May 25, 1937. W. E. LEIBING ET AL 2,081,825

GOVERNOR

Filed Aug. 2, 1934 2 Sheets-Sheet 1

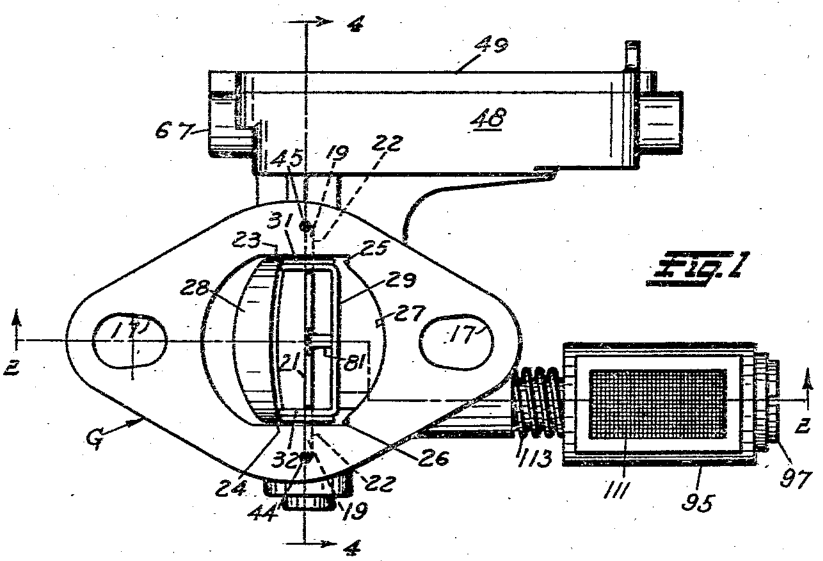


Fig. 1

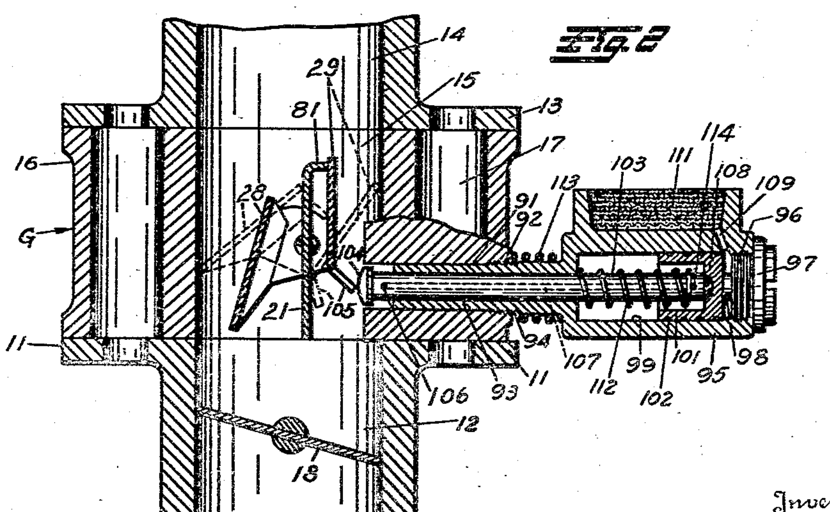


Fig. 2

Inventor
William E. Leibing
Robley D. Fageol

By Strauch & Hoffman
Attorneys

May 25, 1937. W. E. LEIBING ET AL 2,081,825

GOVERNOR

Filed Aug. 2, 1934 2 Sheets-Sheet 2

Fig. 3

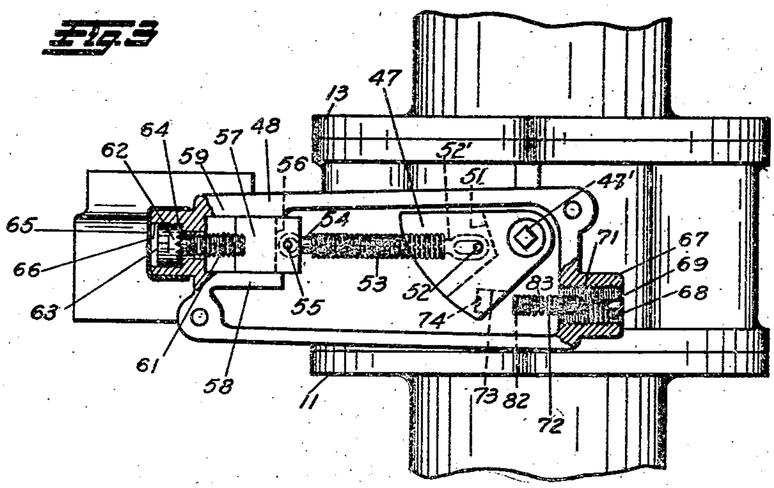
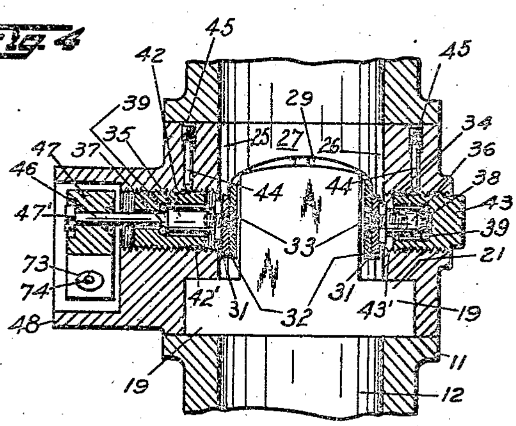


