of air and gas, and produces a dynamic movement of the gaseous medium resulting in the storing of energy even during the termination of medium flow during closing of the engine intake valve structure.

A great number of devices have been proposed for use with internal combustion engine carburetion wherein improved mixing of the air and gas prior to burning is achieved. Additionally, many powered supercharging devices for internal combustion engine carburetion are available wherein air is forced into the engine carburetor under superatmospheric conditions to improve engine performance.

The supercharging of internal combustion engines is normally accomplished by air pump devices powered from the engine, and the expense of such apparatus, and the results achieved, are such that such devices are normally used only for racing and high performance purposes. Devices for improving the mixing of gas and air without resorting to externally powered superchargers often utilize means for imparting to the carbureted air a spinning, swirling, or vortex motion designed to improve the intermingling of the gas and air particles. U.S. Pat. Nos. 1,038,262, 3,301,537 and 3,437,467 are typical of such known devices. Also, improved intermixing of gas and air in the burner art is known as shown by U.S. Pat. No. 2,860,694.

Externally powered superchargers are too expensive for widespread use, and the maintenance, tuning, and operation of such devices precludes use of the same on conventional vehicles. Further, devices for improving the mixing of carbureted air and gas by imparting a spiraling or vortex motion to the gas have not heretofore been commercially practiced to any significant extent, for various reason, and it is still the most common practice to directly permit the carbureted air to enter the carburetor relying upon what incidental mixing occurs between the air and gas as the gaseous mixture flows through the engine and intake manifold and intake valve.

In the operation of an internal combustion engine, either of the two cycle or four cycle type, the flow of the air and gas fuel mixture from the carburetor into the combustion chamber is periodically rapidly interrupted as the intake valve opens and closes. This interruption of the airflow through the carburetor produces shock waves of great magnitude, and with relatively small engines, such as those used in garden tractors, snow mobiles, and the like, the periodic interruption of the gas and air mixture through the carburetor produces back pressures causing the carburetor to "spit back" which may result in improper engine performance, rough running, and creates a potential safety hazard.

### SUMMARY OF THE INVENTION

It is the object of the invention to provide a supercharger for internal combustion engines in which the dynamic forces thereof are self-generated by the flow of air, or air and gas therethrough, and produces a dynamic pressure due to the inertial forces of the gases

flowing therethrough which is capable of pressurizing the combustion chamber upon opening of the engine inlet valve.

Another object of the invention is to provide a supercharger for internal combustion engines wherein the supercharger requires no external power source, yet produces a capacitance conducive to efficient fuel mixing and the creation of a superatmospheric pressure at the engine intake valve. The device of the apparatus produces a highly effective vortex of mixed air and gas wherein the vortexing continues as the fuel mixture enters the combustion chamber producing a stratified charge of combustible mixture within the chamber resulting in superior ignition and burning characteristics.

In the practice of the invention the supercharger consists of a plurality of substantially cylindrical passages, which may be defined in a body, one end of the body constituting an inlet end, and the other end of the body constituting an outlet end. At the inlet end of the passages air, or an air and gas mixture, enters the passages tangentially to produce a vortexing therein. The gas moves axially through the passages continuing the vortexing action. At the outlet end of the passages the gaseous medium is ejected from the passages in a tangential manner, and introduced into a cylindrical outlet chamber in a tangential manner which produces a vortexing of the gaseous medium prior to leaving the supercharger. The introduction and removal of the gaseous medium from the passages is accomplished through vane openings designed in the body, and the vortexing within the passages and outlet chamber occurs in an unhindered manner.

The vane openings within the passages comprise slots of relatively narrow configuration, and as the gaseous medium enters the passages at right angles to the passage lengths, the dimension of the vane openings, and the right angle relationship, functions to confine pressure waves created at the engine due to inlet valve closing, reducing "spit back" and other back pressure phenomenon occurring with internal combustion engine carburetion. This structure confines the lower frequencies radiated from the engine cylinder back through the intake manifold and fuel conduits wherein a high rate of attenuation is produced, particularly in the 60 to 180 cps range.

Baffle means are employed within the supercharger to produce efficient airflow therethrough, and the construction of a supercharger in accord with the invention is relatively economical and feasible with engines of all sizes, including smaller engines employing one or two cylinders.

### BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the invention will be appreciated from the following description and accompanying drawings wherein:

FIG. 1 is a diametrical, elevational, sectional view of a supercharger constructed in accord with the invention as taken along section I—I of FIG. 2,

FIG. 2 is an elevational, sectional view taken through the inlet end of the supercharger along section II—II of FIG. 1,

FIG. 3 is an elevational, sectional view taken through the central region along section III—III of FIG. 1, and

FIG. 4 is an elevational, sectional view taken through the supercharger in accord with the invention through the outlet end thereof along section IV—IV of FIG. 1.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

The inventive concepts may be practiced in a wide variety of embodiments, and by way of illustration, a simplified form of supercharger in accord with the invention is illustrated.

In the illustrated embodiment the supercharger includes an elongated cylindrical body 10 having a longitudinal axis. The body 10 includes an inlet end plate 12 and an outlet end plate 14 attached to the body by screws 16.

The body 10, in the illustrated form, is of an annular configuration having an outer cylindrical surface, and a central coaxial longitudinal bore 18. A plurality of cylindrical passages 20 are located within the body 10 concentrically disposed about the body axis between bore 18 and the outer surface and intersect the ends of the body. The passages 20, for descriptive purposes, each include an inlet end region 22, a central region 24, and an outlet end region 26.

The body wall separating the bore 18, and the passages inlet end region 22 is milled out to provide communication between the bore and the passages. This machining results in a plurality of axially extending inlet vane openings 28 defined by surfaces 30 and 32 which are obliquely disposed to the axis of the body 10, and to the axis of the associated passage 20, such that the surface 30 is substantially tangentially related to the associated passage and surface 32 is tangential to bore 18. Thus, air entering a passage 20 through a vane opening 28 will tangentially enter the passage producing a vortex or rapid spiraling motion of the air within the associated passage.

Adjacent the outlet end region 26 of the passages 20 the body material intermediate the bore 18 and the passages is removed to form a plurality of axially extending outlet vane openings 34, FIG. 4, defined by surfaces 36 and 38. The surfaces 36 are substantially tangentially disposed to the associated passage 20, and the surfaces 38 are substantially tangentially disposed to the bore 18. Thus, air leaving the passages 20 through the vane openings 34 will be injected into the bore 18 adjacent outlet end plate 14 in a tangential manner creating a vortex within the bore 18.

The central region of the bore 18 is plugged by a pair of baffles 40 and 42 which are pressed into the body bore. The baffles 40 and 42 each include an outwardly facing surface 44 of a substantially conical configuration concentric with the axis of the body and converge outwardly toward the associated body end plate. As will be noted in FIG. 1, the baffle 40 is axially positioned so that the maximum radial dimension of the associated surface 44 is in axial alignment with the inner axial end of the vane openings 28, and in a similar manner the surface 44 of the baffle 42 is in alignment with the innermost end of the outlet vane openings 34.

As described above the inlet end of the body 10, and the end of the passages 20 adjacent thereto, are closed by the annular inlet end plate 12, attached to the body by screws 16. The end plate 12 includes a central opening 46 concentric to the body axis having an outward

axially extending neck flange 48. In like manner the outlet end plate 14 includes a coaxial outlet opening 50 and a concentric neck flange 52.

With reference to FIG. 1, the portion of the bore 18 intermediate baffle 40 and end plate opening 12 constitutes an inlet chamber 54 of cylindrical configuration whose outer wall is intersected by the vane openings 28. In like manner the baffle 42 and end plate 14 define an outlet chamber 56 circumscribed by the outlet vane openings 34.

The supercharger in accord with the invention may be attached to either the inlet of the internal combustion engine carburetor, or the outlet, between the carburetor and the engine intake manifold. It is preferred that the supercharger be attached to the carburetor inlet, and in such instance the supercharger is attached to the carburetor, not shown, by the outlet neck flange 52. In such an installation only air is passing through the supercharger, prior to mixing with the gas within the carburetor. If the supercharger is mounted between the carburetor and the engine intake manifold, an air and gas mixture will be passing through the supercharger. In either situation the concepts of the invention are present and practiced.

