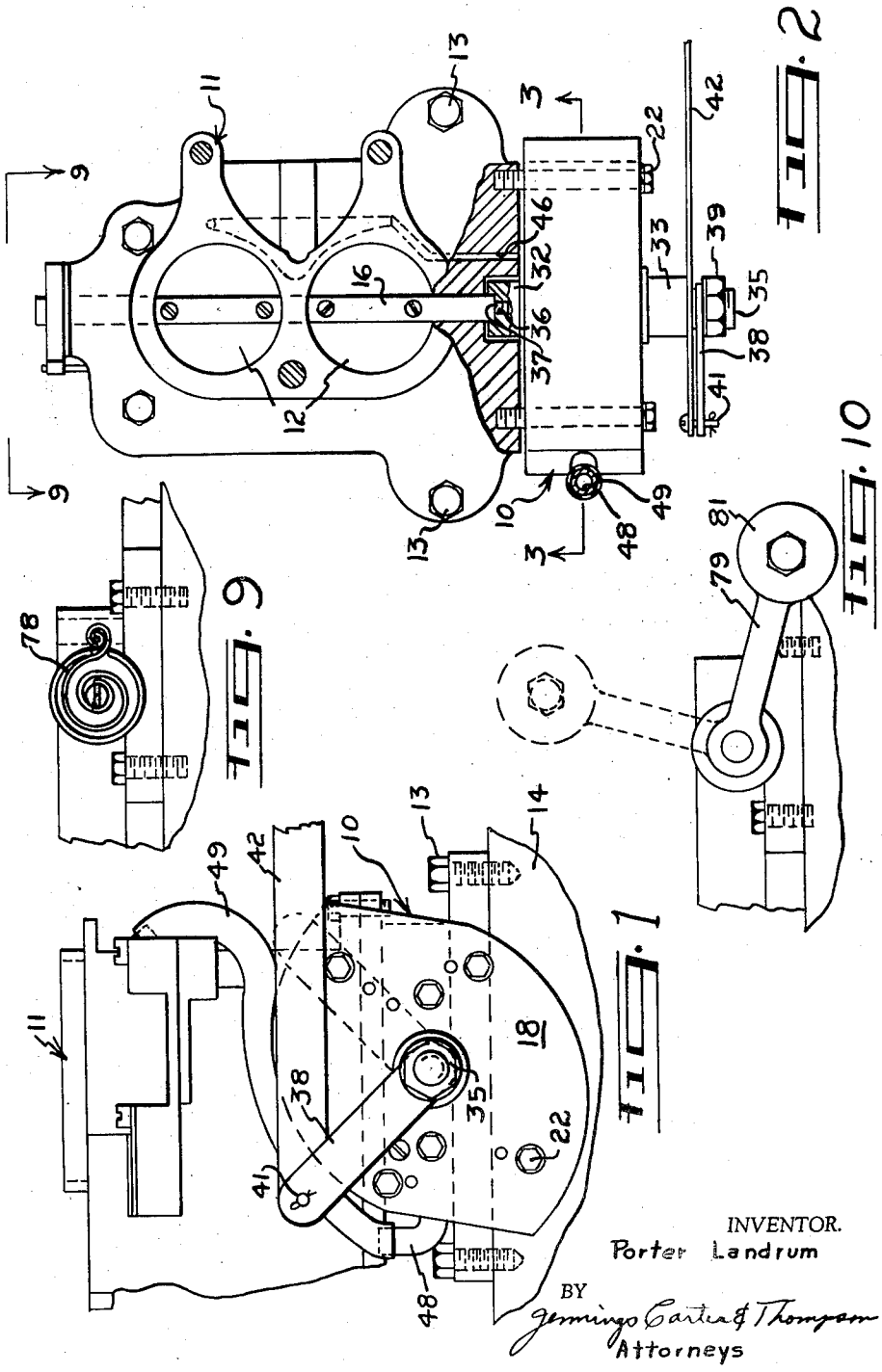
Aug. 4, 1959 P. LANDRUM 2,897,807

THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

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THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 8, 1958 3 Sheets-Sheet 2