Fig. 4



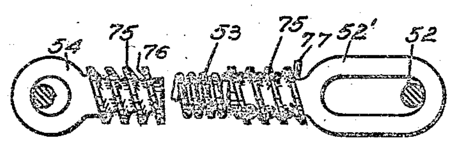


Fig. 6

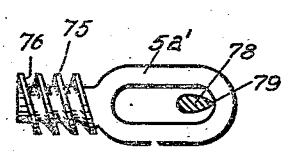


Fig. 7

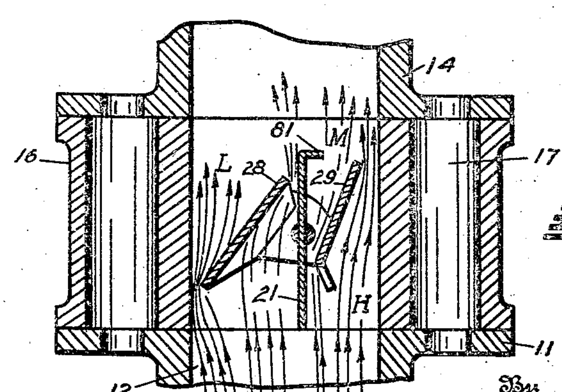


Fig. 5

Inventor
William E. Leibing
Robley D. Fageol

By Strauch & Hoffman
Attorneys

Patented May 25, 1937 2,081,825

UNITED STATES PATENT OFFICE

2,081,825

GOVERNOR

William E. Leibing, Sausalito, and Robley D. Fageol, Oakland, Calif., assignors to Leibing Automotive Devices, Incorporated, San Francisco, Calif., a corporation of Nevada

Application August 2, 1934, Serial No. 738,114

8 Claims. (Cl. 137—153)

This invention relates to methods and apparatus for governing the rates of fluid flow through a conduit, and more particularly, to methods and apparatus for use in association with the intake manifold of a combustion engine for the purpose of automatically preventing the latter from operating above a predetermined maximum speed.

More specifically, the present invention relates to fluid flow governing in response to fluid velocities, aided when desired by pressure differentials; and the preferred embodiment is of the throttle valve type inserted in a conduit conducting the fluid flow to be governed.

While governing devices of various types have been hitherto employed, it has been found that such devices are characterized by a number of disadvantages, among them being a marked tendency to flutter and cause rapid variations in the rate of fuel flow to the engine. Further, they do not respond properly to slight variations in flow and operate over too great a range of speed near the maximum permissible flow. For example, on an engine governed at 1800 R. P. M., it has been found that some governors will commence to flutter and cause a loss of power at 1600 R. P. M. or less so that the engine with which the governor is associated operates sluggishly and inefficiently when approaching its governed speed.

It has also been found in some existing types of governors that the valve or other obstructing means employed offers too much resistance to fluid flow, and sets up eddy currents which are not only detrimental to the free flow of the fluid but also to the fuel mixture itself in that condensation of the atomized fuel therein occurs. In such cases, it has been found that an engine of one hundred horse power rating may develop as little as seventy-five horse power below the governed maximum speed.

In most prior governor constructions, delicate springs, intricate cams, vacuum pistons and other equipment tending toward complexity of design with the resulting maintenance problems and hence relatively high costs, have been employed. Bearings have also been provided open to both vacuum and atmosphere and accordingly have been difficult to maintain in properly lubricated condition and are subject to accumulations of dust and grit. These problems have been found to seriously interfere with governor operation in that smooth valve oscillation and the sensitivity of the governor has been impaired.

Since a substantial amount of room has hitherto been required for the insertion of a governor between the carburetor and manifold flanges where it is ordinarily employed, serious installation problems have hitherto arisen when existing complex and sizeable governors are installed, especially where other attachments, such as degassers, are desirable also in a similar location.

