Jan. 16, 1940. L. LANGHAAR 2,187,243

THROTTLE GOVERNOR

Filed Nov. 19, 1936

Fig. 1.

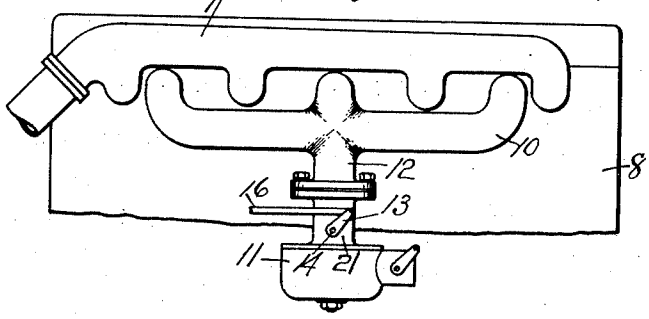


Fig. 2.

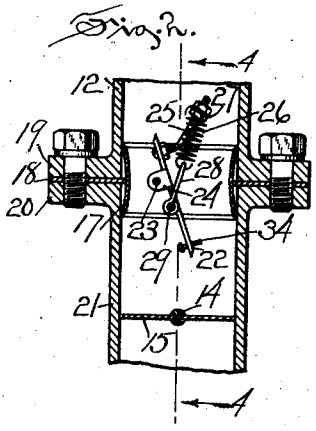


Fig. 3.

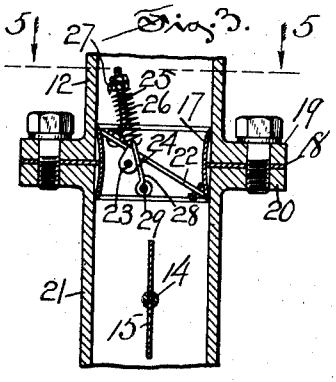


Fig. 4.

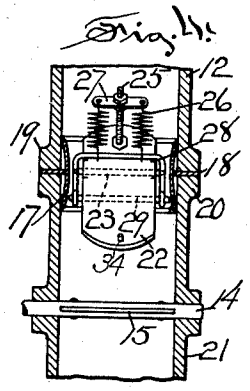


Fig. 6.

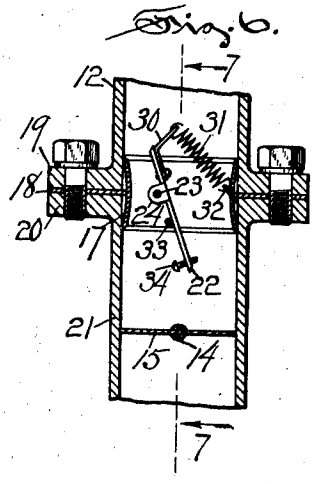


Fig. 5.

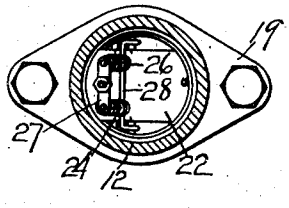
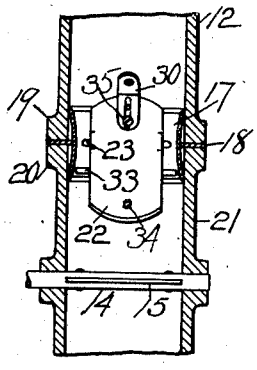


Fig. 7.



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THROTTLE GOVERNOR

Louis Langhaar, Allentown, Pa.

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11 Claims. (Cl. 137—152)

My invention relates to the class of devices which are employed for regulating the admission of a combustible fluid to a motor, and an object of my invention, among others, is the provision of a device of this type which shall automatically prevent a sudden objectionable change in the ratio of the constituent proportions of the elements; a further object of the invention is to provide a device of this class that may be economically constructed, that shall be simple and effective in its operation, and that may be readily installed in existing apparatus, such device to be suitably adjustable and yet suitably difficult of access to discourage tampering.

One form of a governor embodying my invention and in the construction and use of which the objects herein set out, as well as others, may be attained is illustrated in the accompanying drawing in which

Figure 1 is a side view of a portion of an engine equipped with my improved governor.

Figure 2 is a view in lengthwise vertical section through the tube leading from the carbureter to the manifold and showing my improved governor installed therein, the valve being open.

Figure 3 is a similar view showing the valve closed.

Figure 4 is a view in section on a plane denoted by the dotted line **4—4** of Figure 2.