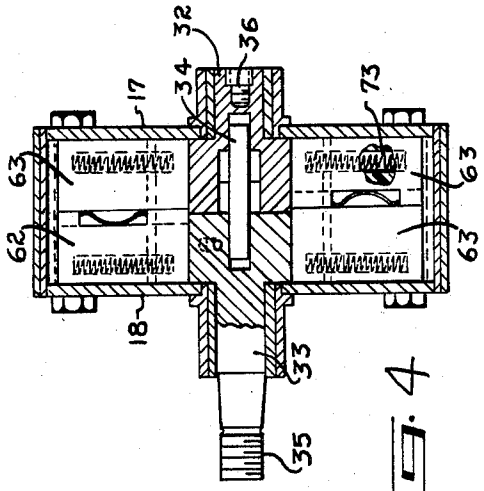


Fig. 4

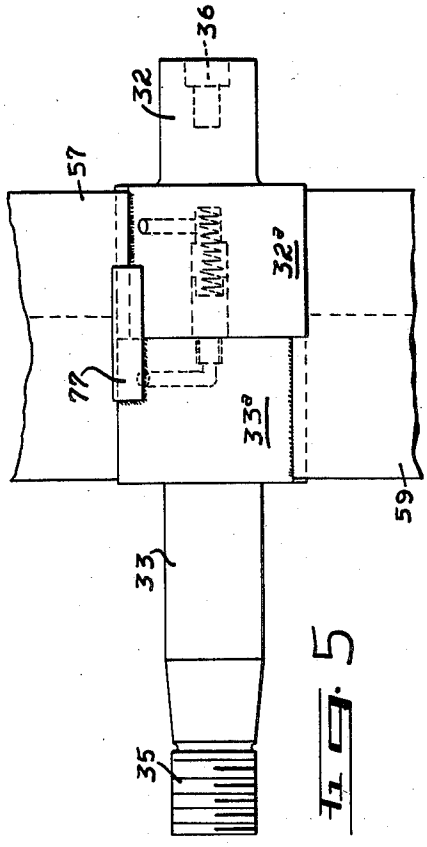


Fig. 5

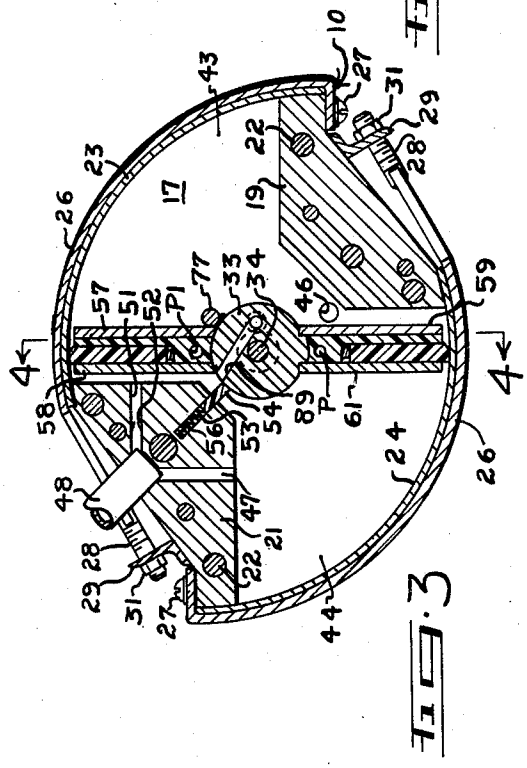


Fig. 3

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THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

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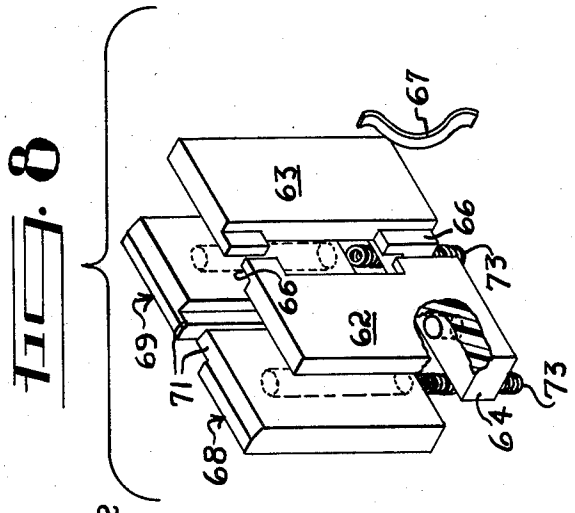


