This invention relates to carburetors and more particularly to an improved carburetor throttle valve designed to enhance the effectiveness of gasoline additives in removing or preventing the formation of deposits in and around the carburetor throttle blade.

Various additives are presently employed in motor fuels to combat the buildup of harmful deposits in the carburetor, intake valves and in the engine cylinders proper. These deposits generally comprise dust, grease, road dirt and other air-suspended particulate matter which escapes retention by the carburetor air filter, and/or gum formed by partial oxidation of the fuel; these are counteracted by detergent and antioxidant additives. In addition to such semi-permanently deposits, under certain ambient temperature and humidity conditions, ice will form in the fuel intake system causing stalling until the engine becomes warm; this is conventionally controlled by de-icing agents added to the motor fuel.

One of the most troublesome areas and the one most sensitive to such deposits is the carburetor throttle body itself, particularly in and around the throttle blade or butterfly disc. In order to remove or retard the growth of solid deposits it is essential to achieve intimate and thorough contact, at least periodically, between liquid fuel containing the requisite additive and the deposit; in other words, a stream of fuel must be directed against the surface from which it is desired to remove the deposit. Experimental studies with a transparent throttle body have shown that with throttle valves of conventional design, effective scrubbing of the throttle body wall is not achieved in what is designated herein as the "critical deposit area." The critical deposit area is defined as that region of the interior surface of the throttle body which is contiguous to or adjacent to the trailing edge of the butterfly disc when the latter is in its fully closed position. Typically, although not necessarily, the butterfly disc is inclined a few degrees to the horizontal (down-draft type carburetor) even when fully closed and is therefore rotated through an angle of slightly less than 90° in moving from its fully closed to fully opened positions.

The critical deposit area therefore assumes the form of a circular or slightly elliptical band, centered on a line formed by the intersection of the plane of the butterfly disc in its fully closed position with the cylindrical wall of the throttle body, and extending approximately 180° around the wall adjacent to or slightly downstream from the axis of rotation of the disc. Carburetor performance is quickly and adversely affected by deposits in this area because of the reduction in an already small clearance between throttle blade and body; such deposits are even more deleterious in the case of a multi-venturi carburetor since the blade-body clearance thereof is considerably smaller than that of a single barrel carburetor.

The reason why a carburetor throttle valve of conventional design does not provide adequate fuel scrubbing of the critical deposit area becomes apparent from a consideration of the geometry of a conventional carburetor body. When the butterfly disc is closed, as when the engine is idling, no fuel-air mixture is able to pass around the periphery of the disc, and the small quantity of fuel which is then required being admitted through idle jets located downstream therefrom. When the butterfly disc is partially open, the liquid phase portion of the inflowing fuel-air mixture descends from the main discharge jet and venturi in the form of a conical spray, impinging upon the inclined flat upstream surface of the butterfly disc and is deflected onto the wall of the throttle body at a region which is a substantial distance downstream from the axis of rotation of the disc and hence substantially removed from the critical deposit area. This results in inadequate scrubbing action on the throttle body wall below the critical deposit area, but not where it is most needed. In consequence thereof, such deposits as road dirt, gum or ice, as the case may be, which tend to accumulate in the critical deposit area remain relatively untouched by the liquid fuel and thus continue to accumulate thereby causing the carburetor to become rapidly detuned.

It is therefore an object of this invention to provide an improved carburetor throttle body assembly wherein the throttle blade or disc is provided with a fluid-deflecting baffle member arranged to receive inflowing liquid fuel from the main body of the carburetor and to deflect it against the critical deposit area of the throttle body while the throttle blade occupies a position intermediate its fully closed and fully opened positions.

A broad embodiment of this invention relates to a carburetor throttle valve assembly comprising a casing having a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a movable flow-obstructing member mounted within said casing, and a fluid-deflecting means connected to said flow-obstructing member and shaped to deflect impinging fluid, when said flow-obstructing member is in a position intermediate its fully closed and fully opened positions, against that region of the interior surface of the casing which is adjacent said flow-obstructing member when the latter is in its fully closed position.

A more specific embodiment of this invention is directed to a carburetor throttle valve assembly comprising a casing having a cylindrical bore defining a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a rotatable flow-obstructing disc member mounted within said casing, means for rotating said disc member about an axis substantially perpendicular to and intersecting the central longitudinal axis of said casing, and the upstream surface of said disc member comprising a fluid-deflecting means shaped to deflect impinging fluid, when said disc member is in a position intermediate its fully closed and fully opened positions, against that region of the interior surface of the casing which is contiguous to the trailing edge of said disc member when the latter is in its fully closed position.

