

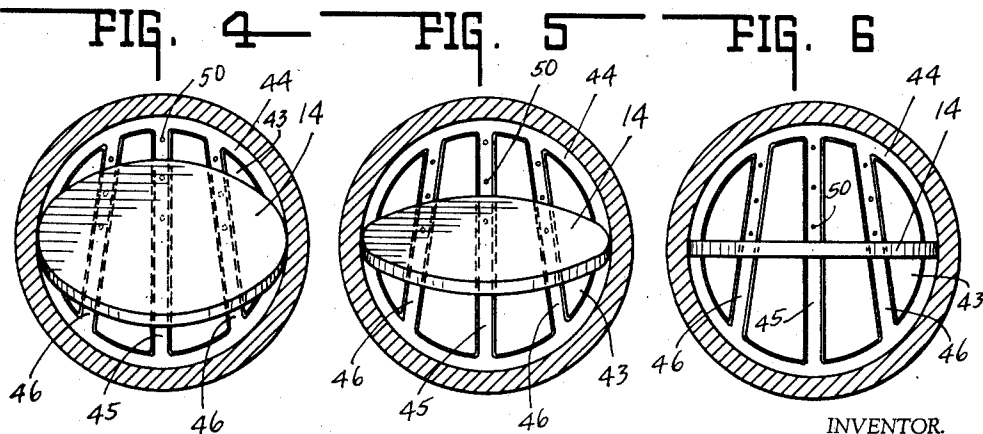
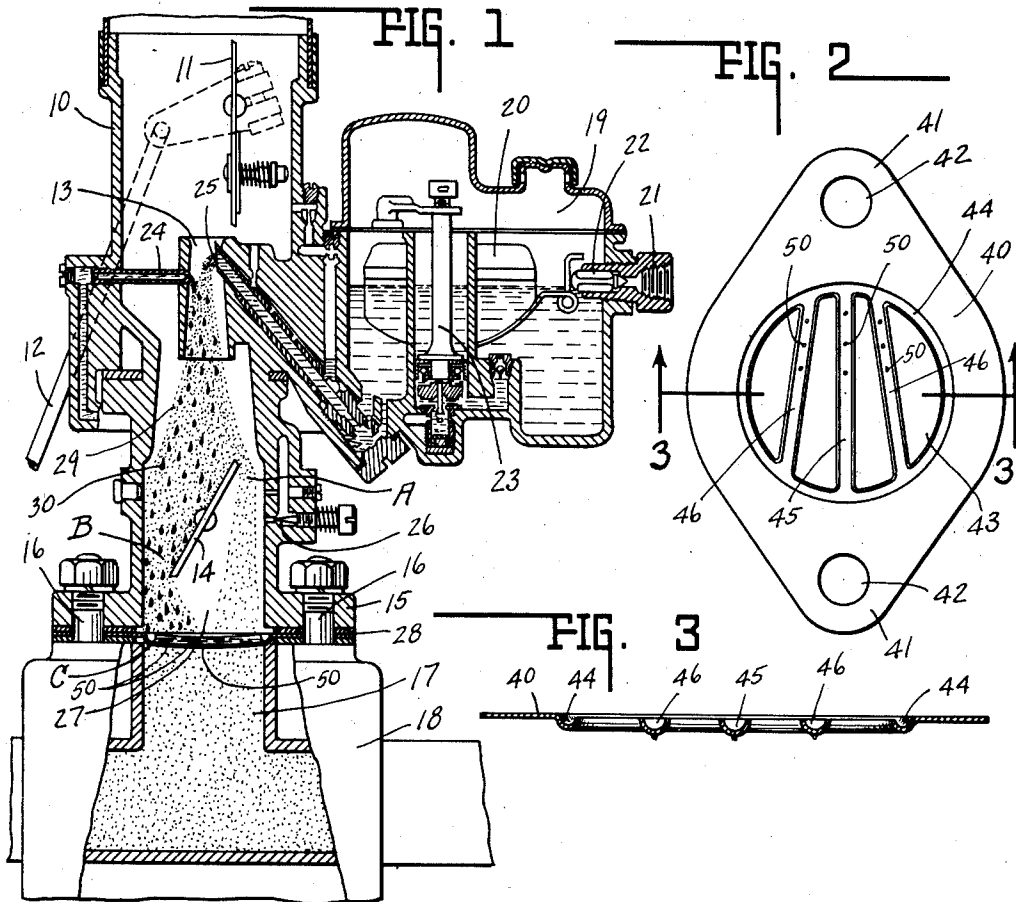
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INTAKE FUEL SYSTEM FOR INTERNAL COMBUSTION ENGINES