Fig. 8

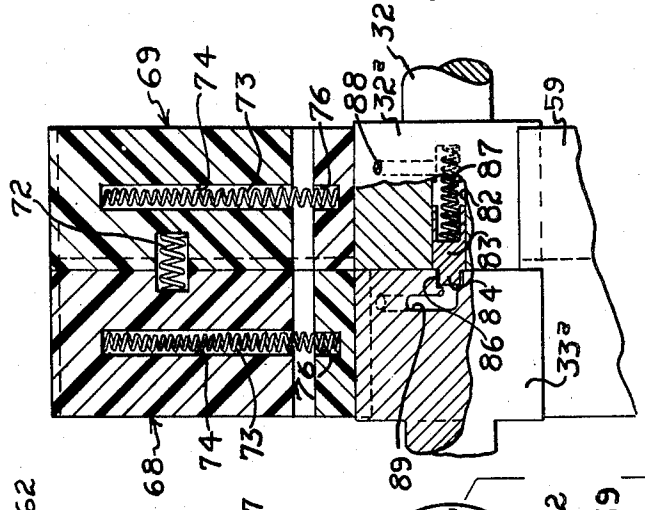


Fig. 9

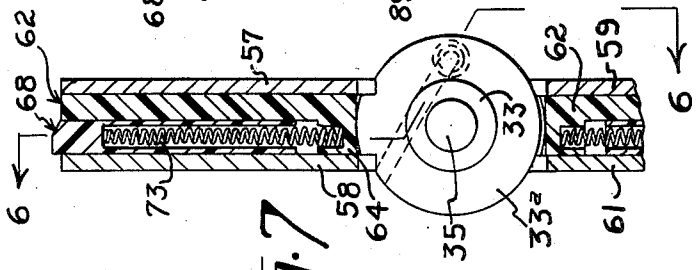


Fig. 7

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THROTTLE CONTROL FOR INTERNAL COMBUSTION ENGINES

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6 Claims. (Cl. 123—103)

This invention relates to control means for the throttle valves of internal combustion engines, and is adapted to be interposed between the usual manual throttle control and the throttle valve of the carburetor of internal combustion engines.

The principal object of my invention is to provide a throttle control which is effective to open the throttle valve of the engine in accordance with the pressure existing in the intake manifold of the engine, the amount of opening being determined by the setting of the manual control, such for instance, as the usual accelerator pedal.

Another object is to provide apparatus of the character designated which will permit the compression ratios of internal combustion engines to be increased over those currently in use, and to permit such engine to operate under varying conditions of speed and load, with fuels of present average octane ratings, all without damage to the engine and without sacrificing any of the performance of such engine.

More specifically, an object of my invention is to permit the use of high compression ratios by limiting the throttle opening at low engine speed and as engine speed increases to exert an increasing opening force on the throttle, whereby at low engine speeds the engine is not overcharged and at higher engine speeds the engine is adequately charged.

A more specific object of my invention is to provide apparatus of the character designated in which the actual opening of the throttle valve is determined by the amount of sub-atmospheric pressure existing in the intake manifold of the engine, whereby the throttle valve may be set for the optimum operating position under all conditions of engine speed.

Briefly, my invention comprises a housing through which pass two independently movable, axially aligned shafts. One of these is connected to the throttle valve of the carburetor while the other is connected so as to be rotated by a manual throttle control such as the usual foot pedal. On the shafts are seating vanes which contact the sides and ends of the housing in substantially air-tight manner, whereby to form a fluid tight chamber in the housing. This chamber is connected to the intake manifold and therefore is under sub-atmospheric pressure. A stop means on the manually operated shaft limits the amount of opening movement of the other shaft. Furthermore, the housing is so arranged that as the throttle valve shaft moves toward open throttle position the effective cross sectional area of the vane controlling the throttle valve increases. Thus, as the throttle valve moves toward open position less manifold vacuum is required to move the throttle toward further open position than is required to move the same toward open position when it is fully closed. Therefore, as the shaft which is connected to the manual throttle control is moved, the stop thereon moves away from the other shaft, permitting the sub-atmospheric pressure in the intake manifold to move the throttle toward open position. The amount of this movement is limited by the position of the stop which