The term "disc" or "disc member," as employed in the specification and appended claims, is intended to include, but not by way of limitation, plate-type flow obstruction members having elliptical or semi-elliptical shapes as well as a circular shape.

In accordance with a preferred embodiment of the invention, the fluid-deflecting means is a raised annular ridge or hump formed in the upstream surface of the throttle disc near its trailing edge. The inner surface of the ridge is gradually inclined or sloped toward the center of the disc whereby to provide a fluid-deflecting surface which is inclined more steeply to the central longitudinal axis of the throttle body than is the throttle disc proper. The annular ridge may be formed integrally with the throttle disc as by casting or machining its upstream surface or by stamping the disc to its desired shape; the annular ridge may also be constructed by a separate piece, as by attaching a beveled ring member to a standard throttle disc. Although deposits tend to accumulate along most of the 180° arc of the critical deposit area, the deposits in the central portion thereof, i.e., directly opposite the axis of rotation of the throttle disc, are the most harmful since the rate of change of throttle valve free area with angular
displacement is greatest at this point. From a practical standpoint, then, it is necessary to deflect the incoming liquid fuel only against the central portion of the critical deposit area which should subtend an angle of at least 20° measured from the center of the throttle disc, and preferably should subtend an angle of at least 90°. In such case the annular ridge will subtend an angle of 20° or more, although it may not be desirable to extend the ridge 360° around the disc if such construction be simpler from a manufacturing standpoint.

The several embodiments of the invention and modifications incident thereto may best be described in conjunction with the accompanying drawings which are presented as illustrative of the best mode of practicing the invention but not with the intention of unduly limiting its broad scope.

FIGURE 1 is a sectional elevation view of the improved carburetor throttle valve of this invention showing the relationship between the ridged throttle disc and the throttle body.

FIGURE 2 is a plan view of the throttle disc of FIGURE 1.

FIGURE 3 is a plan view of an alternate form of throttle disc wherein the annular ridge extends 360° around the disc.

FIGURE 4 is a sectional elevation view of the throttle disc of FIGURE 3 taken along line 4—4 of FIGURE 3.

FIGURE 5 is a plan view illustrating another embodiment of the throttle disc wherein the annular ridge is formed by stamping the throttle plate.

FIGURE 6 is a sectional elevation view of the throttle disc of FIGURE 5 taken along line 6—6 of FIGURE 5.

FIGURE 7 is a plan view of still another embodiment of the throttle disc wherein the annular ridge is formed by attaching a beveled ring segment to the upstream surface of the disc.

FIGURE 8 is a sectional elevation view of the throttle disc of FIGURE 7 taken along line 8—8 of FIGURE 7.

In FIGURE 1 only so much of a complete single barrel downdraft type carburetor, e.g., the throttle body, is shown as will facilitate a clear understanding of the invention. It is obvious that a complete carburetor will additionally include a main body and air horn section, float chamber, idle jets, main jets, and may further include a high speed bypass, accelerator pump, automatic chokes and sundry other appurtenances well-known to those skilled in the carburetor art, none of which are a part of the instant invention.

Although the present discussion is focused upon a single barrel carburetor, it is understood that the invention is directly applicable to multi-barrel carburetors as well. The throttle blades hereinafter described are shown in the drawings as circular discs but it is to be emphasized that elliptical or semi-elliptical blades may be substituted therefor without departing from the spirit of the invention.

In FIGURE 1 there is shown a casing or throttle body housing having extending therethrough a cylindrical bore or passageway 11 defined by wall 12. Line 0—0' is the central longitudinal axis of passageway 11 and of casing 10. The upper open end 13 of passageway 11 is the fuel inlet opening receiving gasoline and primary air from the main body of the carburetor, and the lower open end 14 of passageway 11 is the fuel outlet opening which discharges into the intake manifold of the engine. Casing 10 is provided with an upper flange 15 having threaded holes 16 therein for bolting the main body of the carburetor thereto, and a lower flange 17 having bolt holes 18 therethrough for securing casing 10 to the engine block. A rotatable flow-obstructing disc member or throttle blade 19 is positioned within passageway 11 and is secured to rotary shaft 20 by means of machine screws 21. Shaft 20 extends horizontally through wall 12 and is rotated by suitable linkage connected to the accelerator pedal. The fully closed position of the disc member is represented by plane 0—0' and its fully opened position by axis 0—0'.