In overcoming the above defects and disadvantages which have proven characteristic of prior governors, it is a major object of our invention to provide a fluid flow governor which is essentially compact and simple, requires but little space and substantially no maintenance care; which is highly sensitive without fluttering; which acts quickly in all directions at the set maximum position and at that time produces a large change in flow area upon relatively slight valve movement, and which develops no fluid traps or eddy currents, thereby minimizing flow resistance when the valve is near its closed position, which embodies a throttle valve so designed as to substantially float smoothly in a fluid stream without resistance to flow when it is at or near its open position; which embodies novel means in association therewith for the prevention of so-called throttle cheat, and which is characterized by novel selective adjustment means to insure desirable sensitive valve action without objectionable fluttering in response to velocities of fluid flow at points for which it is not set to operate.

A further major object of this invention is to provide an improved throttle valve structure, especially designed for governing fluid flow through a conduit, but also suitable for use as a controlling or accelerating throttle valve. In this connection, it is an object of the present invention to provide an improved method for throttling the fuel supplied to a combustion engine.

A further object of the present invention is to associate a flow governing valve with the flow regulating (throttle) valve of the combustion engine so that the action of the former is in great part benefited by the position of the latter.

A further object of this invention is to provide a method of governing fluid flow in response to both velocity and pressure differentials, particularly to avoid the possibility of throttle cheat; and to provide a governor suitable for carrying out the method.

Still a further object of this invention is to provide a governor having novel adjustment means associated therewith, in combination with controlling means, reacting against changes in velocity of fluid flow in a conduit conducting the flow to be governed, wherein the governor can be substantially adjusted and set at the time of manufacture at the factory and substantially any range of speeds of a motor governed by a relatively simple adjustment after installation of the governor.

A further object of this invention is to provide a governor having novel means associated therewith for reacting against the variations in fluid flow to be governed whereby the desired governing action is obtained in the absence of fluttering and undesired operation at velocities of fluid flow other than that for which the governor is set.

Still another object of our invention is the provision of novel means in combination with resilient means employed in a governor whereby the correct positioning of the resilient means under all conditions of governor operation, and substantially throughout the life of the governor is insured.

A further object of this invention is the provision of novel means in association with a governor for the elimination of so-called throttle cheat, such means being preferably distinct and separate from the governor whereby failing of the throttle cheat means will not affect the operation of the governor, such means being easily separated and removed from the governor assembly to facilitate cleaning and replacement.

A further object of this invention is the provision of novel means in association with a governor for the elimination of so-called throttle cheat, the means being arranged to be inoperative with reference to the governor except under conditions it is intended to operate, whereby under all other conditions the governor may operate in normal manner, and the sensitivity thereof is not reduced by reason of throttle cheat preventing means secured thereto.

Still a further object of the present invention is the provision of a governor of novel construction whereby an opening of relatively wide area is provided on relatively slight movement of the governing blade from closed position, whereby full fluid flow to the conduit, as is desirable under accelerating conditions, may be obtained.

Additional objects, many of a subordinate or more specific nature, will appear from a study of the following detailed description and the claims appended thereto when taken in connection with the accompanying drawings wherein:

Figure 1 is a plan view of a preferred form of governor embodying the principles of the present invention.

Figure 2 is a section taken on the line 2—2 of Figure 1, wherein the governor is shown in association with a portion of the carburetor and an engine manifold.

Figure 3 is a side elevational view taken partly in section with the cover removed from the governor adjusting mechanism to more clearly illustrate the construction and manner of operation thereof.

Figure 4 is a section taken on the line 4—4 of Figure 1 illustrating the manner of support of the oscillating portion of the governor mechanism.

Figure 5 is a section similar to that shown in Figure 2 with the exception that the throttle cheat mechanism is not shown and the governor valve is shown in half open position.

Figure 6 is an enlarged view illustrating the manner of securing the springs and the fastening means therefor preferably employed in connection with the governor of the present invention, and

Figure 7 is an enlarged view of a modified form of construction embodying a knife edge spring connection.

With continued reference to the drawings, wherein like characters are employed to designate like parts, reference numeral 11 designates an apertured flange of a throttle passageway 12 of a carburetor. Flange 11 is designed for attachment to a flange 13 of an intake manifold 14 but is shown separated therefrom to provide a space for the reception of a flow governor generally indicated at G. If desired a degassing device (not shown) may also be inserted between intake manifold 14 and passageway 12 of the carburetor such as is described in copending application S. N. 568,844, filed October 14, 1931.

The governor G has a cylindrical bore 15 provided therein and aligned with a carburetor passageway 12 and manifold passageway 14, bore 15 being formed within a block 16. Block 16 is generally similar in shape in cross section to flanges 11 and 13 of the carburetor and intake manifold, respectively, and cooperates therewith to form vertical bores 17 for the reception of assembly bolts (not shown) which serve to rigidly secure the governor in its desired position. It is preferred that bores 17 be made slightly larger than the corresponding bores in the adjacent flanges so as to provide for ready connection of the governor to flanges of varying size. Gaskets may be provided between the contacting flanges to insure against leakage from the conduits if desired. It will be noted that the governor block is of thin wafer like formation and hence occupies but little vertical space. Moreover, it will be noted that all mechanism associated therewith as will be hereafter described is enclosed within planes passing through the flanges of governor block 16.