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INTAKE FUEL SYSTEM FOR INTERNAL COMBUSTION ENGINES

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This invention relates to an insert device for increasing the fuel economy of internal combustion engines as well as improving the performance of same.

The chief object of the invention is to provide a device which is relatively simple, has no moving parts, is relatively inexpensive and may be readily installed in present structures.

The chief feature of the invention consists in forming an adapter for insertion between the carburetor and manifold connections of an engine and which adapter includes a plurality of grooved ribs extending across the matching intake passage opening therein and a trapping peripheral groove communicating with the grooved ribs and defining the aforesaid opening.

Other objects and features of the invention will be set forth more fully hereinafter.

The full nature of the invention will be understood from the accompanying drawing and the following description and claims:

In the drawing, Fig. 1 is a more or less diagrammatic, central sectional view of a conventional downdraft carburetor construction, together with engine manifold and with the invention included therebetween, the choke valve being in open position and the throttle valve being in part open position.

Fig. 2 is a top plan view of the invention in insert or adapter form.

Fig. 3 is a relatively enlarged transverse sectional view taken on line 3—3 of Fig. 2 and in the direction of the arrows.

Figs. 4, 5 and 6 are transverse, sectional views of the carburetor throttle valve and passage, looking toward the invention, and Fig. 4 indicates the throttle valve about three-fourths closed or one-fourth open.

Fig. 5 illustrates the valve half open and half closed.

Fig. 6 illustrates the valve in full open position.

Various attempts have been made to improve engine performance, such as by utilizing better grades of gasoline and utilizing heat to facilitate vaporization of the fuel. In the earlier days of the automobile history, the gasoline utilized was highly volatile, being of the character commonly called casing head gas, the same being obtained by trapping the gasoline vapor and condensing it. The gasoline and kerosene fractions of the crude thereupon were "cracked" so as to increase the volatility and the total production per unit volume of crude.

At the present time the fuel utilized in internal

combustion engines is of blended character and as dispensed it is blended for the seasons, higher fractions being utilized during colder weather and vice versa. In view of this condition which is evidenced by the fact that the gasolines now employed are very close to the kerosene utilized in the earlier history, the "hot spotting" or heating of the fuel is of prime necessity and as a result at the present time the gasket material utilized between the carburetor and manifold is of material thickness and of heat insulating character so as to keep as much heat away from the carburetor proper as can be conveniently kept away.

Another condition inherent in carburetor operation wherein the throttle valve is a butterfly valve of balanced or unbalanced type, is that said valve when other than in closed or full open position acts as deflector and this condition is represented in Fig. 1. This deflection brings about a crowding condition in the fuel flow whereby a large percentage of that fuel is crowded toward one end or one side of the manifold. The other end naturally is correspondingly starved and in view of this condition, carburetors are so adjusted that a sufficient amount of fuel mixture is supplied to the starved end of the manifold, which results in an excess being supplied to the opposite end of the manifold since the carburetor usually discharges to the central portion of the manifold. The result is that one, the element of poor fuel economy, or, two, if economy is attempted, conversely, poor performance results because of unequal fuel distribution to the several cylinders.

Furthermore, this deflecting characteristic of the throttle valve permits the particles of liquid fuel to collect together to form droplets and this also means poor engine performance and poor fuel economy.