The constructional details of the disc member are shown in FIGURE 1 and in FIGURE 2, to which latter figure reference is now also made. The diameter of rotation of disc 19 is given by line x—x' in FIGURE 2. The upstream surface of disc 19 is indicated by numeral 22. The leading edge 23 of disc 19 is defined as that half of the peripheral edge of disc 19 which lies upstream from the axis of rotation as the disc is rotated to a more open position; the trailing edge 24 of disc 19 is defined as that half of the peripheral edge of disc 19 which lies downstream from the axis of rotation as the disc is rotated to a more open position. A raised annular ridge 25 is formed in the upstream surface 22 of disc 19 near its trailing edge 24. Ridge 25 is set back a short distance from edge 24 so as not to obstruct or hinder the closing of disc 19 as it is moved into alignment with plane 0—0'. The outer surface 26 of the ridge is inclined more or less abruptly to the plane of the disc, while the inner surface 27 thereof slopes gradually inwardly toward the flat central portion of surface 22. The ridge is preferably ridge concentric to trailing edge 24 and, as evident from FIGURE 2, subtends an angle 0 of about 90° and is substantially symmetric about that radius of disc 19 which is perpendicular to axis x—x'.

When the disc member occupies the partially open position of FIGURE 1, surface 25 is set back a still more steeply to axis 0—0' than is the flat portion of surface 22. A stream of inflowing liquid fuel 28 impinges upon surface 27 and is thence deflected onto wall 12 at the critical deposit area in and about the intersection of plane 0—0' with wall 12 and contiguous to ridge 25. It will be seen that in the absence of such raised annular ridge, the stream of fuel would be deflected onto wall 12 a substantial distance below the critical deposit area.

In FIGURES 3 and 4, there is shown an alternate construction of a throttle disc where in the raised annular ridge is concentric with the downstream edge of the disc and extends 360° therewith. A throttle disc, indicated generally at 29, is attached to rotary shaft 30 by means of screws 31. The leading edge of the disc is indicated by numeral 33 and the trailing edge thereof by numeral 34. A circular ridge 35 is formed in the upstream surface of disc 29 near the peripheral edge thereof. Ridge 35 is set back a short distance from the peripheral edge. The outer surface 36 of the ridge is inclined more or less abruptly to the plane of the disc, while the inner surface 37 thereof slopes gradually inwardly toward the flat central upstream portion of the disc. Although that portion of ridge 35 which is concentric to leading edge 33 of disc 29 does not accomplish any fluid-deflecting function, this construction of the disc may be simpler and less expensive to manufacture than the several embodiments of the disc herein described wherein the ridge subtends an arc of less than 360°.

In FIGURES 5 and 6, there is shown another construction of a throttle disc wherein the raised annular ridge is formed not by machining or casting the upstream surface of the disc, but rather by machine stamping an initially flat, thin disc into the desired shape. A throttle disc 39 is secured to rotary shaft 40 by means of screws 41. The leading edge of the disc is indicated by numeral 43 and the trailing edge thereof by numeral 44. A raised annular ridge 45 is formed by bending the undersurface of the disc 39 upward to provide a hump-shaped protuberance. The outer surface 46 of ridge 45 is inclined steeply to the plane of the disc, while the inner surface 47 thereof slopes gradually inwardly toward the central portion of the upstream surface of disc 39. The ridge is substantially concentric to the trailing edge 44, subtends an angle of about 90°, and is positioned approximately opposite rotary shaft 40.

In FIGURES 7 and 8, there is illustrated still another embodiment, the accelerator pedal of which is formed by attaching a beveled ring segment to the upstream surface of the disc. The throttle disc, indicated
5 generally at 49, is attached to rotary shaft 50 by means of screws 51. The leading edge of disc 49 is indicated by numeral 53 and the trailing edge thereof by numeral 54. A segmented beveled ring member 55 is attached to the upstream surface 52 of disc 49 near trailing edge 54 by welding, brazing, riveting or by other suitable means of attachment. The outer edge 56 of the ring member is set back a short distance from the trailing edge 54 and is perpendicular to upstream surface 52 of disc 49. The inner surface 57 of the ring member is beveled so as to slope gradually inward toward the center of the disc. Ring 55 is formed and positioned so as to be substantially concentric to trailing edge 54 and subtends a central angle of about 90°.

The annular ridge of the foregoing embodiments has been shown to subtend an angle of 90° or 360°; however, it is not intended to limit its construction to these angles, provided only that the minimum angle be at least 20°. Optimum sizes for particular applications may call for angles ranging from 20° to a movable variable from about 60° to about 180°. The physical dimensions of the fluid-deflecting surface are subject to considerable variation and should be established in individual cases in accordance with the flow characteristics of a particular carburetor. Throttle blades of automatic carburetor conventions are commonly made in thickness up to about % of inches; by way of example only, an annular ridge suitable for blades of such diameters may have a height above the flat upstream surface of the blades of from about 0.05 inch to about 0.20 inch; the highest point of the ridge may be set back from the trailing edge of the blade, or more generally from the peripheral edge thereof, a distance of from about 0.05 inch to about 0.30 inch.