in turn is limited by the setting of the manual throttle control. Preferably, the opposite side of the vane which is connected to the throttle valve is connected to atmosphere through a restricted passage. This arrangement prevents the throttle valve from being moved very suddenly to open position upon a sudden movement of the manual control toward open throttle position thereof.

Apparatus illustrating features of my invention is shown in the accompanying drawings forming a part of this application in which:

Fig. 1 is an elevational view of my improved apparatus in place on the carburetor of an internal combustion engine, the carburetor in turn being mounted on the usual intake manifold;

Fig. 2 is a plan view with certain parts broken away and in section;

Fig. 3 is a detailed sectional view taken generally along line 3—3 of Fig. 2;

Fig. 4 is a detail sectional view taken generally along line 4—4 of Fig. 3;

Fig. 5 is a detail fragmental elevational view of the shafts and part of the vanes completely removed from the housing of the device;

Fig. 6 is a detail sectional view of the vanes and shaft assembly taken generally along line 6—6 of Fig. 7;

Fig. 7 is an end elevational view of the shaft and vane assembly with certain parts of the vanes being broken away and in section;

Fig. 8 is an isometric view of one set of the vanes and the springs for holding them in contact with the housing, the view being with the parts in exploded position and with certain of them broken away and in section;

Fig. 9 is an end elevational view of the end of the butterfly valve opposite the throttle valve control apparatus and showing a spring for urging the throttle valve toward closed position; and,

Fig. 10 is a view corresponding to Fig. 9 and showing an arm and weight arrangement which may be used instead of the spring of Fig. 9 for urging the throttle valve toward closed position.

Referring to the drawings for a better understanding of my invention and particularly to Figs. 1 and 2, my improved apparatus comprises a housing indicated generally by the numeral 10 which is adapted to be bolted or otherwise secured onto the side of a carburetor indicated generally by the numeral 11. As will be understood, the carburetor has one or more throttle control valves 12 therein. The carburetor is secured by bolts or the like 13 to an intake manifold 14 of an internal combustion engine, not shown. Certain internal parts of my improved apparatus are connected in a manner later to be described to a shaft 16 on which the valves 12 are mounted in the customary manner.

The housing 10 of my improved apparatus may comprise ends or heads 17 and 18. Mounted between the heads 17 and 18 are two metal spacer blocks 19 and 21 which are shown more clearly in Fig. 3. A number of bolts 22 pass through the ends or heads 17 and 18 and the blocks 19 and 21 thus to hold these parts assembled somewhat in sandwich fashion. Some of these bolts 22 are threaded into suitably tapped holes in the side of the carburetor to hold the entire unit on the carburetor.

The periphery of the housing is formed by thin metal plates 23 and 24 which are curved as shown and which have their ends resting on seats formed on the blocks 19 and 21. The plates 23 and 24 are held assembled around the ends 17 and 18 and onto the blocks 19 and 21 by means of straps of flexible sheet metal indicated at 26. One end of each strap 26 is anchored to the blocks 19 and 21 by screws 27 as shown. The opposite ends carry a pair of bolts 28 which pass through suitable openings in lugs 29 secured to the blocks 19 and 21. Nuts 31

serve to draw the straps tight, thus holding the parts assembled and providing a substantially air-tight housing.

Mounted in suitable bearing projections outstanding from the heads **17** and **18** are a pair of generally axially aligned shafts **32** and **33**. The shafts are held in alignment by means of a centrally disposed centering pin **34** and the shafts are independently rotatable relative to each other. The shaft **32** is provided in its end adjacent the carburetor with a drilled and tapped hole **36** adapted to receive the threaded reduced end **37** of the throttle valve shaft **16**. Thus, shaft **32** is connected to the shaft **16** so that upon rotation of shaft **32** the throttle valves **12** may be moved to open position.