The carburetor outlet in passageway 12 contains a conventional throttle valve 18 designed to be opened and closed manually to control the quantity of fuel mixture drawn into the intake manifold 14.

The governing mechanism comprises an oscillatable valve mechanism for throttling the passageway 15 when the engine reaches a predetermined maximum speed. As previously pointed out, this mechanism must operate smoothly and with great sensitivity and must present no substantial restriction to fuel flow at engine speeds below the governed maximum, i. e., when the governing valve is to be in closed position. These necessary characteristics are present in the following described mechanism.

A substantially T-shaped member, comprising a pair of legs 19 interconnected by a relatively straight flat bridge member 21, is incorporated in the governor block in slots 22 in such a manner that bridge 21 extends horizontally across bore 15 with the side surfaces thereof in vertical planes. Bridge 21 thus does not offer any resistance to fluid flow. Legs 19 likewise have their surfaces in vertical planes and are so located as to position bridge 21 slightly offset from the axis of bore 15 for a purpose to be later described. It will be noted that diametrically opposite sides 23 and 24 of bore 15 adjacent slots 22 and extending upwardly throughout the length of the bore are formed as slightly flat sides leading into notches 25 and 26, respectively, which bound a curved uninterrupted smooth surface 27 of bore 15. Associated with bridge 21 is a governing throttle valve comprising a power vane 28 and a stabilizing vane 29 mounted for unitary oscillation about a horizontal axis that is offset in the same plane as that of bridge 21. Vanes 28 and 29 have short off-set pivoting arms 31 and 32, respectively, which impart to them a U-shape when viewed edgewise as in Figure 1. Arms 31 are spaced for disposition closely adjacent flat portions 23 and 24 of bore 15 and arms 32 are spaced to fit just within arms 31. A pair of screws 33 are employed to securely fasten the pairs of engaged arms at a desired fixed angle relative to one another, upon the enlarged portions 34 of a pair of rotatable supporting shafts 35 and 36. Shafts 35 and 36 are provided with conical portions 37 and 38 respectively which engage bearings 39, in turn held in place by bearing cones 42 and 43 in such manner that both lateral and axial thrusts are taken by the bearings, and the pivoted governor valve is free to oscillate during its operation. Bearing cones 42 and 43 are adjustably secured in tapped apertures 42' and 43' in blocks 16, respectively, and the outer ends of bearing cones 42 and 43 are preferably formed with screw-driver slots or like means to provide convenient means of adjustment of play in bearings 35 and 36. Set screws 44 are preferably provided in bores 45 to lock the cones in their adjusted positions. It will be noted that by reason of the specific shape of the cones where pockets of considerable depth are provided for the surfaces contacting the bearings, dirt, grit and other undesirable matter is prevented from collecting within the cones and if taken in around the threaded cones will immediately pass off into the fluid rather than retreat to the bearings and their cones.

Shaft 35 is provided with a portion 46 of reduced cross section which extends through an aperture in bearing cone 42 and has an inertia member 47 pinned, pressed, threaded or otherwise secured thereto for rotation therewith. Preferably a locking member 47' is employed which is suitably fastened to the outer end of shaft 46.

Inertia member 47 is housed within a housing 48 secured to and preferably formed integral with block 16 at one side thereof, housing 48 being preferably provided with a cover plate 49 to prevent the entrance of dirt or grit to the mechanism contained therein. Inertia member 47 is slotted as shown at 51 and a pin 52 passed through the opposing walls thereof of the slot thus formed. An eyed and threaded member 52' is secured to pin 52 and in turn has secured thereto one end of a spring 53 which at its opposite end is secured to a second threaded and eyed member 54. Member 54 is engaged by a pin 55 mounted in a slotted portion 56 of an adjustment block 57 mounted to reciprocate in guides 58 and 59 preferably formed integral with housing 48. Block 57 is formed with a tapped bore 61 in which is threaded an adjusting screw 62 having an enlarged head 63 thereon. It will be noted that head 63 is provided on its underside with a serrated formation 64 whereby head 63 is maintained in any desired position by reason of the serrations 64 engaging the adjacent portion of housing 48. Thus block 57 may be positioned at any desired point in guides 58 and 59. A cap 65 is preferably provided for open portion 66 of housing 48 in which head 63 of screw 62 operates in order that suitable sealing means may be employed and unauthorized adjustment of screw 62 prevented. It is preferable that screw 62 be provided with a head of a special design such as to require the use of a special key or tool in the hands of authorized persons only for adjustment.