Although the foregoing discussion has been directed to throttle blades having the form of a circular or elliptical disc, it is contemplated that the present invention is applicable to other shapes to throttle blades such as those which are square, rectangular, hexagonal, octagonal, etc. The invention may also be employed with throttle blades which are pivoted at one end thereof instead of being rotatably mounted at the center, and may also be used with a valve plug member which is movable longitudinally in respect of a valve seat whose transverse cross-sectional area varies with longitudinal distance therethrough.

A carburetor throttle valve constructed in accordance with this invention will prevent or retard to a substantial extent the formation of harmful deposits in the critical deposit area as hereinabove defined. Not only does the instant throttle valve improve the effectiveness of gasoline detergents in removing dust, grime and gum, but also promotes the action of deicing additives in combating carburetor icing which also generally occurs in the critical deposit area.

I claim as my invention:

1. A carburetor throttle valve assembly comprising a casing having a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a rotatable flow-obstructing member mounted within said casing and cooperative with the wall of said casing to vary the flow therethrough, and a fluid-deflecting means comprising a raised ridge adjacent to and set back a short distance from the outer edge of said flow-obstructing member mounted within said casing and cooperative with the wall of said casing to vary the flow therethrough, and the upstream surface of said flow-obstructing member comprising a raised ridge adjacent to and set back a short distance from the outer edge of said member, the inner surface of said ridge being gradually inclined toward the central portion of said member and the outer surface of the ridge being inclined more abruptly toward the plane of said member whereby to deflect impinging fluid, when said flow-obstructing member is in a position intermediate its fully closed and fully opened positions, against that region of the interior surface of the casing which is adjacent said flow-obstructing member when the latter is in its fully closed position.

2. A carburetor throttle valve assembly comprising a casing having a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a rotatable flow-obstructing member mounted within said casing and cooperative with the wall of said casing to vary the flow therethrough, and the upstream surface of said flow-obstructing member comprising a raised ridge adjacent to and set back a short distance from the outer edge of said member, the inner surface of said ridge being gradually inclined toward the central portion of said member and the outer surface of the ridge being inclined more abruptly toward the plane of said member whereby to deflect impinging fluid, when said flow-obstructing member is in a position intermediate its fully closed and fully opened positions, against that region of the interior surface of the casing which is contiguous to the normally downstream portion of said flow-obstructing member when the latter is in its fully closed position.

3. A carburetor throttle valve assembly comprising a casing having a cylindrical bore defining a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a rotatable flow-obstructing disc member mounted within said casing and cooperative with the wall of said casing to vary the flow therethrough, means for rotating said disc member about an axis substantially perpendicular to and intersecting the central longitudinal axis of said casing, and the upstream surface of said disc member comprising a raised ridge portion adjacent to and set back a short distance from the peripheral edge of said disc member, the inner surface of said ridge portion being gradually inclined toward the central portion of the disc member and the outer surface of the ridge portion sloping more abruptly toward the plane of the disc member whereby to deflect impinging fluid, when said disc member is in a position intermediate its fully closed and fully opened positions, against that region of the interior surface of the casing which is contiguous to the trailing edge of said disc member when the latter is in its fully closed position.

4. A carburetor throttle valve assembly comprising a casing having a cylindrical bore defining a fluid inlet opening and a fluid outlet opening at opposite ends thereof, a rotatable flow-obstructing disc member mounted within said casing and cooperative with the wall of said casing to vary the flow therethrough, shaft means for rotating said disc member about an axis substantially perpendicular to and intersecting the central longitudinal axis of said casing, and the upstream surface of said disc member having a raised ridge portion near but set back a short distance from the trailing edge of the disc member and subtending an angle of at least 20° measured from the center of the disc member, the inner surface of said ridge portion sloping gradually inwardly toward the flat central portion of the upstream surface of the disc member and the outer surface of the ridge portion sloping more abruptly toward the plane of the disc member.

5. The apparatus of claim 4 further characterized in that said ridge portion subtends an angle of approximately 90° measured from the center of said disc member.

6. The apparatus of claim 4 further characterized in that said ridge portion is substantially parallel to the peripheral edge of said disc member and extends 360° therearound.

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