Shaft **33** is provided with a threaded end **35**. An arm **38** is secured on the threaded end by means of a nut **39**. Pivotally connected in the upper end of arm **38** as at **41** is a manually operated throttle control member **42** which conveniently may be connected for manual operation to the usual foot pedal found in automobiles. The linkage arrangement is such that when the member **42** and arm **38** move to the right as viewed in Fig. 1, the throttle valves are released for opening in a manner later to be explained.

The inside of the housing **10** is divided by the vane means now to be described generally into two compartments **43** and **44**. Compartment **43** is connected through a passage **46** to the sub-atmospheric pressure existing in the intake manifold **14**, whereby the compartment or section **43** of the housing is subjected always to the varying sub-atmospheric pressure existing in the manifold under the different operating conditions of the engine. The compartment **44** is connected through a passage **47** in the housing block **21** to a conduit **48** in turn connected by a rubber hose or the like **49** to the air intake of the carburetor **11**, above the valves **12**. Thus, filtered air is supplied to the connection **48**. Similarly, a passage **51** having a metering valve **52** therein leads to the housing for a purpose later to appear. The block **21** has a slot **53** therein in which is slidably placed a strip sealing element **54** which contacts at its inner end against the sides of the shafts **32** and **33**. A spring **56** holds the seating element in fluid tight engagement with the shafts.

The shafts **32** and **33** are provided with enlarged diameter portions **32a** and **33a**, respectively, as shown in Figs. 4, 5 and 6. Welded to the enlargement **32a** are are plates **57** and **58** which are just slightly shorter than the distance between the ends or heads **17** and **18**. In like manner and diametrically opposite the plates **57** and **58** are other plate **59** and **61**, welded to the enlarged diameter part **33a** of shaft **33**. Spaces are thus defined between the respective pairs of plates.

Fitting in the space between the plates **57** and **58** are blocks of plastic material **62** and **63**. As best shown in Fig. 7, these blocks of material are generally L-shaped in cross transverse section, having lower ends **64** which are thicker than the remainder of the block thereby to provide a shoulder at the lower portions thereof which extends the width and length of each of the blocks **62** and **63**. Further, the blocks are notched out as indicated at **66** to provide sliding tongue and groove mating portions. Still further, the blocks **62** and **63** are urged apart by a spring **67**, this serving to cause the blocks to contact the end walls or heads **17** and **18** of the housing, thus to seal the compartment **43** at the ends.

Also disposed in the spaces between the plates **57** and **58** and occupying the space defined by the thicker lower ends of the blocks **62** and **63**, are a pair of wiping sealing members **68** and **69**. These members likewise are provided with overlapping tongues **71** which fit slidably together. A spring **72** urges the members **68** and **69** away from each other whereby they also seal against the ends or heads **17** and **18**. Further, the members **68** and **69** are urged upwardly by means of springs **73** which fit in holes **74** drilled in the members **68** and **69**. The lower ends of the springs fit in blind holes **76** which are drilled in the thicker portion **64** of the members **62** and **63**.

It will be understood, from what has just been said, that in the space between the plates **59** and **61** are disposed identical sets of the sealing members just described. Therefore, a description of these is believed to be unnecessary and the same numerals have been applied to the respective parts located between the plates **59** and **61**. It will thus be apparent that in effect the shafts **32** and **33** carry substantially identical sets of sealing vanes. Therefore, the compartment **43** which is bounded on one side by the plates **57** and **58** and sealed by the plastic vane members described is in fact substantially fluid-tight from the atmosphere to which the compartment **44** is connected. Further, the plates **23** and **24** are curved or radii struck from the respective points P and P_1, Fig. 3. The effect of this is that as the vane assemblies carried by the shafts rotate, the effective cross sectional area of the vane assemblies increases. Thus, as the throttle valves move toward open position the unit sub-atmospheric pressure in chamber **43** required to hold the valves open decreases. The importance of this will appear later.