In present day automobiles when the driver depresses the foot pedal or accelerator, he simultaneously actuates a pump arrangement for supplying an excess of raw fuel to the venturi in the carburetor and this raw fuel is not all vaporized and as a result there is a definite slight time lag period which critical drivers notice between the engine pickup upon acceleration from the time the throttle is depressed for acceleration.

The condition, mentioned immediately preceding the lag condition last specified, is commonly spoken of in the industry as buckling. In other words, an engine travelling in high gear at slow speed buckles or bucks and the drivers of

the vehicles experiencing the same are forced to shift gears and this is solely because of the poorly carbureted fuel and the deflection before mentioned.

The present invention, therefore, serves to break up the concentration inherent in fuel supply with a butterfly valve controlled carburetor. It also is arranged to trap liquid fuel and prevent its further travel to the manifold. It also is so arranged as to create a turbulent condition in the fuel mixture supplied to the manifold which effects a better distribution of the fuel mixture to the different ends of the manifold and this better distribution as a consequence smoothes out the roughness of engine operation and secures better performance.

The invention by trapping the liquid from the fuel mixture is so arranged that this trapped liquid is vaporized and resupplied to the fuel mixture, thereby insuring maximum economy without disturbing the other desirable conditions created by the invention.

One chief characteristic of the invention and thereby differing from other attempts to improve engine economy and performance, is that most other devices operate on the air bleed principle, that is, at certain times supply additional air to the fuel mixture and at other times withhold such supply. Any variation in the air-to-fuel ratio, therefore, disturbs the proper carburization and is only a make-shift attempt at equalization.

The present invention, it will be noted, as outlined hereinafter more fully, does not disturb the carbureted or fuel-to-air mixture but improves the distribution and insures maximum carburetion of the fuel utilized. The invention applied to the engine of a "President" style Studebaker automobile when operated at 1,000 R. P. M. showed a $4\frac{1}{2}$ additional horsepower at that engine speed than the engine had without the invention applied thereto. This is one example of fuel economy by reason of the utilization of the invention, since to obtain the same horsepower at the same speed, the engine equipped with the invention would require less fuel.

As to performance, the invention when applied to automobiles insures greater flexibility in the engine since all the cylinders are getting their proper amount of fuel and as a result of that and the elimination of the lag previously mentioned, the foot throttle is more sensitive with the result that there is less gear shifting required for city traffic and the automobiles equipped with the invention have smoother performance at lower engine speeds and also the engines have greater accelerating ability.

One possible explanation of some of the advantages is that the invention with the fuel now employed operates to temporarily remove from the fuel mixture the heavy ends or heavy fractions of the fuel which normally would pass in more or less liquid form into the cylinders and this trapped heavy end fuel is thereafter only released as vaporized fuel so that the engine can better handle the same. In other words, with a "cold" motor, heavy end fractions have a tendency to dampen out and stop flame propagation so that very poor performance and energization is obtained with a cold engine under standard practice.

With the present invention, these heavy end fractions, as stated, are temporarily removed from the fuel mixture and then are returned to the fuel mixture in vapor form so that the so-called dampening or killing of flame propagation

by the heavy ends does not occur and the flame propagation is even or uniform from one fraction to another and progressive and thus giving the proper engine performance, it being, of course, understood the lighter ends or fractions fire and expand and that the successively heavier fractions in turn ignite, burn and expand. The present blended fuels are all based on the principle of successive burning of successive fractions so that the continuous burning and gas expansion occurs in the cylinder throughout the power stroke.

In view of the many million automobiles now utilized, the invention has been intentionally illustrated as of the adaptor type although it is to be understood that the structural parts of the invention may be incorporated in the carburetor or in the manifold intake whenever and wherever desired and with this understanding, the invention will be described in detail as an insert arrangement.

In the drawing the numeral 10 indicates a downdraft carburetor having the choke valve 11 therein controlled as at 12. This carburetor has a Venturi passage construction 13 and included in the carburetor is the throttle valve 14 of butterfly type suitably controlled by hand and/or foot control means, usually a foot pedal. The carburetor is provided with a flange 15 for connection as illustrated at 16 to the intake passage 17 of the intake manifold 18 of the engine.

