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SECTIONAL BUTTERFLY VALVE

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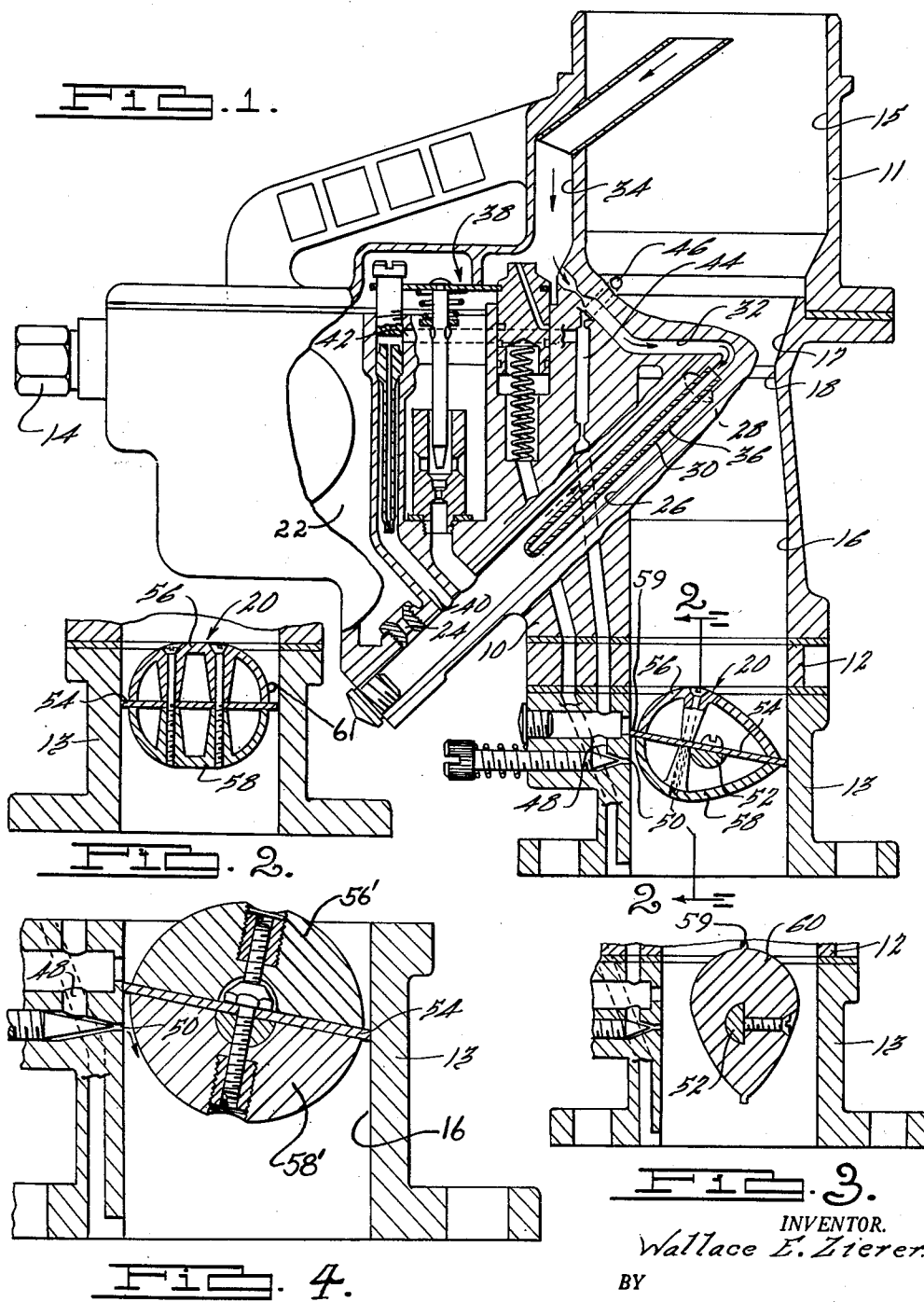


FIG. 3.
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SECTIONAL BUTTERFLY VALVE

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This invention relates to a carburetor for an internal combustion engine and more particularly to a throttle valve structure.

It is a principal object of the invention to provide a throttle blade that is so shaped that it evenly distributes fuel to the various manifold branches.

It is also an object of the invention to provide a throttle valve that is particularly adapted to restrict vehicle speed for where an engine is provided with a carburetor having a capacity in excess of that desired for a particular application past attempts have been made to limit the speed of the engine by reducing the capacity of the carburetor and have resulted in the common use of controls which limit the rotation of the throttle blade beyond a predetermined position or utilize a spring loaded valve or plate with a fixed orifice to partially close the air and fuel mixture passage of the carburetor. Devices of these types possess inherent disadvantages principally relating to the fact that control of the vehicle is limited to a small portion of accelerator pedal travel and that overtravel beyond this point is either obstructed or exerts no noticeable effect upon the operation of the engine. It is desirable to control the vehicle throughout the full travel of the accelerator and it is an object of this invention to provide a throttle valve so shaped that it restricts the maximum flow of air in the conduit, but varies the restriction throughout the entire range of throttle movement.