Figure 5 is a view in cross section on a plane denoted by the dotted line **5—5** of Figure 3.

Figure 6 is a view similar to Figure 2 but illustrating a modification of the structure.

Figure 7 is a view in section on a plane denoted by the dotted line **7—7** of Figure 6.

It is a purpose of my invention to minimize the injurious effects caused by a sudden inrush of air in the intake of a throttle controlled internal combustion engine due to sudden throttle opening. The great difference in the physical properties of the air and fuel causes greatly unbalanced proportions of fuel to air with any sudden change in air velocity through the carbureter; while at the same time the sudden loss of partial vacuum, or sudden increase in absolute pressure which means the same thing, causes sudden change in the dew point and temperature of the fuel mixture. All of these sudden changes seriously affect engine operation. There is no known reason for a richer mixture during acceleration than at any other time but the problem is to maintain a normal mixture due to these various unbalancing factors. The so-called accelerating pump is not for the purpose of making the mixture richer as is sometimes supposed, but is merely a powerful squirt pump used in the effort to correct the period of abnormal mixture leanness during acceleration with the object of trying to keep the mixture up to normal richness. Such a pump is a palliative not a correction of conditions. My invention tends to correct the abnormal conditions which cause the abnormally lean fuel mixture during early acceleration stages. And whereas the accelerating pump tends to cause an injurious mechanical shock to the engine and whole transmission mechanism, my invention tends to smooth out shock with or without the accelerating pump. I regard the accelerating pump as of some advantage in any event because perfect correction of the basic faults is not practical, as a vacuum gauge shows abnormal conditions during acceleration no matter what is done. My invention tends to minimize these abnormalities with or without an accelerating pump, with consequent improvement in the engine and mechanical and rear tire maintenance costs. The rear tires are specified because the rear wheels are usually the drivers in present automobile design, reference naturally being to the tires receiving the driving strain and shock.

By the use of my invention illustrated and described herein these advantageous results are attained by placing a governor valve between the carbureter throttle and the cylinder and by so making this valve that it is instantly closed by an abnormally sudden inrush of air, yet leaving sufficient aperture for smooth acceleration in the closed position, with automatic re-opening when the initial high surge of intake air subsides to actual engine demands.

The governor valve may be any form of a butterfly valve or check valve tending to close by the force of the fluid flow to restrict the passage and I use the words "butterfly valve" and "check valve" indiscriminately to signify such function.

The attainment of these highly desirable objectives also results in a superior speed governor merely by adjusting the valve so that the closing point corresponds to the desired top engine speed, and by providing suitable adjustment therefor.

One of the great objectives in governor design has been to make a governor which would prevent what is commonly known as cheating. By cheating is meant higher speed with gradual throttle open than when the throttle is suddenly opened and held open. The governor should cut off at the same engine speed regardless of how the throttle is used, other things being equal. Many devices have been invented with that object in

view. It is not a matter of complicated devices, but simply correct valve spring resistance in the closed position for any given governor and engine proportions. Because of unknown and indeterminate variables, no formula is possible, and the results are entirely empirical by trial and adjustment. But it is necessary to provide suitable and simple adjustment within the required range, as also determined by prior trial. Complicated adjustments are very objectionable, and if correct setting is beyond the knowledge of the average potential user then it becomes worthless. For governors are not laboratory instruments, but things of ordinary usage by people of ordinary mechanical knowledge. If dealing with any given fixed condition, it would be simple to make a spring by trial to suit that condition. But with a commercial instrument such as a governor which must be adapted for a wide range of variable conditions, it is impractical if not impossible to make any one spring to cover all the possible demands, and therefore adjustment should cover change in leverage as well as in spring tension. The word "force" in claims as applied to the spring or springs embraces spring strength and leverage, meaning resultant force.

A very important feature is simplicity of installation. Bulky governors are substantially as old as automobiles themselves. A commercial governor should be a simple small self-contained device applicable to a commercial engine without change in the engine or carbureter connections. While I do not limit myself thereto, one of the very advantageous features of my governor is its adaptation to a flanged construction as shown, which permits easy installation between the carbureter and manifold without any special studs or carbureter connections. Another advantage of such flanged construction is that the mechanism is protected from tampering and from changing speed limits by unauthorized persons, without complete removal which they are not apt to attempt. The carbureter may be easily sealed in place if desired. Locks are unfortunately but small protection, and any exposed or accessible means of adjustment offers a challenge.