The carburetor includes the float chamber 19 mounting the float 20 therein. The chamber includes the fuel intake line 21 controlled by the valve 22 in turn controlled by the float 20. The carburetor illustrated includes a pump indicated generally by the numeral 23 and this discharges as at 24 and this pump operates in junction with the throttle so that when the throttle is advanced the pump is operated to supply additional fuel.

The carburetor bowl also discharges to the venturi, as indicated at 25. The low speed or low idle adjustment supply is indicated at 26. The intake passage of the carburetor is indicated generally by the numeral 27 and the same matches or registers with the intake passage of the engine manifold 17. The two structures are secured together, as stated, by the bolts 15 and have interposed therebetween sealing and heat insulating arrangements 28.

As indicated at 29, the fuel from the jets 24 and 25 is somewhat cone like as it leaves the venturi insofar as the vapor mixture is concerned, and included therein are the fuel droplets 30 which have not been vaporized. The action of the throttle butterfly valve is illustrated clearly in Fig. 1 showing the deflecting characteristics of this valve and whereby only a minor portion of the vapor, when the valve is not fully opened, passes between the upper end of the valve and the intake passage, as indicated generally at A. The larger portion of the fuel mixture is deflected and concentrated and passes beyond that valve as indicated at B. Such liquid fuel as is intercepted by this valve is deflected toward the lower end of the valve and toward the carburetor intake wall immediately contiguous thereto. The completely vaporized fuel is thereupon uniformly distributed in the intake 17 by means of the invention now to be described more specifically, reference being had to Figs. 2 and 3.

In these figures, it is noted the invention is illustrated as of plate construction and of the adapter insert type. It includes a body portion

40 and the same is enlarged as at 41 to match the flange contour of the carburetor and intake manifold. It includes holes 42 therethrough adapted to permit passage of connecting bolts 16, so that when those bolts are tightened down, the invention is included in the carbureting system.

The body portion 40 is provided with a "central" opening 43 defined by a groove 44. The exterior diameter of the groove is approximately that of the intake passageway. The hole 43, therefore, is slightly smaller. As shown clearly in Fig. 1, the hole is slightly eccentric from the true center and this condition is indicated more particularly at C, and this eccentricity is utilized so that the groove portion 44 which is closer to the mathematical center of the insert or the center between the two openings 41 is positioned in the passageway so as to constitute a real trap.

Extending medianly in the present form of the invention and across the opening 43 is a grooved rib arrangement, the same being longitudinally aligned with the centers of the opening 42. This groove arrangement 45 communicates at opposite ends with the groove 44.

At each side of the central grooved rib 45 is a second rib 46 and as shown clearly in the several figures, these ribs are preferably non-parallel to each other and non-parallel to the central rib 45. They are directed toward each other or inclined toward each other in the direction of the eccentric portion, more specifically mentioned hereinbefore, and the angle of inclination is approximately 8°. The limits of inclination are obtained between 5° and 10°, the 8° inclination being preferred in most instances since it insures the best performance.

It will be noted as a result of this inclination and the eccentricity previously referred to, that a considerable amount of rib obstruction is positioned in alignment with the downstream side of the deflecting valve arrangement, so that maximum trapping of liquid fuel there will be effected. Each of the ribs, as previously stated, communicates at opposite ends with the opening defining wall groove 44. These ribs are of greater depth insofar as their grooves are concerned, than the wall defining groove and rib 45 has the deepest groove as shown in Fig. 3.

In longitudinal section, these ribs preferably are bowed so that the deepest portion is approximately at the central portion of the rib. Between that central portion and the junction of the rib with the opening defining groove and more particularly the so-called eccentric portion thereof, each grooved rib is pierced with a minute or capillary type hole which preferably is left with a ragged or raw edge and this is on the downstream side or convex side of the grooved rib. The air or fuel mixture passing through the opening 43 creates on the underface of these grooved ribs a high vacuum or pressure depression and this high vacuum or pressure depression draws the collected liquid fuel on these ribs at this lower portion outwardly through the minute holes.