On the opposite end of housing 48, a projecting portion 67 is formed which is tapped to receive a threaded member 68. Threaded member 68 is preferably formed with screw-driver slots or the like at the outer end thereof to facilitate adjustment and to enable it to be locked in place by a pin 69 passing through a slot, and through holes provided in the adjacent portion of housing 48. Member 68 at its inner end has a threaded projection 71 thereon to secure a resilient member or spring 72. Opposite member 72 in inertia member 47 is a recess 73 formed with a button or projecting portion 74 therein to center spring 72 when engaged in recess 73.

In connection with springs 53 and 72, attention is directed to Figures 6 and 7, wherein a special spring fastening means is disclosed. In Figure 6, spring engaging members 52' and 54 are illustrated on a relatively large scale. It will be noted that each eyed and threaded member involves an eye, the shape of which may vary, and a threaded portion 75 which is preferably standard throughout. The threads on portion 75 are not formed of a pitch equal to the pitch of the coils of the springs employed, but are preferably formed of a pitch calculated to be greater than that of the coils of the springs when under their greatest degree of tension and fully expanded. The threads are further formed with the walls 76 thereof, against which the coils of the springs react, at approximately an angle normal to the axis of the threaded portion whereby pockets are formed for the individual spring coils. By the employment of the relatively large pitch described, it has been found that the possibility of the springs working loose is eliminated whereas with conventional threads as hitherto employed, the spring coils have tended to slip off the thread at the end of the threaded portion and wear the threads until it is no longer possible to keep the springs secured thereto. The present arrangement has also been found to prevent cutting or undesirable wear of the springs at their point of contact with the threads. Further, by the formation of the walls of the thread in a manner whereby pockets are formed for the spring coils, a maximum resistance is presented to the escape of the wire therefrom. It has been found preferable in the threading and unthreading of springs from said types of fastenings to leave portions of the ends of the springs available as shown at 77. It has also been found preferable in cases where an undue amount of friction has resulted from the employment of pins such as illustrated at 52 and 55 to employ pins of the type shown at 78 in Figure 7 wherein a knife edge 79 is provided at the point in contact with an eyed and threaded member such as 52' and any resulting friction is accordingly kept to a minimum.

The tension of spring 53 normally urges inertia member 47 to a position such as shown in Figure 3, which corresponds to the wide open valve position shown in Figure 2. In this position, the throttle valve is yieldingly held in engagement with a spacing or stop element 81 preferably integrally secured to bridge 21 and arranged to position vane 29 in a substantially vertical position. In this position, pin 52 is in the end of the slot provided in member 52' and is preferably slightly offset from a horizontal plane through the shaft 46. By reason of this offset, it will be noted that when inertia member 47 rotates in a counterclockwise direction in Figure 3 in response to closing movement of the governor valve, the resistance to movement of the valve will uniformly increase due to increasing length of the effective crank arm between pin 52 and shaft 46 as well as due to the continued stretching of spring 53. Spring 72 does not engage inertia member 47 until the governor approaches a closed position and is employed primarily to insure a smooth, easy governing action and to prevent fluttering at points approximating closed position. It will be noted that spring 72 is not of the same pitch throughout, but is provided with a portion 82 of relatively fine pitch engaging recess 73 in inertia member 47 and a portion 83 of relatively coarse pitch immediately adjacent thereto and next to the threaded projection 71.

In adjusting the portion of the governor so far described, spring 72 may be adjusted by threaded member 68 and requires adjustment only for the characteristic of the governor which is determined by simple tests conducted at the factory at the time of manufacture. Adjustment of spring 72 bears substantially no relation to the particular speed or range of speeds over which the governor is designed to operate, and the adjustment of spring 72 need not be disturbed after the governor has left the factory. After the governor has been placed in association with the carburetor and manifold of a combustion engine, screw 62 may be adjusted to cause block 57 to reciprocate in guides 58 and 59 and so change the tension of spring 53. By this means, the governor may be accurately set to govern for any desired speed and screw 62 thereafter sealed as an insurance against unauthorized adjustment.

With further reference to the structure of the governing throttling valve, power vane 28 is given an approximately cylindrical curvature between pivot arms 31 so as to form a scoop for the fuel current to which it is subjected. In addition, it preferably has greater effective exposed area than has stabilizing vane 29 and is disposed at a greater distance from the pivotal axis than is the latter, whereby the closing torque developed by the power vane is much greater and more effective than that developed by the vane 29 in resistance to the closing movement of the valve.

Vane 29 is preferably flat, and in its normal open position, adjacent a stop 81 on bridge 21 (as shown in Figures 1 and 2), its plane is substantially parallel to the axis of the conduit whereby it offers substantially no resistance to fluid flow. Vanes 28 and 29 are not parallel, vane 28 being preferably set at a slight angle preferably about 15° relative to vane 29 and opening toward the carburetor so that, in the fully opened valve position, this vane will produce a rotative component. This angle is preferably accurately maintained by the interlocking faces of legs 32 of vane 29, the faces abutting vane 28 in a manner whereby they may not be altered by the act of assembling screws 33.