Another very important feature of my invention is the elimination of an oscillating shaft and a bearing therefor, as these eventually gum and stick. This is more important now than formerly, with the use of modified fuels such as ethyl gasoline. The valve in my governor oscillates on its pivot, in preferred construction, though I do not limit myself thereto, and the contact between pivot and valve is always swept clean by the fuel mixture; besides which no accurate fit is needed and the hole may be made considerably larger than the pivot so as to produce a rocking motion thereon. I use the word "pivot" in the broad sense of a fulcrum, regardless of whether the valve oscillates on said pivot or the pivot moves as a shaft with the valve.

In the accompanying drawing the numeral 8 denotes a motor that may be of any ordinary construction of the internal combustion type, 9 the exhaust manifold, 10 the intake manifold, 11 the carbureter and 12 the fuel supply tube leading from the carbureter to the intake manifold, all of which parts may be of ordinary and well known construction and which also include a throttle arm 13 secured to the shaft 14 of a throttle valve 15 located to control the passage in the tube 12 between the carbureter and manifold 10. A throttle rod 16, connected at one end with the arm 13, extends to any suitable location or device for operating the valve 15.

As a matter of convenience and economy I so construct my improved device that it may be made at a minimum cost and may be readily attached to motor equipment in common use, such device comprising a case 17 of tubular form and having a flange 18 projecting preferably from it in position to be secured between the flanges 19—20 at the adjacent ends respectively of the fuel supply tube 12 and that part 21 thereof projecting from the carbureter 11. In that type of the structure shown in Figs. 2 to 4 my improved governor valve 22 is secured to a pivot 23 which comprises a pivotal mount for said valve that preferably has ears 24 projecting from opposite side edges thereof and as shown in Figs. 2 and 3 of the drawing, which ears receive the pivot 23 that extends across the case 17, as shown in dotted lines in Fig. 4 of the drawing.

A spring supporting finger 25 projects upwardly from the valve 22, this finger being preferably bent as shown in Figs. 2 and 3 to effect quick sudden action of the valve as will now be explained. Springs 26 are attached at the opposite ends of each to opposite ends of a cross-piece 27 and to a bail 28 pivotally mounted on a shaft 29 extending across the case 17, and as shown in dotted lines in Fig. 4 of the drawing.

It will be noted that the cross-piece 27 is held between nuts threaded on to the finger 25 whereby a method of adjusting the initial spring tension may be obtained. This also provides for varying the final spring tension and leverage in relation to the initial spring force on the valve 22 by rotary adjustment of the cross-piece 27 on the finger 25; the latter being effected in any one of several ways. One spring will function as well as two, but I prefer two springs for some sizes of governor as permitting better spring proportions for durability. In case one spring is used, it is clear that rotating piece 27 on finger 25 gives a different spring leverage, and yet the piece 27 may be adjusted up or down on the finger 25 to give whatever initial force on the valve 22 is required. As the leverage is increased by said rotary adjustment, the spring extension is also increased as the valve closes and therefore the final force on the valve 22 is increased in relation to the initial force, and vice versa. If two springs of different strength and stiffness are simultaneously used, then such rotary adjustment throws more or less load on one or the other depending on direction of rotation, with the same effect in varying the final force in relation to the initial. Therefore this provides a composite tension and leverage adjustment to get any desired initial and final resistance on the valve 22 as it moves from the open to the closed position, within the spring limits. By this combination adjustment, it is practical to reduce cheating to a negligible amount, very simply and quickly. It is understood that in operation the valve 22 is normally in its full open position, being held in the position by the spring or springs 26. The valve is unbalanced, but the ordinary force of the current of fluid mixture is insufficient to close it. However, upon higher velocity of such current the valve snaps into closed position. Reopening depends upon restoration of the normal rate of fuel mixture flow, for whatever speed limit the user decides is normal.

Naturally when the check valve closes it must not shut air tight or it will stop the motor. A suitable passage must at all times be left to per-

mit engine operation, as appears at opposite edges of the valve in both structures shown herein. The size of the passage when the valve is closed may be varied as by the use of a stop screw **34** inserted through the valve **22**. This will enable the valve to be positioned to permit passage of the proper amount of fuel suitable for the requirements of any particular engine.

It will be noted that my improved governor valve is placed between the carbureter and the intake manifold to the motor so that the major part of the combustible fluid is affected. I say major part because sometimes auxiliary fuel mixture control devices are connected between the carbureter and the cylinder into the intake manifold for auxiliary regulation of the fuel mixture, and in such case all the fuel mixture would not pass through the carbureter. It is important to note that my improved governor does not require any special engine, or carbureter or engine intake design, and is a complete and self-contained unit ready for installation in an ordinary commercial engine; and that no springs, levers or other operating parts project for external control or operation.