The ragged or raw edge defining said holes in addition to this vaporization incident to this vacuum action, seems to have the effect of tearing the liquid gasoline into still further minute portions so that what liquid is discharged from these grooves through these holes indicated by the numeral 50 is fully vaporized, and these holes constitute the sole source of relief or discharge for such liquid which is trapped by any or all

of the groove arrangements. Herein three of these holes are shown in each rib and, as stated, are positioned between the center of the rib and the junction of that rib with the eccentric portion of the opening defining groove 44.

It is to be noted also that the several rib arrangements constitute means for creating turbulence and, of course, with a minimum amount of interference to fuel mixture flow, and this high turbulence provides better distribution of the fuel and air and serves to insure uniform distribution in the manifold.

The fundamental distinction between this invention and others seeking to effect the same objectives, to-wit, properly vaporized fuel, better fuel distribution in the manifold and a more homogenous mixture of the fuel, is that this invention does not alter the fuel-to-air ratio.

This invention merely is supplementary to the carburetor and does not alter the normal carburetion but merely continues the process of vaporization of the heavy ends or fuel fractions after the same have left or been discharged from the fuel jets in liquid form into the intake system.

One peculiar result has been observed in addition to fuel economy and the like previously mentioned, and that is that where heretofore it has been necessary to continue movement up a hill at slow speeds by shifting gears to a lower speed than the high speed position, it has been possible to continue vehicle travel up the hill without shifting gears. In other words, if a vehicle to accelerate on a hill, were travelling at ten to twelve miles per hour under high speed gear shift control, such a vehicle equipped with the invention can now accelerate on such a hill when travelling at but five miles per hour. Of course, on the level, it is quite obvious that the gear range of flexibility of control without requiring gear shifting is even more pronounced insofar as it relates to city driving requiring many stops and starts incident to traffic control.

While the invention has been illustrated and described in great detail in the drawing and foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. An insert for inclusion between an engine manifold and a carburetor having substantially vertically aligned matching intake passages and connecting portions said insert having a passage matching opening therethrough, groove forming means peripherally defining the opening, the groove being directed upstream, the groove defined opening being but slightly smaller than the passages, and a plurality of similarly directed grooved ribs extending into the opening and communicating with the peripheral groove.

2. An insert for inclusion between an engine manifold and a carburetor having substantially vertically aligned matching intake passages and connecting portions and having a passage matching opening therethrough, groove forming means peripherally defining the opening, the groove being directed upstream, the groove defined opening being but slightly smaller than the passages, and a plurality of similarly directed

grooved ribs extending across the opening and communicating at opposite ends with the peripheral groove, the latter draining to the former, the grooved ribs including minute apertures therethrough for downstream liquid fuel discharge and vaporization.

3. An insert for inclusion between an engine manifold and a carburetor having substantially vertically aligned matching intake passages and connecting portions and having a passage matching opening therethrough, groove forming means peripherally defining the opening, the groove being directed upstream, the groove defined opening being but slightly smaller than the passages, and a plurality of similarly directed grooved ribs extending across the opening and communicating at opposite ends with the peripheral groove, the carburetor passage including a butterfly valve therein which shunts liquid fuel impinging thereon to the downstream end of the valve when not closed and into the carburetor intake passage portion immediately adjacent that downstream end of the valve, the opening being slightly offset relative to the matching passages, that portion of the peripheral groove offset inwardly into the intake being closest to the downstream end of the valve, and the rib ends adjacent the aforesaid offset portion of the peripheral groove being positioned closer together than the opposite ends, all for the purpose described.

4. An insert for inclusion between an engine manifold and a carburetor having substantially vertically aligned matching intake passages and connecting portions and having a passage matching opening therethrough, groove forming means peripherally defining the opening, the groove being directed upstream, the groove defined opening being but slightly smaller than the passages, and a plurality of similarly directed grooved ribs extending across the opening and communicating at opposite ends with the peripheral groove, the carburetor passage including a butterfly valve therein which shunts liquid fuel impinging thereon to the downstream end of the valve when not closed and into the carburetor intake passage portion immediately adjacent that downstream end of the valve, the opening being slightly offset relative to the matching passages, that portion of the peripheral groove offset inwardly into the intake being closest to the downstream end of the valve, and the rib ends adjacent the aforesaid offset portion of the peripheral groove being positioned closer together than the opposite ends, all for the purpose described, the opening peripheral defining groove draining to the grooved ribs.