Vane 28 must of course face the carburetor as shown in the illustrated embodiment, and functions best when disposed on side of the conduit toward which main throttle valve 18 concentrates the fluid flow as shown in Figure 2.

To avoid throttle cheat or to insure closing of the valve under throttle conditions where the vacuum is relatively high and the velocity of a degree so low that it will not close the governor valve, a bore 91 is provided in block 16 and formed with a tapped portion 92 at its outer end. A sleeve 93 having a threaded portion 94 thereon is arranged to be screwed into bore 91 with portions 92 and 94 entering into threaded engagement. Sleeve 93 is preferably formed integral with a housing member 95 having an open end 96 closed by screw 97 threaded therein and having a projection 98 on the inner end thereof. The interior of housing 95 is formed as a cylinder 99 with a piston 101 operating therein, preferably formed with dirt grooves 102. Cylinder 101 is positioned to react against one end of reciprocatory plunger 103 extending through sleeve 93. Plunger 103 has a head 104 disposed thereon, arranged to engage a lug 105 formed on vane 29. Plunger 103 is preferably of a size to permit an equilibrium of pressures to be maintained between bore 15 and the space immediately in rear of head 104 at all times so that the pressures in bore 15 can be communicated by means of an aperture 106, bore 107, and a second aperture 108 to cylinder 99. A passage 109 is formed in the right end of cylinder 99 communicating with an air filter medium 111 whereby air under atmospheric pressures may pass into the chamber defined by projection 98 and the right end of piston 101. Filter 111 may comprise a series of layers of screen material 115 or screen material combined with fibrous material. Plunger 103 is preferably provided with a spring 112 suitably pinned thereon as by pin 114 to insure the return of piston 101 to a position at the right end of cylinder 99 upon the establishment of a sufficiently high pressure in bore 15. A spring 113 is provided in conjunction with housing 95 to maintain it in fixed position relative to block 16.

As previously stated, at times in the operation of the engine to which the governor of this invention may be connected, the conditions may be such that a relatively low vacuum exists in bore 15 and the velocity is of such a low degree as not to effect closing of the governor valve. In such a case, it is then possible by proper manipulation of throttle valve 18 to gradually build up the supply of fuel to the engine without disturbing the position of the governor valve and obtain speeds far in excess of those for which the governor is set to operate. This is known as throttle cheat. Prior constructions, in attempting to overcome such a condition have usually been built in as a part of the governor and have been attached to the governing blade. This has been found highly disadvantageous since if the device employed to prevent throttle cheat fails, the entire governor becomes inoperative. Furthermore the operation of the governor under other than throttle cheat conditions is hampered and the sensitivity thereof is reduced. In the present device when the vacuum in bore 15 attains a predetermined value, the vacuum is communicated past head 104 through aperture 106, bore 107, aperture 108 to the interior of cylinder 99 where the vacuum becomes effective on the left side of piston 101. Since the pressure on the opposite side of piston 101 due to aperture 109 is substantially atmospheric, piston 101 forces plunger 103 against the action of spring 112 to contact plunger head 104 with projection 105 on vane 29 and effects closing of the governor valve or urges the valve toward closed position, thereby preventing the engine from going above a maximum speed. By proper positioning of housing 95 with reference to block 16 and the proper selection of spring 112, it has been found possible to set the throttle cheat mechanism for operation at any predetermined vacuum within bore 15 and thus avoid throttle cheat under any conditions, the mechanism being inoperative with respect to the governor at all pressures above said predetermined vacuum.

Assuming that the governor of this invention has been installed on a motor vehicle and properly adjusted, by means of screw 62, to prevent the engine from exceeding a speed corresponding to, for instance, thirty-five miles per hour, the operation is as follows:

As the engine idles the resulting vacuum in bore 15 is high and therefore piston 101 holds governor in the closed position. A gradual opening of the carburetor throttle slightly raises the pressures between carburetor throttle and governor throttle and as it will be noted that piston 101 is operated by pressures existing on carburetor side of governor valve, such increase of pressures enables springs 53, 72 and 112 to slightly open the governor, due to the lesser effort developed by piston 101, so that gradual openings of the carburetor throttle cause the governor throttle to follow along in exact reproduction of the carburetor throttle movement. This is true until the governed speed for which the governor is set is reached, at which point the governor blade will be in equilibrium with the in-going fluid and the carburetor throttle may then be fully opened without further movement of the governor throttle.

The above is true of gradual openings only and represents the functions of the throttle cheat assembly. If, however, the engine is idling and therefore the throttle cheat assembly is holding the governor throttle closed and the carburetor throttle is suddenly fully opened, such immediate full opening restores atmospheric pressure below the governor valve, whereby the throttle cheat piston 101 immediately returns to its outer or inoperative position.