Upon the engine cranking and starting, air will be drawn through the supercharger during each opening of the engine inlet valve, or valves, as a new combustion charge is drawn into the cylinder, or cylinders. Thus, air enters into the body 10 through the opening 46, enters the inlet chamber 54, and passes into the inlet end regions 22 of the passages 20 through the vane openings 28. The rapid introduction of air into the passages 20 through the vane openings 28 in a tangential manner as regulated by the vanes causes a strong vortex spiraling of the air within the passages 20. The air axially moves in a spiral manner through the passages 20 to the left, FIG. 1, and upon the air reaching the passages outlet end region 26 the air is rapidly drawn from the passages through the vane openings 34 into the outlet chamber 56. As the vane openings surfaces 36 are tangentially related to the passages 20 the direction of the vortex of air within the passages aids in the ejecting of the air from the passages, and the substantially tangentially relationship of the vane openings 34 to the outlet chamber creates a strong vortexing of the air within the outlet chamber 56. The vortexing air is drawn from the chamber 56 through opening 50 into the carburetor for mixing with gasoline, and the air is then drawn into the engine combustion chamber through the inlet valve, not shown.

The strong vortex action of the air within the outlet chamber 56 continues as the air passes through the carburetor, and passes into the engine combustion chamber. Such vortexing produces an efficient distribution of the gas and air mixture within the combustion chamber, particularly adjacent the combustion chamber cylinder walls, and excellent fuel burning characteristics are achieved during ignition. When the supercharger in accord with the invention is used in conjunction with a two cycle engine, the combination gas and air mixture is, of course, drawn into the engine crankcase, and the vortexing of the air likewise aids in effectively distributing the combustible mixture within the engine cylinder.

The flow of air in the inlet chamber 54 is smoothly directed toward the vane openings 28 by the conical configuration of the baffle 40 and a vortexing occurs in

the inlet chamber itself. In a similar manner the discharging of the air from the outlet chamber 56 is facilitated by the configuration of the baffle 42, and the baffle 42 does not interfere with, or adversely affect, the vortexing occurring within the outlet chamber 56.

Due to the opening and closing of the engine intake valve, or valves, the drawing of the air through the supercharger occurs in cycles, the duration and frequency of which is determined by the rotational velocity of the engine and the number of cylinders. Thus, in effect, the airflow through a carburetor tends to be of an intermittent character. With each closing of the engine intake valve pressure and shock waves are created of significant force and velocity. These forces are transmitted back through the carburetor, and tend to create a "spit back" condition, particularly with small engines. However, with the supercharger of the invention the presence of the continuous vortex within the outlet chamber 56 due to the inertia of the air therein, plus the fact that the passages 20 are disposed at right angles to the direction of gas flow through the vane openings 34, tends to trap such shock waves, and prevent carburetor spit back and back pressure.

Supercharging of the combustion chamber is created by the invention due to the presence of the plurality of tubes 20 having strong vortexing existing therein, and the vortexing occurring in the outlet chamber 56, and the inlet chamber 54. The vortex action of the air within the passages and chambers permits the inertial forces created in the air during the engine charging stroke to continue the dynamic movement of the air even when the airflow of the engine is terminated due to the closing of the intake valve. This dynamic condition of the air tends to create a superatmospheric pressure within the outlet chamber 56, and within the carburetor and engine intake manifold itself, so that upon opening of the engine intake valve the air and gas mixture is rapidly introduced into the engine combustion chamber thereby producing a supercharging without the necessity of pumps or externally powered apparatus.

It is believed that the apparatus of the invention produces a standing wave at the outlet chamber 56 which minimizes the effect of back pressure waves, and the supercharger construction cuts off the lower frequencies radiated from the cylinder due to the vortexing turbulence and the right angle flow of gas through the vane openings 34. Additionally, the high velocity within the passages 20 maintains the dynamic character of the flow through the supercharger, and the vortexing within the supercharger maintains high inertial values in that no screw or deflector mechanisms are required.