5. An insert for inclusion between an engine manifold and a carburetor having substantially vertically aligned matching intake passages and connecting portions and having a passage matching opening therethrough, groove forming means peripherally defining the opening, the groove being directed upstream, the groove defined opening being but slightly smaller than the passages, and a plurality of similarly directed grooved ribs extending across the opening and communicating at opposite ends with the peripheral groove, the carburetor passage including a butterfly valve therein which shunts liquid fuel impinging thereon to the downstream end of the valve when not closed and into the carburetor intake passage portion immediately adjacent that downstream end of the valve, the opening being slightly offset relative to the matching pas-

sages, that portion of the peripheral groove offset inwardly into the intake being closest to the downstream end of the valve, and the rib ends adjacent the aforesaid offset portion of the peripheral groove being positioned closer together than the opposite ends, all for the purpose described, the opening peripheral defining groove draining to the grooved ribs, and the latter including minute apertures therethrough for downstream liquid fuel discharge and vaporization.

6. An adapter insert for inclusion in a substantially vertically directed intake system for an engine and including an opening therethrough of approximately the same outline and area as the intake passage and substantially registering therewith, said insert including an upstream directed opening defining groove forming means arranged to trap the intake passage wall collected liquid fuel, and upstream directed grooved ribs communicating with the groove means and extending into the opening from the groove means to trap liquid fuel in the intake passage, the ribs having minute apertures therethrough for collected fuel downstream discharge and vaporization.

7. An adapter insert for inclusion in a substantially vertically directed intake system for an engine and including an opening therethrough of approximately the same outline and area as the intake passage and substantially registering therewith, said insert including an upstream directed opening defining groove forming means arranged to trap the intake passage wall collected liquid fuel, and upstream directed grooved ribs communicating with the groove means and extending into the opening from the groove means to trap liquid fuel in the intake passage, the ribs having minute apertures therethrough for collected fuel downstream discharge and vaporization, the pitch of the ribs being toward the center of the opening.

8. An adapter insert for inclusion in a substantially vertically directed intake system for an engine and including an opening therethrough of approximately the same outline and area as the intake passage and substantially registering therewith, said insert including an upstream directed opening defining groove forming means arranged to trap the intake passage wall collected liquid fuel, and upstream directed grooved ribs communicating with the groove means and extending into the opening from the groove means to trap liquid fuel in the intake passage, the ribs having minute apertures therethrough for collected fuel downstream discharge and vaporization, the ribs extending across the opening and having the same general longitudinal direction, the grooves, with reference to the median plane in that direction, being progressively shallower toward the outermost grooves.

9. An adapter insert for inclusion in a substantially vertically directed intake system for an engine and including an opening therethrough of approximately the same outline and area as the intake passage and substantially registering therewith, said insert including an upstream directed opening defining groove forming means arranged to trap the intake passage wall collected liquid fuel, and upstream directed grooved ribs communicating with the groove means and extending into the opening from the groove means to trap liquid fuel in the intake passage, the ribs having minute apertures

therethrough for collected fuel downstream discharge and vaporization, the ribs extending across the opening and having the same general longitudinal direction, the grooves, with reference to the median plane in that direction, being progressively shallower toward the outermost grooves, the pitch of the ribs being toward the center of the opening.

10. In combination with the valve controlled intake passage of an internal combustion engine, a groove member projecting into said passage

from the wall thereof and extending but a slight distance therefrom, the said groove member being down-stream of the passage valve and directed up-stream of the passage for trapping fuel wall condensate, and a plurality of ribs projecting into said passage from said groove member, said ribs having up-stream directed grooves therein each in communication with the channel of said groove member.

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