Further, such quick opening from light flow position causes the governor throttle to also snap wide open where it will remain until the engine reaches governed speed at which point the governor throttle will close again, but without any assistance from the throttle cheat piston, for it must be noted that as long as carburetor throttle is in the wide open position, pressures below the governor throttle are substantially atmospheric and therefore spring 112 holds piston 101 in the inoperative position.

In the operation of the governor, as the velocity flow against power vane 28 in part overcomes the spring tension, the valve rotates relatively slowly toward closed position. Slight valve movement brings vane 29 into play to create a resistance augmenting that of spring 53. However, the greater effective area and lever arm of power vane 28 is sufficient to overcome the combined resistances. As a matter of fact, it has been found in actual tests, that for some reason difficult of explanation, the vane 29 appears to lose its power of resistance after substantial movement, but the opposed portions remain evenly balanced due to the increasing resistance of spring 53. Spring 72 is idle during the major closing portion of the governor valve, but is so designed as to come into action just prior to the actual closing and at the point where undesirable fluttering of the governor valve has hitherto occurred in prior constructions. At this point, there are combined velocity and pressure conditions which suddenly tend to force the governor valve shut. These conditions are diagrammatically illustrated in Figure 5 wherein the several valve edges are beginning to throttle the conduit to cause the development of pressure differences on opposite sides of the valve, high, medium and low pressure areas being designated by the letters H, M and L respectively, it will be seen that the pressure differential cooperates with the velocity to force the valve in a clockwise direction. Spring 72 at this time supplements spring 53 and the two springs yieldingly stop further movement of the valve, the final position of the latter of course depending upon the predetermined set given to block 57.

It will be noted that due to the special design of the governing valve with a plurality of through openings, the total cross-sectional area of flow in positions other than closed is not restricted to any material degree nor does it vary greatly during the greater part of range of oscillation between fully open and partially closed position. It follows that the governor valve offers no material restriction to fuel flow and that the engine can develop full power and speeds at all velocities below the maximum governed speed.

However, only a small angle of valve oscillation is required to cause rapid opening and closing of the valve near the governed speeds, which accordingly means that the valve is very sensitive, although not undesirably so. This is due to the fact that there are four passages in the valve having four seats for a similar number of valve edges. Each vane has an edge designed to cooperate with the bridge member 21 and an edge designed to cooperate with a portion of bore 15. Four-point closure of the governing valve is thus accomplished with the valve in its governing position. Having been adjusted for a maximum vehicle speed of thiry-five miles per hour, the valve has been found to be sensitive to a degree that permits the development of substantially full power up to thirty-four miles per hour, and if the carburetor throttle be held wide open, the governor will go from a fully open position to a position permitting of a speed equivalent to 35 M. P. H. in a range of 1 M. P. H. It should be further noted that if a load (such as a hill) be imposed on the engine with governor in the above working position, the governor blade will again be fully open at a speed of 34 M. P. H. or the speed at which it originally started to close.

The governing valve may be likened to an air foil since its slip-stream design causes it to "fly" a steady course in a fluid current. The power vane 28 acts as a lifting wing while the trailing vane 29 serves as a stabilizing wing. The combined wings resist fluttering, and undesirable oscillations in response to rapid fluctuations in velocity, and thus permit the engine to develop driving torque uniformly in proportion to the movement of throttle 18.

In Figure 2, in dotted lines a governor valve is shown in completely closed position. Ordinarily the valve will never reach this position since the vehicle will seldom be held down to such a correspondingly low speed. When employed as a governing valve, it is not essential that the valve fully close the bore 15 either centrally or adjacent the walls of the latter. However, it is intended that this type of valve be used as a substitute for the present more or less ineffective types of throttle valves, as well as for a governor valve. When used in place of the usual throttle valve such as throttle 18, the valve of the present invention will preferably have its vanes enlarged to seat fully and completely against bridge 21 at their inner edges and fully against the sides of bore 15 at their outer edges.

The chief advantages of this type of valve over existing valves for the use as main or governing throttles is as follows. A butterfly or similar type of valve causes the formation of blind traps when the throttle is in a partially open condition with the resulting production of swirling eddy currents. These eddy currents not only prevent a smooth unbroken flow direct to the engine, but also prevent proper fluid mixtures by causing much of the vaporized and atomized fuel to come out of the mixture in the form of liquid droplets that are too large for efficient combustion. It is also observed when employing transparent conduits in connection with carburetors and governors as have been employed by applicants for experimental purposes.

The valve of the present invention is not subject to the above disadvantages since it does not provide flow traps and affords a structure such as to form four distinct passages therethrough when in open position. Moreover, these several passages increase very rapidly in cross-sectional area while the valve is rotated through only a very small angle so that flow restrictions and eddy currents are substantially eliminated, even when the valve is in partially closed position. The resistance, of course, is even less when the valve is open further.