In that type of the structure shown in Figs. 6 and 7 the parts are much the same as hereinbefore described, the attachment for connection of one end of a spring to the valve being a plate **30** adjustably secured to and projecting from the valve, and a single spring **31** being employed to hold the valve in its open position, the opposite end of said spring being secured to an anchor **32** projecting from the inside of the case **17**, and as shown in Figs. 6 and 7 of the drawing. The plate **30** is adjustably secured as by a screw **35** extending through a slot in the plate, as shown in Fig. 7. A stop **33** extends across the case and against which the valve rests when in its open position. It will be noted that the action of the valve and the influence of the spring thereon is substantially as hereinbefore described, except that a combination adjustment is omitted and a direct spring adjustment for tension only is used instead; the final tension in relation to initial depending upon the spring stiffness.

I use a stop for the valve in its open position because that permits a definite initial resistance on the valve below which it will not move, and which greatly improves the performance. It is old practice to use some leverage and spring arrangement acting on the toggle joint principle for holding a governor valve open, but such arrangement is neither positive nor definite because a toggle joint when the component parts are nearly in a straight line can be moved by the slightest force acting crosswise of the toggle and therefore such arrangement tends to cause fluttering operation.

The cross-piece **27** serves a further and valuable function besides acting as a spring anchorage. In the open position of the valve it is in the line of the fuel mixture flow, and therefore acts as an auxiliary vane tending to close the valve. In the closed position of the valve, the piece **27** is out of the line of flow and therefore inoperative as a vane. Therefore the closing force of the piece **27** while acting as a vane in the open position requires stronger spring tension to resist closure than if it did not so act. This aids in obtaining definite valve action for a broader range of governor speed, particularly in the lower speed ranges wherein the fuel mixture velocity is relatively low. But in the closed position of the valve the fuel mixture pressure tending to hold it closed does not vary as greatly with different engine speeds as does the initial tension, because the external pressure is almost constant at one atmosphere or about 14.7 lbs. per square inch at sea level and the partial vacuum within the intake manifold does not vary greatly in the closed valve position. As the spring or springs must be designed for durability within narrow space limits of size and extension, this vane action of the piece **27** assists greatly in obtaining proper spring proportions with suitably strong closed position tension. The piece **30** of Figs. 6 and 7 may also be made of any desired size to act likewise. Or any other piece or pieces attached to the valve **22** to function likewise would serve the same purpose.

The vane function of the pieces **27** and **30** as just described further assists governor proportions. It is clear that as the valve **22** approaches alignment with the line of fuel flow, that is, more nearly wide open, greater fuel mixture velocity will be required to close it for any given spring resistance. It is important to have a wide fuel mixture passage to obtain full power from the engine. With the part **27** or **30** or any similarly functioning piece acting as an auxiliary vane in the open position of the valve **22**, such vane functions to compensate for the greater valve resistance as just described with a wider valve opening. The more nearly the valve **22** is parallel to the line of fuel flow, the greater is the proportionate aid given by such auxiliary vane action, and therefore one compensates for the other to permit a wider fuel mixture passage in the open position of the valve. The force of the fuel mixture flow exerts only an angular reaction on the valve **22**, decreasing rapidly as the valve approaches wide open position until when the valve is parallel to the line of flow the said angular reaction is zero; while at the same time by permitting greater flow past the valve **22**, the fuel mixture velocity pressure on such auxiliary vane increases, so that it would be entirely practical to have the valve **22** wide open in the direct line of flow in its open position. The part **27** or **30** or any similar vane exerts powerful leverage on the valve **22** in the open position, so that the actual force of the fuel mixture flow on such vane need only be relatively light; or conversely such vane may be correspondingly small so as not to impede flow.

It is to be noted that the part **25** in Figures 2, 3 and 4 also is included in such vane action, and I therefore define the word "vane" as used to include any part or parts participating in the action as just described.

Wherever the word "closed" or an equivalent is used it means the closed position of the valve, independent of the amount of passage closure.

The valve itself may be symmetrically mounted and balanced and may in its open position be parallel to the line of flow so that it offers no appreciable resistance thereto in which case a vane attached to the valve offers an unbalanced condition of resistance to the fuel mixture flow tending to close the valve by said flow, and therefore the word "unbalanced" refers to dynamic balance independent of pivotal location in relation to the valve.