Welded to the enlarged portion **33a** of shaft **33** is a stop member **77**. This stop member is adapted, when the parts are in the positions of Figs. 1, 2 and 3, positively to contact the plate **57**, thus to hold the shaft **32** in its counter-clockwise motion position as viewed in Figs. 1 and 3, namely, in closed throttle position. Further, when the manual control rod **42** is actuated the stop **77** moves to the right, or clockwise, as viewed in Figs. 1 and 3, thereby freeing the shaft **32** and hence the throttle valves to opening movement in response to the vacuum applied through opening **46** into the compartment **43**. Therefore, if there exists sufficient vacuum in the compartment **43** the throttle valves are opened to the degree permitted by the stop **77**.

It will be understood that the shaft **16** and hence the throttle valves **12** are urged toward closed position by suitable means such as the coil spring **78** shown in Fig. 9. If desired, and as modification, spring **78** may be replaced by an arm **79** on the end of which is a weight **81**. See Fig. 10.

When first starting an internal combustion engine it is desirable that the throttle control **42** be mechanically connected to the throttle valves in the normal manner. As soon as the engine starts I have provided means effective automatically to disengage the same, thereby to free the valves **12** for actuation in accordance with the manifold vacuum as determined by my improved apparatus.

In order to effectuate the foregoing I drill a small opening **82** in the enlarged portion **32a** of shaft **32**. This in effect forms a cylinder. In this cylinder I place a small piston **83** which has a reduced diameter end **84** adapted to fit, when both shafts **32** and **33** are in closed throttle position, into a hole **86** provided in the enlarged diameter part **33a** of shaft **33**. A spring **87** urges the piston toward the left as viewed in Fig. 6. The opening **82** is connected by a passage **88** to chamber **43**. The opposite end of the piston is connected to atmospheric pressure through a passage **89** which opens into the space to the left of the plate **58** as shown in Fig. 3. Therefore, when the engine is at rest and no vacuum is applied to passage **88**, spring **87** urges the small end **84** of the piston into the opening **86**, thus locking shafts **32** and **33** together. This permits the throttle valves to be opened upon actuation of the manual control **42** in the usual manner. As soon as vacuum is applied to the passage **88** the piston is pulled out of the opening **84**, freeing the shafts for independent rotation for the purposes now to be described.

From the foregoing the method of constructing and using my improved apparatus together with the advantages thereof may now be more fully explained and understood.

With the apparatus in place on the carburetor of an engine as illustrated and connected to the intake manifold vacuum as shown, when the engine is idle the throttle valves **12** are opened when the accelerator pedal is depressed. This is due to the connection of the piston **83** which locks the shafts **32** and **33** together. As soon as the engine starts vacuum is applied through opening **88** to the right-handmost end of the cylinder **82** as viewed in Fig. 6, thus withdrawing the detent end **84** of the piston **83** from the opening **86**. With the engine idling the parts are as shown in Figs. 3 and 4 with the exception, of course, that the shafts **32** and **33** are free to rotate clockwise as viewed in Fig. 3, independently of each other. When the accelerator is opened the stop **77** is moved clockwise as viewed in Fig. 3. With the engine under no load it will be apparent that the vane assembly between the plates **57** and **58** will move to the right as viewed in Fig. 3, opening the throttle valves **12** to such a position that the vacuum exerted in the compartment or section **43** equals the pull of the spring **78** or the weight **81**, as the case may be. The amount of this opening will be determined by the strength of the spring **78** or the weight **81** as limited by the amount of clockwise movement of stop **77**, the latter, as stated, being determined by the manual throttle control means. It will further be seen that the engine will open its own throttle in accordance with the optimum amount of fuel that it can use inasmuch as this optimum amount of fuel is in direct proportion to the vacuum in the intake manifold, under all conditions. Therefore, when the stop moves to the right the throttle valves are freed for opening to the optimum position in accordance with the manifold vacuum.

At the usual automobile cruising speeds of say 60 to 70 miles an hour it will be understood that the pressure in the manifold of the engine is lower than it is when the engine is idling or when it is running at lower speeds, at part throttle. Therefore, in view of the increasing effective area of the vanes carried between the plates **57—58** and **59—61** as they rotate clockwise, the throttle will be held in more fully open position with lower pressure in the manifold at nearly full throttle open position than at closed or part open throttle position. I thus assure that the throttle in fact is held in the optimum position at high speeds so that the engine at such high speeds is fully charged with fuel upon each stroke of the pistons.