It is an additional object of the invention to provide a throttle valve of substantial mass so that it retains heat and retards the formation of ice on the blade thereof due to evaporation of the ice.

It is a further object of the invention to provide a throttle valve of sufficient width to restrict the passage of air in the immediate vicinity of the carburetor idling jet and the vacuum spark hole during partially open throttle conditions to thereby impart a high velocity to the air passing the jet and hole to facilitate the discharge of fuel from the jet and to facilitate the spark advance in the distributor.

In the drawings:

Fig. 1 is an elevational view, partly in section, of a downdraft carburetor incorporating my novel governor therein;

Fig. 2 is a section taken on the line 2-2 of Fig. 1;

Fig. 3 is a vertical sectional elevation of a portion of a carburetor showing a solid throttle valve form of my invention; and

Fig. 4 is a sectional elevation of a portion of the carburetor showing a modified form of my invention.

Referring to the drawings, the carburetor comprises an assembly of a body 10, an air horn 11, an insulator 12 and a body flange 13. The body flange 13 is adapted to be secured to an engine intake manifold (not shown). A nipple 14 is adapted to be connected by a fuel line (not shown) to a source of supply of fuel such as a fuel pump (not shown). The air horn 11 is provided with a tubular part 15 which serves as an air inlet to a fuel mixture passage 16 which includes a Venturi portion 17 having a throat 18. The egress of the fuel mixture to the engine intake manifold is controlled by a throttle valve 20.

The body portion of the carburetor is provided with the usual reservoir 22 and a main fuel injection means controls the mixture with air of fuel passing through a metering jet 24. A tubular passage 26 connects jet 24 with orifice 28 and the mixture chamber 16. A tubular passage 30 which is positioned within the passage 26 is connected by ducts 32 and 34 with the atmosphere in air horn 11. The tubular passage 30 is concentrically disposed within the passage 26 and provided with a plurality of holes 36 in its side walls. Air entering tubular passage 30 escapes through holes 36 and mixes with fuel in passage 26.

A conventional mechanism 38 is adapted to vary the fuel mixture ratio in response to the degree of vacuum in a manner which is well known to those familiar with the art. Reference may be had to the copending application of Thomas M. Ball, Serial No. 668,795, now Patent No. 2,551,719 for a further description of this mechanism.

Liquid fuel for engine idling is aspirated up through idling tube 40 and through passage 42 to a passage 44. The latter passage has an orifice 46 open to the atmosphere and an orifice 48 connected to an idling jet 50. Fuel and air pass down passage 44 and are discharged from jet 50.

The throttle valve 20 is of the butterfly valve type and includes conventional shaft 52 which is rotatably mounted in the body flange 13 transversely of the fuel mixture passage 16. A conventional throttle blade 54 is secured to the shaft 52 and in the form of the invention illustrated in Fig. 1 a pair of oppositely disposed lobular restrictor elements 56 and 58 are carried by the blade 54. The restrictor elements 56 and 58 have convex outer surfaces and are so shaped that in

cross section in a plane normal to shaft 52 they each have an airfoil contour and when assembled with the throttle blade the assembly resembles a teardrop. Fig. 2 illustrates the contour in a plane parallel to shaft 52. In Fig. 1 the dimension of the throttle valve 20, with the restrictor elements 56 and 58 superimposed thereon, is of substantial magnitude in a direction transverse to the blade 54 so that on throttle open positions the cross sectional area of the passage 15 is materially reduced by the obstruction presented by the throttle valve. Satisfactory results have been obtained where the dimension of the throttle valve is such that at wide open throttle position the unobstructed area through which air may travel is approximately 25% of the cross sectional area of the passage 16. Also, as is evident from Figures 1 and 3 the unobstructed area in the region of the throttle valve is less than the cross sectional area of the Venturi throat 18 whereby even at wide open throttle the maximum flow capacity is limited by the throttle valve and not by the Venturi throat area as in conventional carburetors.

Referring to Fig. 1 it will be seen that when the throttle blade 54 is in the position illustrated the capacity of the fuel mixture passage 16 is substantially completely obstructed. When the shaft 52 is rotated so that the blade 54 assumes a position parallel with the axis of the passage 16 the maximum flow capacity is obtained, but even this capacity is restricted by the elements 56 and 58 for the capacity is considerably less than the available capacity of the passage which would be obtained if the restrictor elements 56 and 58 were not present on the blade 54. In other words, the capacity of the fuel mixture passage is reduced to a predetermined maximum value by the restrictor elements. The contour of the restrictor elements is so predetermined that rotation of the shaft 52 progressively decreases the flow capacity through the passage 16 from the predetermined maximum value at wide open position of the throttle to substantially zero at the throttle closed position illustrated in Fig. 1. The capacity of the fuel mixture passage is thus gradually varied throughout the entire normal operating range of the throttle mechanism.