It is appreciated that the inventive concept could be practiced by introducing the air into the passages 20 externally of the body 10, rather than through the inlet chamber 54, and likewise, a wide variety of configurations of the outlet chamber are within the scope of the invention, and it is intended that the invention be confined only by the scope of the following claims:

I claim:

1. A supercharger for use with a carburetor for internal combustion engines characterized by its ability to dynamically retain the movement of carburetor air and provide mixing of the combustible mixture through generation of a vortex comprising, in combination, an elongated body having an axial center, an inlet end and

an outlet end, a chamber defined at said outlet end, means defining a plurality of longitudinally extending passages in said body extending between said ends thereof, each of said means defining said passages having an inlet and an outlet adjacent said body inlet end and outlet end, respectively, means defined at said passages' inlets for imparting a vortex motion to air entering said passages, and discharge means defined at said passages' outlets for discharging air from said passages into said chamber at an angle to said body axial center to create a vortex within said chamber concentric to said body axial center.

2. In a supercharger for use with a carburetor for internal combustion engines as in claim 1 wherein said means defining said passages are of substantially cylindrical configuration and said means defined at said passages' inlets and said discharge means comprise vane openings intersecting said passages in substantially tangential relationship.

3. A supercharger for use with a carburetor for internal combustion engines characterized by its ability to dynamically retain the movement of carburetor air and provide mixing of the combustible mixture through generation of a vortex comprising, in combination, an elongated body having an axial center, an inlet end and on outlet end, a cylindrical chamber defined in said body at said outlet end concentric to said body axial center, means defining a plurality of longitudinally extending substantially cylindrical passages in said body extending between said ends thereof, each of said means defining said passages having inlet air guiding means adjacent said body inlet end associated therewith for imparting a vortex motion to air entering each of said passages, and each of said passages having outlet air guiding means adjacent said body outlet end communicating with said chamber for discharging the vortexing air within said passages into said chamber obliquely with respect to said body axial center to produce a vortex within said chamber about said body axial center.

4. In a supercharger for use with a carburetor for internal combustion engines as in claim 3 wherein said passages inlet end air guiding means comprise means defining an opening tangentially intersecting each passage defining means adjacent said inlet end, and each outlet air guiding means comprises means defining tangentially an opening intersecting its associated passage defining means and tangentially intersecting said chamber.

5. In a supercharger for use with a carburetor for internal combustion engines as in claim 4 wherein said means defining openings tangentially intersecting said chamber comprise means defining elongated slots extending in the direction of the length of the associated passage, said slots of a length substantially equal to the axial length of said chamber and in radial alignment therewith.

6. In a supercharger for use with the carburetor for internal combustion engines as in claim 3 wherein means defining passages are concentrically disposed about said body axial center and are parallel thereto.

7. A supercharger for use with a carburetor for internal combustion engines characterized by its ability to dynamically retain the movement of carburetor air and provide mixing of the combustible mixture through generation of a vortex comprising, in combination, an elongated body having an axial center, an inlet end and

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an outlet end, an inlet coaxial chamber defined in said body intersecting said body inlet end, an outlet coaxial cylindrical chamber defined in said body intersecting said body outlet end, the combined axial dimension of said chambers being less than the axial dimension of said body wherein said body includes a central region intermediate said ends and chambers, means defining a plurality of cylindrical passages in said body substantially parallel to said body axial center and located at a greater radial distance from said body axial center than the maximum radial dimension of said chambers, means defining a plurality of passage inlet openings in said body each inlet opening communicating with said inlet chamber and one of said passages, each of said inlet opening tangentially being related to its associated passage whereby air entering said passages creates a vortex therein means defining a plurality of passage outlet openings in said body each outlet passage opening communicating with said outlet chamber and one

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of said passages, each of said passage openings being tangentially related to its associated passage and said outlet chamber whereby air entering said outlet chamber from said outlet openings creates a vortex within said outlet chamber.

8. In a supercharger for use with a carburetor for internal combustion engines as in claim 7 wherein said openings comprise means defining axially extending slots, said openings having an axial dimension substantially equal to the axial dimension of the associated chamber.

9. In a supercharger for use with a carburetor for internal combustion engines as in claim 7 wherein said chambers each include a radially disposed baffle facing the adjacent body end, said baffles being of a generally conical configuration concentric to said body axial center and converging toward the adjacent body end.

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