My invention is further characterized by the fact that with it applied to an internal combustion engine I can increase the compression ratio considerably above the ratios currently employed in automobile engines. For instance, I have increased the compression ratio of a standard eight-cylinder 1958 model Chevrolet automobile engine from 9.2 to approximately 11. With my invention applied to such engine I have been able to operate the same on fuels of an octane rating of around 80 and have improved the efficiency thereof without losing any of the desired performance. This is brought about due to the fact that it is impossible with my invention applied to such an engine to damage the engine by suddenly "kicking down" the throttle at very low speeds. In that connection it will be apparent that the metered opening **51** holds the throttle vane shaft assembly against sudden clockwise rotation, in the event the throttle pedal is suddenly kicked down. This prevents overloading the engine with fuel at low engine r.p.m., resulting in protecting the engine and saving fuel.

From the foregoing it will be seen that my invention is particularly characterized by the fact that it assures that at high speeds the engine is adequately charged while at low speeds the engine is not overcharged. This permits the compression ratio of such engine to be raised materially without damage to the engine.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In throttle control means for internal combustion engines having an intake manifold and a manually operated throttle valve control, a substantially fluid-tight chamber having at least some portions of its inner peripheral walls curved, end walls for the chamber, a pair of concentrically disposed independently movable shafts disposed in the chamber adjacent the center thereof, vanes on the shafts dividing the chamber into two sections and having portions making substantially fluid-tight sealing contact with the curved peripheral walls and said end walls, means connecting one section of said chamber to the atmosphere, means connecting the other section to the sub-atmospheric pressure in the intake manifold, means connecting one of said shafts to the manual throttle control and the other thereof to the throttle valve of the carburetor, and stop means for mechanically limiting rotation of the shaft connected to the throttle valve in response to rotation of the other shaft upon actuation of the manual throttle control.

2. The combination with an internal combustion engine having an intake manifold and a carburetor with a throttle valve therein, and a manually operable throttle member, of a substantially fluid-tight chamber having a pair of movable vanes therein dividing the chamber into two sections one of which is maintained substantially fluid-tight by the vanes and the other of which is connected to the atmosphere, a connection from the fluid-tight chamber to the manifold whereby a chamber bounded by common sides of the vanes is subjected to the sub-atmospheric pressure existing in the manifold, means mounting the vanes for movement in a common direction of rotation, means operatively connecting one of said vanes for movement toward the atmospheric pressure side thereof in response to throttle opening movement of the control member, and stop means operable upon movement of the throttle member controlled vanes effective to free the other of said vanes for movement toward throttle valve open position in response to the sub-atmospheric pressure existing in the manifold.

3. The combination with an internal combustion engine having an intake manifold and a carburetor with a throttle valve therein together with a manually operable throttle member, of a chamber having therein a pair of independently movable vanes which maintain a part of the chamber substantially fluid-tight in all positions of said vanes, a pressure transmitting connection between said part of the chamber and the intake manifold, means manually to move one of said vanes in a direction to increase the volume of the fluid-tight part of the chamber, means connecting the other of said vanes to the engine throttle valve whereby rotation thereof moves the throttle valve, and a stop associated with the manually movable vane effective to limit the throttle valve opening in accordance with the setting of the manually movable vane.

4. Apparatus as defined in claim 3 in which the effective cross sectional area of the vanes increases as the parts are moved toward open throttle position.

5. Apparatus as defined in claim 3 in which the chamber containing said vanes has curved walls against which the ends of the vanes slide, said walls being curved on an increasing radius relative to the ends of the vanes, whereby upon movement of the parts toward open throttle position the effective area of the vanes increases, and means urging the vanes into sealing contact with said curved walls.

6. Apparatus as defined in claim 3 in which the movement toward open throttle position of the vane connected

to the throttle valve is pneumatically retarded, whereby sudden movement towards open throttle position of the manually controlled vane does not correspondingly and suddenly move the throttle valve vane toward open throttle position.

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