The governing valve of the present invention prevents excessive racing of the engine when the latter is idle or being driven, as well as when it is under load. For example, the device is adjusted to prevent engine speed above 1800 R. P. M. under load. When the engine is racing with vehicle idle or is being driven by downgrade travel with open throttle, where the same amount of fuel mixture would ordinarily drive the engine faster than if the engine were under load, springs 53 and 72 permit the valve to close slightly more than it does for maximum permissible speed under load. It should be noted that if a positive stop were used instead of the yielding stop of the present device, the engine would be run above safe or permissible speeds under certain of the above mentioned conditions.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:—

1. In a throttling device for controlling fluid flow through a conduit, pivoted valve means within said conduit directly responsive to and arranged to be actuated toward closed position by the velocity of fluid flow through said conduit, means to urge said valve means toward closed position at a predetermined degree of vacuum in said conduit, and means for maintaining said urging means inoperative with respect to said valve means at all pressures above said predetermined vacuum.

2. In a throttling device for controlling fluid flow through a conduit, pivoted valve means within said conduit directly responsive to and arranged to be actuated toward closed position by the velocity of fluid flow through said conduit, means to urge said valve means toward closed position at a predetermined degree of vacuum in said conduit, and means for positively engaging said urging means with said valve means only when said urging means is urging said valve toward closed position, said valve means being otherwise independent of said urging means.

3. In a throttling device for controlling fluid flow through a conduit, a valve structure operable within said conduit, said valve structure comprising a set of spaced cooperating elements designed to form, as the valve is opened, a plurality of passages for fluid flow substantially straight through the valve structure in the direction of the axis of the conduit, and means arranged to contact with at least one of said elements to effect closing of said valve at a predetermined vacuum in said conduit, said means comprising a plunger and a piston for actuating said plunger, one side of said piston being subject to atmospheric pressure, said valve being free to move relative to said plunger except under said predetermined vacuum.

4. In a throttling device for controlling fluid flow through a conduit, a valve structure pivoted for oscillation within said conduit, said valve structure comprising a set of interconnected spaced flow controlling wings designed to provide upon relative slight oscillation from closed position, a relatively large effective flow area across said conduit to permit a substantially straight and unrestricted flow through said valve structure, a bridge element disposed within the conduit and with respect to which the spaced wings are designed to seat when said valve is closed, means to urge said valve toward closed position at a predetermined degree of vacuum in said conduit, and means for positively engaging said urging means with said valve only when said urging means is urging said valve toward closed position, said valve being otherwise independent of said urging means.

5. In combination with the intake conduit of an engine having a control valve of the butterfly type, a flow-responsive valve disposed in said conduit for limiting the engine speed to a predetermined maximum comprising a power element and a stabilizing element, said flow responsive valve being located closely adjacent and so related to said control valve that the latter concentrates fluid flow upon said power element when the engine is operating above idling speeds, means to urge said valve toward closed position at a predetermined degree of vacuum in said conduit, and means for positively engaging said urging means with said valve only when said urging means is urging said valve toward closed position, said valve being otherwise independent of said urging means.

6. In a throttling device for controlling fluid flow through a conduit, a flow responsive valve comprising a power element leading into the fluid flow and a stabilizing element leading away from the fluid flow, means for supporting said elements for movement, means positioned between said elements whereby a four point closing of said flow responsive valve is accomplished, means to urge said valve toward closed position at a predetermined degree of vacuum in said conduit, and

means for positively engaging said urging means with said valve only when said urging means is urging said valve toward closed position, said valve being otherwise independent of said urging means.

7. In a governing device for limiting fluid flow through a conduit, a valve in said conduit arranged to control the effective flow area therein, said valve being responsive to velocity of fluid flow and arranged to provide a four-point closure, means to mount said valve for oscillation, resilient means associated with said means in a manner to yieldingly resist movement of said valve effected by velocity of fluid flow, said resilient means being positioned to proportionally increase in force as said valve approaches closed position, means to urge said valve toward closed position at a predetermined degree of vacuum in the conduit, and means for positively engaging said urging means with said valve means only when said urging means is urging said valve toward closed position, said valve means being otherwise independent of said urging means.

8. In a maximum speed governing device, a conduit, a pivoted valve in said conduit for controlling the effective flow area therein and responsive to the velocity of fluid flow therethrough, and means to close said valve upon the establishment of a predetermined vacuum in said conduit, said means comprising a reciprocatory plunger positioned to contact said valve to effect closing thereof, a cylinder secured to said governing device, a piston in said cylinder for operating said plunger, means to subject one side of said piston to vacuum in said conduit, means to subject the opposite side of said piston to atmospheric pressure and means to maintain said valve closing means inoperative with reference to said valve at all pressures above said predetermined vacuum.

WILLIAM E. LEIBING.
ROBLEY D. FAGEOL.