In accordance with the provisions of the patent statutes I have described the principles of operation of my invention together with the device which I now consider to represent the best embodiment thereof; but I desire to have it understood that the device shown is only illustrative and that the invention may be carried out by

other means and applied to uses other than those above set out.

I claim:

1. A self-contained governor for influencing flow of air through a conduit, said governor comprising an unbalanced butterfly valve pivotally mounted in the governor assembly to be closed solely by action of current passing through said conduit, and a spring to hold said butterfly valve normally open below some pressure thereon, said butterfly valve and spring being adapted for insertion as a unit within said conduit.

2. A self-contained governor for influencing air flow through a conduit, said governor comprising an unbalanced butterfly valve normally held open by a spring and otherwise independent in its closing movements, a stop to receive said valve in its open position, said butterfly valve and stop and spring being adapted for unitary insertion within said conduit.

3. A self-contained governor for influencing flow of air through a conduit, said governor comprising a pivotally mounted butterfly valve and a vane connected thereto tending to close said butterfly valve by the velocity of a current of air acting thereon, and a spring connected to said butterfly valve to hold it normally open against the force of said air flow below some velocity, all of the said governor parts comprising a unit adapted to be collectively connected to said conduit within the path of the air flow therein.

4. A self-contained governor for influencing air flow through a conduit having a flange for assembly purposes, said governor comprising a pivotally mounted unbalanced butterfly valve and a spring adjustably connected thereto for holding said valve open below some air current velocity, said valve being otherwise independent in its closing movements and a carrier for said governor parts adapted for insertion with said governor parts as a unit within the orifice of said flange, and a flange on said carrier for securing it in operative position.

5. A self-contained governor for influencing air flow through a conduit, said governor comprising a case with a pivotally mounted unbalanced butterfly valve and a finger connected to said valve with a spring anchorage piece adjustably and rotatably mounted thereon, and a spring connected to said piece and to said case for holding said butterfly valve normally open below some air current velocity, the butterfly valve and finger and anchorage piece and spring all being within the path of air current flow when said governor is in use.

6. A governor for influencing air flow through a conduit, said governor comprising an unbalanced butterfly valve and a spring to hold said butterfly valve open below some air current velocity, said valve being closed by said current at some higher velocity against the spring resistance, and means for adjusting the initial spring resistance and the final spring resistance both independently and in relation to each other to permit higher or lower final resistance for the same initial resistance, said butterfly valve being adapted for mounting within the path of a current of air through said conduit.

7. A self-contained governor for influencing air flow through a conduit, said governor comprising a valve normally held open by a spring below some air current velocity and having a vane tending to close said governor valve by the air flow velocity acting thereon, said vane being presented flatwise to the air current in both the open and closed positions of said valve but shielded from said air flow velocity by the governor valve in its closed position, said governor being adapted for incorporation as a unit within said conduit.

8. A governor for influencing air flow through a conduit and a positively controlled valve for regulating the air flow through said conduit, said governor comprising a check valve and a spring, a carrier for said valve and said spring, said spring being operatively and adjustably mounted to hold said check valve open in said carrier against the force of the air flow below some velocity thereof, said check valve being closed by the force of some higher velocity of said air against said spring resistance, and means for varying the final spring force in the valve closed position while maintaining the same initial force in the open valve position, said means being adaptable for varying both the final and initial spring force both in absolute amount and in relation to each other, said carrier being adapted for mounting with said check valve in the path of flow of air through said conduit.

9. A governor for influencing air flow through a conduit, said governor comprising a check valve and multiple springs, a carrier for said check valve and said springs, said springs being operatively mounted to hold said check valve open against the force of the air flow below some velocity thereof and to permit closure by some higher velocity of said air flow, and adjustable means simultaneously affecting said multiple springs to vary both their absolute and relative force in both the open and closed positions of said check valve, said carrier being adapted for mounting with the said conduit with said check valve in the path of said air flow.

10. A self-contained governor for influencing air flow through a conduit, said governor comprising an unbalanced butterfly valve pivotally mounted in the governor assembly, and a spring to hold said butterfly valve normally open below some pressure thereon, said butterfly valve and spring being adapted for insertion as a unit within said conduit.

11. A self-contained governor for influencing air flow through a conduit, said governor comprising an unbalanced butterfly valve normally held open by a spring, a stop to receive said valve in its open position, said butterfly valve and stop and spring being adapted for unitary insertion within said conduit.

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