It will be noted that at wide open throttle position the rounded contour of the throttle valve evenly distributes the air into paths which travel on opposite sides thereof which facilitates an even distribution in the manifold. In the use of the conventional throttle blade the blade when partially open, tends to force heavy particles of fuel to one side of the passage 16. The present device approximates a uniform distribution of these particles to all walls of the passage. In the form of the invention illustrated in Fig. 1 the restrictor elements 56 and 58 have been illustrated as hollow shells.

In Fig. 3 a valve similar to that illustrated in Fig. 1 has been shown where the entire valve is formed of one solid piece 60. In other respects the two forms of the invention are similar.

In Fig. 4 a modified form of the invention is illustrated in which the restrictor elements 56' and 58' each have the contour of a segment of a sphere and their maximum combined dimension normal to the blade 54 is less than the diameter of the blade 54 so that when the blade 54 is rotated to vertical position the restrictor elements 56' and 58' materially obstruct the flow capacity of the passage 16 to a maximum predetermined value similar to that described with

reference to the Fig. 1 form of the invention. The lobular restrictor elements 56' and 58' are adapted to cooperate to form a throttle assembly of spherical form. The throttle blade 54 is adapted to progressively decrease the flow capacity through the passage from the predetermined maximum value at wide open throttle position to substantially zero at fully closed throttle position as an incident to the operation of the throttle mechanism throughout the entire normal operating range. The restrictor elements 56' and 58' are illustrated as solid elements in Fig. 4 although they could, if desired, be provided with a hollow section as illustrated in connection with the Fig. 1 form of the invention.

The large mass of the throttle valves described herein provides an additional desirable effect in that it retains heat which retards the formation of ice on the edge of the throttle valve due to evaporation caused by the rapid passage of air thereover. This difficulty occurs, on occasion, with blade type throttle valves.

When the idling jet 50 is located immediately adjacent the centerline of the throttle valve under partially open throttle conditions a restricted path for air is provided adjacent the jet 50 and the high velocity of this restricted air is able, by aspiration, to induce a flow of fuel from the idling jet to augment the main fuel supply. The flow characteristics of the fuel from the idling jet 50, corresponding to individual partially open throttle conditions, can thus be partially predetermined by the contour of the restrictor elements or throttle member. It is preferable to retain an annular ledge 59 to seal the conduit in throttle closed position and to assure a transfer to the idling jet at this time as is well known in the art. The ledge 59 is illustrated as a portion of the blade in Fig. 1 and as an extension of the solid valve 60 in Fig. 3.

A conventional spark advance hole 61 (Fig. 2) located adjacent the throttle member serves to connect a spark advance mechanism in the usual distributor (not shown) with the source of vacuum in passage 16 in a manner well known in the art. However, with my improved throttle member the vacuum conditions in the hole 61 for any throttle position can be predetermined by the contour of the throttle member due to its restrictive effect and the velocity effect of the air passing by the hole 61.

I claim:

1. A control device for modifying the operating characteristics of a carburetor of the type having a cylindrical fuel and air mixture passage provided with a Venturi throat and a flat, circular throttle blade carried by a throttle shaft extending transversely of said passage downstream of said Venturi throat for rotary movement of said blade, said control device comprising first and second segments of a sphere which are substantially equal and symmetrical, each of said segments having an equatorial periphery defining the outer edge of a flat face portion of a diameter slightly less than the diameter of said flat, circular throttle blade and means for removably fastening said first and second segments to said throttle blade with the flat face portions of said segments in abutting relationship with opposite flat sides of said throttle blade and with the equatorial periphery of each of said segments in concentric relationship with the circumference of said circular throttle blade.

2. A control device for modifying the operating characteristics of a carburetor of the type having

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a cylindrical fuel and air mixture passage provided with a Venturi throat and a flat, circular throttle blade carried by a throttle shaft extending transversely of said passage downstream of said Venturi throat for rotary movement of said blade, said control device comprising first and second segments of a sphere which are substantially equal and symmetrical, each of said segments having an equatorial periphery defining the outer edge of a flat face portion of a diameter slightly less than the diameter of said flat, circular throttle blade and means for removably fastening said first and second segments in abutting relationship with opposite flat sides of said throttle blade and with the equatorial periphery of each of said segments in concentric relationship with the circumference of said circular throttle blade, said fastening means including first and second opposed threaded elements adapted to be carried by said throttle shaft and said throttle blade and to extend in opposite radial directions normal to said throttle blade from the center thereof, and first and second nut members, each being adapted to be threaded on one of said elements, said first and second segments each being penetrated by an opening extending normal to the face portion thereof and coaxial with the

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equatorial periphery thereof, each of said openings being adapted to receive one of said threaded elements, and each of said segments having a recessed portion formed in the curved surface thereof concentric with the respective opening therein to receive one of said nut members when the latter is threaded on its associated threaded element to hold its respective segment on said throttle blade.

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